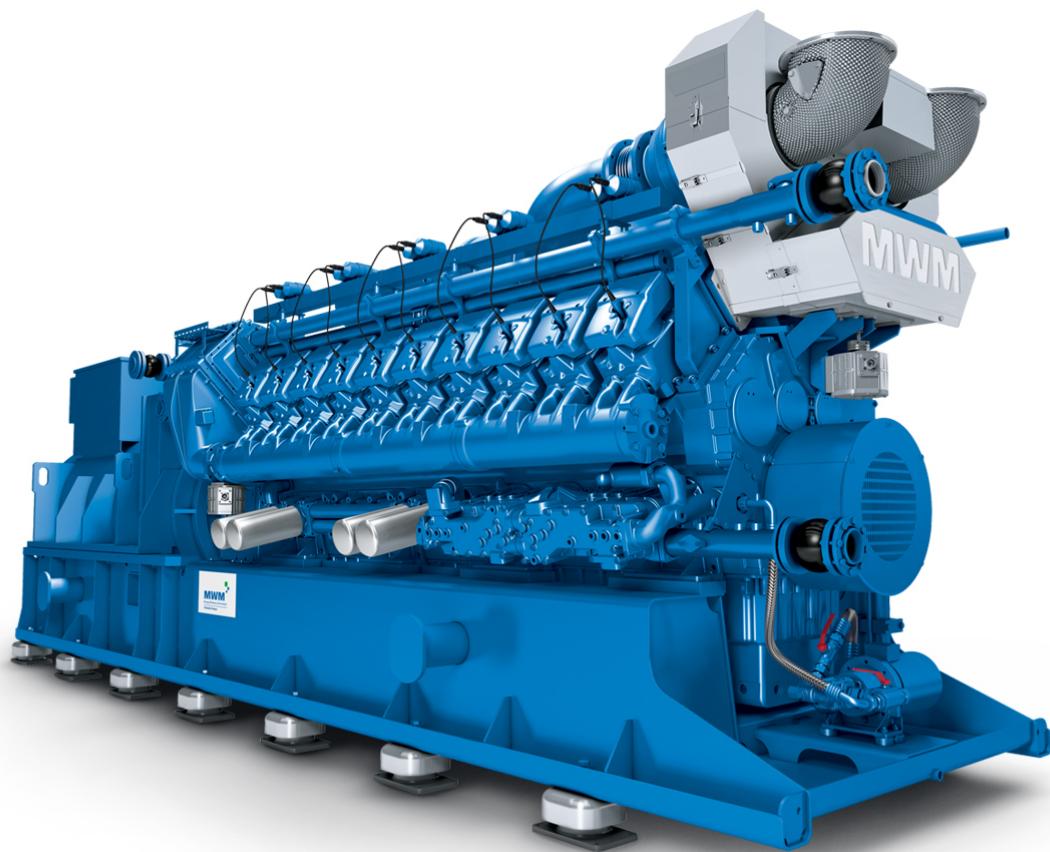


Genset

**TCG 2020
valid for TEM
Operating manual
2024-06, Language EN
Operator Level (OL)**



The original language of this document is German.
All translations are based on the German original.

Technical modifications required to improve our products are reserved with regard to specification data and other technical information contained in the document. No parts of this document may be reproduced in any form or by any means without the written approval of the manufacturer.

The document contains information that is necessary for maintenance and repair work on the product. When performing the work listed in the maintenance schedule, only original parts or parts and operating media approved by the manufacturer may be used.

Masthead

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1 Release Notes

Special tool	As link in the work instructions	New
Genset operating manual	Work instructions	New numbering system and new competence levels
Genset operating manual	Transfer	To a new editorial system
OL-MRA10 / 52-10-03	Visually inspecting the coupling [▶ 571]	Changed work instructions
OL-MRA10 / 43-17-01	Checking the wastegate [▶ 501]	Technical data changed
OL-MRA10 / 48-30-10	Removing and installing the mixture pressure sensor (V12 engine with wastegate) [▶ 534]	New work instructions
OL-MRA10 / 01-50-01	Checking the crankcase ventilation (model UPF) [▶ 317]	New work instructions
Glossary	List of abbreviations	Last page of documentation

2 Safety information

2.1 General safety notes

General safety notes can be found in the [Safety and Product Information Specification](#).

You can retrieve the document from the Service Library.

Follow all information in this specification.

2.2 Information on operating media

All information on operating media can be accessed in the Service Library. When using operating media, observe the respective specification:

- [Specification for fuel gas](#)
- [Specification for auxiliary media](#)
- [Specification for coolant](#)
- [Specification for lube oil](#)
- [Specification for combustion air](#)

3 Technical data

Contents

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3.1 Genset product data

All product data for the genset can be found on the genset data sheet, see *Operating Manual, chapter General, section Specifications*.

3.2 Technical data

3.2.1 Genset

3.2.1.1 Genset rating plate



9007200903634187

- 1 Power code
- 2 Manufacturer
- 3 Year of manufacture
- 4 Rated power factor
- 5 Maximum ambient temperature (degrees Celsius)
- 6 Rated voltage (volts)
- 7 Mass (kilograms)
- 8 Fuel
- 9 Power class according to DIN 8528-5
- 10 Rated current (Ampere)
- 11 Rated frequency (Hertz)
- 12 Maximum installation height (meters)
- 13 Rated power (kilowatts)
- 14 Serial number

3.2.1.2 Tightening specifications for metric coarse pitch thread

The following table is valid for all screw connections for which component-specific torque data have not been specified.

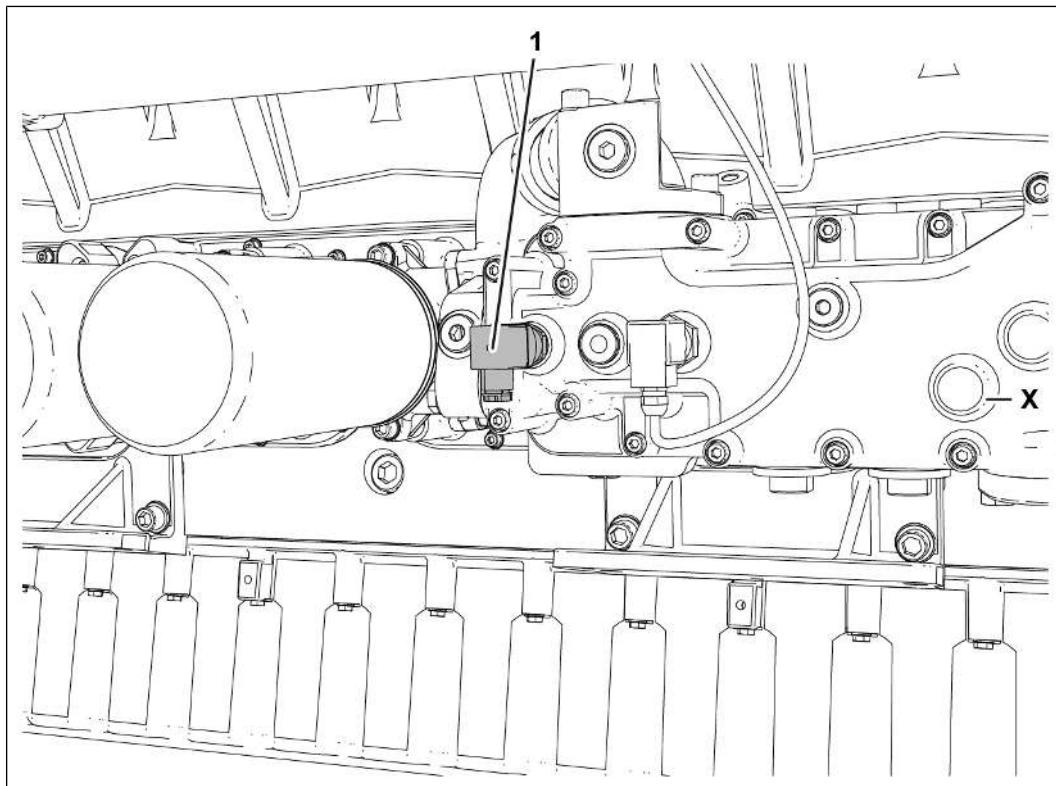
Standard metric thread*	Torque for each strength class		
	8.8	10.9	12.9
M4	2.5 Nm	3.5 Nm	4.5 Nm
M5	5.0 Nm	7.5 Nm	8.5 Nm
M6	8.5 Nm	13 Nm	15 Nm
M8	20 Nm	30 Nm	36 Nm
M10	42 Nm	60 Nm	70 Nm
M12	70 Nm	110 Nm	120 Nm
M14	110 Nm	170 Nm	200 Nm
M16	180 Nm	260 Nm	300 Nm
M18	260 Nm	360 Nm	420 Nm
M20	360 Nm	500 Nm	600 Nm
M22	480 Nm	700 Nm	800 Nm
M24	600 Nm	850 Nm	1000 Nm
M27	900 Nm	1300 Nm	1500 Nm
M30	1200 Nm	1700 Nm	2000 Nm
*) The table applies to all screw connections for which component-specific torque data have not been specified.			

3.2.1.3 Tightening specifications for union nuts

Union nut	
Pipe diameter	Torque
6 mm	35 Nm
8 mm	45 Nm
10 mm	60 Nm
12 mm	75 Nm

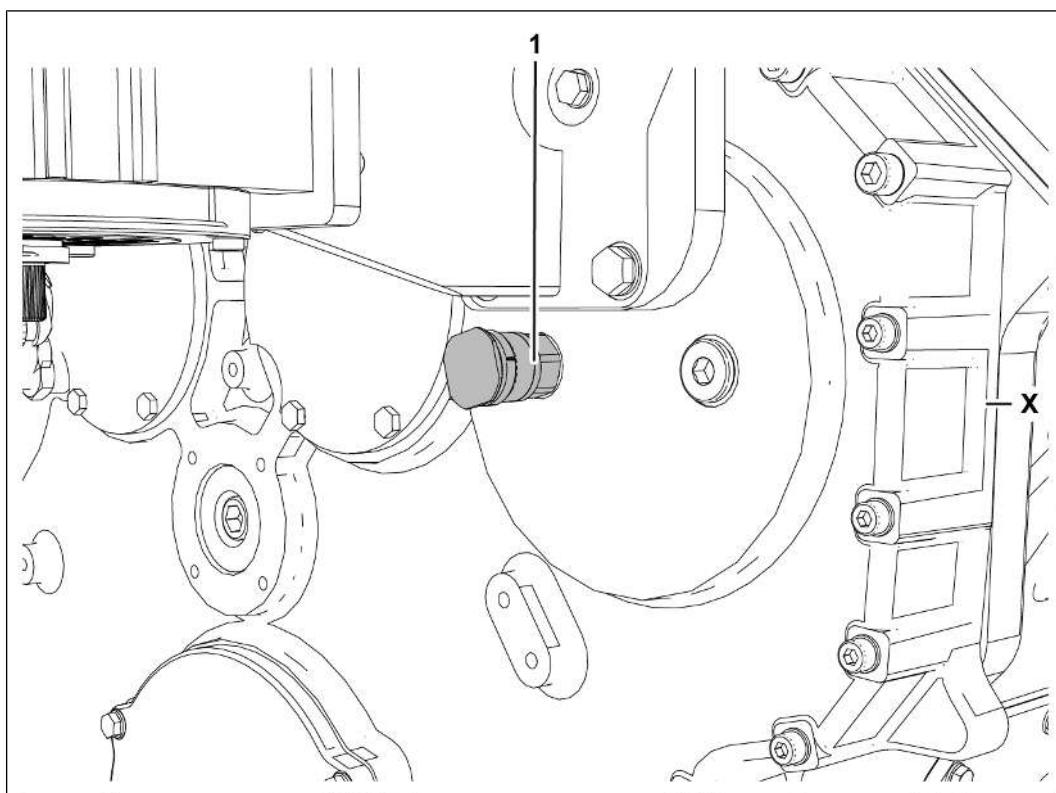
3.2.2 Pressure sensor

3.2.2.1 Technical data



2666440971

Lube oil pressure sensor on lube oil cooler			
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
¹⁾ Renew sealing ring.			

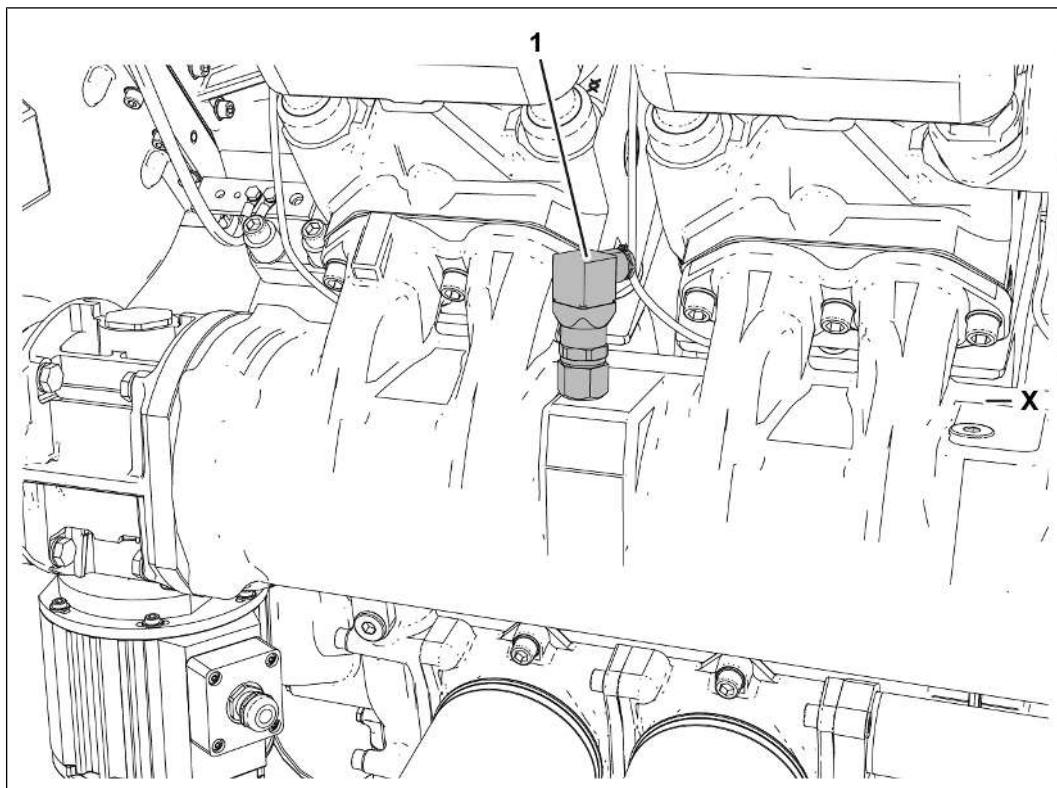


2665808267

Crankcase pressure sensor on cover

1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

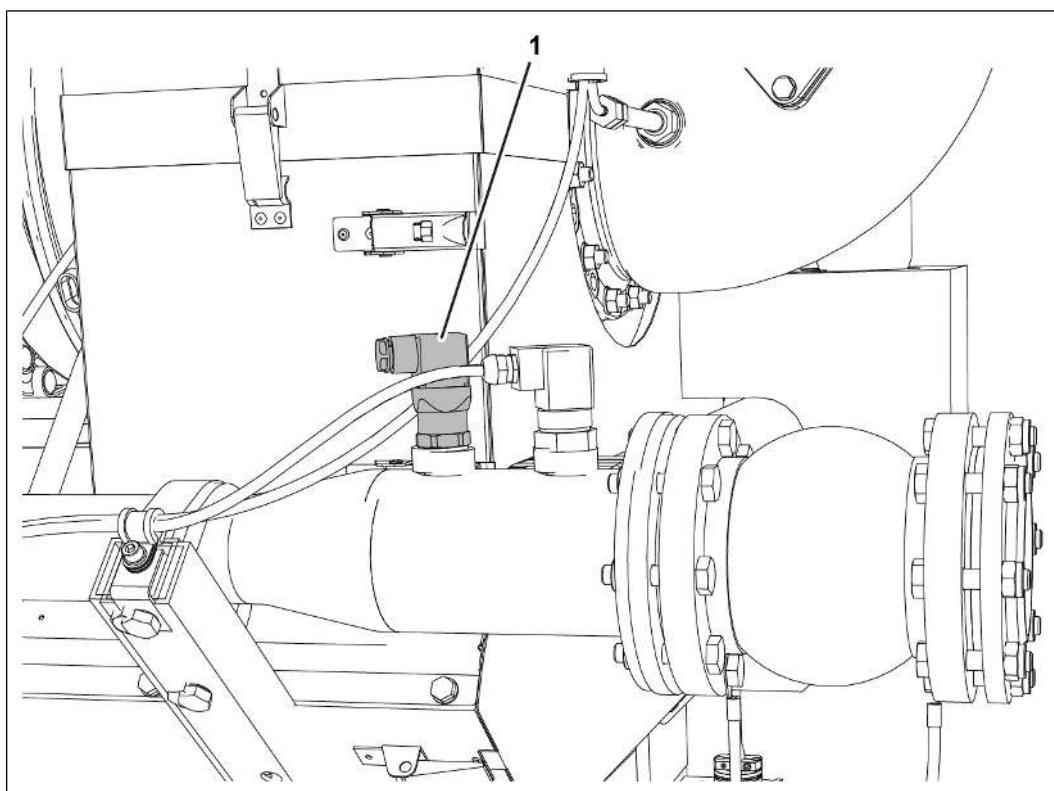


2666325131

Mixture pressure sensor on mixture pipe

1.	Pressure sensor ¹⁾	M14 x 1.5	10 Nm
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¹⁾ Renew sealing ring.

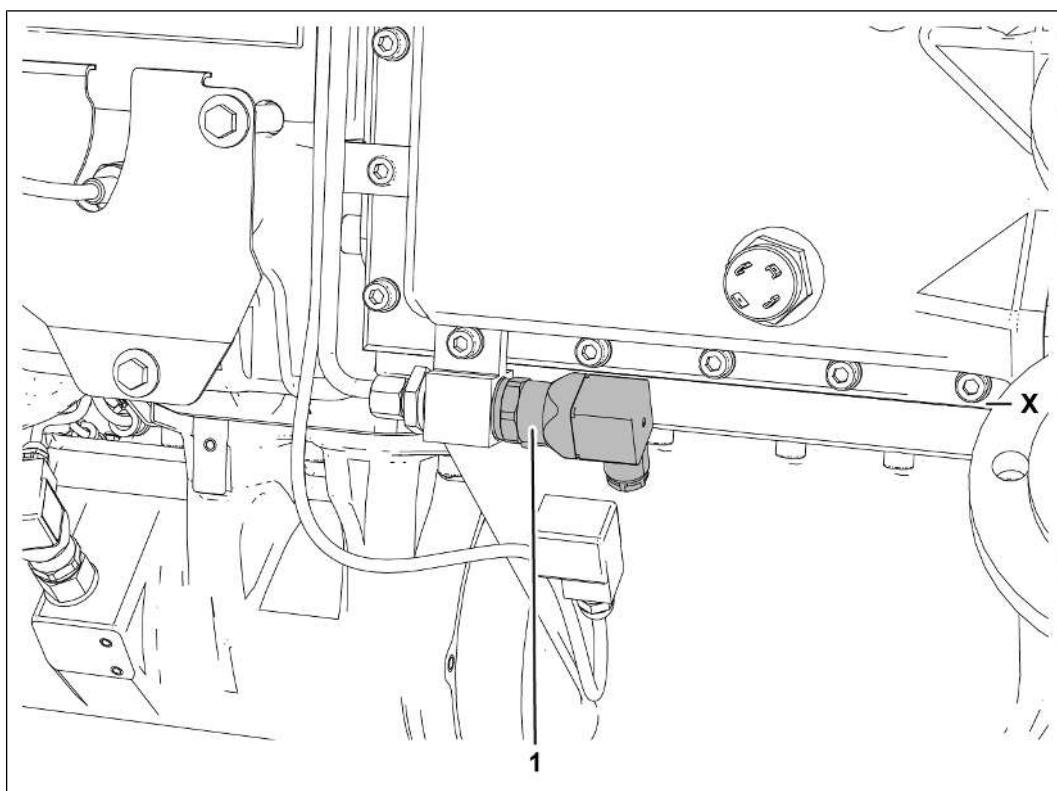


2671698955

Coolant pressure sensor on coolant pipe

1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.



3151413515

Mixture pressure sensor on line			
1.	Pressure sensor ¹⁾	M14 × 1.5	10 Nm
¹⁾ Replace sealing ring.			

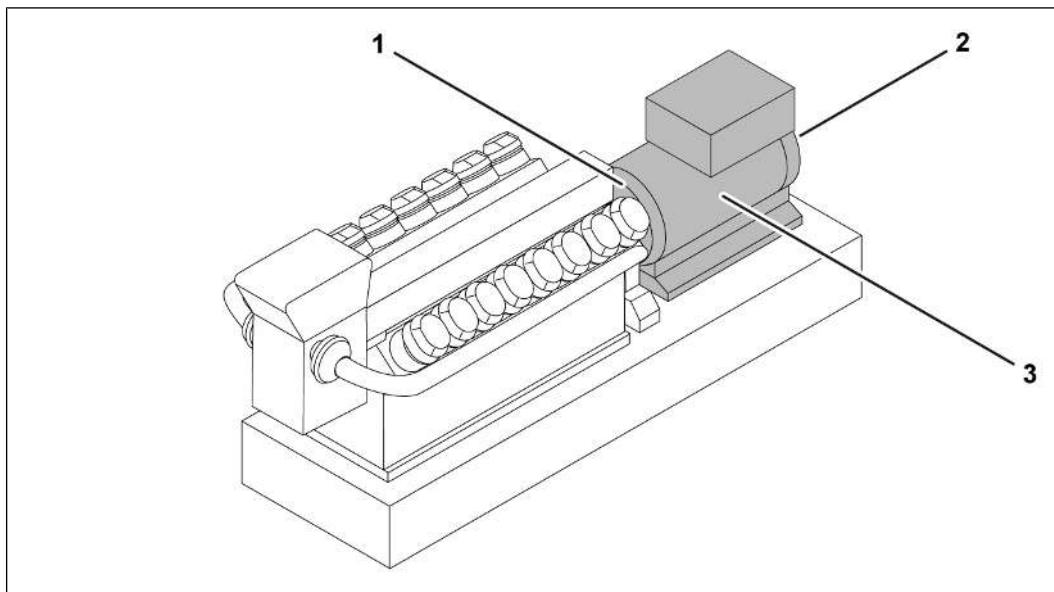
3.2.3 Generator

Part number: (null)

3.2.3.1 Rating plate

Position

The rating plate is attached to the side of the generator.



1895445003

- 1 Drive end (DE)
- 2 Non-drive end (NDE)
- 3 Generator side with rating plate

Description

Caterpillar Energy Solutions GmbH Manufactured by Marelli Motori Spa					CE		
3~GENERATOR					Prod. (1)		
Type (2)	Nr. (3)			I.CI. (4)			
Code (5)	T.amb. (6) °C			Cos. φ (7)			
Serv. (8)	IP (9)	kg (10)		EXCIT.		Δ T	
kVA (11)	V (12)	A (13)	Hz (14)	min ⁻¹ (15)	V (16)	A (17)	Cl. (18)
BEARING TYPE AND LUBRICATION							
D-End (19)	(21)	h	(23)	g			(25)
N-End (20)	(22)	h	(24)	g			
(26) Grease 3x amount shown prior to first start							
Made in Italy				IEC 60034-1 / EN 60034-1			

1944825227

-
- 1 Date of manufacture
 - 2 Generator type designation
 - 3 Serial number
 - 4 Insulation class
 - 5 Generator code
 - 6 Ambient temperature (degrees Celsius)
 - 7 Power factor (in cosine phi)
 - 8 Type of application (e.g. S1: continuous operation)
 - 9 Degree of protection (International Protection Code)
 - 10 Weight (in kilograms)
 - 11 Rated power (in kilovolt-amperes)
 - 12 Rated voltage (in volts)
 - 13 Rated current (in amperes)
 - 14 Frequency (in hertz)
 - 15 Speed (in revolutions per minute)
 - 16 Rated exciter voltage (in volts)
 - 17 Rated exciter current (in amperes)
 - 18 Heating class
 - 19 Generator bearing type at drive end
 - 20 Generator bearing type at non-drive end
 - 21 Lubrication interval for drive end generator bearing (in operating hours)
 - 22 Lubrication interval for non-drive end generator bearing (in operating hours)
 - 23 Lubrication quantity for drive end generator bearing (in grams or liters)
 - 24 Lubrication quantity for non-drive end generator bearing (in grams or liters)
 - 25 Lube oil type (lubricating grease for generators with rolling bearings or lube oil for generators with sleeve bearings)
 - 26 Note for generators with rolling bearings: "Before the first start, fill with 3x as much lubricating grease as specified".

Type designation

Type		Explanation
MJ	B	Generators for low voltage industrial applications
	H	Generators for medium or high voltage industrial applications

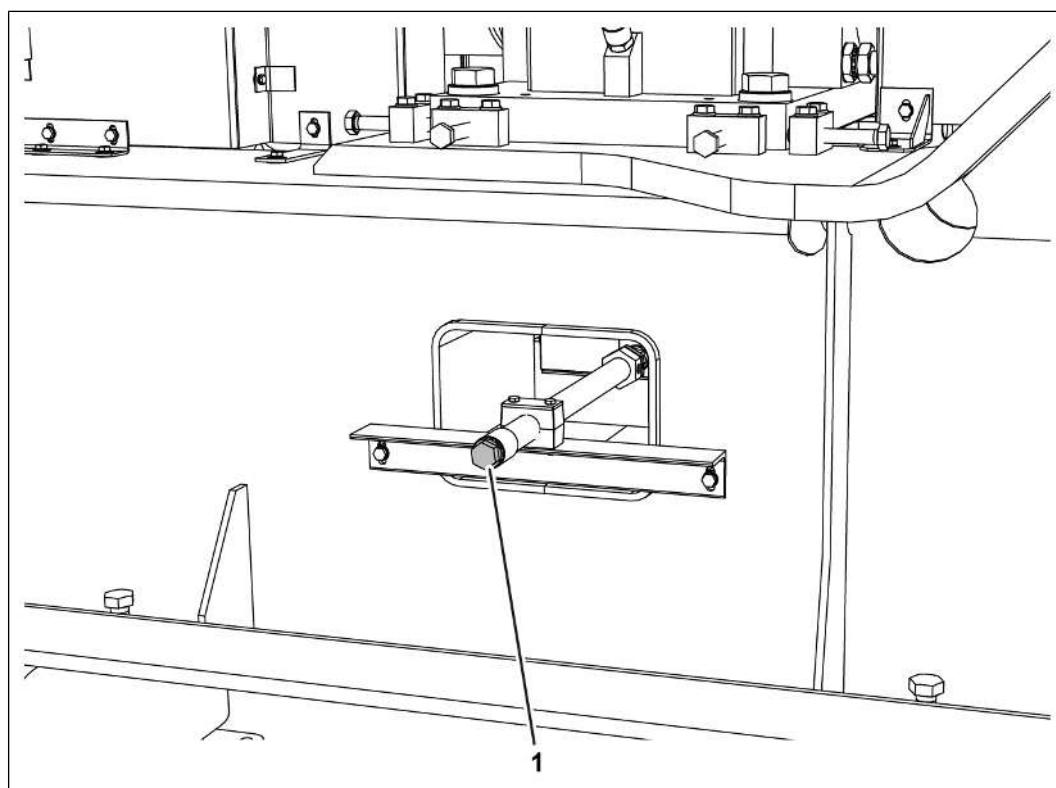
3.2.3.2 Tightening specifications for generator types MJB and MJH

Tightening torques for screw thread with strength class 8.8 in Nm (0/+5 %)							
Type of use	M5	M6	M8	M10	M12	M14	M16
Securing connections between steel components (such as covers, feet, etc.)	5.8	10	25	48	85	130	200
Securing connections between components where at least one component is made of cast iron (such as generator shields, etc.)	5.2	9	22	42	75	115	180
Securing connections between components where at least one component is made of aluminum (such as covers, permanent magnet generators (PMGs), etc.)	4.6	8	20	38	65	100	160

Tightening torques for screw thread with strength class 8.8 in Nm (0/+5 %)							
Type of use	M18	M20	M22	M24	M27	M30	1/4"
Securing connections between steel components (such as covers, feet, etc.)	290	400	560	700	1050	1400	—
Securing connections between components where at least one component is made of cast iron (such as generator shields, etc.)	260	360	500	600	900	1250	—
Securing connections between components where at least one component is made of aluminum (such as covers, permanent magnet generators (PMGs), etc.)	230	320	440	550	800	1100	—

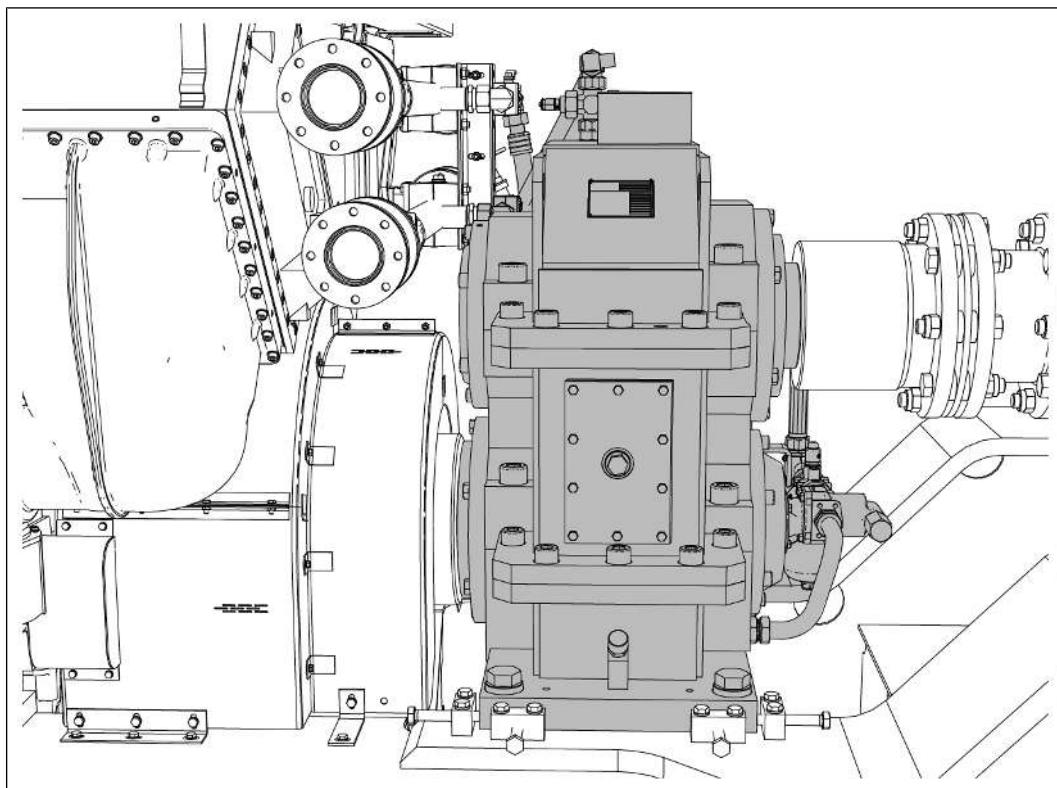
3.2.4 Transmission

3.2.4.1 Technical data



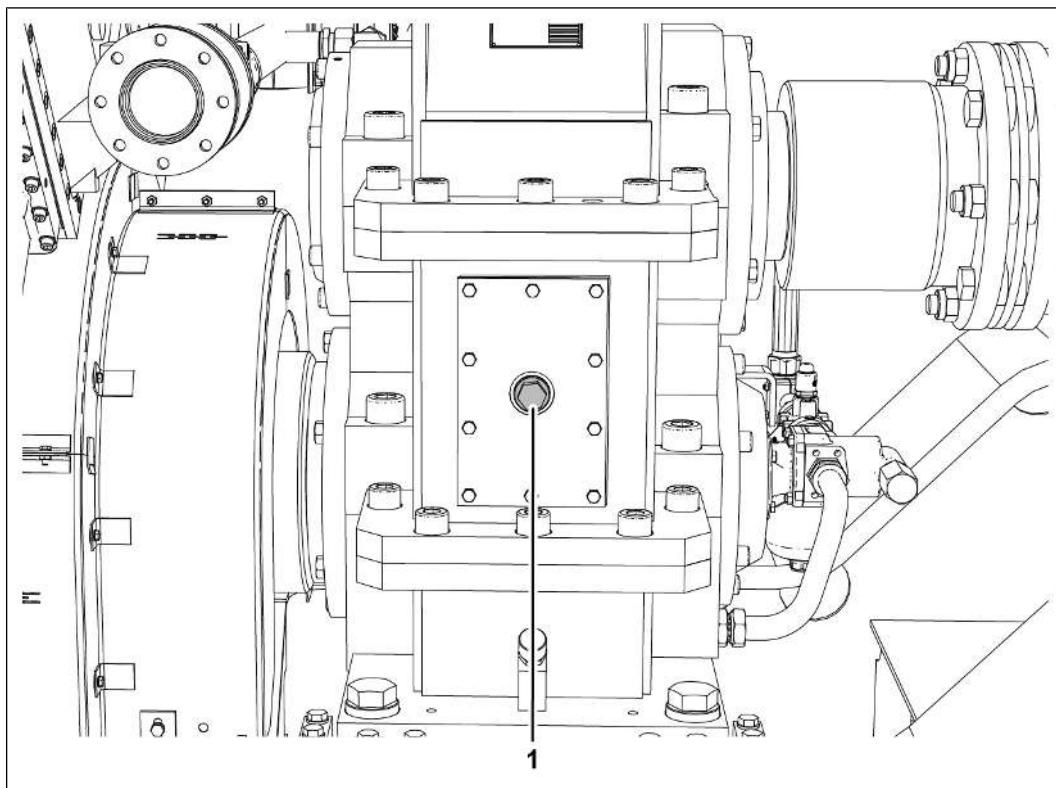
2022315147

Drain screw on lube oil pipe	
1.	Screw ¹⁾ Hand tight
¹⁾ Renew sealing ring.	



2022957963

Standard values			
Metric	Unit	Description	Value
M12	Screw	Value to add	78 Nm
M16	Screw	Value to add	190 Nm
M20	Screw	Value to add	370 Nm
M24	Screw	Value to add	640 Nm
M30	Screw	Value to add	1280 Nm
M36	Screw	Value to add	2220 Nm
M42	Screw	Value to add	3560 Nm
M48	Screw	Value to add	5370 Nm



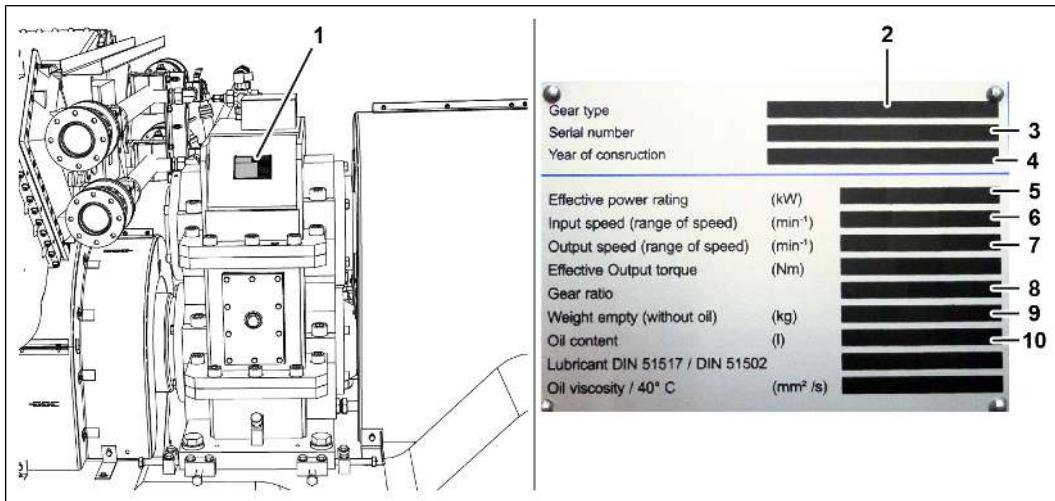
2022317579

Filler screw on inspection hole cover

1.	Screw ¹⁾	Hand tight
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¹⁾Renew sealing ring.

3.2.4.2 Rating plate Transmission



2800807563

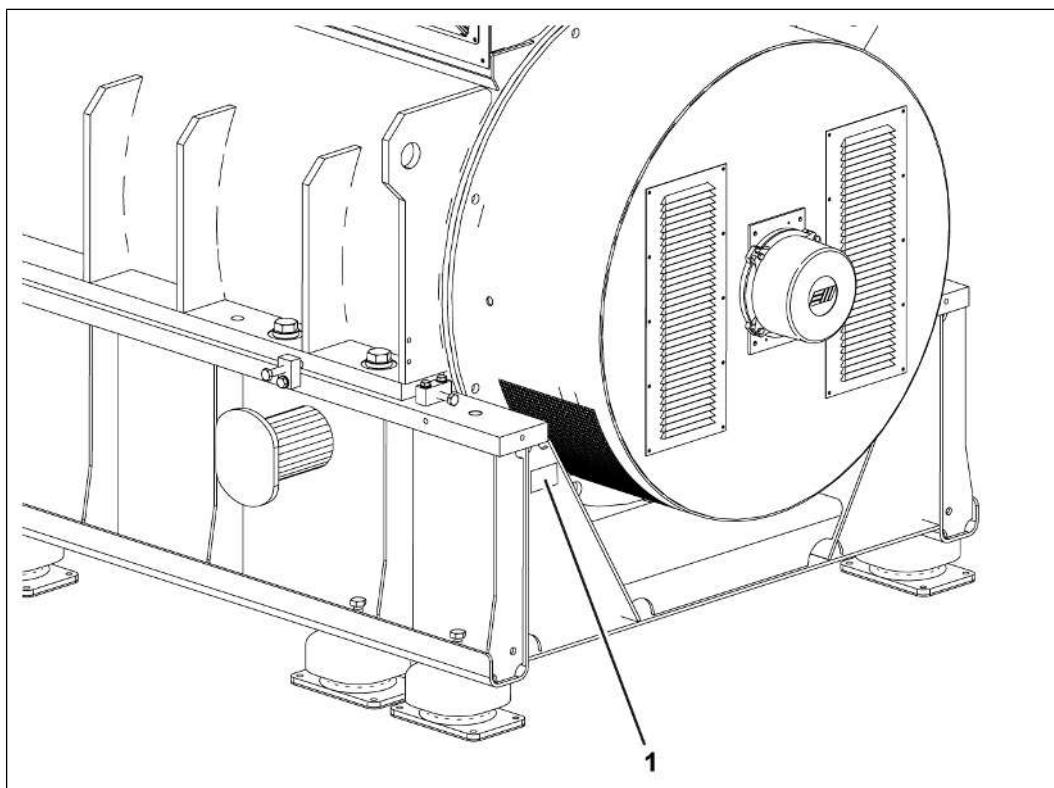
- 1 Position on transmission
- 2 Transmission type
- 3 Serial number
- 4 Year of manufacture
- 5 Power
- 6 Input speed
- 7 Output speed
- 8 Transmission ratio
- 9 Net weight
- 10 Lube oil amount

The rating plate (1) is attached to the transmission.

- Specific technical data are shown.

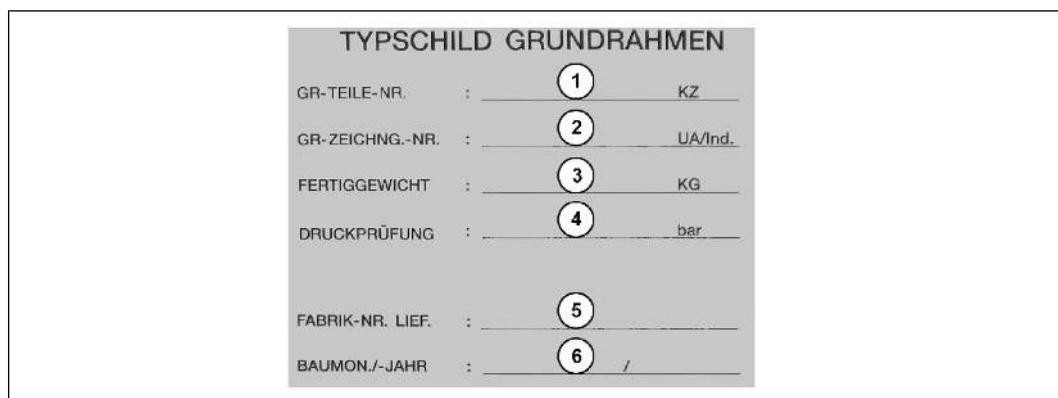
3.2.5 Base frame

3.2.5.1 Base frame rating plate



1071742731: Position on the base frame

1 Rating plate

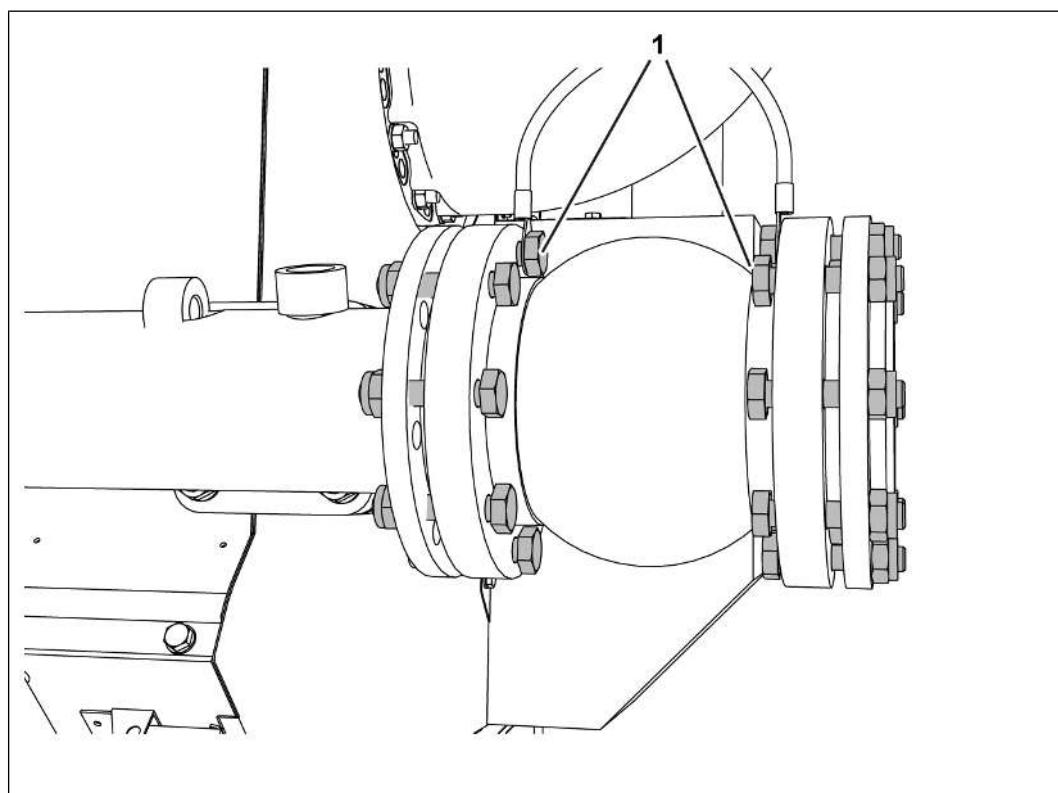


605088267: Rating plate

- 1 Base frame part number
- 2 Drawing number
- 3 Finished weight or empty weight for base frame with lube oil tank (kilograms)
- 4 Pressure test (bar)
- 5 Manufacturer's serial number
- 6 Year of construction (month/year)

3.2.6 Rubber expansion joint

3.2.6.1 Technical data



492132619

Rubber expansion joint on flange			
1	Screw ¹⁾	M10 x 30 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 30 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 40 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 45 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 50 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 55 - 8.8	20 Nm

¹⁾ Counterhold the nut when tightening.

3.2.7 Cooling system

3.2.7.1 Technical data

Hollow screws	
Size of thread	Torque
M8 x 1	12 Nm
M10 x 1	18 Nm
M12 x 1.5	29 Nm
M14 x 1.5	39 Nm
M16 x 1.5	49 Nm

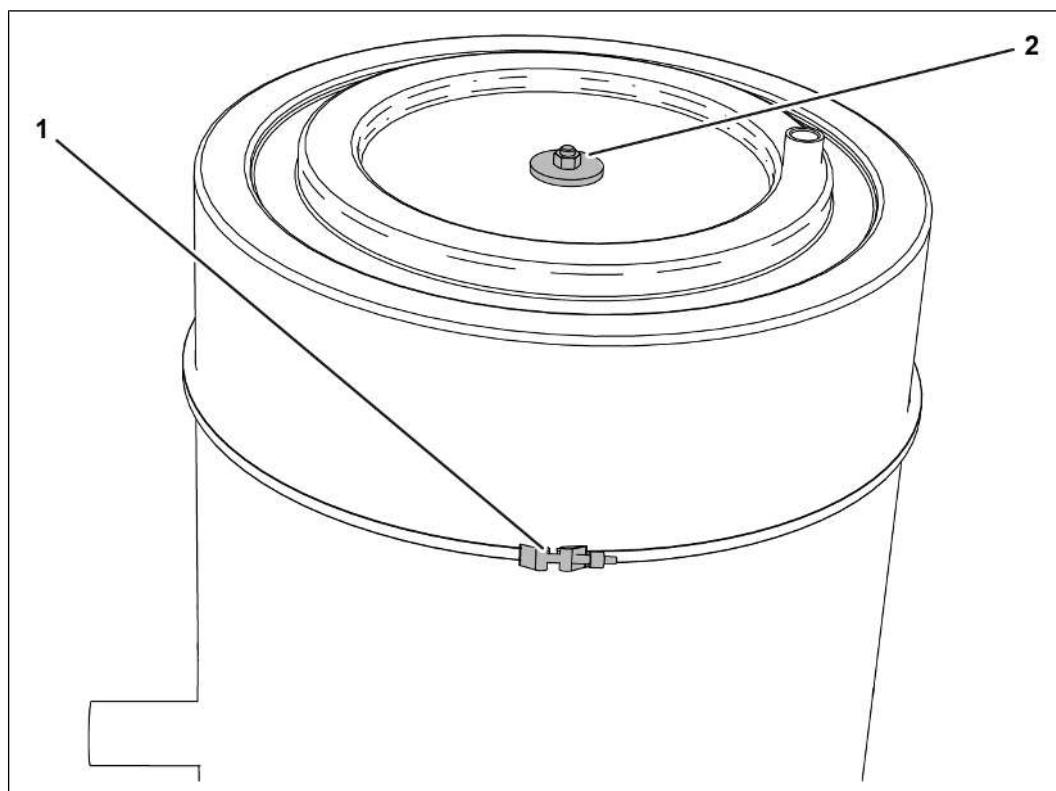
Union nut	
Pipe diameter	Torque
6 mm	35 Nm
8 mm	45 Nm
10 mm	60 Nm
12 mm	75 Nm

3.2.8 Crankcase**3.2.8.1 Technical data**

Crankcase chamber pressure	
On commissioning	-2 mbar to -4 mbar

3.2.9 Crankcase ventilation**3.2.9.1 Technical data**

Differential pressure at full load		
Inner filter insert	Stage 1	35 to 80 mm WS
Outer filter insert	Stage 2	0 to 1 mm WS
WS=water column		
Limit values for separating quality		
Inner filter insert	Stage 1	Max. 5 mg/m ³
Outer filter insert	Stage 2	Max. 0.1 mg/m ³

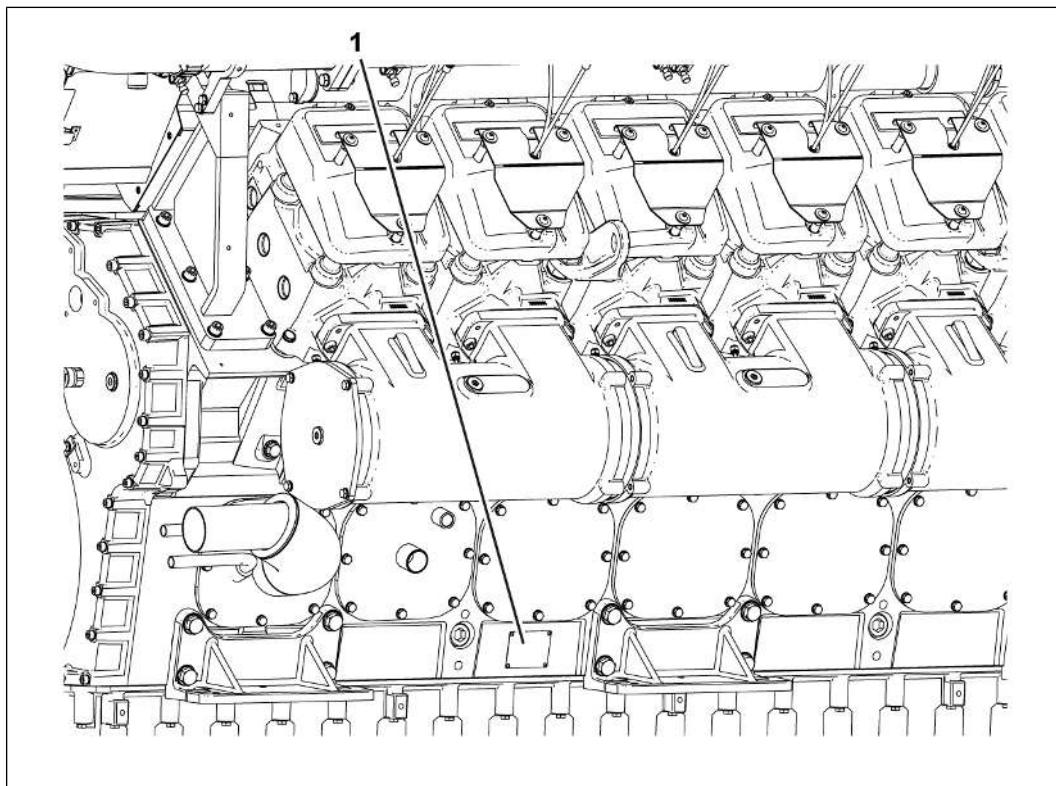


3011493387

Crankcase ventilation		
Clamping clip on filter housing		
1.	Screw	M8 x 60 Hand tight
Filter cover on housing		
2.	Nut	M10 10 Nm
Imbalance of the drum		
50 Hz	2810 rpm	Max. 7.0 mm/s
60 Hz	3340 rpm	Max. 8.0 mm/s

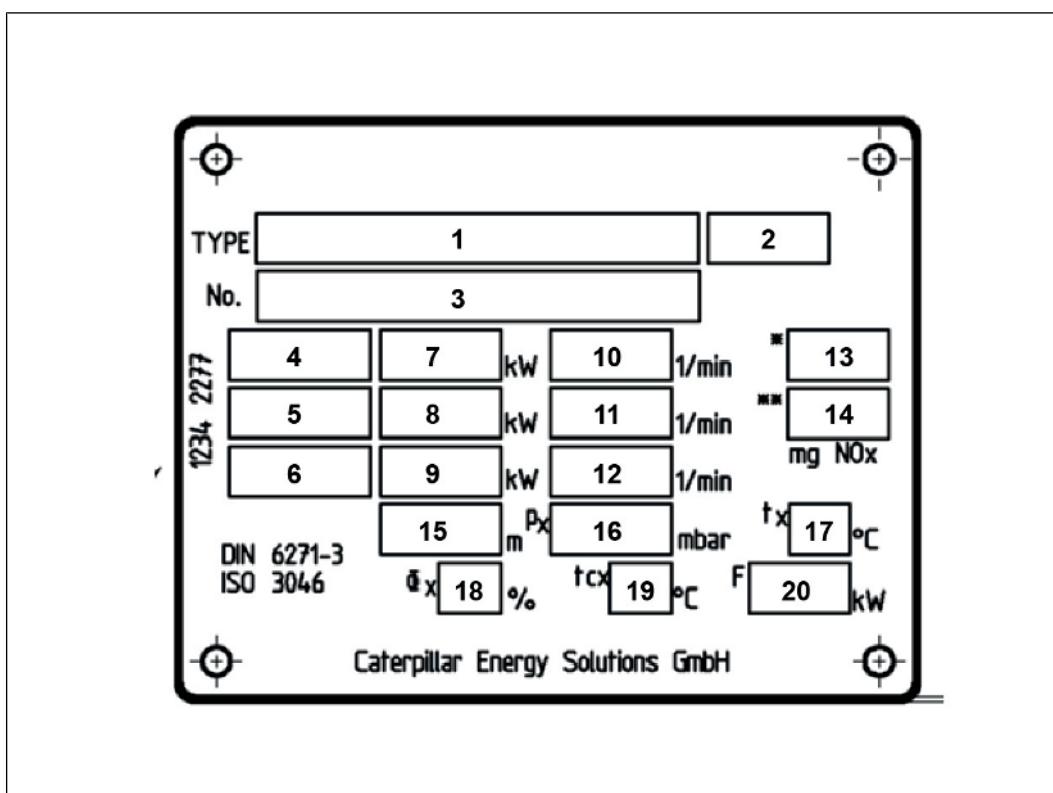
3.2.10 Engine

3.2.10.1 Engine rating plate



116337931

1 Rating plate



397495435

- 1 Designation of engine design
- 2 Year of construction
- 3 Engine number
- 4 Power code according to DIN ISO 3046 Part 7 and power code for the gas type, see Information on the power codes
- 5 As position 4
- 6 As position 4
- 7 Power (kilowatts)
- 8 As position 7
- 9 As position 7
- 10 Engine speed (revolutions per minute)
- 11 As position 10
- 12 As position 10
- 13 Nitrogen oxide emission (milligram)
- 14 As position 13
- 15 Maximum installation height (meters)
- 16 Air pressure at the installation location (millibar)
- 17 Charge air coolant temperature at the installation location (degree Celsius)
- 18 Relative humidity at the installation location (percent)
- 19 Mixture coolant temperature at the installation location (degree Celsius)
- 20 Lube oil pump power (kilowatts)

Information on the power codes

In this document, the following power codes are used:

- b = Biogas
- n = Natural gas
- s = Sewage gas
- l = Landfill gas
- m = Mine gas
- p = Propane gas

The symbols * or ** before the power codes refer to the corresponding nitrous oxide emission; refer to positions 13 and 14.

3.2.10.2 Type designation

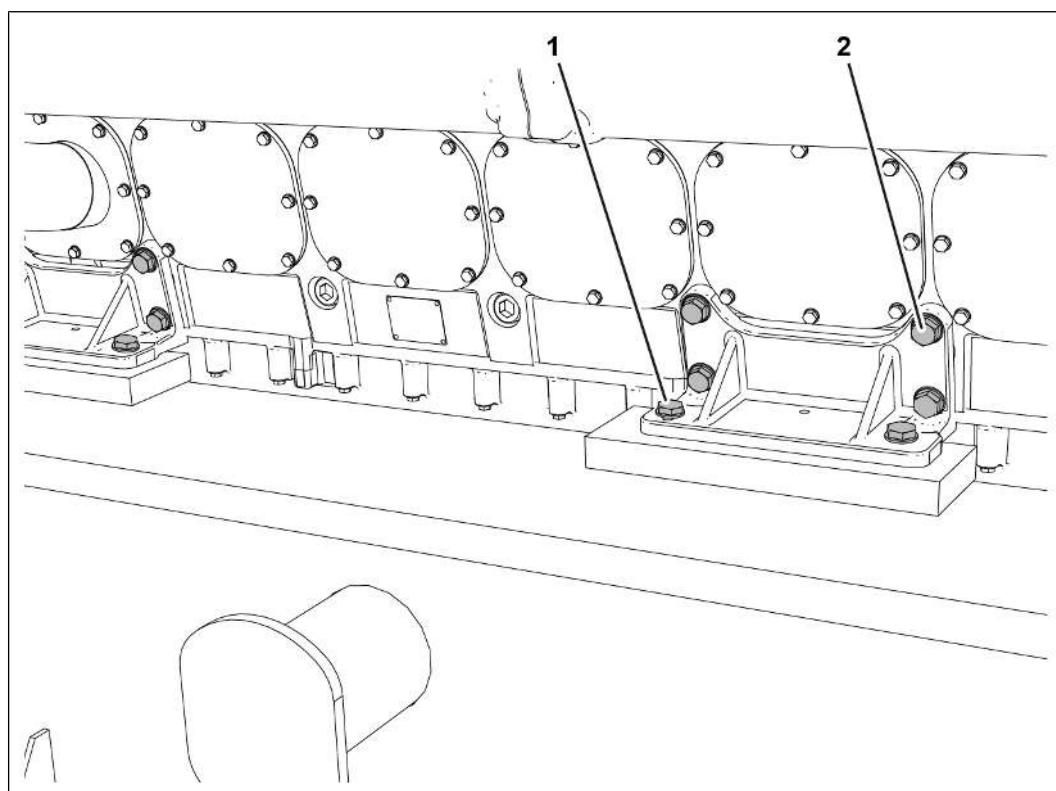
The type designation for an engine consists of a combination of the following letters, numbers and symbols:

- The letter **T** indicates the engine is equipped with an exhaust turbocharger.
- The letter **C** indicates the engine is equipped with a mixture cooler.
- The letter **G** indicates the engine type, e.g. Gas or Diesel.
- The four-digit sequence **xxxx** indicates the model series.
- The letter **V** indicates the engine arrangement, e.g. V-engine.
- The two-digit sequence **yy** indicates the number of cylinders.
- The string **z** is an additional identifier indicating, for example, the maximum power or the fuel gas that must be used.

3.2.10.3 Engine product data

All product data for the engine can be found on the engine data sheet, see *Operating Manual, chapter General Specifications*.

3.2.10.4 Technical data

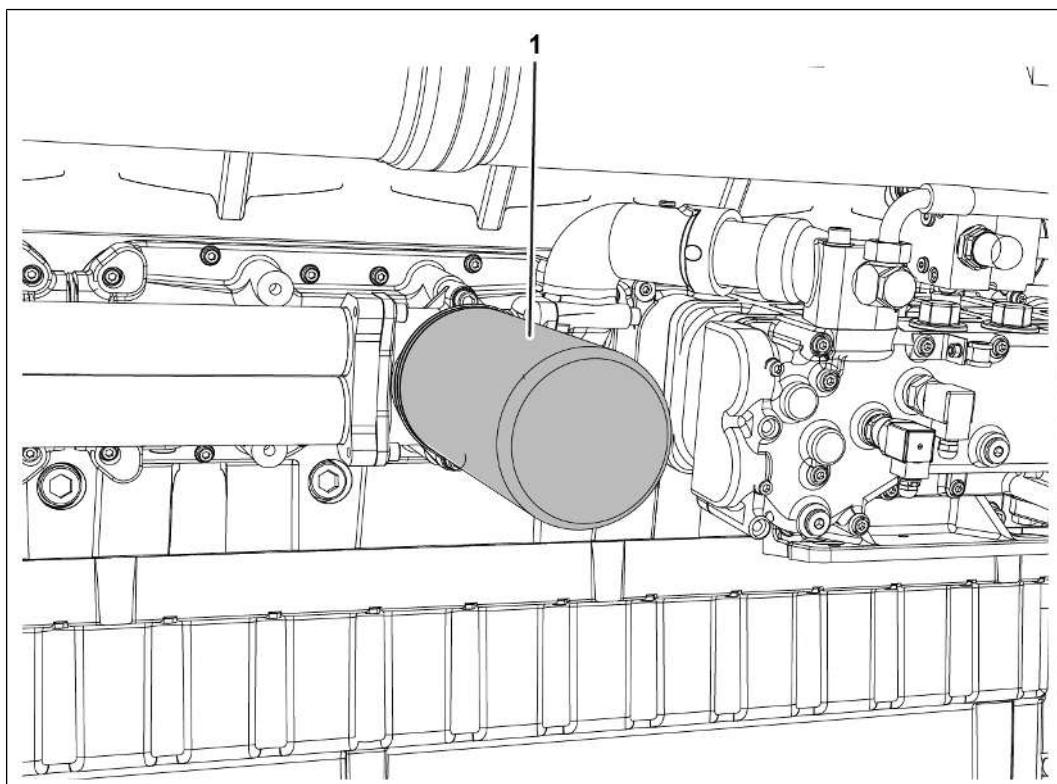


2663808139

Lug on crankcase			
1.	Screw	M16 x 40 - 10.9	180 Nm
Lug on base frame			
2.	Screw	M16 x 40 - 8.8	210 Nm

3.2.11 Lube oil filter

3.2.11.1 Technical data

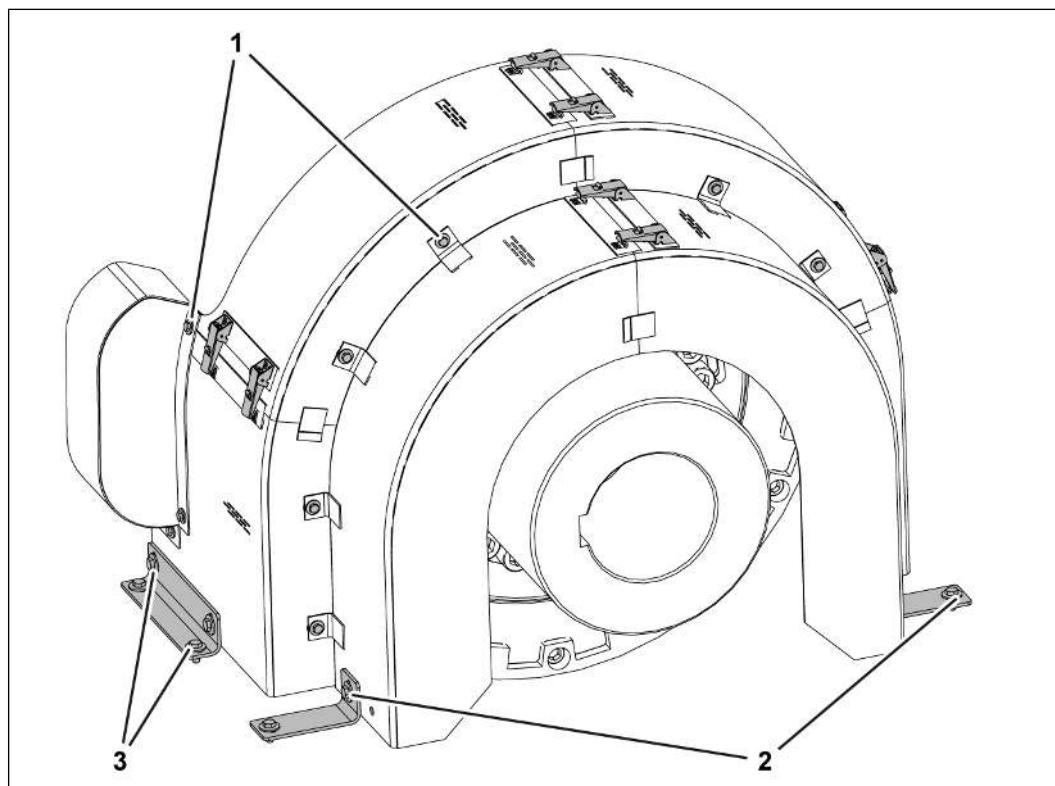


2623375755

Lube oil filter on holder			
1	Lube oil filter	Attach	Hand-tight until in contact with the seal
		Screw tight	Plus 1 turn
Wet the lube oil filter seal with lube oil.			

3.2.12 Flywheel

3.2.12.1 Technical data

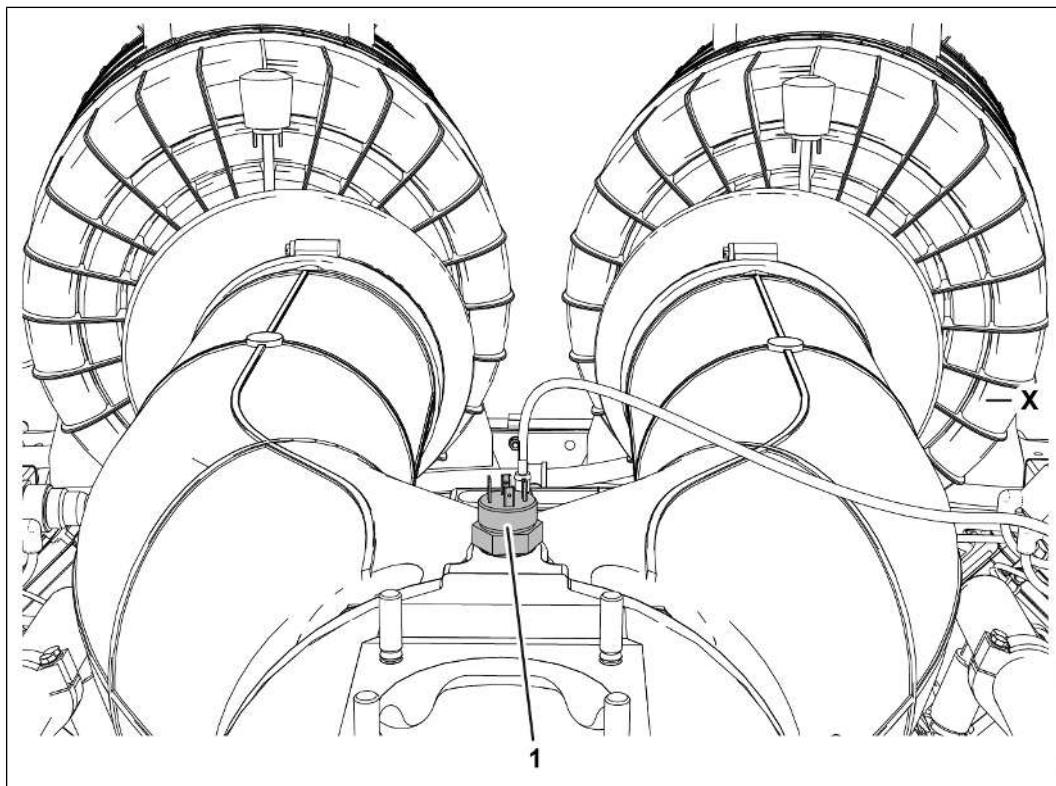


2672621963

Protective cover assembly			
1.	Screw	M6 x 16 - 8.8	10 Nm
2.	Screw	M8 x 20 - A4 - 70	10 Nm
Holder protective cover on base frame			
3.	Screw	M8 x 20 - A4 - 70	10 Nm

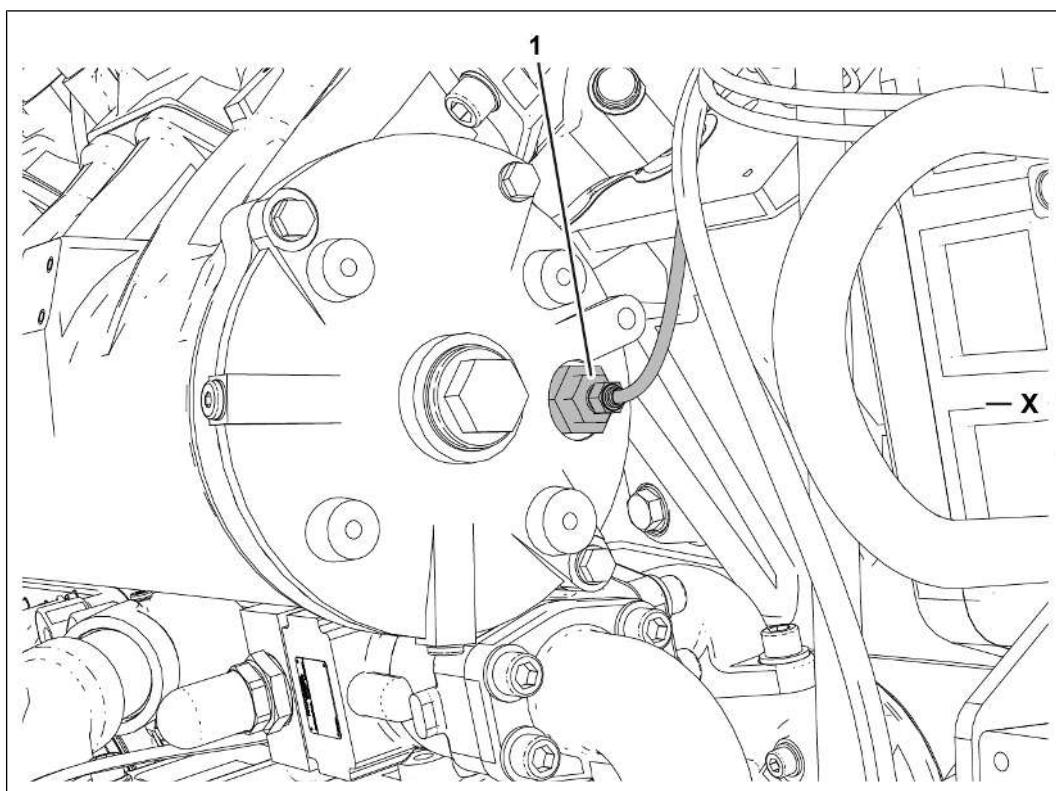
3.2.13 Temperature sensor

3.2.13.1 Technical data



2665850251

Intake air temperature sensor on manifold		
1.	Temperature sensor ¹⁾ G3/4 - 16 - 2 A	20 Nm
¹⁾ Renew sealing ring.		

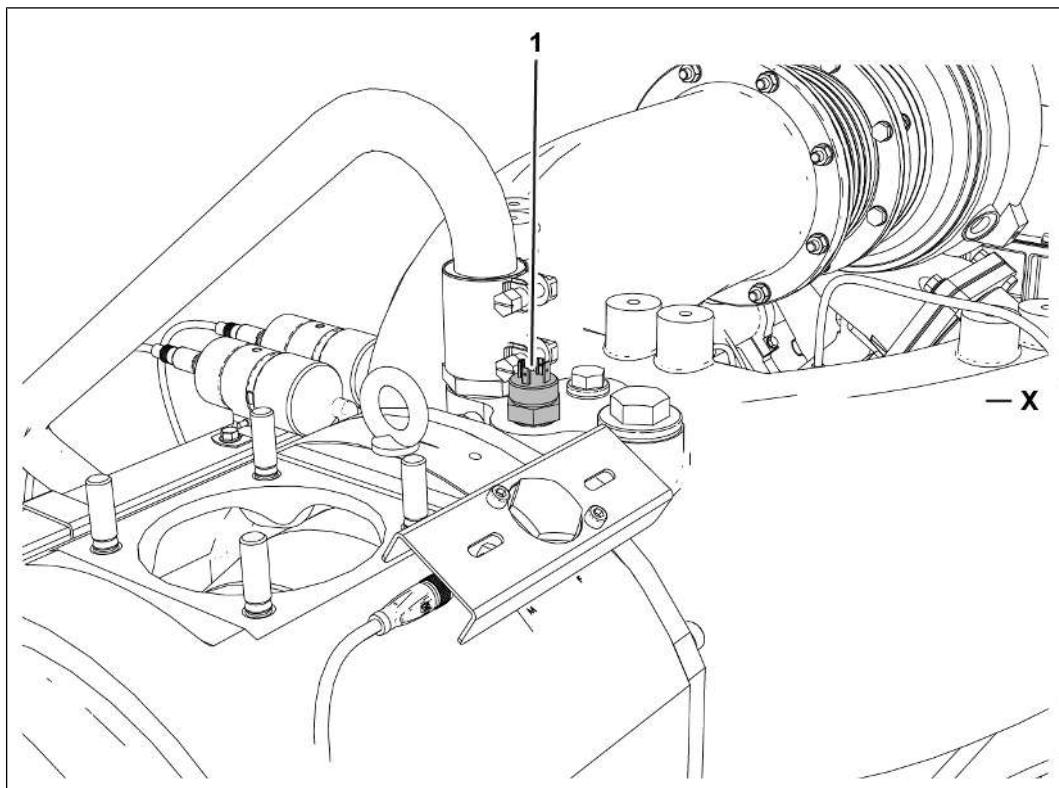


2665888907

Mixture temperature sensor on cover

1.	Temperature sensor ¹⁾	M12 x 1	15 Nm
----	----------------------------------	---------	-------

¹⁾ Renew sealing ring.

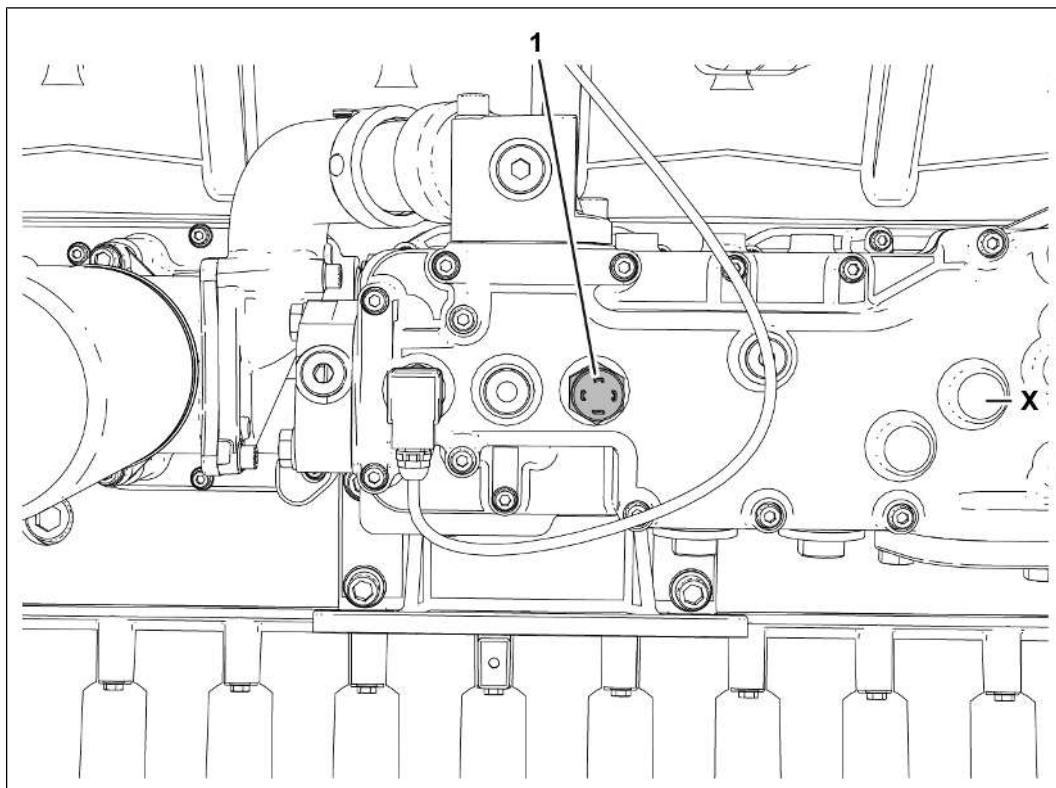


2666454027

Mixture temperature sensor on manifold

1.	Temperature sensor ¹⁾	G 1/2	20 Nm
----	----------------------------------	-------	-------

¹⁾ Renew sealing ring.

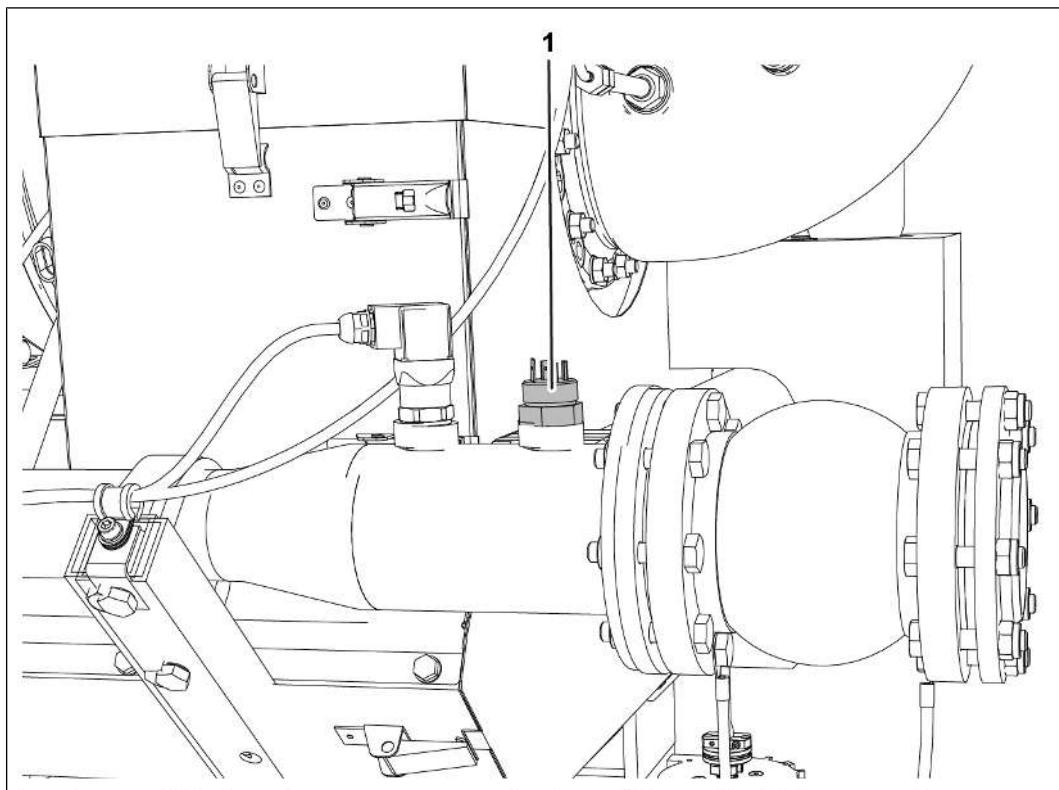


2666479883

Lube oil temperature sensor on lube oil cooler

1.	Temperature sensor ¹⁾	G1/2	20 Nm
----	----------------------------------	------	-------

¹⁾ Replace sealing ring.

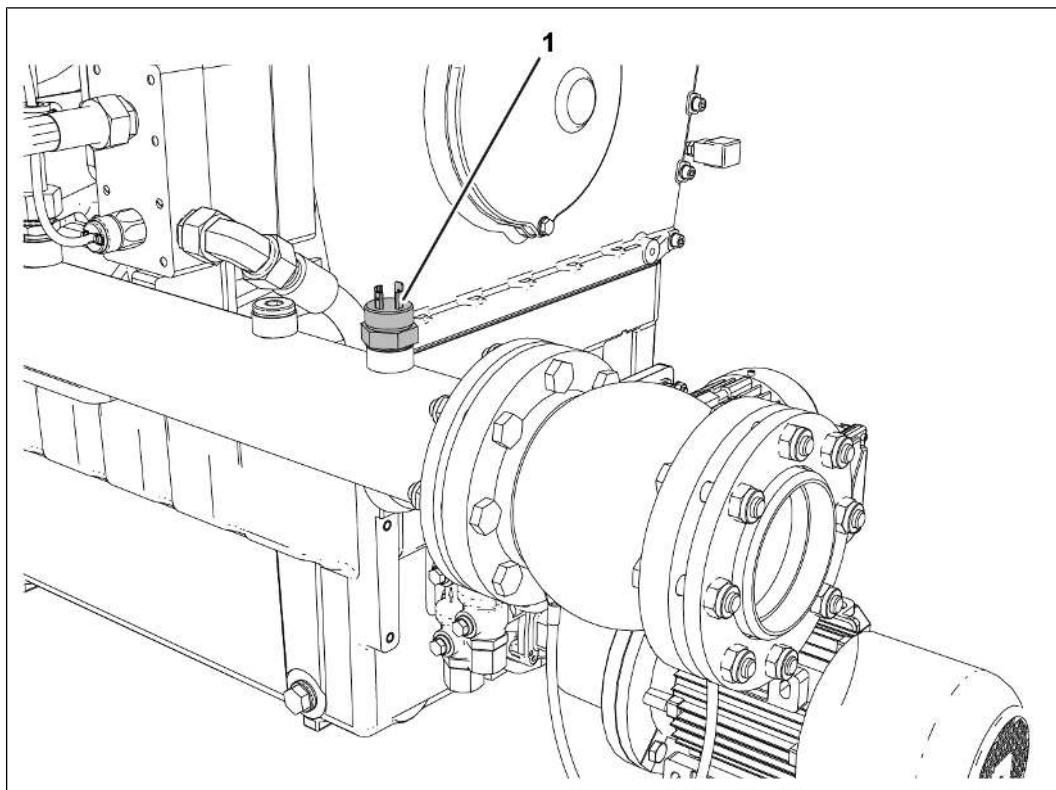


2671724811

Coolant temperature sensor on coolant pipe

1.	Pressure sensor ¹⁾	G 1/2	20 Nm
----	-------------------------------	-------	-------

¹⁾ Renew sealing ring.

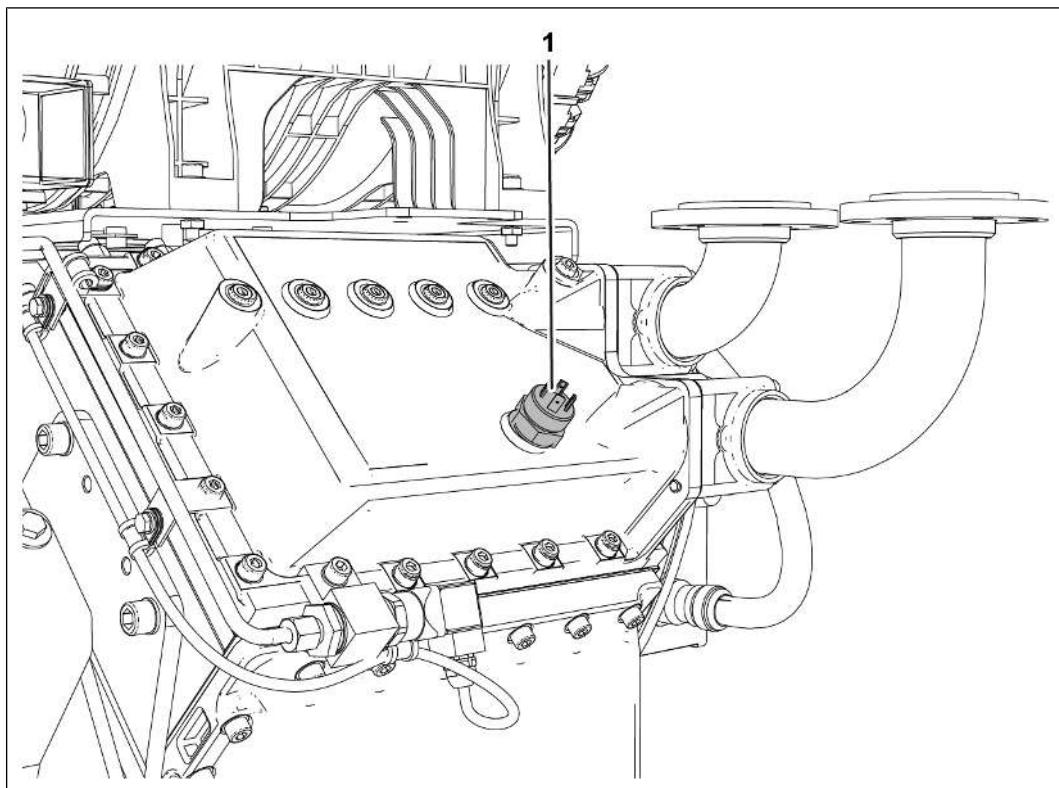


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Coolant temperature sensor on coolant pipe

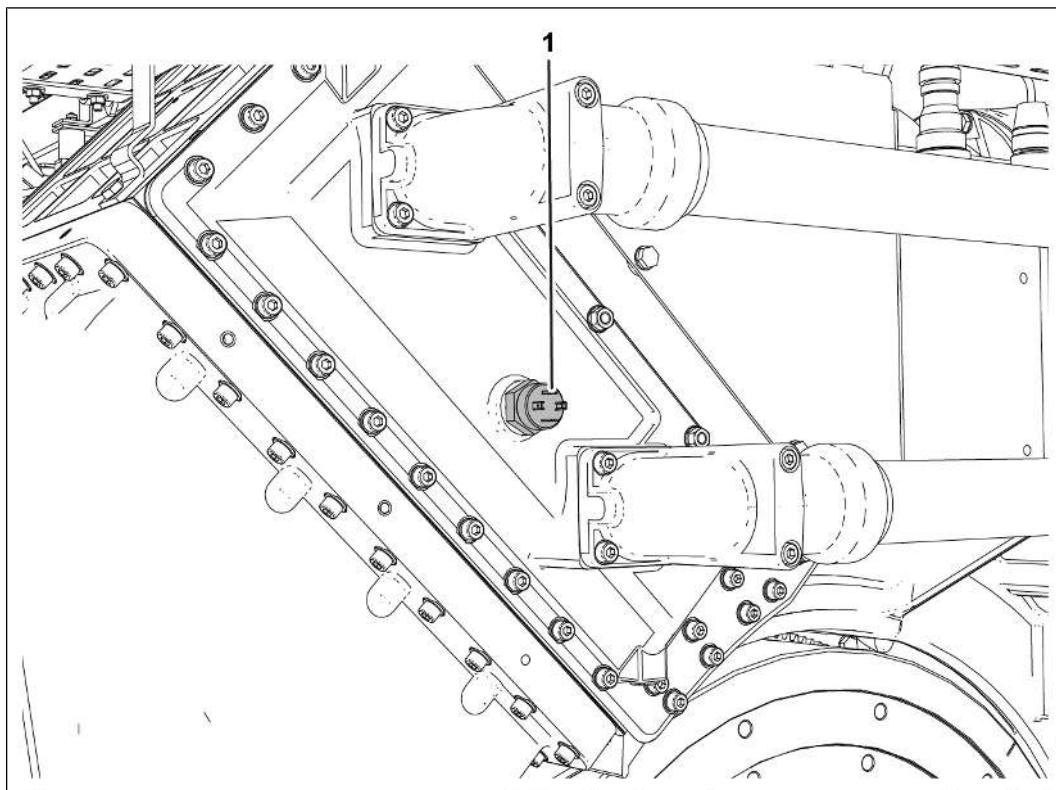
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
----	-------------------------------	-------	-------

¹⁾ Renew sealing ring.



2671814923: V12/V16 engine

Coolant temperature sensor on mixture cooler (V12/V16 engine)			
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
¹⁾ Renew sealing ring.			



2672502411: V20 engine

Coolant temperature sensor on mixture cooler (V20 engine)

1.	Pressure sensor ¹⁾	G 1/2	20 Nm
----	-------------------------------	-------	-------

¹⁾ Renew sealing ring.

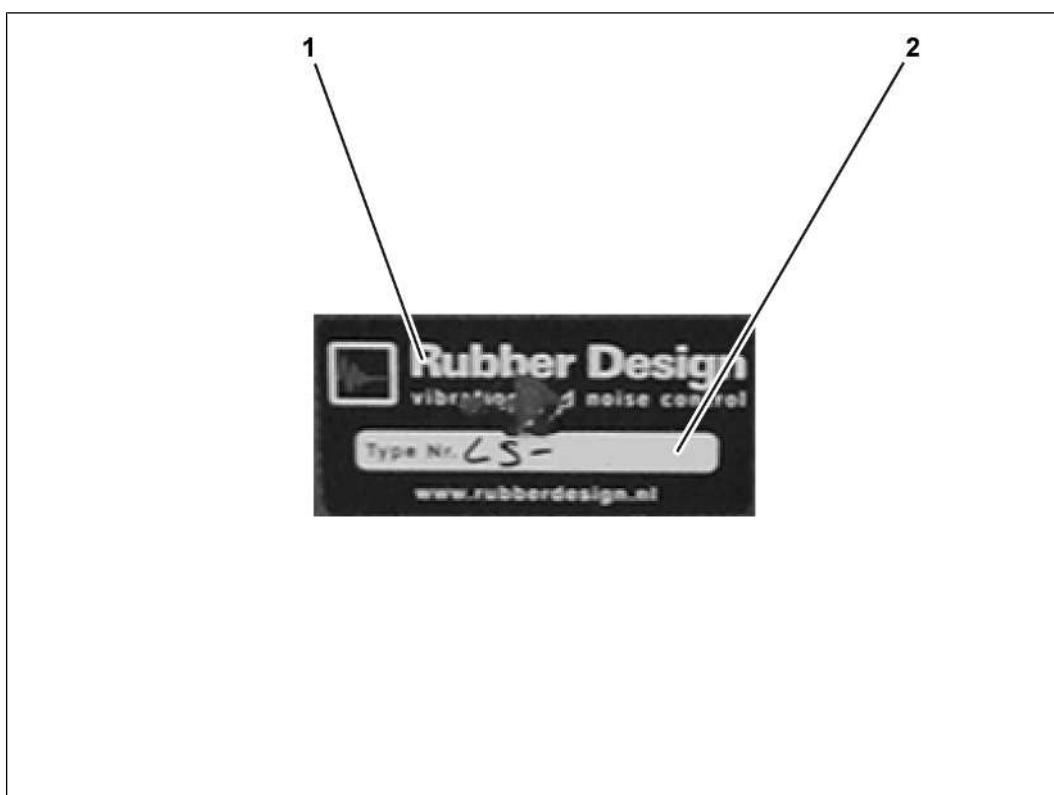
3.2.14 Anti-vibration mounting

3.2.14.1 Anti-vibration mounting rating plate



605032843: Position

1 Rating plate

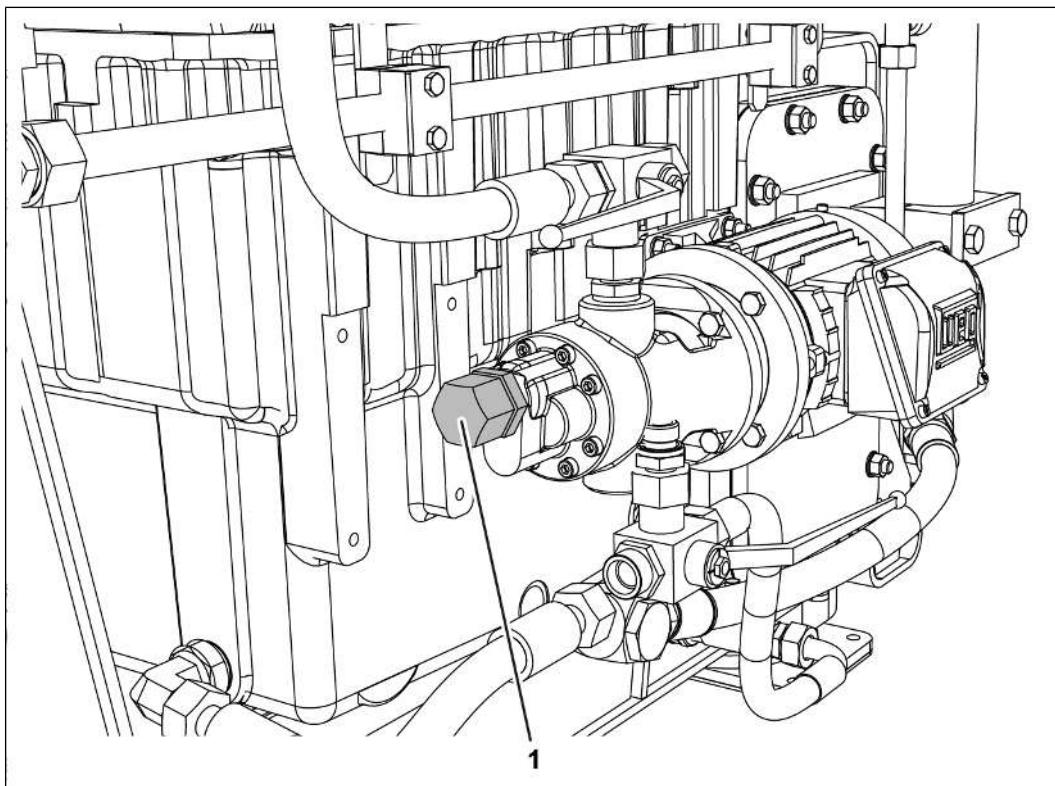


605030923: Rating plate

- 1 Manufacturer name
- 2 Type number

3.2.15 Prelubrication pump

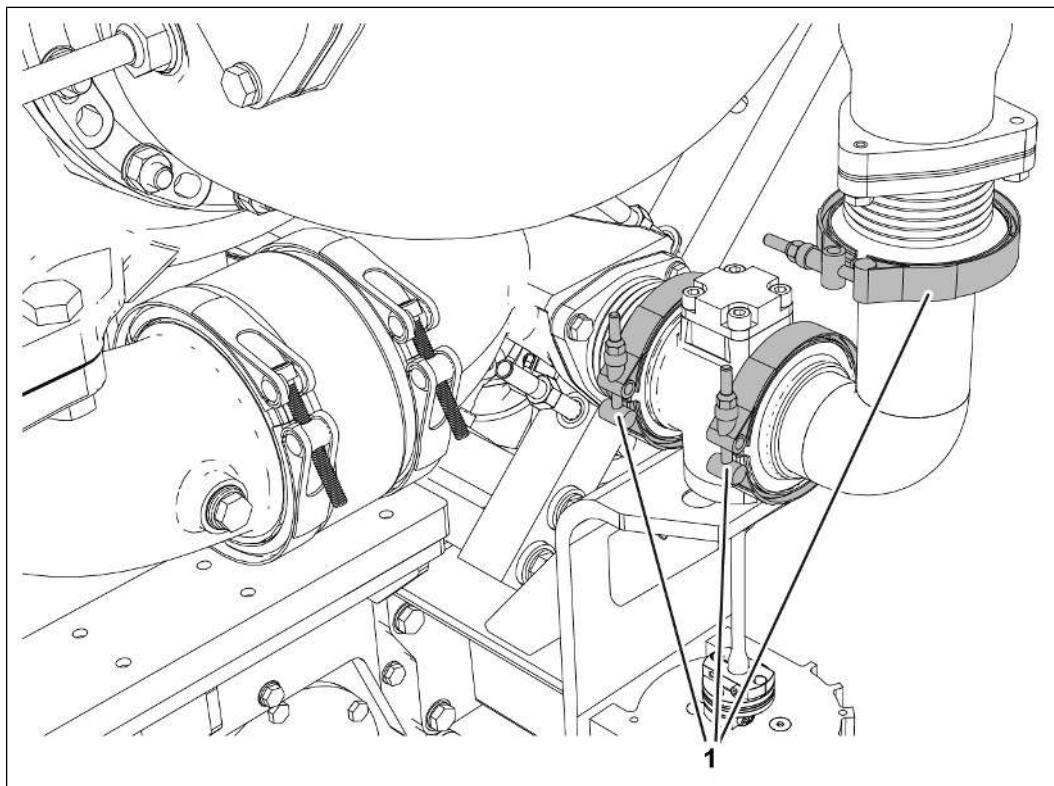
3.2.15.1 Technical data



2635507083

Pressure limiting valve on prelubrication pump

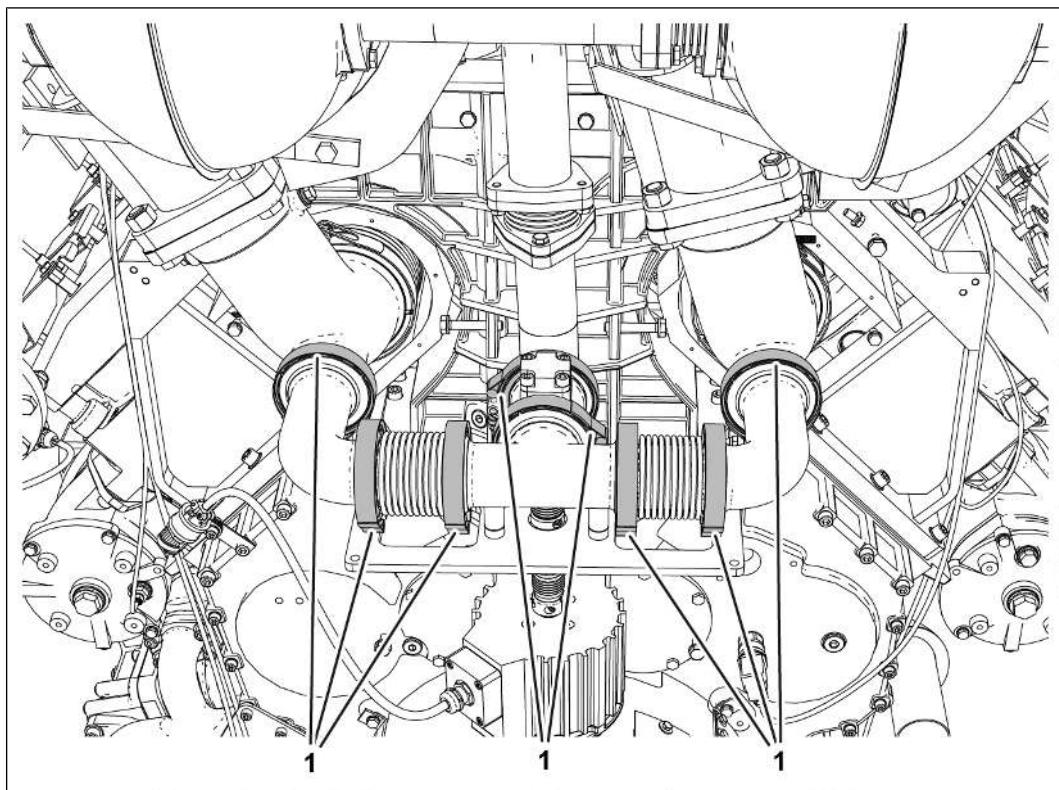
1.	Cap nut	M8	70 Nm
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3.2.16 Wastegate**3.2.16.1 Technical data**

2834306443

Wastegate clamping clip (V12 engine)

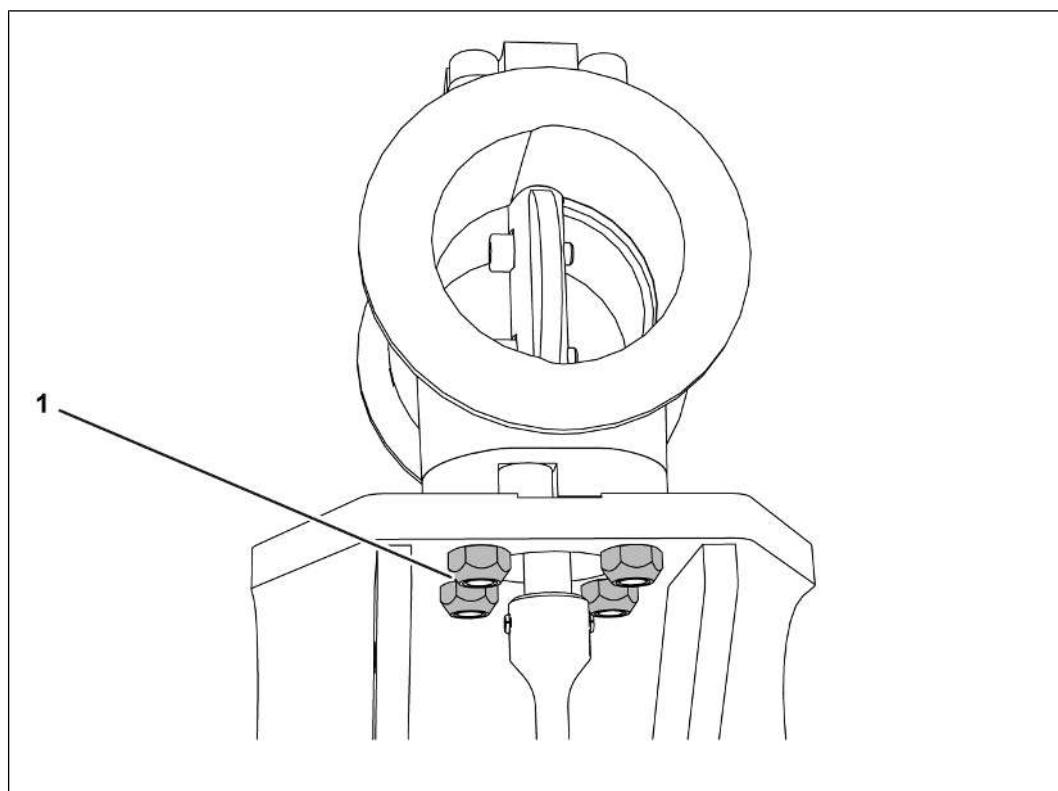
1.	Clamping clip	5 Nm
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2834308875

Wastegate clamping clip (V20 engine)

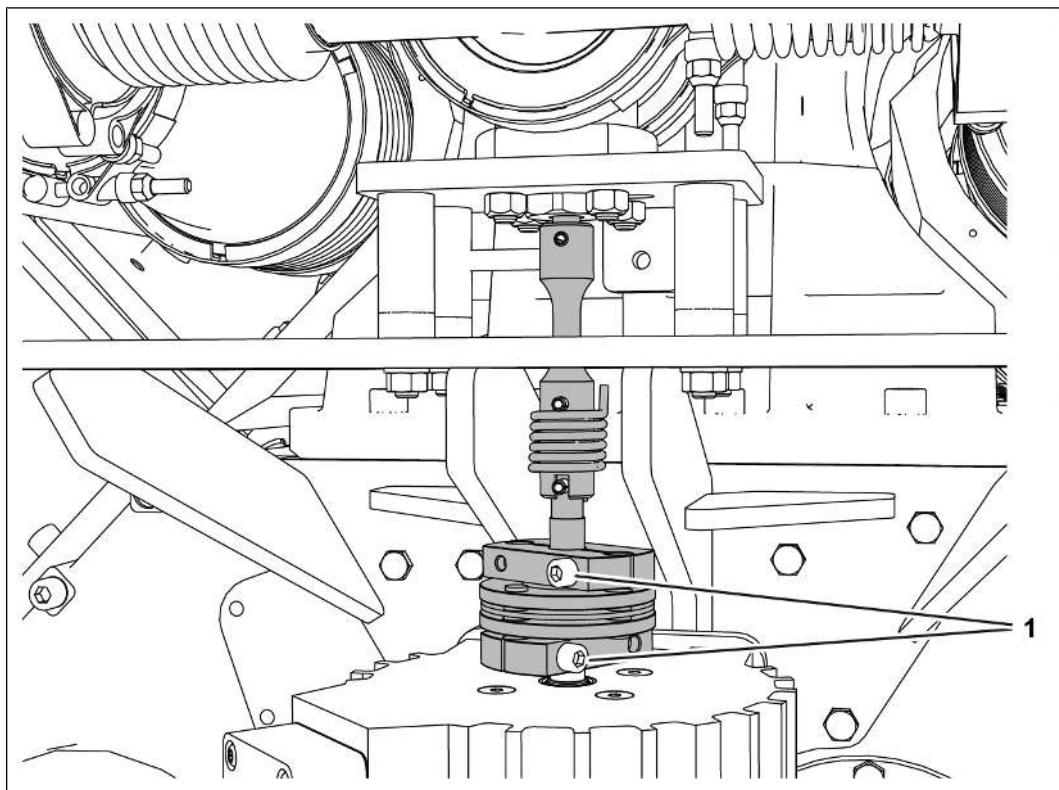
1.	Clamping clip	5 Nm



572641803

Wastegate exhaust flap on holder

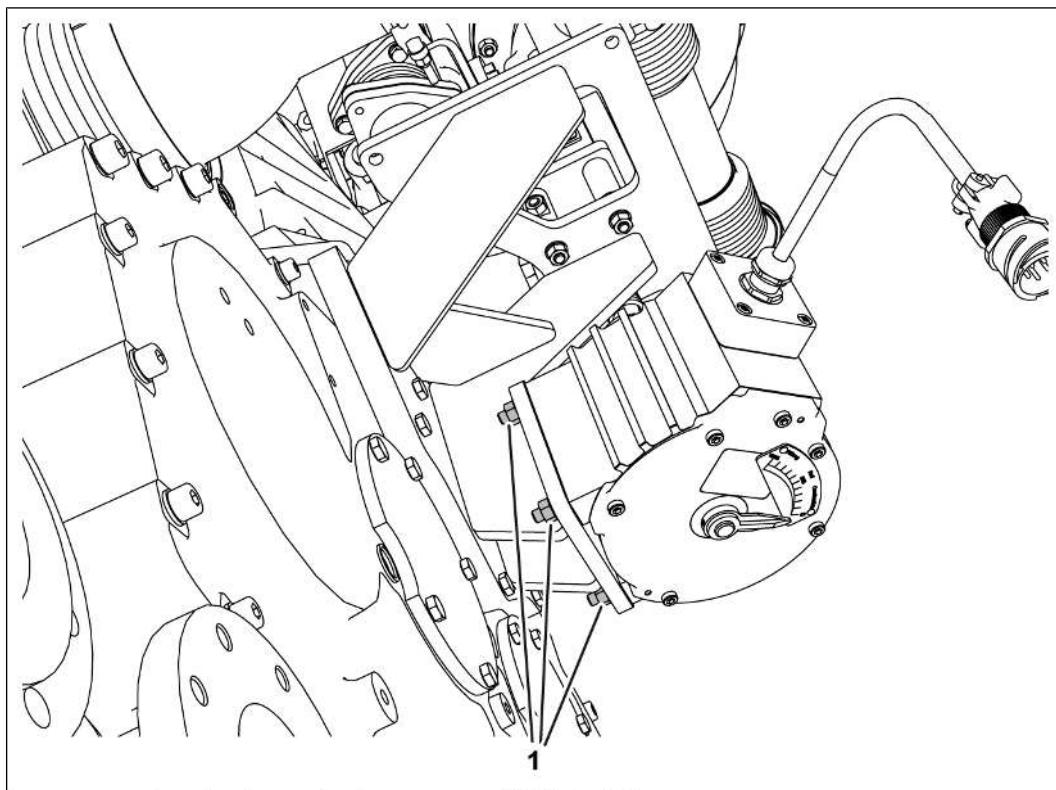
1.	Nut	M8	20 Nm



3043270411

Wastegate drive shaft on coupling (V12 engine with torsion spring)

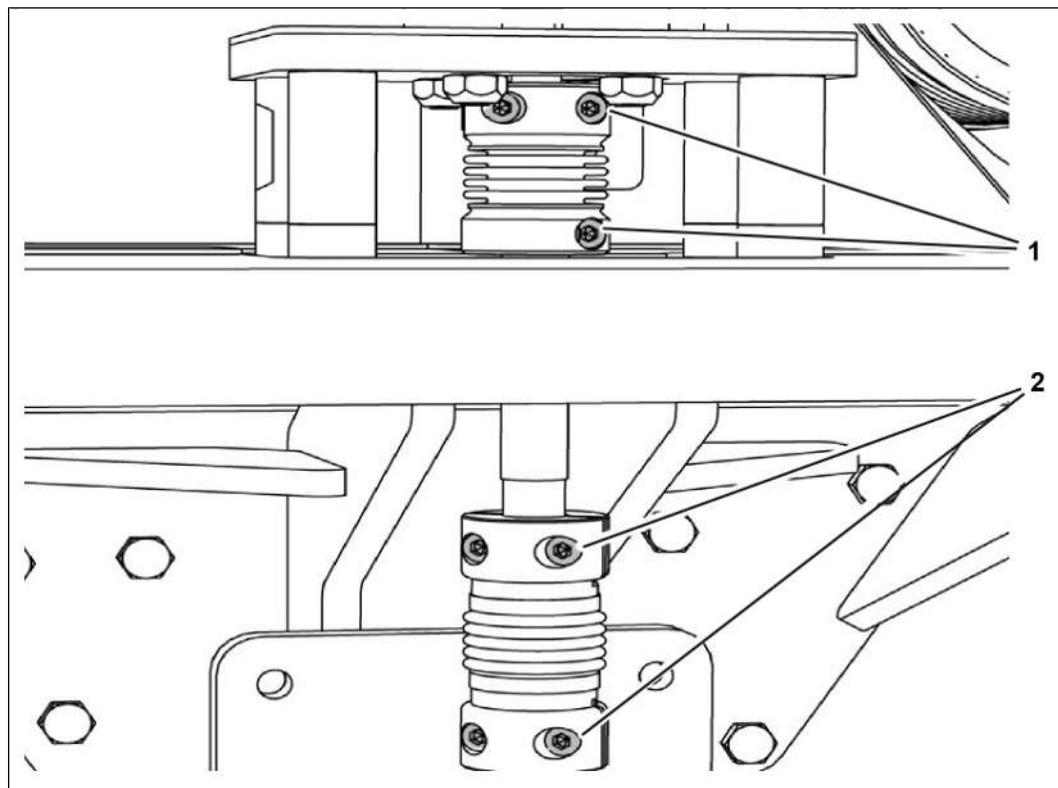
1.	Screw	M6 × 30 - 8.8	10 Nm



578111883

Wastegate actuator on bracket (V20 engine)

1.	Nut	M8	20 Nm

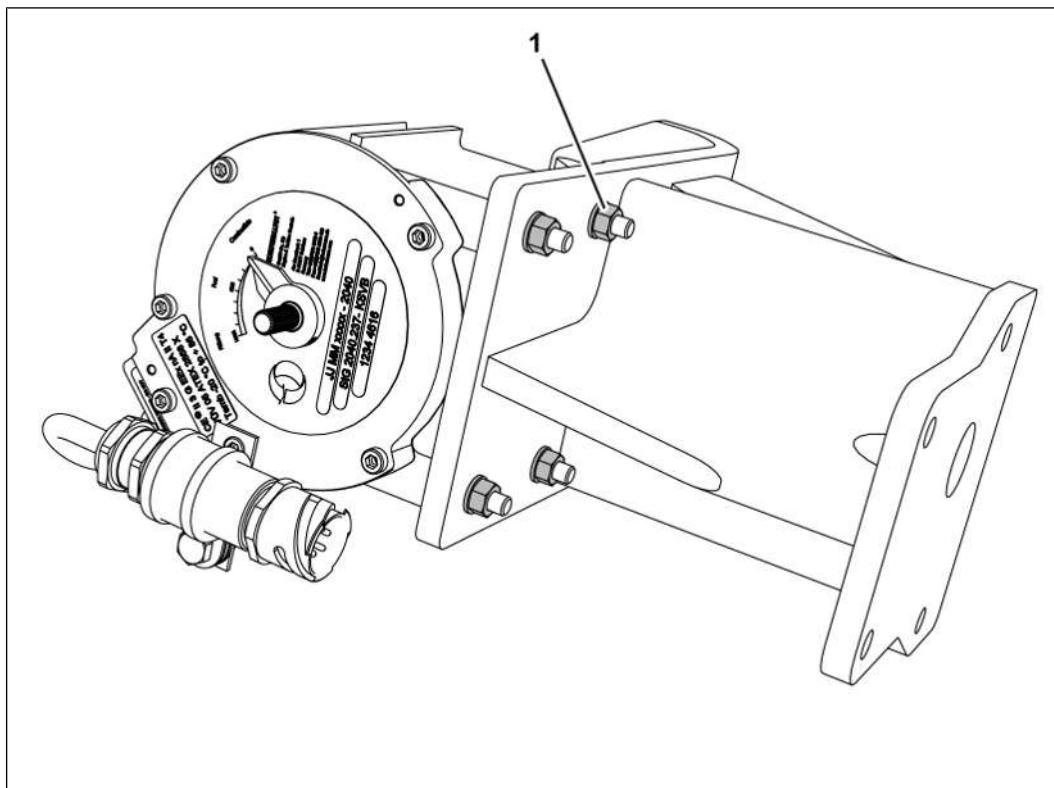


3123624459

Wastegate drive shaft on coupling (V12 engine without torsion spring)

Variant 1:

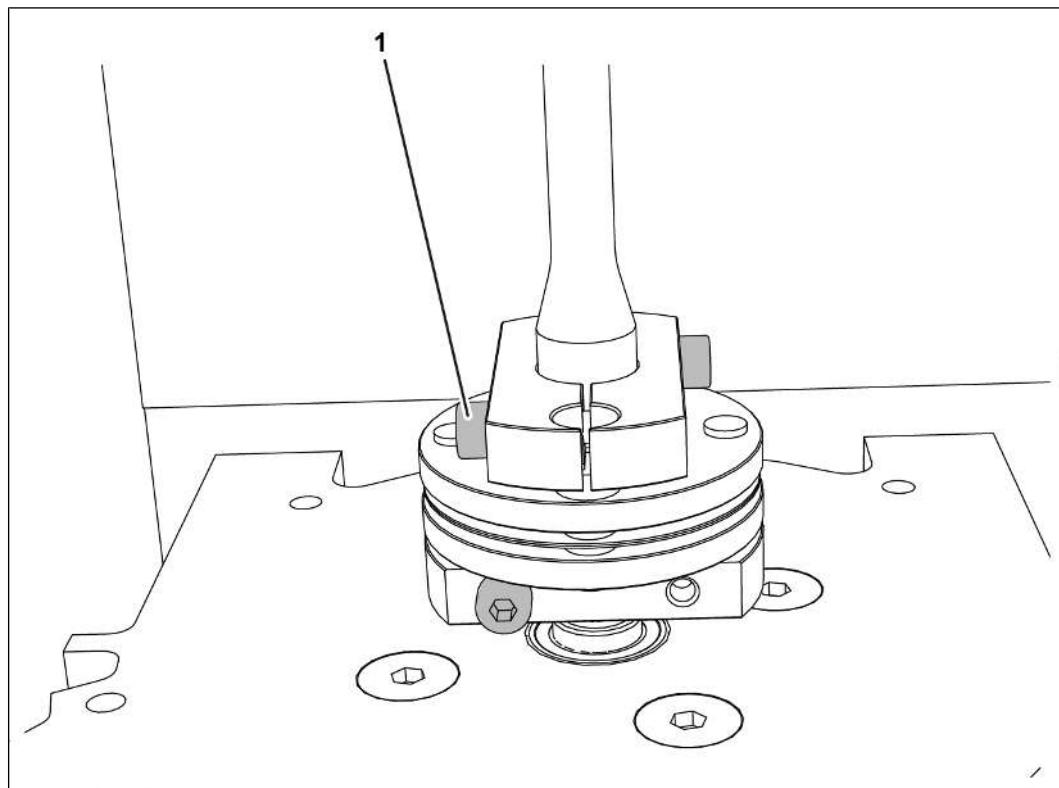
1.	Screw	M5 × 16 - 12.9	10 Nm
2.	Screw	M5 × 16 - 12.9	8 Nm



3123564939

Wastegate actuator on holder (V12 engine)

1.	Nut	M8	20 Nm



3117084555

Wastegate drive shaft on coupling (V12 engine)

Variant 1:

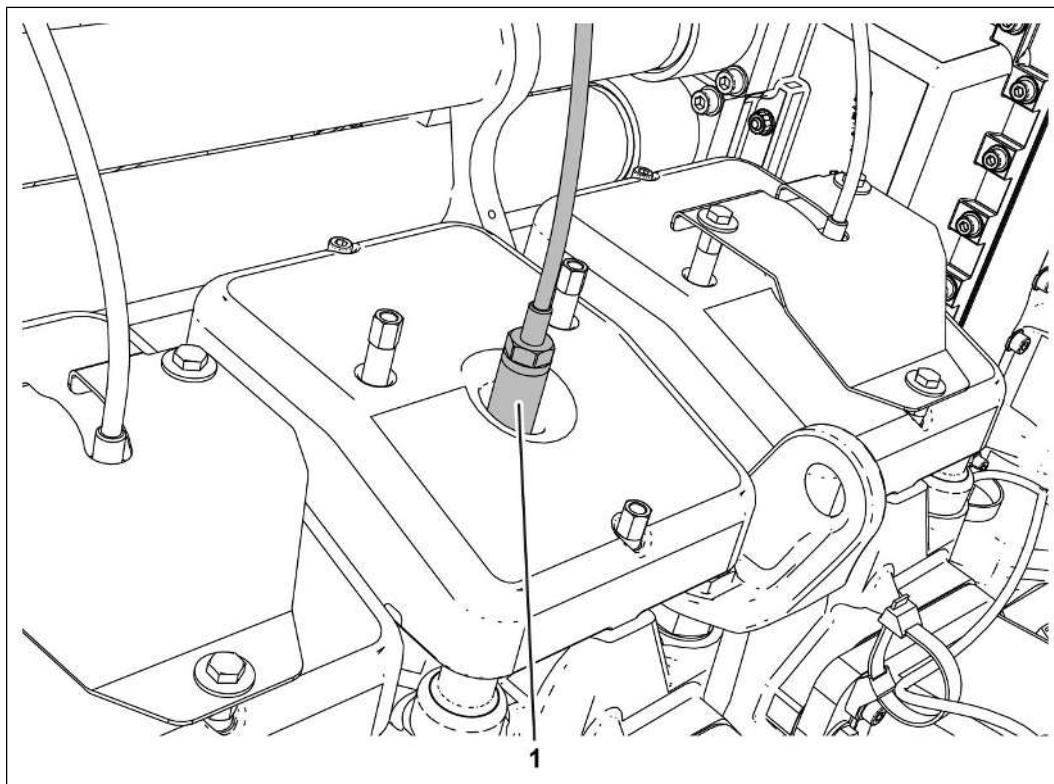
1.	Screw	M4 × 20 - 10.9	4.5 Nm
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Variant 2:

1.	Screw	M6 × 30 - 8.8	10 Nm
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3.2.17 Spark plug

3.2.17.1 Technical data



9007199756441867

Spark plug on cylinder head

1. Spark plug M18 x 1.5 50 Nm

Replace sealing ring.

When the engine is at operating temperature, re-tighten the spark plug to its specified torque.

Spark plug (short-circuit test)

Spark plug socket against spark plug body Infinite kOhm

Spark plug on cylinder head (socket)

1. Spark plug 50 Nm

Renew sealing ring.

Tighten the spark plugs with torque on the engine at operating temperature.



2848618635

Electrode spacing (socket)		
1.	Electrode spacing	0.25 mm

3.2.18 Ignition system

3.2.18.1 Technical data

Ignition angle		
According to TEM	Parameters	11304
Ignition timing		
According to TEM	Parameters	11304

3.2.19 Cylinder head

3.2.19.1 Technical data

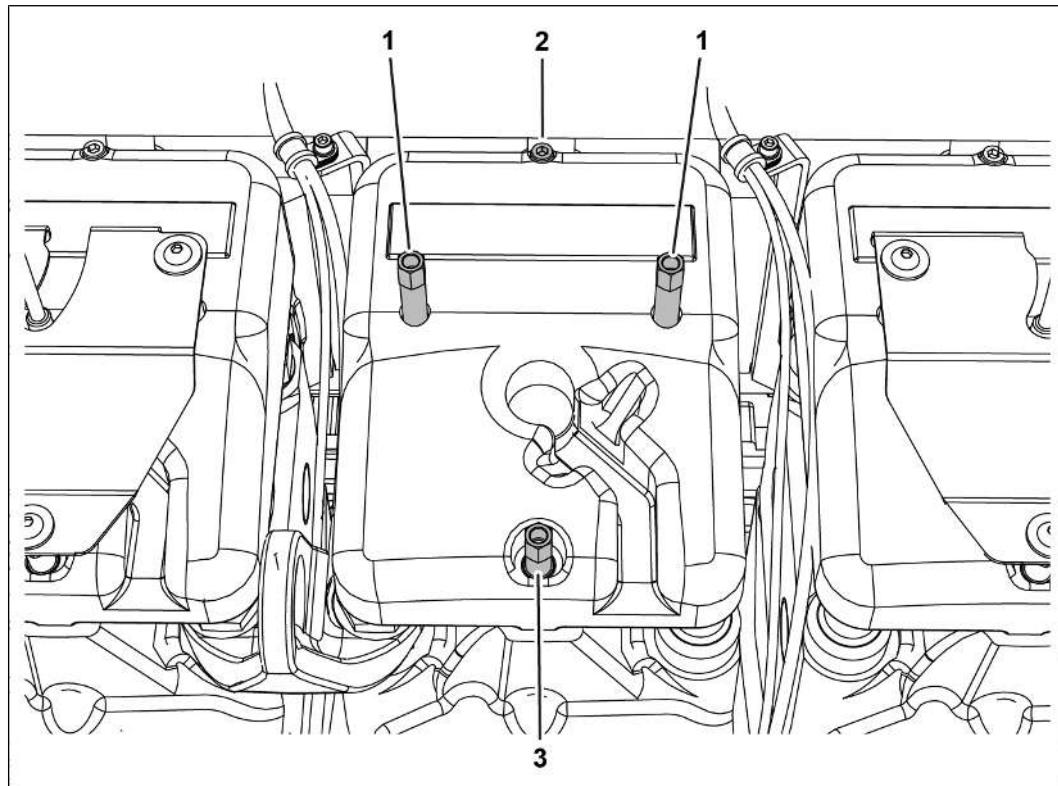
V12 engine valve setting		
	Ignition TDC	A1 B2 A5 B4 A3 B1 A6 B5 A2 B3 A4 B6
	Overlap	A6 B5 A2 B3 A4 B6 A1 B2 A5 B4 A3 B1
V16 engine valve setting		
	Ignition TDC	A1 B2 A6 B5 A8 B7 A3 A7 B6 A4 B8 A2 B3 A5 B1 B4

	Overlap	B6 A4 B8 A2 B3 A5 B1 B4 A1 B2 A6 B5 A8 B7 A3 A7
V20 engine valve setting		
	Ignition TDC	A1 B7 A2 B5 A4 B3 A6 B1 A8 B2 A10 B4 A9 B6 A7 B8 A5 B10 A3 B9
	Overlap	A10 B4 A9 B6 A7 B8 A5 B10 A3 B9 A1 B7 A2 B5 A4 B3 A6 B1 A8 B2

Valve residue with mounted cylinder head			
	Inlet/Outlet	Nominal value	74.7 mm
	Inlet/Outlet	Wear limit	71.2 mm
Valve residue with removed cylinder head			
	Inlet/Outlet ¹⁾	Nominal value	0 to 0.4 mm

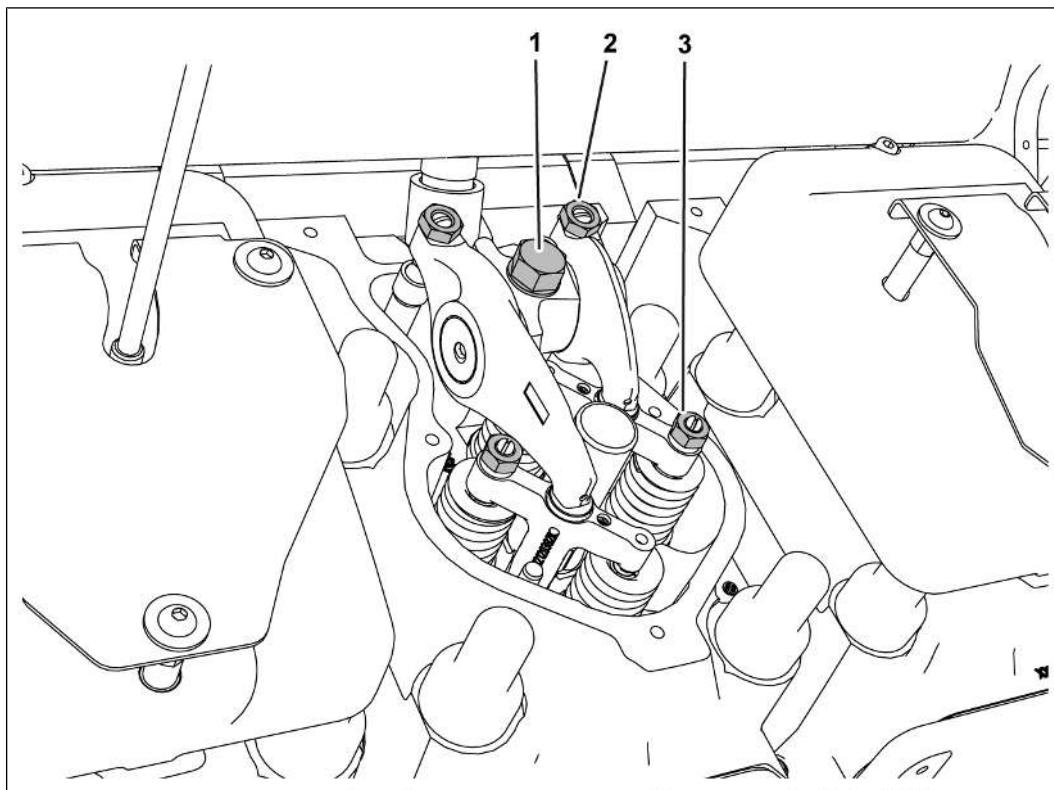
¹⁾ Measured from middle of the valve plate to the cylinder head sealing surface.

Valve clearance		
Inlet valve	Setting value	0.3 mm
Outlet valve	Setting value	0.7 mm
Rocker arm jack		
Valve crosshead	Setting value	0.05 mm

Technical data

601964555

Cylinder head cover on cylinder head			
1	Screw	M8 x 85 - 10.9	25 Nm
2	Screw	M8 x 85 - 10.9	25 Nm
3	Screw	M8 x 55 - 10.9	25 Nm



473350667

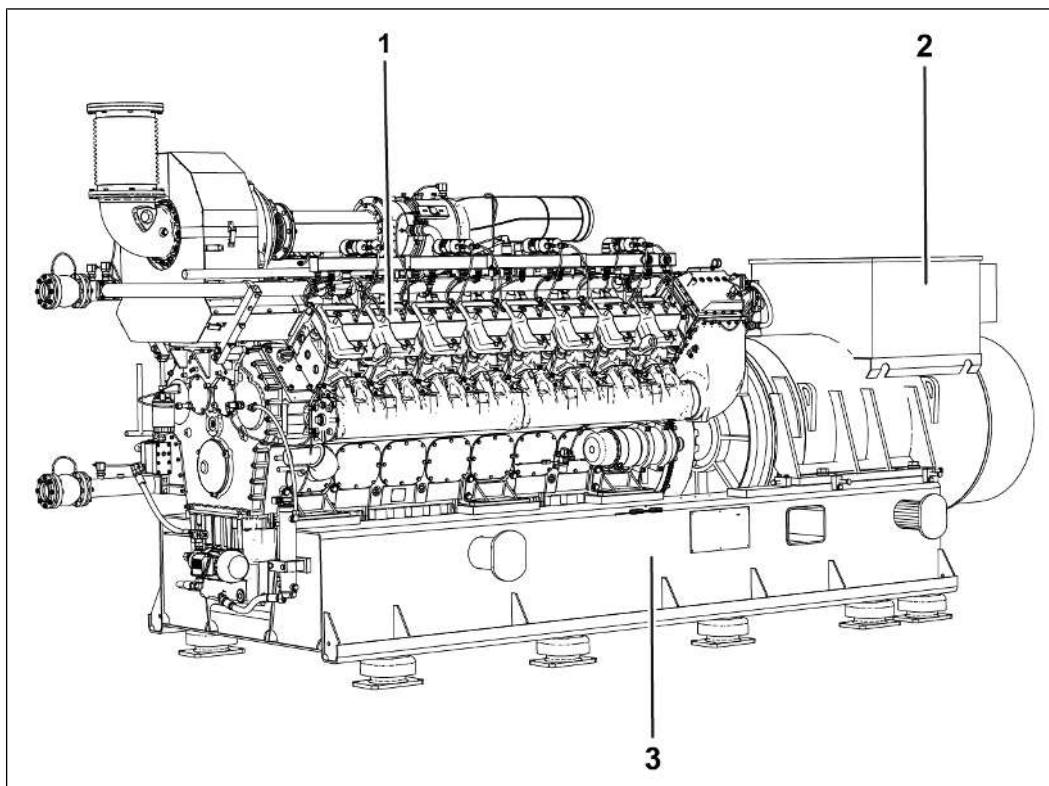
Rocker arm jack on cylinder head			
1.	Screw	M16 x 80 - 10.9	30 Nm
			Stage 2 +120°
Lock nut on valve crosshead			
2.	Nut	M12	45 Nm
3.	Nut	M10	40 Nm

4 Structure and function

4.1 Genset

4.1.1 Genset

4.1.1.1 Functional description



2786552331

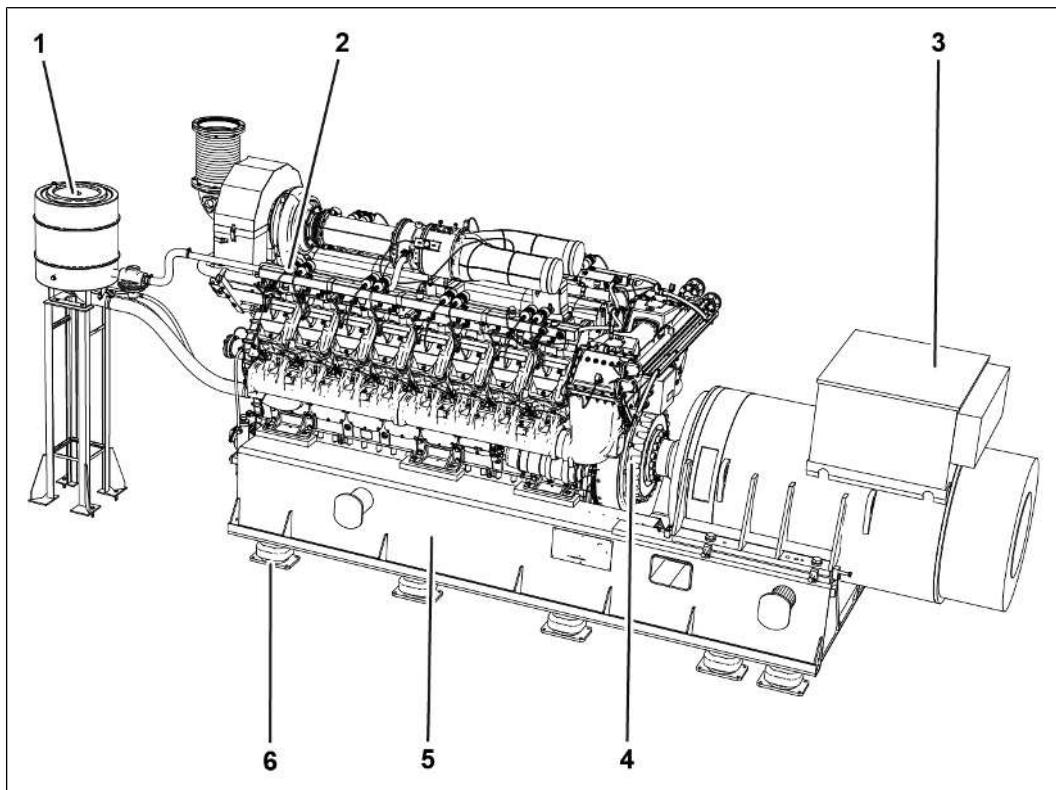
- 1 Engine
- 2 Generator
- 3 Base frame

The genset consists of an engine and a generator, which are mounted on a base frame.

The genset generates electric current and heat from the fuel gas it runs on.

A generator converts the mechanical energy of the combustion process into electrical energy.

The electrical energy can either be consumed directly or fed into the electric grid.

4.1.1.2 Assemblies

2786622603

- 1 Crankcase ventilation
- 2 Engine
- 3 Generator
- 4 Coupling
- 5 Base frame
- 6 Anti-vibration mounting

The genset consists of the following main assemblies:

- Engine
 - Intake air system
 - Exhaust system
 - Fuel gas system
 - Lube oil system
 - Cooling system
 - Electrical system
- Crankcase ventilation
- Generator
- Coupling

- Base frame
- Anti-vibration mounting

4.1.1.3 Speed control

The [electronic control](#) [▶ 79] regulates the speed. A speed sensor detects the actual speed. The electronic control compares the sensor signal of the actual speed with the active set speed. The electronic control compensates for speed deviations by adjusting the actuator. The actuator is connected to the [throttle valve](#) [▶ 87]. The throttle valve affects the engine.

Speed control by the electronic control is only possible when idle and in island operation. When idle and in grid-parallel operation, the engine should run at a constant speed. Load changes of the consumers cause speed changes. As long as the load changes of the consumers are small enough, the speed changes caused by them are completely compensated for by the electronic control. The power controller is deactivated.

For detailed notes and information on speed control and power control, see *Operating Manual, chapter Operation, section Control*.

4.1.1.4 Power control

The power control takes place electromechanically. Here, an actuator adjusts the [throttle valve](#) [▶ 87]. The [electronic control](#) [▶ 79] regulates the actuator. Power control is possible only in mains parallel mode.

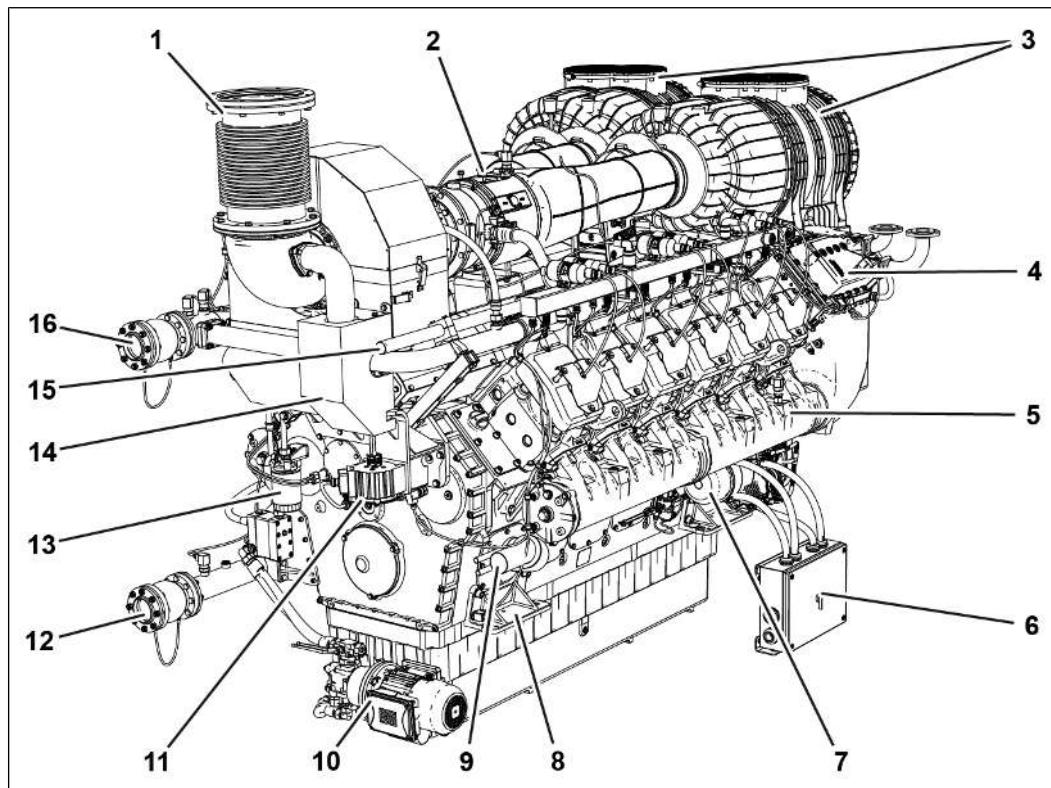
For detailed notes and information about power control, see *Operating Manual, chapter Operation, section Control*.

The power is controlled in pre-defined load steps. The power controller is activated. For detailed information on load steps, see *Operating Manual, chapter General, section Installation directive*.

4.2 Engine

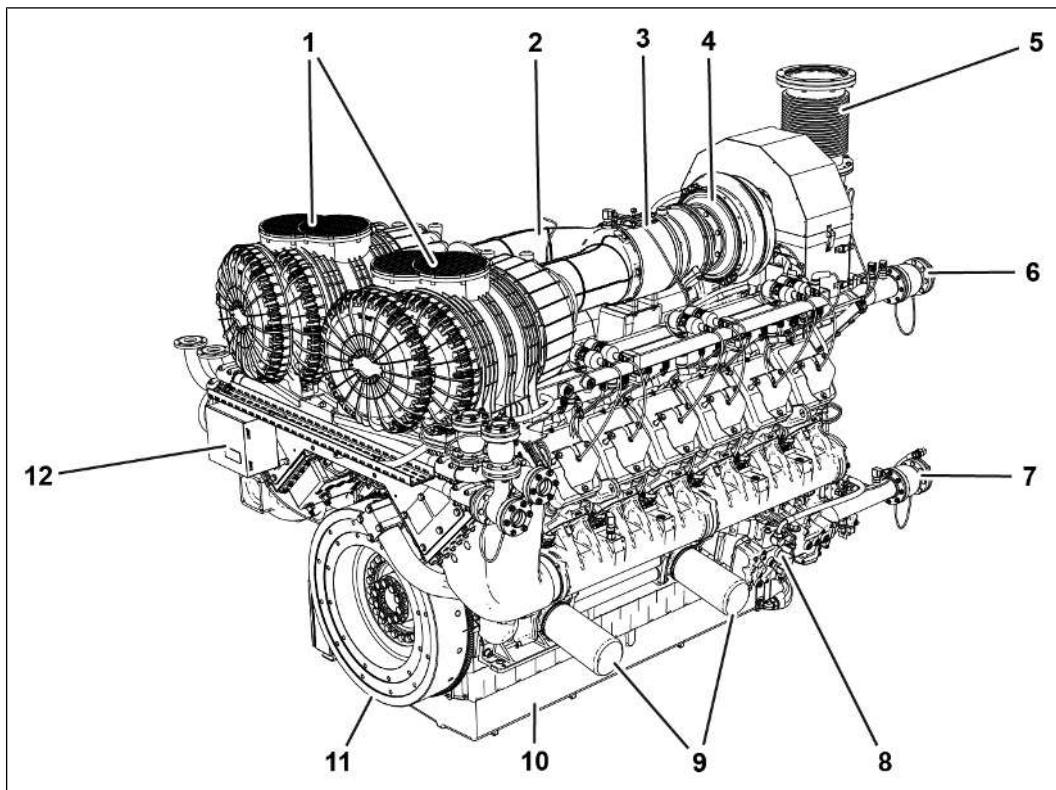
4.2.1 Engine

4.2.1.1 Assembly overview



2789495051: Cylinder side A

- 1 Exhaust manifold
- 2 Gas-air mixer
- 3 Intake air filter
- 4 Mixture cooler
- 5 Mixture pipe
- 6 Battery disconnection switch
- 7 Starter
- 8 Lug
- 9 Crankcase ventilation inlet
- 10 Prelubrication pump
- 11 Wastegate actuator
- 12 Coolant inlet (engine cooling circuit)
- 13 Lube oil filter for exhaust turbocharger
- 14 Wastegate cover
- 15 Crankcase ventilation connection (engine inlet)
- 16 Coolant outlet (engine cooling circuit)



2789448203: Cylinder side B

- 1 Intake air filter
- 2 Intake air manifold
- 3 Gas-air mixer
- 4 Exhaust turbocharger
- 5 Exhaust expansion joint
- 6 Coolant outlet (engine cooling circuit)
- 7 Coolant inlet (engine cooling circuit)
- 8 Lube oil cooler
- 9 Lube oil filter
- 10 Lube oil sump
- 11 Flywheel
- 12 Ignition control device

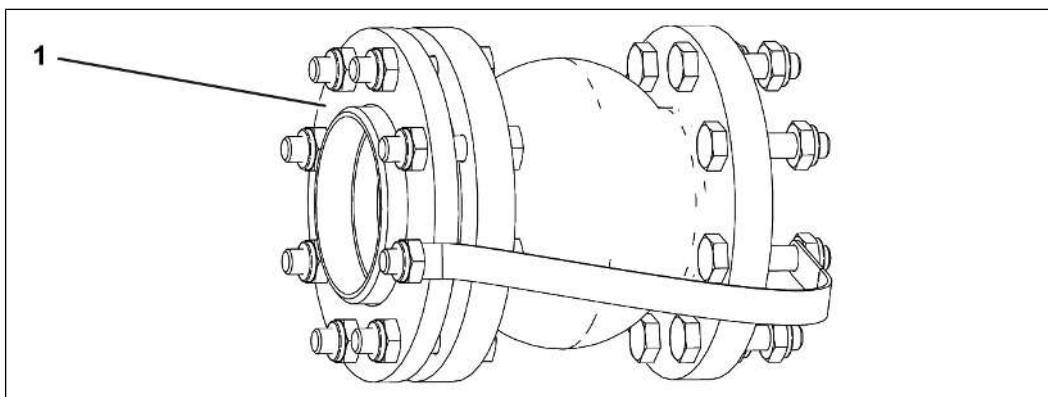
4.2.1.2 Functional description

The engine is a liquid-cooled four-stroke gas engine. The gas type depends on the location and operational area of the engine. The permissible gas type is indicated on the rating plate of the engine.

The engine drives the generator. The engine is connected to the generator shaft by a coupling.

4.2.2 Rubber expansion joint

4.2.2.1 Functional description



151128075

1 Rubber expansion joint

The piping from the genset is connected to the plant piping by means of a rubber expansion joint.

Different rubber expansion joints are used for the lube oil system and the cooling system.

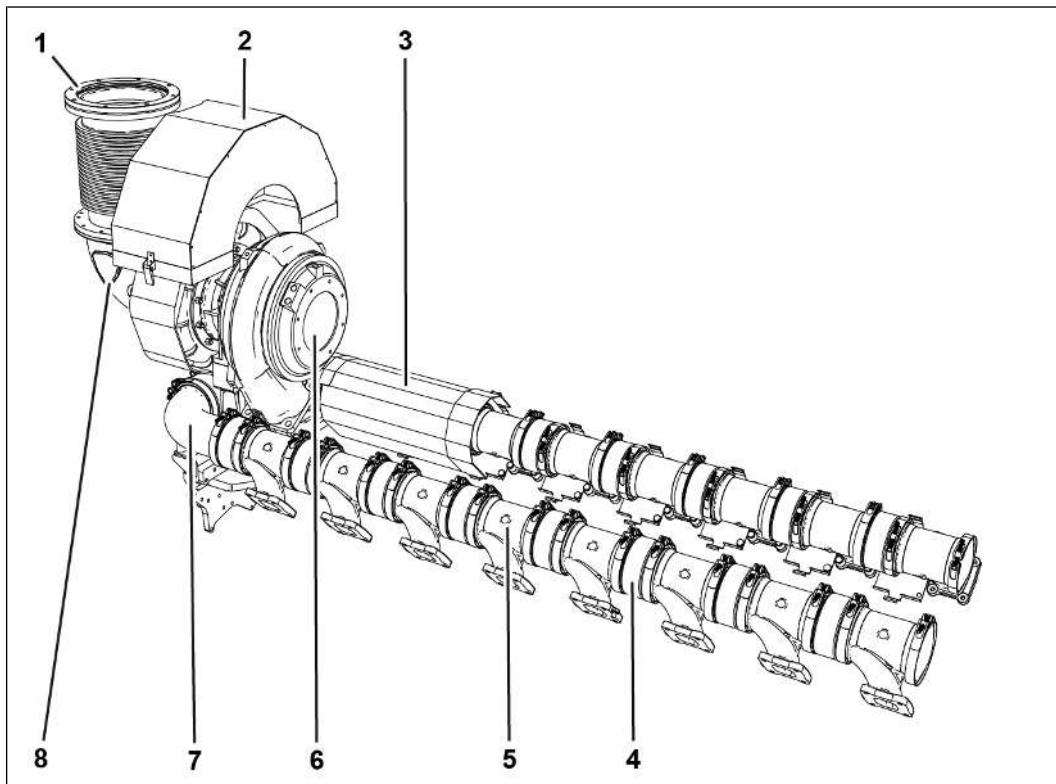
- The rubber expansion joints for the cooling system have an orange-and-blue marking.
- The rubber expansion joints for the lube oil system have a red-and-blue marking.

NOTE

The rubber expansion joint is not intended to compensate for assembly inaccuracies.

The rubber expansion joint has the following tasks:

- isolates the vibrations of the elastically-mounted genset from the fixed-mounting system piping;
- reduces thermal and mechanical stresses in piping and the system components thereof;
- dampens vibration and noise;
- absorbs axial, lateral and angular movements while in operation.

4.2.3 Exhaust system**4.2.3.1 Exhaust system****Functional description**

2735225483

- 1 Exhaust expansion joint
- 2 Exhaust turbocharger cover
- 3 Exhaust pipe cover
- 4 Exhaust expansion joint
- 5 Exhaust pipe
- 6 Exhaust turbocharger
- 7 Exhaust manifold
- 8 Exhaust manifold

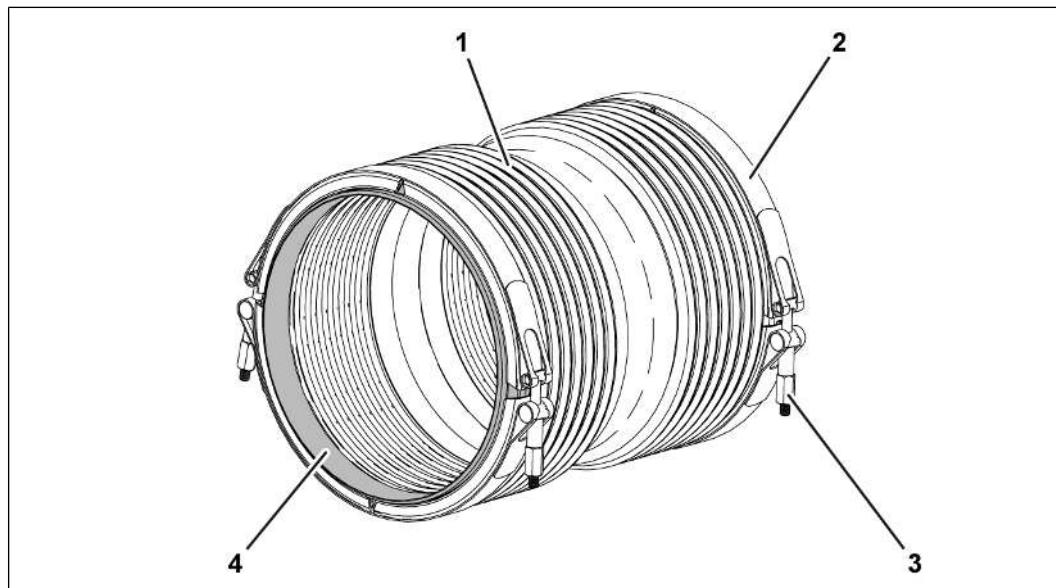
Exhaust gas is produced during the combustion of the gas-air mixture.

The exhaust manifold and the exhaust pipes direct the exhaust gases out of the cylinders and into the atmosphere. The exhaust turbocharger is connected to an exhaust expansion joint and exhaust pipe via an exhaust manifold.

Depending on the genset design, the exhaust system may be equipped with a wastegate.

4.2.3.2 Exhaust expansion joint

Functional description



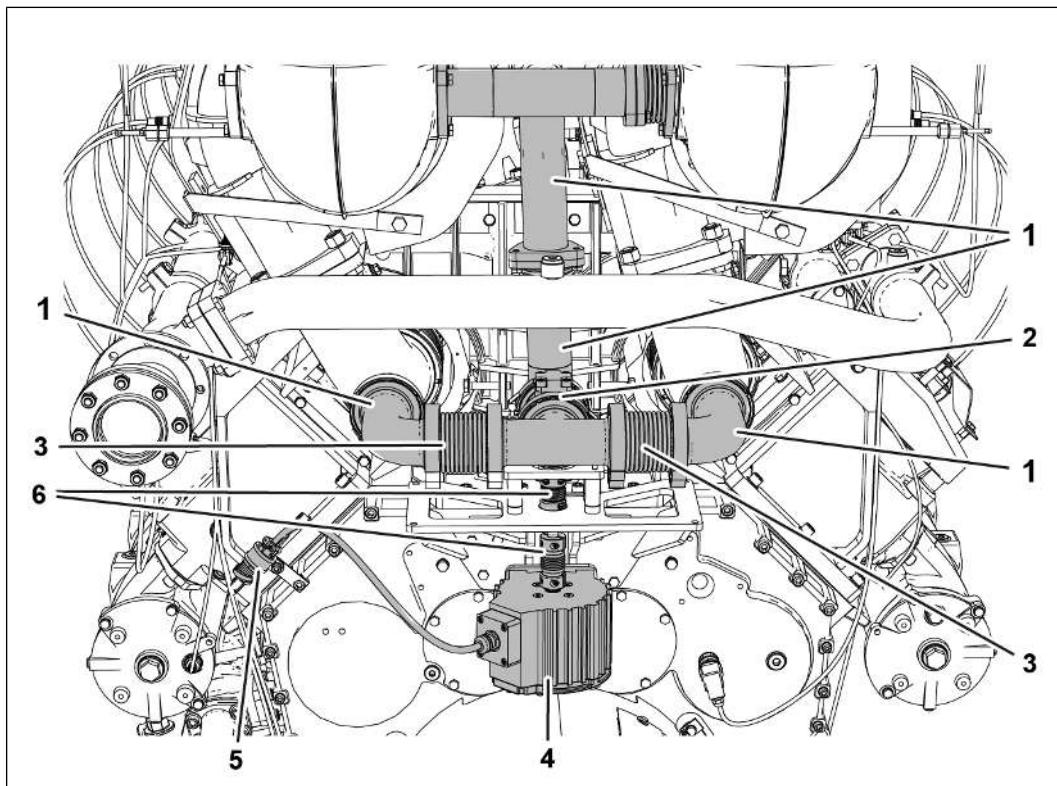
605240459

- 1 Exhaust expansion joint
- 2 Clamping clip
- 3 Tensioning nut
- 4 Flared tube end

The exhaust expansion joint is mounted between the exhaust turbocharger and exhaust line. The exhaust expansion joint compensates for changes in the length of the exhaust pipe that occur due to heating. In addition, it attenuates oscillations and vibrations in the elastically-affixed genset from the immovable on-site exhaust line.

4.2.3.3 Wastegate

Functional description



2790198283

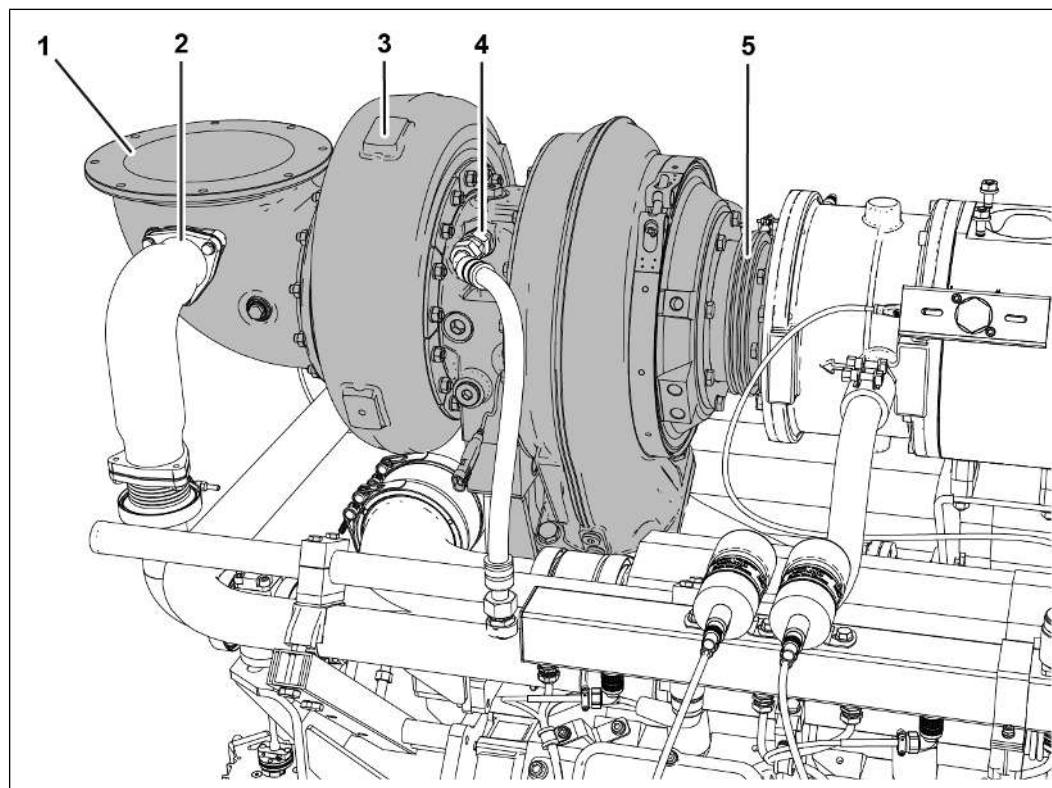
- 1 Exhaust manifold
- 2 Exhaust flap
- 3 Expansion joint
- 4 Actuator
- 5 Connector
- 6 Coupling

The wastegate regulates the power of the exhaust turbocharger. The unneeded exhaust gas quantity reaches the exhaust pipe directly and does not pass through the turbine wheel. The wider the wastegate is open, the more exhaust gas flows past the exhaust turbocharger and the lower the power from the exhaust turbocharger.

The electronic control regulates the actuator in accordance with the currently measured values of intake air temperature and air pressure. The wastegate compensates for fluctuating environmental conditions in the intake air temperature and the air pressure.

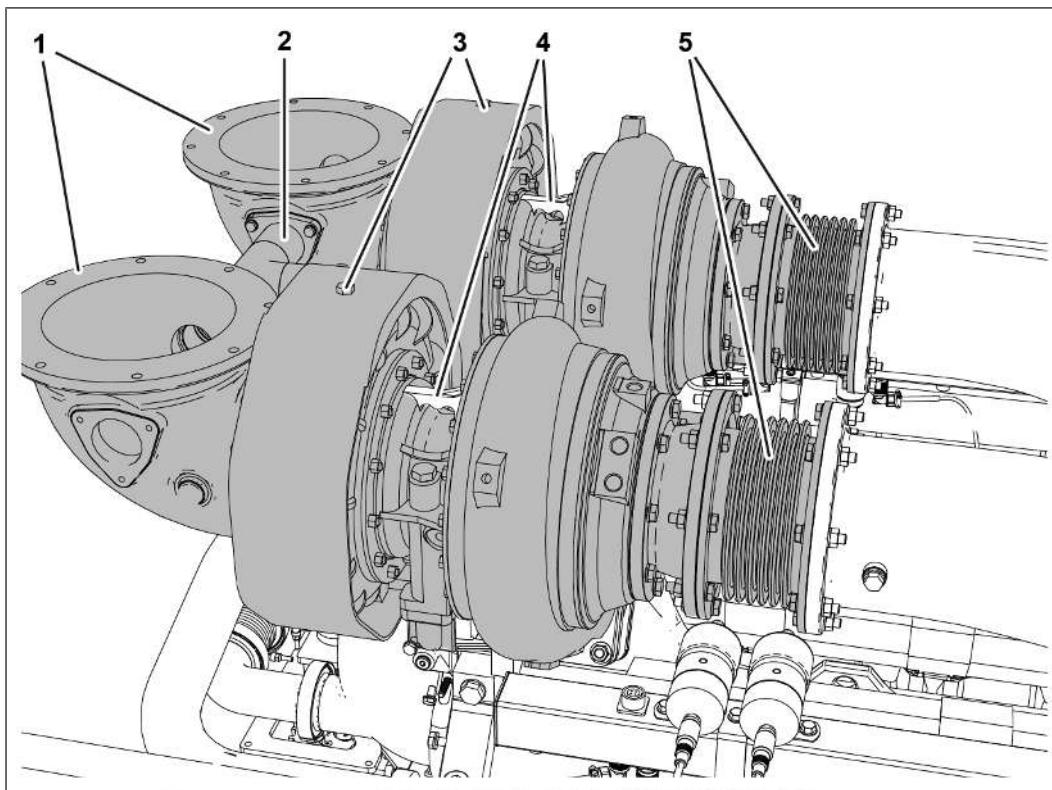
4.2.3.4 Exhaust turbocharger

Functional description



2769840523: V12 and V16 genset

- 1 Exhaust manifold
- 2 Wastegate connection
- 3 Exhaust turbocharger
- 4 Coolant connection
- 5 Expansion joint



2769842955: V20 genset

- 1 Exhaust manifold
- 2 Wastegate connection
- 3 Exhaust turbocharger
- 4 Lifting point
- 5 Expansion joint

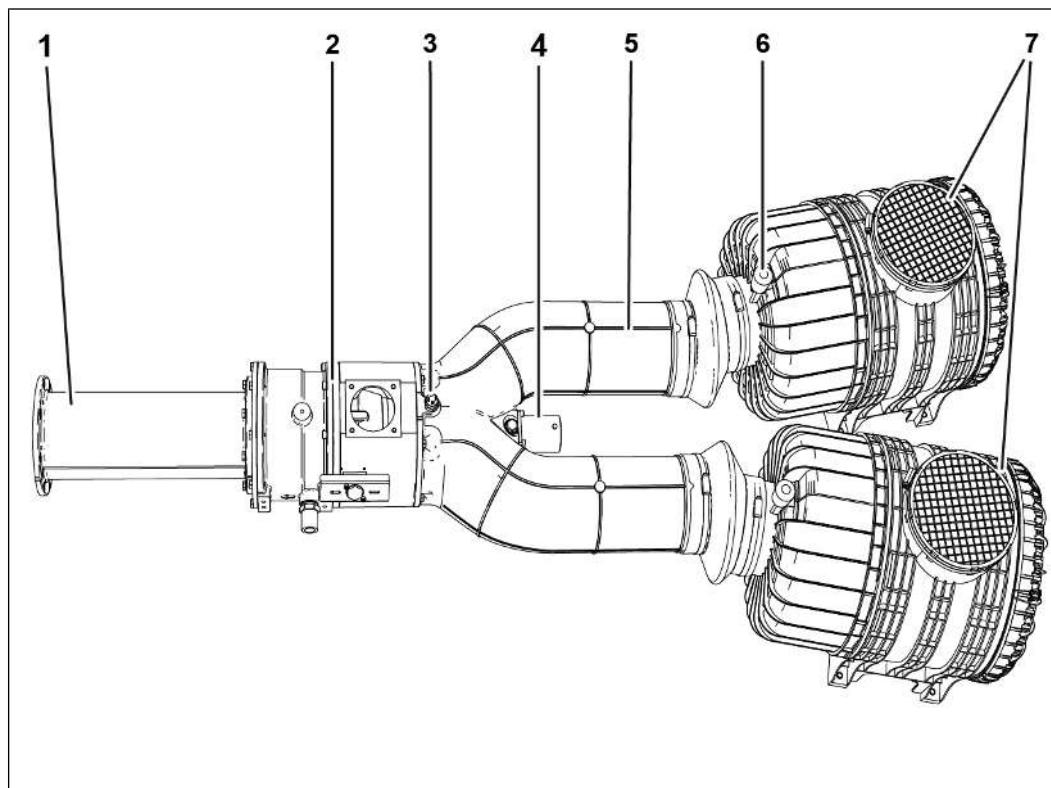
The exhaust turbocharger uses the exhaust energy and compresses the gas-air mixture (mixture turbocharging). The mixture turbocharging enables a higher level of performance of the engine, while at the same time reducing pollutant emissions.

Since the temperature of the gas-air mixture increases drastically when it is compressed by the exhaust turbocharger, a mixture cooler is assembled upstream of the mixture pipe. The mixture cooler cools the gas-air mixture to the set temperature before the gas-air mixture enters the cylinders through the mixture pipe and the inlet valves. The exhaust gas flows out of an output and into the atmosphere via the exhaust pipe and the exhaust muffler.

4.2.4 Intake air system

4.2.4.1 Intake air system

Functional description



2771390731

- 1 Mixture pipe
- 2 Gas-air mixer
- 3 Intake air temperature sensor
- 4 Stepper motor
- 5 Intake air manifold
- 6 Service indicator
- 7 Intake air filter

The intake air filters draw in air, filter out dirt particles from it and pass the filtered air to the gas-air mixer.

- The filtered air is also known as combustion air, and must meet certain requirements.
- For more information on combustion air, see Technical Bulletin (TR) 2132, [Specification for combustion air](#).

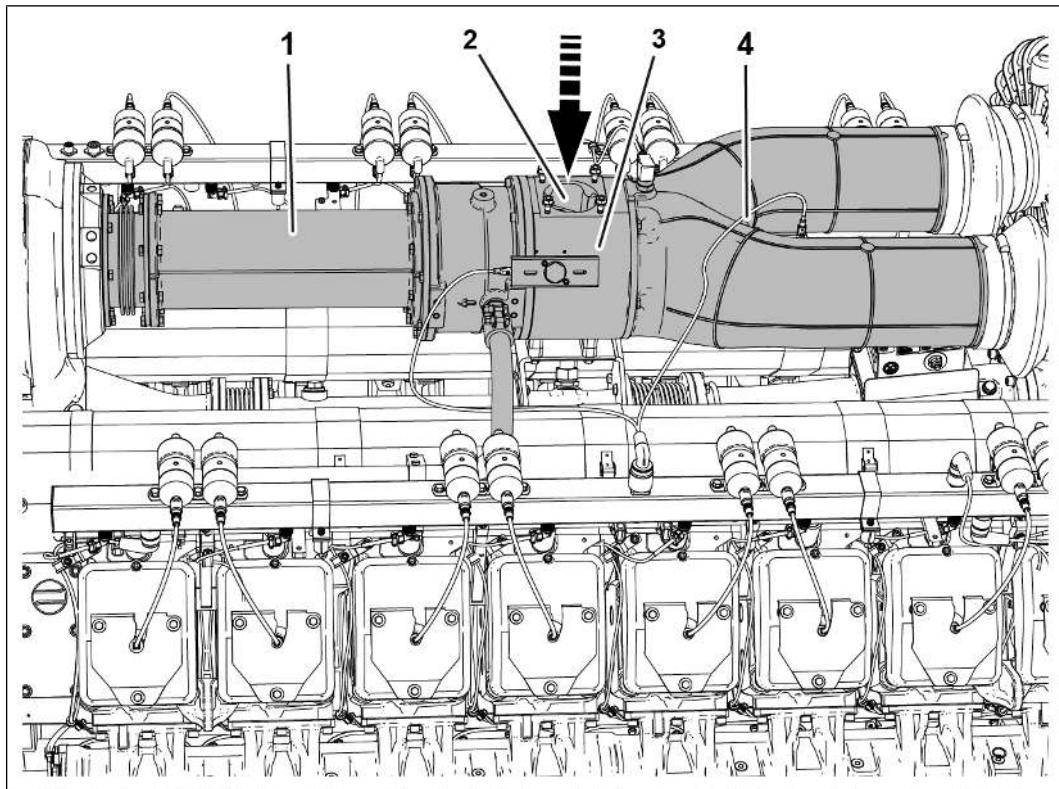
A temperature sensor that measures the temperature of the air and transmits it to the electronic control is installed in the intake air manifold.

NOTE

Intake air temperature

Values for the intake air temperature are listed on the genset data sheet.

A service indicator indicates how dirty the intake air filter is.

4.2.5 Fuel gas system**4.2.5.1 Fuel gas system****Functional description**

2772057355

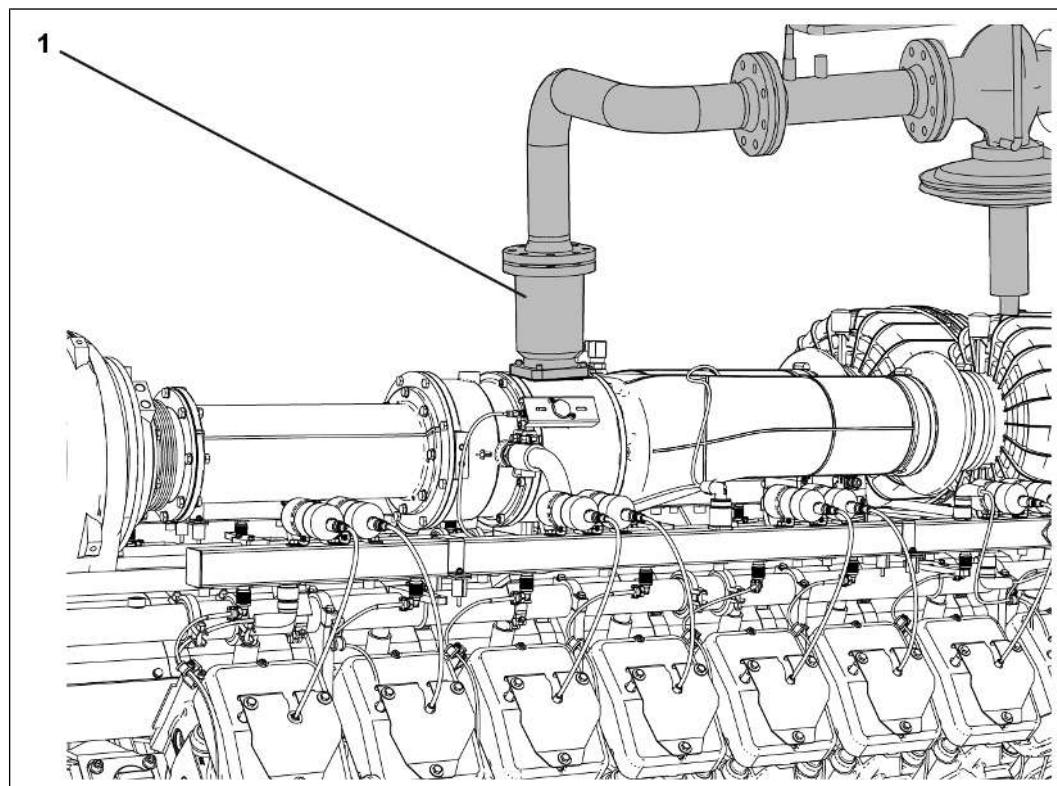
- 1 Mixture pipe
- 2 Fuel gas inlet (arrow)
- 1 Gas-air mixer
- 2 Intake air manifold

The fuel gas system supplies the quantity of the gas-air mixture to the engine necessary for operating the genset.

For the combustion process, the gas-air mixer feeds the engine with an optimal ratio of fuel gas and combustion air.

Functional description

Connection to the gas train



2772059787

- 1 Expansion joint

The gas-air mixer is connected to the fuel gas line leading to the gas train via an expansion joint.

- The expansion joint attenuates oscillations and vibrations between the elastically-afixed genset and the immovable gas train.

Functional description

For safety reasons when decommissioning the genset, all fuel gas is removed from the gas train, the mixture system and the cylinders. This procedure is known as purging and is performed automatically by the electronic control.

The electronic control closes the gas valves in the gas train. The following components are drained until empty by the suction effect of the coasting engine:

- Gas supply to the engine
- Gas-air mixer
- Exhaust turbocharger
- Mixture cooler
- Mixture pipe

The ignition remains on until the fuel gas left in the cylinder has been combusted completely. Only when the crankshaft has shut down does the electronic control switch off the ignition.

4.2.6 Compressed air system

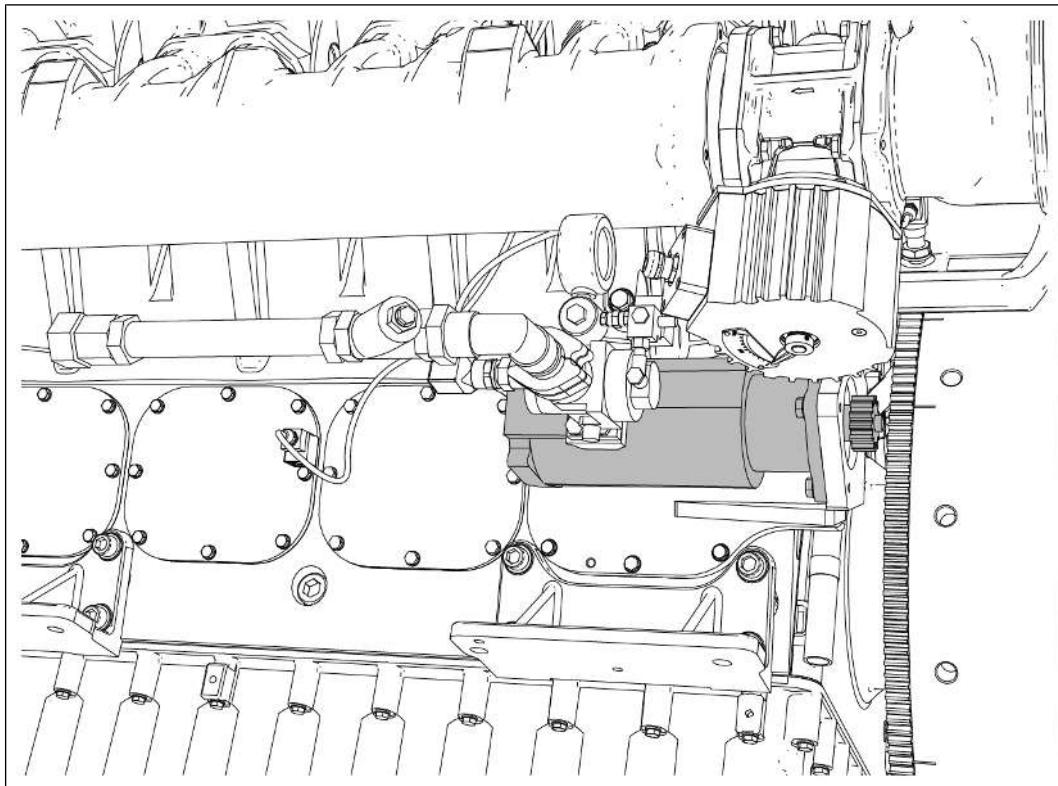
4.2.6.1 Compressed air starter

Functional description

Starter (compressed air)

Different starters are installed:

- Starter (compressed air starter)
- Electric starter (single starter)
- Electric starter (double starter)



2780249995: View of compressed air starter

The starter has the task of accelerating the engine crankshaft up to ignition speed.

Triggered by the electronic control, control air pushes the starter pinion into the flywheel ring gear.

- The working air (compressed air) causes the genset to build up to the starting speed.
- The compressed air starter presses the starter pinion into the ring gear on the flywheel and turns the crankshaft up to the starting speed.

Once the genset has reached the specified speed, the electronic control switches off the compressed air supply.

- The spring force automatically pulls out the starter pinion of the flywheel gear ring.
- Further start operations with the genset running are blocked.

4.2.7 Electrical system

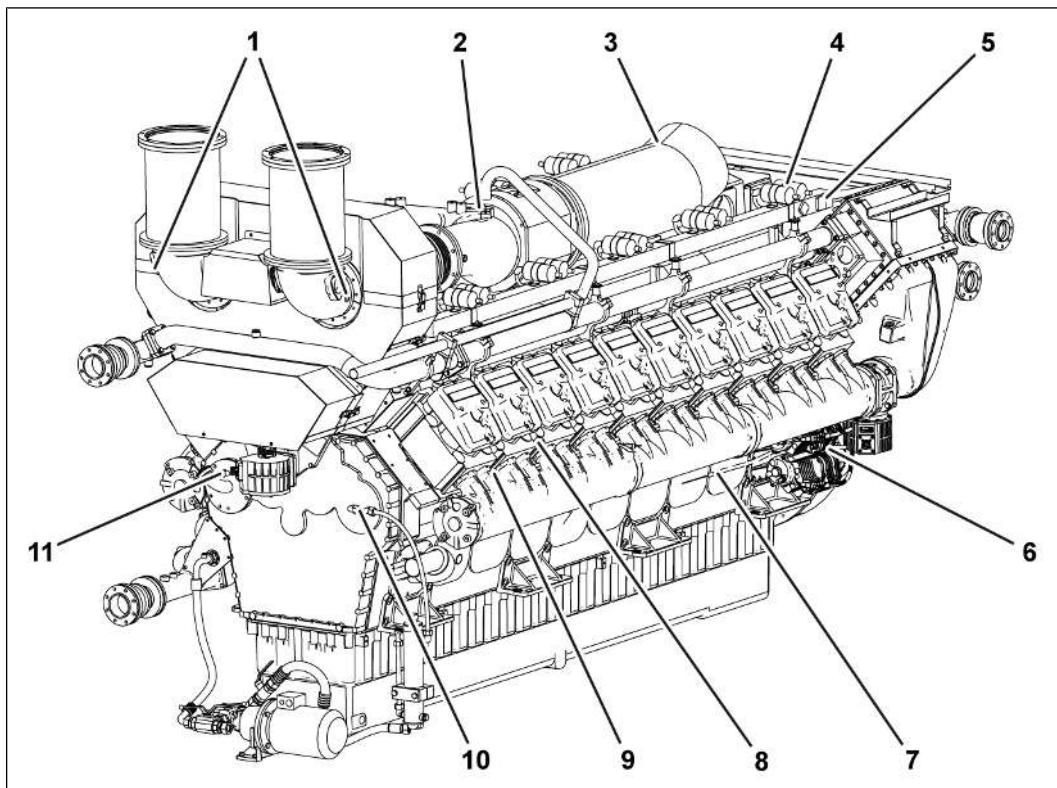
4.2.7.1 Electrical system

Functional description

Parts of the electrical system are installed both on the engine and in the plant.

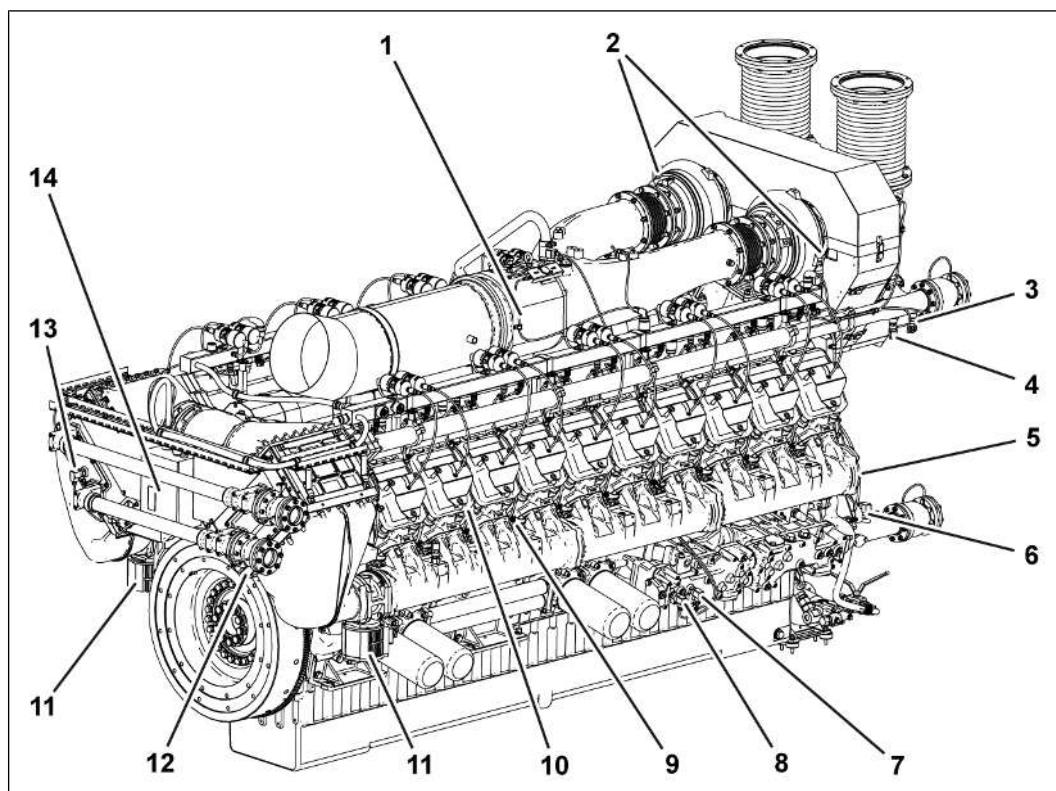
The engine electrical system consists of the following components:

- Starter
- Ignition system
- Anti-knock control
- Control devices, wiring harness, and sensors
- Electronic control



2776180875: Electrical components, cylinder side A and free end

- 1 Exhaust turbocharger temperature sensor
- 2 Stepper motor for gas-air mixer
- 3 Mixture temperature sensor
- 4 Ignition coil
- 5 Multifunction rail
- 6 Starter
- 7 Starter relay
- 8 Knock sensor
- 9 Combustion chamber temperature sensor
- 10 Crankcase pressure sensor
- 11 Camshaft sensor
- not Intake air temperature sensor
- pic-
ture
d

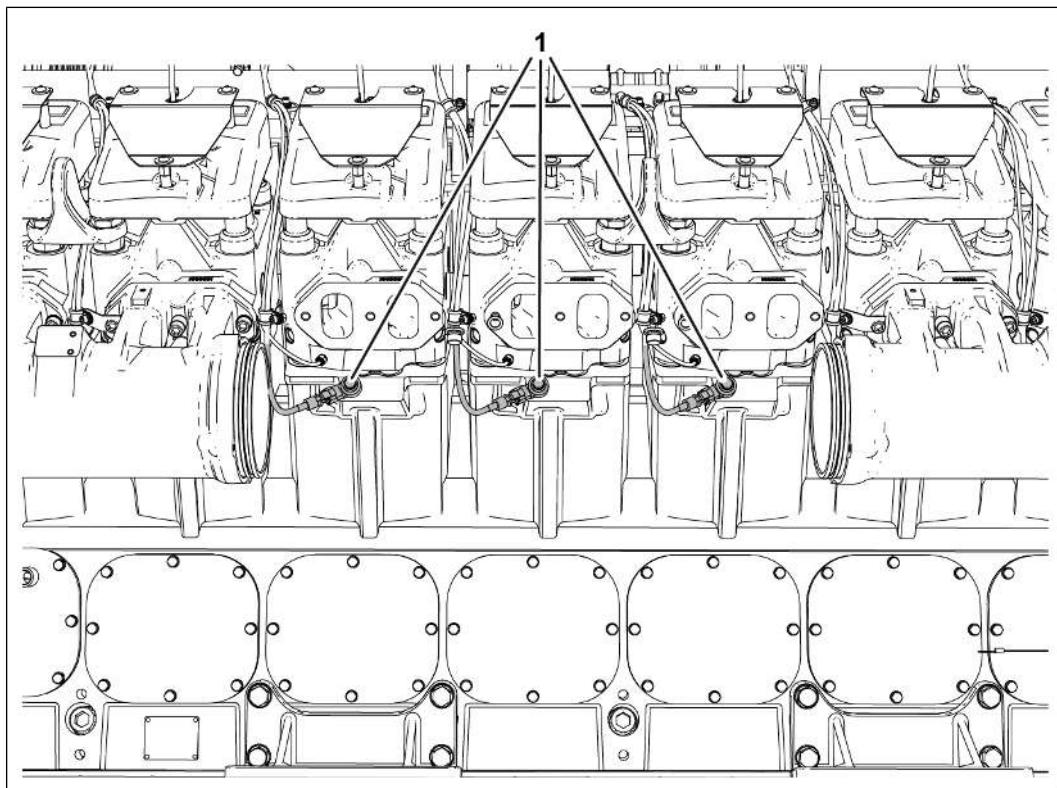


2776183307: Electrical components, cylinder side B and drive end

- 1 Gas-air mixer proximity switch
- 2 Exhaust turbocharger speed sensor
- 3 Coolant temperature sensor
- 4 Coolant pressure sensor
- 5 Mixture temperature sensor
- 6 Coolant temperature sensor
- 7 Lube oil temperature sensor
- 8 Lube oil pressure sensor
- 9 Combustion chamber temperature sensor
- 10 Knock sensor
- 11 Speed control actuator
- 12 Crankshaft sensor
- 13 Coolant temperature sensor
- 14 Ignition control device

4.2.7.2 Knock sensor

Functional description



2787046027

1 Knock sensor

The knock sensors are installed on the crankcase downstream of the mixture pipe. Each cylinder is monitored by a knock sensor. Together with the control system, the knock sensors make up the [anti-knock control \(AKC\)](#) system, which reduces the danger of the fuel gas self-igniting (knocking combustion).

The following conditions can lead to knocking combustion:

- Fuel gases with a fluctuating methane number
- Fuel gases with a low methane number
- Change of the fuel gas composition

Knocking combustion causes extreme mechanical and thermal stresses. Knocking combustion can cause engine damage. The anti-knock control constantly adjusts the ignition timing until knocking combustion is sufficiently reduced. The anti-knock control determines the optimum ignition timing for every single cylinder and ensures safe operation of the genset.

If the following conditions occur at the same time, the electronic control stops the genset:

- Ignition timing is below 9° before top dead center (9° before TDC).
- Knocking combustion

For all necessary information on the fuel gas types, see *Operating Manual, chapter Operating media regulations, Technical Bulletin (TR) 3017 Specification for fuel gas*.

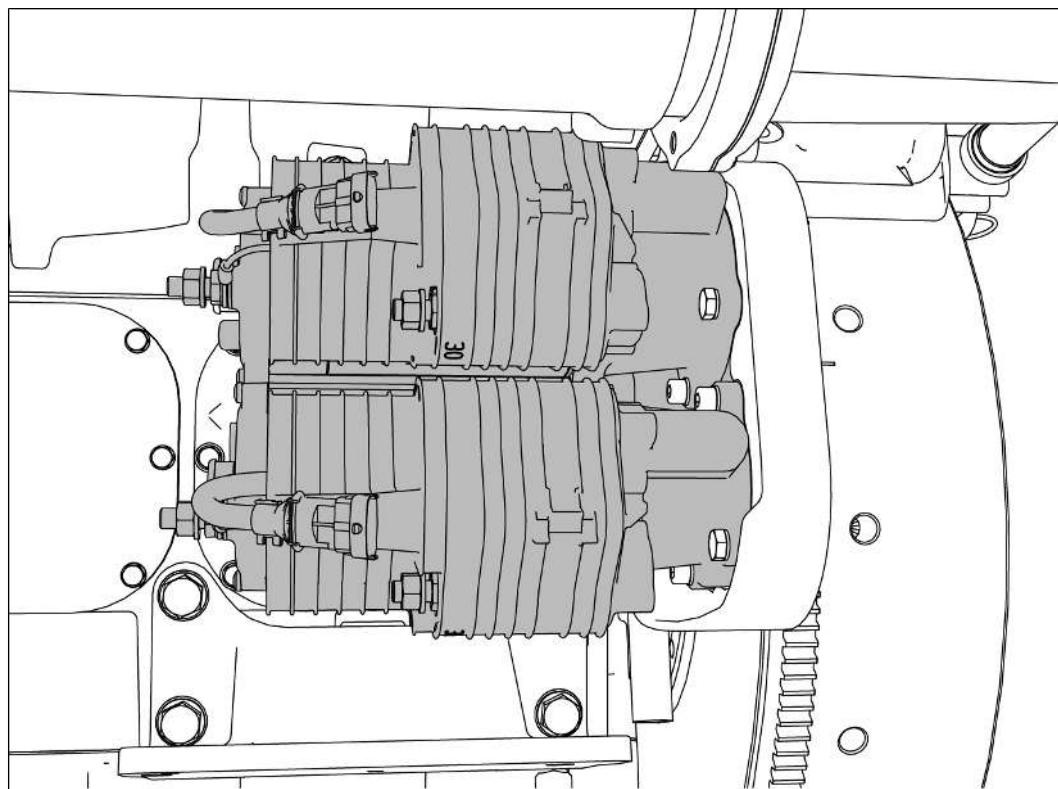
4.2.7.3 Electric starter

Functional description

Starter (double starter)

Different starters are installed:

- Starter (compressed air starter)
- Electric starter (single starter)
- Electric starter (double starter)



1725178507: View of double starter

The double starter consists of two single electric starters.

The starter has the task of accelerating the engine crankshaft up to ignition speed.

- For this purpose, the starter receives the signal to engage via the electronic control.

An electric motor drives the starter pinion in the gear ring of the flywheel via an axially movable multi-disc coupling and thereby drives the crankshaft.

To avoid damage to the tooth flanks, the full torque is not transmitted until the starter pinions have been fully engaged.

When the genset has reached the specified speed, the starter receives the signal to track out the starter pinions via the electronic control.

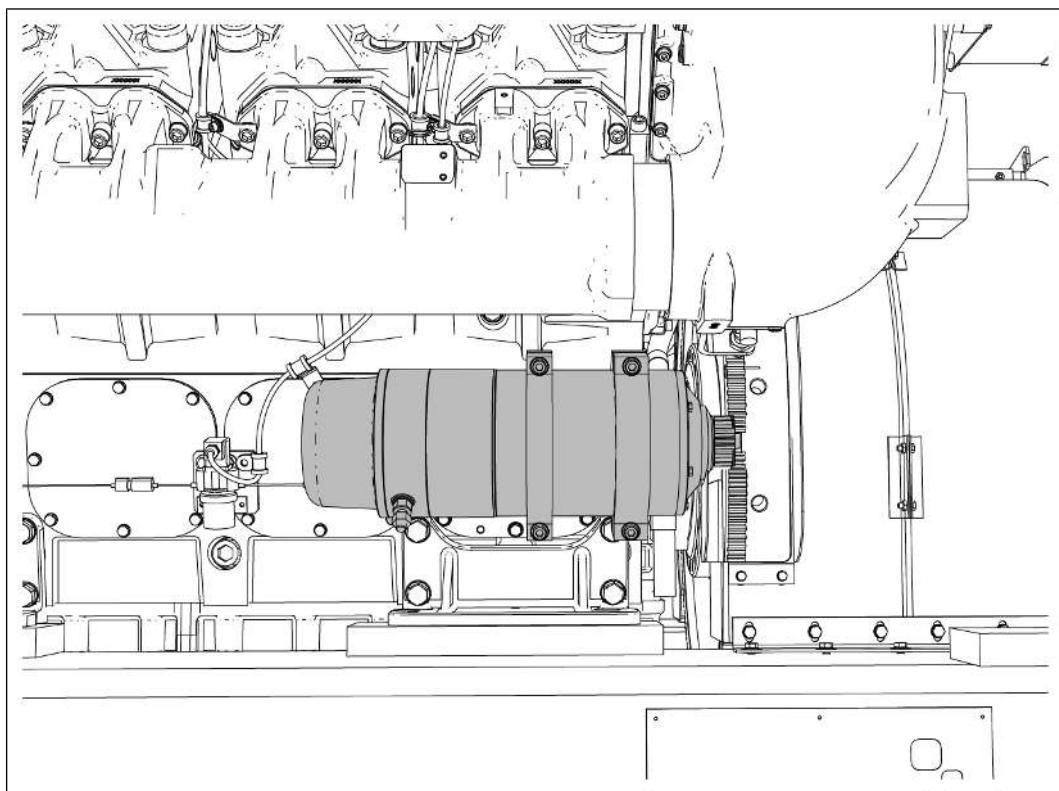
- Further start operations with the genset running are blocked.

Functional description

Starter (single starter)

Different starters are installed:

- Starter (compressed air starter)
- Electric starter (single starter)
- Electric starter (double starter)



2779640459: View of single starter

The starter has the task of accelerating the engine crankshaft up to ignition speed.

- For this purpose, the starter receives the signal to engage via the electronic control.

An electric motor drives the starter pinion in the gear ring of the flywheel via an axially movable multi-disc coupling and thereby drives the crankshaft.

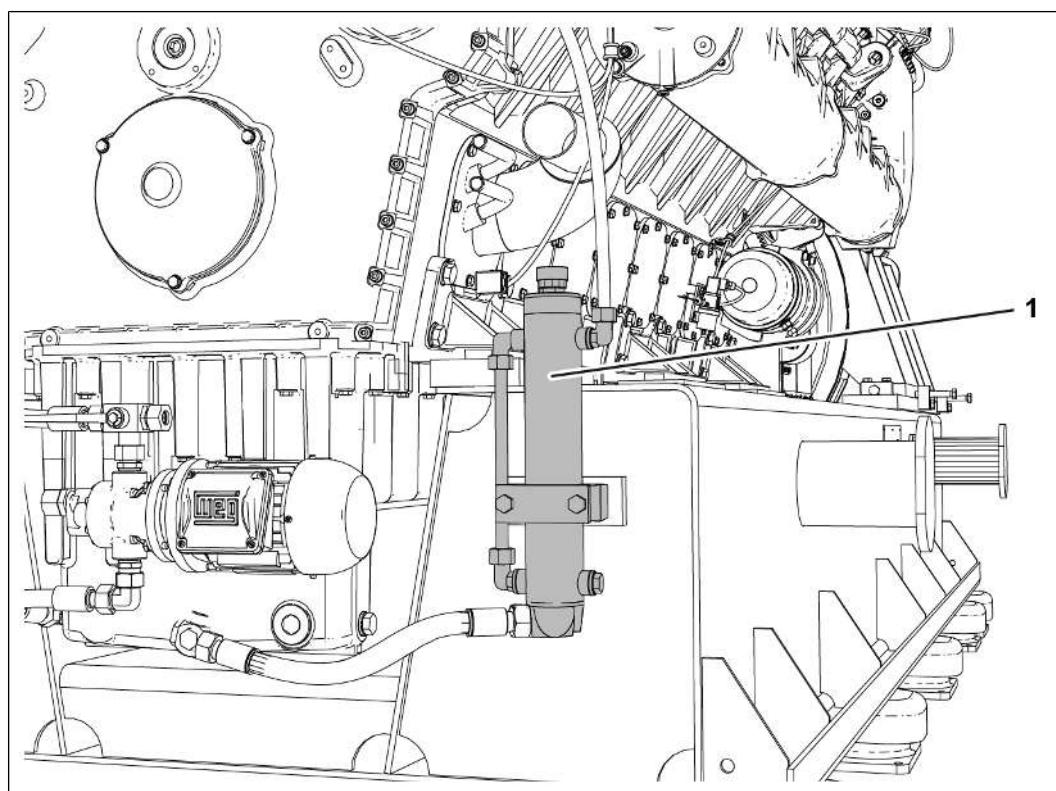
To avoid damage to the tooth flanks, the full torque is not transmitted until the starter pinions have been fully engaged.

When the genset has reached the specified speed, the starter receives the signal to track out the starter pinion via the electronic control.

- Further start operations with the genset running are blocked.

4.2.7.4 Level sensor

Functional description



2776238987

1 Level sensor

The level sensor is mounted on the free end of the engine.

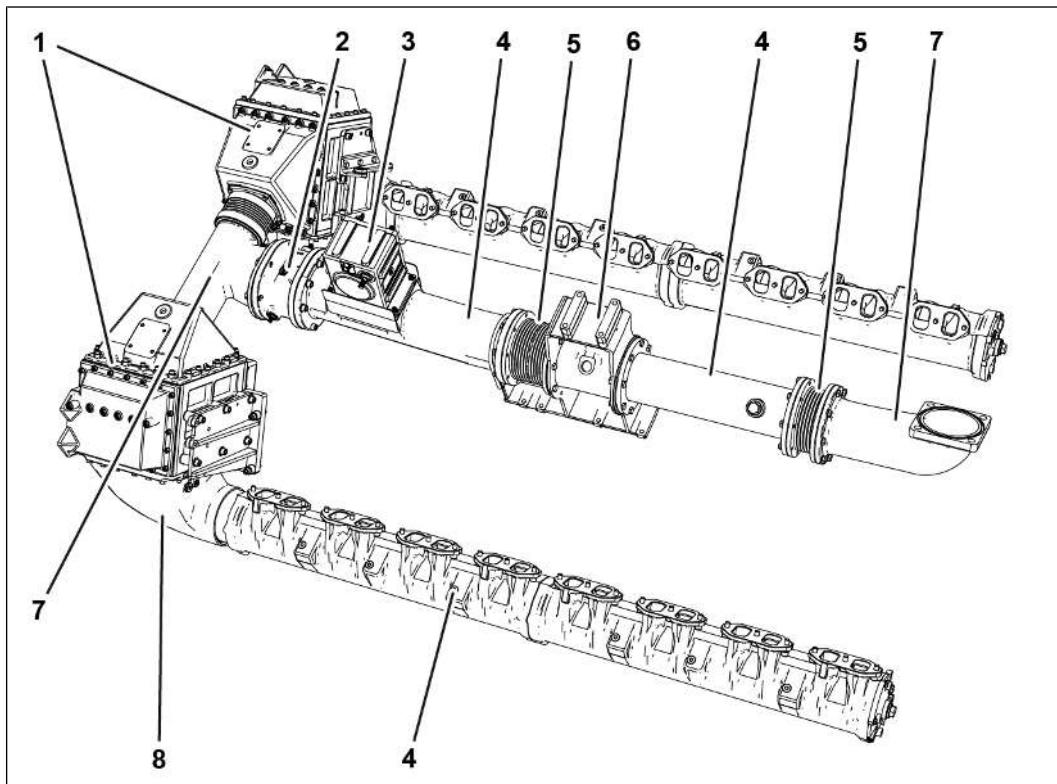
The level sensor transmits the current measured lube oil level from the engine to the electronic control.

- This controls the automatic lube oil refill and the lube oil change.

4.2.8 Mixture system

4.2.8.1 Mixture system

Functional description



2776449163

- 1 Mixture cooler
- 2 Throttle valve
- 3 Actuator
- 4 Mixture pipe
- 5 Expansion joint
- 6 Holder
- 7 Mixture manifold
- 8 Mixture cooler cover

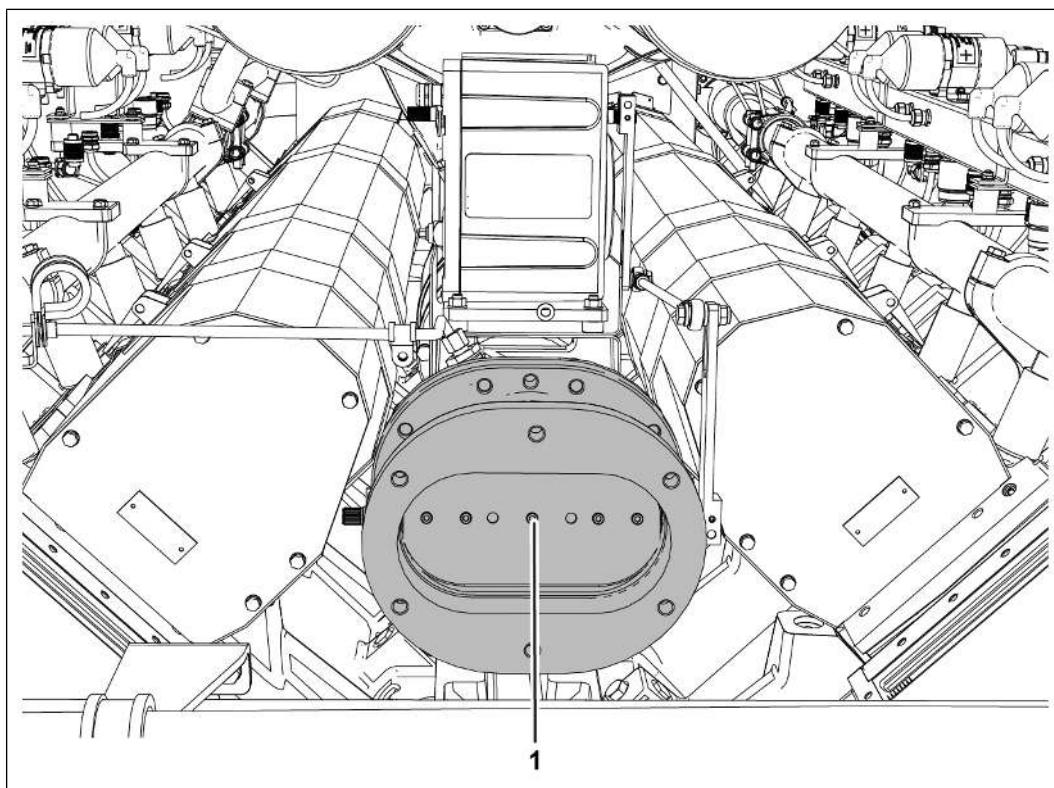
The mixture system feeds the turbocharged mixture through the mixture cooler to the cylinder heads.

The mixture pipe and the mixture manifold direct the turbocharged mixture from the exhaust turbocharger to the mixture cooler, where the turbocharged mixture is cooled to the setpoint temperature specified by the control, see also [Functional description \[▶ 103\]](#).

The cooled mixture is fed from the mixture cooler to the inlet channels in the cylinder heads. The throttle valve regulates the flow rate of the mixture.

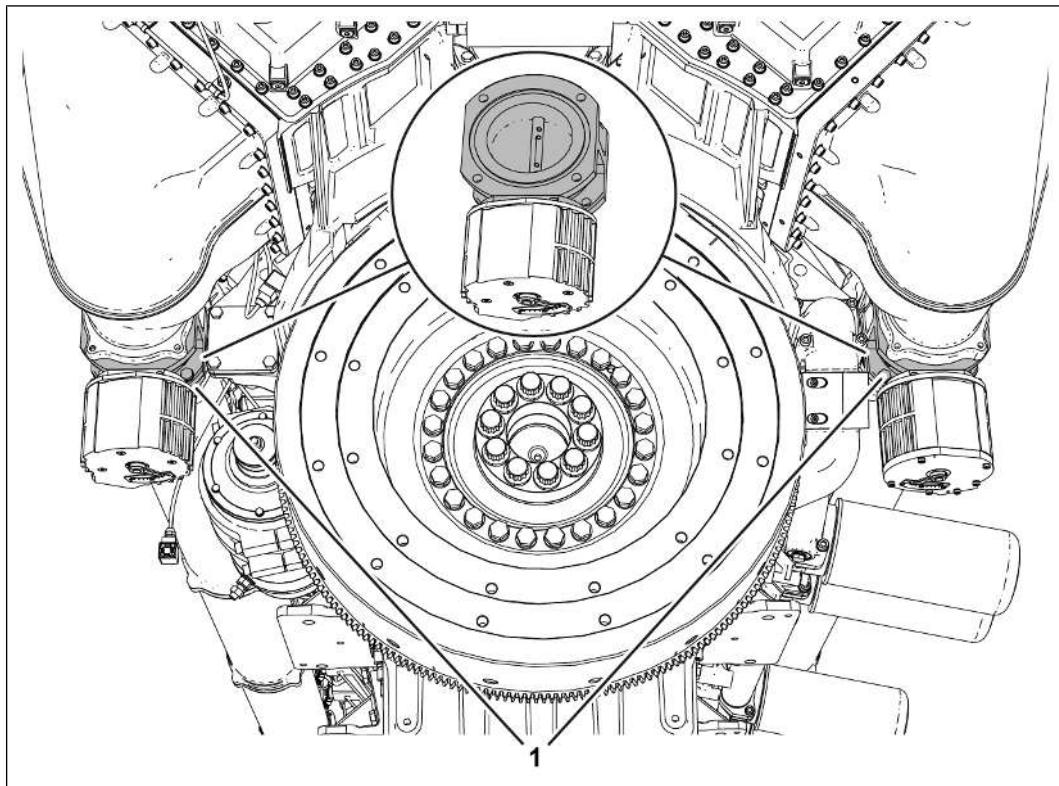
4.2.8.2 Throttle valve

Functional description



2776125195: V12/V16 engine

1 Throttle valve



2776115467: V20 engine

1 Throttle valve with actuator (inset)

Installed versions of the throttle valve vary.

- The V12/V16 engine is equipped with one throttle valve.
- The V20 engine is equipped with two throttle valves.

Together with the actuator, the throttle valve regulates the amount of mixture.

The actuator has the following characteristics:

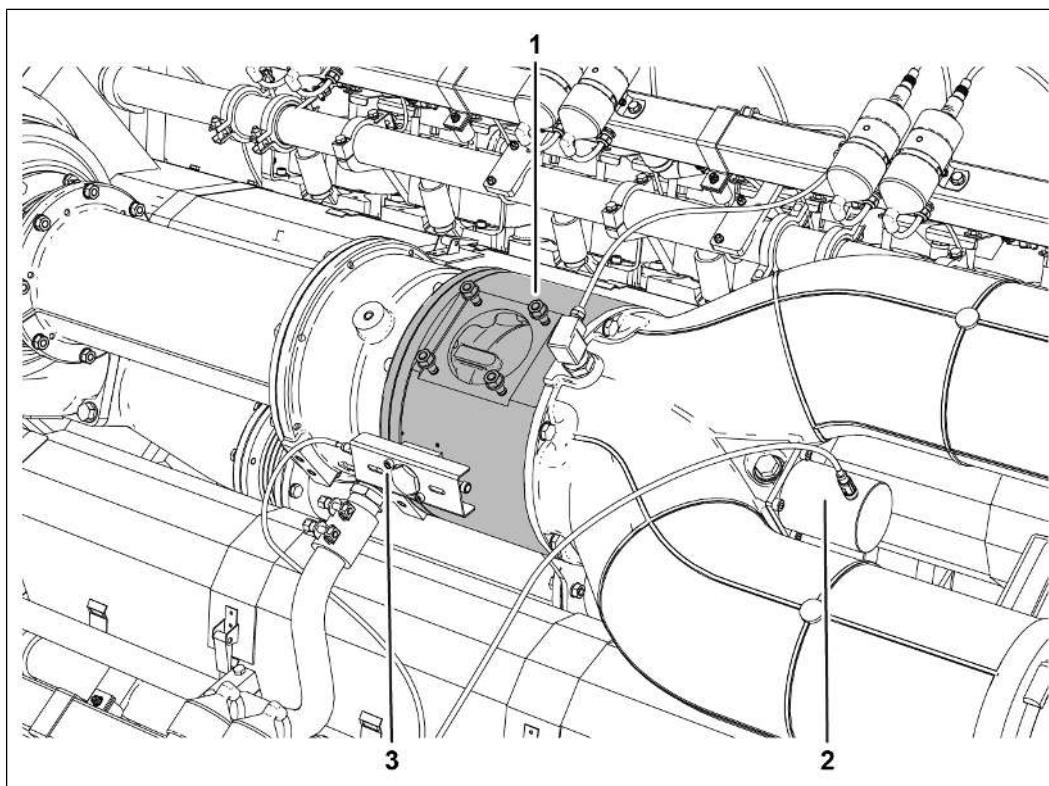
- High adjusting forces which act in both directions
 - Insensitivity towards a slow change in voltage of the power supply
- Low current consumption
- Insensitivity towards a slow change in voltage of the power supply
 - Sudden, abrupt voltage changes in quick succession can lead to controller malfunctions.

The actuator contains a DC motor that applies torque to the regulator output shaft via an intermediate gearbox.

A sensor takes contactless readings of the position of the feedback cam on the actuator's output shaft and transmits the values to the electronic control.

4.2.8.3 Gas-air mixer

Functional description



2776412683

- 1 Gas-air mixer
- 2 Stepper motor
- 3 Proximity switch

The gas-air mixer is the connection to the gas train. It is installed between the intake air system and the mixture system.

- The gas-air mixer mixes fuel gas and intake air in an optimal ratio to form a combustible mixture.

The gas-air mixer works according to the Venturi principle.

- The flow speed is at maximum at the tightest point in the gas-air mixer, resulting in negative pressure.
- With the resulting negative pressure, a ring gap mixes in the fuel gas.
- The stepper motor regulates the ring gap, which in turn determines the mixing ratio of fuel gas to intake air.

Additional information

The gas train supplies the engine with fuel gas, necessary for the operation of the genset.

- For more information on the gas train, see *Operating Manual, chapter Operation, section Gas supply*.

For more information on fuel gas, see [Technical Bulletin \(TR\) 3017 Specification for fuel gas](#).

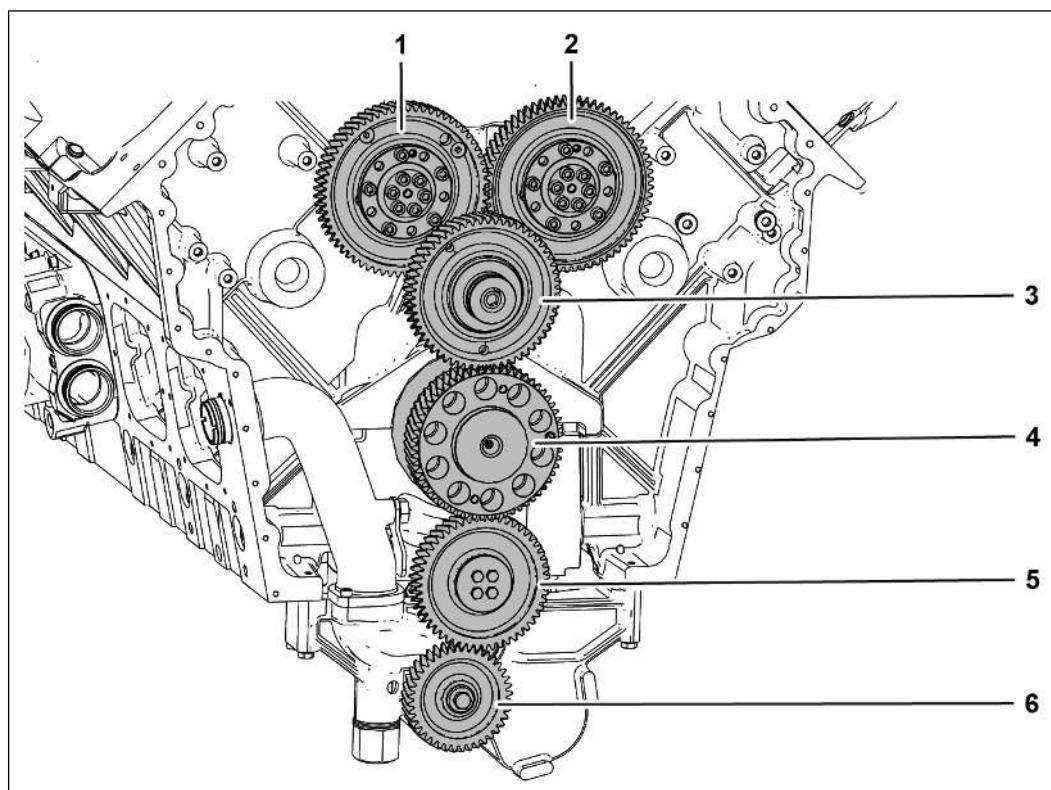
For more information on combustion air, see [Technical Bulletin \(TR\) 2132, Specification for combustion air](#).

4.2.9 Mechanical system

4.2.9.1 Mechanical system

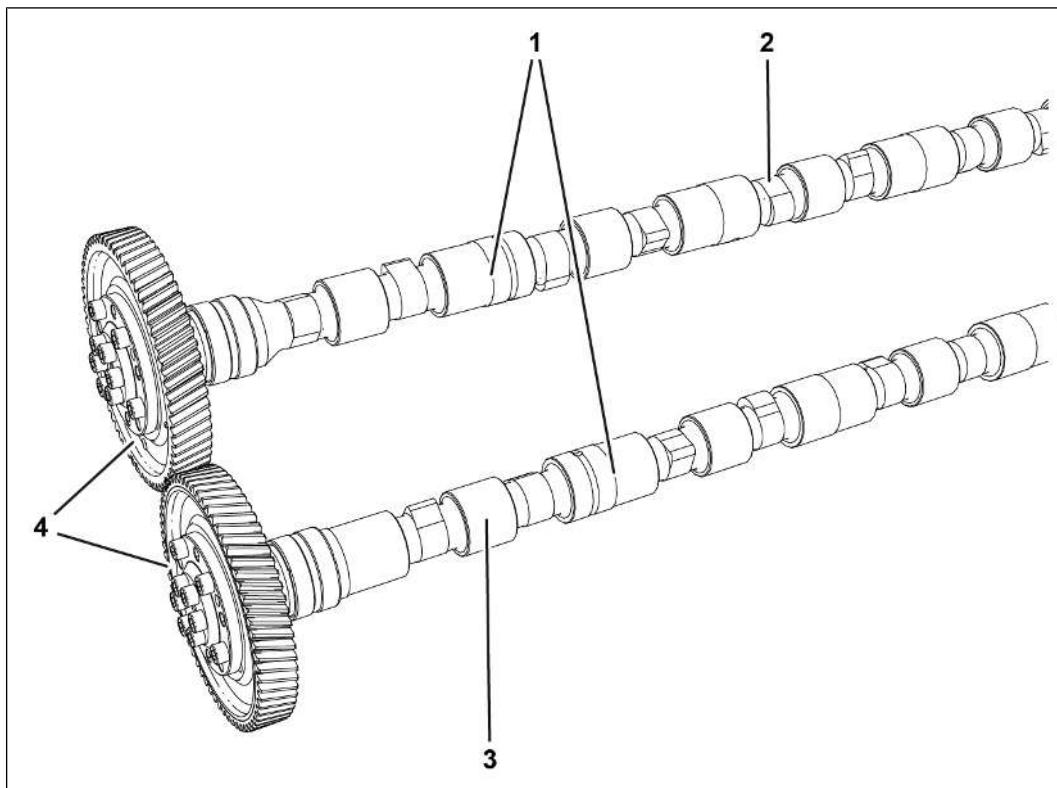
Functional description

The mechanical control consists of:



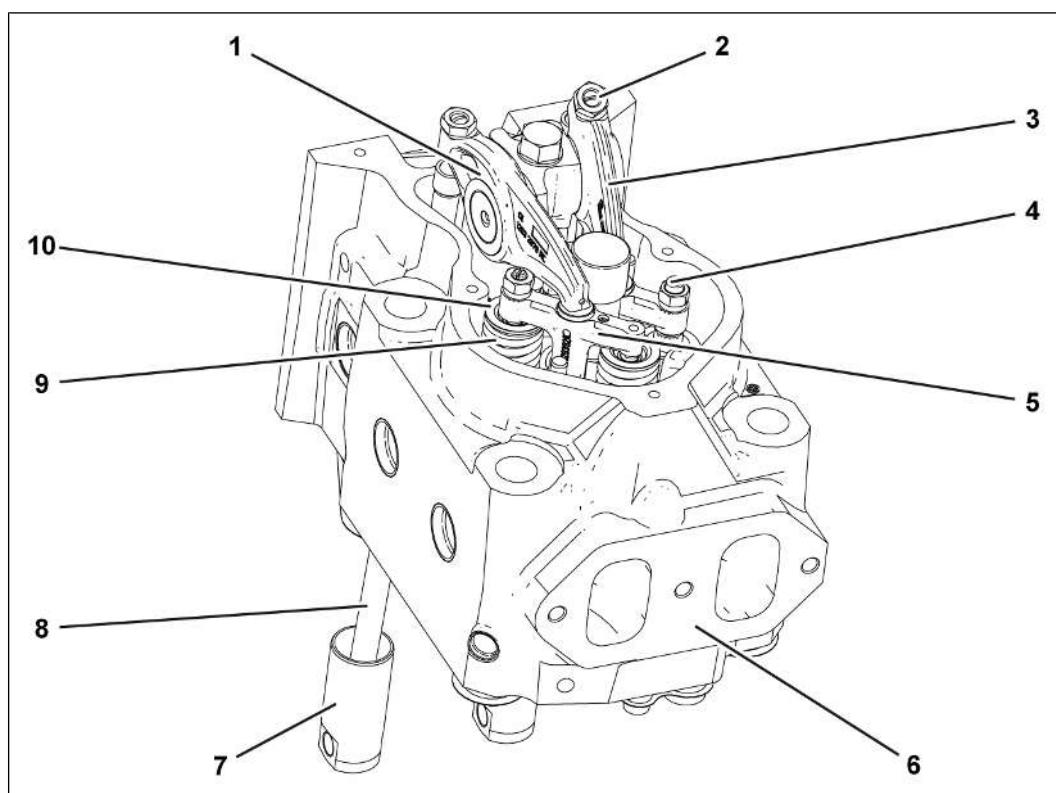
1981542411

- 1 Camshaft gear wheel (cylinder side B)
 - 2 Camshaft gear wheel (cylinder side A)
 - 3 Intermediate gear
 - 4 Crankshaft gear wheel
 - 5 Lube oil pump intermediate gear
 - 6 Gear wheel of lube oil pump
- Gear drive, see [Functional description \[▶ 101\]](#).



1983290123

- 1 Camshaft
 - 2 Cams
 - 3 Camshaft gear
 - 4 Bearing pins
- Camshaft, see [Functional description \[▶ 102\]](#).



150823307: TCG 3020

- 1 Inlet rocker arm
 - 2 Setting screw for valve clearance
 - 3 Outlet rocker arm
 - 4 Setting screw for valve crosshead
 - 5 Valve crosshead
 - 6 Cylinder head
 - 7 Roller tappet
 - 8 Push rod
 - 9 Valve spring
 - 10 Spring plate
- Valve train, see [Functional description \[▶ 97\]](#).

Functional description of the mechanical control

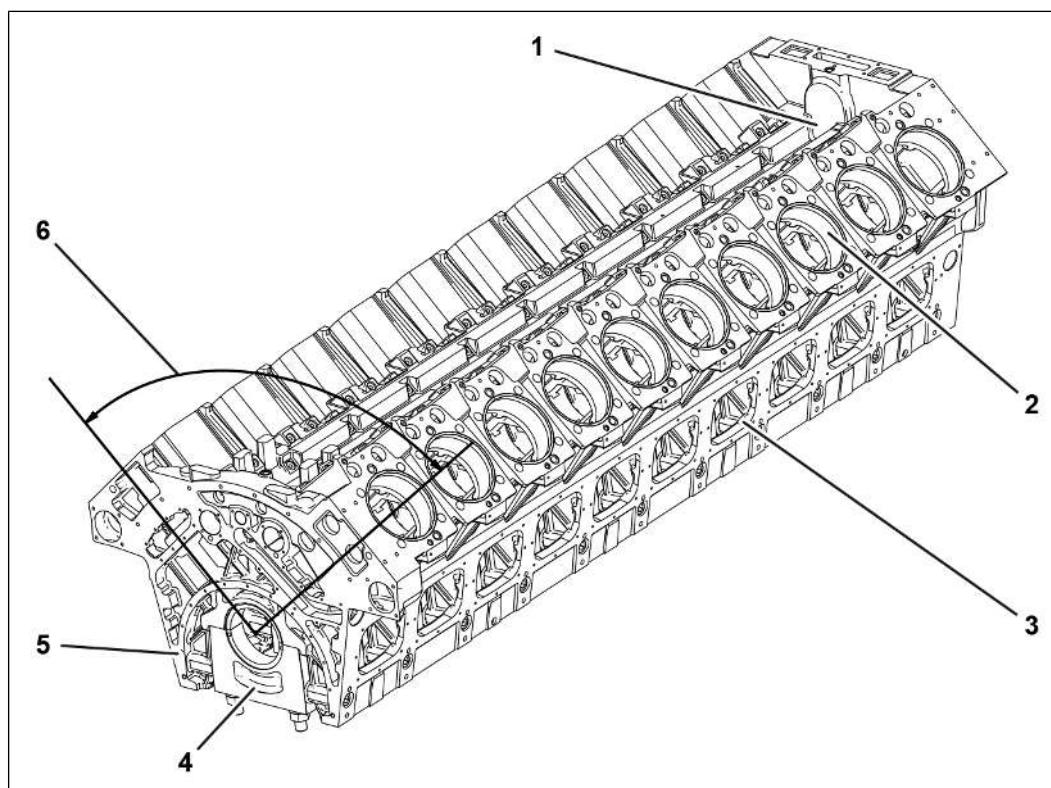
The gear wheel of the crankshaft drives the gear wheels of the camshafts (and the lube oil pump) via an intermediate gear.

The camshaft transmits its action to tappets and push rods to control the inlet valves and outlet valves according to the ignition sequence.

- The push rods are moved by the camshaft in a linear fashion, and transmit the motion to the rocker arms, which in turn press on the valve crossheads.
- One valve crosshead apiece activates both inlet valves or both outlet valves in this way.

4.2.9.2 Crankcase

Functional description



2788325515

1

2

1 Crankcase

2 Bore for cylinder liner

3 Maintenance opening

4 Main bearing cover

5 Side panel

6 Cylinder bank angle 90°

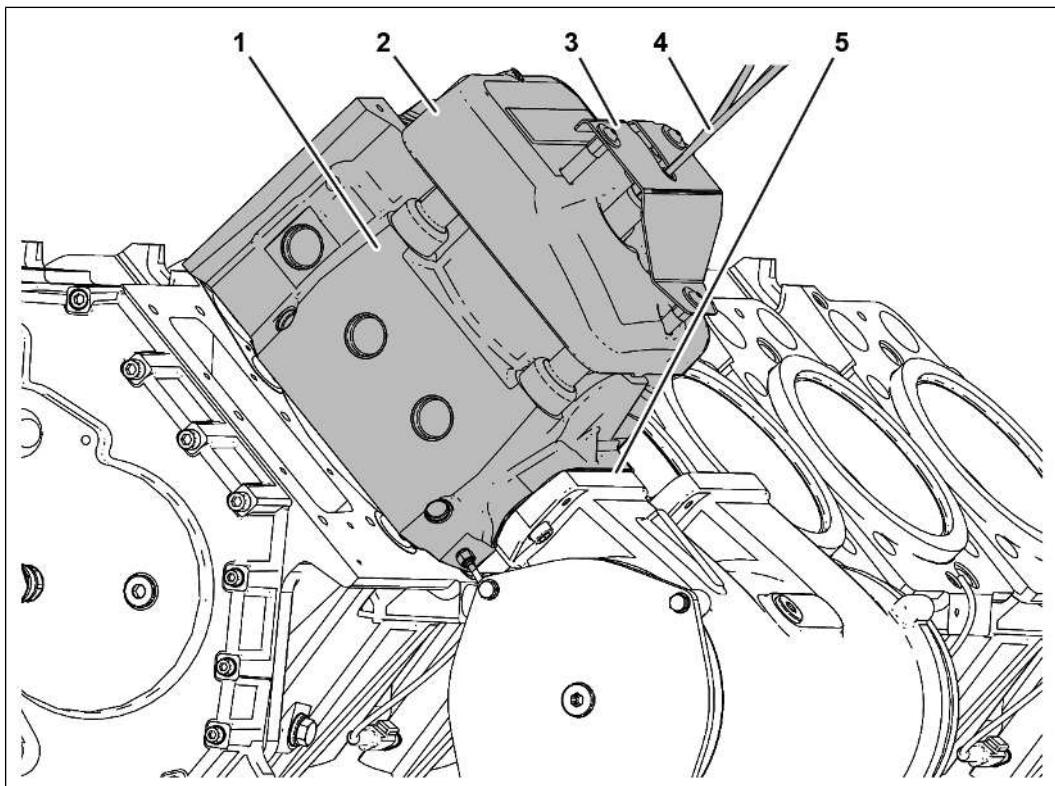
The crankcase is the central component of the engine.

The crankcase is used to accommodate:

- Cylinder heads
- Cylinder liners
- Crankshaft
- Camshaft
- Mechanical engine control

4.2.9.3 Cylinder head

Functional description



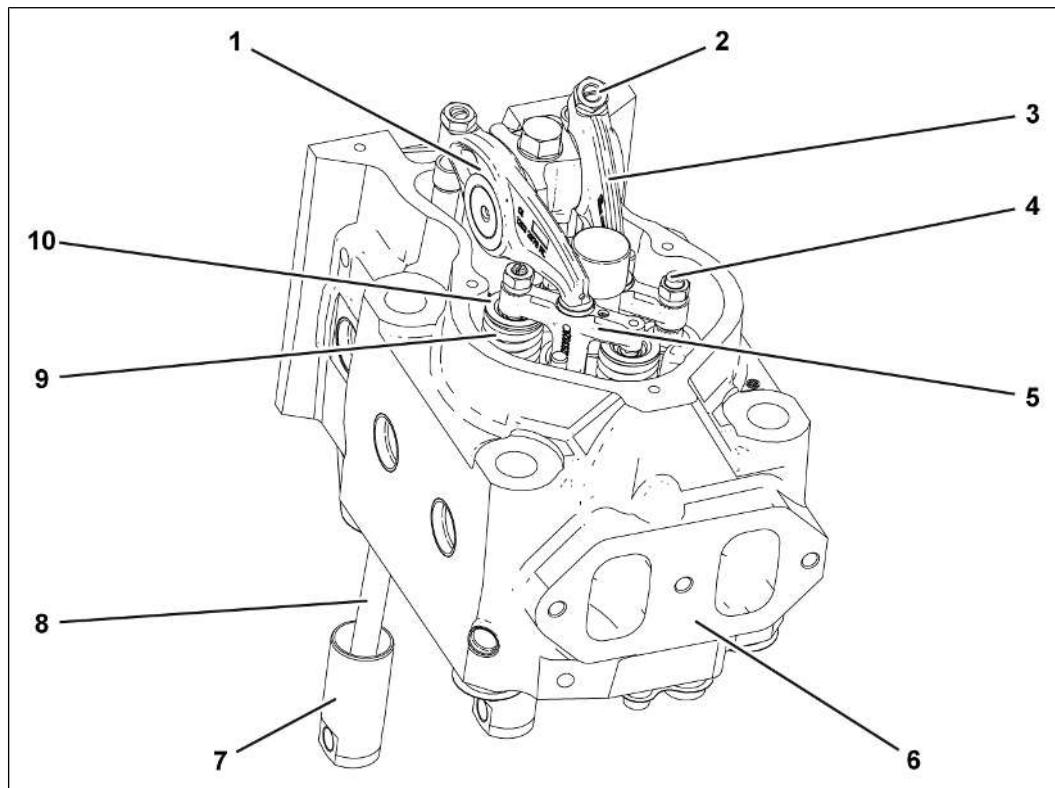
9007201200566283

- 1 Cylinder head
- 2 Cylinder head cover
- 3 Spark plug cover
- 4 Ignition cable
- 5 Inlet connection piece

Each cylinder has its own cylinder head that covers the engine combustion chamber. The cylinder head contains inlet ducts for the gas-air mixture and the outlet duct for the exhaust gas; it also contains the valve train.

- It is possible to replace an individual cylinder head very quickly thanks to its superb accessibility and optimized design.
- The cylinder heads are liquid-cooled and integrated in the engine cooling system.

The spark plug is screwed into the cylinder head and connected to the ignition coil by the ignition cable. For safety, a spark plug cover is installed over the spark plug.

Functional description

150823307: TCG 3020

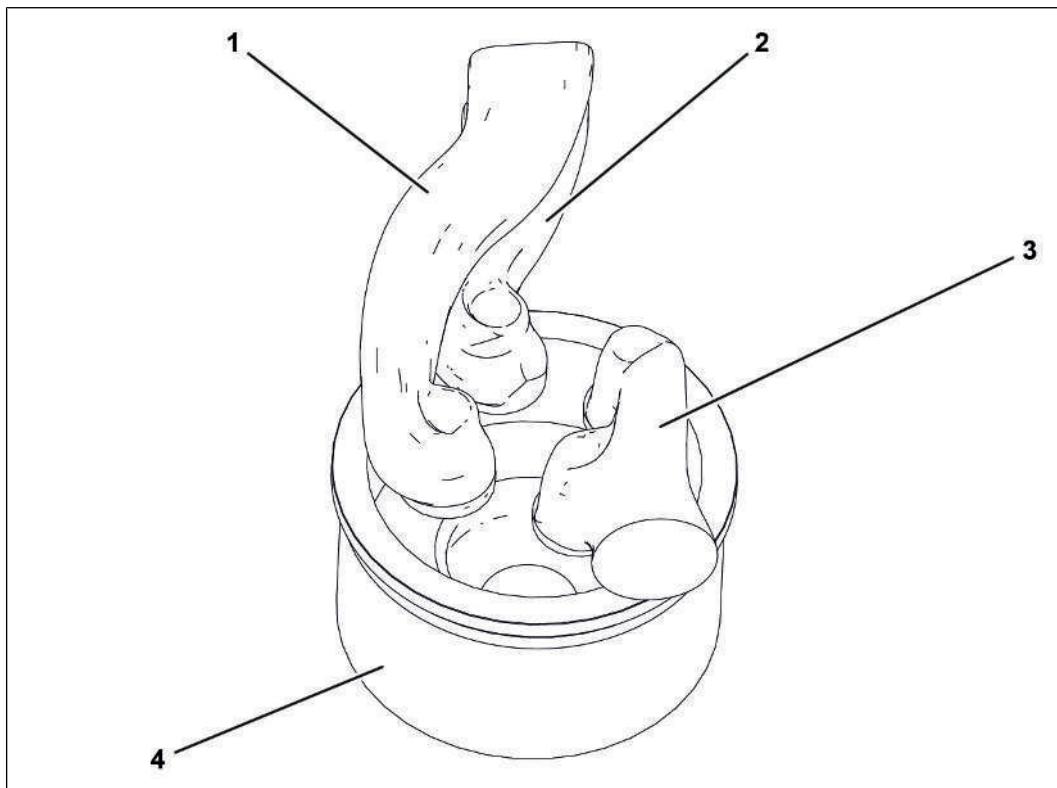
- 1 Inlet rocker arm
- 2 Setting screw for valve clearance
- 3 Outlet rocker arm
- 4 Setting screw for valve crosshead
- 5 Valve crosshead
- 6 Cylinder head
- 7 Roller tappet
- 8 Push rod
- 9 Valve spring
- 10 Spring plate

Each cylinder head has four valves.

- Two inlet valves ensure an optimum filling degree per cylinder.
- Two outlet valves enable exhaust gas to quickly flow out.

The push rods are moved by the camshaft in a linear fashion, and transmit the motion to the rocker arms, which in turn press on the valve crossheads.

- One valve crosshead controls both inlet valves while another controls both outlet valves.

Functional description

18014398899376139

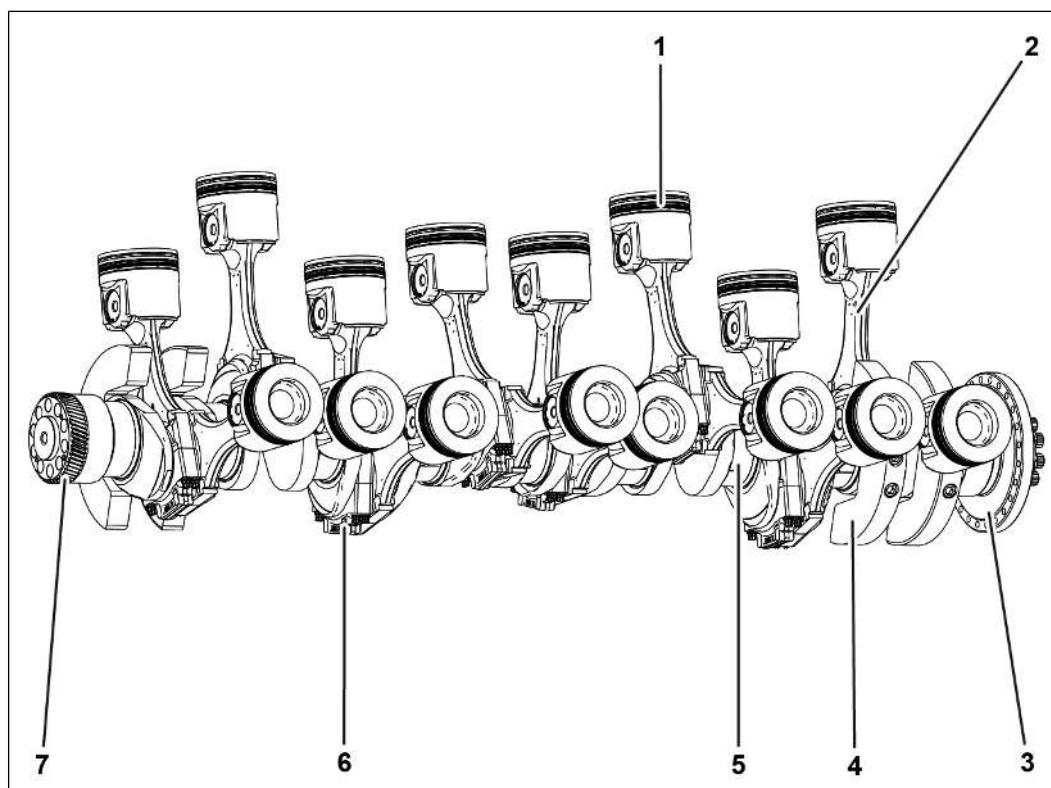
- 1 Swirl duct
- 2 Filling duct
- 3 Outlet duct
- 4 Cylinder liner

The cylinder heads are designed according to the cross flow principle. Here, the inlet and outlet ducts are arranged tangentially opposite each other.

The inlet ducts are aligned so that the gas-air mixture flows vertically onto the recess on the combustion side of the piston. The outlet ducts route the exhaust gases into the exhaust system from the cylinder head. The outlet ducts converge into one single channel.

4.2.9.4 Crankshaft drive

Functional description



1982663691

- 1 Piston
- 2 Con-rod
- 3 Flywheel flange
- 4 Counterweight
- 5 Crankshaft
- 6 Con-rod bearing
- 7 Crankshaft gear wheel

The crankshaft drive is installed in the crankcase.

- The crankshaft drive converts the linear motion of the pistons into the rotary motion of the crankshaft.
- The con-rod transmits the piston force, resulting from the combustion pressure, to the crankshaft.
 - The crankshaft transmits the kinetic energy to the flywheel.

The flywheel in turn transmits the stored kinetic energy onward to the generator shaft via the coupling.

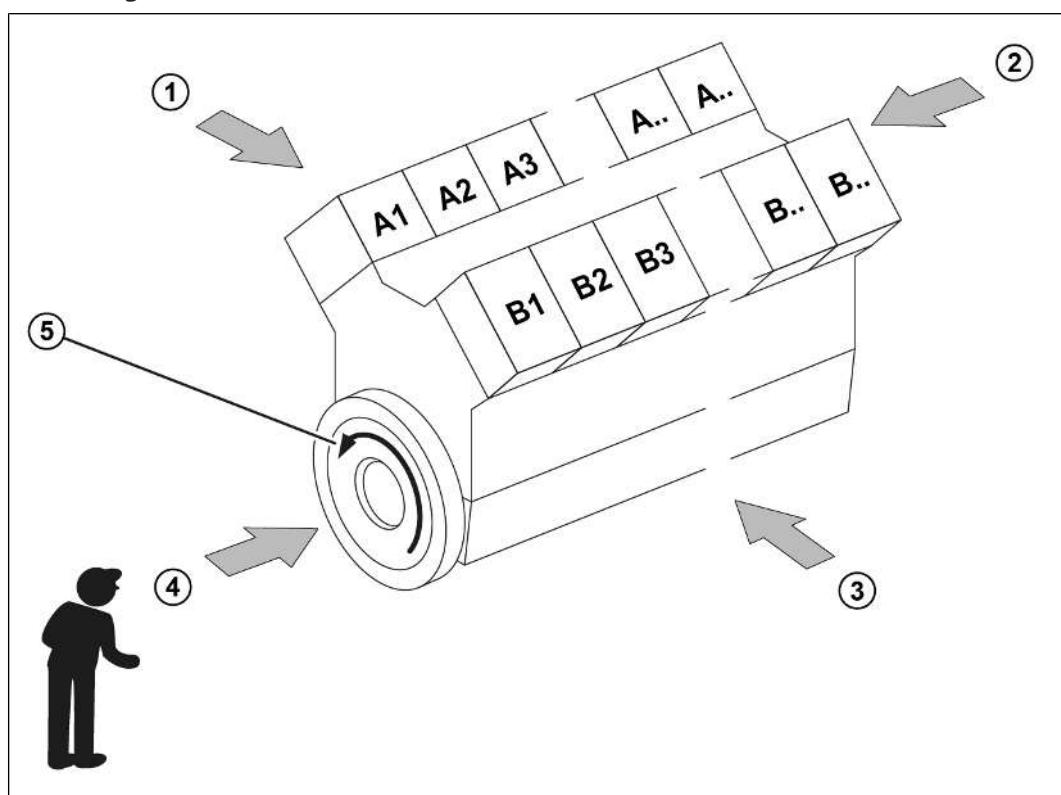
- The inertia of the flywheel ensures a uniform transmission of the force.

A torsional vibration damper may be installed on the crankshaft on the engine side opposite the flywheel.

- The torsional vibration damper reduces the short-term torque spikes caused by the discontinuous power transmission of the pistons in the combustion process.
- In this way, the torsional vibration damper relieves the crankshaft and ensures smooth engine operation and stable speeds.

4.2.9.5 Cylinders

Cylinder designation



9007201097739019

- 1 Cylinder side A (left engine side)
- 2 Free end (face side, i.e. side opposite the coupling)
- 3 Cylinder side B (right engine side)
- 4 Drive end (flywheel side or coupling side)
- 5 Flywheel direction of rotation (arrow)

Every cylinder has an alphanumeric code.

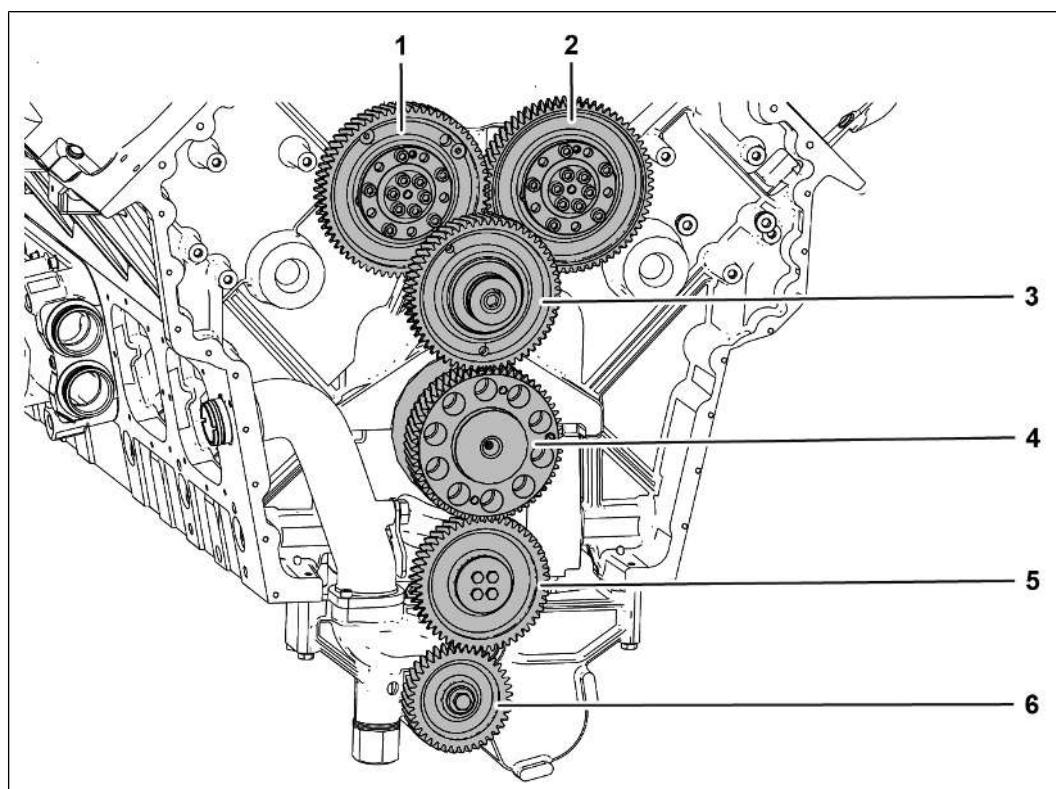
The cylinders are counted sequentially, beginning from the drive end.

- The first cylinder on the left engine side has the code A1.
- The first cylinder on the right engine side has the code B1.
- The cylinders are counted sequentially on each engine side.

The engine's direction of rotation is counterclockwise as seen from the drive end (anticlockwise rotation).

4.2.9.6 Gear drive

Functional description



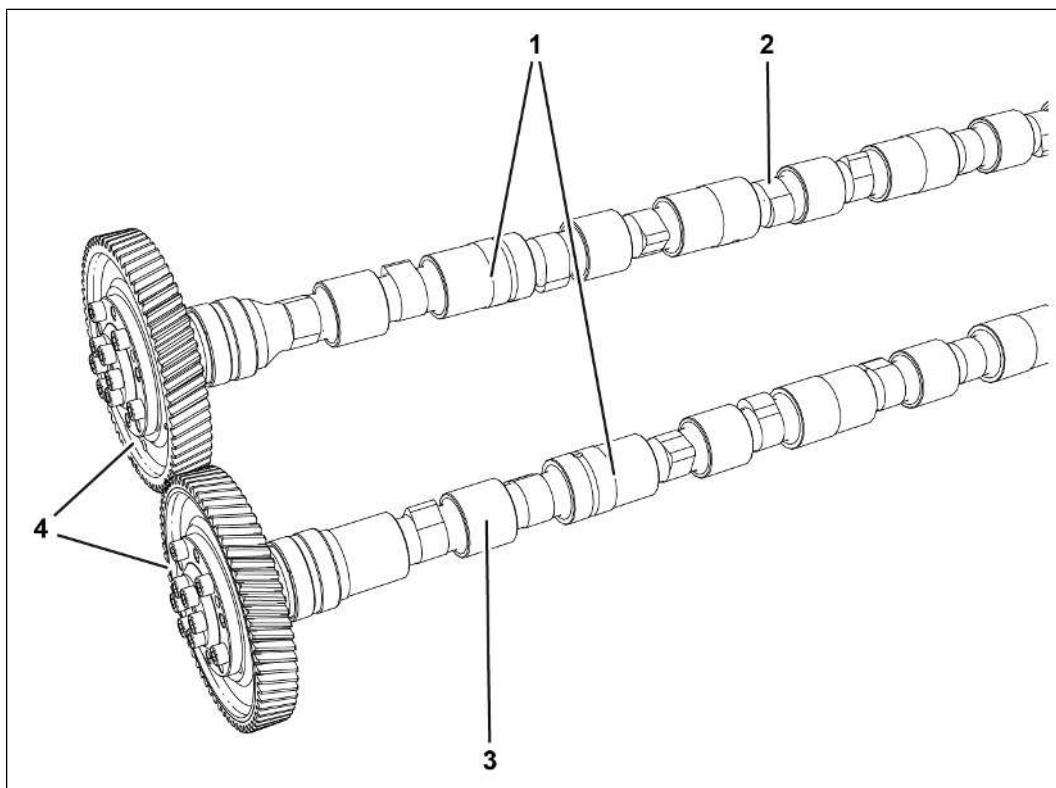
1981542411

- 1 Camshaft gear wheel (cylinder side B)
- 2 Camshaft gear wheel (cylinder side A)
- 3 Intermediate gear
- 4 Crankshaft gear wheel
- 5 Lube oil pump intermediate gear
- 6 Gear wheel of lube oil pump

The gear drive is installed on the free end (opposite side of the coupling).

The gear wheel of the crankshaft drives the gear wheels of the camshafts and the lube oil pump via an intermediate gear.

- The intermediate gear drives both camshaft gears, which mesh with each other.
- The intermediate gear of the lube oil pump drives the lube oil pump.

4.2.9.7 Camshaft**Functional description**

1983290123

- 1 Camshaft
- 2 Cams
- 3 Bearing pins
- 4 Camshaft gear

The camshaft rests on replaceable bearing liners in the crankcase.

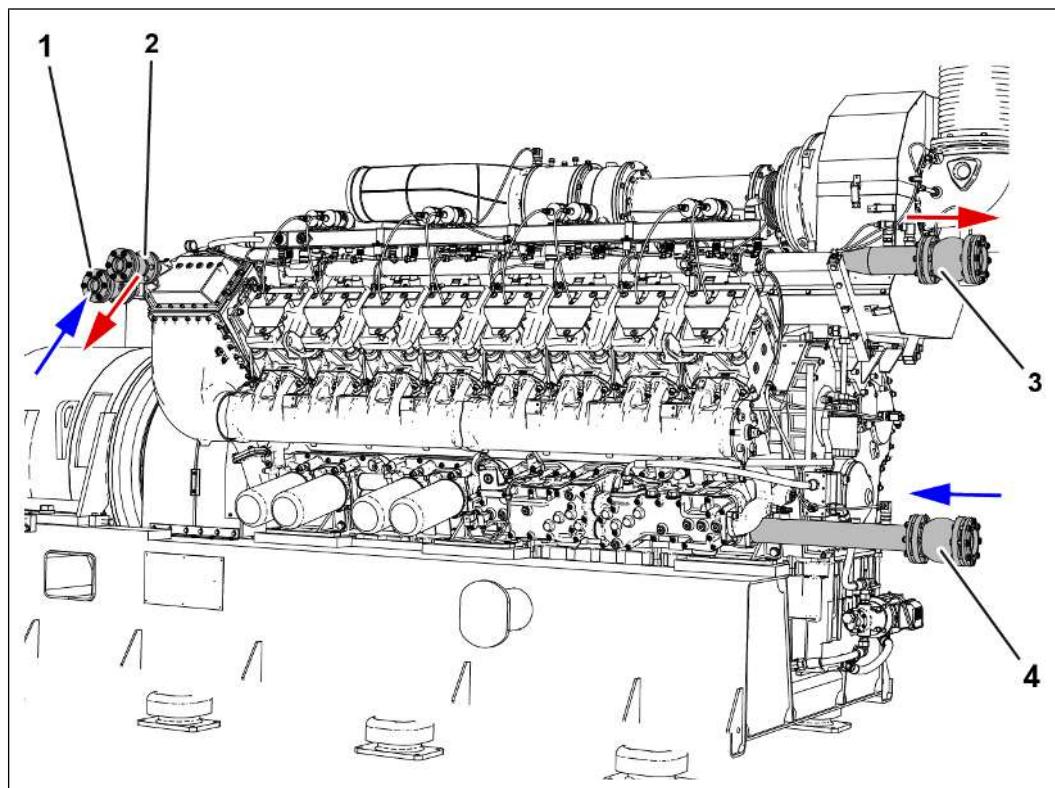
The camshaft is responsible for opening and closing the inlet valves and outlet valves at the right times.

- The individual cams on the camshaft press on the valves of each cylinder and open them with the precise stroke and in a strictly defined sequence.

4.2.10 Cooling system

4.2.10.1 Cooling system

Functional description



2787668107

- 1 Coolant inlet (mixture cooling circuit)
- 2 Coolant outlet (mixture cooling circuit)
- 3 Coolant outlet (engine cooling circuit)
- 4 Coolant inlet (engine cooling circuit)

The cooling system has the following functions:

- Dissipating combustion heat
- Cooling the engine
- Cooling the gas-air mixture

The cooling system consists of the engine cooling circuit and mixture cooling circuit.

Engine cooling circuit

The engine cooling circuit is the **HT** circuit and contains the following assemblies:

- Mixture cooler
- Lube oil cooler
- Engine

- Dump cooling circuit (optional)
- Heat utilization

Mixture cooling circuit

The mixture cooling circuit is the **LT** circuit and contains the following assemblies:

- Mixture cooler
- Radiator

The mixture cooling circuit lowers the mixture temperature and increases the engine power.

Control and monitoring

The electronic control monitors the following in the cooling system:

- Coolant temperature
- Coolant fill level
- Coolant pressure

Coolant

The coolant consists of water mixed with a cooling system protection agent. The cooling system protection agent prevents damage resulting from:

- Corrosion
- Frost
- Cavitation

External cooling system

For additional information and a schematic diagram of the external cooling system, see *Operating Manual, chapter General, section P&I diagram.*

4.2.11 Lube oil system

4.2.11.1 Lube oil system

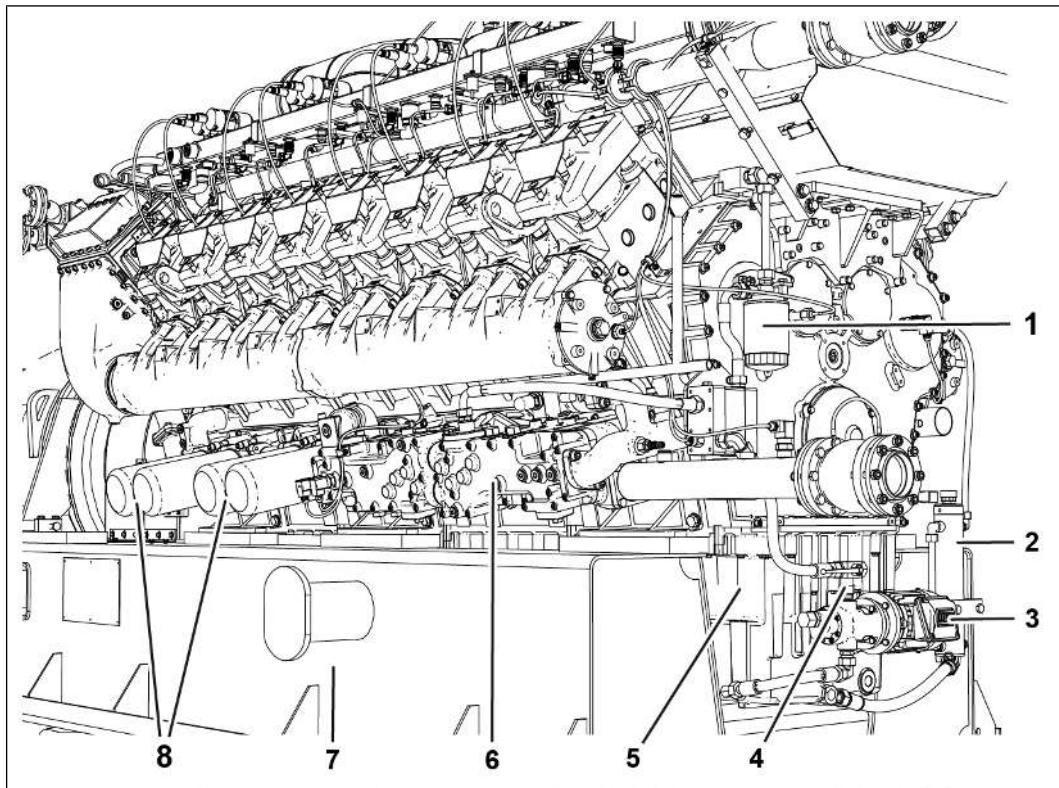
Functional description

The engine lubrication is designed as a so-called wet sump lubricating system.

The lube oil from the lube oil sump and in the expanded lube oil volume forms the lube oil volume that is available to the engine for lubrication.

The lube oil reduces the friction between components which rub against each other and dissipates heat from the sliding points.

- A lube oil film on the cylinder running surfaces reduces the sliding friction of the pistons and piston rings.
- Furthermore, the lube oil transports absorbed contaminants to the lube oil filter, where they are filtered out.



2789518347: Components of the lube oil system

- 1 Lube oil filter for exhaust turbocharger
- 2 Level sensor
- 3 Prelubrication pump
- 4 Ball valve
- 5 Lube oil sump
- 6 Lube oil cooler
- 7 Base frame with lube oil tank, if necessary
- 8 Lube oil filter

A prelubrication pump is mounted on the free side of the genset and is started via the electronic control.

- The duration and intervals of the prelubrication process are defined in the electronic control.

The lube oil pump installed in the lube oil sump aspirates lube oil from the lube oil sump and pumps this through the lube oil cooler and lube oil filter in the engine's lube oil circuit.

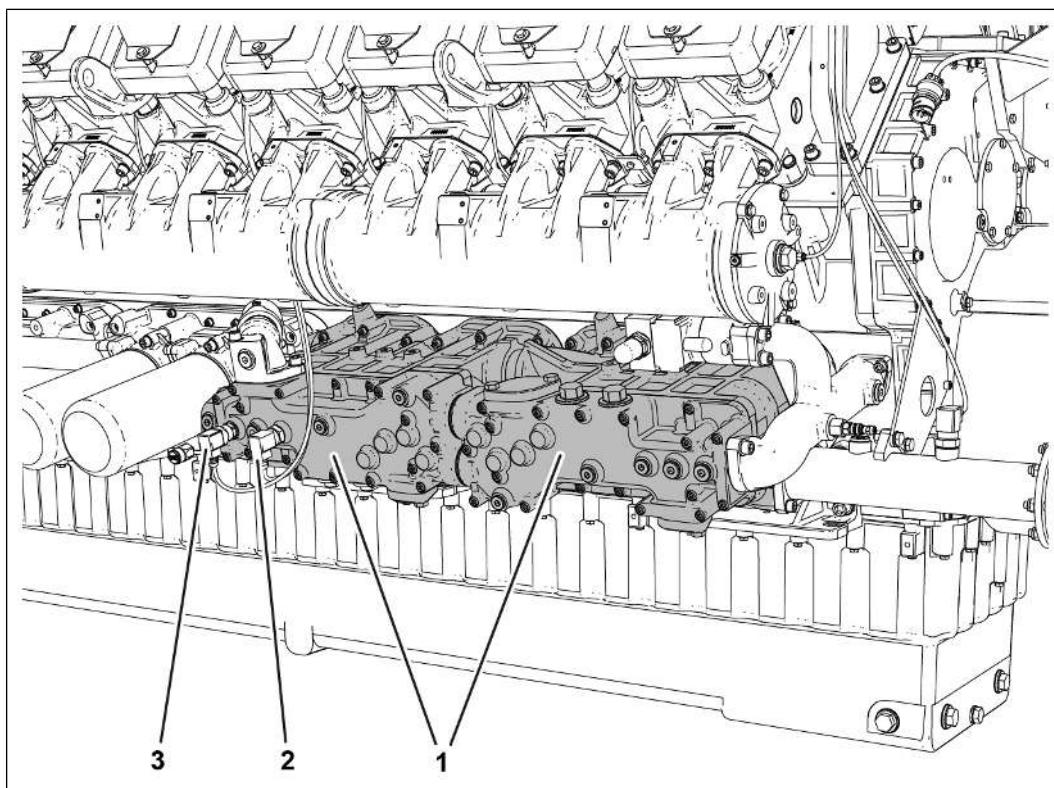
Pressure valves integrated in the lube oil circuit adjust the lube oil pressure.

The lube oil cooler is fitted with a bypass valve to prevent overpressure when starting.

The electronic control regulates the automatic lube oil refill and monitors the lube oil levels with a level sensor for this purpose.

4.2.11.2 Lube oil cooler

Functional description



2796608267

- 1 Lube oil cooler
- 2 Temperature sensor
- 3 Pressure sensor

The lube oil cooler is mounted on cylinder side B on the crankcase.

- The lube oil cooler is mounted in the flow direction upstream of the lube oil filters.

The lube oil cooler features a heat exchanger which is supplied with lube oil from one side and coolant from the other side.

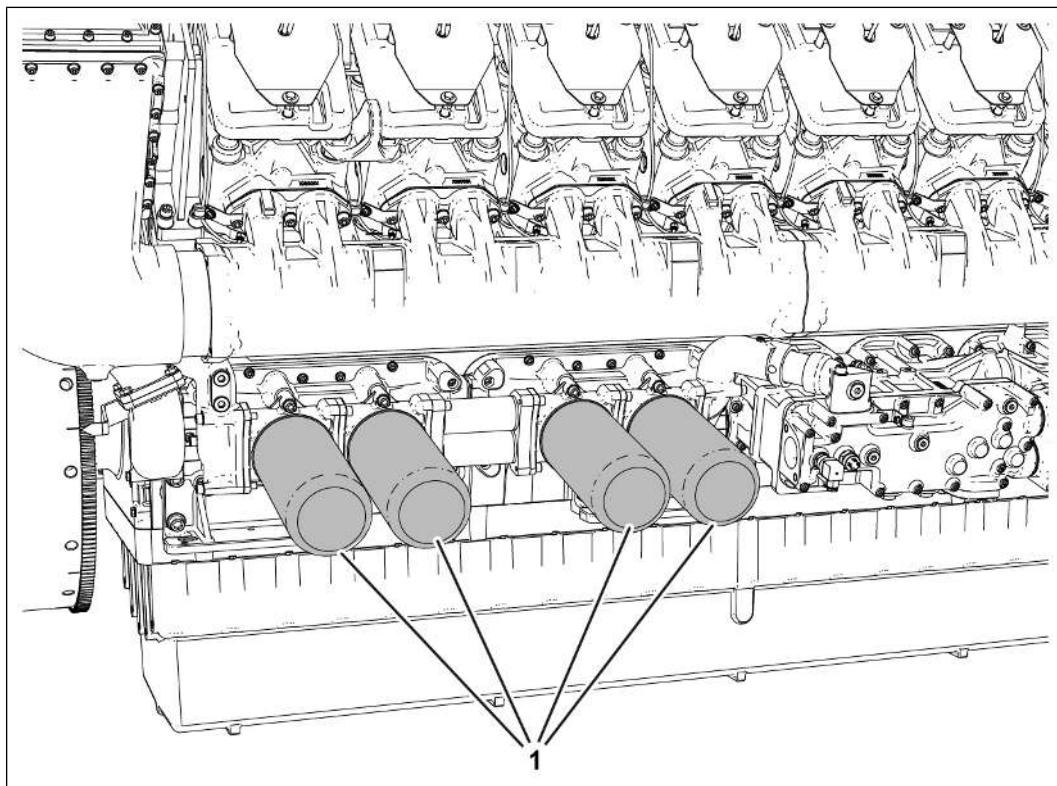
The two media approach the same temperature within the heat exchanger of the lube oil cooler.

- Lube oil that is cooler than the coolant heats up.
- Lube oil that is warmer than the coolant cools down.

To prevent overpressure when starting, the lube oil cooler is fitted with a bypass valve.

4.2.11.3 Lube oil filter

Functional description



2796579979

1 Lube oil filter

The number of lube oil filters differs depending on the number of cylinders.

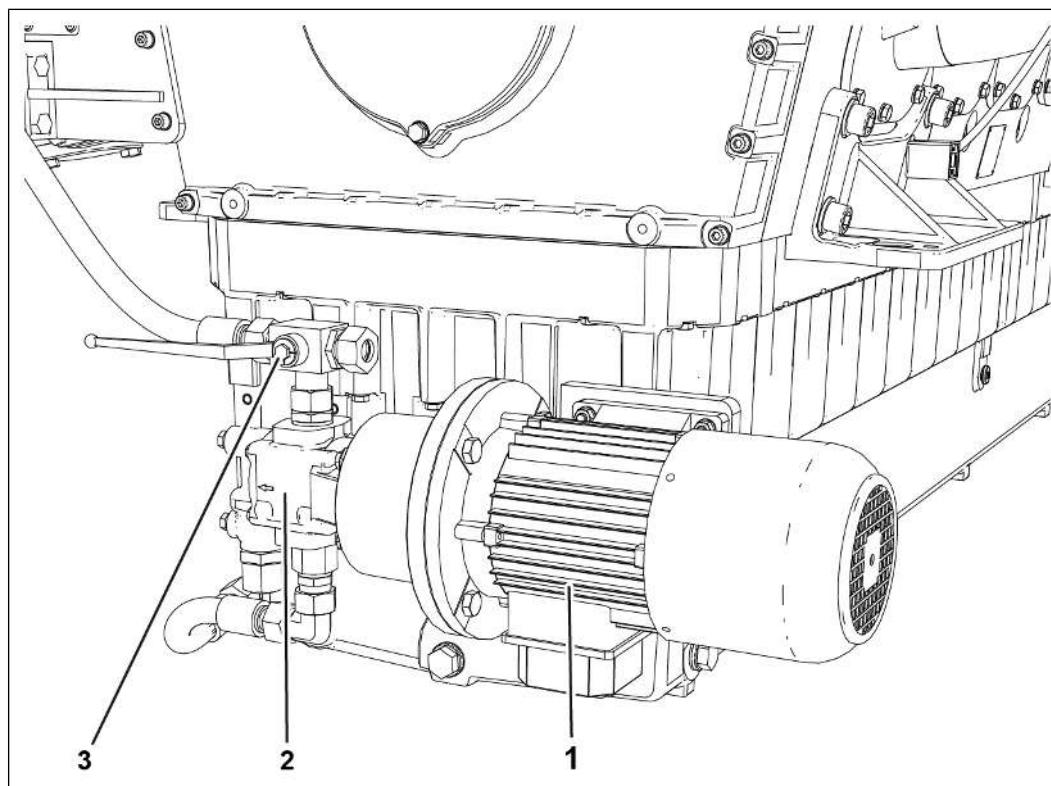
- Two or four lube oil filters can be installed.

Lube oil filters make sure that the lube oil is free of dirt particles.

- The lube oil pump feeds the lube oil through the lube oil filter, after which the filtered lube oil passes to the lubrication points in the engine.

4.2.11.4 Prelubrication pump

Functional description



2789786635

- 1 Prelubrication pump
- 2 3-way valve
- 3 Ball valve

The prelubrication pump is installed on the free end of the genset.

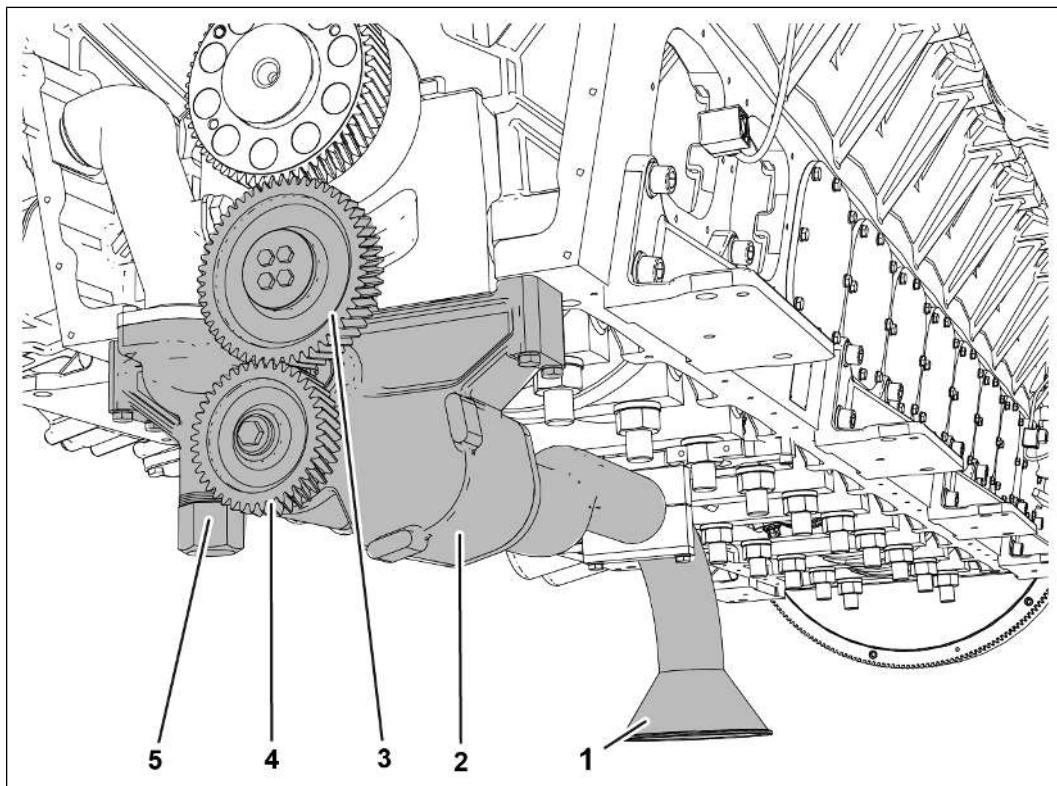
Before the genset is started, the electronic system turns on the prelubrication pump. The duration and intervals of the prelubrication process are defined in the electronic system.

In the case of gensets that are in operationally-ready condition, the electric prelubrication pump lubricates the genset at regular intervals.

A start is only possible once the prelubrication process has been cycled through completely.

The prelubrication pump has the following functions:

- Interval lubrication
- Prelubrication before every engine start
- Relubrication after shutting down engine
- Pumping out the lube oil for a lube oil change
- Filling the lube oil cooler and lube oil filter after a lube oil change

4.2.11.5 Lube oil pump**Lube oil pump**

2796646283

- 1 Lube oil pipe
- 2 Lube oil pump
- 3 Intermediate gear
- 4 Drive wheel
- 5 Pressure control valve

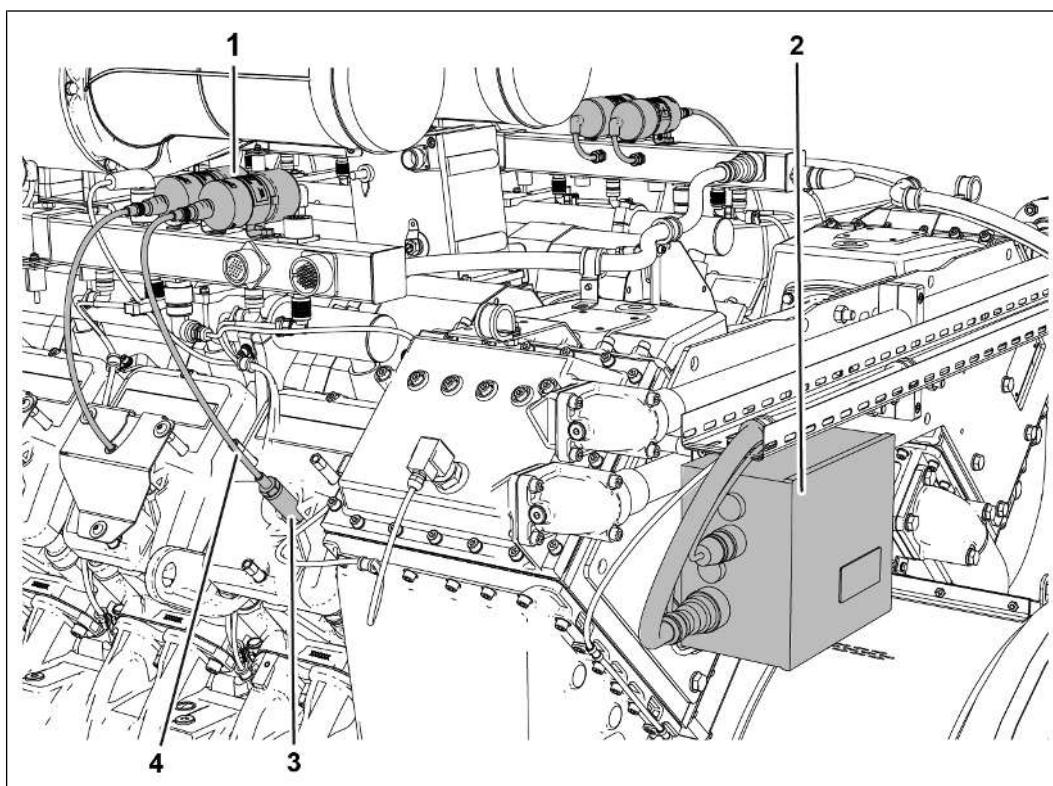
The lube oil pump is mounted in the lube oil sump.

- The lube oil pump transports the lube oil through the lube oil cooler to the lube oil filter.
- The lube oil pump is fitted with a pressure control valve.

4.2.12 Ignition system

4.2.12.1 Ignition system

Functional description



2791267467

- 1 Ignition coil
- 2 Ignition control device
- 3 Spark plug
- 4 Ignition cable

The electronic control generates the ignition pulse and transmits the ignition pulse to the ignition coils as a voltage pulse.

The high voltage generated in the ignition coil is transmitted to the spark plug via the ignition cable.

At the head of the spark plug is the spark plug chamber, which has holes in it.

A voltage pulse sets off a spark in the spark plug chamber, which ignites the mixture in the spark plug chamber.

The resulting flame fronts pass through the holes and into the cylinder combustion chamber, igniting the mixture.

Advantages of a prechamber spark plug:

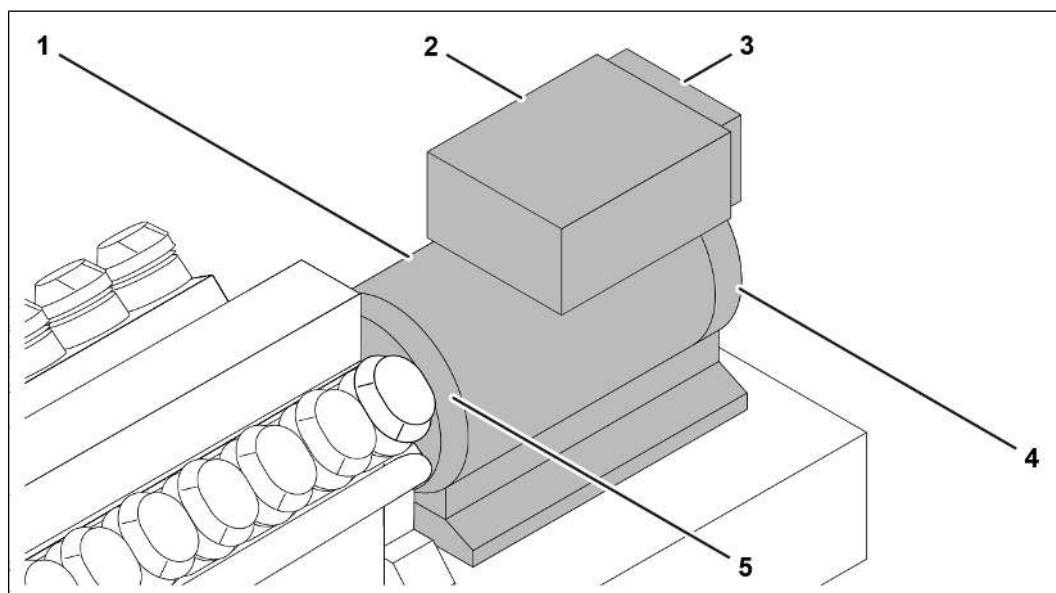
- Uniform propagation of the flame front across the entire combustion chamber
- More effective combustion
- Low electrode wear and therefore:
 - Greater service life of the spark plug

4.3 Generator

4.3.1 Generator

Part number: (null)

4.3.1.1 Functional description



408368011

- 1 Generator
- 2 Main terminal box
- 3 Auxiliary terminal box (if necessary, also mounted on the drive end)
- 4 Non-drive end
- 5 Drive end

The generator converts the mechanical energy of the engine into electrical energy.

Brushless, self-excited, and self-regulating three-phase synchronous generators, which are suitable for mains parallel mode, mains back-up, or island mode depending on their intended application, are used as standard.

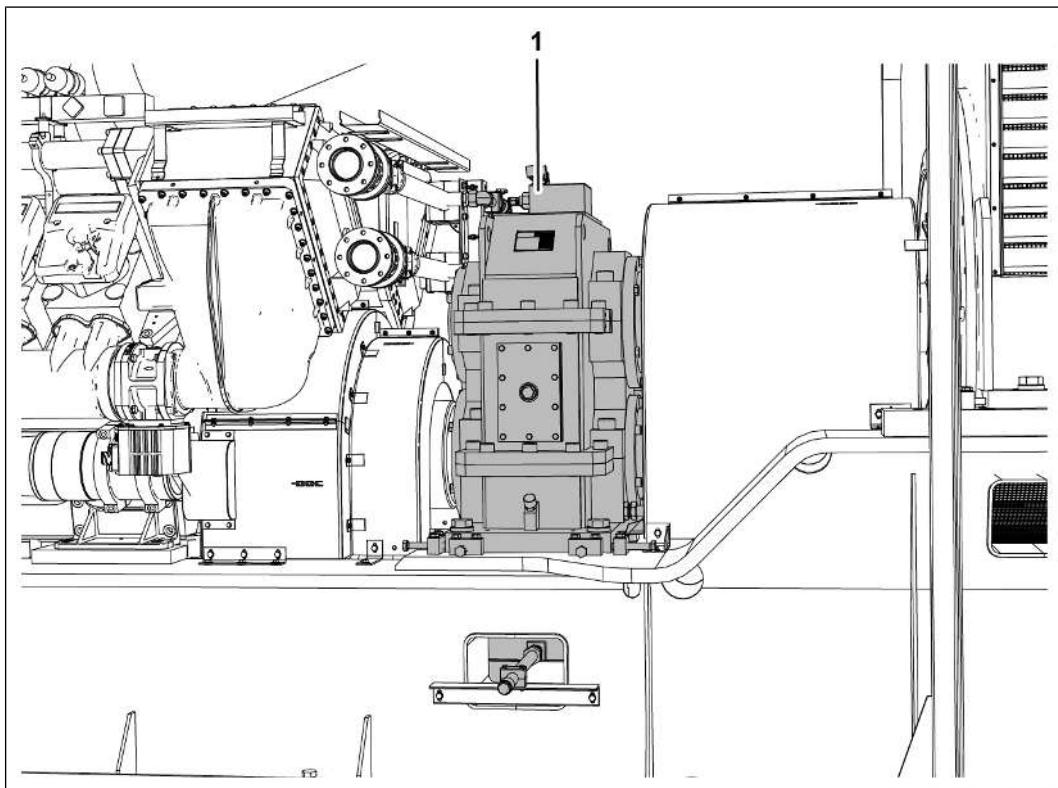
The generator is mounted on the base frame in the power flow direction downstream of the engine and coupling.

One generator bearing each is mounted both on the drive end and on the non-drive end of the generator. Depending on the type of generator, these generator bearings can be designed as sleeve bearings or rolling bearings.

4.4 Transmission

4.4.1 Transmission

4.4.1.1 Functional description



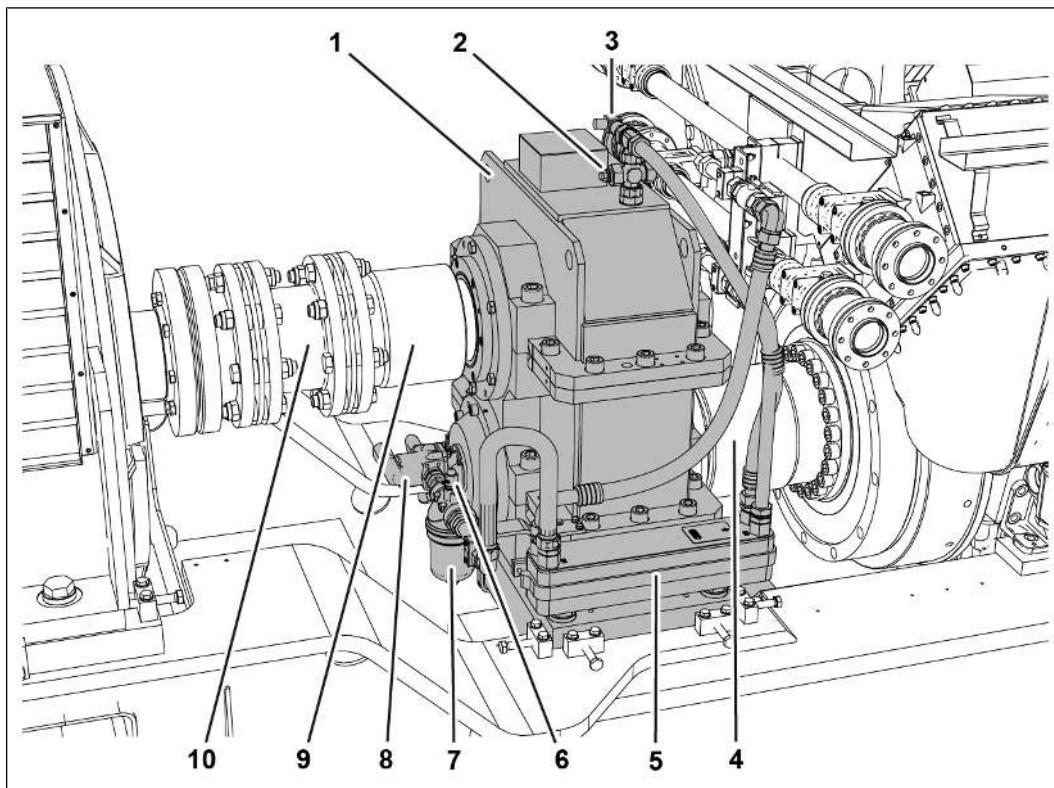
2735103883

A transmission (1) is installed between the engine and generator, which is designed as a single-stage spur transmission.

- The transmission is mounted on the base frame and connected to the engine and generator via couplings.

The transmission adjusts the speed from the engine to the required speed to the generator.

- In this way, the required nominal speed for the frequency of 60 Hz is achieved.



2001964171

- 1 Transmission
- 2 Temperature sensor
- 3 Oil pressure switch
- 4 Transmission flange to engine
- 5 Heat exchanger
- 6 Service indicator
- 7 Lube oil filter
- 8 Lube oil pump
- 9 Transmission flange to generator
- 10 Coupling

The lube oil pump is mounted next to the lube oil filter on the generator side of the transmission.

- The lube oil pump sucks the lube oil out of the transmission housing and pumps the lube oil through the lube oil filter.

A service indicator provides information on the degree of dirt contamination and the associated change of the lube oil filter.

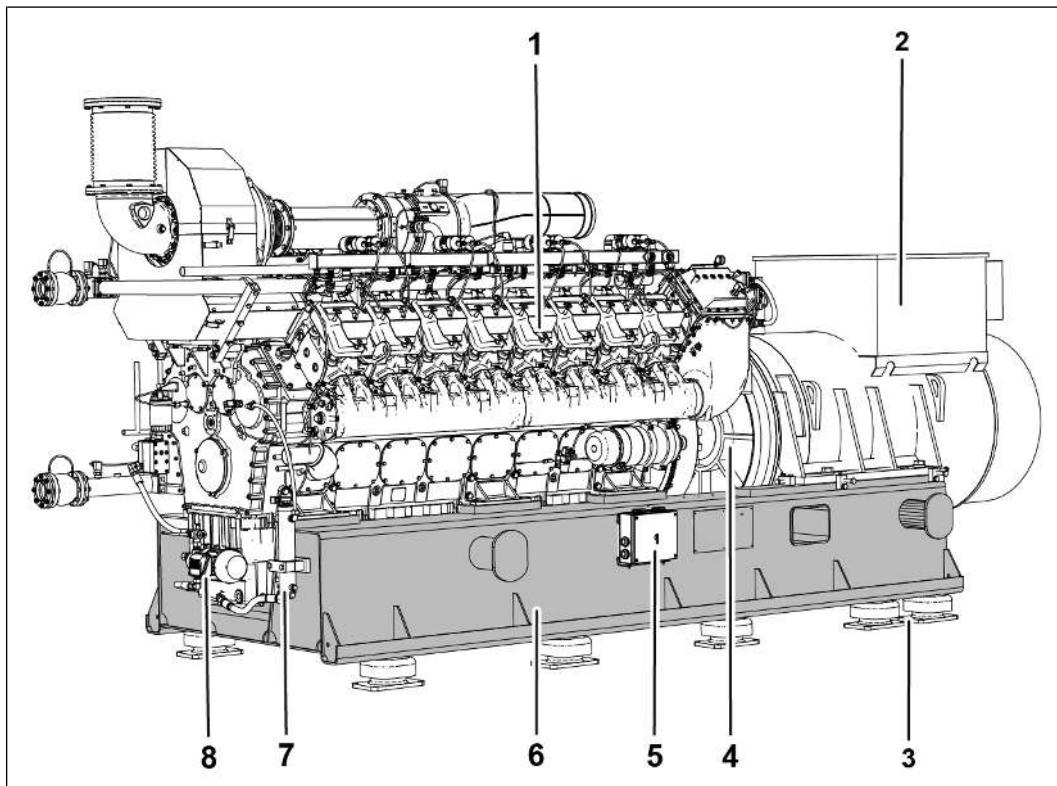
A heat exchanger is mounted on the transmission to cool the lube oil.

- The filtered lube oil cools down in the heat exchanger and flows back into the transmission.

4.5 Base frame

4.5.1 Base frame

4.5.1.1 Functional description



2785676171

- 1 Engine
- 2 Generator
- 3 Anti-vibration mounting
- 4 Coupling
- 5 Terminal box
- 6 Base frame
- 7 Level sensor
- 8 Prelubrication pump

The base frame rests on anti-vibration mountings.

The genset components are mounted on the base frame.

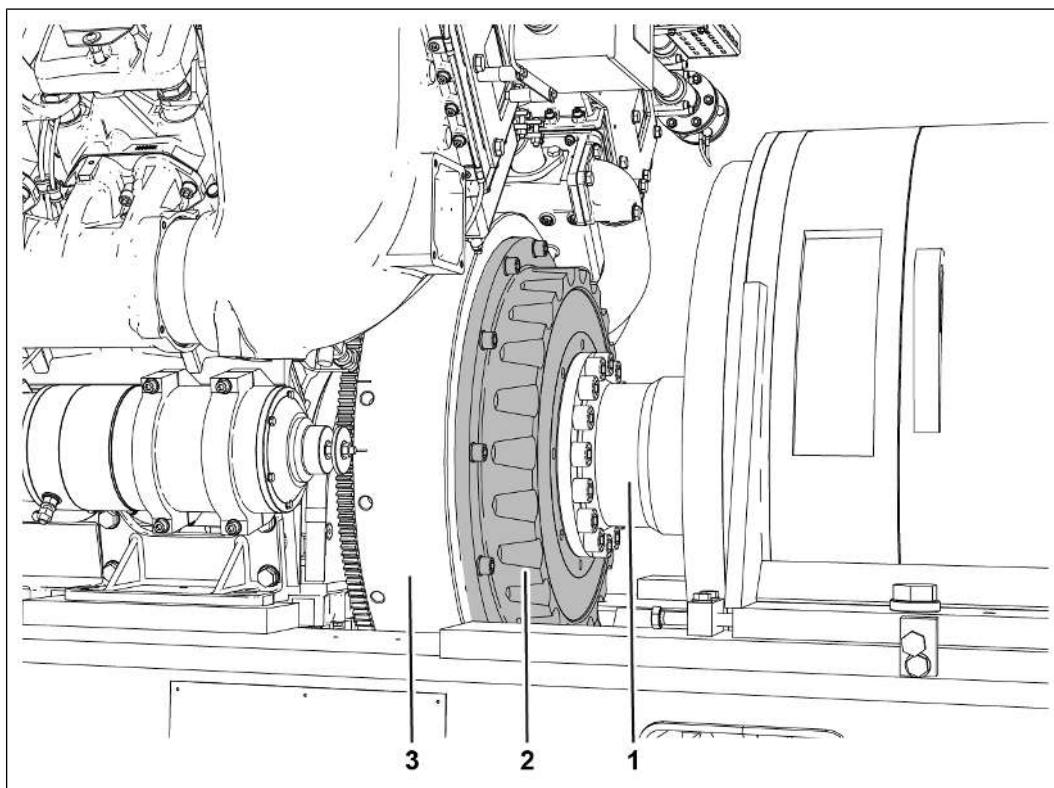
The base frame is available with or without an integrated lube oil tank.

- The integrated lube oil tank increases the lube oil volume for the engine, extending the lube oil change intervals.

4.6 Coupling

4.6.1 Coupling

4.6.1.1 Functional description



2674928779

- 1 Generator flange
- 2 Coupling
- 3 Flywheel

An elastic coupling connects the engine and generator with each other.

- The elastic coupling cannot be switched.

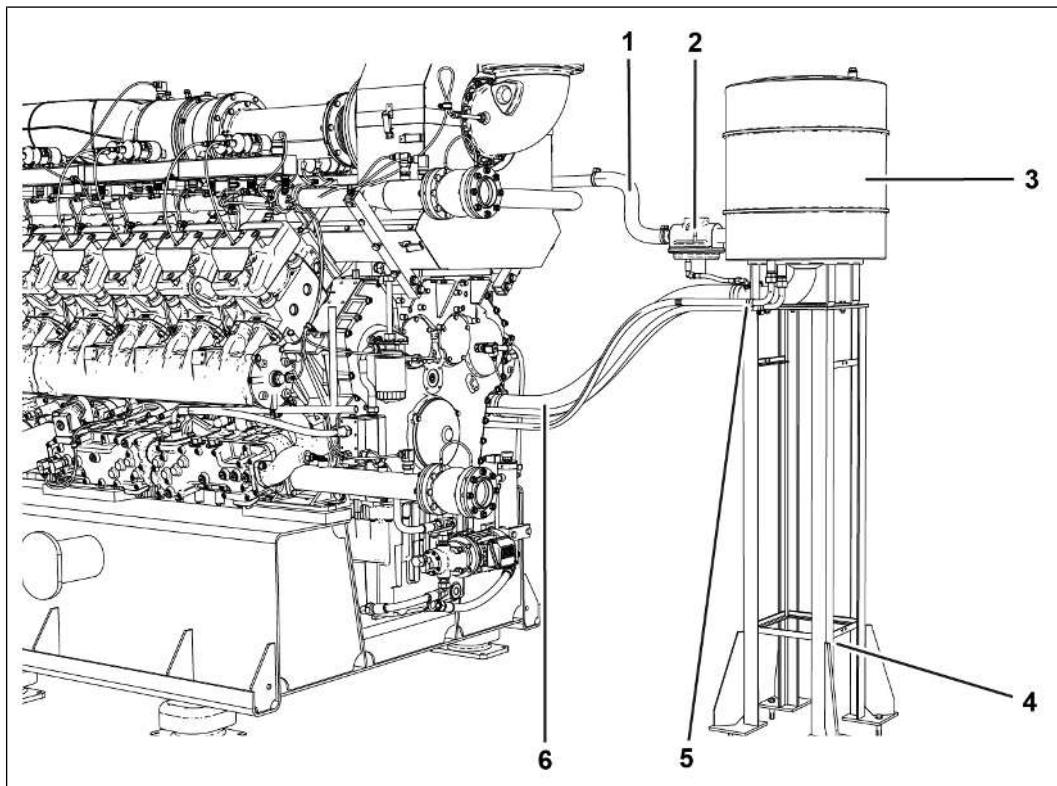
The coupling has the following functions:

- Torque transmission from the crankshaft to the generator shaft
- Absorption and damping of rotational vibrations and load spikes
- Compensation for radial, axial, and angular shaft misalignment within the tolerance range

4.7 Crankcase ventilation

4.7.1 Crankcase ventilation

4.7.1.1 Functional description



2674997643

- 1 Return line from blowby gas into the intake air line
- 2 Gas pressure controller
- 3 Lube oil separator
- 4 Support
- 5 Return line to lube oil sump
- 6 Supply to the lube oil separator

Negative pressure sucks blowby gas through a lube oil separator and into the engine's intake air system.

The lube oil separator separates the lube oil particles from the blowby gas and directs the filtered lube oil back into the lube oil sump.

During compression of the gas-air mixture in the cylinder, a small amount of the gas-air mixture flows from the combustion chamber into the crankcase chamber.

Inside the crankcase chamber, the blowby gas mixes with the lube oil mist; the mass of the mixture and the motion of the piston together produce a positive pressure.

Under sufficient pressure, the blowby gas can become an explosive mixture.

To prevent the formation of such an explosive mixture, the blowby gas is vacuumed out of the crankcase by the crankcase ventilation.

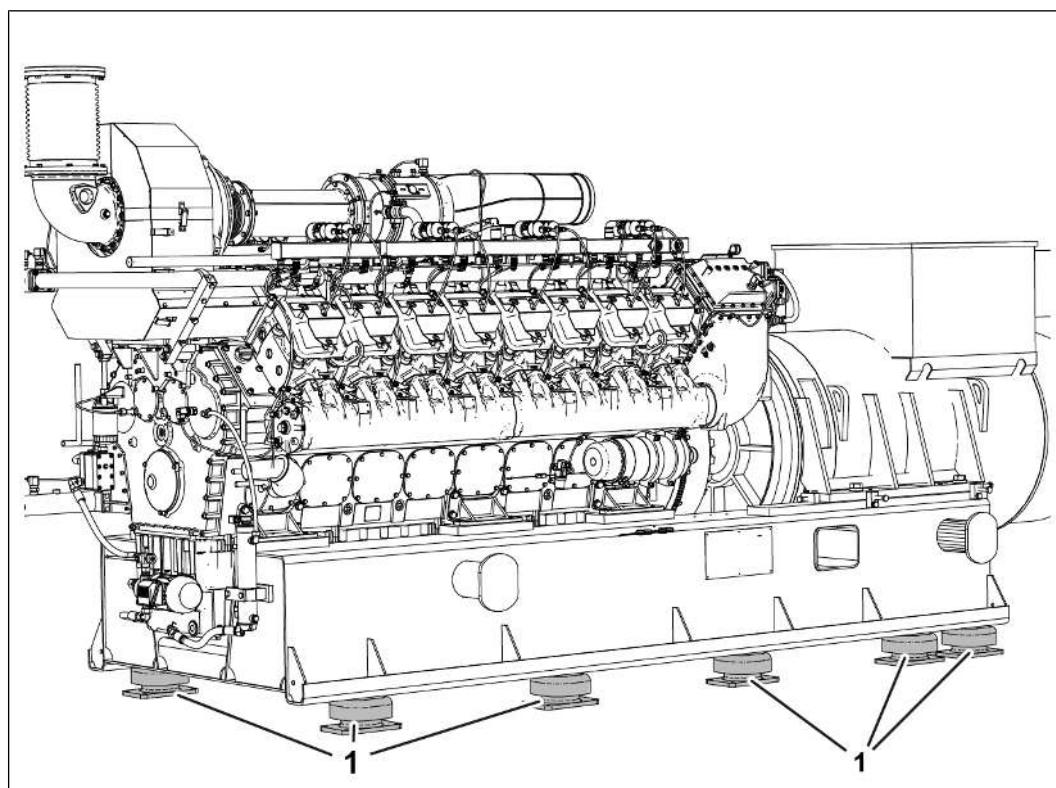
A return line directs the filtered lube oil back to the lube oil sump.

The electronic control monitors the crankcase chamber pressure with the aid of a gas pressure controller.

4.8 Anti-vibration mounting

4.8.1 Anti-vibration mounting

4.8.1.1 Functional description



2785746187

1 Anti-vibration mounting (elastic support)

To achieve the best possible degree of vibration attenuation and noise isolation between the genset and the foundation, anti-vibration mountings are placed underneath the base frame.

- When set correctly, there is an equal load on each anti-vibration mounting, and the genset is aligned properly.
- The anti-vibration mountings can only be vertically adjusted within a certain range; they ensure the genset is aligned properly and produce the proper vibration characteristics.

5 Transport and storage

5.1 Genset

5.1.1 Preservation, packaging, transport, and storage

For general information on this topic, see [Specification for corrosion protection, packaging, transport, and storage](#).

6 Assembly

6.1 Genset

6.1.1 Connecting the genset to the electrical supply

General information

On the genset, all the sensors and electrical consumers are bundled into the wiring harness at delivery.

The genset is aligned and screwed into the foundation.

DANGER



Electric shock if live components are touched.

Can lead to severe injuries or even death.

- Only authorized specialist personnel may work on the electrical system.
- In the case of single-phase motors, the residual charge of the capacitor can also result in an electrical voltage via the motor terminals when the engine is at a standstill.
- Perform the following in the sequence described:
 - Turn off electrical power and disconnect the system.
 - Secure against reconnection.
 - Check that equipment is de-energized.
 - Ground and short-circuit the electrical system.
 - Cover or cordon off adjacent components which are electrically live.

Connecting the genset with single starter to the electrical supply:

- ✓ The necessary switchgear cabinets have been set up
1. Check that all fuses are properly installed in the genset control cabinet.
 2. Check that all functional units in the genset control cabinet are switched off.
 3. Connect the electrical system of the genset to the terminal strip in the genset control cabinet.
 4. Connect the modem to the telephone dialing unit in the genset control cabinet.
 5. Connect the function selection unit of the genset control cabinet to the operating computer touchscreen.
 6. Connect the genset control cabinet to the power supply.

Connecting the genset with double starter to the electrical supply:

- ✓ The necessary switchgear cabinets have been set up

1. Check that all fuses are properly installed in the genset control cabinet.
2. Check that all functional units in the genset control cabinet are switched off.
3. Connect the electrical system of the genset to the terminal strip in the genset control cabinet.
4. Connect the modem to the telephone dialing unit in the genset control cabinet.
5. Connect the function selection unit of the genset control cabinet to the operating computer touchscreen.
6. Connect the terminal box of the double starter to the power supply.
7. Connect the genset control cabinet to the power supply.

Connecting the genset with compressed air starter to the electrical supply:

- ✓ The necessary switchgear cabinets have been set up
1. Check that all fuses are properly installed in the genset control cabinet.
 2. Check that all functional units in the genset control cabinet are switched off.
 3. Connect the electrical system of the genset to the terminal strip in the genset control cabinet.
 4. Connect the modem to the telephone dialing unit in the genset control cabinet.
 5. Connect the function selection unit of the genset control cabinet to the operating computer touchscreen.
 6. If necessary, connect the terminal box of the coolant preheating to the power supply.
 7. Connect the genset control cabinet to the power supply.

6.1.2 Earthing the genset

Tools:

- Standard tools

DANGER

Electric shock if live components are touched

Severe injury or death may result.

- Only authorized specialist personnel may work on the electrical system.
- Turn off electrical power supply and secure against restarting prior to all work.

- ✓ Plant is stopped.

1. Connect the protective conductor and the protective equipotential bonding according to the circuit diagram
2. Create protective earthing and operational earthing on the plant

6.2 Cooling system

6.2.1 Connecting the on-site cooling system with the genset

Auxiliary media:

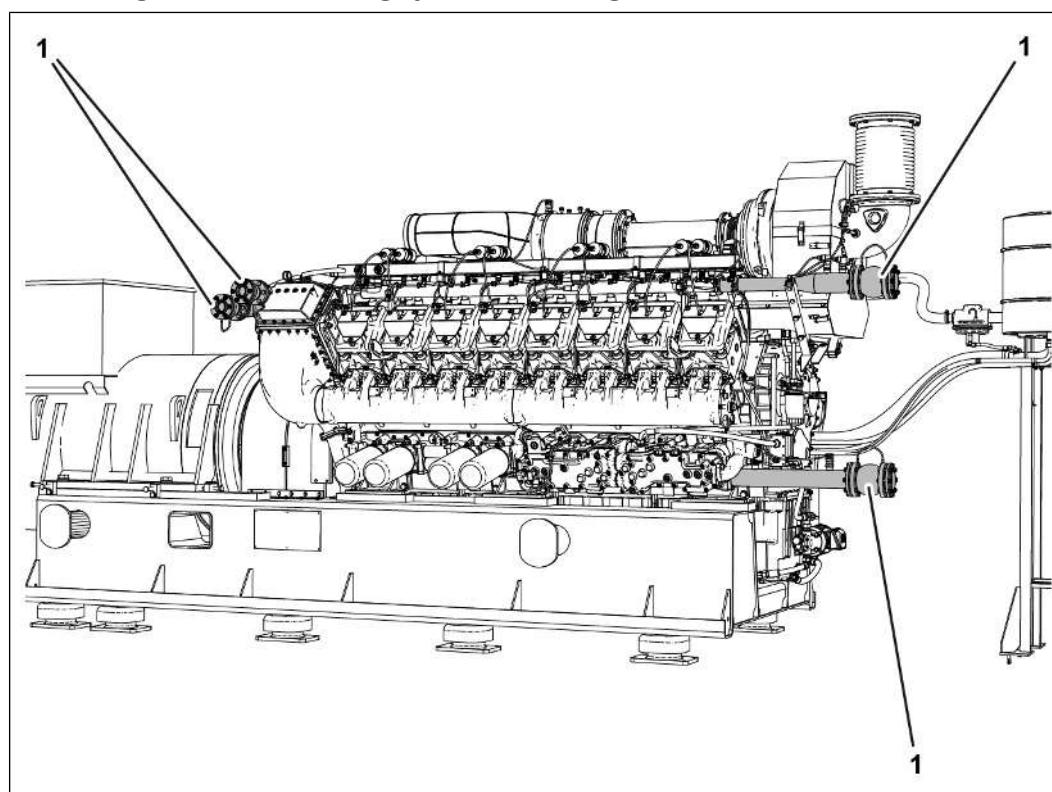
- Cooling system protection agent

General information

For detailed instructions on assembling the on-site cooling system, see:

- Operating Manual, chapter General - section P&I diagrams
- Operating Manual, chapter General - section Specifications, Genset data sheet
- Operating Manual, chapter Assembly note, section Genset add-on parts
- Operating Manual, chapter Operating media regulations
 - Specification for coolant

Connecting the on-site cooling system with the genset:



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- 1 Cooling system expansion joint

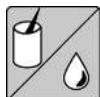
The prerequisite for this is:

- ✓ The on-site cooling system has been fully assembled.
- ✓ All piping has been cleaned.
- ✓ A leak test of on-site cooling system has been conducted.

1. **CAUTION! Piping and hoses can tear off. Minor or severe injuries may result. Always install the piping and hoses so that they are free of tension and are decoupled from the system.** Connect the flange of the rubber expansion joint (1) with the flange of the coolant pipe.
 - For information on the rubber expansion joint, see OL-MRA10 / 00-50-10 [Removing and installing the rubber expansion joint \[▶ 305\]](#).
2. Close all coolant valves on the genset.
3. Close all coolant valves on the external cooling equipment.
4. Fill coolant and check coolant level, see OL-MRA10 / 38-01-23 [Emptying and filling the cooling system \[▶ 472\]](#)
 - For detailed data on the coolant amount, see genset data sheet, *Operating Manual, chapter General, section Specifications*.
5. Start coolant pump and vent the cooling system.
6. Check the coolant level again and top up, if necessary.
7. Perform a leak test.

6.3 Lube oil system

6.3.1 Connecting the on-site lube oil system to the genset



Auxiliary media:

- Lube oil

General information

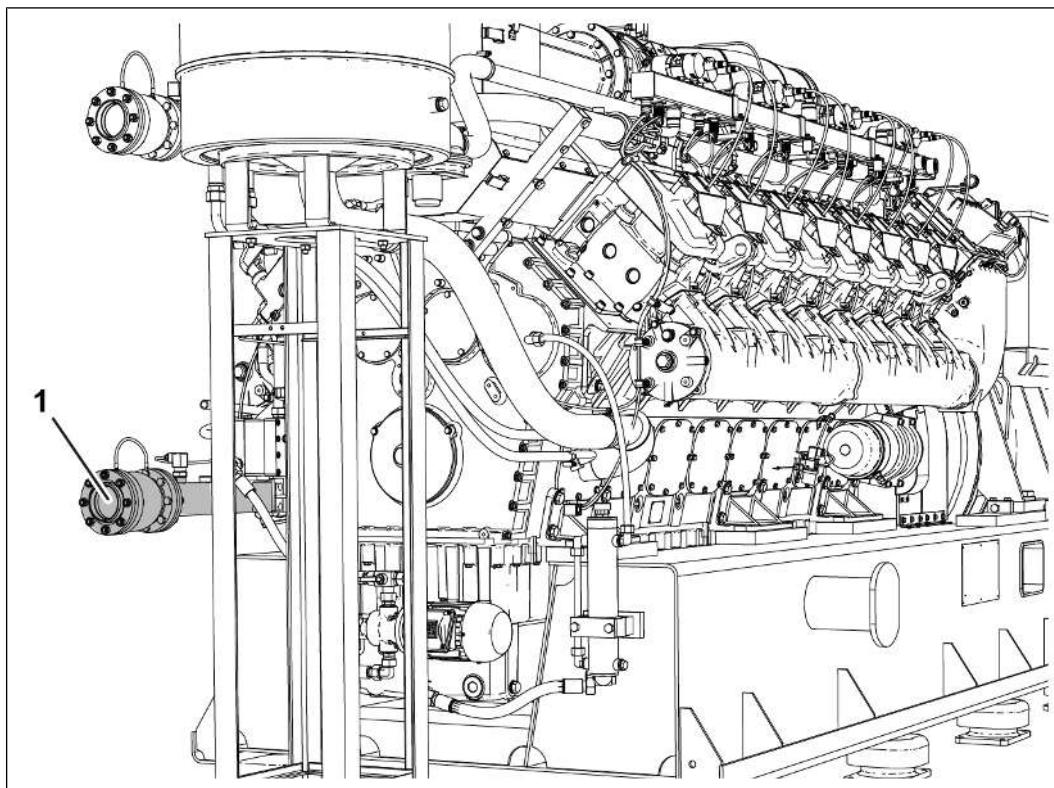
For detailed notes on installing the on-site lube oil system, see:

- Operating Manual, chapter General - section P&I diagrams
- Operating Manual, chapter Assembly notes - section Lube oil system
- Operating Manual, chapter Operating media regulations
 - Technical Bulletin TR 2105 [Specification for lube oil](#)

Connecting the on-site lube oil system to the genset:

The prerequisite for this is:

- The on-site lube oil system has been installed fully.
- All piping has been cleaned.
- A leak test has been carried out on the on-site lube oil system.



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1. **CAUTION! Piping and hoses can tear off. Minor or severe injuries may result. Always install the piping and hoses so that they are free of tension and are decoupled from the system.** Connect all flange connections (1) between the lube oil lines of the genset and the on-site lube oil supply.

Additionally perform the following work steps to connect an external lube oil supply (optional):

1. Connect all flange connections between the lube oil lines of the genset and the external lube oil supply.
2. Perform a leak test.
3. Close all lube oil valves on the genset.
4. Close all lube oil valves on the external lube oil equipment.
5. Fill external lube oil supply with lube oil.
6. Open all lube oil valves on the genset.
7. Open all lube oil valves on the external lube oil equipment.
8. Start TEM.
9. Start the prelubrication pump.
 - The prelubrication fills, if necessary, the lube oil tank in the base frame of the genset.

- The TEM automatically stops the prelubrication when the lube oil level is too low.
10. Check lube oil level in the TEM.

6.4 Fuel gas system

6.4.1 Connecting the fuel gas system to the genset

General information

For detailed instructions on assembling the on-site fuel gas system, see:

- [Layout of power plants](#), see Service Library
- P&I diagram
- See Service Library, Technical Bulletin ([TR 3017](#)), [Specification for fuel gas](#)

These documents can be found in the Service Library and in the order-specific operating manual.

DANGER



Explosion due to flammable gases.

Severe injury or death can result.

- Sufficiently ventilate the room.
 - Do not smoke.
 - Do not use any naked flames.
 - Use only ATEX-approved devices and tools.
 - Only qualified specialist personnel may work on the fuel gas system.
-

NOTE

When using solid piping, oscillations and vibrations are transmitted from the genset to the fuel gas line.

The fuel gas line and components of the fuel gas system may be damaged.

- Use a suitable expansion joint to decouple the genset and thereby minimize vibrations.
-

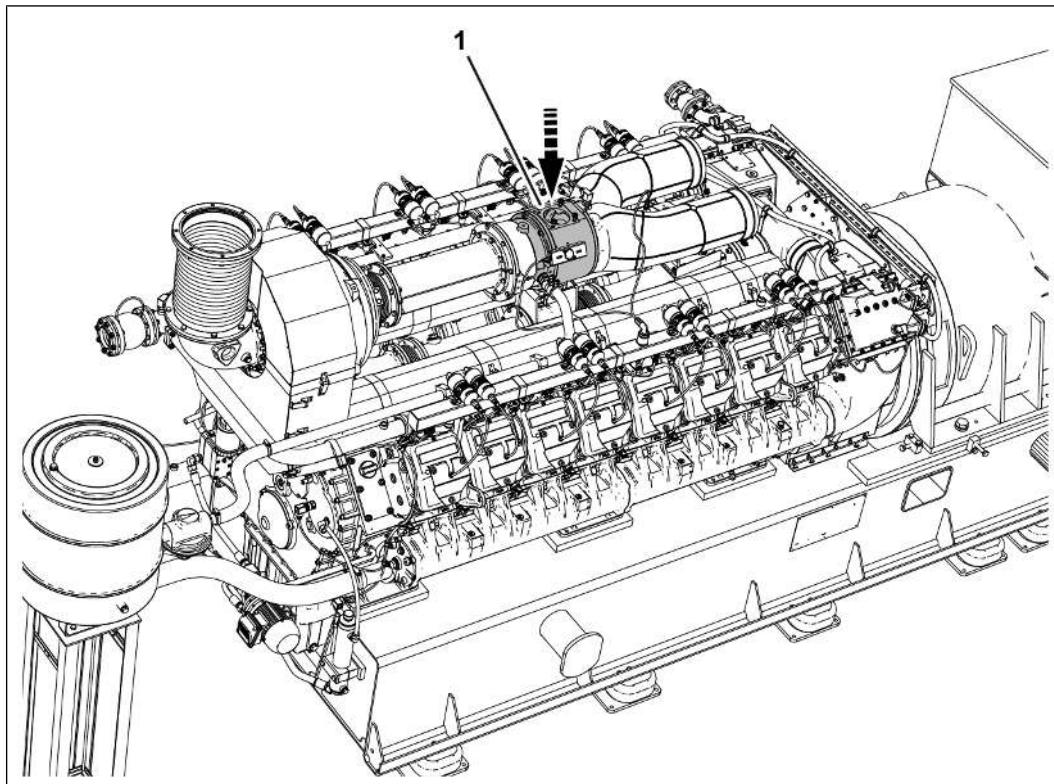
Connecting the fuel gas system to the genset:

The prerequisite for this is:

- ✓ The gas train has been fully assembled.
- ✓ All piping has been cleaned.
- ✓ A leak test has been carried out on the on-site gas connection.

- ✓ All safety functions for explosion protection have been checked and are functioning properly.

1. Check whether all the flanges and line sections are dry, clean, and free of welding beads and cinders.



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2. Mount fuel gas line or fuel gas hose to the gas-air mixer (1)
 - To prevent uncontrolled vibrations, decouple genset with a suitable expansion joint.
 - Assemble the fuel gas line or fuel gas hose so that it is decoupled from the system and not under tension.
3. Assemble the flange connections.

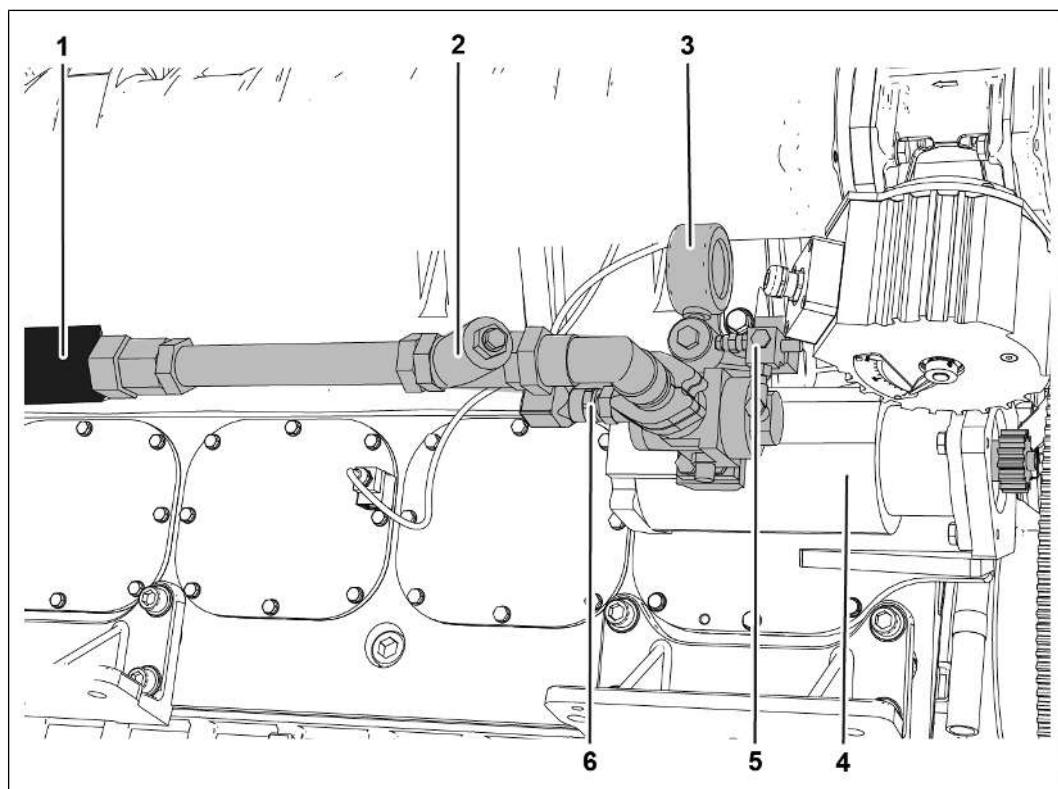
See also

Assembly [▶ 123]

6.5 Compressed air system

6.5.1 Connecting the starter system to a genset with compressed air system

The starter system is fully installed.



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- 1 High-pressure hose (air supply)
- 2 Dirt trap
- 3 Pressure gauge
- 4 Starter (compressed air)
- 5 Solenoid valve
- 6 Pressure reduction valve

Install a valve to relieve the compressed air in the compressed air line between the last shut-off valve on site and the compressed air connection on the genset.

- For example a 3-way valve

Connect the compressed air line to the compressed air starter.

Start the compressor.

- Wait for pressure to increase until the specified operating pressure is reached.

Slowly open the supply valve on the compressed air system.

Conduct a leak test on the compressed air system.

- Use leak detection spray if necessary.

6.6 Intake air system

6.6.1 Connecting the on-site intake air system to the genset



Spare parts:

- Flexible pipe
 - Pipe length depends on the on-site installation situation.

Combustion air requirements

The intake air must fulfill specific requirements. If the requirements cannot be fulfilled or can be fulfilled only partially, the operating conditions and thus the maintenance intervals and maintenance measures will change.

Always contact the manufacturer if this is the case.

For detailed notes on the requirements for combustion air and installing the on-site intake air system, see:

- P&I diagram
- Technical Drawings
- [Assembly \[▶ 123\]](#)
- [Specification for combustion air](#)

These documents can be found in the Service Library and in the order-specific operating manual.

Connecting the on-site intake air system to the genset:

- ✓ The on-site intake air system has been fully assembled.
 - ✓ The genset has been bolted to the foundation and aligned with the intake air system.
 - ✓ All piping has been cleaned.
 - ✓ The leak test of the on-site intake air system has been conducted.
1. Clean connection nozzles of the intake filter, see [Removing and installing the intake air filter \[▶ 423\]](#)
 2. In the case of remote intake air filters, fix the connection nozzle of the intake filter with a flexible pipe on the intake air inlet pipe
 3. Check all the screw connections on pipe flanges and hose flanges, as well as on the connection nozzle of the intake air system for tight fit.

6.7 Exhaust system

6.7.1 Connecting the on-site exhaust system to the genset

General information

- Only qualified and trained specialist personnel are permitted to perform this task.

For more information and instructions on connecting the exhaust system, see:

- *Operating Manual, chapter General, section Genset installation*
- P&I diagram
- Genset drawing

NOTE

Aligning the on-site exhaust system with the genset

The genset's exhaust manifold and the connection on the on-site exhaust pipe must be aligned so that they both line up flush with one another.

- This is the only way to ensure that the connecting exhaust expansion joint can properly perform its function during operation and is not subjected to torsional stresses due to adverse pipe tension. The exhaust expansion joint is intended to prevent impermissible forces coming from the on-site pipe system from acting on the exhaust turbocharger housing, or the transmission of engine vibrations onto the pipe system.

NOTE

Alignment

If the exhaust line connection is only assembled after the genset has been installed, then it must be aligned with the exhaust manifold.

If the on-site piping is already present, then the genset must be aligned accordingly before it is set down at the installation site.

7 Commissioning

7.1 Genset

7.1.1 Operating and auxiliary media

Operating and auxiliary media are required for safe and proper operation of the product.

All operating and auxiliary media must be stored, transported and disposed of in accordance with the regulations. The operator is personally responsible for this.

Disposal includes recycling and also the removal of operating and auxiliary media, where recycling has priority. Regional, national, and international laws and regulations govern the details of disposal and its monitoring.



Risk of destruction of components

Components can be damaged or destroyed due to the use of unsuitable operating and auxiliary media or due to improper application.

- Only use approved operating and auxiliary media
- Information from the supplier in the form of enclosed labels or on the packaging must always be observed
- The manufacturer assumes no responsibility for any damage that occurs due to the use of unsuitable operating and auxiliary media or due to their improper application

To ensure flawless operation, the following information must be noted and complied with:

- Use operating media in accordance with the current operating media specifications
- Carry out the maintenance and operation as per the documentation provided
- Comply with and document all the maintenance intervals according to the maintenance schedule provided

All the operating media for safe operation is specified in the operating media regulations. Adhere to the specified production specifications. Only information in the engine-specific or plant-specific contracts form exceptions.

For further information on operating and auxiliary media, see *Operating Manual, chapter General, section Operating media regulations*.

7.1.2 Check before commissioning

All notes on operating media, see [Information on operating media \[▶ 9\]](#).

Always perform the work described below:

- Before the initial commissioning
- After long pauses in operation

- After maintenance work
- After repair work

General checks

1. Visually inspect genset components, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 212\]](#).
 - Check all lines and connections for leaks.
 - Check that electrical cabling and electrical connections are in good condition.
2. Perform a test/function run, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 220\]](#).
 - Check the control cable and sensors.
 - Check the function of the monitoring devices, shut-off devices, and remote control equipment.
3. Check the control cable and sensors, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 220\]](#).
4. Check all monitoring equipment, shut-off equipment and remote control equipment for functionality, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 220\]](#).
5. Check that actuator moves freely.
 - See OL-MRA10 / 27-17-01 [Checking the speed control actuator \(V12/V16 engine\) \[▶ 464\]](#).
 - See OL-MRA10 / 27-17-01 [Checking the speed control actuator \(V20 engine\) \[▶ 466\]](#).
6. Check gas train for leaks, see *Operating Manual, chapter Work instructions, section Gas supply*.

Checking the coolant level

1. Close all valves and plug valves on the genset and on the cooling equipment which are designed to drain the coolant.
 - Vent the coolant chambers via the venting lines while the coolant pump is running, see OL-MRA10 / 38-01-23 [Emptying and filling the cooling system \[▶ 472\]](#).
2. Check the coolant fill level, see OL-MRA10 / 38-01-23 [Emptying and filling the cooling system \[▶ 472\]](#).
3. Set the pressure on the expansion vessel according to the specifications in the genset data sheet, see *Operating Manual, chapter General, section Specifications*.

Checking the intake air temperature

1. Check the value of the ambient temperature on the electronic control, see *Operating Manual, chapter Control*.
 - If necessary, cool the room with an external air conditioner.
 - If circumstances dictate, do not commission the genset.

Checking the lube oil pressure

1. Check lube oil pressure in the electronic control, see *Operating Manual, chapter Control*
 - If necessary, check the lube oil level and remedy, see OL-MRA10 / 02-01-22 [Performing lube oil change \(without lube oil tank in base frame\)](#) [▶ 338].

Checking the prelubrication



Risk of destruction of components

Overheating due to insufficient prelubrication

Can damage or destroy the genset.

- Do not start the genset until the lube oil level is sufficiently high.
 - Only start the genset if the prelubrication pump is operational.
-
1. Enable the prelubrication pump at the TEM.
 - The TEM starts the prelubrication.
 - The prelubrication takes about 20 minutes.
 - **NOTE! The genset cannot be started!** If the prelubrication pump is faulty or the lube oil level is too low, the TEM stops the prelubrication.

Visually inspecting the compressed air starter

1. Check the compressed air starter and all the components that are connected to it.
 - Check for tight fit.
 - Visually inspect for leaks.
2. Check the pressure on the pressure gauge.
 - See the genset data sheet.
 - If the set display is different, readjust the pressure supply using the handwheel.

Checking the transmission lube oil level

1. Check transmission lube oil level.
 - Observe the manufacturer's specifications.
2. See OL-MRA10 / 03-03-01 [Checking the lube oil level \(transmission\)](#) [▶ 369].

Checking the lubrication of the generator rolling bearing

1. Check the lubrication of the generator rolling bearing.
 - Fill the lubricant of the generator rolling bearing according to the manufacturer's specifications.

7.1.3 Start the genset

General information

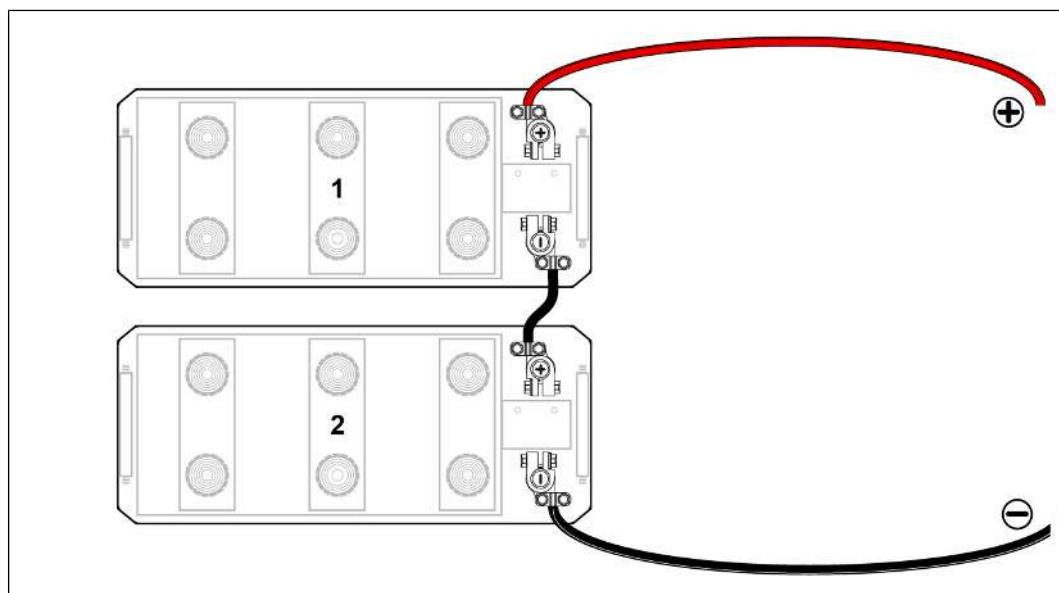
There are two ways to start the genset.

1. AUTO control (automatic operation)
 2. MANUAL control (manual operation)
- With AUTO control (automatic operation) the genset is automatically started after activation.
 - With MANUAL control (manual operation) the genset is started manually.

If the genset is secured against unintentional starting, first restore the power supply.

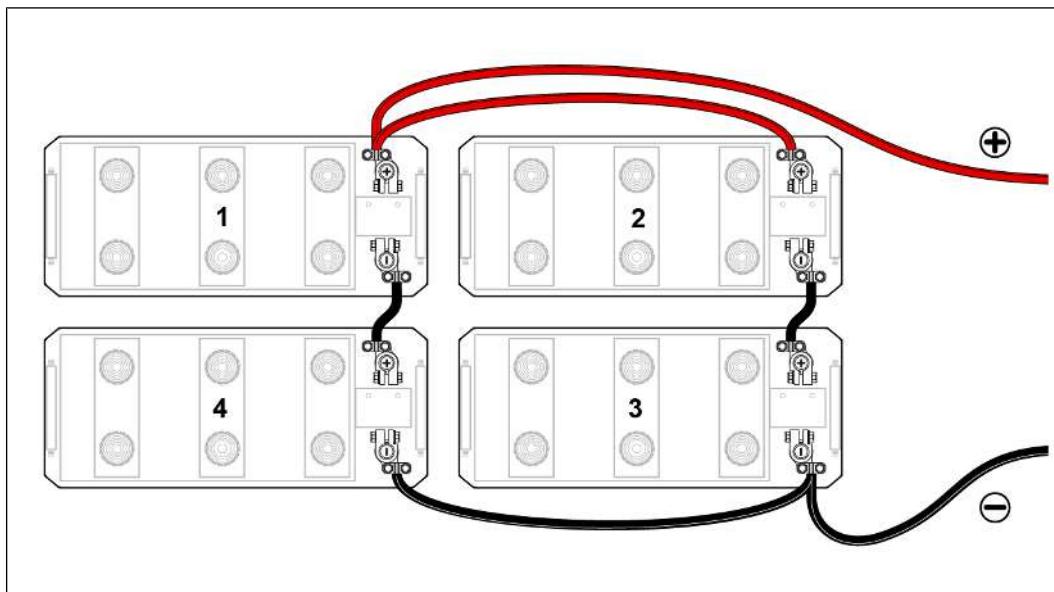
- Refer to Chapter "**Preparing the genset for start-up**".

Preparing the genset for start-up:



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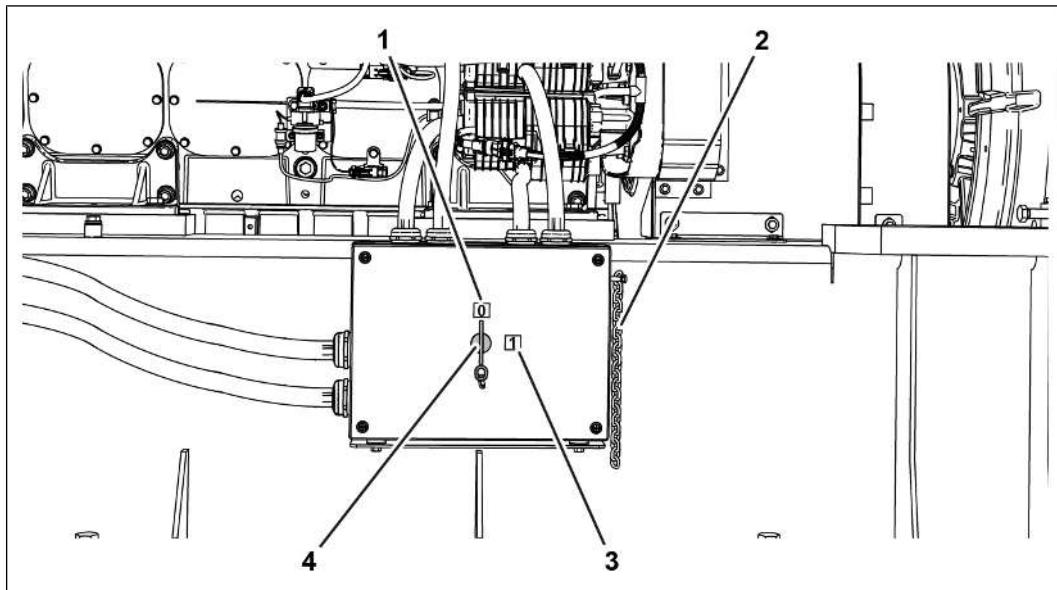
1. Connect the starter battery (two starter batteries).
 - Dismantle the covering cap of starter battery 1 at the positive terminal.
 - Mount the connection bridge of starter battery 1 at the positive terminal.
 - Mount the connection bridge of starter battery 2 at the negative terminal.
 - Mount the coving cap of starter battery 1 at the positive terminal again.



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2. **NOTE! The batteries must be connected in such a way that the flow of current through all 4 batteries is equally long!** Connect the starter battery (four starter batteries).

- Dismantle the covering cap of starter battery 2 at the positive terminal.
- Mount the connection bridge of starter battery 2 at the positive terminal.
- Mount the covering cap of starter battery 2 at the positive terminal again.
- Dismantle the covering cap of starter battery 1 at the positive terminal.
- Mount the connection bridge of starter battery 1 at the positive terminal.
- Mount the covering cap of starter battery 1 at the positive terminal again.
- Mount the connection bridge of starter battery 4 at the negative terminal.
- Mount the connection bridge of starter battery 3 at the negative terminal.



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3. Unlock battery disconnection switch.
 - With the key (4), set the battery disconnection switch on the terminal box from position 0 (1) to position 1 (3).
 - Fasten the key (4) to the terminal box with the chain (2).
4. Establish the compressed air supply and release pressure (optional).
 - Remove the U-lock and chain from the hand lever of the ball valve in the compressed air line.
 - Open the ball valve upstream of the starter valve in the compressed air line.
 - Close the valve for the compressed air relief in the compressed air line.
 - Open the supply valve on the compressed air system.
5. Commission the gas analysis device (optional).
 - Remove all locks from the hose lines.
 - Screw the screw connection onto the process gas input connection on the gas analysis device.
 - Screw the screw connection onto the calibration gas input connection on the gas analysis device.
 - Screw the screw connection onto the purge gas input connection on the gas analysis device.
 - Screw the screw connection onto the process gas output connection on the gas analysis device.
 - Open the housing and bring the circuit breaker into the "ON" position in order to turn on the gas analysis device.
 - The gas analysis device starts a self-test.

- Close the housing of the gas analysis device.
- 6. Establish the fuel gas supply.
 - Remove the U-lock and chain from the hand lever of the ball valve in the drain.
 - Close the drain ball valve.
 - Commission the gas analysis device, see "**System documentation, chapter Gas supply**".
 - Remove the U-lock and chain from the hand lever of the ball valve in the fuel gas line.
 - Open ball valve of the fuel gas line upstream of the gas train.
 - Check if the pressure has built up on the fuel gas line pressure gauge.

Starting the genset (manual operation and automatic operation):

1. The person responsible for the work reports to the person responsible for the plant that the genset and the associated plant periphery is ready for operation.
2. Start the genset.
 - Wait for the release for the genset and the plant periphery by the person responsible for the plant.
3. Remove the information sign from the control cabinet and genset.
4. Remove the U-lock from the emergency stop button.
5. Activate MANUAL (manual operation) or AUTO (automatic operation).
 - Start the genset.

7.1.4 Initial commissioning

The initial commissioning is carried out in consultation between the operator and the commissioner.

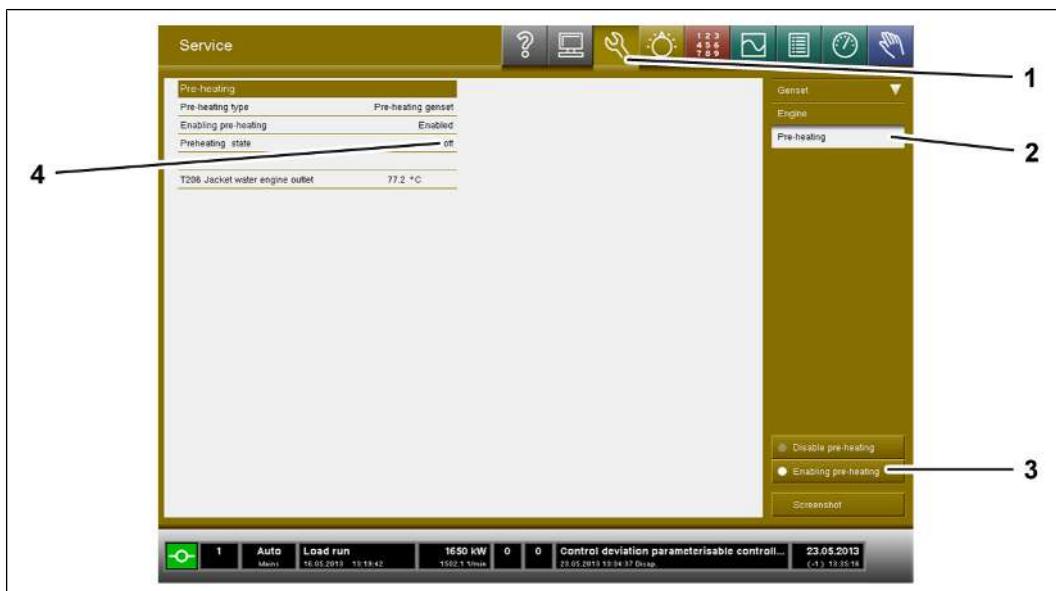
Have the work for the initial commissioning carried out according to the commissioning specification. Only have the work performed by employees from the manufacturer or people authorized by the manufacturer.

7.1.5 Establishing operational readiness

Preheating the gensex

The preheating unit keeps the coolant at the preset temperature, even if the gensex has been stopped.

In the engine cooling circuit the coolant temperature hence reaches the required operating temperature even shortly after starting. The coolant is preheated independently of the temperature in the heating circuit.



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1. Press the Functional group "Service" button (1).
 - The Service mask opens.
 2. Press the Pre-heating button (2).
 - The Pre-heating mask opens.
 3. Press the Enabling pre-heating button (3).
 - In the Preheating state dialog area, the status display changes from **off** to **status display On** (4).
- ⇒ The coolant preheating is switched on.

Checking the gensex room ventilation

- ✓ Gensex room ventilation is installed.
 - ✓ Electronic control is ready for operation.
1. Check the value for the room temperature on the electronic control, see TEM system manual or operating computer touchscreen [TEM Operating Manual](#).
 - If necessary, cool down the room temperature using an air conditioner.
 - If in doubt, do not start the gensex.

Checking the intake air temperature

- ✓ Intake air preheating is installed (optional).
 - ✓ Electronic control is ready for operation.
1. Check the value for the intake air temperature on the electronic control, see TEM system manual or operating computer touchscreen [TEM Operating Manual](#).
 - If necessary, warm up the intake air temperature using the intake air preheating (optional).
 - If necessary, cool down the intake air temperature using an external air conditioner.
 - If in doubt, do not start the genset.

Checking the lube oil supply on the exhaust turbocharger



Risk of destruction of components

Improper maintenance of the exhaust turbochargers

The genset can be damaged.

- Only allow service personnel to service the exhaust turbocharger.
- Only allow repairs on the exhaust turbocharger from authorized specialist personnel.

NOTE

During operation, the exhaust turbochargers heat up. This heating can cause lubricants and pastes that were used during assembly to melt and evaporate.

In the first few hours following commissioning, the heated lubricants and pastes can escape as oily liquids.

If oily liquid continues to escape a few hours after commissioning the genset, identify the root cause and eliminate immediately.

1. Check lube oil supply.

- If oily liquid escapes even though the lube oil supply of the exhaust turbocharger is working properly, get in touch with service partner.

Checking the lube oil pressure using the control

NOTE

The electronic control monitors the lube oil pressure.

- If the measured lube oil pressure falls below the permissible limit value, the electronic control outputs a warning message.
 - Afterwards the electronic control automatically stops the genset.

1. Check the value for the lube oil pressure on the electronic control, see TEM system manual or operating computer touchscreen [TEM Operating Manual](#).
 - If necessary, top up the lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(without lube oil tank in base frame\)](#) [▶ 338].

Prelubricating the genset

If the genset receives a start demand, the electronic control automatically starts the prelubrication.

A prelubrication process always lasts at least 20 minutes.

- The electronic control does not start the genset until the prelubrication is fully completed.

Prelubrication can also be started manually.

- For this see the operating manual for TEM [TEM Operating Manual](#).

Establishing operational readiness using the control

1. Check whether there are pending messages on the electronic control.
 - If warnings and alarms are pending, eliminate the causes and contact service partner if necessary.
 - Acknowledge pending warnings and alarms, see TEM system manual or operating computer touchscreen [TEM Operating Manual](#).
2. For starting the genset in automatic operation see [Start the genset](#) [▶ 136].
3. Perform test run and function run, see OL-MRA10 / 00-11-30 [Performing test run and function run](#) [▶ 220].

7.1.6 Recommissioning the genset

- ✓ The preheating device for the coolant is operated with reduced power during decommissioning
1. Start up the preheating device for the coolant at the standard value
 - If possible, operate the preheating device for the coolant for three days before the recommissioning.

7.1.7 Recommissioning the genset within two months

Work that must be performed by the operator or operating personnel:

1. Open the shut-off device in the gas train
2. Unlock the battery disconnection switch and secure the key to the terminal box in such a way that it cannot be detached
3. At temperatures that pose a risk of frost, switch off the preheating device for the coolant

7.1.8 Recommissioning the genset after more than two months

After decommissioning for more than two months, the recommissioning must be performed by the service personnel.

Work that must be performed by the operator or operating personnel:

1. Remove all the covers
2. Open the shut-off device in the gas train
3. Open the exhaust flap if necessary in the case of a multi-engine plant

Work that must be performed by the service personnel:

1. Perform a propulsion chamber check (optional)
2. Check combustion chambers with endoscope
3. Re-couple generator with roller bearings with the engine
4. Check and, if necessary, top up the lube oil level for generators with sleeve bearings
5. Check the connection points between the genset and plant
6. Visually inspect the exhaust turbocharger (inlet and outlet)
7. Perform checks as per maintenance level E60
8. Perform and document commissioning in accordance with the commissioning specification

8 Operation

8.1 Genset

8.1.1 Decommissioning the genset

The genset is decommissioned under the following conditions:

- Genset at a standstill.
- The electronic control is switched off.

In this condition, there is **still** a risk associated with undertaking troubleshooting and maintenance tasks.

- The genset is **not** secured against an inadvertent start-up.
- Continuously monitor the operating state for the duration of the work.

During certain troubleshooting and maintenance tasks, also:

- Disconnect the power supply.

In this condition, there is no risk associated with undertaking troubleshooting and maintenance tasks.

For details on decommissioning the genset, see [Stopping the genset \[▶ 163\]](#).

8.1.2 Decommissioning the genset in an emergency situation

Decommission the genset in an emergency situation:

1. Operate the emergency stop button.
2. Inform the on-site supervisor.
3. Alert a doctor and the fire department.
4. Evacuate personnel from the danger zone.
5. Initiate first aid measures.
6. Turn off the main switch and secure it against restart.
7. Keep access routes for emergency services vehicles clear.

After emergency services / evacuation measures:

1. Inform the competent authorities if the emergency situation is severe.
2. Commission specialized personnel with the task of troubleshooting.
3. Before commissioning, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 212\]](#).
4. Ensure that all safety devices are present and functional.
5. Finally, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 220\]](#).

8.1.3 Commissioning the genset

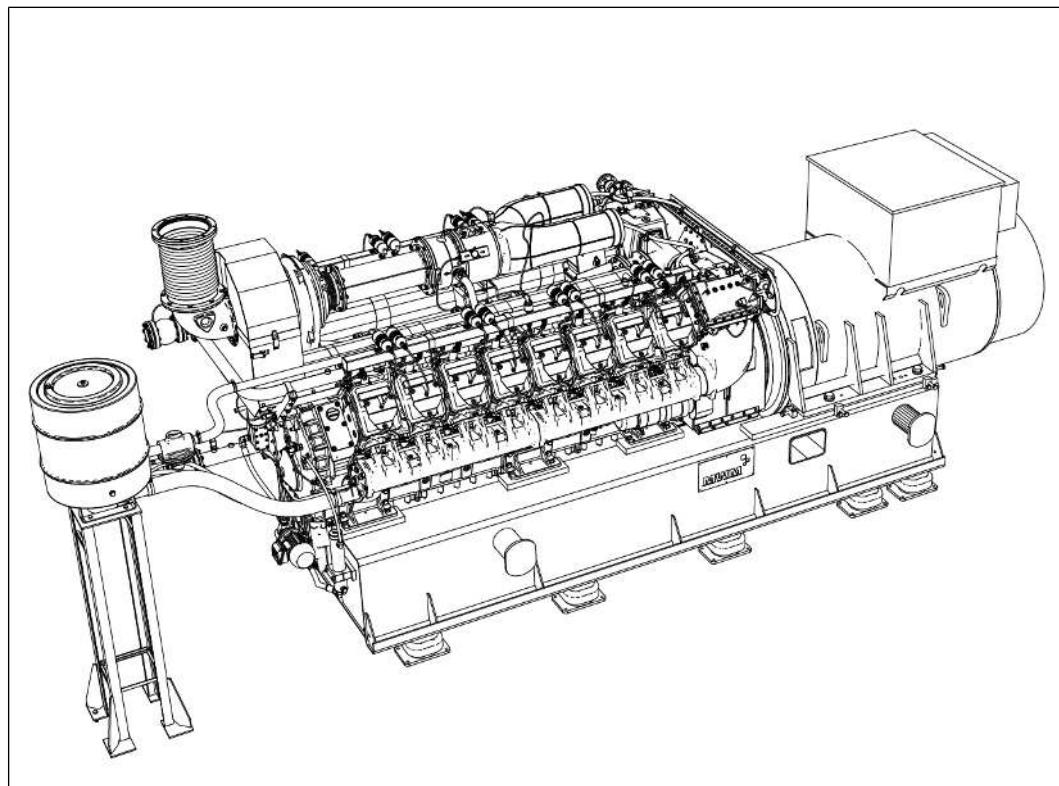
The following control modes can be activated on the electronic control:

- AUTO (automatic operation)
 - The electronic control automatically starts the genset once a demand is made.
- MANUAL (manual operation)
 - The electronic control starts the genset once a manual start demand is triggered.

For all relevant information on the control modes, see [here Operating Manual, chapter Operation, section Control TEM Operating Manual](#).

1. Activate AUTO control mode.
2. Or activate MANUAL control mode.

8.1.4 Industrial safety around the genset



2567968779

The warning messages apply to all work instructions for target groups with competence levels Operator Level, Maintenance Level, and Service Level.

**DANGER**

Explosion due to gases which ignite.

This leads to severe injuries and even death.

- Sufficiently ventilate the room.
- Do not smoke.
- Do not use any naked flames.
- Use only ATEX-approved devices and tools.
- Only qualified specialist personnel may work on the fuel gas system.

**DANGER**

Risk of falling as a result of unsecured work at great height.

Severe injury or death can result.

- Wear personal protective equipment.
- Use a scaffold or fall protection for carrying out work at a height of 1.70 m or higher.
- Secure components and tools from falling down.

**DANGER**

From rotating components.

Severe injury or death can result.

- Only perform assembly work when the genset is switched off.
 - Secure against reconnection.
- Only begin assembly when rotating components have come to a complete stop.
- Reattach dismantled protective covers and protective claddings after assembly.

**DANGER**

Electric shock if live components are touched.

Can lead to severe injuries or even death.

- Only authorized specialist personnel may work on the electrical system.
- In the case of single-phase motors, the residual charge of the capacitor can also result in an electrical voltage via the motor terminals when the engine is at a standstill.
- Perform the following in the sequence described:
 - Turn off electrical power and disconnect the system.
 - Secure against reconnection.
 - Check that equipment is de-energized.
 - Ground and short-circuit the electrical system.

-
- Cover or cordon off adjacent components which are electrically live.
-

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

CAUTION



Injury when touching sharp edges

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Handle sharp-edged components carefully.
-

CAUTION



Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.
-

Danger to the environment



When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

The area at the installation site and at the genset is divided into workstation, operating range, and danger zone. All required information about these areas and about access authorization can be found under the heading *Danger zone, operating range, and workstation* in Chapter *Safety information* in the order-specific operating manual.

8.1.5 Components of the electronic control

The control consists of the following main components:

- Operating terminal Touchscreen with operating computer software
- Genset control cabinet
- Auxiliary cabinet with I/O controller

For detailed information on the plant control, see Operating Manual, Chapter Operation, section Control:

- Software Description for Operating Terminal Touchscreen (BRT)
- TEM system manual

See also Chapter Setup and function, Electrical system of the engine.

8.1.6 Monitoring operation (TEM)

1. Check that the genset is running smoothly, and check for noises, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 220\]](#).
2. Visually inspect the genset and plant parts for leaks, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 212\]](#).
3. Check genset and plant parts for leaks, see OL-MRA10 / 00-15-30 [Performing an auxiliary drive test \[▶ 225\]](#)



Risk of destruction of components

Risk of destruction of components due to improper recommissioning or improper operation following a warning or fault message

Components can be damaged or destroyed.

- If the electronic control has stopped the genset owing to a fault, always rectify the root cause of the fault first.
- Never continue operating the genset in case of a warning or alarm, without having rectified the root cause of the warning or alarm.
- Recommission the genset only after the fault has been properly eliminated.
- Acknowledge a warning or alarm only if the root cause of the warning or alarm has been eliminated.
- If you continue to operate the genset or recommission it without the root cause of the fault having been eliminated, the warranty claim against the manufacturer will be void.

Monitoring during operation

Two fixed limit values are defined in the electronic control for all the operating parameters. If the first limit value is reached, the electronic control displays a warning. If the second limit value is exceeded, the electronic control displays a fault message and stops the genset.

The electronic control constantly monitors the operation of the genset and the related plant components.

1. At regular operating time intervals, check the operation values of the genset and the related plant components.
 - Check the operation values on a daily basis, see [here Operating Manual, chapter Operation, section Control, TEM Operating Manual](#).
 - In the event of deviations from the standard values, search for and eliminate the root causes.
2. Record all the warning and fault messages before eliminating the root causes.

Monitoring in the event of reverse power



Risk of destruction of components

Risk of destruction of components due to reverse power

Components can be damaged or destroyed.

- In the event of reverse power, always disconnect the genset from the electric grid.
- Do not stop the genset with the emergency stop button.
- In the event of reverse power, ensure that the coolant pumps are in operation during the entire reverse power episode. If necessary, establish a separate power supply.

Reverse power is generated if the following events occur simultaneously:

- The genset is running under load in grid-parallel operation.
 - The electronic control stops the genset.
 - The generator circuit breaker does not open.

If the electronic control stops the genset, also close the shut-off valves in the gas train.

The electronic control switches off the ignition. Combustion is no longer possible.

The electronic control opens the network section switch. If the network section switch jams mechanically, the power connection between the generator and electric grid remains active. In this case, manually disconnect the generator section switch from the electric grid. If the generator section switch is not disconnected from the electric grid, the generator acts as an electric motor due to the power input. The generator continues to turn the engine of the genset at rated speed.

If the heat is no longer being dissipated, for instance because the coolant pumps are switched off, the engine can overheat until irreparably damaged.

1. Ensure that all coolant pumps are running during the entire reverse power episode.
 - Do not stop the genset with the emergency stop button.
2. Manually disconnect the generator section switch from the electric grid.
3. Inform the plant supervisor about the reverse power.

Monitoring the coolant volume of the genset

1. Check the coolant fill level and the coolant system pressure, see OL-MRA10 / 38-01-23 [Emptying and filling the cooling system \[▶ 472\]](#).
2. Check the coolant quality, see OL-MRA10 / 38-03-01 [Checking the cooling system protection agent \[▶ 485\]](#).

Checking the electric starter

1. Perform a weekly check of the electric starter, see OL-MRA10 / 00-16-01 [Checking the starting system \[▶ 276\]](#).
 - Check the functioning of the electric starter, see OL-MRA10 / 00-15-30 [Performing an auxiliary drive test \[▶ 225\]](#).
2. Replace the electric starter if applicable. Contact service partner.

Checking compressed air starter

1. Check the compressed air starter weekly, see OL-MRA10 / 00-16-01 [Checking the starting system \[▶ 276\]](#).
 - Check the functioning of the compressed air starter, see OL-MRA10 / 00-15-30 [Performing an auxiliary drive test \[▶ 225\]](#).
2. Replace the electric starter if applicable. Contact service partner.

8.1.7

Overview of the operation modes

The electronic control distinguishes between the following operation modes:

- Grid-parallel operation: power-controlled
- Island operation: speed-controlled

For more information on the operation modes, see *Operating Manual, General, Application and Installation Guide* and *Operating Manual, Chapter Operation, section Control, TEM System Manual and Software Description (BRT)*.

8.1.8

Software access authorizations

The software offers a range of operating and display options. The operating options are assigned with graded access authorization (level).

The operator can acquire the required access authorization only by participating in training. After completing the training, the operator receives a personalized authorization dongle that corresponds to the level of knowledge acquired.

The release of the access authorization is temporary. If the validity has expired, the operator must re-acquire the access authorization through another training program.

The operator logs on to the operating computer with their authorization dongle. The operating computer software activates the access options in accordance with the level of the logged-in operator.

Further information on the training options can be found on the homepage of the training center:

<https://www.mwm.net/trainings/training-center-service/seminar-program/>

For more information on access authorizations, see *Operating Manual, chapter Operation, section Control, Software Description (BRT)*.

8.2 Generator

Part number: (null)

8.2.1 Generator operating states

Main machine idle

If the generator is running without being connected to the mains and excitation is approved, then the main windings will be live even when no load current is flowing. The electronic control maintains the speed of the drive engine. The drive engine is under low load in idle mode.

Main machine with load

The magnetic field of the turning rotor induces a voltage in the generator's main windings. The rotor draws the energy required for generating the magnetic field from the exciter (excitation), which is activated by the automatic generator voltage controller (AVR). The current consumed by the consumers creates a counter-magnetic field.

The counter-magnetic field generates a counter-torque at the generator shaft. The counter-torque brakes the gas engine. The greater the current strength in the main windings, the stronger the braking torque.

The actuator regulates the speed of the engine and thus the power output of the engine. The frequency of the generator depends on the engine speed. The generator voltage controller (AVR) indirectly controls the strength of the magnetic field and thus the generator's voltage.

Island operation/Grid-parallel operation

Single genset in island operation	Adjustment of excitation by the voltage controller causes a direct change in voltage at the generator terminals.
-----------------------------------	--

Multiple genset plants in island operation or grid-parallel operation

Adjustment of excitation changes the reactive power output or reactive power consumption of the relevant generator (and ultimately also indirectly changes the system voltage in island plants).

For this reason, the "power factor control" mode (constant ratio of active and apparent power) is often used in grid-parallel operation. "Automatic reactive power load share" mode (equal, percentage distribution of the reactive power requirement that occurs in island operation to all gensets involved) dominates in multiple genset plants in island operation.

Synchronization



Risk of destruction of components

If the generator is connected in parallel to a high-power grid without sufficient synchronization, damage can occur to the generator's rotor shaft and to the engine.

If the generator is connected in parallel to a lower-power grid without sufficient synchronization, damage can occur to devices in the grid.

- Preset parameters are stored in the control system. Never change these parameters arbitrarily.

Synchronization is required so that the generator can feed electric current into the interconnected grid or consumer mains. The voltage and frequency are defined by the grid. A single genset in island operation is an exception. In this case, it can be connected immediately once the generator's rated voltage is reached.

A synchronization device handles synchronization of the generator with the grid. The synchronization device adjusts the engine speed and generator voltage during the synchronization process. The synchronization device and generator protection device(s) must be provided by the operator.

In order to synchronize the generator with the grid, the synchronization device correlates the current angular position and voltage difference of the voltage generated by the generator to the grid voltage. The engine control initially regulates the engine speed and transfers control to the synchronization device at nominal speed. The synchronization device determines the difference between the value, frequency, and phase position of the generator voltage to the grid voltage. The synchronization device then automatically synchronizes the generator with the grid by adjusting the voltage and speed.

The phase position of the generator is adjusted to the grid voltage by briefly changing the engine speed. The same applies to adjusting the generator voltage using the voltage controller. When the adjustment is carried out, the synchronization device closes the generator circuit breaker (GCB).

From this point on, the required operating modes as well as the setpoints that may be required for these can now be set externally using various connection options.

NOTE

The relevant grid operator specifies the grid code according to the requirements of the grid in question. For this, the grid operator takes into account regulations coordinated and laid out in associations, as well as national, European, or international committees.

8.3 Transmission

8.3.1 Operation

General information:

For systems with 60 Hz application, a transmission is used.

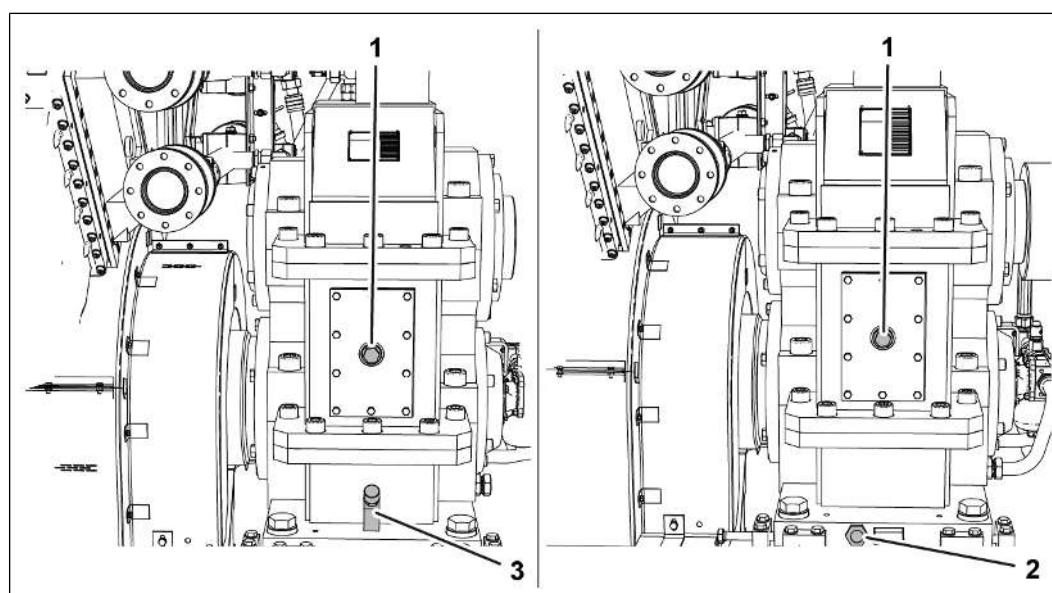
The transmission has the task of transforming the engine speed to the corresponding generator speed.

The transmission lubrication is designed as a pressure circulating lubrication. The lube oil pump mounted on the transmission feeds the lube oil through the lube oil filter and onwards to the heat exchanger and lubricating points.

The visual service indicator on the lube oil filter shows if the lube oil filter is clogged up.

The lube oil pressure is monitored by an oil pressure switch. If the permissible limit value is fallen below, the genset will be automatically turned off by the TEM without prior warning.

The lube oil temperature will be monitored by a Pt100 resistor. If the permissible limit values are exceeded or fallen below, a warning will be given and then the genset will be automatically turned off by the TEM.



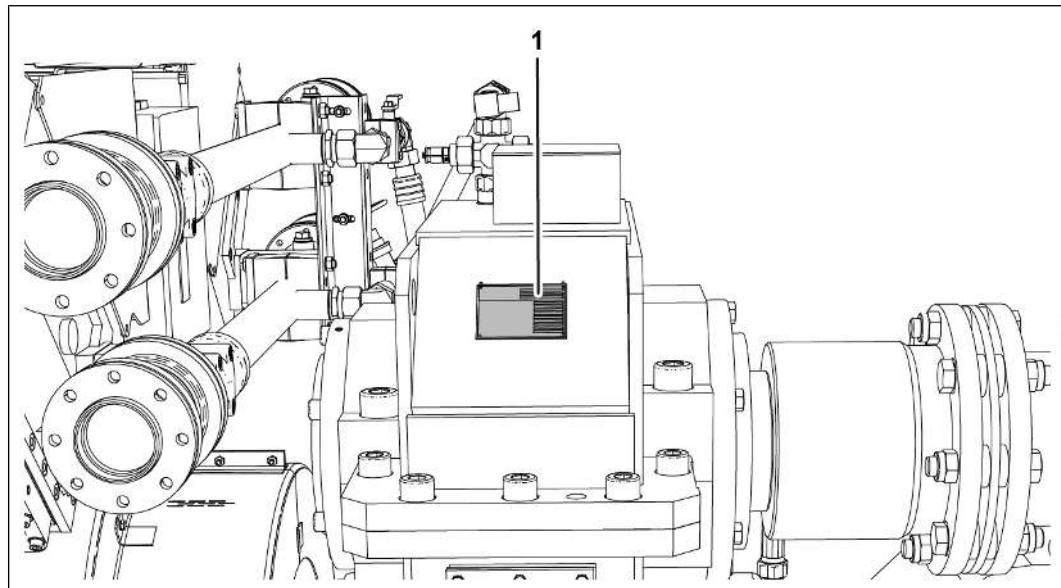
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- 1 Inspection hole cover with filler screw
- 2 Inspection glass
- 3 Dipstick

Different transmission designs are used.

- The crucial difference is the facility for checking the lube oil level.

Rating plate:

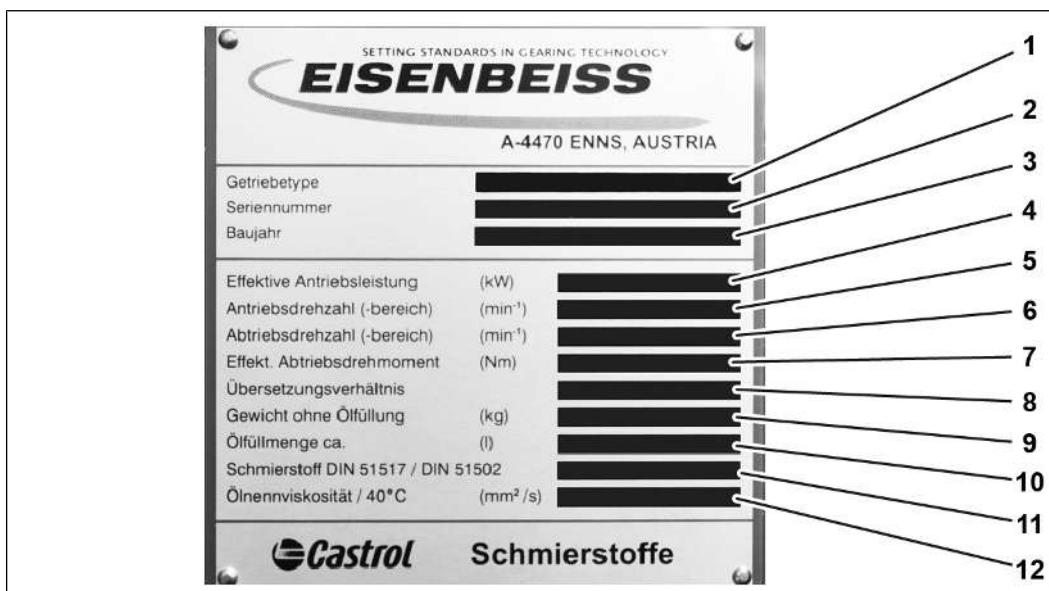


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1 Rating plate

The rating plate is fastened to the transmission.

Designation of the data fields.



2001034507

- 1 Transmission type
- 2 Serial number
- 3 Year of construction
- 4 Effective drive power in kW
- 5 Drive speed in rpm
- 6 Drive speed in rpm
- 7 Effective drive torque in Nm
- 8 Transmission ratio
- 9 Weight without lube oil filling in kg
- 10 Lube oil quantity in liters
- 11 Lubricant as per DIN 51517 / DIN 51502
- 12 Lube oil viscosity as per ISO-VG

Lube oil:

Only a synthetic transmission lube oil may be used in the transmission type GU320 and GU360.

Transmission lube oils have the following properties as per API classifications (API: American Petroleum Institute) and SAE classes (SAE: Society of Automotive Engineers):

- Protection against wear on the tooth flank and the bearing surfaces
- Aging protection and corrosion protection
- Sealing compatibility, e.g. with elastomers

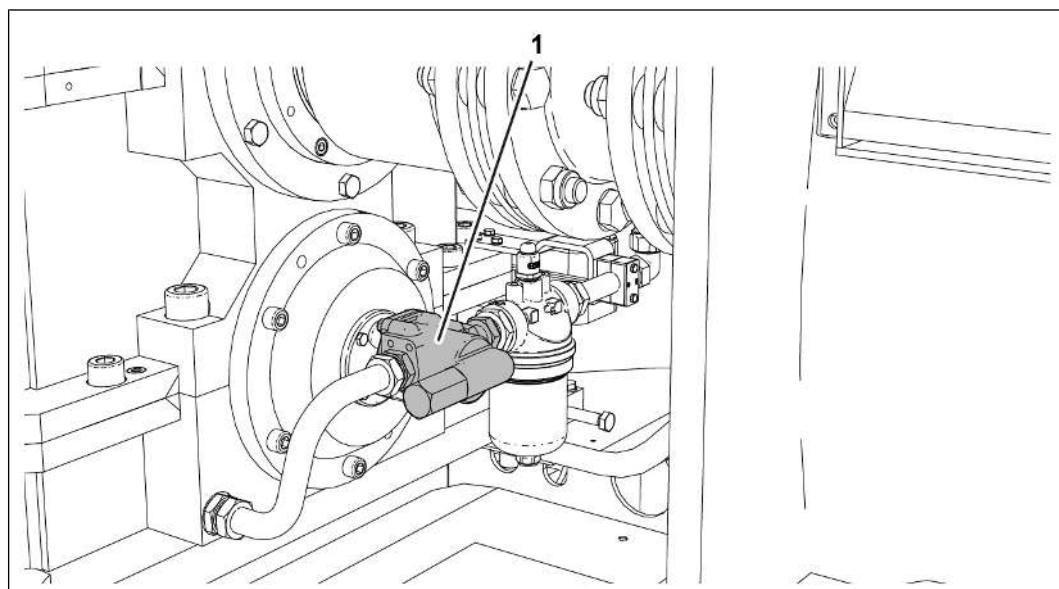
For products that are approved as transmission lube oil, see Technical Bulletin (TR) 2105 [Specification for lube oil](#).

The transmission should be filled for the first time before being commissioned by the operator.

Check the lube oil level:

- The transmission should be checked for oil leaks during the daily visual inspection of the plant.
- It is only possible to check the lube oil level when the genset is stopped. The inspection can be carried out at the same time as maintenance work on the engine.
- The procedure for checking the lube oil level is described in the work instructions.

Lube oil pump:



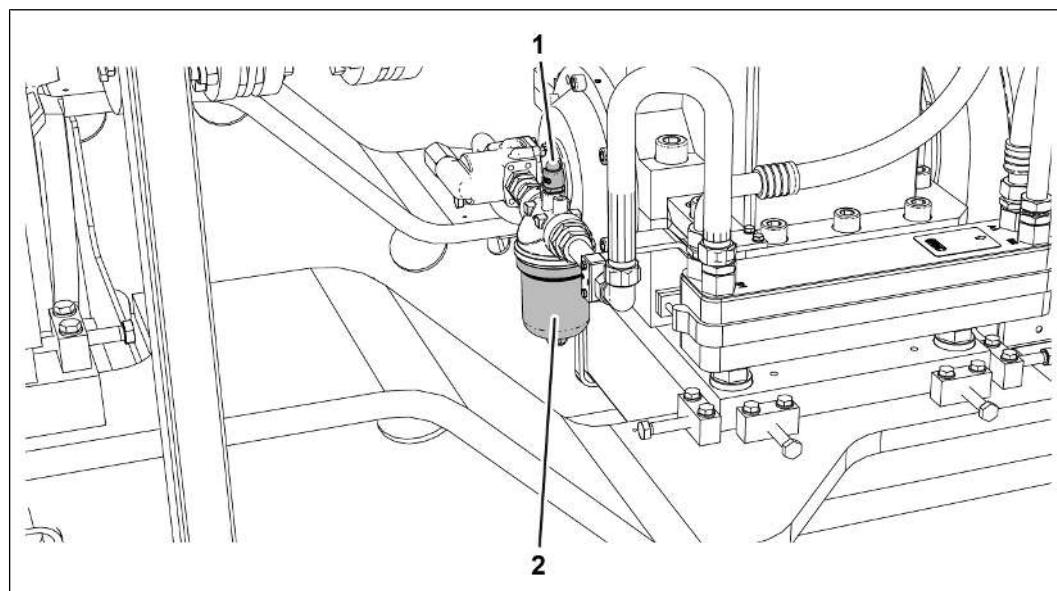
2001267339: Protective cover dismantled

1 Lube oil pump

The lube oil pump is designed as a gearwheel pump and works according to the rotating displacement principle.

The lube oil is sucked up from the transmission housing by the lube oil pump and forced through the lube oil filter. The filtered lube oil is cooled down in the downstream heat exchanger and pumped into the transmission housing to the individual lubricating points.

Lube oil filter:



2001269771: Protective cover dismantled

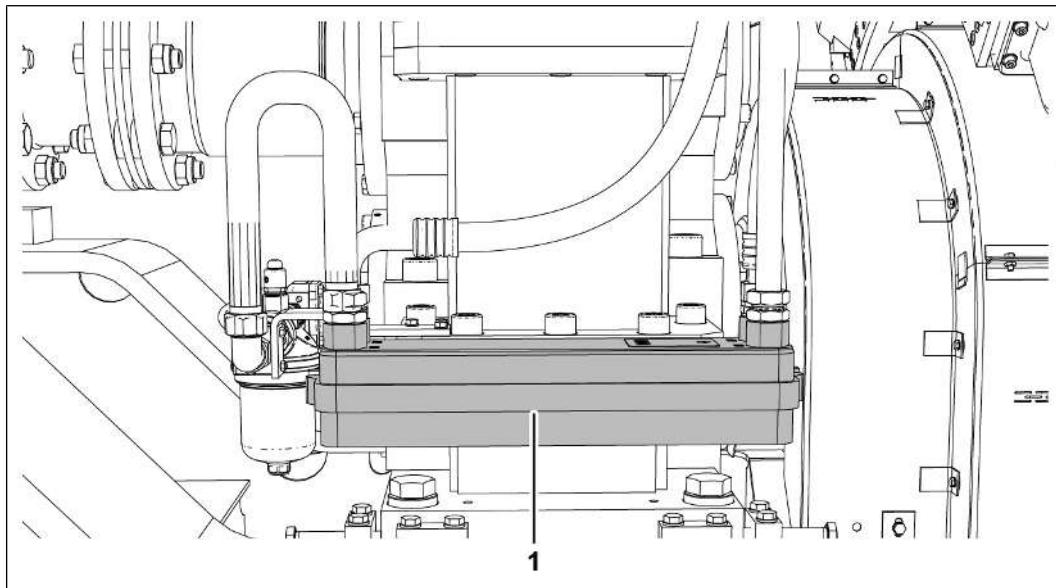
- 1 Service indicator
- 2 Lube oil filter

The lube oil is pumped through the lube oil filter.

- Dirt particles are filtered out of the lube oil.

A visual service indicator is attached to the lube oil filter.

- A permanent pressure difference measurement is carried out.
- If the specified maximum pressure difference is reached, the display changes from green to red.
- The filter insert then has to be replaced.

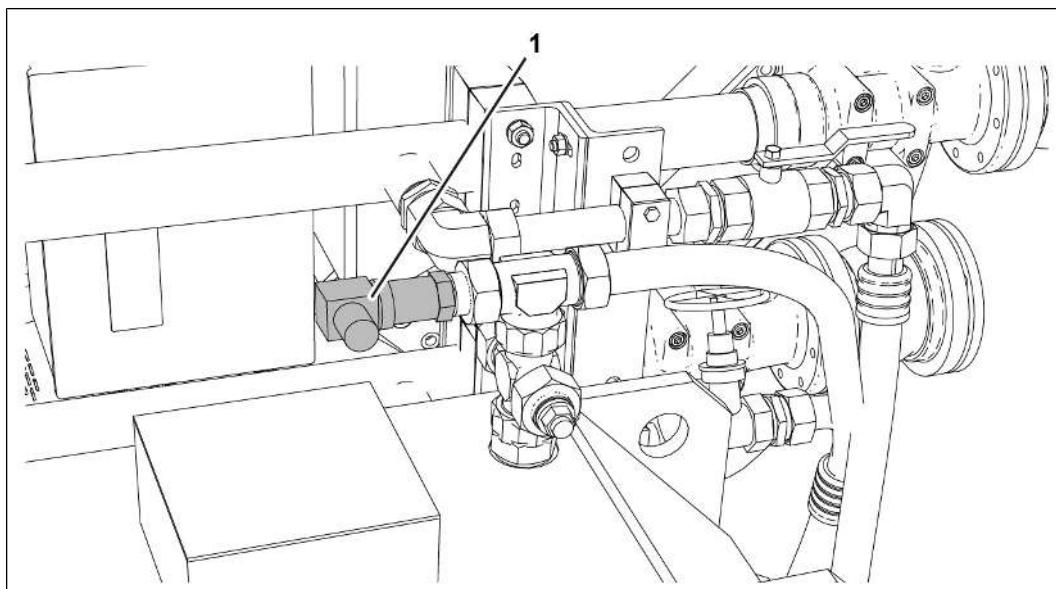
Lube oil heat exchanger:

2001374731: Different lube oil heat exchanger designs are in use!

1 Lube oil heat exchanger

A lube oil heat exchanger is attached to the transmission for cooling the transmission lube oil.

- The lube oil heat exchanger is integrated into the engine's mixture cooling circuit and is supplied with coolant.

Oil pressure switch:

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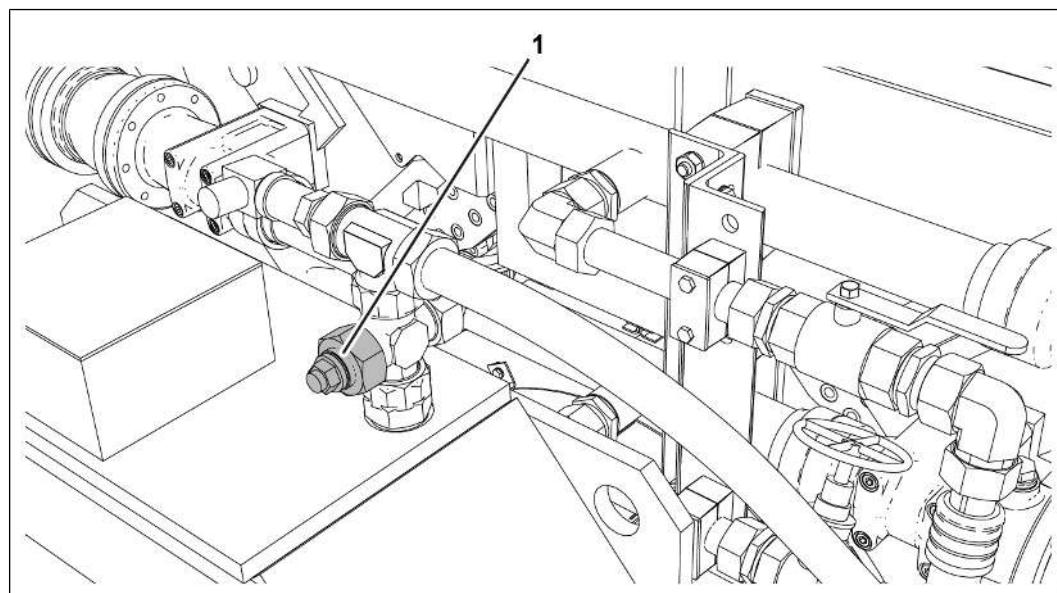
1 Oil pressure switch

An oil pressure switch is used for monitoring the transmission oil pressure.

The transmission oil pressure is monitored by the TEM.

- If the measured pressure falls below the permissible limit value, the genset will be automatically switched off by the TEM without prior warning.

Temperature sensor:



2001312267

1 Temperature sensor

A temperature sensor (Pt100 resistor) is installed to measure the transmission lube oil temperature.

The transmission lube oil temperature will be monitored by the TEM.

- If the measured temperature exceeds the permissible limit value, the genset is automatically switched off by the TEM following a warning message.

Transport, storage and preservation:

For general information on this topic, see Technical Bulletin (TR) 2169 [Specification for corrosion protection, packaging, transport, and storage](#).

9 Decommissioning

9.1 Genset

9.1.1 Stopping the genset

General information

There are two ways to stop the genset.

1. AUTO control (automatic operation)
2. MANUAL control (manual operation)

Secure the genset against accidental commissioning.

- Make sure that no one commissions the genset during maintenance or repair work.
- If necessary, interrupt the power supply, see chapter "**Prevent the genset from being started**".

CAUTION



Prevent the genset from being started

Property damage and personal injury.

- Place an information sign on the switchgear cabinet and on the genset.
 - Attention! Maintenance work! Do not start the genset!
 - Lock the emergency stop button with a U-lock.
-



Risk of destruction of components

Risk of destruction of components

The TEM will be damaged or deleted.

- Ensure the power supply to the BIOS battery of the TEM.
 - Without the power supply to the buffer battery, the TEM will be damaged or deleted.
 - Do not switch off fuse for the BIOS battery.
-

NOTE

Automatic operation

The genset is decommissioned by a demand signal of the superior control.

- The electronic control automatically stops the genset.
-

Stopping the genset (automatic operation):

- ✓ The person responsible for the work has reported to the person responsible for the plant that the genset and the associated plant periphery have been decommissioned.
- 1. **NOTE! The genset shuts down automatically in automatic operation.** Trigger the demand signal for disconnecting the generator circuit breaker in the superior plant control.
 - The electronic control system powers down the genset in a controlled manner until the generator circuit breaker opens.
- 2. Wait until the prelubrication pump and the coolant pump have come to a complete standstill.
 - The prelubrication pump and the coolant pump continue running for a time preset in the control.
- 3. Allow the ventilation to keep running until the temperature preset in the control is reached.
- 4. Switch off the control.
 - Activate the emergency stop button.
- 5. **NOTE! Ensure power supply to the BIOS battery of the TEM.** Switch off fuses.
- 6. Allow the genset and plant periphery to cool down to the ambient temperature.
- 7. Secure the genset against commissioning.
 - Operate the emergency stop button on the TEM CB.
 - Lock the emergency stop button with a U-lock.
 - Remove the key from the U-lock and keep it in a safe place.
 - **CAUTION! Prevent the genset from being started.** Place a visibly clear information sign on the control cabinet and on the genset.

Stopping the genset (manual operation):

- ✓ The person responsible for the work has reported to the person responsible for the plant that the genset with the associated plant periphery has been decommissioned.



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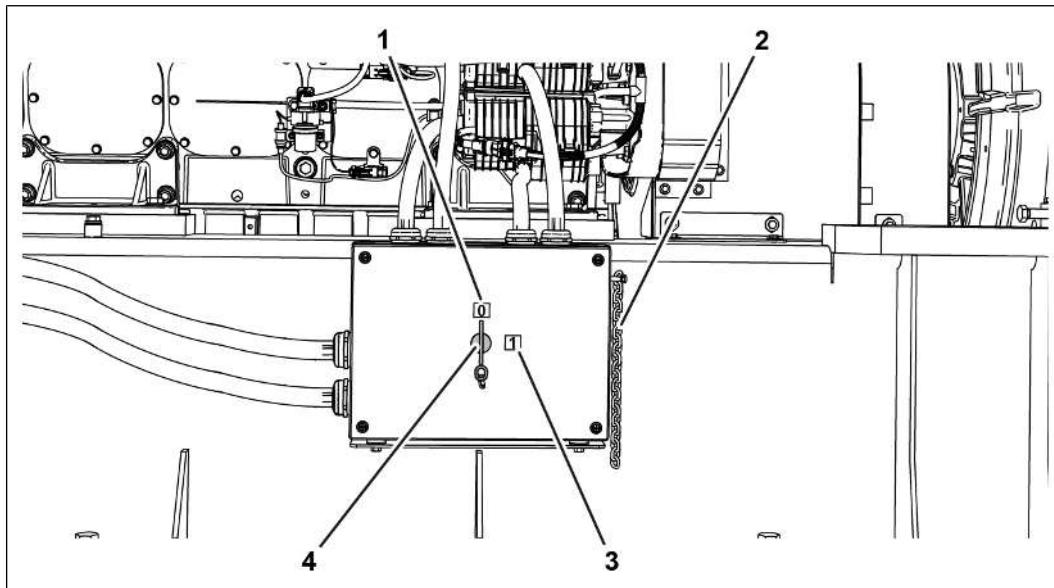
1. Press the OPEN GCB (5) button.
 - The symbol (2) flashes.
 - The display in the status bar (4) shows Relieving.
 - After successful relieving: the symbol (2) lights up continuously gray (opened).
 - The display in the status bar (4) shows Idle and the idle speed.
2. Press the MODULE STOP (3) button.
 - The symbol (1) flashes.
 - The display in the status bar (4) shows Shutting down.
 - After successful shutting down: the symbol (2) lights up continuously gray (still).
 - The display in the status bar (4) shows Ready.
3. Wait until the prelubrication pump and the coolant pump have come to a complete standstill.
 - The prelubrication pump and the coolant pump continue running for a time preset in the control.
4. Allow the ventilation to keep running until the temperature preset in the control is reached.
5. Switch off the control.
 - Activate the emergency stop button.
6. Switch off fuses.
7. Allow the genset and plant periphery to cool down to the ambient temperature.
8. Secure the genset against commissioning.
 - Operate the emergency stop button on the TEM CB.

- Lock the emergency stop button with a U-lock.
- Remove the key from the U-lock and keep it in a safe place.
- **CAUTION! Prevent the genset from being started.** Place a visibly clear information sign on the control cabinet and on the genset.

Preventing the genset from being started:

1. Shut off the fuel gas supply.
 - Close ball valve of the fuel gas line upstream of the gas train.
 - Secure the hand lever of the ball valve with a chain and U-lock.
 - Decommission the gas analysis device, see "**Plant documentation, chapter Gas supply**".
 - Open ball valve in the drain and release the pressure in the fuel gas line.
 - Secure the hand lever of the ball valve with a chain and U-lock.
 - Check if the pressure is released on the fuel gas line pressure gauge.
2. Decommission the gas analysis device (optional).
 - Unscrew the screw connection on the gas analysis device from the process gas input connection.
 - Unscrew the screw connection on the gas analysis device from the calibration gas input connection.
 - Unscrew the screw connection on the gas analysis device from the purge gas input connection.
 - Unscrew the screw connection on the gas analysis device from the process gas output connection.
 - Close all open hose lines.
 - Start the "Cal. purge gas" function in the control system to purge the gas analysis device with air.
 - Open the housing and bring the circuit breaker into the "OFF" position to turn off the gas analysis device.
 - Close the housing of the gas analysis device.
3. Disconnect the compressed air supply and release the pressure (optional).
 - Close the supply valve on the compressed air system.
 - Open the valve for compressed air relief in the compressed air line.
 - Relieve the line pressure completely.
 - Close ball valve upstream of the starter valve in the compressed air line.
 - Secure the hand lever of the ball valve with a chain and U-lock.
 - Remove the key and keep it safe.

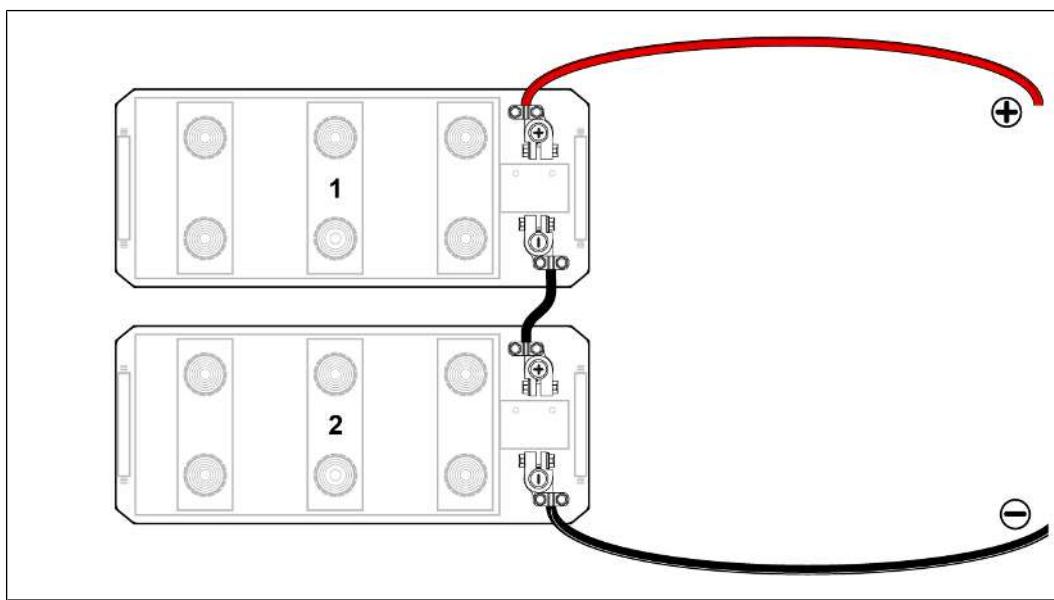
- Check that the compressed air line is free of pressure.
- Ventilate the compressed air line between the starter valve and ball valve.



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4. Lock battery disconnection switch.

- Remove the key (4) on the terminal box from the chain (2).
- With the key (4), set the battery disconnection switch on the terminal box from position 1 (3) to position 0 (1).
- Remove the key (4) from the battery disconnection switch and keep it safe.

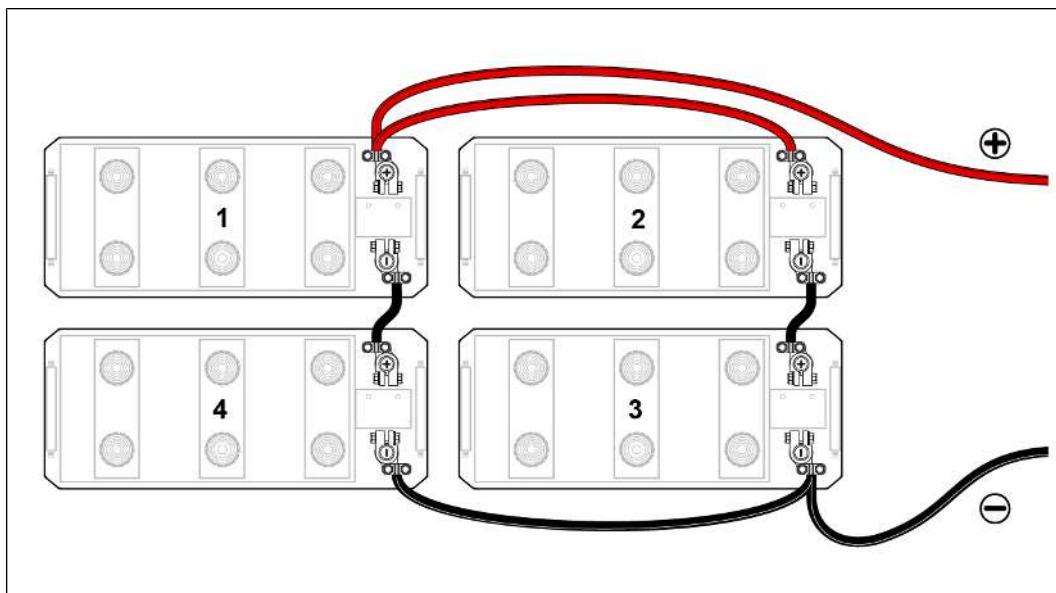


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5. Disconnect the starter battery (two starter batteries).

- Dismantle connection bridge of the starter battery 2 at the negative terminal.
- Dismantle the covering cap of starter battery 1 at the positive terminal.

- Dismantle connection bridge of starter battery 1 at the positive terminal.
- Remove the connection bridge and set aside.
- Mount the coving cap of starter battery 1 at the positive terminal again.



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6. Disconnect the starter battery (four starter batteries).
 - Dismantle connection bridge of the starter battery 4 at the negative terminal.
 - Dismantle connection bridge of the starter battery 3 at the negative terminal.
 - Dismantle the covering cap of starter battery 1 at the positive terminal.
 - Dismantle connection bridge of starter battery 1 at the positive terminal.
 - Remove the connection bridge and set aside.
 - Mount the coving cap of starter battery 1 at the positive terminal again.
 - Dismantle the covering cap of starter battery 2 at the positive terminal.
 - Dismantle connection bridge of starter battery 2 at the positive terminal.
 - Remove the connection bridge and set aside.
 - Mount the coving cap of starter battery 2 at the positive terminal again.
7. Stop the prelubrication pump.
 - Wait for follow-up time of the prelubrication pump to elapse.
 - Check that the emergency stop button has been operated.
 - The interval lubrication is switched off.
 - The prelubrication pump is not operating.

9.1.2 Decommissioning the genset



Risk of destruction of components

Components can be damaged or destroyed due to improper decommissioning.

- Perform the work specified in this chapter in accordance with the duration of the decommissioning
- Secure the genset against starting for the entire duration of the decommissioning
 - Attach signs to the touchscreen, switchgear cabinet, and genset with the following text: CAUTION! OUT OF ORDER! Start the genset ONLY after consulting the operator.



Risk of destruction of components

Components can be damaged or destroyed due to improper storage.

- Ensure the following storage conditions:
 - Frost-proof (constant temperature of +10 °C to +40 °C)
 - Neutral, dry atmosphere (constant humidity up to maximum 60 % rH)
 - In a humid environment, use desiccants to prevent the build-up of condensation or use heating
 - If necessary, add anti-freeze agents to the coolant or empty the cooling system
 - Necessary information on coolant, storage, and preservation can be found in the order-specific operating manual in chapter *Regulations*.
- Ensure that no foreign bodies, dust or humidity penetrate

Different work must be performed depending on the duration of the decommissioning.

The following periods are distinguished between for the decommissioning:

- Decommissioning for maximum two months, see [Decommissioning the genset for up to two months \[▶ 170\]](#)
- Decommissioning for two to eight months, see [Decommissioning the genset for two to eight months \[▶ 170\]](#)
- Decommissioning for more than eight months, see [Decommissioning the genset for more than eight months \[▶ 171\]](#)

The power supply for the plant must be ensured during the entire decommissioning period. The superior control system must therefore remain ready for operation.

In order to save energy, the preheating device for the coolant can be operated at reduced power (approx. 25 °C).

9.1.3 Decommissioning the genset for up to two months

Work that must be performed by the operator or operating personnel:

1. Close the shut-off device in the gas train
2. Lock battery disconnection switch and keep the key in a safe place
3. The preheating device for the coolant must be switched on if there is a risk of frost

9.1.4 Decommissioning the genset for two to eight months

Work that must be performed by the operator or operating personnel:

- ✓ All work is performed as in section [Decommissioning the genset for up to two months](#)
[▶ 170]
- 1. **NOTE! Avoid aeration inside the engine (chimney effect).** Decommissioning the exhaust system and charging
 - Seal intake air filter shut with suitable cover (e.g. film).
 - In the case of a multi-engine plant with a common exhaust line, close the exhaust flap of the decommissioned genset.
 - Additional information on the exhaust line and shut-off flap can be found in the order-specific operating manual in chapter *Notes on planning*.
- 2. Decommissioning the fuel gas system
 - Close the shut-off device in the gas train.
- 3. Decommissioning the lube oil system
 - Perform a lube oil analysis.
 - If the results of the lube oil analysis exceed or undercut the limit values, renew the lube oil.
 - After changing the lube oil, operate the genset for at least twelve hours.
 - Information on the limit values for lube oil can be found in the order-specific operating manual in chapter *Regulations*.
- 4. Decommissioning the cooling system
 - Switch on the coolant pumps once a month and let them run for ten minutes.
- 5. Decommissioning the compressed air system (optional)
 - Drain the compressed air container once a month.
 - After draining, fill the compressed air container with compressed air.
 - Check the system pressure each month if using a version with automatic drainage.
Replenish the compressed air if necessary.

Work that must be performed by a qualified gas technician:

1. Decommissioning the fuel gas system
2. **NOTE! Gas trains for natural gas plants are excluded from the cleaning.** Clean the gas train

Work that must be performed by a qualified electrician:

1. Decommissioning the generator
 - Check the insulation resistance of the generator every six months.
 - If necessary, dry the generator.

9.1.5 Decommissioning the genset for more than eight months**Work that must be performed by the operator or operating personnel:**

- ✓ All work is performed as in section [Decommissioning the genset for two to eight months \[▶ 170\]](#)

1. Decommissioning the plant
 - Close all the openings on the genset

Work that must be performed by the service personnel:

1. **NOTE! Generators with roller bearings can be damaged or destroyed due to improper decommissioning. To avoid damage to the roller bearings due to hardened lubricating grease, rotate the generator shaft during the shutdown time.**
Decommissioning the generator with roller bearings
 - Disconnect the generator from the engine.
 - Starting after eight months, the generator shaft must be turned through 30 revolutions each month.
2. **NOTE! Generators with sleeve bearings can be damaged or destroyed due to improper decommissioning. To avoid damage to the sleeve bearings, the generator shaft must not be rotated during the shutdown time.** Decommissioning the generator with sleeve bearings
 - Disconnect the generator from the engine.
 - Secure the rotor with a blocking clip.
 - Fill corrosion protection agent into the filler openings of the sleeve bearings.

10 Troubleshooting

10.1 Genset

10.1.1 Fault displays

All the warning messages and fault messages appear as text messages on the control system.

- There may be other acoustic or visual fault displays in the immediate vicinity of the genset.
- The operator is responsible for integrating the genset into the signal chain of the overall plant.

Displaying fault displays in the start mask

Description of the warning messages and fault messages in the status bar

The operation log shows precise information on the respective warning message or fault message.

If several faults occur at the same time, the status bar displays the Collective fault fault message.



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1. Open start mask (1).
 - The status bar (2) displays pending fault messages and collective faults.

Displaying fault displays in the start mask

Description of the warning messages and fault messages in the operation log mask

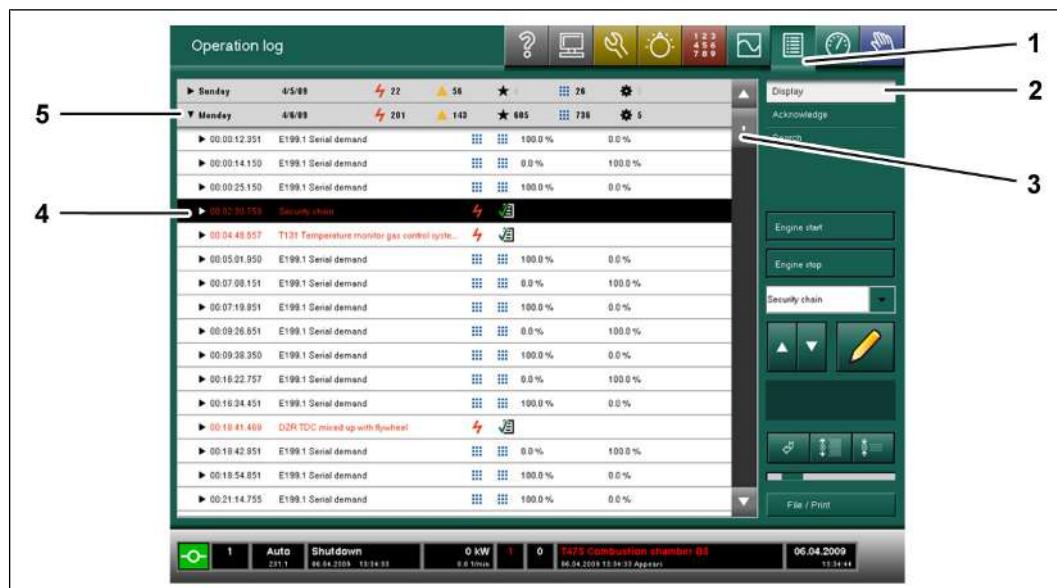
The operation log records the operation of the genset in full with all defined text messages, warning messages and fault messages.

The TEM stores supplementary information for each event in the operation log.

- It is possible to retrieve additional information in the detailed view.
- Associated events are connected to each other via links (e.g. fault – fault acknowledged).
- Event traces can be followed without a complex search.

If multiple fault messages are displayed at the same time, always observe the top fault message first.

- The following messages may be sequence faults that result from the first fault.



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1. Press the Operation log button (1).
– The Operation log mask opens.
2. Navigate with the scroll bar (3) to the desired day bar (5).
3. Select and tap fault message (4).
– The fault message (4) is colored in.
4. Press the Display button (2).
– In case of acknowledgeable warning messages and fault messages, a detailed window of the fault message is shown.

Acknowledging fault displays in the Operation log mask

Acknowledging warning messages and fault messages individually or as a whole

The Operation log mask allows users to acknowledge warning messages or fault messages.

NOTE

If the cause of the warning message or fault message has been eliminated, the control system enables the Acknowledge button.

- The Acknowledge button is then colored white.
-

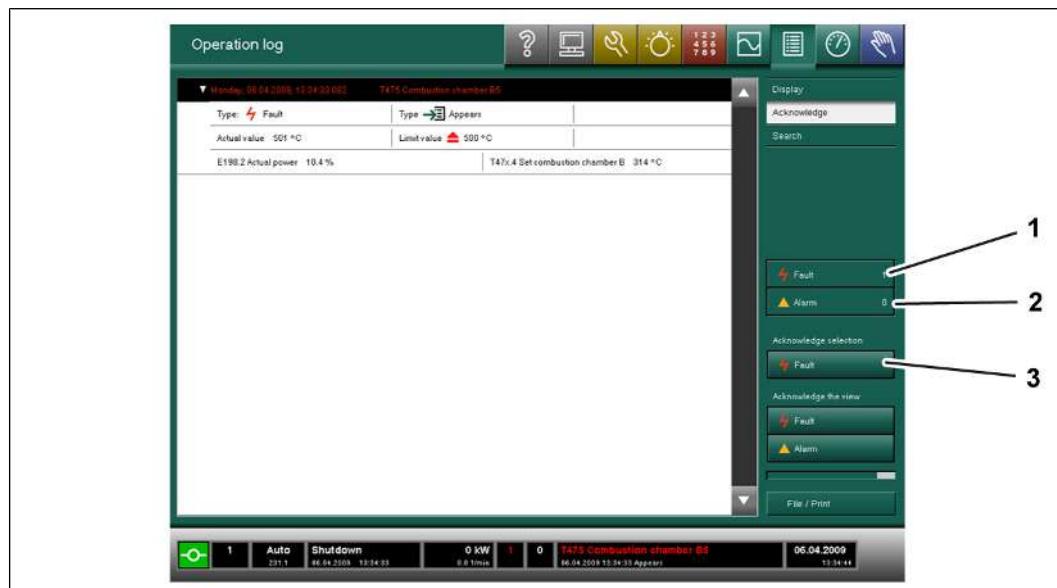
NOTE

If operating the emergency stop switch has triggered the fault message.

- Reset the emergency stop module in the Service screen before commissioning.
 - For more information on this, see OL-MRA10 / 00-15-30 [Performing an auxiliary drive test](#) [▶ 225].
 - Section, Service - Checking the reset emergency stop module.
-

Warning messages and fault messages can be acknowledged in two ways:

- Acknowledging individual warning messages or fault messages.
- Acknowledging all visible warning messages or fault messages in dialog area.



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1. Acknowledging individual warning and fault messages.

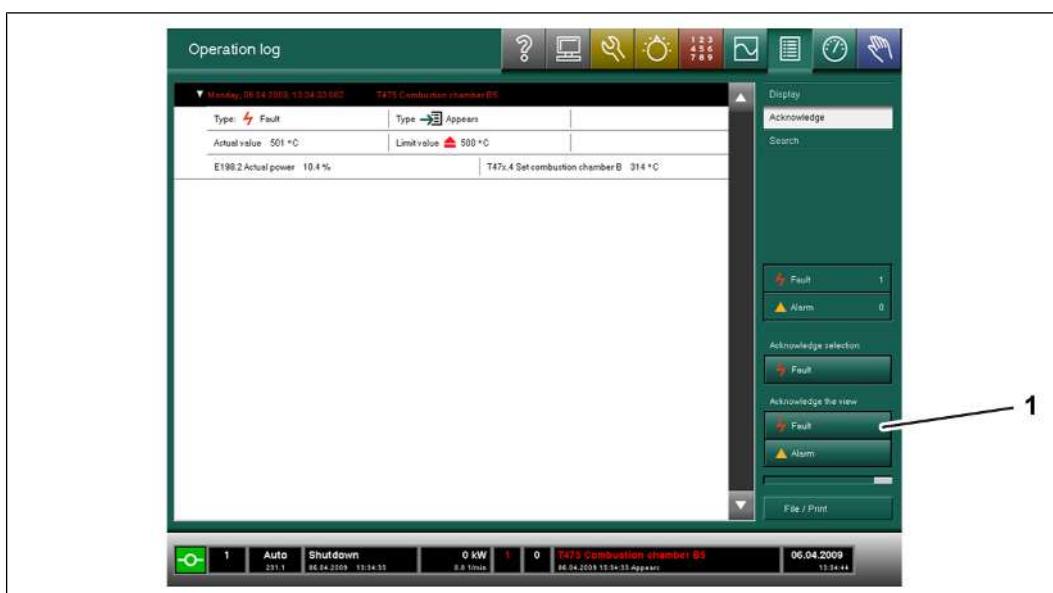
- **NOTE! The label of the toggle button (3) displays the selected type of message!** Using the Fault (1) or Alarm (2) buttons select and activate a message.
 - Press toggle button (3) to acknowledge the selection.

- The selected message is acknowledged.
- The Operation log no longer displays the message.
- The control system saves the successful acknowledgement with the applicable warning message or fault message in the operation log.



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2. Acknowledging all visible warning messages.
 - Press Alarm button (1) to acknowledge the view.
 - All acknowledgeable warning messages are acknowledged.
 - The Operation log no longer displays the messages.
 - The control system saves the successful acknowledgement with the applicable warning messages in the operation log.



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3. Acknowledging all visible fault messages.
 - Press Fault button (1) to acknowledge the view.
 - All acknowledgeable fault messages are acknowledged.
 - The Operation log no longer displays the messages.
 - The control system saves the successful acknowledgement with the applicable fault messages in the operation log.

10.1.2 Checking after troubleshooting

1. Ensure that all the protective covers are mounted completely and are functional.
2. Ensure that all safety devices are mounted completely and functional.
3. Ensure that there are no people in the danger zone.
4. Reset emergency stop devices.
5. Acknowledge all faults on the control system.

10.2 Generator

10.2.1 Fault table for generator

Component and fault	Possible cause	Troubleshooting
Generator voltage is too high	Nominal value specification adjusted incorrectly	1. Contact person: Qualified electrician
	Measuring lines connected incorrectly	1. Contact person: Qualified electrician

Component and fault	Possible cause	Troubleshooting
	Generator controller is defective	1. Contact person: Qualified electrician
Voltage fluctuations in the generator	Engine speed is not constant	1. Check engine speed 2. Correct load step if necessary 3. Contact person: service partner
	Nominal value specification adjusted incorrectly	1. Contact person: Qualified electrician
	Generator controller is defective	1. Contact person: Qualified electrician
Generator voltage cannot be increased	Set point adjuster or connection line broken	1. Contact person: Qualified electrician 2. Contact person: service partner
Generator builds no voltage	Exciter safety switch has been triggered	1. Contact person: service partner
	Excitation diodes faulty	
Generator voltage drops greatly under load	Input speed drops under load	1. Contact person: service partner
	Protective fuse faulty	
	Excitation diodes faulty	

Table 1: Generator generates no voltage or an incorrect voltage, or is faulty

10.3 Mixture system

10.3.1 Fault table for mixture system

Component and fault	Possible cause	Troubleshooting
Flange connection to the mixture pipe leaks.	Seal is faulty. Sealing ring is faulty.	1. Contact person: service partner

Component and fault	Possible cause	Troubleshooting
	Loose screw connection.	1. Contact person: service partner

Table 2: Mixture pipe leaks

Component and fault	Possible cause	Troubleshooting
Mixture temperature is too high.	Mixture temperature sensor is faulty.	1. Renew mixture temperature sensor.
Mixture temperature is too low.		
Mixture pressure is too high.	Mixture pressure sensor is faulty.	1. Renew mixture pressure sensor.
Mixture pressure is too low.		

Table 3: Mixture values are not correct

10.4 Engine

10.4.1 Fault tables for engine

Component and fault	Possible cause	Troubleshooting
Gas supply interrupted	Gas shut-off elements closed	1. Open gas shut-off elements
	Leakage	1. Contact person: Qualified gas technician
	Gas pressure controller is hanging	1. Contact person: Qualified gas technician
Gas supply interrupted	Gas pressure too high or too low	1. Contact person: Qualified gas technician
Speed control is not functioning	Actuator faulty	1. Contact person: service partner
Power supply interrupted	Power supply to the genset switch cabinet interrupted	1. Contact person: Qualified electrician
Ignition does not take place	Control device faulty	1. Contact person: service partner
	Cable broken	

Component and fault	Possible cause	Troubleshooting
Camshaft sensor does not give any signal	Spacing too large	1. Contact person: service partner
	Sensor or sensor cable faulty	1. Contact person: service partner
Crankshaft sensor does not give any signal	Spacing too large	1. Check setting
	Sensor or sensor cable faulty	1. Renew sensor
The electronic control has stopped the engine (cooling system is not functioning)	Too little coolant	1. Check coolant
	Leakage	1. Contact person: service partner
	Coolant pump faulty	1. Contact person: service partner
	Coolant pump leaking	1. Contact person: service partner
	Cooling system dirty	1. Contact person: service partner

Table 4: Engine is at a standstill

Component and fault	Possible cause	Troubleshooting
Gas supply interrupted	Gas shut-off elements closed	1. Open gas shut-off elements
Power supply interrupted	Power supply to the genset switch cabinet interrupted	1. Contact person: Qualified electrician
	Power supply to the starter interrupted	1. Checking battery disconnection switch
Ignition does not take place	Spark plug faulty	1. Check spark plug
	Ignition cable faulty	1. Check ignition cable
	Ignition coil faulty	1. Contact person: Qualified electrician
	Main control device faulty	1. Contact person: service partner

Component and fault	Possible cause	Troubleshooting
Engine does not turn	Starter system faulty	<ol style="list-style-type: none"> 1. Check power supply 2. Checking the starter 3. Check start signal 4. Check compressed air supply (optional) 5. Contact person: service partner
Camshaft sensor does not give any signal	Spacing too large	<ol style="list-style-type: none"> 1. Contact person: service partner
Crankshaft sensor does not give any signal	Spacing too large	<ol style="list-style-type: none"> 1. Check setting

Table 5: Engine does not start

Component and fault	Possible cause	Troubleshooting
Inlet valves do not close	Valve clearance too small	<ol style="list-style-type: none"> 1. Checking the valve clearance
	Inlet valve leaking	<ol style="list-style-type: none"> 1. Contact person: service partner
Outlet valves do not close	Valve clearance too small	<ol style="list-style-type: none"> 1. Checking the valve clearance
	Outlet valve leaking	<ol style="list-style-type: none"> 1. Contact person: service partner
	Oil residues at the outlet valve	<ol style="list-style-type: none"> 1. Contact person: service partner
Compression pressure too low	Piston rings faulty	<ol style="list-style-type: none"> 1. Contact person: service partner
	Cylinder liner worn	<ol style="list-style-type: none"> 1. Contact person: service partner

Component and fault	Possible cause	Troubleshooting
Gas supply is impaired	Gas line not ventilated	1. Contact person: Qualified gas technician
	Stepper motor of gas-air mixer faulty	1. Contact person: service partner
Ignition takes place irregularly or does not take place at all	Spark plug faulty	1. Check spark plug

Table 6: Engine is misfiring and does not run quietly

Component and fault	Possible cause	Troubleshooting
Ignition does not take place	Spark plug faulty	1. Check spark plug
	Ignition cable faulty	1. Check ignition cable
	Ignition coil faulty	1. Contact person: Qualified electrician
	Main control device faulty	1. Contact person: service partner
Signal from camshaft sensor is too weak	Spacing too large	1. Contact person: service partner
	Camshaft sensor faulty	1. Contact person: service partner
Signal from crankshaft sensor is too weak	Spacing too large	1. Check setting
	Crankshaft sensor faulty	1. Renew crankshaft sensor

Table 7: Engine ignites irregularly

Component and fault	Possible cause	Troubleshooting
Poor heat transmission (primary heating circuit to secondary heating circuit)	Heat exchanger silted	1. Contact person: service partner
Poor heat transmission (secondary heating circuit)	3-way valve faulty	1. Contact person: service partner
Poor cooling efficiency (cooling circuit)	Coolant pressure too low	1. Checking the coolant level
	Coolant pressure sensor faulty	1. Renew coolant pressure sensor
	Coolant temperature sensor faulty	1. Renew coolant temperature sensor
	Leakage	1. Contact person: service partner
	Coolant pump faulty	1. Contact person: service partner
	Coolant pump leaking	1. Contact person: service partner

Table 8: Engine is overheating

10.5 Coupling

10.5.1 Fault table for coupling

Component and fault	Possible cause	Troubleshooting
Cracks in the elastomer	Coupling overloaded	1. Contact person: service partner
	Coupling worn out	1. Contact person: service partner
	Coupling aligned incorrectly	1. Contact person: service partner
Elastomer becoming detached	Coupling aligned incorrectly	1. Contact person: service partner

Table 9: Coupling damaged or faulty

10.6 Transmission

10.6.1 Fault table

Troubleshooting:

Component and fault	Possible cause	Troubleshooting
Transmission noises	Transmission fastening has come loose.	Tighten fastening in accordance with tightening specifications.
Transmission noises	Damage to gear teeth	Contact service partner.
Transmission noises	Too much bearing clearance	Contact service partner.
Transmission noises	Bearing faulty	Contact service partner.
Transmission noises	Coupling defective	Contact service partner.

Component and fault	Possible cause	Troubleshooting
Transmission becomes too hot.	Lube oil level too high	Drain lube oil.
Transmission becomes too hot.	Lube oil contaminated or out-of-date	Change lube oil. Replace lube oil filter.
Transmission becomes too hot.	Lube oil pump faulty	Contact service partner.

Component and fault	Possible cause	Troubleshooting
Loss of lube oil at the transmission	Housing covers or joints insufficiently sealed	Contact service partner
Loss of lube oil at the transmission	Sealing ring on drive shaft / output shaft defective	Contact service partner.

Component and fault	Possible cause	Troubleshooting
Foamy lube oil	Unsuitable lube oil	Change lube oil, rinse transmission.
Foamy lube oil	Contaminated lube oil	Change lube oil, rinse transmission.
Foamy lube oil	Mixed lube oil types	Change lube oil, rinse transmission.

Component and fault	Possible cause	Troubleshooting
Coolant in lube oil	Heat exchanger defective	Contact service partner.

Component and fault	Possible cause	Troubleshooting
Lube oil pressure too low	Lube oil level too low	Check lube oil level, correct if necessary.
Lube oil pressure too low	Lube oil filter contaminated	Check and if necessary replace lube oil filter.
Lube oil pressure too low	Unsuitable lube oil	Change lube oil, rinse transmission.
Lube oil pressure too low	Lube oil pump faulty	Contact service partner.
Lube oil pressure too low	Lube oil too hot	Contact service partner.
Lube oil pressure too low	Suction line of the lube oil pump blocked	Contact service partner.

Component and fault	Possible cause	Troubleshooting
Lube oil pressure too high	Lube oil filter contaminated	Check and if necessary replace lube oil filter.
Lube oil pressure too high	Unsuitable lube oil	Change lube oil, rinse transmission.
Lube oil pressure too high	Heat exchanger contaminated	Contact service partner.

10.7 Intake air system

10.7.1 Fault table for intake air system

Component and fault	Possible cause	Troubleshooting
Air supply interrupted	Intake air filter defective	Exchange intake air filter
	Clamping clips loose	Tighten screw connection
Air supply insufficient	Intake air filter defective	Exchange intake air filter
	Check air quality	1. Contact person: service partner

Table 10: Intake air system is leaking or faulty

10.8 Cooling system

10.8.1 Fault table for cooling system

Component and fault	Possible cause	Troubleshooting
Coolant pump not functioning	Fuse faulty	1. Contact person: Qualified electrician
	Cable clamp loose	1. Contact person: Qualified electrician
	Coolant pump faulty	1. Contact person: Qualified electrician
Coolant pump output is too low	Air in cooling system	1. Contact person: service partner
	Coolant pump is connected in the wrong direction of rotation	1. Contact person: Qualified electrician
	Speed too low	1. Contact person: Qualified electrician
	Coolant pump faulty	1. Contact person: Qualified electrician
Coolant pump is making noises	Pre-pressure too low	1. Adjust pre-pressure as per specification

Component and fault	Possible cause	Troubleshooting
	Bearing faulty	1. Contact person: service partner
Engine stopped by the electronic control (coolant volume too low)	Too little coolant	1. Check coolant 2. Top up coolant if necessary
	Leakage	1. Contact person: service partner
Engine stopped by the electronic control (coolant temperature too high)	Too little coolant	1. Check coolant 2. Top up coolant if necessary
	Coolant temperature sensor defective	1. Replace coolant temperature sensor

Table 11: Cooling system is depressurized or faulty

10.9 Exhaust system

10.9.1 Fault table for exhaust system

Component and fault	Possible cause	Troubleshooting
Flange connection to the exhaust heat exchanger is leaking	Gasket faulty	1. Contact person: service partner
	Loose screw connection	1. Contact person: service partner
Insufficient performance of the exhaust heat exchanger (pressure loss)	Upstream side of the exhaust heat exchanger is dirty	1. Contact person: service partner
	Exhaust gas side of the exhaust heat exchanger is dirty	1. Contact person: service partner
Water comes out the condensate nozzle of the exhaust heat exchanger when the genset is switched off	Pressure tank leaking	1. Decommission the exhaust heat exchanger immediately 2. Contact person: service partner

Component and fault	Possible cause	Troubleshooting
	Loose screw connection	1. Contact person: service partner

Table 12: Exhaust system is leaking or faulty

11 Maintenance

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11.1 Genset

11.1.1 Fluoropolymer elastomers on the genset

General information

Installed seals, sealing rings, and molded parts for high thermal loads are partially manufactured from fluoropolymer elastomers (FPM).

The material decomposes and forms caustic acids at temperatures above 315 °C (caused by engine fire, for example).

- The residues are sticky and have a black appearance.

NOTE

Information on disposal

For the corresponding disposal regulations, see the genset operating manual under user instructions.



DANGER

Heated fluoropolymer elastomers.

Severe injury or death can result.

- Wear personal protective equipment.
 - Ensure sufficient ventilation.
 - Take off soiled clothing immediately and dispose of them according to the national regulations.
-

General information

Installed seals, o-rings, and molded parts for high thermal loads are partially manufactured from fluoropolymer elastomers (FPM).

The material decomposes and forms caustic acids at temperatures above 315 °C (caused by engine fire for example).

- The residues are sticky and have a black appearance.
-

NOTE

Information on disposal

The disposal regulations in the end customer documentation must be observed.

**DANGER**

Heated fluoropolymer elastomers.

Severe injury or death can result.

- Wear personal protective equipment.
- Ensure sufficient ventilation.
- Take off soiled clothing immediately and dispose of them according to the national regulations.

Notes on components made of fluoropolymer elastomers:

If damage to seals, o-rings or molded parts made of fluoropolymer elastomers (FPM) has occurred due to high temperatures, proceed as follows:

- Visual inspection of all seals, o-rings, and molded parts that are damaged by the effects of heat.
- Remove and dispose of material residues properly.
- Items of clothing that came into contact with material residues must be disposed of according to the national regulations.

11.1.2 Conducting checks after maintenance is complete

- ✓ The maintenance tasks are complete
- 1. Ensure that all the protective covers are mounted completely and are functional.
- 2. Ensure that all safety devices are assembled completely and are functional.
- 3. Ensure that there are no people in the danger zone.
- 4. Commission the genset, see [Start the genset \[▶ 136\]](#).

11.1.3 Performing cleaning

For cleaning instructions, see OL-MRA10 / 00-02-80 [Cleaning the genset \[▶ 215\]](#).

- For information on cleaning agents, see Technical Bulletin 2147 [Specification for auxiliary media](#).

For more information on cleaning components and parts, see *Operating Manual, chapter Maintenance information*.

11.1.4 Performing cutting work, grinding work, soldering work, and welding work on the genset**General information****NOTE**

Necessary qualification for performing the work.

Welding work may only be carried out by qualified personnel.

- A welding supervisor with the corresponding qualification must be involved, for protection.

Person responsible for cutting work, grinding work, soldering work, and welding work:

- Has been made aware of the potential dangers by the client.
- Is familiar with the applicable guidelines and regulations as well as the on-site safety notes.
- Knows and observes the on-site accident prevention regulations of the country-specific legislation.

The following points must be observed and complied with.

DANGER

Explosion due to gases which ignite.

This leads to severe injuries and even death.

- Sufficiently ventilate the room.
- Do not smoke.
- Do not use any naked flames.
- Use only ATEX-approved devices and tools.
- Only qualified specialist personnel may work on the fuel gas system.

CAUTION

Optical radiation.

Minor or severe injuries may result.

- Wear personal protective equipment.
- Close off the working area for unauthorized persons.

**DANGER**

Poisoning from vapors and gases

This leads to severe injuries and even death.

- Wear personal protective equipment.
- Ensure sufficient ventilation.
- Extract vapors.

Notes on performing cutting work, grinding work, soldering work, and welding work on the genset:

Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).

Protect components in the immediate vicinity of the working area.

- Remove the battery and store it safely if necessary.
- Remove connector from the electronic components (e.g. switchgear cabinet, switchgear box, control device, sensors).
- Remove electronic components in the immediate vicinity of the working area.
- Sensitive surfaces (e.g. air cleaner) must be covered with non-conductive and non-flammable material.
- Seal or cover openings on the engine and genset.

When welding, always attach the ground terminal of the welding device in the immediate vicinity of the welding location.

- If necessary, remove paint from the area of the ground terminal.

Avoid fire hazards and flying sparks.

- Fully remove flammable substances from the area at risk.
- Flammable objects (e.g. cables, expansion joints) must be covered with non-conductive and non-flammable material or removed.

Seal or cover openings to other work areas.

When working with strong heat development on the gas system (or fuel system).

- The gas system (or fuel system) is fully emptied, vented, and purged if necessary.
- Lock the fuel gas lines (or fuel lines).

Keep a sufficient number of fire extinguishers within easy reach.

When the work is complete, remove the covers and seals to other work areas.

Re-apply paint that was removed.

- Prevent corrosion on areas where paint was removed.

Protect components in the immediate vicinity of the working range.

- Remove covers placed on the engine and genset.
- Remove covers placed on sensitive surfaces.
- Re-install electronic components in the immediate vicinity of the working range.
- Re-attach connectors of the electronic components (e.g. switchgear cabinet, switch box, control device, sensors).
- Install battery if necessary.

Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

11.1.5 Maintenance and inspection schedule

All maintenance work that is required for fault-free operation is summarized in the maintenance and inspection schedule. The maintenance and inspection schedule is sorted according to maintenance levels (M levels) and stored accordingly.

In the following cases, always contact the manufacturer:

- Increased wear is noticeable during checks or maintenance work.
- Questions arise during maintenance work
- Questions arise during maintenance intervals

The manufacturer's contact details can be found in the Masthead or on the [homepage](#).

For all required information on the maintenance and inspection schedule, see [Maintenance \[▶ 189\]](#).

11.1.6 Performing maintenance work

Each maintenance procedure is described in a separate work instruction. The maintenance and inspection schedule specifies the correct work instructions for each maintenance procedure. The respective maintenance procedures are described in detail in the work instructions, see Work instructions.

For more information on maintenance procedures on individual components, see the order-specific operating manual or consult the Service Library.

11.2 Transmission

11.2.1 Notes for maintenance on the transmission

It is imperative that maintenance work and repair work be performed.

- The maintenance intervals specified in the maintenance and inspection schedule apply.
- The maintenance information on the rating plate and in the original supplier documentation of single components is not binding.

The relevant work requires specialist knowledge.

Therefore, the work can only be performed by personnel who meet the qualification (competency) specified in the maintenance schedule.

The abbreviations in the maintenance schedule have the following meanings:

- **OL:** The maintenance activity requires competence level "Operator Level" (formerly CL 1).
- **ML:** The maintenance activity requires competence level "Maintenance Level"
- **SL:** The maintenance activity requires competence level "Service Level" (formerly CL 2 and CL 3).
- **BL:** The maintenance activity requires competence level "BOP Specialist Level" (formerly CL Q).

Further information on personnel and personnel qualifications:

- See Operating Manual, Competence level, Product-related competence levels for operating personnel and specialist personnel.
- See Operating Manual, Knowledge and requirements, Knowledge, skills, and authorization.

11.2.2 Maintenance information for transmission

General information

Only average maintenance intervals can be indicated.

- These are based on a max lube oil temperature of 80 °C (synthetic oil).
- If you have any questions, please contact service partner.

For more information on competencies, see [Notes for maintenance on the transmission \[▶ 194\]](#).

Change intervals for lube oil

NOTE

The period of use a lube oil filling is limited by the individual stresses and environmental influences.

The lube oil sample (at least 1 liter) should be examined every 2000 operating hours and released for further operations.

- If a lube oil analysis is dispensed with, the following tables provide a rough reference value for the change intervals.
-

First lube oil change	The following lube oil changes at lube oil temperature	The following lube oil change intervals	Time limit
After 300 to 500 oh	70° C	16000 oh	Generally after 24 to 36 months
	80° C	8000 oh	
	90° C	4000 oh	

Maintenance work

If required	50 oh after commissioning	Daily to weekly	Weekly to monthly	Maintenance work
OL	OL			Clean lube oil filter.
OL	OL			Change lube oil. <ul style="list-style-type: none"> • Depending on the stress, see table change interval for lube oil
		OL		Check service indicator for lube oil filter.
		OL		Check transmission for leaks.
		OL		Check transmission noise for changes.
			OL	Check fastening screws for firm fit.
			OL	Visually inspect external condition of the transmission (dirt, oil deposits).
			OL	Visually inspect the condition of the transmission lube oil.
			ML	Check ventilation filter.

Mont hly or when the en- gine is at a stand- still	When- ever the lube oil is chang ed	Every 1 to 2 years	Maintenance work
OL			Check the lube oil level
	SL		Check tooth flank. <ul style="list-style-type: none">• Check surface characteristics and contact pattern of the tooth flank
	SL	SL	Check the lube oil system
	SL	SL	Check monitoring devices
		SL	Check internal condition

11.3 Coupling

11.3.1 Maintenance information for coupling

General information:

The abbreviations in the maintenance schedule have the following meanings:

- **OL:** The maintenance activity requires competence level "Operator Level" (formerly CL 1).
- **ML:** The maintenance activity requires competence level "Maintenance Level"
- **SL:** The maintenance activity requires competence level "Service Level" (formerly CL 2 and **CL 3**).
- **BL:** The maintenance activity requires competence level "BOP Specialist Level" (formerly CL Q).

Further information on personnel and personnel qualifications:

- See Operating Manual, Competence level, Product-related competence levels for operating personnel and specialist personnel.
- See Operating Manual, Knowledge and requirements, Knowledge, skills, and authorization.

Maintenance work:

As specified	If required	Maintenance work
OL		<p>Visually inspecting the coupling</p> <ul style="list-style-type: none"> • Visually inspect the surface for cracks, brittleness and wear. • Perform a visual inspection for signs of aging and corrosion. • Check that screws are seated correctly as per the applied color marking. • Perform these tasks at the same time as maintenance work on the genset.
	SL	<p>Checking the coupling</p> <ul style="list-style-type: none"> • Visually inspect the surface for cracks, brittleness and wear. • Perform a visual inspection for signs of aging and corrosion. • Check that screws are seated correctly as per the applied color marking. • Retighten the screw connections if necessary. • Perform these tasks at the same time as maintenance work on the genset.
	SL	Replacing the coupling

11.4 Tools

11.4.1 Tool competence level OL

11.4.1.1 Tool kit (standard) 1212 8419

	<p>Tool kit consisting of:</p> <ul style="list-style-type: none">• 1203 0366 tool case• 1203 0375 Open-end wrench 46• 0115 1236 Open-end wrench 36 × 41• 1203 0358 Feeler gauge set 0.05 to 0.5• 0115 1247 Socket wrench insert 22 × 12.5• 0155 1248 Socket wrench insert 24 × 20• 0155 1249 Socket wrench insert 27 × 20• 0155 1250 Socket wrench insert 30 × 20• 0155 1251 Socket wrench insert 32 × 20• 1203 0376 Socket wrench insert width across flats 36, extra deep• Socket wrench insert, inside width across flats 17• 1203 0354 Slide CH 1772/39• 1203 0348 Extension CH 1772/38• 1203 0356 Extension CH 1915/7• 1203 0360 Extension D 601/602• 0115 1239 Transition piece A 20 × 12.5• 1203 0350 Torque wrench 0 to 210 Nm (0 to 21 kpm)• 1203 0346 Extension for torque wrench• 1203 0362 Ratchet 1/2 inch• 1203 0352 Ratchet 3/4 inch• 1205 1887 Extension for slide 3/4 inch• 0115 1262 Hex key 5• 0111 0476 Hex key, bronzed 5• 0115 1263 Hex key 6• 60115 1264 Hex key 8• 0115 1260 Hex key 10
---	--

- 0115 1261 Hex key 12
- 1203 0377 Pin wrench 3/16 inch
- 0115 1253 Pliers A 10
- 0115 1254 Pliers A 19
- 0115 1256 Pliers C 40
- 1203 0369 Brush
- 1203 0364 Handle D 601/602
- 1203 0373 Bolt for loosening the holding pins
- 1203 0378 Box spanner size 22
- 1203 0370 Extension for brushes for tube cooler
- 1203 0371 Circular brush CH 1988/2
- 1203 0374 Circular brush CH 1988/4
- 1213 5586 Wrench (half-moon wrench) 27

11.4.1.2 Tool kit (standard) 1214 1852

	<p>Tool kit consisting of:</p> <ul style="list-style-type: none">• 1203 0366 tool case• 1203 0375 Open-end wrench 46• 0115 1236 Open-end wrench 36 × 41• 1203 0358 Feeler gauge set 0.05 to 0.5• 0115 1247 Socket wrench insert 22 × 12.5• 0155 1248 Socket wrench insert 24 × 20• 0155 1249 Socket wrench insert 27 × 20• 0155 1250 Socket wrench insert 30 × 20• 0155 1251 Socket wrench insert 32 × 20• 1203 0376 Socket wrench insert width across flats 36, extra deep• Socket wrench insert, inside width across flats 17• 1203 0354 Slide CH 1772/39• 1203 0348 Extension CH 1772/38• 1203 0356 Extension CH 1915/7• 1203 0360 Extension D 601/602
---	---

- 0115 1239 Transition piece A 20 × 12.5
- 1203 0350 Torque wrench 0 to 210 Nm (0 to 21 kpm)
- 1203 0346 Extension for torque wrench
- 1203 0362 Ratchet 1/2 inch
- 1203 0352 Ratchet 3/4 inch
- 1205 1887 Extension for slide 3/4 inch
- 0115 1262 Hex key 5
- 0111 0476 Hex key, bronzed 5
- 0115 1263 Hex key 6
- 60115 1264 Hex key 8
- 0115 1260 Hex key 10
- 0115 1261 Hex key 12
- 1203 0377 Pin wrench 3/16 inch
- 0115 1253 Pliers A 10
- 0115 1254 Pliers A 19
- 0115 1256 Pliers C 40
- 1203 0369 Brush
- 1203 0364 Handle D 601/602
- 1203 0373 Bolt for loosening the holding pins
- 1203 0378 Box spanner size 22
- 1203 0370 Extension for brushes for tube cooler
- 1203 0371 Circular brush CH 1988/2
- 1203 0374 Circular brush CH 1988/4
- 1213 5586 Wrench (half-moon wrench) 27

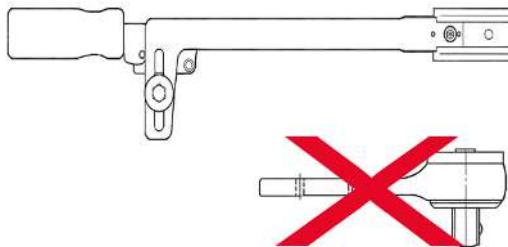
11.4.1.3 Tool kit (standard kit, small) 1215 0000

	<p>Tool kit consisting of:</p> <ul style="list-style-type: none">• 1215 8074 Tool case• 0115 4248 Open-end wrench 8 × 10• 0115 4250 Open-end wrench 12 × 14• 0115 4251 Open-end wrench 13 × 17• 0115 4252 Open-end wrench 14 × 15• 0115 4254 Open-end wrench 19 × 22• 0112 9228 Open-end wrench 24 × 27• 0703 8432 Open-end wrench 30 × 32• 0112 4755 Box wrench 13 × 17• 0115 4230 Box wrench 19 × 22• 0115 4231 Box wrench 24 × 27• 0115 4367 Feeler gauge set 0.05 to 1.0 × 100• 0110 3964 Socket wrench insert 10 × 12.5• 0110 3965 Socket wrench insert 13 × 12.5• 0110 3966 Socket wrench insert 14 × 12.5• 0110 3967 Socket wrench insert 17 × 12.5• 0110 3968 Socket wrench insert 19 × 12.5• 0110 2416 Socket wrench insert 22 × 12.5• 0115 2905 Cross handle A 12.5• 0110 2415 Extension B 12.5 × 250• 0115 4232 Universal joint C 12.5• 0110 3385 Screwdriver A 0.8 × 4.0• 0110 4281 Screwdriver A 1 × 5.5
---	---

11.4.1.4 Tool kit (extension II) 1216 3078

	<p>Tool kit consisting of:</p> <ul style="list-style-type: none">• 1231 1004 Tool case• 1215 7944 Acidimeter for battery• 1215 8292 Lab case for fluid• 1215 8153 Strap wrench for filter cartridges• 0115 3425 square wrench (double filter switchover)
---	--

11.4.1.5 Torque wrench 1203 0350

	<p>Torque wrench, measuring range 1 to 210 Nm (0 to 21 kpm).</p> <p>The ratchet is not included!</p> <ul style="list-style-type: none">• Ratchet 3/4 inch 1203 0352• Ratchet 1/2 inch 1203 0362
--	---

11.4.1.6 Extension for torque wrench 1203

	<p>Extension or lever</p> <ul style="list-style-type: none">• Included in tool kit 3 (Part no. 1221 1523).
---	--

11.4.1.7 Key for the setting screw of the valve crosshead 1230 3225

	For tightening the lock nut during the valve crosshead setting.
---	---

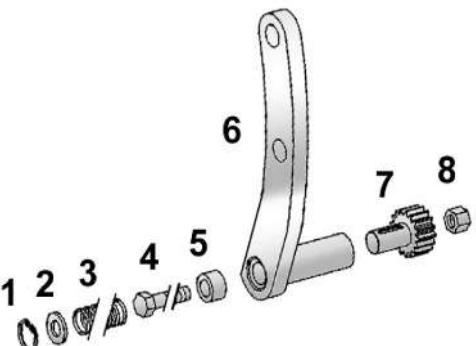
11.4.1.8 Measuring device for valve wear 1221 7445

	For the measurement of valve wear. <ul style="list-style-type: none">• For mounting on the cylinder head.
--	---

11.4.1.9 Depth caliper gauge for valve wear 1221 7475

	For measuring valve wear.
---	---------------------------

11.4.1.10 Engine turning gear 1244 1150

	For turning the crankshaft.
Consisting of: 	<p>Components:</p> <ul style="list-style-type: none">• 1. Circlip 0110 7814• 2. Washer 0110 7110• 3. Compression spring 0132 0762• 4. Hexagonal screw (M10 × 30 - 8.8) 0115 1513• 5. Bushing 1213 3880• 6. Holder 1244 1148• 7. Pinion 1203 6885• 8. Hexagonal nut 0111 7548

11.4.1.11 Engine turning rod 1242 0844

	For turning the crankshaft.
---	-----------------------------

11.4.1.12 Lube oil filter key 1215 8153

	For loosening the lube oil filter cartridge.
---	--

11.4.1.13 Set for coolant test 1221 7483

	To determine the fresh water values and coolant values. <ul style="list-style-type: none">• (Replaces test cases 1213 0382 and 1215 8292).
--	--

11.4.1.14 Socket for spark plug (hooked spark plug) 1214 1853

	Socket for removing and installing the hooked spark plug.
---	---

11.4.1.15 Socket wrench insert for spark plug (prechamber spark plug) 1230 1538

	For removing and installing the prechamber spark plug.
---	--

11.4.1.16 Spark plug thread cleaner 1251 5557

	For cleaning spark plug thread and spark plug seat in the spark plug adaptor.
---	---

11.4.1.17 Timing light 1221 7826

	For checking the ignition timing. <ul style="list-style-type: none">• Replaces the part number 1215 3977.
--	---

11.4.1.18 Acidimeter 1215 7944

	For checking the battery fluid. <ul style="list-style-type: none">• Measuring the acid density
---	--

11.4.1.19 Lubricating grease mass flowmeter 1221 8953

 A handheld digital device with a black rectangular body and a long, thin metal probe extending from the side. The probe has a small circular component at its tip. The device features a small LCD screen and several buttons on the front panel.	<p>For measuring the lubricating grease quantities for the generator rolling bearing.</p> <p>In conjunction with:</p> <ul style="list-style-type: none">• Hand-operated grease pumps• Electrically operated grease pumps• Compressed air operated grease pumps
---	--

12 Work instructions

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Visually inspecting the genset

Valid for:

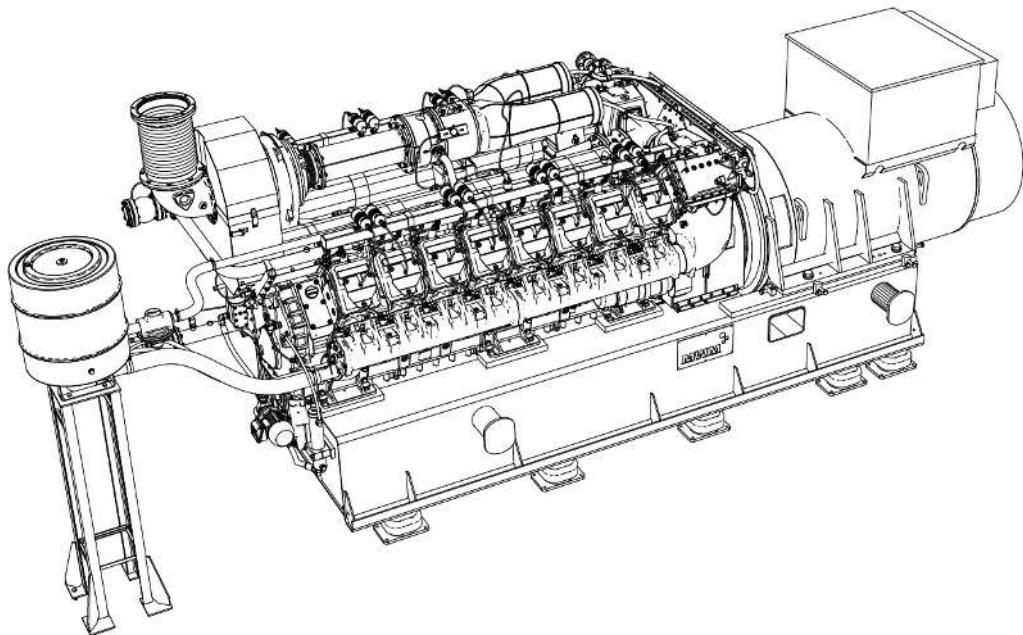
TCG 2020



Tools:

- Standard tools

General information



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Visually inspect the general condition of the genset during a daily inspection round.



CAUTION

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

Visually inspecting the genset:

1. Check the general condition of the genset.

- Check the genset for cleanliness, see OL-MRA10 / 00-02-80 [Cleaning the genset \[▶ 215\]](#).

- Check safety devices for functionality and completeness.
- Check the engine for noise emission.
- In case of increased or abnormal noise emission, contact service partner.

2. **Check the electronic control.**

- Check the display data and pilot lights on the switchgear and the electronic control, see TEM Operating Manual.
- Compare the current operation values with the values in the commissioning log from the operations log, see TEM Operating Manual.
- If the operation values are outside the tolerances, contact service partner.

3. **Check the intake air system.**

- Visually inspect the service indicator of the intake air filter.
- If necessary, renew the intake air filter, see OL-MRA10 / 22-10-10 [Removing and installing the intake air filter](#) [▶ 423].

4. **Check the exhaust system.**

- Check the exhaust system with all corresponding components for leaks.
- Check the exhaust system with all corresponding components for damage.
- Renew damaged components and eliminate leaks, also contact service partner.

5. **Check the fuel gas system.**

- Check the gas pressure in the gas train.
- Renew the gas filter insert if necessary.
- Check the fuel gas system with all corresponding components for leaks.
- Check the fuel gas system with all corresponding components for damage.
- Renew damaged components and eliminate leaks, also contact service partner.

6. **Check the lube oil system.**

- Check the lube oil system with all corresponding components for leaks.
- Check the lube oil system with all corresponding components for damage.
- Renew damaged components and eliminate leaks, also contact service partner.
- Check the lube oil level, see OL-MRA10 / 02-01-22 [Performing lube oil change \(without lube oil tank in base frame\)](#) [▶ 338]

7. **Check the cooling system.**

- Check the cooling system with all corresponding components for leaks.
- Check the cooling system with all corresponding components for damage.
- Check rubber expansion joints, see OL-MRA10 / 00-50-01 [Checking the rubber expansion joint](#) [▶ 301]
- Renew damaged components and eliminate leaks, also contact service partner.

8. Check the generator.

- Check the generator for noise emission.
- In case of increased or abnormal noise emission, contact service partner.
- If necessary, lubricate the generator rolling bearing.
- If necessary, check the generator bearing sensors, contact service partner.
- In case of strongly fluctuating or high bearing temperatures, contact service partner.

9. Check the coupling.

- Check the coupling for noise emission.
- In case of increased or abnormal noise emission, contact service partner.

10. Check the compressed air system.

- Drain the compressed air container and top it up.
- Check the compressed air system with all corresponding components for leaks.
- Check the compressed air system with all corresponding components for damage.
- Renew damaged components and eliminate leaks, also contact service partner.

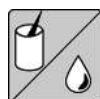
Cleaning the genset

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools



Auxiliary media:

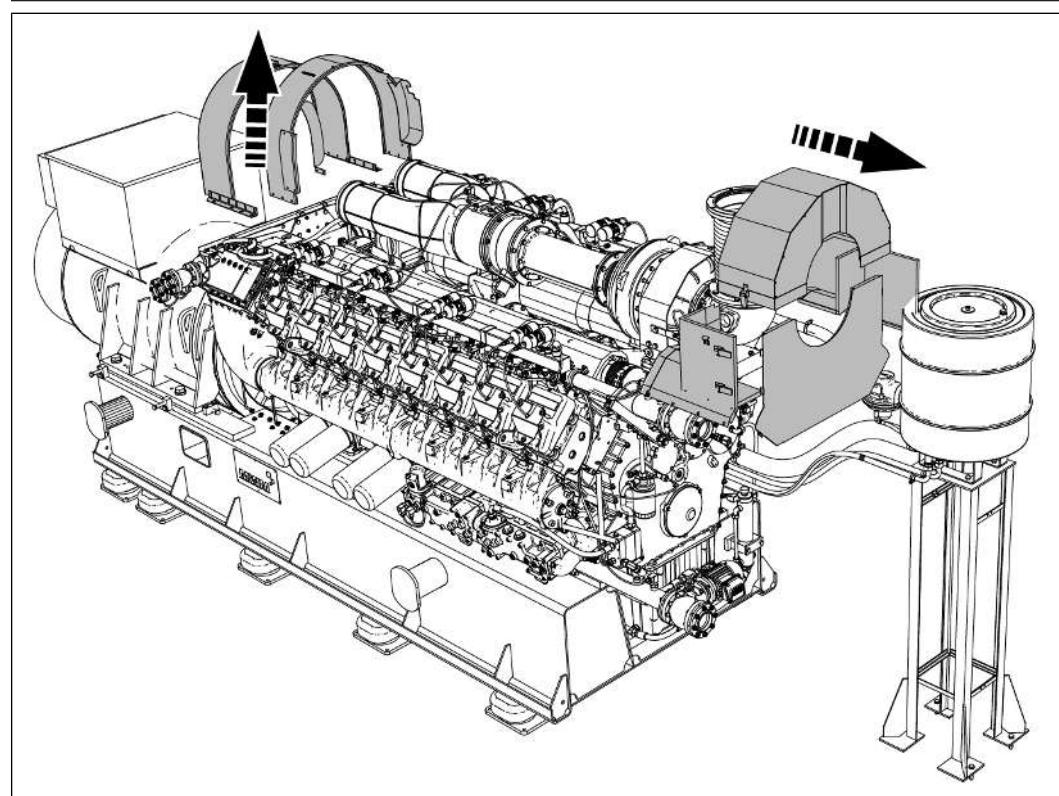
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Sealing plug
- Covers

General information

NOTE

Information about the cleaning agents

Technical Bulletin (TR) 2147 Specification for auxiliary media.



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The genset is turned off and cooled down to ambient temperature.



Risk of destruction of components

Cleaning with pressure cleaning systems

Destruction of components

- Do not use pressure cleaning systems.
 - Lubricated components or components with grease filling (joints, bearings) can lose their lubrication protection or their grease filling.
 - Sensitive components (sensors, rubber bushings, sealing rings) can be damaged.
 - The internal components that come into contact with cleaning agents can corrode.



DANGER

Explosion due to gas formation or deflagration

Severe injury or death can result.

- Thoroughly dry all the housing covers and housing panels before mounting.

Preparing for cleaning:

1. Dismantle the housing covers (e.g. protective covers).
2. Dismantle the housing panels (e.g. heat insulating covers of the exhaust pipe).
3. Seal electric and electronic components or cover so that they are watertight.
4. Seal engine openings (e.g. air inlet) or cover so that they are waterproof.

NOTE

With partially dismantled gensets

Seal housing openings or cover so that they are watertight.

5. **NOTE! See (TR) 2147 Specification for auxiliary media TR 2147** Select a suitable cleaning agent.

Cleaning the genset:

1. **NOTE! Observe action time as per manufacturer instructions.** Spray genset with cleaning agents
2. **WARNING! Do not use pressure cleaning systems.** Spray genset with strong water jet or wash off
3. **NOTE! Observe action time as per manufacturer instructions.** Spray dismantled protective covers and heat insulating coverings with cleaning agents
4. Spray dismantled housing covers and housing panels with strong water jet or wash off.
 - If the desired cleanliness is not achieved, repeat the cleaning procedure.

Ending the cleaning procedure:

1. Blow out water accumulation with compressed air.
2. Remove covers from electric and electronic components.
3. Remove covers and seals from engine openings.
4. **DANGER! Explosion due to gas formation or deflagration.** Dry and mount the housing panels (e.g. heat insulating covers of the exhaust lines)
5. **DANGER! Explosion due to gas formation or deflagration.** Dry and mount the housing covers (e.g. protective covers)
6. Mount all the safeguards properly and check for proper functioning.

Performing a test run

Valid for:
TCG 2020, TCG 2020 K

General information

NOTE

The test runs are divided into function test runs (without load, to check the control and shutdown) and load test runs (with load).

The description of both processes is attached.

- Gensets in stand-by mode (e.g. emergency power systems) should have function test runs performed at monthly intervals. A load test run (with load) should be carried out at the latest after 10 function test runs (without load).
 - A load test run should be carried out after repairs (e.g. replacing pistons, cylinder liner, etc). If this is not possible, a function test run must be carried out.
-



Risk of destruction of components

Genset running in overspeed.

The genset can be severely damaged.

- Immediately press the emergency stop button and stop the genset.
 - Find cause and rectify and if necessary also contact service partner.
-

NOTE

Control for pump run-on.

The control for the pump run-on functions only if the TEM shuts down the engine.

- When the genset is stopped by means of an emergency stop, the genset is shut off immediately without heat removal.
-

Performing a function test run:

1. Use the TEM to check whether the engine runs at a constant speed without load.
2. Check the functioning of all displays and control functions.
3. Visually inspect the genset during the function test run, see [Visually inspecting the genset \[▶ 212\]](#).
 - If irregularities occur during the test run, decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 163\]](#).

-
4. Find and eliminate the cause of the irregularities.
 5. Repeat the function test run.

Perform a load test run:

1. **NOTE! Allow for a duration of at least one hour for the load test run.** Perform a load test run.
 - Operate the engine with at least 40 % of the maximum load.
 - Increase the engine load by 10 % every ten minutes.
 - If irregularities occur during the test run, decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).
2. Find and eliminate the cause of the irregularities.
3. Repeat the load test run.

Performing test run and function run

Valid for:

TCG 2020, TCG 2020 K

General information

Perform a test run and function run after all work for maintenance and repair.

In case of any irregularities during the test run and function run, decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).

The operation values are specified in the commissioning report.

- If a commissioning report is not available, use the report of the test cell inspection.

A test run and function run last at least one hour.

Starting the genset

- ✓ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)



641491723

1. Wait until the power demand of 50.0 % is reached in the Speed, power (1) dialog area.
2. Press down the + button (2) until the power demand of 100.0 % is reached in the Speed, power dialog area.
 - The genset progresses over the power ramp to 100.0 % power or to the power permitted for the operation.
3. When the maximum power (100 %) is reached, document the operation values and compare them to the values in the commissioning report or in the test bench report.
 - In the event of warnings or fault messages, find and eliminate the cause before putting the genset back into operation. Contact service partner if necessary.

Decommissioning the genset after the test run and function run



641489291

1. Press functional group Operation (1).
2. Press the DE-LOAD button (4).
3. The genset progresses over the the power ramp to 5 % of the power.
4. Check the actual power (2) in the Speed, power dialog area.
 - Once the actual power (2) remains consistently below 5 % of the power, the circuit breaker opens.
 - The genset runs in idle mode.
5. Press the STOP button (3).
 - The genset is decommissioned.
6. Check whether all the auxiliary drives are functioning and running properly, see also OL-MRA10 / 00-15-30 Performing an auxiliary drive test [▶ 225].
7. Visually inspect the genset, see OL-MRA10 / 00-02-03 Visually inspecting the genset [▶ 212]

Performing black start

Valid for:
TCG 2020

General information

Program sequence for black start:

- The black start is done via the plant control.
- The specific plant documentation, operating manuals and system manuals apply.

Prerequisites for the black start are:

- The genset is in island operation.
- TEM is ready.
- No fault messages are pending in the operation log.

NOTE

Differential pressure fault

The differential pressure fault occurs because the pumps have no power supply in a black start and are not operational.

The Bridge Δp monitoring in the exhaust heat exchanger circuit function suppresses the differential pressure faults for up to 60 seconds.

- This function depends on the settings of the time relay in the TEM system switchgear cabinet.
-



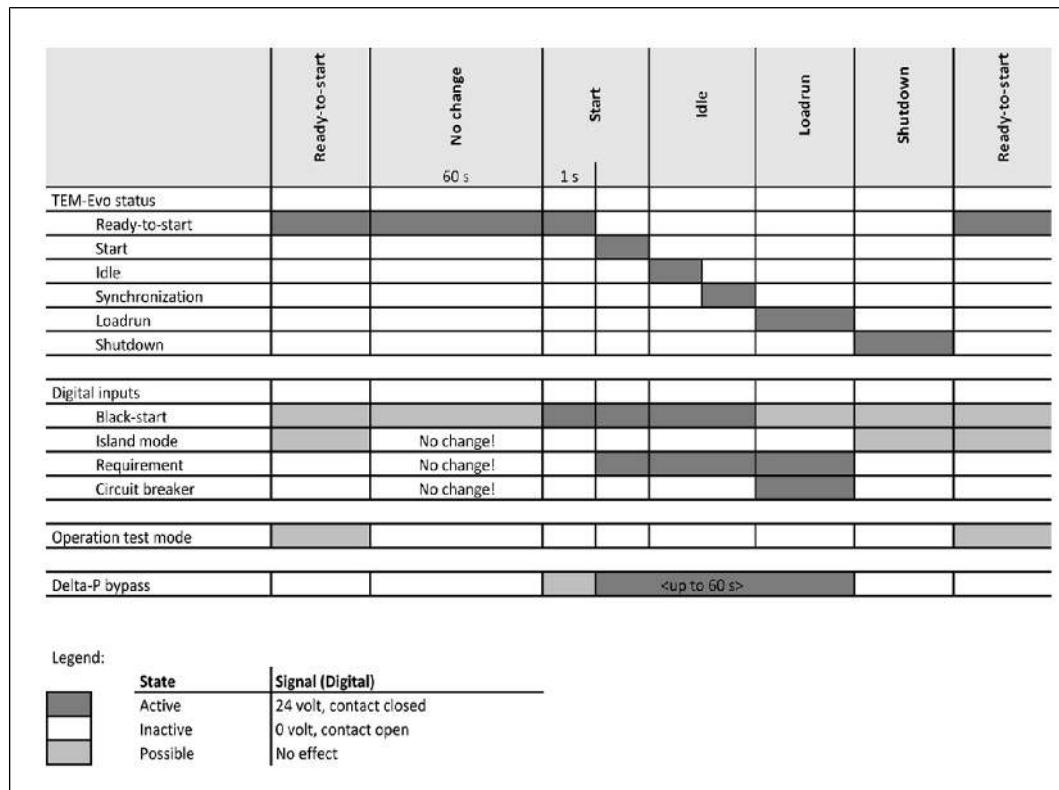
Risk of destruction of components

Risk of destruction of components

The genset can be damaged by an improperly executed black start.

- Do not carry out a black start within the stable phase (60 seconds before the start process).
 - Do not change the signals for island operation, demand or power switch.
 - Do not acknowledge any fault messages in the operation log during the black start phase.
-

Performing black start:



2621883659

- ✓ The genset is in island operation.
 - ✓ TEM is ready.
 - ✓ No fault messages are pending in the operation log.
1. Establish prerequisites for the black start.
 - If the TEM is displaying the "Ready" status, wait 60 seconds until the start.
 2. Trigger black start via the plant control.
 - The plant control sends the black start signal (+24 volts, contact closed).
 - The plant control sends the island operation signal (0 volts, contact open).
 - The plant control sends the demand signal (+24 volts, contact closed).
 - The start process begins.

Performing an auxiliary drive test

Valid for:
TCG 2020

General Information

NOTE

Some of the test steps listed in the following are optional depending on the engine variant and engine equipment.

The plant control only provides auxiliary drives for the test that are available and enabled in the parameters.



Risk of destruction of components

Insufficient prelubrication

Can lead to engine damage.

- Allow the prelubrication pump to run for at least three minutes before every auxiliary drive test.
-

Performing auxiliary drive test:

In the test mode the control checks whether the superior plant control correctly activates the individual auxiliary drives.

The test mode is only available under the following preconditions:

- The genset is decommissioned.
- Manual operation is selected.
- Quick stop function is not activated.

It is not possible to start the genset in test mode.

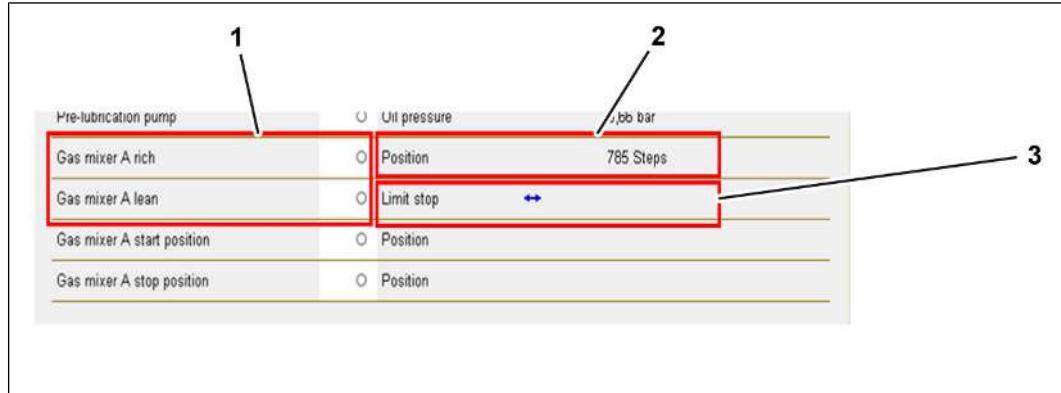
- Individual auxiliary drives (e.g. starter) can only be actuated via the Touch button for safety reasons.
- The auxiliary drive then only stays switched on for as long as the Touch button is pressed.

Description of the test results and measured values

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK
	Blue plus sign	Actuator has reached the plus limit stop (e.g. rich, hot)
	Blue minus sign	Actuator has reached the minus limit stop (e.g. lean, cold)
	Blue double arrow	Actuator moves or stops between the limit stops

Checking the actuators (e.g. gas-air mixer, emergency cooler)

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.



605649163

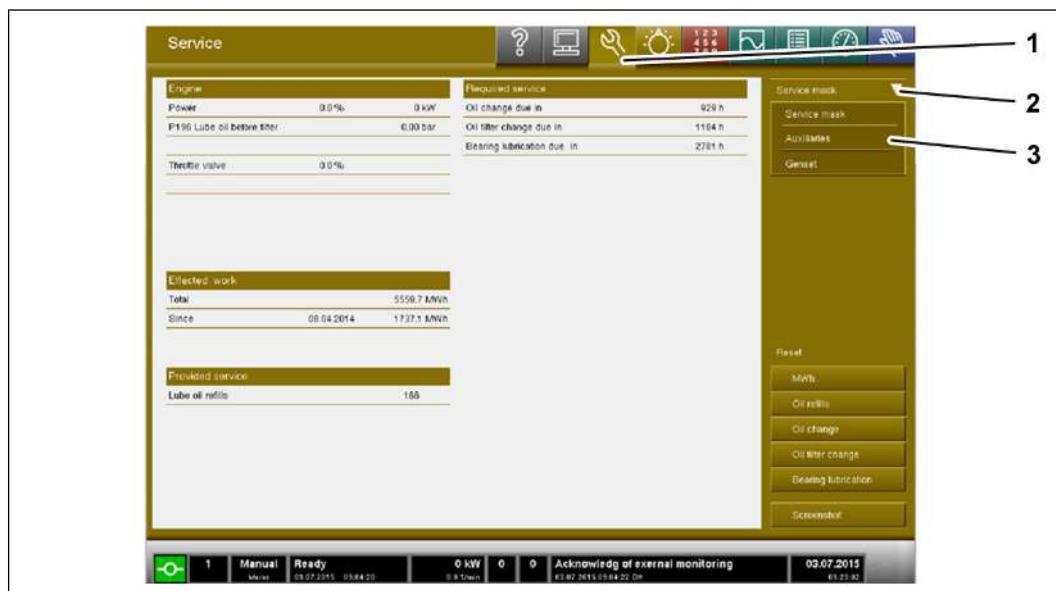
1. The auxiliary drive is named in the Auxiliary dialog area (1).
 - The adjustment can be made into the plus range (e.g. rich, warmer) or into the minus range (e.g. lean, colder) in this dialog area.
2. The position of the actuator currently calculated is shown in steps in the Actuator dialog area (2).
3. The two limit stops and the intermediate positions are shown in the Actuator limit stop dialog area (3).

Selecting manual operation and opening the Auxiliaries mask group



605580555

1. Press the Operation button (1).
 - The Operation mask opens.
2. Press the MANUAL button (2).
 - The operating mode changes from automatic to manual.



605758219

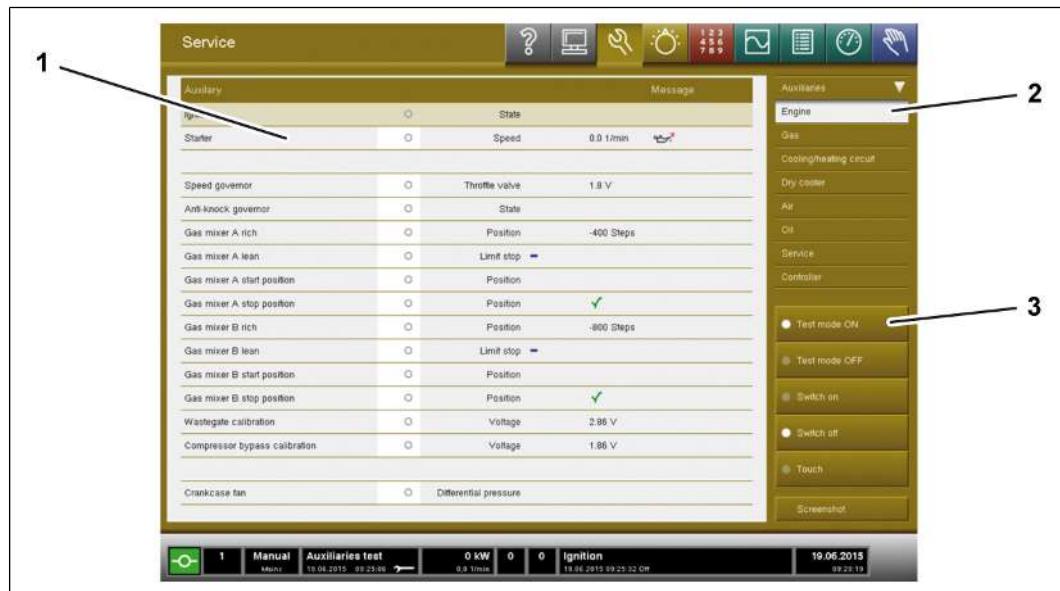
3. Press the Functional group Service button (1).
 - The Service mask opens.

4. Press the Service mask button (2).
 - The Engine mask opens.
5. Press the Auxiliaries button (3).
 - The Auxiliary mask group opens.

Engine auxiliary drive test

Auxiliary drive test for engine - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).

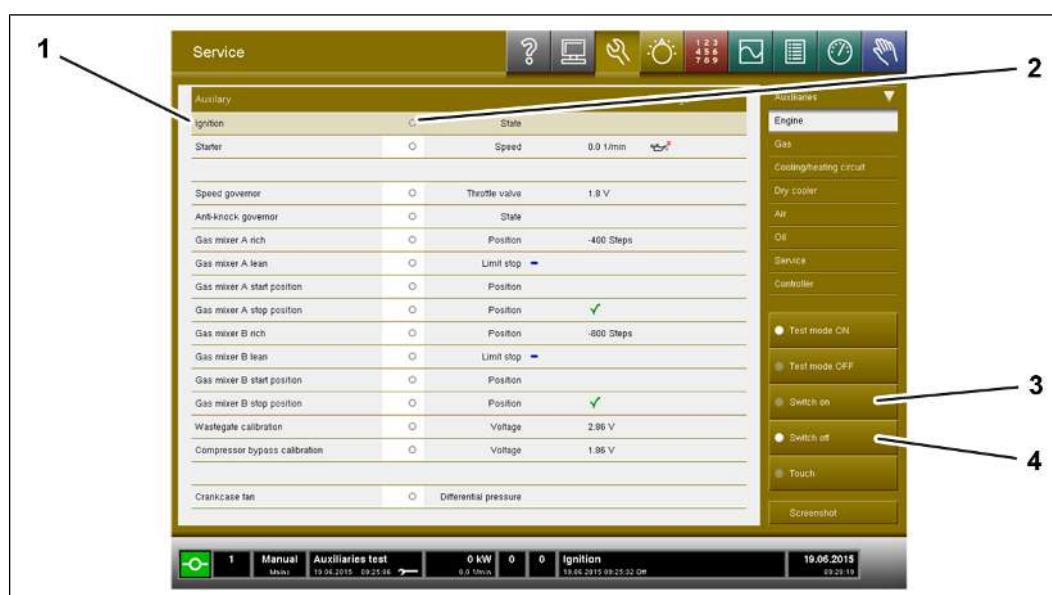


605710091

1. Press the Engine button (2).
 - The Engine dialog area (1) opens.
2. Press the Test mode ON button (3).
 - The control switches off all auxiliary drives.

Auxiliary drive test for engine - Checking the ignition

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605714955

1. In the Engine dialog area next to the entry Ignition (1), tap the white area (2) to activate the Speed governor auxiliary drive.
 - The Ignition auxiliary drive is activated.
2. Press the Switch on button (3).
 - The test result is shown in the Engine dialog area.

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

1. Press the Switch off button (4).

Auxiliary drive test for engine - Checking the starter

1. The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).
2. Switch on the prelubrication pump (see work instructions B 8-1-2, section Starting the prelubrication).
 - Leave the prelubrication pump running for at least three minutes.



605707659

3. In the Engine dialog area next to the entry Starter (1), tap the white area (2) to activate the Starter auxiliary drive (1).
 - The Starter auxiliary drive is activated.
4. Press the Touch button (4) and hold for a short time.
 - The speed (3) is shown in the Engine dialog area.
5. Check function of the starter.
 - The speed (3) changes in the Engine dialog area.
6. Check lube oil pressure of the genset.

Auxiliary drive test for engine - Checking the net starting device

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).

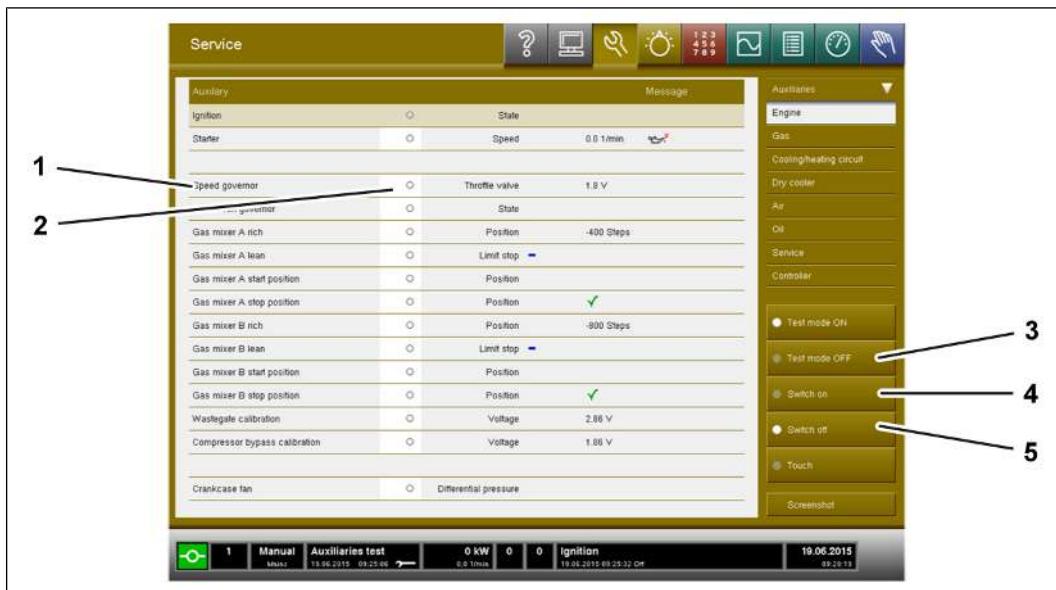


605705227

1. In the Engine dialog area next to the entry Net starting device (1), tap the white area (2) to activate the Net starting device auxiliary drive.
 - The Net starting device auxiliary drive is activated.
2. Press the Touch button (4) and hold for a short time.
 - A green dot (3) is shown in the Net starting device dialog area during the test. The green dot (3) shows that the net starting device is activated by the control.

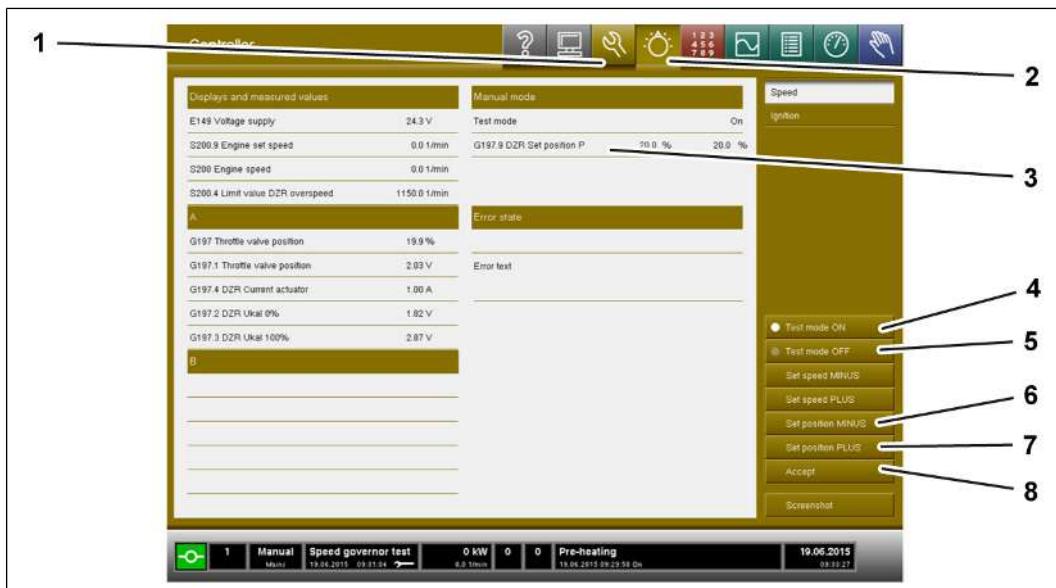
Auxiliary drive test for engine - Checking the speed governor

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605694091

1. In the Engine dialog area next to the entry Speed governor (1), tap the white area (2) to activate the Speed governor auxiliary drive.
2. The Speed governor auxiliary drive is activated.
3. Press the Switch on button (4).
 - The speed governor conducts a calibration cycle. For this the speed governor moves up from 0 % to 100 % and back down to 0 %.
4. Press the Switch off button (5).
5. Press the Test mode OFF button (3).



605621131

6. Press the Functional group "Controller" button (2).
 - The Controller mask opens.

7. Press the Test mode ON button (4).
8. Set set position to 20 %.
 - Press the Set position PLUS (7) or the Set position MINUS (6) button.
 - The set position is shown in percent in the Manual mode Set position dialog area (3).
9. Press the Accept button (8).
 - The adjustment in percent is shown in the Manual mode Set position dialog area (3).
 - As soon as the speed governor has reached the set position, the values in the Manual mode Set position dialog area (3) must be identical.
10. Read off display on the actuator.
 - The mechanical display on the actuator and the set target position must be identical.
11. Perform test for the set positions 50 %, 75 % and 90 % in the same way as for set position 20 %.
12. Press the Test mode OFF button (5).
13. Reset set position to 0.0 %.
14. Press the Set position PLUS (7) or the Set position MINUS (6) button.
 - The set position is shown in percent in the Manual mode Set position dialog area (3).
15. Press the Functional group Service button (1).
 - The Service mask opens.
16. Press the Test mode ON button (4).

Auxiliary drive test for engine - Checking the anti-knock governor

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605691659

1. In the Engine dialog area next to the entry Anti-knock governor (1), tap the white area (2) to activate the Anti-knock governor auxiliary drive (1).
2. The Anti-knock governor auxiliary drive is activated.
3. Press the Switch on button (3).
 - The test result is displayed in the Engine dialog area (see table in section Display of test results and measured values).
4. Press the Switch off button (4).

Auxiliary drive test for engine - Checking the gas-air mixer A mixture

NOTE

Perform the check for Gas-air mixer B corresponding to the check for Gas-air mixer A.

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605696523

1. In the Engine dialog area next to the entry Gas mixer A rich (6), tap the white area (7) to activate the Gas mixer A rich auxiliary drive.
 - The Gas mixer A rich auxiliary drive is activated.
 - The control shows a minus sign in the Limit stop dialog area (1) if the gas-air mixer is set to the lean limit stop.
2. Press the Switch on button (2).
 - The display in the Limit stop dialog area (1) must change from the minus sign to a double arrow during the test.
3. Observe gas-air mixer A via the inspection window to see whether it adjusts itself in the rich direction.
4. The control shows a plus sign in the Limit stop dialog area (1) if the gas-air mixer is set to the rich limit stop.
 - The gas-air mixer may move a maximum of 4000 steps out of the initial position in the rich direction. Be sure to observe the mathematical sign of the initial position for this. If the initial position is e.g. -400 steps, the maximum value must not exceed 3600 steps.
5. Press the Switch off button (3).
6. In the Engine dialog area next to the entry Gas mixer A lean (5), tap the white area (4) to activate the Gas mixer A lean auxiliary drive.
 - The Gas mixer A lean auxiliary drive is activated.
 - The control shows a plus sign in the Limit stop dialog area (1) if the gas-air mixer is set to the rich limit stop.

7. Press the Switch on button (2).
 - The display in the Limit stop dialog area (1) must change from the minus sign to a double arrow during the test.
8. Observe gas-air mixer A via the inspection window to see whether it adjusts in the lean direction.
9. The control shows a minus sign in the Limit stop dialog area (1) if the gas-air mixer is set to the rich limit stop.
 - The gas-air mixer may move a maximum of 4000 steps out of the initial position in the lean direction. Be sure to observe the mathematical sign of the initial position for this. If the initial position is e.g. -400 steps, the maximum value must not exceed 3600 steps.
10. Press the Switch off button (3).

Auxiliary drive test for engine – Checking the gas-air mixer A start position

NOTE

Perform the check for Gas-air mixer B corresponding to the check for Gas-air mixer A.

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605698955

1. In the Engine dialog area next to the entry Gas mixer A start position (6), tap the white area (7) to activate the Gas mixer A start position auxiliary drive.
 - The Gas mixer A start position auxiliary drive is activated.
2. Press the Touch button (4) and hold for a short time.
 - Gas-air mixer A moves to start position.
 - The display 0 Steps is shown in the Position Steps dialog area (1).
 - A plus sign is shown in the Limit stop dialog area (2).
 - The test result is shown in the Position test result dialog area (3).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the Position dialog area (3), repeat the auxiliary drive test for gas-air mixer A start position.

If a red lightning bolt is also shown in the Position dialog area (3) when the auxiliary drive test is repeated, contact service partner.

Auxiliary drive test for engine – Checking the gas-air mixer A stop position

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605700875

1. In the Engine dialog area next to the entry Gas mixer A stop position (6), tap the white area (7) to activate the Gas mixer A stop position auxiliary drive.
 - The Gas mixer A stop position auxiliary drive is activated.
2. Press the Touch button (4) and hold for a short time.
 - Gas-air mixer A moves to the stop position.
 - A negative value is shown in the Position Steps dialog area (1).
 - A minus sign is shown in the Limit stop dialog area (2).
 - The test result is shown in the Position test result dialog area (3).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

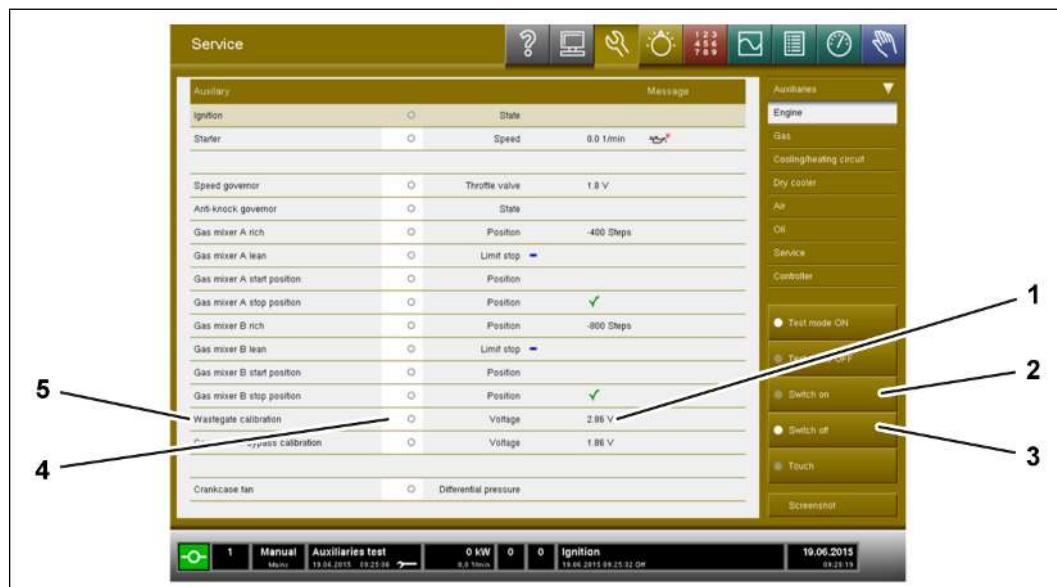
If a red lightning bolt is shown in the Position dialog area (3), repeat the auxiliary drive test for gas-air mixer A start position.

If a red lightning bolt is also shown in the Position dialog area (3) when the auxiliary drive test is repeated, contact service partner.

Auxiliary drive test for engine - Checking the wastegate calibration (optional)**NOTE**

The auxiliary drive test for the wastegate calibration is only available for V20 engines.

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



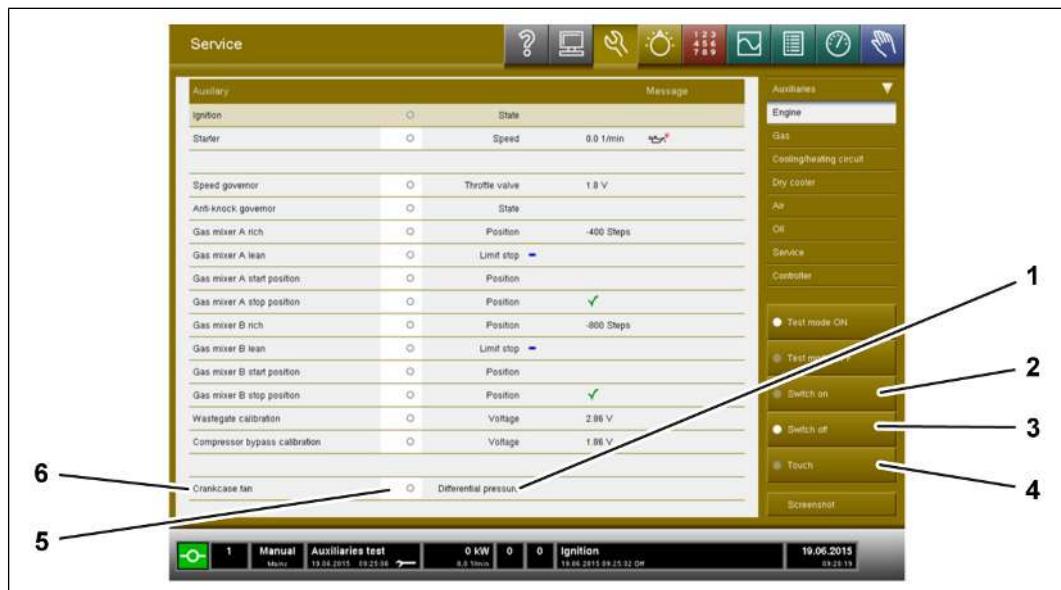
605712523

1. In the Engine dialog area next to the entry Wastegate calibration (5), tap the white area (4) to activate the Wastegate calibration auxiliary drive.
 - The Wastegate calibration auxiliary drive is activated.
2. Press the Switch on button (2)
 - The actuator conducts a calibration cycle. For this the actuator moves up from 0 % to 100 % and back down to 0 %
 - The actuation voltage (1) is shown in the Voltage dialog area.

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

Auxiliary drive test for engine - Checking the crankcase fan

- ✓ The auxiliary drive test for engine - test mode is switched on (see section [Auxiliary drive test for engine - Switching on test mode \[▶ 228\]](#)).



605702795

1. In the Engine dialog area next to the entry Crankcase fan (5), tap the white area (6) to activate the Crankcase fan auxiliary drive.
 - The Crankcase fan auxiliary drive is activated.
2. Press the Switch on button (2).
 - The test result is shown in the Differential pressure dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the Differential pressure dialog area (1), repeat the Crankcase fan auxiliary drive test.

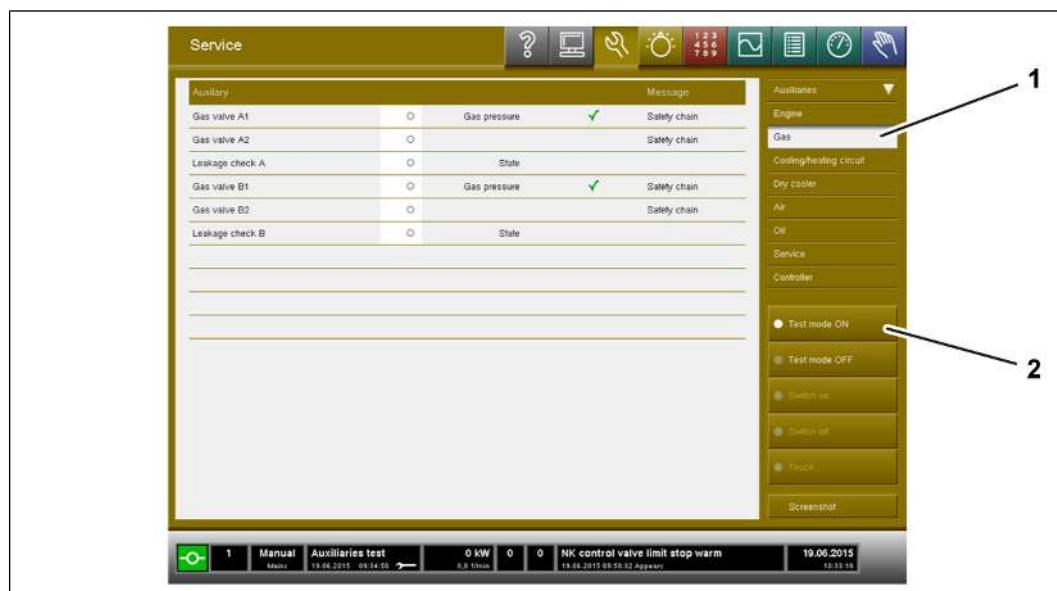
If a red lightning bolt is also shown in the Differential pressure dialog area (1) when the auxiliary drive test is repeated, contact service partner.

1. Press the Switch off button (3).
2. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (4).

Auxiliary drive test for gas

Auxiliary drive test for gas - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).



605672203

1. Press the Gas button (1).
 - The Gas dialog area opens.
2. Press the Test mode ON button (2).
 - The control switches off all auxiliary drives.

Auxiliary drive test for gas - Checking the gas valve A1

NOTE

The TEM system displays the auxiliary drive test for the gas valve B1 and B2 for dual gas operation only.

Perform the check for gas valves A2, B1 and B2 corresponding to the check for gas valve A1.

- ✓ The auxiliary drive test for gas - test mode is switched on (see section [Auxiliary drive test for gas - Switching on test mode \[▶ 241\]](#)).



605654027

1. In the Gas dialog area next to the entry Gas valve A1 (4), tap the white area (3) to activate the Gas valve A1 auxiliary drive.
 - The Gas valve A1 auxiliary drive is activated.
2. Press the Touch button (2) and hold for a short time.
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.
 - The test result is shown in the Gas pressure dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the Gas pressure dialog area (1), repeat the Gas valve A1 auxiliary drive test.

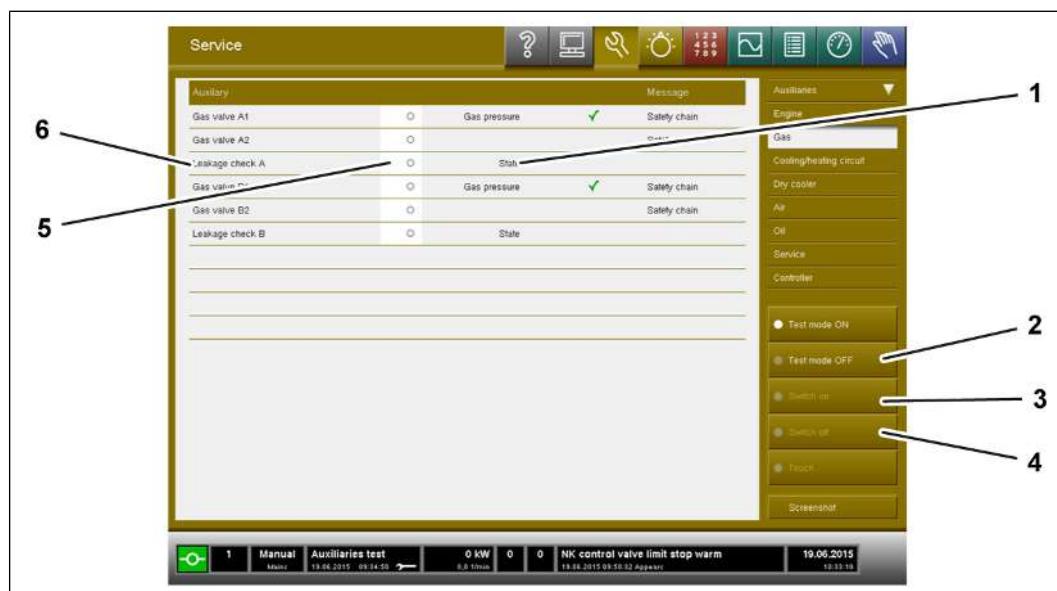
If a red lightning bolt is also shown in the Gas pressure dialog area (1) when the auxiliary drive test is repeated, contact service partner.

Auxiliary drive test for gas - Checking the leakage A**NOTE**

The system displays the auxiliary drive test for the leakage check B for dual gas operation only.

Perform the check for Leakage check B corresponding to the check for Leakage check A.

- ✓ The auxiliary drive test for gas - test mode is switched on (see section [Auxiliary drive test for gas - Switching on test mode \[▶ 241\]](#)).



605651595

1. In the Gas dialog area next to the entry Leakage check A (6), tap the white area (5) to activate the Leakage check A auxiliary drive.
 - The Leakage check A drive is activated.
2. Press the Switch on button (3).
 - The test result is shown in the State dialog area (1).
 - The test result is shown in the Gas pressure dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the State dialog area (1), repeat the auxiliary drive test for leakage check A.

If a red lightning bolt is also shown in the State dialog area (1) when the auxiliary drive test is repeated, contact service partner.

1. Press the Switch off button (4).
2. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (2).

Auxiliary drive test for cooling/heating circuit

Auxiliary drive test for cooling/heating circuit - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).



605665419

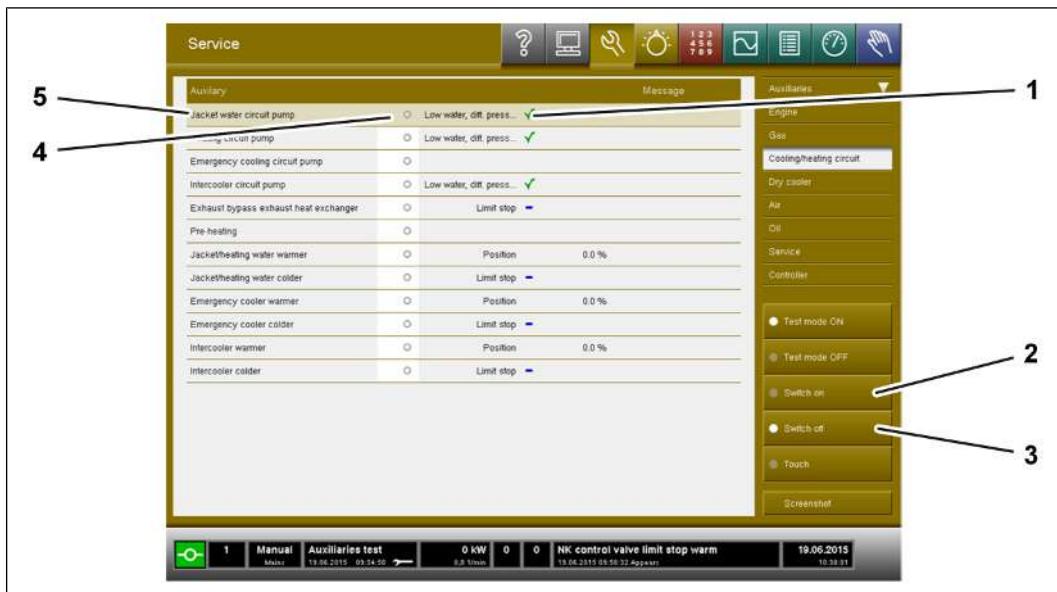
1. Press the Cooling/heating circuit button (1).
 - The Cooling/heating circuit dialog area opens.
2. Press the Test mode ON button (2).
 - The control automatically switches off all auxiliary drives.

Checking the jacket water circuit pump

NOTE

Perform the checks for the heating circuit and mixture cooling circuit pumps corresponding to the check for the jacket water circuit pump.

- ✓ The auxiliary drive test for cooling/heating circuit - test mode is switched on (see section [Auxiliary drive test for cooling/heating circuit - Switching on test mode \[▶ 244\]](#)).



605670283

1. In the Cooling/heating circuit dialog area next to the entry **Jacket water circuit pump** (5), tap the white area (4) to activate the **Jacket water circuit pump auxiliary drive**.
 - The Engine cooling circuit drive is activated.
 - A green checkmark is shown in the **Low water, diff. press...** dialog area (1).
2. Press the **Switch on** button (2).
 - An additional symbol is shown in the **Low water, diff. press...** dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

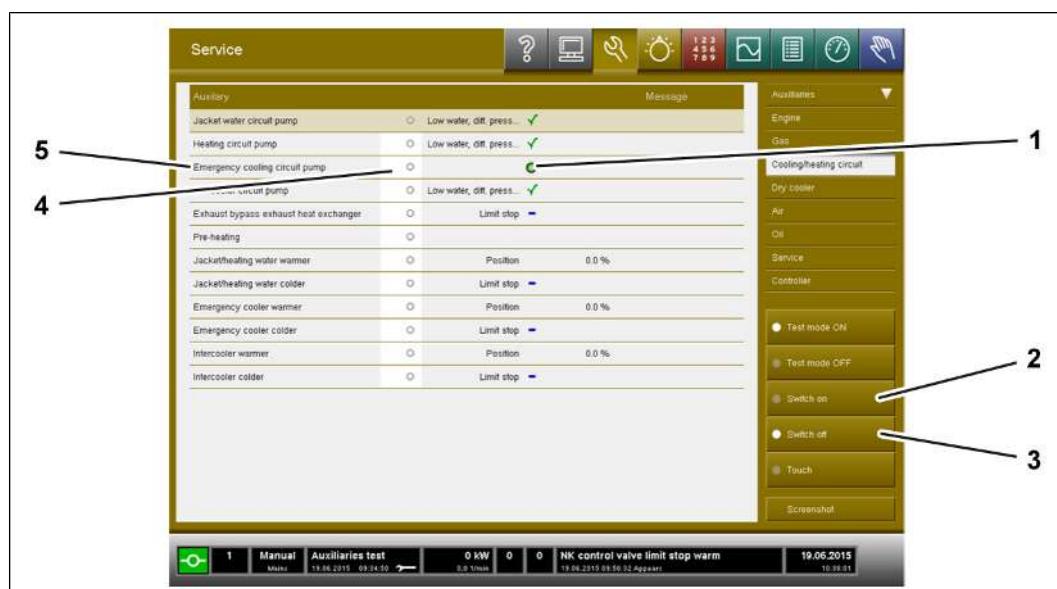
If a red lightning bolt is shown in the Low water, diff. press... dialog area (1), repeat the auxiliary drive test for the jacket water circuit pump.

If a red lightning bolt is also shown in the Low water, diff. press... dialog area (1) when the auxiliary drive test is repeated, contact service partner.

1. Press the Switch off button (3).

Checking the emergency cooling circuit pump

- ✓ The auxiliary drive test for cooling/heating circuit - test mode is switched on (see section [Auxiliary drive test for cooling/heating circuit - Switching on test mode \[▶ 244\]](#)).



605662987

1. In the Cooling/heating circuit dialog area next to the entry Emergency cooling circuit pump (5), tap the white area (4) to activate the Emergency cooling circuit pump auxiliary drive.
 - The Emergency cooling circuit pump auxiliary drive is activated.
2. Press the Switch on button (2).
 - A green dot (1) is shown in the Emergency cooling circuit pump dialog area during the test. The green dot (1) shows that the emergency cooling circuit pump is activated by the control.
3. Press the Switch off button (3).

Checking the exhaust bypass exhaust heat exchanger

- ✓ The auxiliary drive test for cooling/heating circuit - test mode is switched on (see section [Auxiliary drive test for cooling/heating circuit - Switching on test mode \[▶ 244\]](#)).



605656459

1. In the Cooling/heating circuit dialog area next to the entry Exhaust bypass exhaust heat exchanger (5), tap the white area (4) to activate the Exhaust bypass exhaust heat exchanger auxiliary drive.
 - The Exhaust bypass exhaust heat exchanger auxiliary drive is activated.
 - A symbol in the Limit stop dialog area displays the position of the exhaust bypass: Plus = Rich or Minus = Lean.
2. Press the Switch on button (2).
 - The display in the dialog area Limit stop (1) must change from the displayed symbol to a double arrow during the test.
 - If the actuator is moved from the lean limit stop to the rich limit stop, the control shows a plus sign.
 - If the actuator is moved from the rich limit stop to the lean limit stop, the control shows a minus sign.
3. Press the Switch off button (3).

Checking the pre-heating (electric preheating)

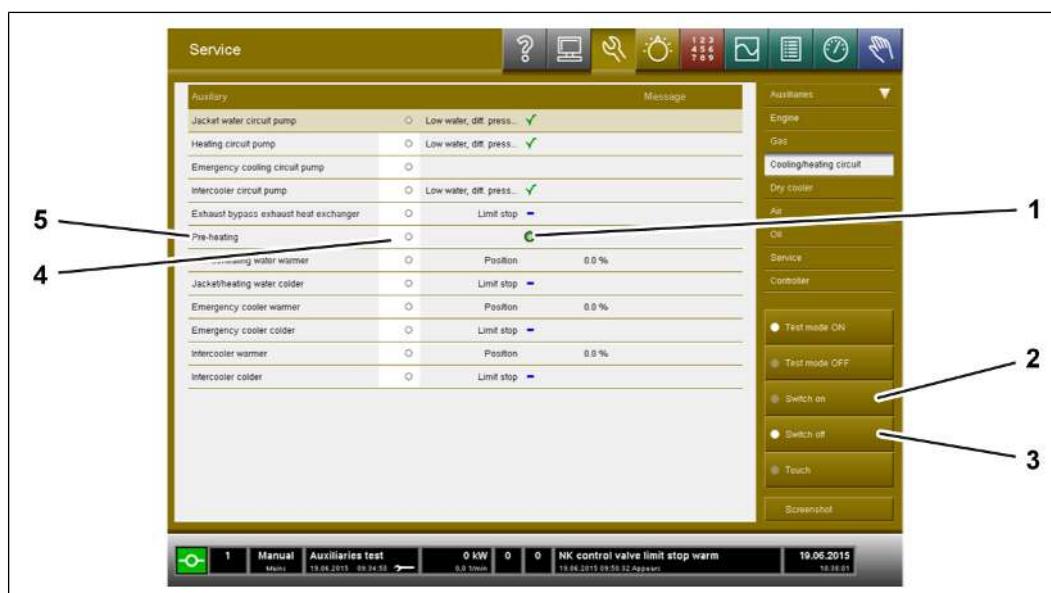


Risk of destruction of components

Components can be damaged due to a lack of coolant during the inspection of the pre-heating.

Before checking the electric preheating, check that the cooling system is completely filled with coolant (see Work instructions B 9-0-4 Emptying and filling the cooling system)4

- ✓ The auxiliary drive test for cooling/heating circuit - test mode is switched on (see section [Auxiliary drive test for cooling/heating circuit - Switching on test mode \[▶ 244\]](#)).



605667851

1. In the Cooling/heating circuit dialog area next to the entry Pre-heating (5), tap the white area (4) to activate the Pre-heating auxiliary drive.
 - The Pre-heating auxiliary drive is activated.
2. Press the Switch on button (2).
 - A green dot (1) is shown in the Pre-heating dialog area during the test. The green dot (1) shows that the emergency cooling circuit pump is activated by the control.
3. Check whether the coolant lines warm up.

NOTE

If the coolant lines do not warm up within a few minutes, repeat the auxiliary drive test for preheating.

If the coolant lines do not warm up when the auxiliary drive test is repeated, contact service partner.

4. Press the Switch off button (3).

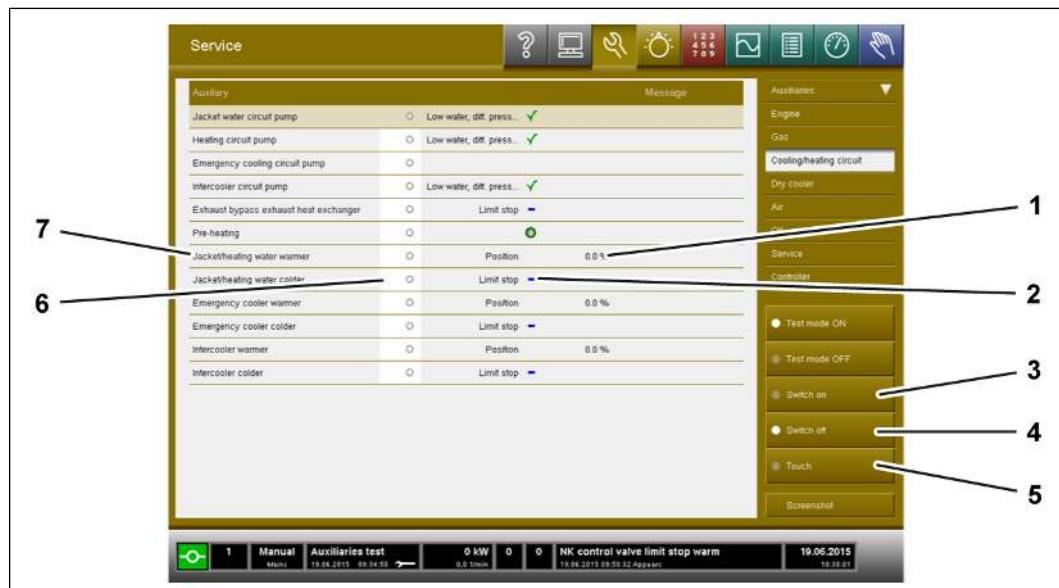
Checking Jacket/heating water warmer

NOTE

Perform the following checks corresponding to the Jacket/heating water warmer check:

- Jacket/heating water colder
- Emergency cooler (NK radiator/dry cooler)
- Mixture cooler (intercooler radiator)

- ✓ The auxiliary drive test for cooling/heating circuit - test mode is switched on (see section [Auxiliary drive test for cooling/heating circuit - Switching on test mode \[▶ 244\]](#)).



605658891

1. In the Cooling/heating circuit dialog area next to the entry **Jacket/heating water warmer** (7), tap the white area (6) to activate the **Jacket/heating water warmer auxiliary drive**.
 - The **Jacket/heating water warmer auxiliary drive** is activated.
 - A symbol in the **Limit stop** dialog area displays the position of the exhaust bypass: Plus = Rich or Minus = Lean.
2. Press the **Switch on** button (3).
 - The display in the **Limit stop** dialog area (2) changes from the displayed symbol to a double arrow during the test.
 - The continuous percentage display of the actuator's position is shown in the **Position** dialog area (1).
 - If the actuator has reached the warm limit stop, a plus sign is shown in the **Limit stop** dialog area (2) and the percentage display 100.0 % is shown in the **Position** dialog area (1).

- If the actuator has reached the cold limit stop, a minus sign is shown in the Limit stop dialog area (2) and the percentage display 0.0 % is shown in the Position dialog area (1).

NOTE

The percentage display of the position is a calculated value. This value can deviate from the absolute 0.0 % display or 100.0 % display at the start of the test.

During the auxiliary drive test for jacket/heating water warmer the control also carries out the calibration of the time and travel of the actuator.

3. Press the Switch off button (4).
4. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (5).

Auxiliary drive test for radiator

Auxiliary drive test for radiator - Switching on test mode

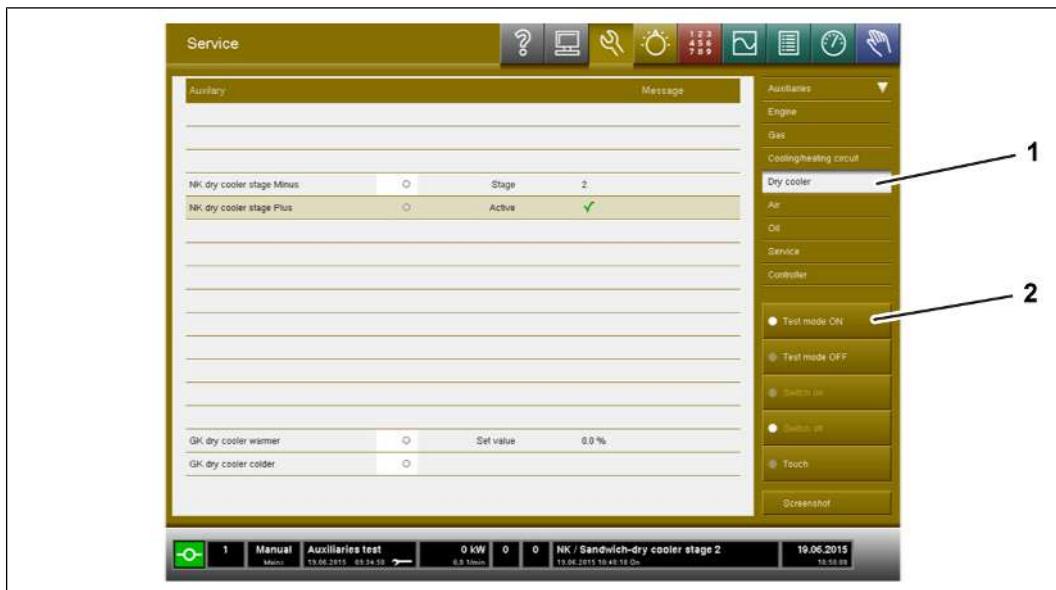
NOTE

The speed of the radiator can be adjusted infinitely or in individual stages depending on the system installed.

Infinitely variable radiators are equipped with a frequency converter.

Step-controlled radiators are equipped with stage switching.

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).



605755787

1. Press the Radiator button (1)
 - The Radiator dialog area opens.
2. Press the Test mode ON button (2)
 - The control automatically switches off all auxiliary drives.

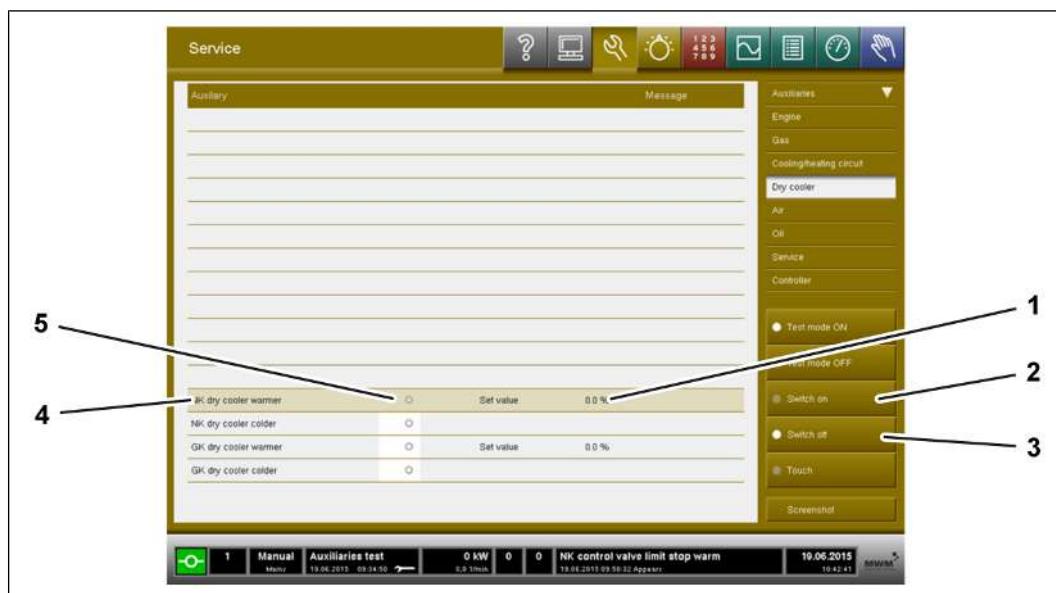
Auxiliary drive test for radiator - Checking the dry cooler emergency cooling circuit (NK radiator) with frequency converter

NOTE

Perform the checks for NK radiator colder and radiator intercooler circuit (GK dry cooler) corresponding to the check of NK radiator warmer.

The set value for the NK radiator warmer test is 100.0 %.

- ✓ The auxiliary drive test for radiator - test mode is switched on (see section [Auxiliary drive test for radiator - Switching on test mode \[▶ 251\]](#)).



605750923

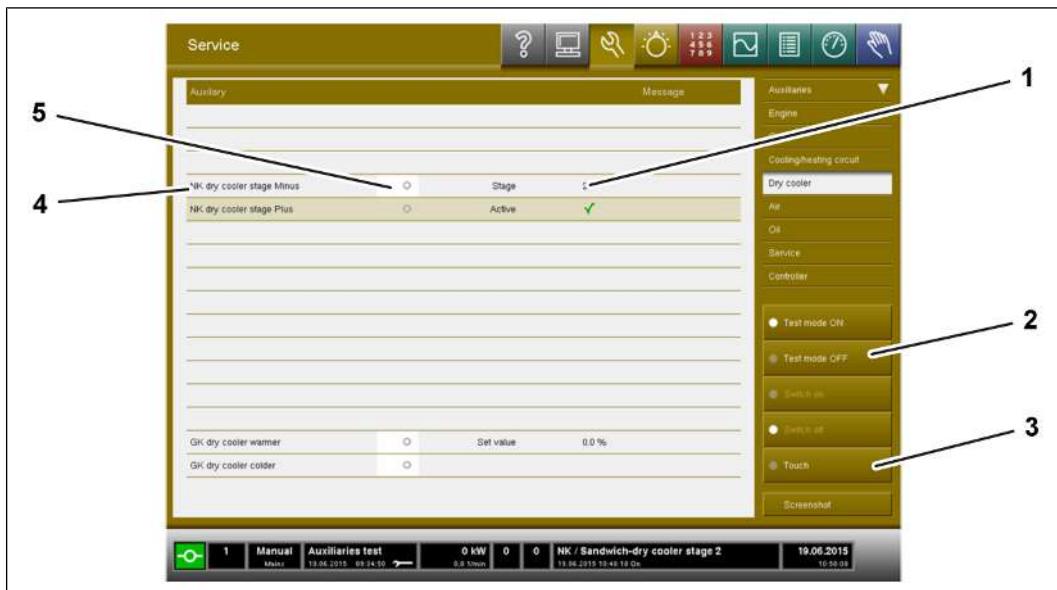
1. In the Radiator dialog area next to the entry Radiator warmer (7), tap the white area (6) to activate the NK radiator warmer auxiliary drive.
 - The NK radiator warmer auxiliary drive is activated.
2. Press the Switch on button (2).
 - The fan speed is shown as a percentage display in the Set value dialog area.
 - The fan continuously decreases the speed until the setpoint value of 0.0 % (1) is reached.
3. Press the Switch off button (3).

Auxiliary drive test for radiator - Checking the radiator emergency cooling circuit (NK radiator) with stage switching

NOTE

Perform the checks for NK radiator warmer and radiator intercooler circuit (GK radiator) corresponding to the check of NK radiator warmer.

- ✓ The auxiliary drive test for radiator - test mode is switched on (see section [Auxiliary drive test for radiator - Switching on test mode \[▶ 251\]](#)).



605753355

1. In the Radiator dialog area next to the entry NK radiator stage Minus (4), tap the white area (5) to activate the NK radiator stage Minus auxiliary drive.
 - The NK radiator stage Minus auxiliary drive is activated.
2. The current fan stage is shown in the Fan stage dialog area (1).
3. Press the Switch on button (2).
 - The fan speed is shown as a percentage display in the Set value dialog area.
 - The fan continuously decreases the speed until the setpoint value of 0.0 % is reached.
4. Press the Touch button (3)
 - The next fan stage up is shown in the Fan stage dialog area (1).
 - If the highest fan stage is reached and the Touch button (3) is tapped again, the control switches the fan off. The fan stage 0 is shown in the Fan stage dialog area (1).
 - The fan increases the speed up to the corresponding speed for the stage.
 - The test result is shown in the Fan stage dialog area.

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the Low water, diff. press... dialog area (1), repeat the auxiliary drive test for radiator.

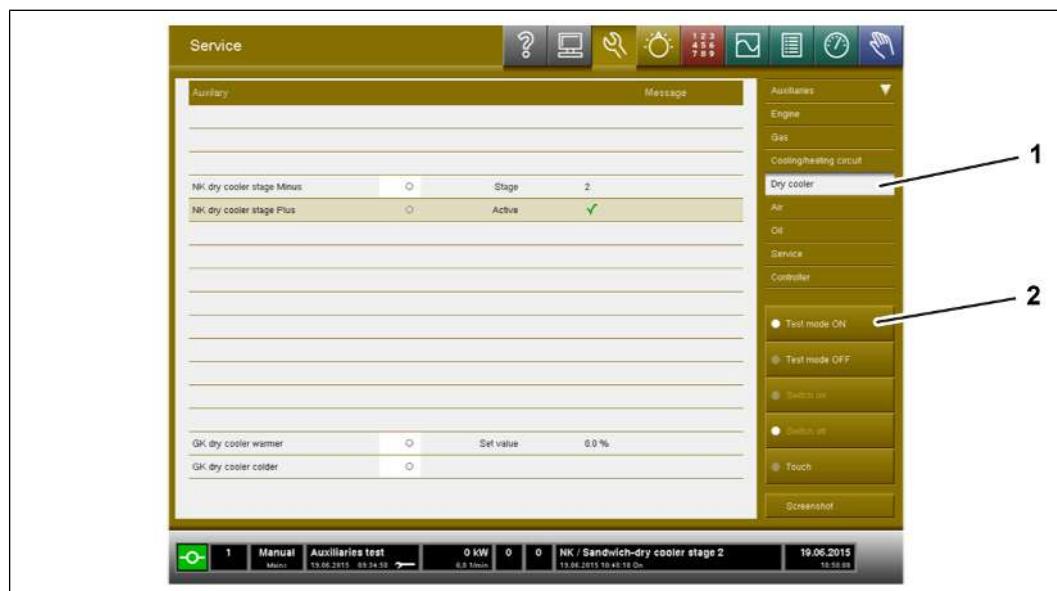
If a red lightning bolt is also shown in the Fan stage dialog area when the auxiliary drive test is repeated, contact service partner.

1. Perform a test for all fan stages.
2. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (2).

Auxiliary drive test for air

Auxiliary drive test for air - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).



605755787

1. Touch the Air button (1).
 - The Air dialog area opens.
2. Press the Test mode ON button (2).
 - The control automatically switches off all auxiliary drives.

Auxiliary drive test for air - Checking the AVW circuit pump

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605677067

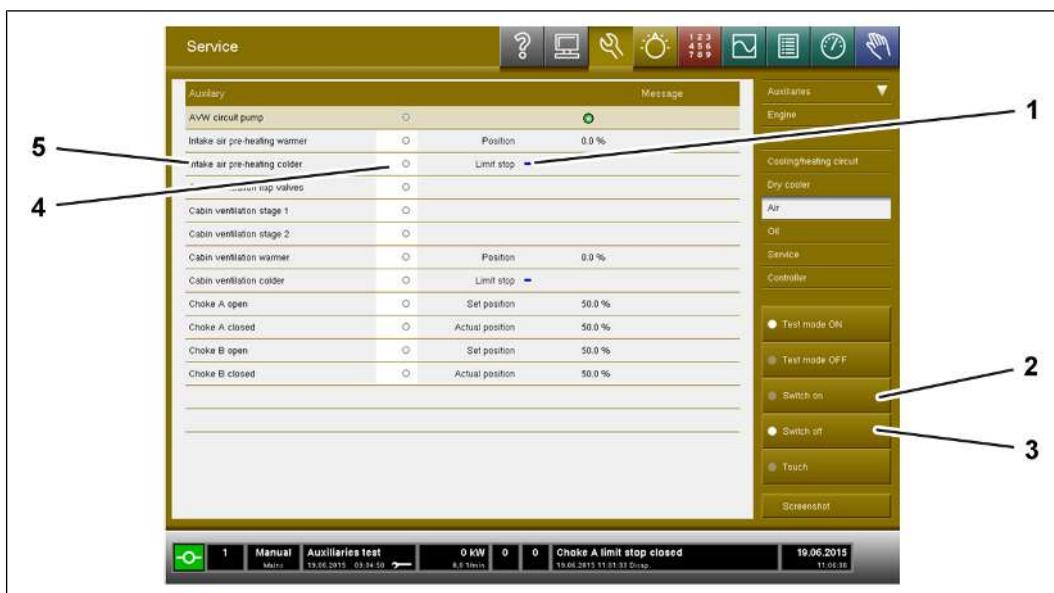
1. In the Air dialog area next to the entry AVW circuit pump (5), tap the white area (4) to activate the AVW circuit pump auxiliary drive.
 - The AVW circuit pump auxiliary drive is activated.
2. Press the Switch on button (2).
 - A green dot (1) is shown in the AVW circuit pump dialog area during the test. The green dot (1) shows that the AVW circuit pump is activated by the control.
3. Press the Switch off button (3).

Auxiliary drive test for air - Checking the intake air preheating

NOTE

Perform the check for intake air preheating warmer corresponding to the check for intake air preheating colder.

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605674635

1. In the Air dialog area next to the entry Intake air pre-heating colder (5), tap the white area (4) to activate the Intake air pre-heating colder auxiliary drive.
 - The Intake air pre-heating colder auxiliary drive is activated.
 - A symbol in the Limit stop dialog area (1) displays the position of the actuator: Plus = Rich or Minus = Lean.
2. Press the Switch on button (2).
 - The display in the Limit stop dialog area must change from the displayed symbol to a double arrow during the test.
 - The Limit stop dialog area changes to the Position dialog area. The actuator's position is shown as a percentage display in the Position dialog area.
 - A plus sign is shown in the Limit stop dialog area and the percentage display 100.0 % is shown in the Position dialog area when the actuator has reached the warm limit stop.
 - A minus sign is shown in the Limit stop dialog area and the percentage display 0.0 % is shown in the Position dialog area when the actuator has reached the cold limit stop.

NOTE

The percentage display of the position is a calculated value. This value can deviate from the absolute 0.0 % display or the 100.0 % display at the start of the test.

During the auxiliary drive test for intake air preheating warmer, the control also carries out the calibration of the time and travel of the actuator.

3. Press the Switch off button (3).

Auxiliary drive test for air - Checking the cabin ventilation flap valves

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605684363

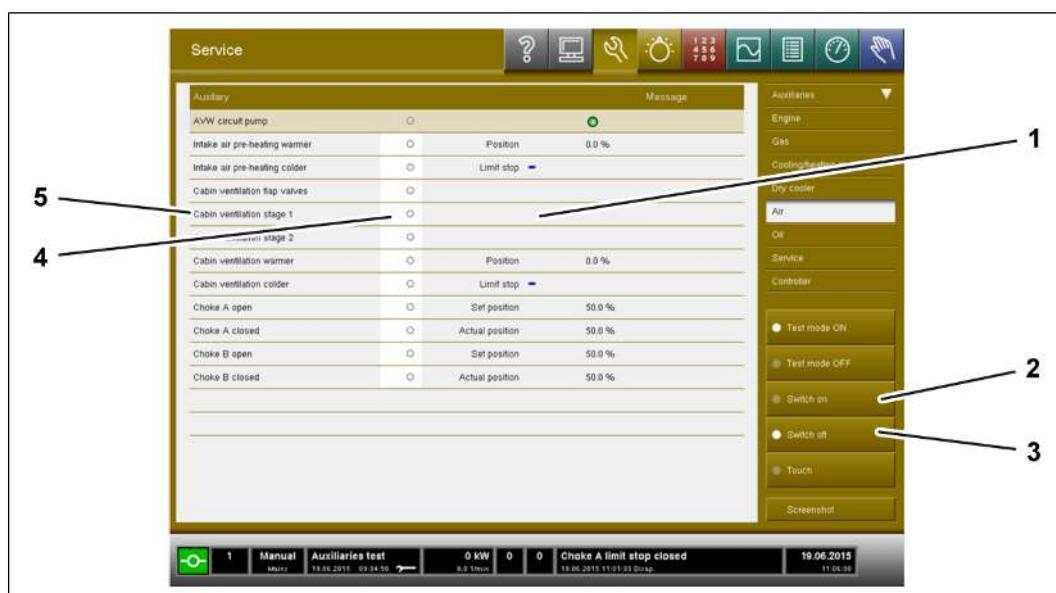
1. In the Air dialog area next to the entry Cabin ventilation flap valves (5), tap the white area (4) to activate the Cabin ventilation flap valves auxiliary drive.
 - The Cabin ventilation flap valves auxiliary drive is activated.
2. Press the Switch on button (2).
 - A green dot (1) is shown in the Cabin ventilation flap valves dialog area during the test. The green dot (1) shows that the cabin ventilation flap valves are activated by the control.
3. Press the Switch off button (3).

Auxiliary drive test for air - Checking the cabin ventilation stage 1

NOTE

Perform the check for Cabin ventilation stage 2 corresponding to the check for Cabin ventilation stage 1.

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605679499

1. In the Air dialog area next to the entry Cabin ventilation stage 1 (5), tap the white area (4) to activate the Cabin ventilation stage 1 auxiliary drive.
 - The Cabin ventilation stage 1 auxiliary drive is activated.
2. Press the Switch on button (2).
 - The test result is shown in the Cabin ventilation stage 1 dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

If a red lightning bolt is shown in the Cabin ventilation stage 1 dialog area (1), repeat the auxiliary drive test for Cabin ventilation stage 1.

If a red lightning bolt is also shown in the Cabin ventilation stage 1 dialog area (1) when auxiliary drive test is repeated, contact service partner.

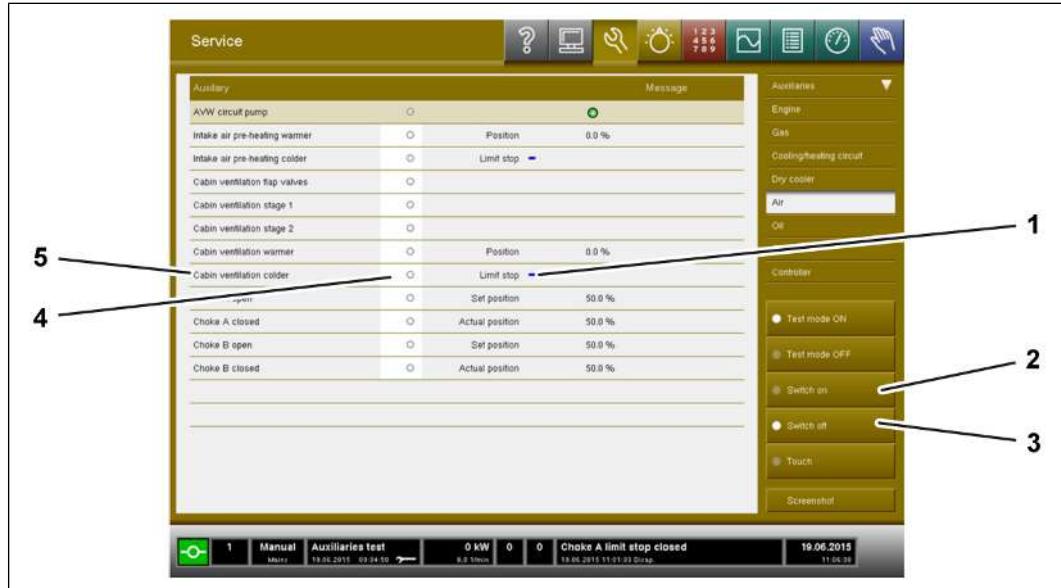
1. Press the Switch off button (3).

Auxiliary drive test for air - Checking the cabin ventilation

NOTE

Perform the check for Cabin ventilation warmer corresponding to the check for Cabin ventilation colder.

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605681931

1. In the Air dialog area next to the entry Cabin ventilation colder (5), tap the white area (4) to activate the Cabin ventilation colder auxiliary drive.
 - The Cabin ventilation colder auxiliary drive is activated.
 - A symbol in the Limit stop dialog area (1) displays the position of the actuator: Plus = Limit stop cold. Minus = Limit stop warm.
2. Press the Switch on button (2).
 - The display in the dialog area Limit stop (1) must change from the displayed symbol to a double arrow during the test.
 - The Limit stop dialog area changes to the Position dialog area. The actuator's position is shown as a percentage display in the Position dialog area.
 - A plus sign is shown in the Limit stop dialog area (1) and the percentage display 100.0 % is shown in the Position dialog area when the actuator has reached the warm limit stop.
 - A minus sign is shown in the Limit stop dialog area (1) and the percentage display 0.0 % is shown in the Position dialog area when the actuator has reached the cold limit stop.

NOTE

The percentage display of the position is a calculated value. This value can deviate from the absolute 0.0 % display or the 100.0 % display at the start of the test.

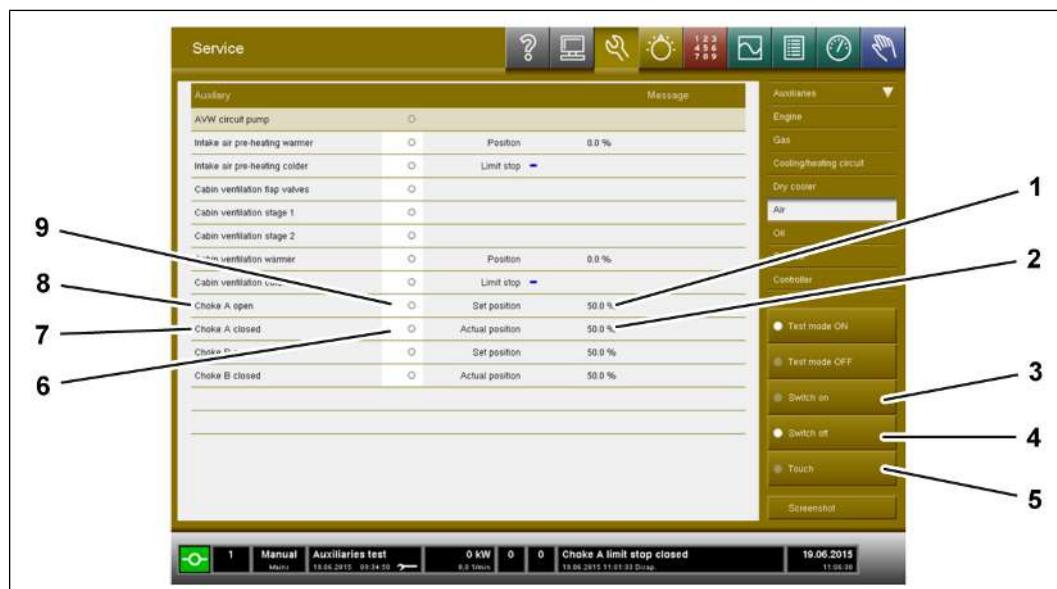
During the auxiliary drive test for cabin ventilation warmer, the control also carries out the calibration of the time and travel of the actuator.

3. Press the Switch off button (3).

Auxiliary drive test for air - Checking the choke A**NOTE**

Perform the checks for Choke B corresponding to the checks for Choke A.

- ✓ The auxiliary drive test for air - test mode is switched on (see section [Auxiliary drive test for air - Switching on test mode \[▶ 255\]](#)).



605686795

1. In the Air dialog area next to the entry Choke A open (8), tap the white area (9) to activate the Choke A open auxiliary drive.
 - The Choke A open auxiliary drive is activated.
 - The control shows a minus sign in the Limit stop dialog area if the actuator is set to limit stop open.
2. Press the Switch on button (3).
 - The actuator opens the choke A.
 - The Set position (1) and Actual position (2) dialog areas continuously show the position of the choke A in percent during the test.

- The percentage display 100.0 % is shown in the Set position (1) and Actual position (2) dialog areas when the actuator has reached the open limit stop.
- The Set position dialog area (1) also shows the Limit stop display.

NOTE

The percentage display of the position is a calculated value. This value can deviate from the absolute 0.0 % display or the 100.0 % display at the start of the test.

During the auxiliary drive test Choke A open the control also carries out the calibration of the time and travel of the actuator.

3. Press the Switch off button (4).
4. In the Air dialog area next to the entry Choke A closed (8), tap the white area (9) to activate the Choke A closed auxiliary drive.
 - The Choke A closed auxiliary drive is activated.
 - The control shows a plus sign in the Limit stop dialog area if the actuator is set to the limit stop closed.
5. Press the Switch on button (3).
 - The actuator closes the choke A.
 - The Set position (1) and Actual position (2) dialog areas continuously show the position of the choke A in percent during the test.
 - The percentage display 0.0 % is shown in the Set position (1) and Actual position (2) dialog areas when the actuator has reached the closed limit stop.
 - The Set position dialog area (1) no longer shows the Limit stop display.

NOTE

The percentage display of the position is a calculated value. This value can deviate from the absolute 0.0 % display or the 100.0 % display at the start of the test.

During the auxiliary drive test Choke A closed the control also carries out the calibration of the time and travel of the actuator.

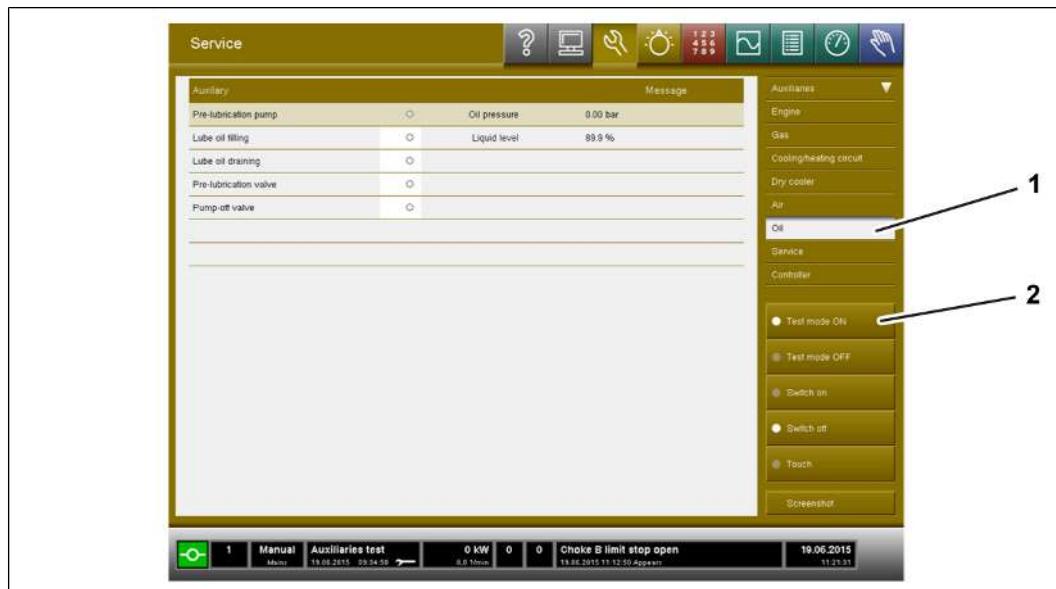
6. Press the Switch off button (4).
7. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (5).

Auxiliary drive test for oil

Auxiliary drive test for oil - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.

- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).

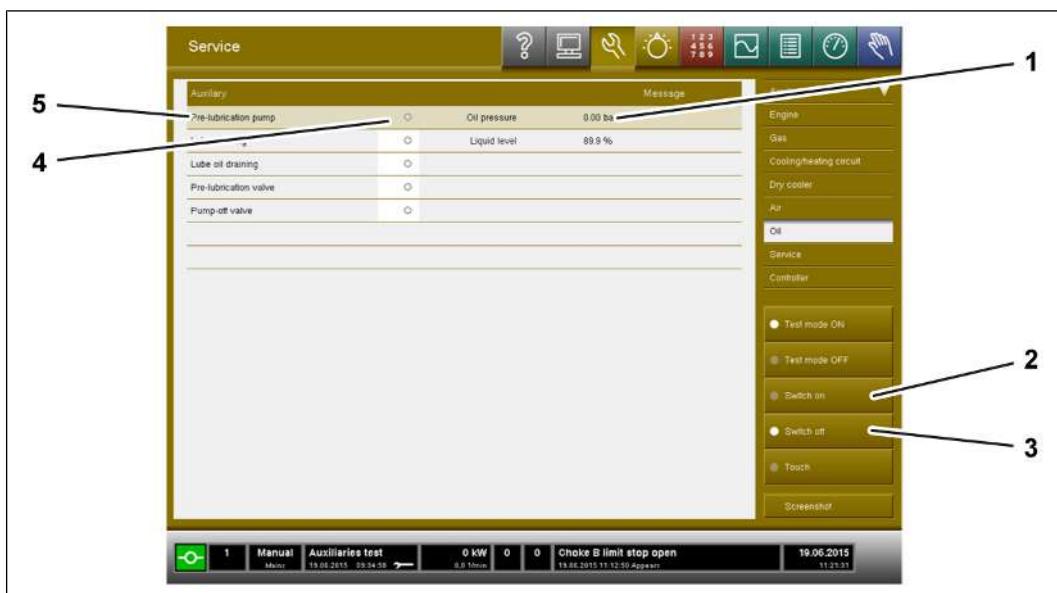


605724683

1. Press the Oil button (1).
 - The Oil dialog area opens.
2. Press the Test mode ON button (2).
 - The control automatically switches off all auxiliary drives.

Auxiliary drive test for oil - Checking the prelubrication pump

- ✓ The auxiliary drive test for oil - test mode is switched on (see section [Auxiliary drive test for oil - Switching on test mode \[▶ 262\]](#)).



605727115

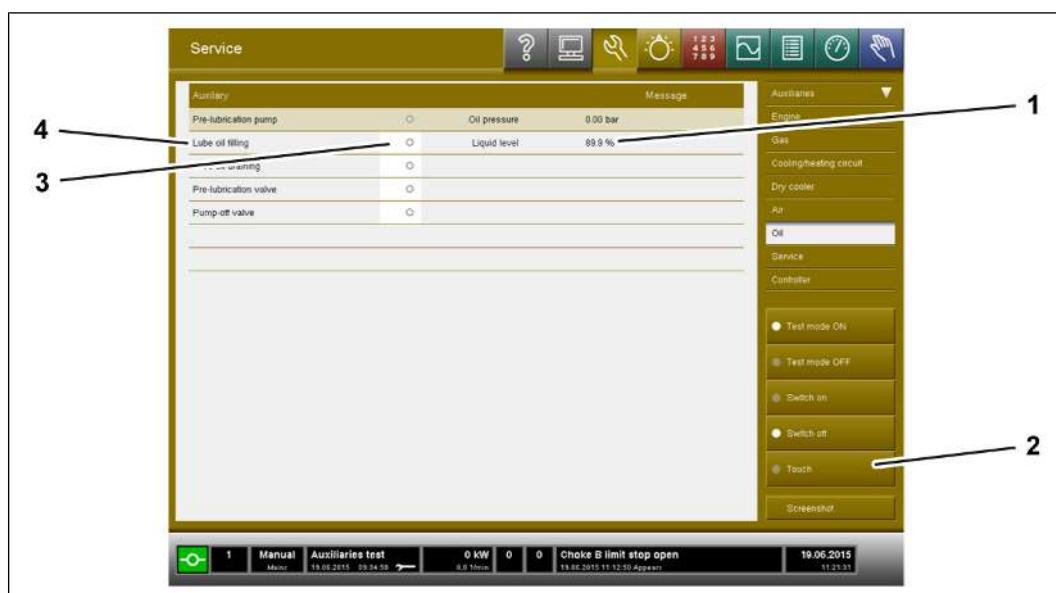
1. In the Oil dialog area next to the entry Pre-lubrication pump (5), tap the white area (4) to activate the Pre-lubrication pump auxiliary drive.
 - The Pre-lubrication pump auxiliary drive is activated.
2. Press the Switch on button (2).
 - Visually inspect the direction of rotation at the prelubrication pump.
 - The control continuously displays the current oil pressure (1) in the Oil dialog area.
3. Press the Switch off button (3).

Auxiliary drive test for oil - Checking the lube oil filling

NOTE

The auxiliary drive test for lube oil filling checks the solenoid valves for the lube oil supply. Depending on the structure of the plant, various valves are installed in differing numbers. During the auxiliary drive test for lube oil filling, the solenoid valves open and fill the lube oil sump of the engine with lube oil. There is no feedback regarding the current lube oil level in the lube oil sump in the Oil dialog area.

- ✓ The auxiliary drive test for oil - test mode is switched on (see section [Auxiliary drive test for oil - Switching on test mode \[▶ 262\]](#)).



605719819

1. In the Oil dialog area next to the entry Lube oil filling (4), tap the white area (3) to activate the Lube oil filling auxiliary drive.
 - The Lube oil filling auxiliary drive is activated.



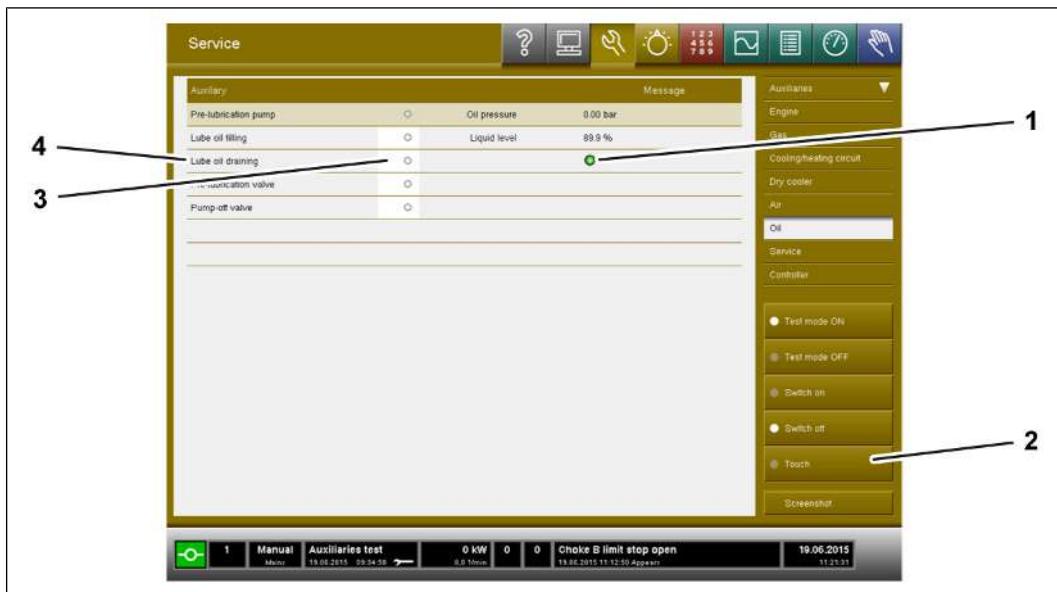
Risk of destruction of components

Components can be damaged or destroyed due to a too high lube oil level.

- Do not fill lube oil sump over 100.0 %.
 - Only ever press the Touch button (2), do not hold it down.
2. Press the Touch button (2).
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.
 - The control system displays the current oil level as a percentage value (1) in the Oil dialog area.

Auxiliary drive test for oil - Checking the lube oil draining

- ✓ The auxiliary drive test for oil - test mode is switched on (see section [Auxiliary drive test for oil - Switching on test mode \[▶ 262\]](#)).

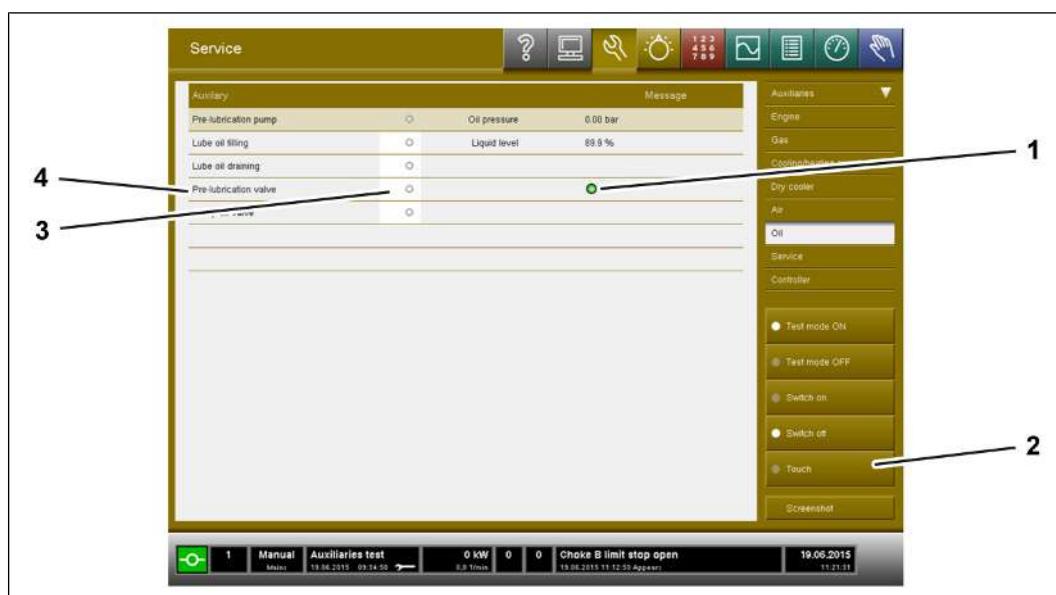


605722251

1. In the Oil dialog area next to the entry Lube oil draining (4), tap the white area (3) to activate the Lube oil draining auxiliary drive.
 - The Lube oil draining auxiliary drive is activated.
2. Press the Touch button (2).
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.
 - A green dot (1) is shown in the Oil dialog area during the test. The green dot (1) shows that the solenoid valves are activated by the control.

Auxiliary drive test for oil - Checking the prelubrication valve

- ✓ The auxiliary drive test for oil - test mode is switched on (see section [Auxiliary drive test for oil - Switching on test mode \[▶ 262\]](#)).



605729547

1. In the Oil dialog area next to the entry Pre-lubrication valve (4), tap the white area (3) to activate the Pre-lubrication valve auxiliary drive.
 - The Pre-lubrication valve auxiliary drive is activated.
2. Press the Touch button (2) and hold for a short time.
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.
 - A green dot (1) is shown in the Oil dialog area during the test. The green dot (1) shows that the solenoid valves are activated by the control.

Auxiliary drive test for oil - Checking the pump-off valve

- ✓ The auxiliary drive test for oil - test mode is switched on (see section [Auxiliary drive test for oil - Switching on test mode \[▶ 262\]](#)).



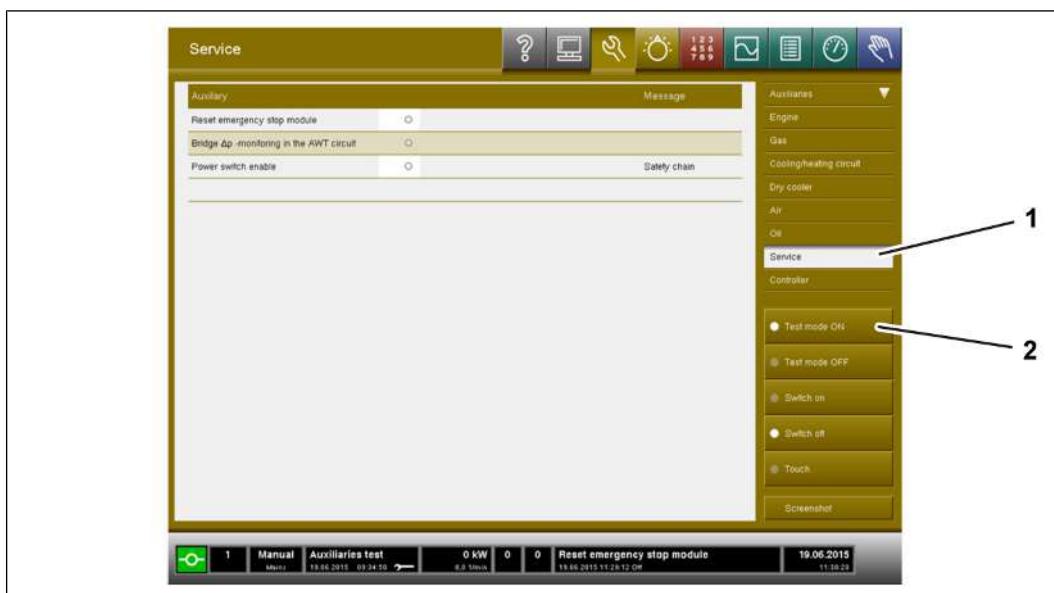
605717387

1. In the Oil dialog area next to the entry Pre-lubrication valve (7), tap the white area (6) to activate the Pre-lubrication valve auxiliary drive.
 - The Pre-lubrication valve auxiliary drive is activated.
2. In the Oil dialog area next to the entry Pump-off valve (5), tap the white area (4) to activate the Pump-off valve auxiliary drive.
 - The Pump-off valve auxiliary drive is activated.
3. Press the Touch button (2) and hold for a short time.
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.
 - A green dot (1) is shown in the Oil dialog area during the test. The green dot (1) shows that the solenoid valves are activated by the control.
4. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (2).

Auxiliary drive test for service

Auxiliary drive test for service - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).

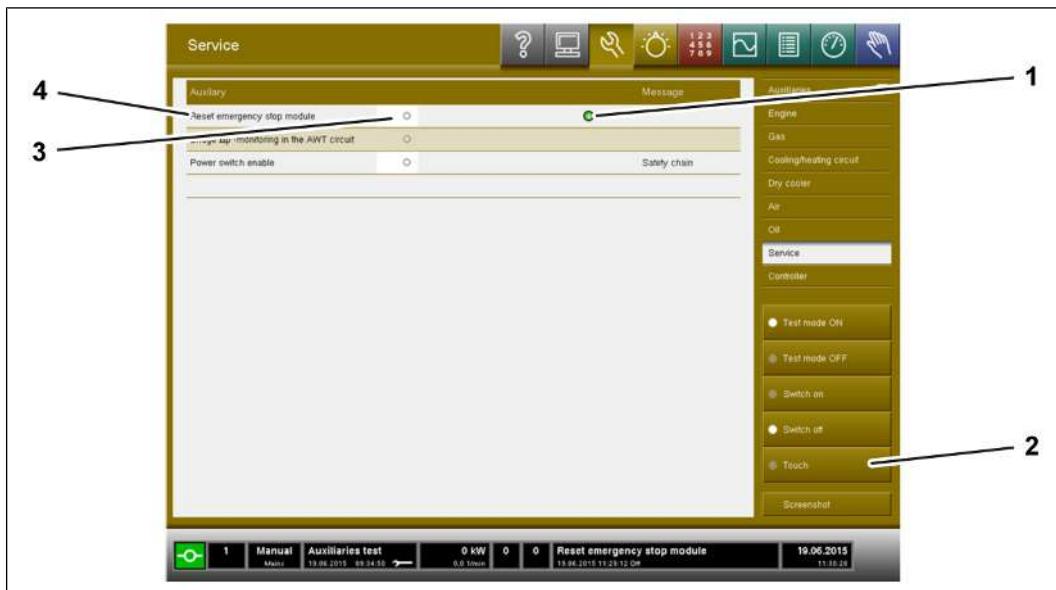


605746059

1. Press the Service button (1).
 - The Service dialog area opens.
2. Press the Test mode ON button (2).
 - The control automatically switches off all auxiliary drives.

Auxiliary drive test for service - Checking the reset emergency stop module

- ✓ The auxiliary drive test for service - test mode is switched on (see section [Auxiliary drive test for service - Switching on test mode \[▶ 268\]](#)).

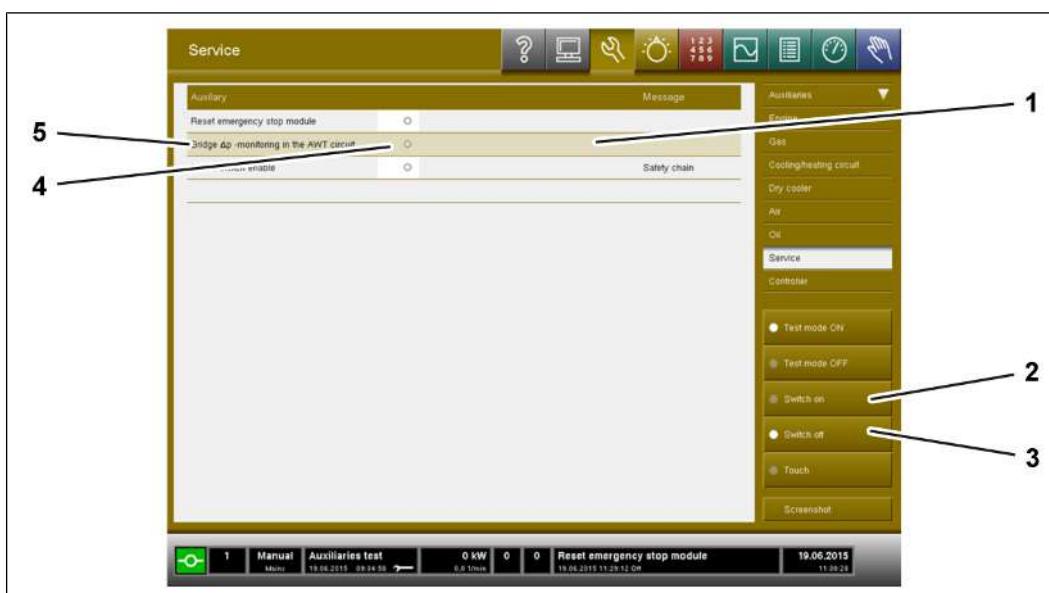


605743627

1. In the Service dialog area next to the entry Reset emergency stop module (4), tap the white area (3) to activate the Reset emergency stop module auxiliary drive.
 - The Reset emergency stop module auxiliary drive is activated.
2. Press the Touch button (2) and hold for a short time.
 - A green dot (1) is shown in the Service dialog area during the test. The green dot (1) shows that the solenoid valves are activated by the control.

Auxiliary drive test for service - Checking the bridge Δp monitoring in the AWT circuit

- ✓ The auxiliary drive test for service - test mode is switched on (see section [Auxiliary drive test for service - Switching on test mode \[▶ 268\]](#)).



605748491

1. In the Service dialog area next to the entry Bridge Δp monitoring in the AWT circuit (5), tap the white area (4) to activate the Bridge Δp monitoring in the AWT circuit auxiliary drive.
 - The Bridge Δp monitoring in the AWT circuit auxiliary drive is activated.
2. Press the Switch on button (2)
 - The test result is shown in the Service dialog area (1).

Symbol	Description	Function and meaning
	Red lightning bolt	Test result is not OK
	Green checkmark	Test result is OK

NOTE

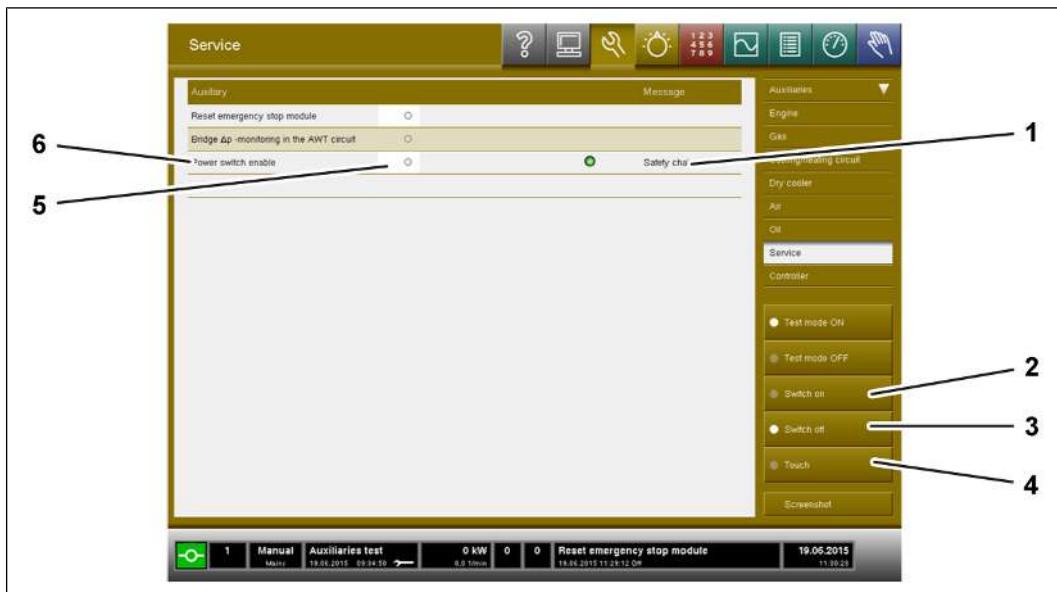
If a red lightning bolt is shown in the Service dialog area, repeat the auxiliary drive test Bridge Δp monitoring in the AWT circuit.

If a red lightning bolt is also shown in the Service dialog area when the auxiliary drive test is repeated, contact service partner.

1. Press the Switch off button (3).

Auxiliary drive test for service - Checking the power switch enable

- ✓ The auxiliary drive test for service - test mode is switched on (see section [Auxiliary drive test for service - Switching on test mode \[▶ 268\]](#)).



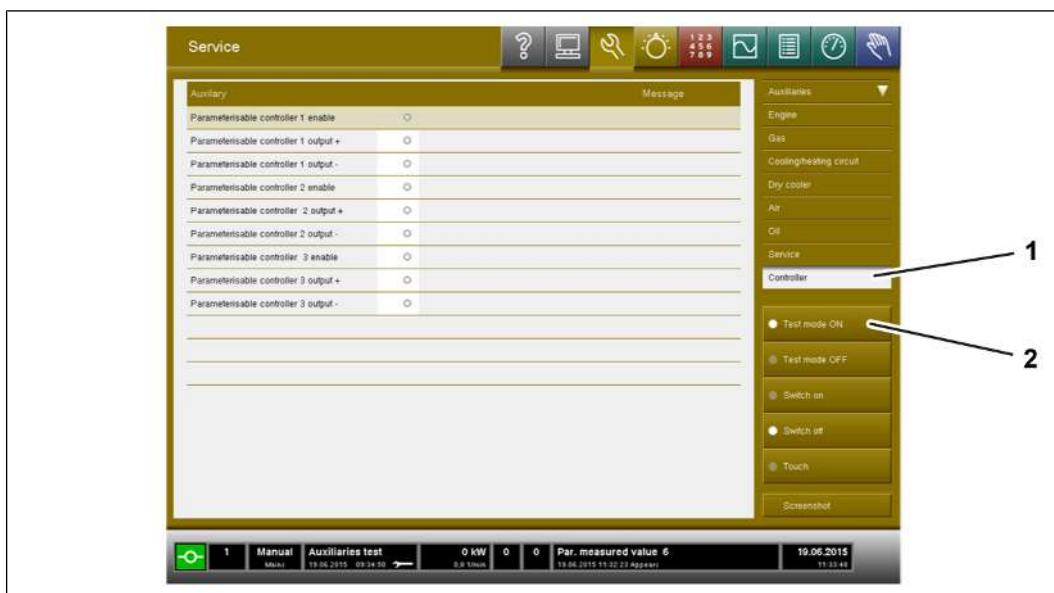
605741707

1. In the Service dialog area next to the entry Power switch enable (6), tap the white area (5) to activate the Power switch enable auxiliary drive.
 - The Power switch enable auxiliary drive is activated.
2. Press the Switch on button (2).
 - A green dot is shown in the Service dialog area (1) during the test. The green dot shows that the emergency switching off module is activated by the control.
3. Press the Switch off button (3).
4. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (4).

Auxiliary drive test for controller

Auxiliary drive test for controller - Switching on test mode

- ✓ Genset is stopped.
- ✓ Quick stop function is not activated.
- ✓ Manual operation is selected.
- ✓ The Auxiliaries mask group is open (see section Selecting manual operation and opening the mask group Auxiliaries).
- ✓ The Auxiliaries mask group is open (see section [Selecting manual operation and opening the mask group Auxiliaries \[▶ 227\]](#)).



605739275

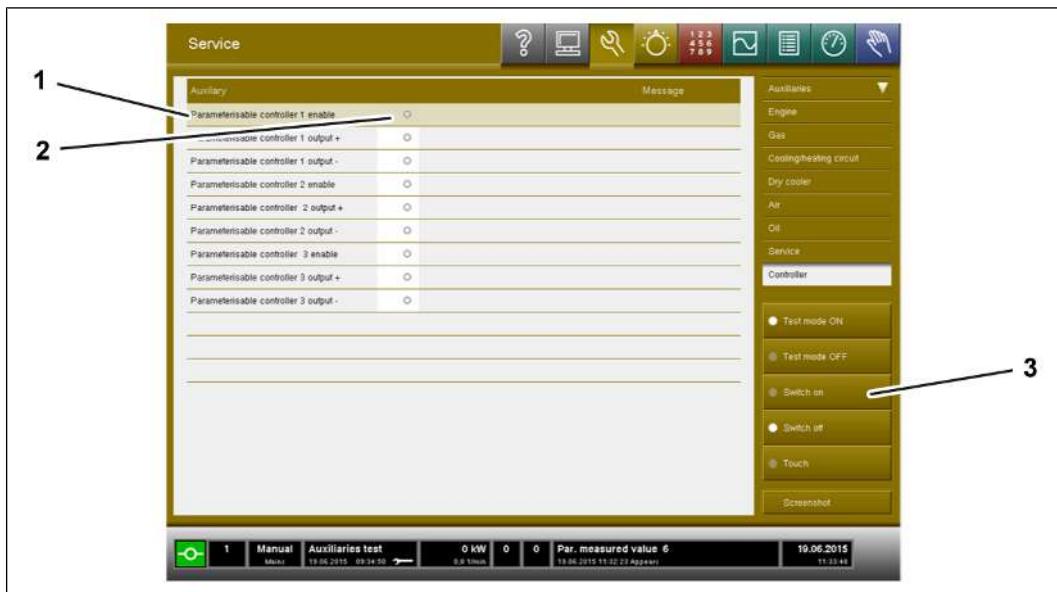
1. Press the Controller button (1).
 - The Controller dialog area opens.
2. Press the Test mode ON button (2).
 - The control automatically switches off all auxiliary drives.

Auxiliary drive test for controller - Switching on Parameterisable controller 1 enable

NOTE

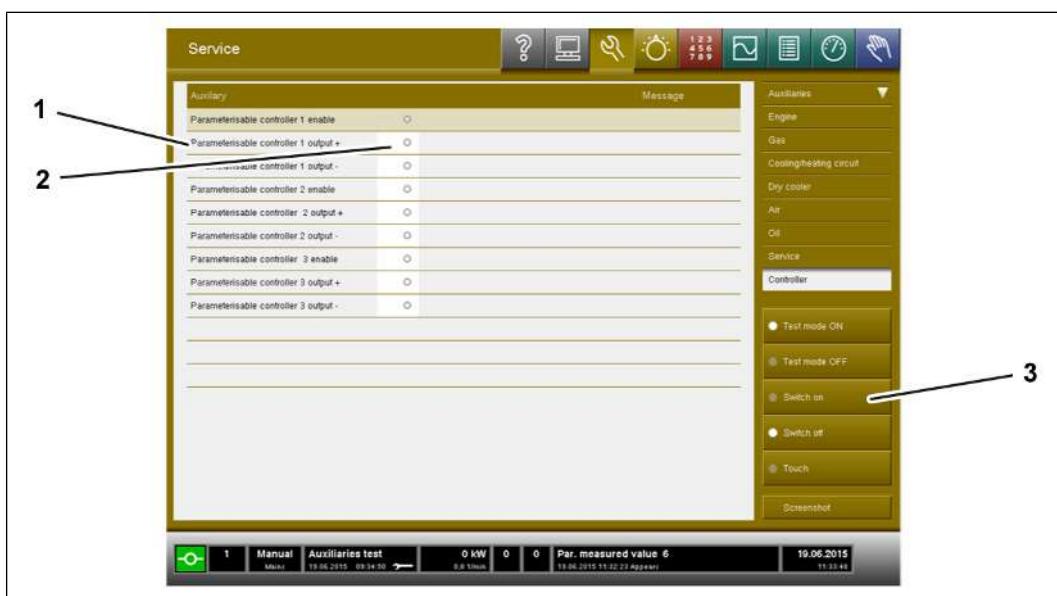
Perform the checks for enabling the parameterizable controllers 2 and 3 corresponding to the check for enabling the parameterizable controller 1.

- ✓ The auxiliary drive test for controller - test mode is switched on (see section [Auxiliary drive test for controller - Switching on test mode \[▶ 272\]](#)).



605736843

1. In the Controller dialog area next to the entry Parameterisable controller 1 enable (1), tap the white area (2) to activate the Parameterisable controller 1 enable auxiliary drive.
 - The Parameterisable controller 1 enable auxiliary drive is activated.
2. Press the Switch on button (3).

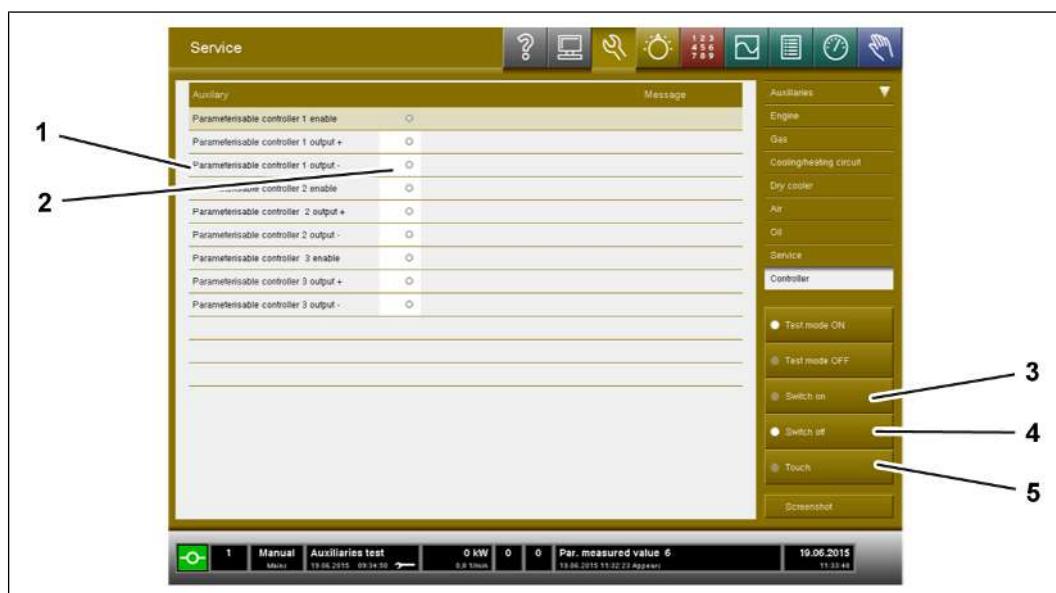


605734411

3. In the Controller dialog area next to the entry Parameterisable controller 1 output + (1), tap the white area (2) to activate the Parameterisable controller 1 output + auxiliary drive.
 - The Parameterisable controller 1 output + auxiliary drive is activated.

4. Press the Switch on button (3).

- Controller 1 opens.



605731979

5. In the Controller dialog area next to the entry Parameterisable controller 1 enable output - (1), tap the white area (2) to activate the Parameterisable controller 1 enable output - auxiliary drive.
- The Parameterisable controller 1 enable output - auxiliary drive is activated.
6. Press the Switch on button (3).
- Controller 1 closes.
7. Press the Switch off button (4).
8. If you do not want to carry out another auxiliary drive test, press the Test mode OFF button (5).

Checking the starting system

Valid for:
TCG 2020 K, TCG 2020



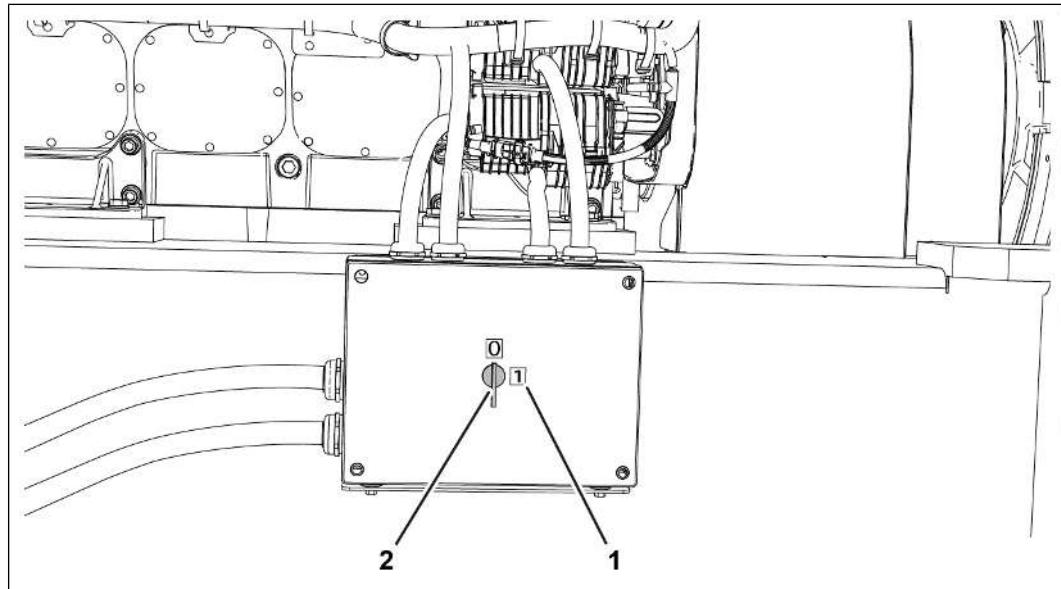
- Tools:
- Standard tools

General information

The person responsible for the work reports to the person responsible for the plant that the genset with the associated plant periphery has been operationally induced to stop.

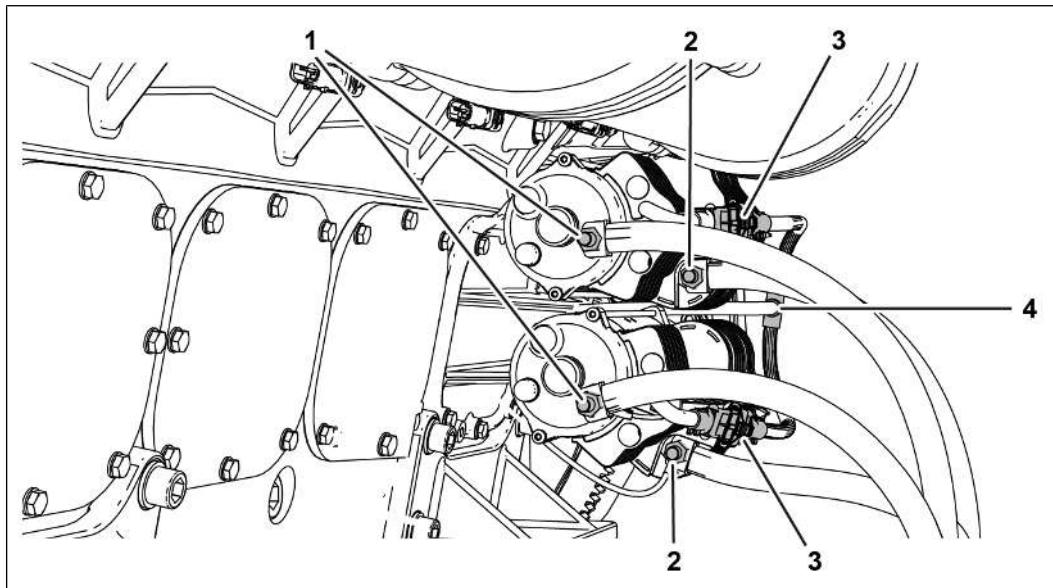
Check the battery disconnection switch:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).



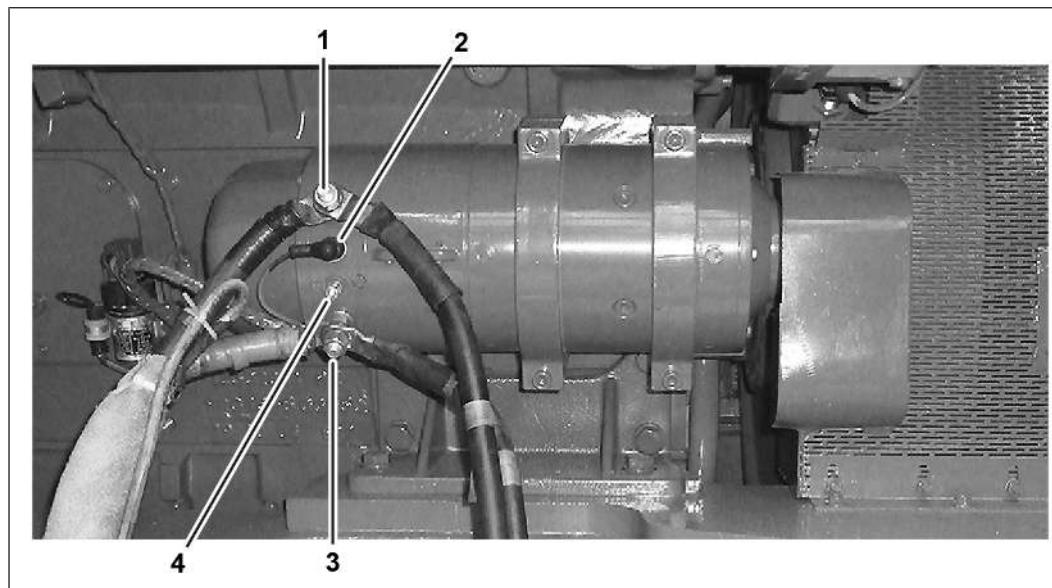
2616286603

1. Check all the connection bridges for tight fit on the starter battery, if present.
2. Check the position of the battery disconnection switch (2).
 - To start, the battery disconnection switch (2) must be in position 1 (1).

Checking the double starter:

2616303755: Double starter

1. Check the signal cable (4) on the double starter.
 - Check the plug-in connection (3) for tight fit.
 - Check signal cable for damage.
 2. Check terminals on double starter.
 - Check ground terminals (2) for corrosion.
 - Check positive terminals (1) for corrosion.
 - Check screw connection for tight fit.
 - If necessary, tighten nuts.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Checking the single starter:

2616308363: Single starter

1. Check all cables at the single starter.
 - Battery negative pole (1).
 - Starter control (2).
 - Battery positive pole (3).
 - Not assigned, is free (4).
 - Check screw connection for tight fit.
 - If necessary, tighten nuts.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Taking lube oil samples

Valid for:
TCG 2020



Tools:

- Standard tools



Auxiliary media:

- Lube oil sample containers with firmly fitting cover
 - Content min. 50 ml to max. 100 ml

General information

The flawless operation and a good wear behavior of the genset depend essentially on the condition of the lube oil.

- Therefore the lube oil must be checked regularly according to the maintenance schedule.
- The lube oil gives important information about the condition of the engine.
An accurate inspection of the lube oil sample is only possible in a laboratory.



CAUTION

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.



Danger to the environment

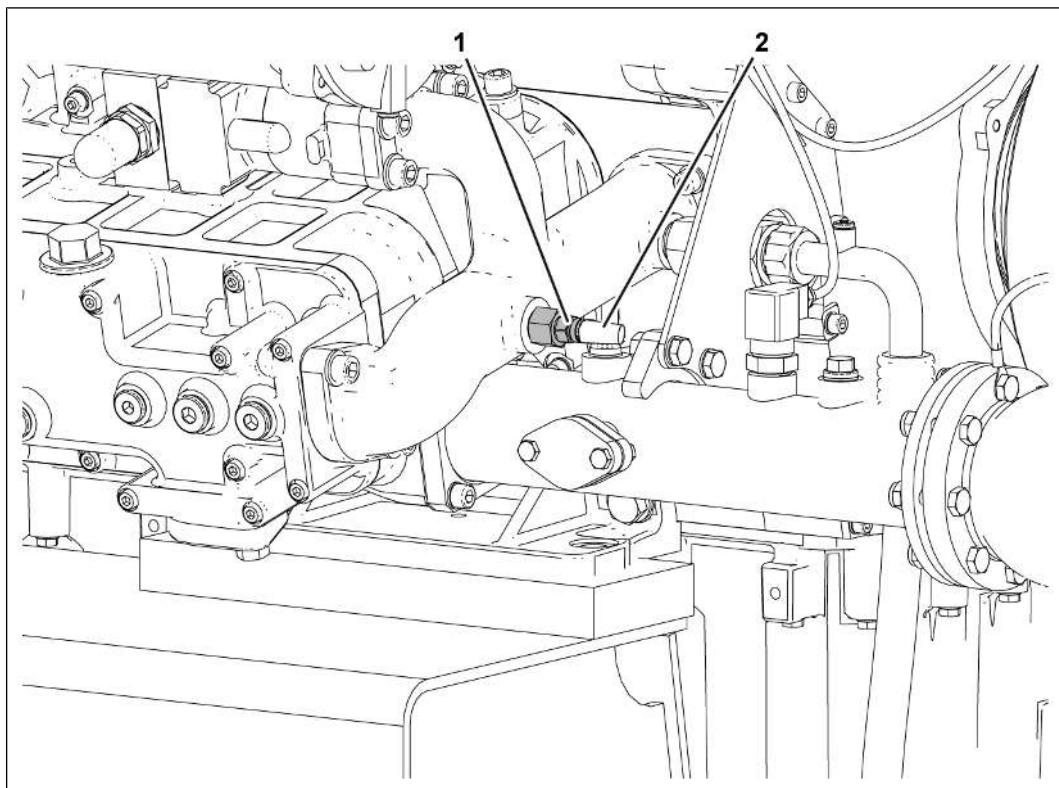
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

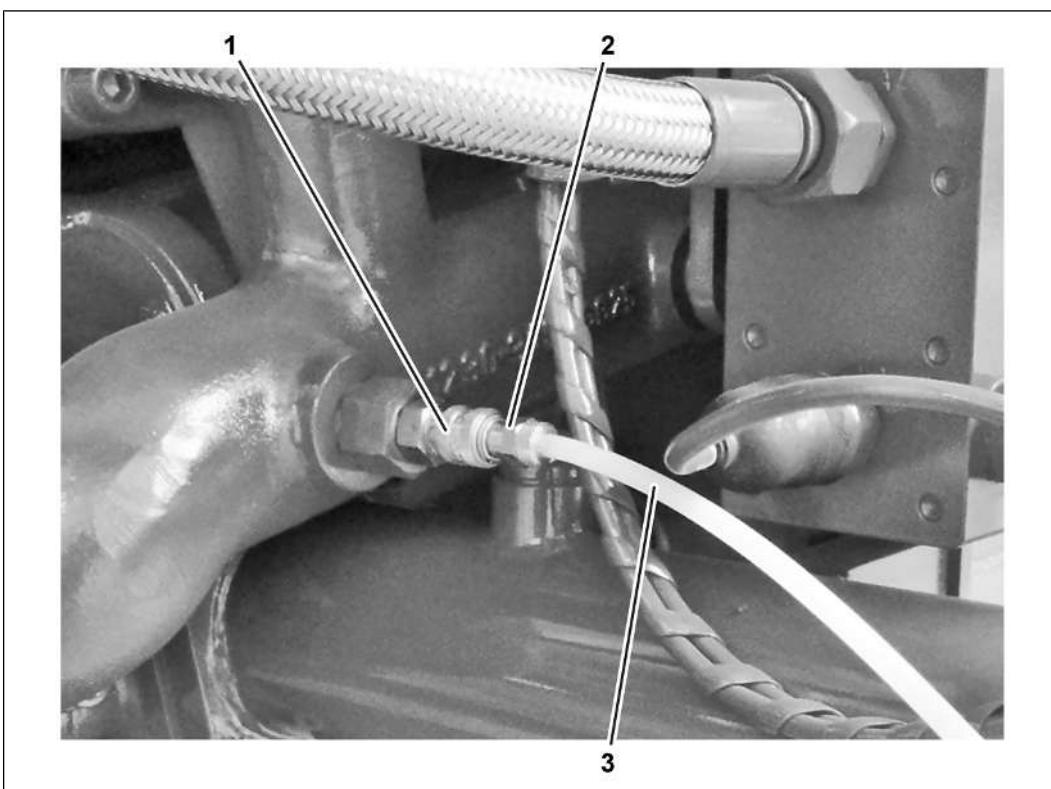
Taking lube oil samples:

- ✓ The genset is in operation
- ✓ The lube oil temperature is at least 60 °C



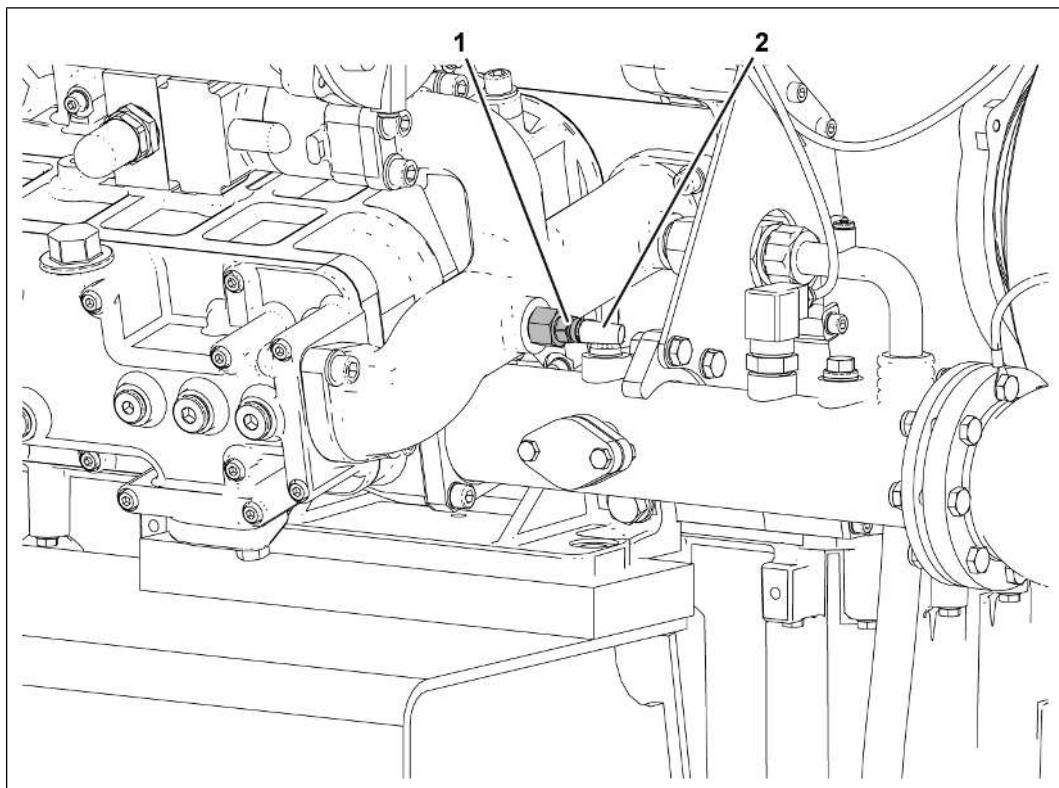
2616445323

1. Place the collecting tray underneath.
2. Remove the cover from the (2) lube oil extraction valve (1).



2616447755

3. Position hose line (3) in the collecting tray.
4. **WARNING! Danger of burns!** Press the coupling piece (2) with hose line (3) into the lube oil extraction valve (1) until it latches in
 - Once the coupling piece (2) latches in, hot lube oil immediately flows out under pressure.
 - Drain at least 100 ml of lube oil.
5. Fill the sample tank for the lube oil sample with lube oil.
 - Fill the required lube oil amount.
6. Unlock the coupling piece (2) and remove from the lube oil extraction valve (1) along with the hose line (3).



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7. Place the cover (2) on the lube oil extraction valve (1).
8. Remove the collecting tray.
 - Properly dispose of collected operating medium.
9. Fill out the sample cover letter.
10. Send the sample tank with the lube oil sample and sample cover letter to the laboratory for the lube oil analysis.
 - Pack the sample tank so it will not be damaged during transport.

Sampling the fuel gas

Valid for:

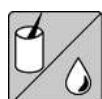
TCG 3016, TCG 2032, TCG 2020, TCG 3020



Tools:

- Standard tools

Sample bag (polyvinyl fluoride)



Auxiliary media:

- Extraction valve (stainless steel or nickel-plated brass)

Extraction hose (Teflon), length max. 0.5 m, diameter 6 x 1 mm

Adapter for connecting the bag

Additionally for non-natural gas:

- Pressure measuring device

Temperature measuring device

Humidity measuring device

General information

Fuel gas analyses must be clearly labeled. The fuel gas analysis must contain the fuel gas type in accordance with a selection of the analysis values. In case of doubt regarding the required scope of the analysis for the respective fuel gas type, contact service partner

For further information on analysis methods and analysis values, see the cover letter for fuel gas sampling.

- The form for documentation can be found in the Service Library [OL-MRA10 00-21-25 Measurement sheet for fuel gas sampling](#).



540348811: Sample bag made of polyvinyl fluoride

Use a sample bag made of polyvinyl fluoride for correctly taking a sample of the fuel gas.

- For further information, contact service partner.

DANGER

Explosion due to gases which ignite.

This leads to severe injuries and even death.

- Sufficiently ventilate the room.
 - Do not smoke.
 - Do not use any naked flames.
 - Use only ATEX-approved devices and tools.
 - Only qualified specialist personnel may work on the fuel gas system.
-

NOTE

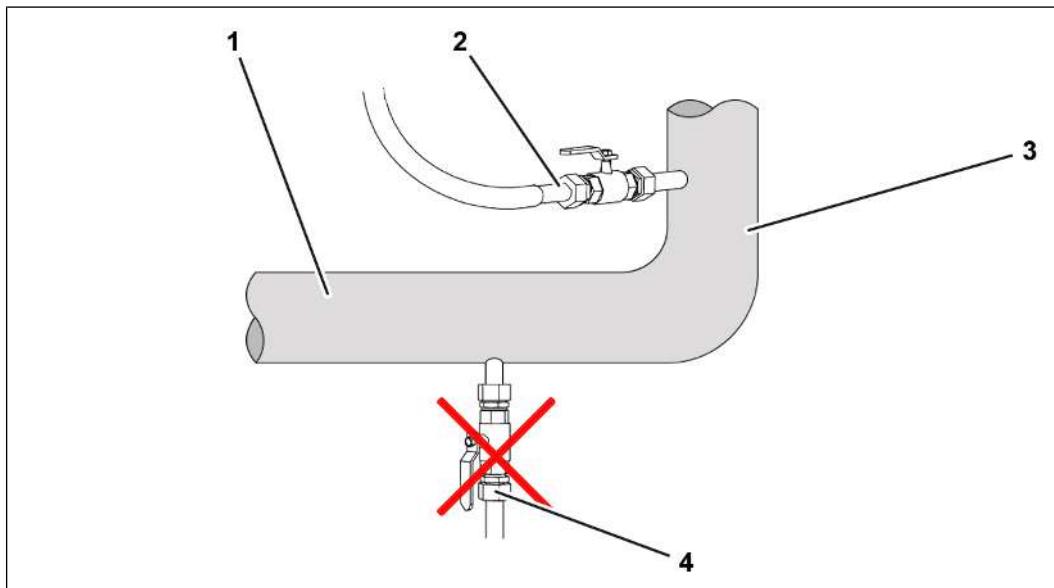
Condensate ruins the fuel gas sample taken

Condensate can ruin the result even if it was drained before taking the sample and the fuel gas is visually dry.

Sampling the fuel gas:

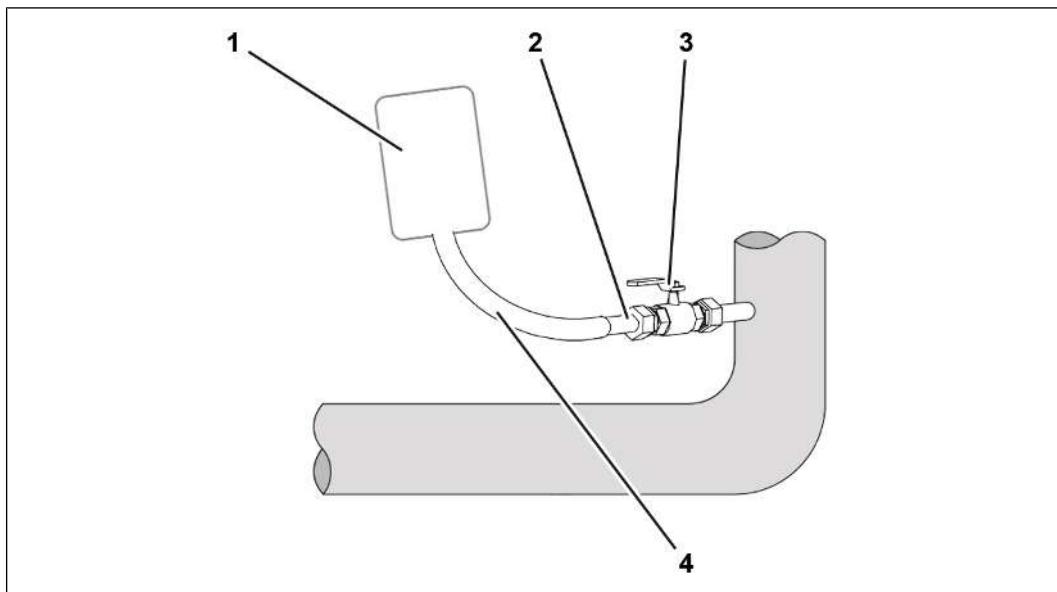
- ✓ The genset is in operation.
- ✓ The fuel gas production has been running for at least three hours.
- ✓ The engine load is 100 % (full load).
- ✓ The gas volume flow must be at least 75 % of the operating volume flow which occurs at full load operation of the gas engine system.

- ✓ The sample bags and extraction hose for fuel gas sampling must be made of polytetrafluoroethylene (PTFE), e.g. Tedlar film.
- ✓ The extraction hose is made as short as possible.
- ✓ All the surfaces which come in contact with the fuel gas during sampling are free from deposits (dirt, condensate).
- ✓ In the piping, the fuel gas temperature is maximum 50 °C. There is a risk of condensate formation in case of large differences between the ambient temperature and the fuel gas temperature. In order to prevent condensate formation, heat the sampling valves if necessary.
- ✓ All valves which come into contact with the fuel gas sample are designed in stainless steel or nickel-plated brass.
- ✓ The sampling point of the fuel gas sample is in the fuel gas line upstream of the engine (excess pressure range).
- ✓ In the case of landfill gas installations, ensure that the intake pressure when taking the fuel gas sample is at a similar order of magnitude as the intake pressure at full-load operation.
- ✓ In the case of landfill gas installations, sampling is only usable from gas collecting lines.



540351243

1. Select a line section for the sampling point (2) of the fuel gas sample
 - Gas must constantly flow through the line section and the line section must be free of condensate. Falling or rising pipes are very suitable (3).
 - In case of horizontal pipes (1), select a sampling point (2), which diverges from the pipe upwards or laterally
 - In case of sampling points (4) which e.g. diverge downwards, there is the danger of condensate accumulating in the fuel gas sample.



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2. Connect the sample bag (1) with the extraction hose (4) to the valve (2) of the sampling point
3. Open the ball valve (3) of the valve
4. Fill the sample bag (1) with the fuel gas sample
5. Close the ball valve (3) of the valve
6. Remove the sample bag (1) from the extraction hose (4) and close it securely
7. Remove the extraction hose (4) from the valve (2)
8. Fill out the sample cover letter
 - Always specify the deviations from the prerequisites described above while taking a sample of the fuel gas ⇒ see Appendices b, cover letter for the fuel gas sampling.
9. Send the sample bag (1) and sample cover letter for the fuel gas analysis to a certified laboratory
 - Pack the sample bag (1) so that it is not damaged.

Checking pollutant emissions in the exhaust gas (TEM)

Valid for:
TCG 2016 C, TCG 2020



Tools:

- Recommended measuring devices
 - TESTO 340
 - TESTO 350 XL or Ecom D

NOTE

Dual gas operation requires separate parameter settings for each type of gas being used. For exhaust emissions measurements in dual gas operation, consult your service partner.

Notes on the purpose of nitrogen oxide measurement

When operating the product, you must comply with locally applicable laws, regulations, ordinances, and directives regarding emission protection. The amount of nitrogen oxide in the exhaust gas is an indicator of whether emission protection regulations are being fulfilled.

The operator is required to conduct emission measurements in order to prepare for measurements by an accredited body. The operator's emissions measurements are not a replacement for measurements carried out by an accredited body.

Adjust the engine to the available fuel gas based on the measured nitrogen oxide concentration. In this way, you can adjust the mixture ratio of your gas-air mixture to make it either richer or leaner.

Notes on measurement devices

In order to properly measure nitrogen oxide levels, use a measuring device capable of measuring at least the values of the following gas components **at the same time**:

- Oxygen (O) in volume percent (% by vol.)
- Nitrogen monoxide (NO) in parts per million (ppm)
- Nitrogen dioxide (NO₂) in parts per million (ppm)

Caterpillar Energy Solutions GmbH recommends the use of the measuring devices listed above.

Notes on the target group

The operator will require access authorization Level 100 in order to change the parameters. After the completion of a training module, the operator receives access authorization in the form of a personalized TEM dongle.

After the exhaust gas measurement, have the engine settings adjusted only by persons qualified and trained by the manufacturer.

The required information on the training options can be found on the homepage:

<https://www.mwm.net/trainings/training-center-service/seminar-program/>

Notes on the exhaust gas measurement process

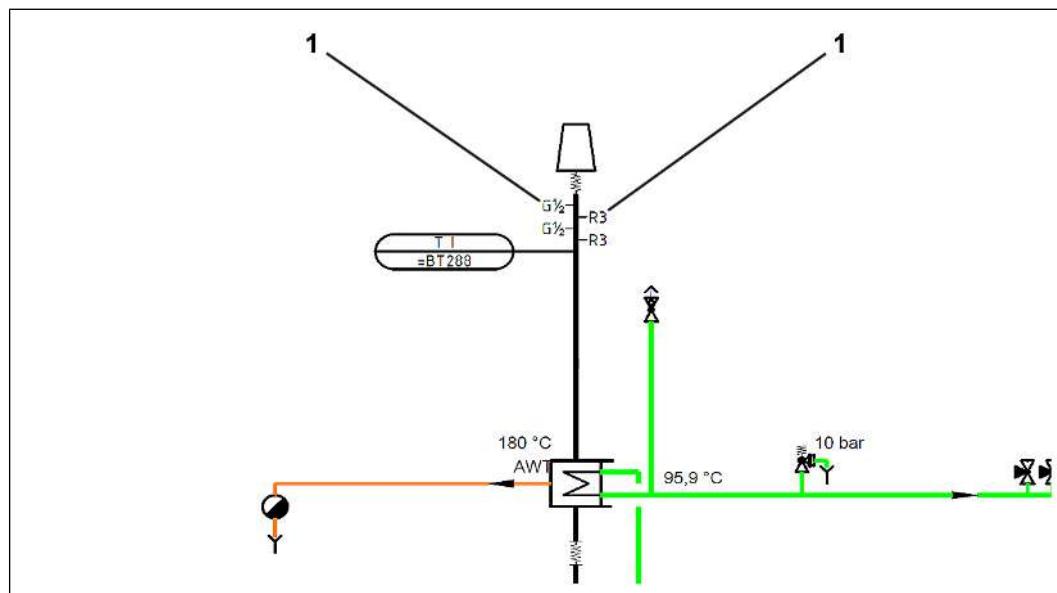
For a relevant exhaust gas measurement, the exhaust system must have heated up to operational temperature. Before starting the exhaust gas measurement, the genset must run at 100 % load until all operation values have reached steady state.

The genset must run in grid-parallel operation. In certain cases, however, the genset can only run in island operation if, for example, no mains connection is present. The operator must ensure that the genset runs in stationary mode without any change to the load.

To obtain relevant nitrogen oxide values during exhaust gas measurement, you must perform multiple measurements in the standard operational load range. Operationally relevant load ranges run between a minimal continuous power of 50 % and the maximum

power of 100 %. Notes on the operationally relevant load ranges are provided on the genset data sheet. You will find the document in Chapter [Technical data \[▶ 11\]](#) in the order-specific operating manual.

Selecting an emissions-relevant measuring point



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1. You will find a suitable gauge fitting (1) for the exhaust gas measurement in the exhaust line in front of the flue opening.
 - For more information on the installation location of the gauge fitting (1), see P&I diagram. You can find the document in the order-specific operating manual.

Performing an emissions-relevant exhaust gas measurement

- ✓ Commission the genset, see [Start the genset \[▶ 136\]](#)
 - ✓ Exhaust system has warmed up to operating temperature
 - ✓ Instrumentation has been calibrated according to manufacturer instructions
 - ✓ Work in pairs
1. Select a measuring point on the on-site exhaust line.
 2. **CAUTION! Touching hot components can cause minor to severe burns. Wear fireproof gloves.** Unscrew the sealing plug from the measuring point



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3. Check whether the genset is running with the highest operation-relevant load (maximum load: 100 %)
 - Push the measuring sensor (2) into the measuring point.
 - Start the measuring procedure.
 - **NOTE! The procedure for exhaust gas measurement depends on the measuring device used. Observe the instructions from the manufacturer.** Read and document measurement results from the display (1).
4. Repeat the measurement procedure for the following load ranges:
 - Average operationally relevant load (ideal load: 75 %)
 - Minimum operationally relevant load (minimum recommended load: 50 %)
 - Minimum load (minimum load: >30 % in automatic operation)
5. Assess the result after each measurement. See section *Assessing the measurement result*.
6. After each measurement, correct the nitrogen oxide concentration according to the measurement result. See section *Correcting nitrogen oxide concentration in the exhaust gas*.

Assessing the measurement result

1. **NOTE! The oxygen concentration depends on the type of fuel gas. When biogas is used, the oxygen concentration is approx. 7 % by volume. When natural gas is used, the oxygen concentration is approx. 11 % by volume.** Assess the oxygen concentration
 - An excessive oxygen concentration indicates external fresh air intake or an incorrect engine setting. Remedy the cause and repeat the measurement.

- Too low oxygen concentration indicates an incorrect engine setting or a defective measuring device. Remedy the cause and repeat the measurement.
2. Convert the nitrogen oxide values' unit of measurement:
 - $\text{NO (ppm)} + \text{NO}_2 \text{ (ppm)} = \text{NO}_x \text{ (ppm)}$
 - $\text{NO}_x \text{ (ppm)} \times 2.05 (21 \% - 5 \%) / (21 \% - O_{2 \text{ meas}}) = \text{NO}_x \text{ mg/m}^3$
 3. If the measurement result is incorrect, you must correct the set combustion chamber temperature.

Correcting nitrogen oxide concentration in the exhaust gas

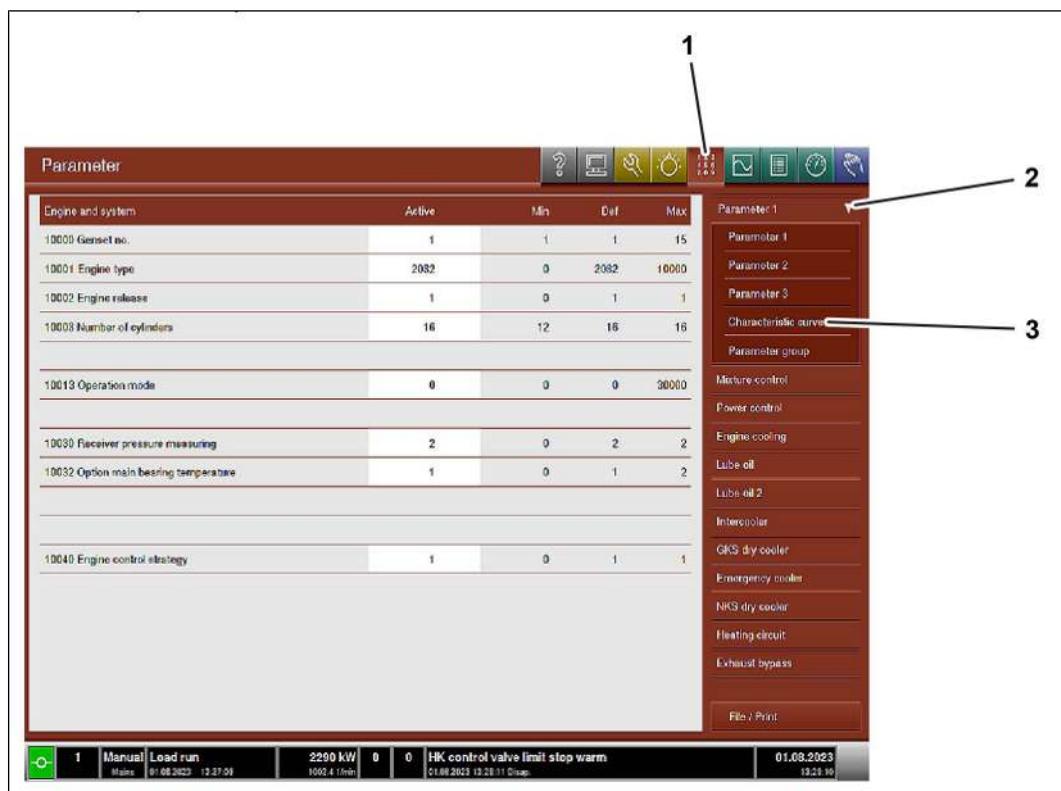
NOTE! If you have measured a nitrogen oxide value higher than the value specified in the genset data sheet, you must lower the combustion chamber set temperature. If you have measured a nitrogen oxide value lower than the value specified in the genset data sheet, you must raise the combustion chamber set temperature.

Additional information on adjusting the combustion chamber set temperature for special gas types or operating modes can be found in the Service Bulletins:

- Notes for the TCG 2020 series can be found in [Service Bulletin \(SM\) 6643 Reduction of the combustion chamber temperature](#).
- Notes for all other series can be found in [Service Bulletin \(SM\) 6540 Setting Values and Mode of Operation for Biogas](#).

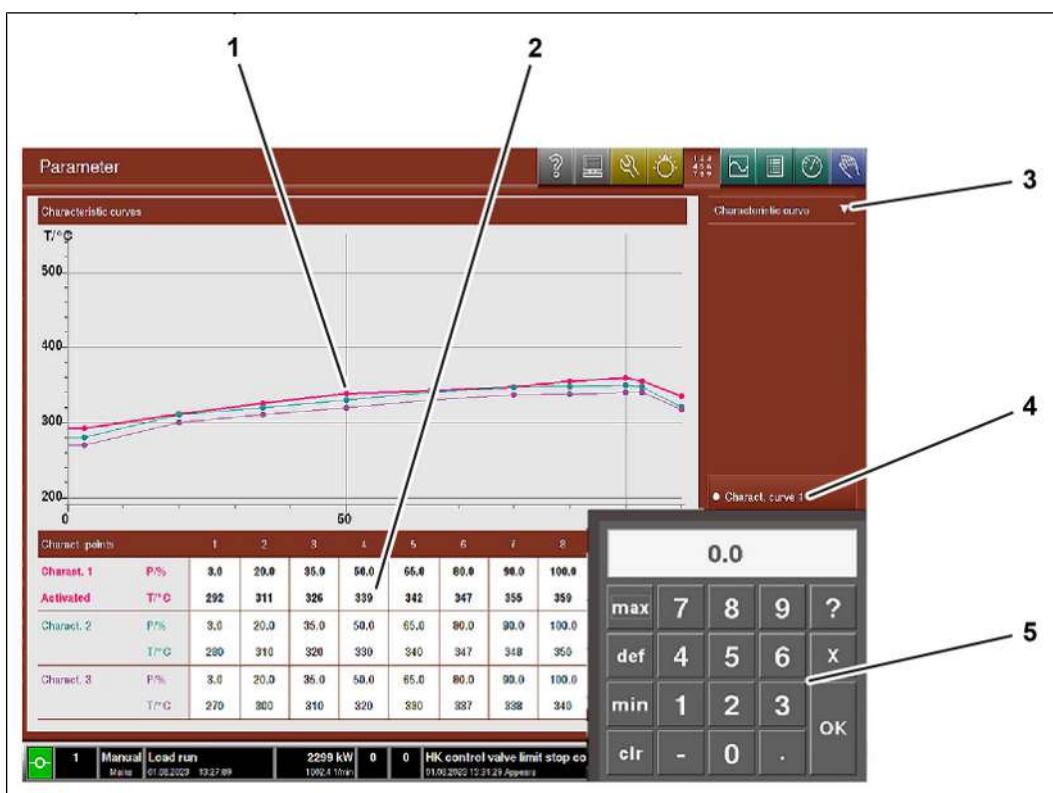
Contact your service partner for assistance.

- ✓ Measuring device is connected to the measuring point and is in operation.
1. **CAUTION! The operator must take into account deviating nitrogen oxide values when operating the genset. Deviating nitrogen oxide levels cause environmental damage and engine damage. The operator must maintain the nitrogen oxide values specified in the genset data sheet.** Compare the converted nitrogen oxide value with the genset-specific value
 - The genset-specific value is indicated on the genset data sheet. You will find the document in Chapter [Technical data \[▶ 11\]](#) in the order-specific operating manual.



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2. Adjust the combustion chamber set temperature.
 - Open the functional group Parameters (1).
 - Open subgroup Parameters 1 (2).
 - Select subgroup Characteristic curve (3).



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3. Open subgroup Characteristic curve (3).
4. Activate subgroup Characteristic curve 1 (4).
5. **NOTE! 10 points on the characteristic curve are defined for each combustion chamber set temperature curve. The intervals between the characteristic curve points correspond to a load change of 10 %. For example, if you want to change the combustion chamber set temperature for the 30 % load range, select characteristic curve point 3 (1). In the Characteristic curves dialog area, select the characteristic curve point that you wish to modify**
 - In the characteristic curve table, select the associated table cell (2). An input field (5) opens.
 - **CAUTION! In the dialog, never change the characteristic curve by dragging the characteristic curve points. Dragging the characteristic curve results in interval steps that are too large. The control will automatically apply the modified values to the characteristic curve table.** Using the keypad, change the new value for the combustion chamber set temperature in 2 to 3 K increments.
6. After each change, allow the genset to continue running unaltered for at least 5 minutes.
7. Measure the nitrogen oxide concentration in the exhaust gas.
 - Perform the exhaust gas measurement as described above.
8. Continue to adjust the combustion chamber set temperature according to the measurement result, if necessary.

-
9. **NOTE! The combustion chamber set temperature characteristic curve must have a continuous contour. The combustion chamber set temperature characteristic curve must not have any discontinuities.** Adjust the combustion chamber set temperature for the neighboring load points if necessary
 10. Repeat the procedure until the required nitrogen oxide limit value has been reached.
 - The nitrogen oxide limit has been met when the nitrogen oxide measurement plus the measuring instrument's measurement error are cumulatively below the nitrogen oxide limit.
- ⇒ **NOTE! The setting is for stationary operation. In transient operation, the emissions may deviate from the configured nitrogen oxide values.** The exhaust gas measurement is complete, and the nitrogen oxide value has been set.

Checking the mounting buffers

Valid for:
TCG 2020 K, TCG 2020

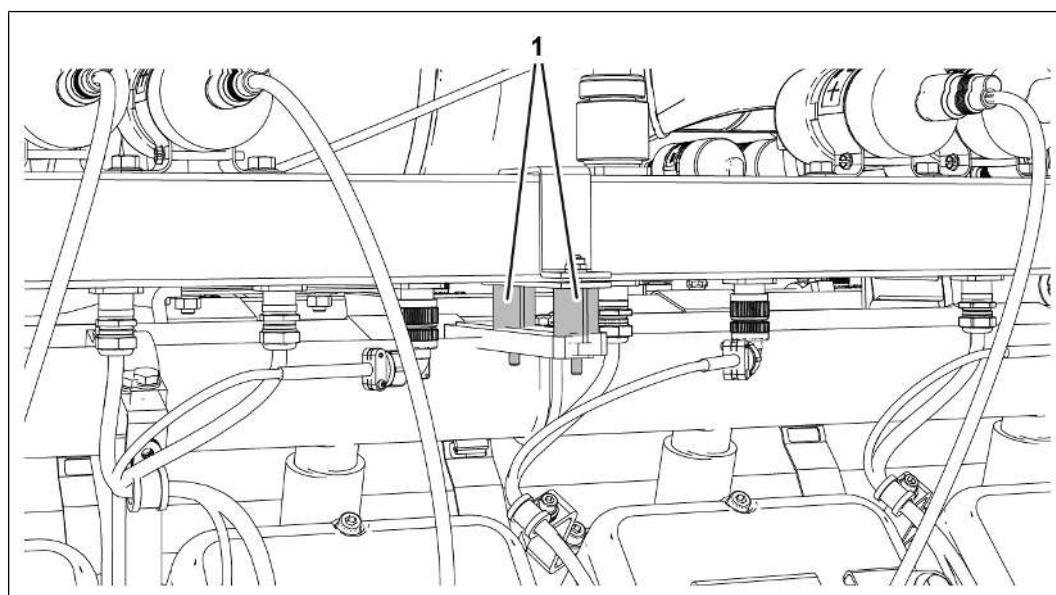


Tools:

- Standard tools

Checking the mounting buffer:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).



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1. Visually inspect mounting buffer (1) for visible defects.
 - In the case of visible defects replace the mounting buffer, see OL-MRA10 / 00-47-01 [Removing and installing the mounting buffers \[▶ 296\]](#).
 - Visible defects are cracks, porosity or other damage.
2. Check all screw connections for tight fit.
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Removing and installing the mounting buffers

Removing the mounting buffers

Valid for:

TCG 2020 K, TCG 2020

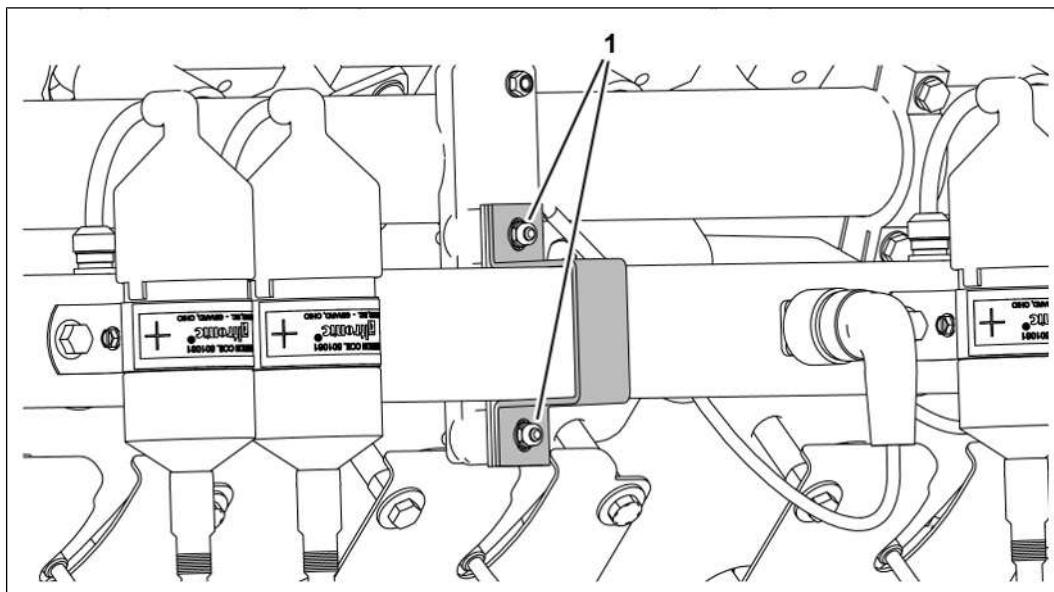


Tools:

- Standard tools

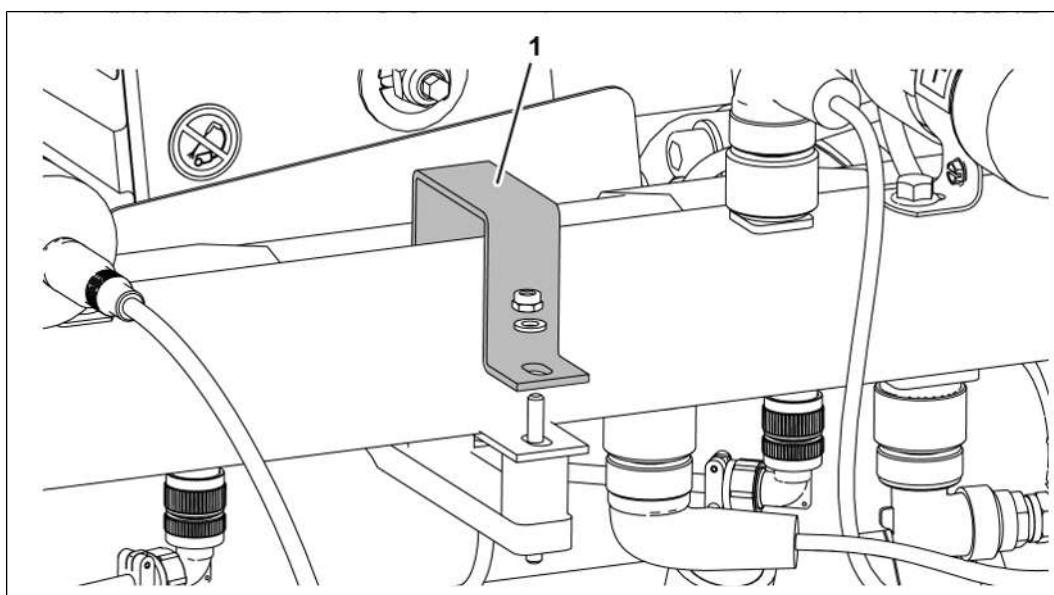
Removing the mounting buffer:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 163](#).



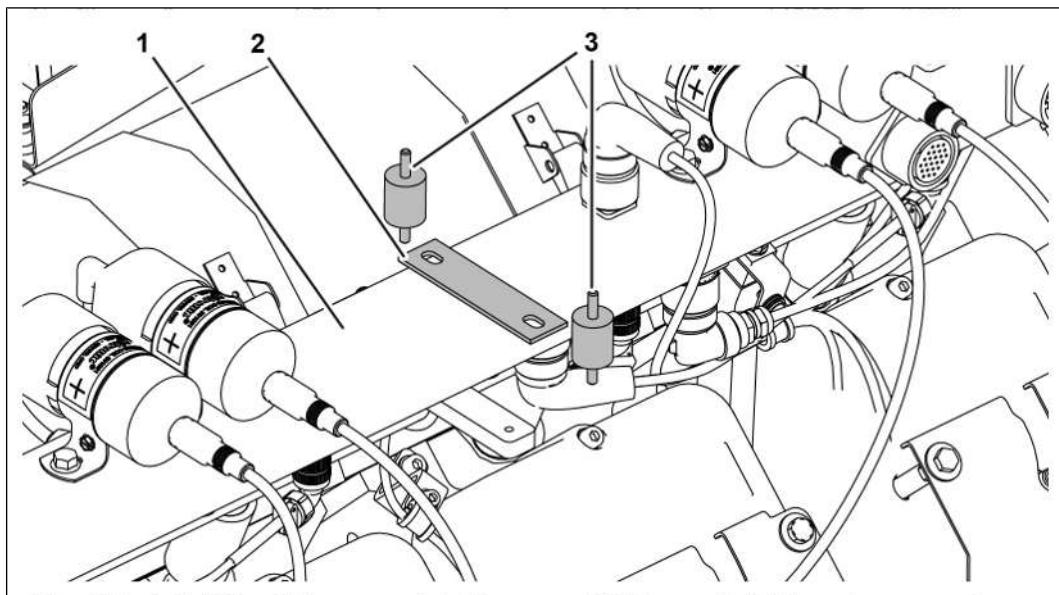
2616702347

1. Unscrew nuts (1).



2616704779

2. Remove upper part of bracket (1).



2616707211

3. Slightly lift multifunction rail (1).
4. Remove lower part of bracket (2) and mounting buffer (3).

Installing the mounting buffers

Valid for:

TCG 2020 K, TCG 2020



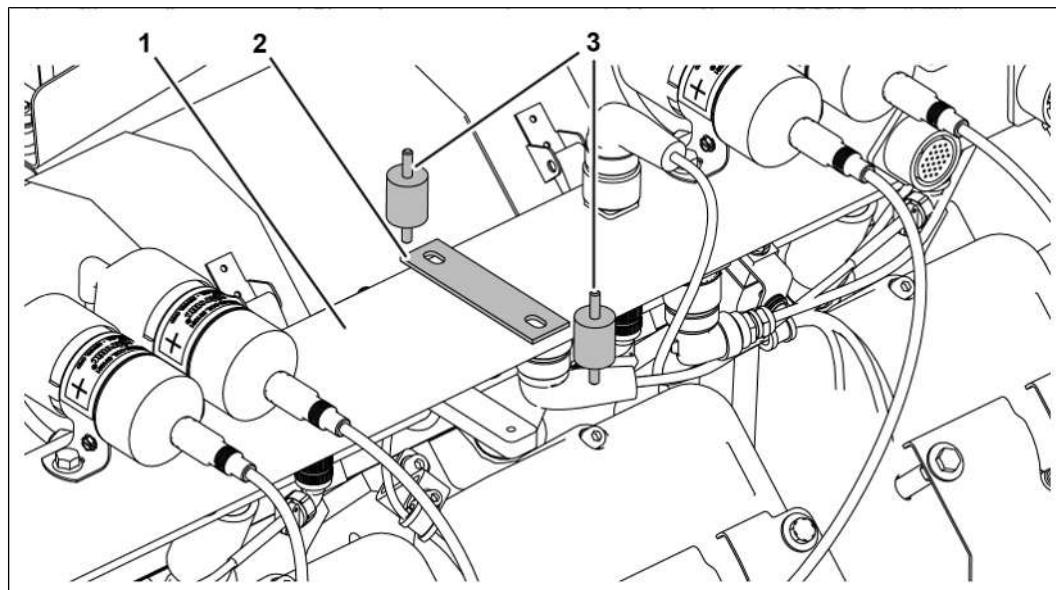
Tools:

- Standard tools



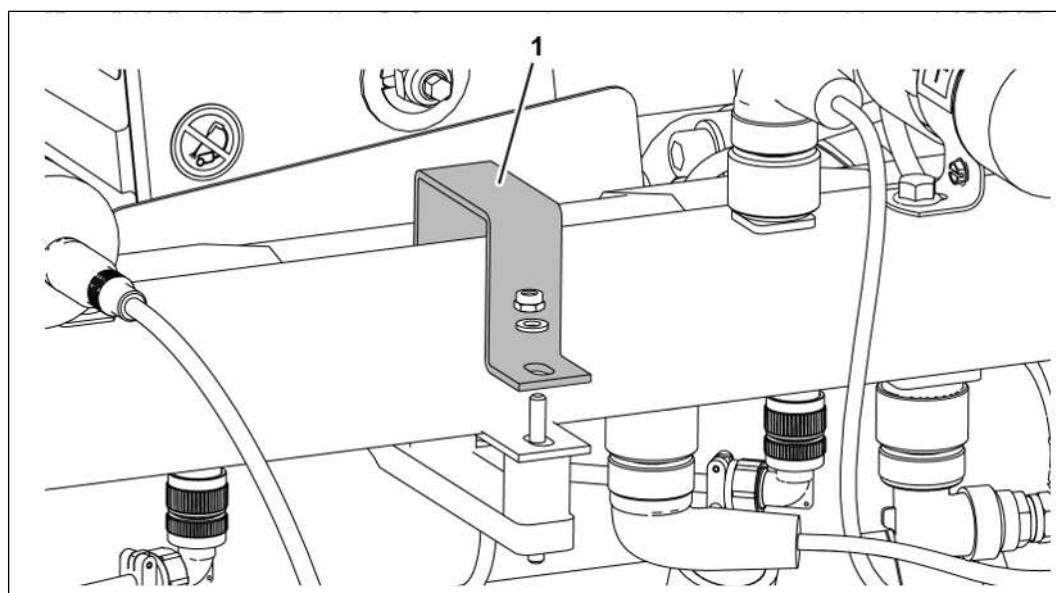
Spare parts:

- Mounting buffers, if necessary

Installing the mounting buffer:

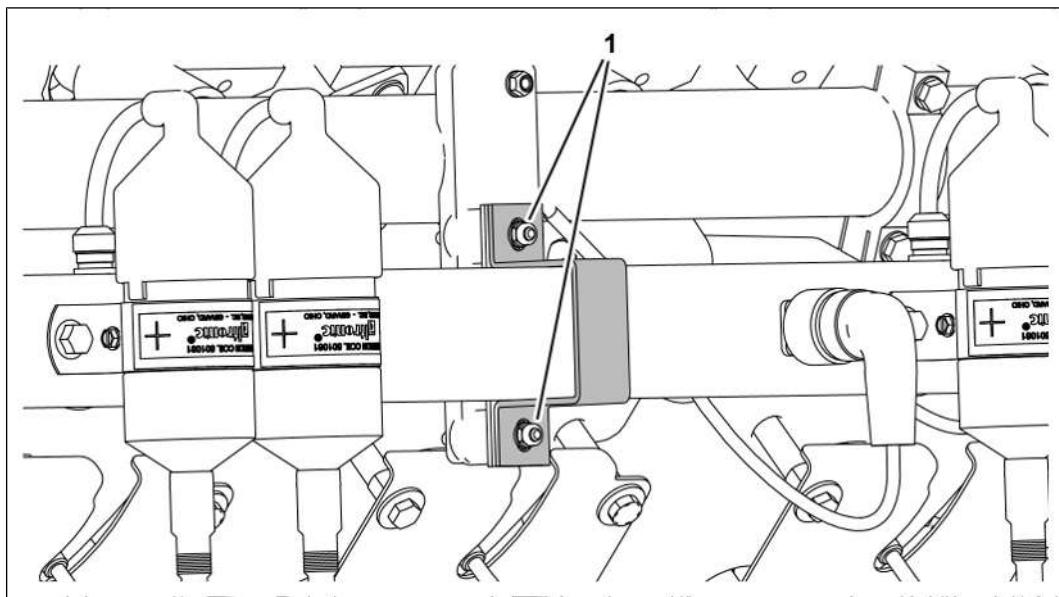
2616707211

1. Slightly lift multifunction rail (1).
2. Insert lower part of bracket (2) and mounting buffer (3).



2616704779

3. Mount upper part of bracket (1).



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4. Tighten nuts (1).

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Checking the rubber expansion joint

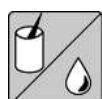
Valid for:

TCG 2020 K, TCG 2020, TCG 3020



Tools:

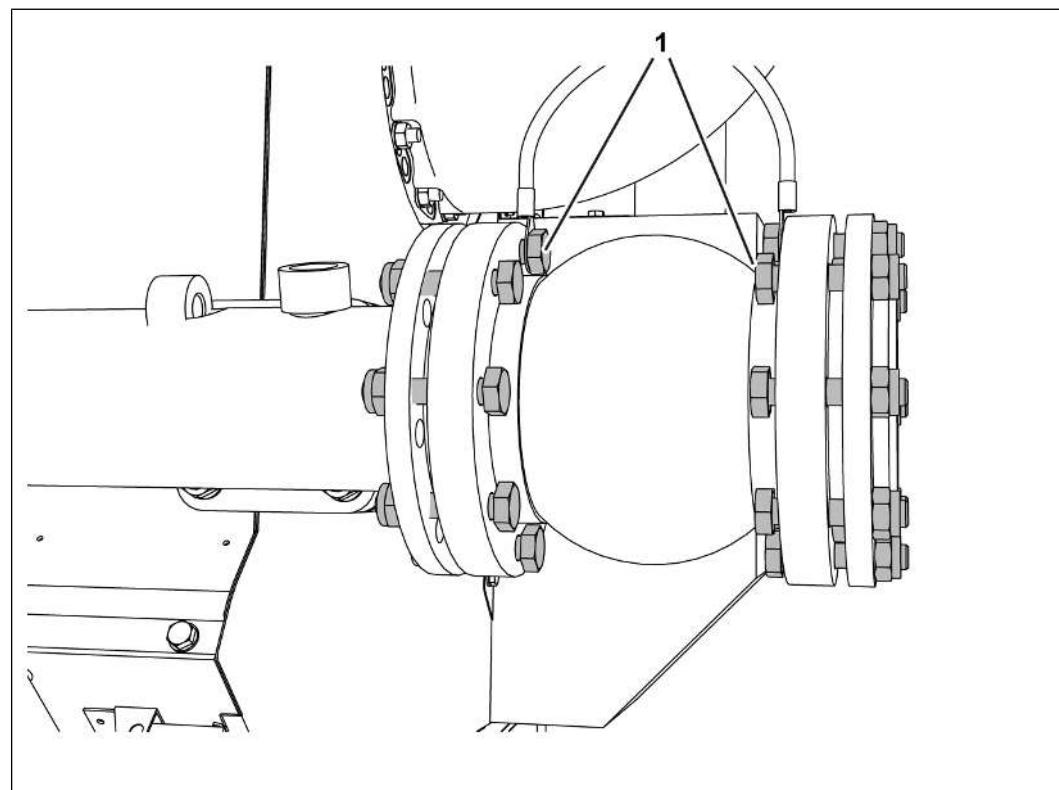
- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



Auxiliary media:

- Standard cleaning agent
 - (e.g. soap)

Technical data



492132619

Rubber expansion joint on flange			
1	Screw ¹⁾	M10 x 30 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 30 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 40 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 45 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 50 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 55 - 8.8	20 Nm

¹⁾ Counterhold the nut when tightening.

General information



Risk of destruction of components

Incorrectly installed rubber expansion joints

Damage to the component or environment

- Note the colored marking of the rubber expansion joint, as this indicates the permissible type of use.
 - ⇒ Orange/blue for coolant.
 - ⇒ Red/blue for mineral lube oils.
 - ⇒ Yellow/blue/yellow for synthetic lube oils.



CAUTION

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.



Risk of destruction of components

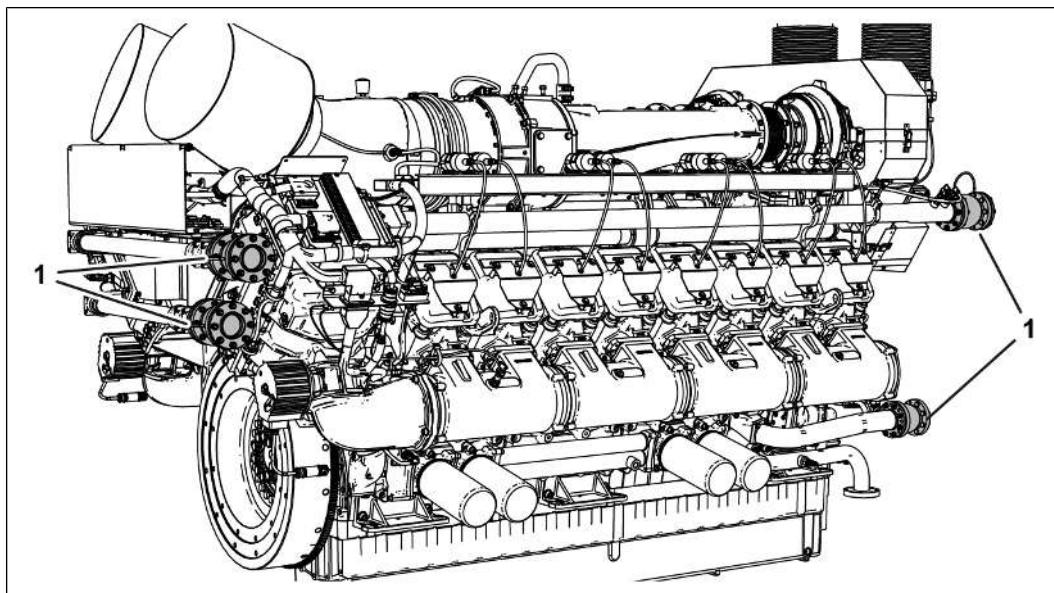
Risk of destruction of components

The rubber bellows can be damaged or destroyed due to incorrect cleaning.

- Do not use solvents.
- Do not use sharp objects as cleaning aids.
 - Do not use wire brushes or sandpaper.
- Use only soap and warm water for cleaning.

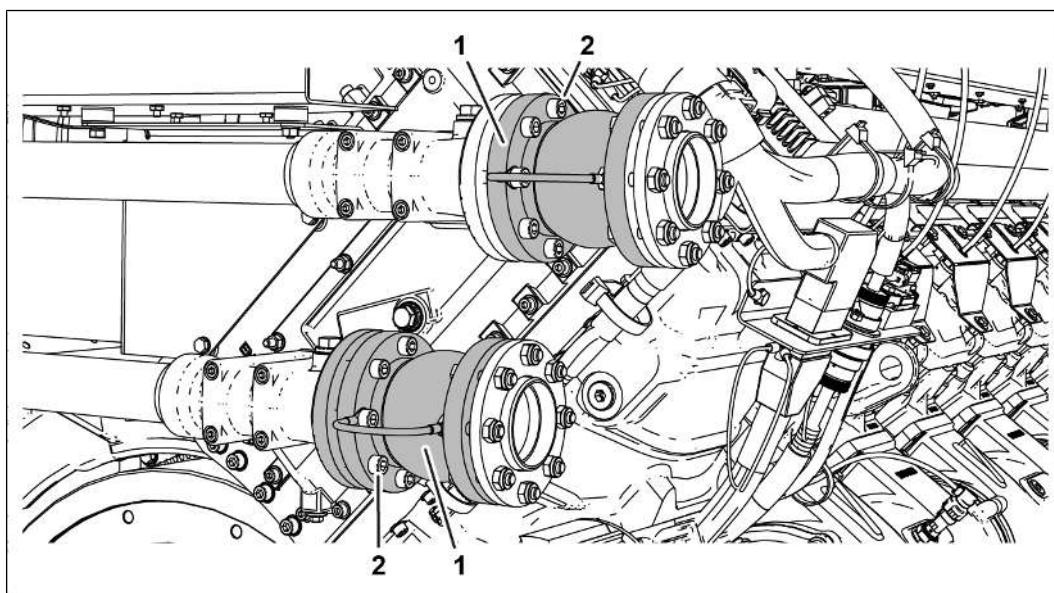
Checking the rubber expansion joint:

- ✓ Decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 163\]](#).



492135051

1. Visually inspect the rubber expansion joint (1) for visible defects.
 - In the case of visible defects, replace the rubber expansion joint, see [OL-MRA10 / 00-50-01 Removing and installing the rubber expansion joint \[▶ 305\]](#).
 - Visible defects are, for example, formation of bubbles, surface cracks or uneven deformation.



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2. Clean the rubber bellows (1).
3. Check all screw connections (2) for tight fit.
 - Tighten screws while countering at the nuts if necessary.

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Removing and installing the rubber expansion joint

Removing rubber expansion joint

Valid for:
TCG 2020, TCG 3020



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

NOTE

The work described below is performed on one rubber expansion joint.

Proceed in the same way for all others.

Do not damage rubber bellows, do not allow any hard impacts or strokes, do not throw.

Do not attach chains or ropes to the rubber bellows section.



CAUTION

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-



Risk of destruction of components

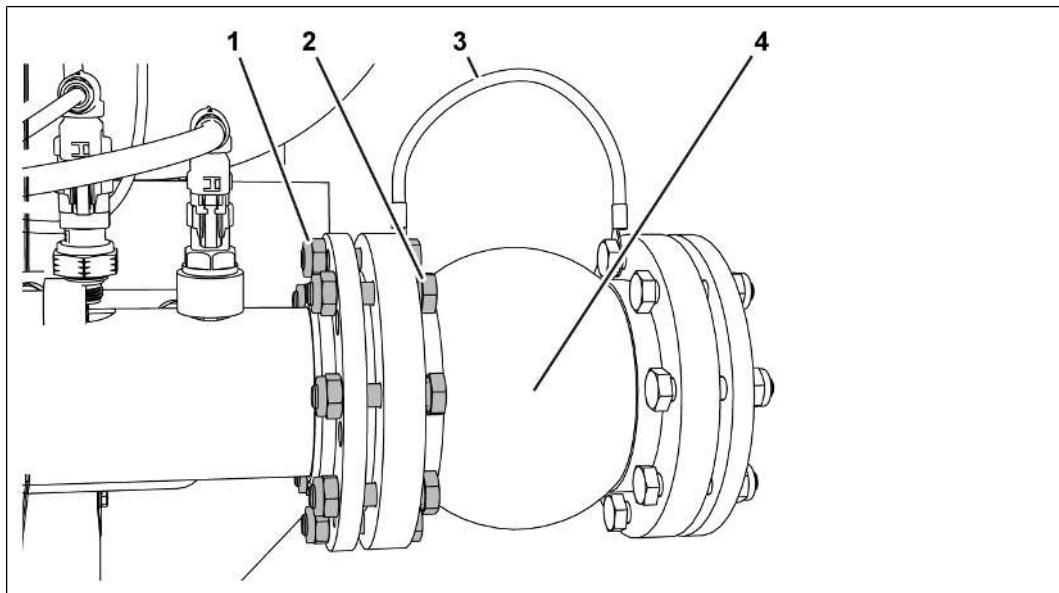
Incorrectly installed rubber expansion joints

Damage to the component or environment

- Note the colored marking of the rubber expansion joint, as this indicates the permissible type of use.
 - ⇒ Orange/blue for coolant.
 - ⇒ Red/blue for mineral lube oils.
 - ⇒ Yellow/blue/yellow for synthetic lube oils.

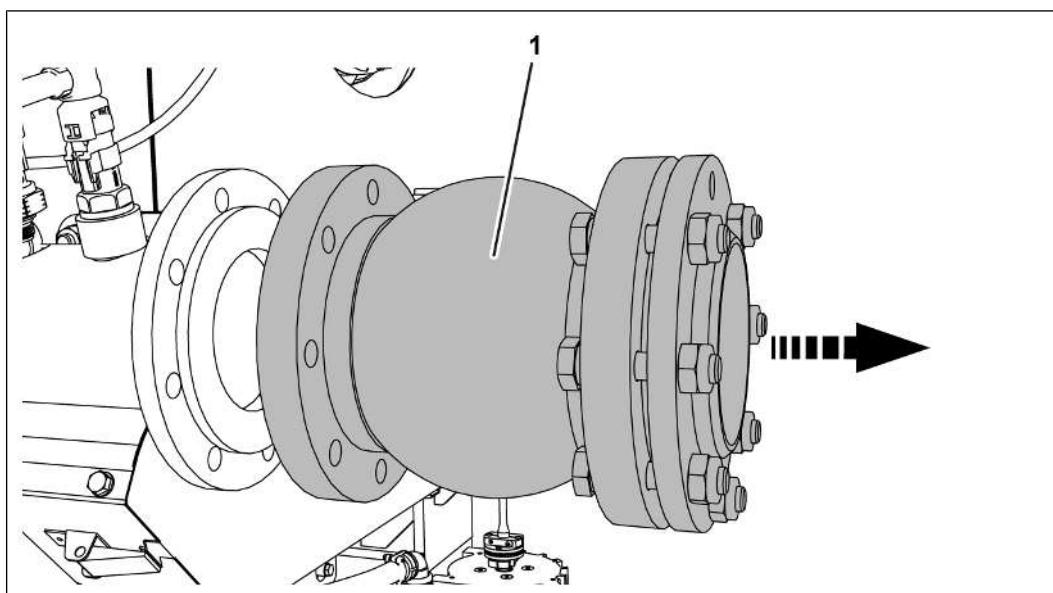
Removing rubber expansion joint:

- ✓ Empty the cooling system if necessary, see OL-MRA10 / 38-01-23 [Emptying the cooling system \[▶ 472\]](#).
- ✓ If necessary, pump out lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(without lube oil tank in base frame\) \[▶ 338\]](#).



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1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the rubber expansion joint (4).
 - **WARNING! Hold the wrench on the bellows side and turn the wrench on the side of the counter flange.** Unscrew screws (2).
 - Counterhold the nuts (1).
 - Remove the ground cable (3).



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3. Remove the rubber expansion joint (1) (arrow).
 - Place the rubber expansion joint on a suitable underlay.
 - Collect escaping medium.

Installing rubber expansion joint

Valid for:

TCG 2020 K, TCG 2020, TCG 3020



Tools:

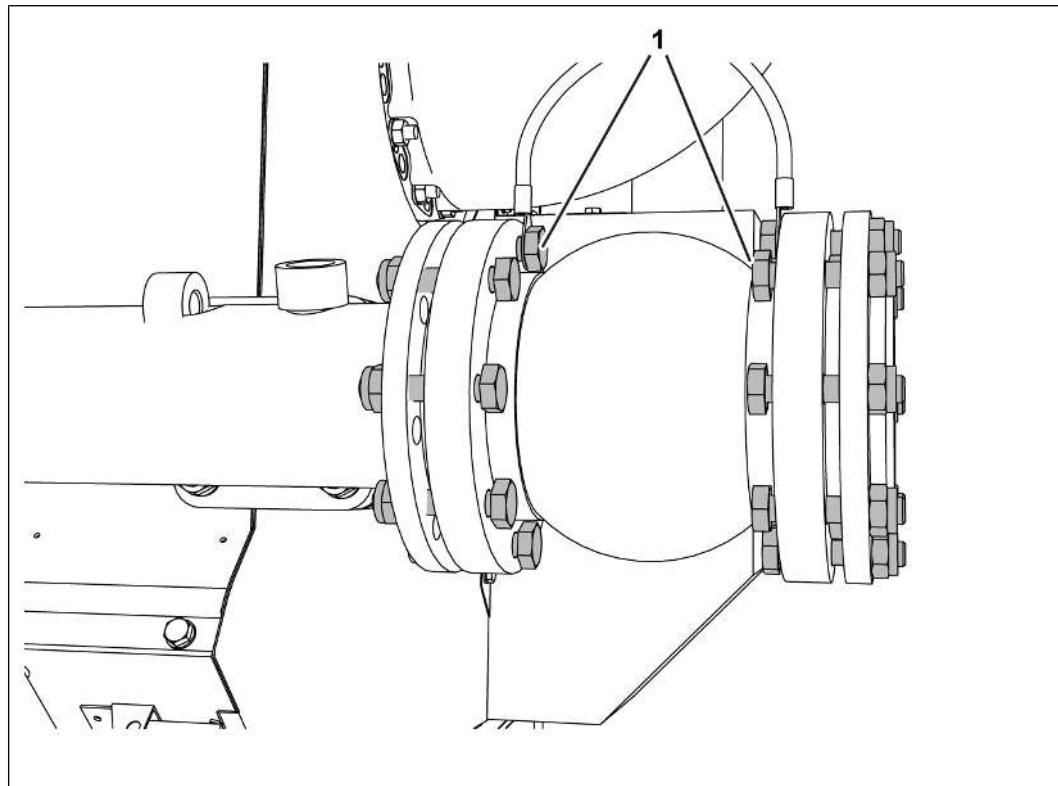
- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



Spare parts:

- If applicable, rubber expansion joint
- Self-locking hexagon nuts
- If applicable, cooling system protection agent
- Lube oil if necessary

Technical data



492132619

Rubber expansion joint on flange			
1	Screw ¹⁾	M10 x 30 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 30 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 40 - 10.9	20 Nm
1	Screw ¹⁾	M10 x 45 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 50 - 8.8	20 Nm
1	Screw ¹⁾	M10 x 55 - 8.8	20 Nm

¹⁾ Counterhold the nut when tightening.

General information

NOTE

The work described below is performed on one rubber expansion joint.

Proceed in the same way for all others.

Check rubber expansion joints for damage, e.g. from transport, before installation.

Keep both the interior and exterior of the rubber bellows clear of foreign bodies such as dirt or insulation material, and check this before and after assembly.

Do not damage rubber bellows, do not allow any hard impacts or strokes, do not throw.

Do not attach chains or ropes to the rubber bellows section.

The sealing surfaces of the flanges must be flat and clean.

Torsional stress (rotation) during assembly and operation is not permissible.

Rubber expansion joints must not be loaded mechanically.

Continuing piping must be fastened according to the specifications.

Protect rubber bellows during welding work; cover with non-conducting material.

Do not apply paint to or insulate the rubber bellows.

Seals are not required, since the surface of the rubber expansion joint serves as a seal.

Do not exceed the permissible test pressure of the rubber expansion joint.



Risk of destruction of components

Incorrectly installed rubber expansion joints

Damage to the component or environment

- Note the colored marking of the rubber expansion joint, as this indicates the permissible type of use.
 - ⇒ Orange/blue for coolant.
 - ⇒ Red/blue for mineral lube oils.
 - ⇒ Yellow/blue/yellow for synthetic lube oils.



Risk of destruction of components

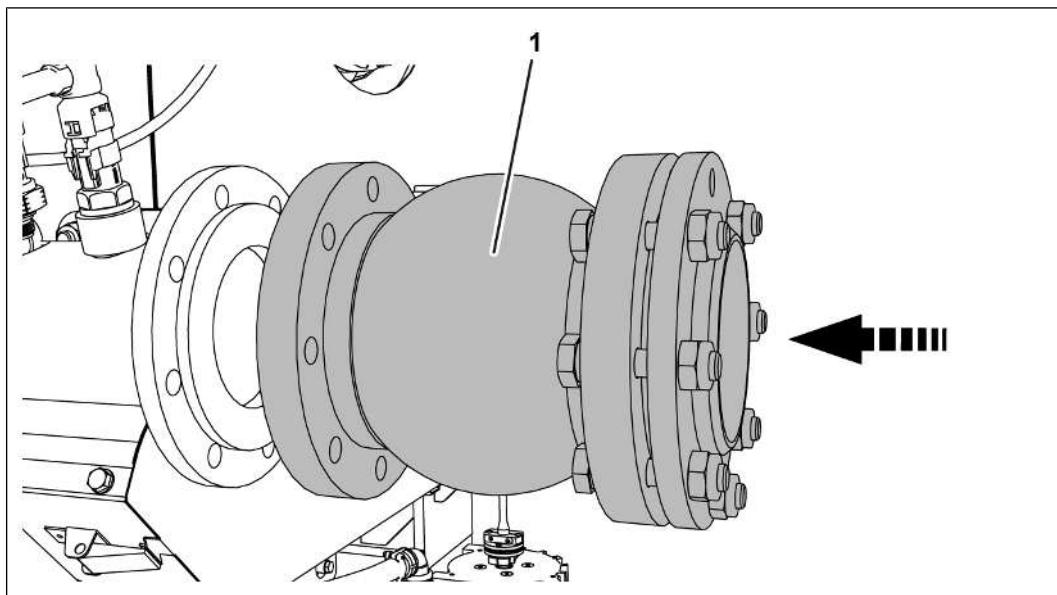
Risk of destruction of components

Due to incorrect tool handling.

- Hold the wrench on the bellows side and turn the wrench on the side of the counter flange.

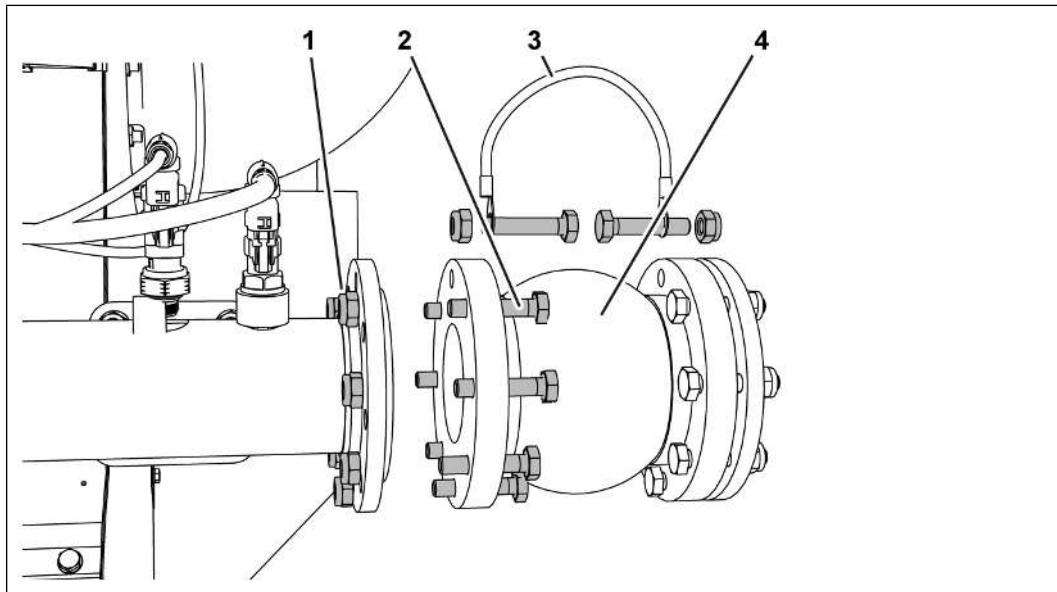
Installing rubber expansion joint:

1. Clean the sealing surface.
2. Check the component for damage and wear, see OL-MRA10 / 00-50-01 [Checking the rubber expansion joint \[▶ 301\]](#)



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3. Attach the rubber expansion joint (1) to the pipe (arrow).



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4. **WARNING! Hold the wrench on the bellows side and turn the wrench on the side of the counter flange.** Mount the rubber expansion joint (4)
 - **NOTE!** Always insert screws from the rubber bellows side to prevent damage to the rubber bellows from protruding screw threads. Tighten screws (2).
 - Attach the ground cable (3).
 - **NOTE!** Self-locking nuts must be replaced. Counter at the nuts (1).
5. Remove the collecting tray.
 - Properly dispose of collected operating medium.

-
- ⇒ If necessary, fill the cooling system, see OL-MRA10 / 38-01-23 [Filling the cooling system](#) [▶ 478].
 - ⇒ If necessary, top up the lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(without lube oil tank in base frame\)](#) [▶ 338].

Working with hexavalent chromium (Cr6)

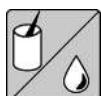
Valid for:

TCG 2020, TCG 2020 K, TCG 3020



Tools:

- Standard tools



Auxiliary media:

- Lube oil (WD-40)
 - Or comparable lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil](#).
- Personal protective equipment
 - Single-use nitril gloves according to standard EN374-1
 - Eye protection EN 166
 - Single-use protective suit (Tyvek brand)
 - Breathing protection FFP3 or maintenance-free half-mask with FFP3 filter
- For disposal
 - PVC bag
 - Lockable transport box
 - National regulations for disposal

General information

It is possible that yellow residue is visible on the heat or exhaust system.

NOTE

When working on components with hexavalent chromium (Cr6) residue

Wash hands and face before eating, drinking or smoking.

Wash hands before using the restroom.



Danger to the environment

Incorrectly transported, stored and disposed of components or operating media

When working with hexavalent chromium (Cr6), take appropriate measures to protect persons and the environment.

- Collect and dispose of hexavalent chromium (Cr6) properly according to the national regulations.
-

**WARNING**

Injuries due to improper handling when working with components contaminated with hexavalent chromium (Cr6)

This can lead to minor or severe injuries.

- Close off the working area for unauthorized persons.
- Wear personal protective equipment.
- Avoid contact with skin.
- Use a suitable tool for inserting and removing the components into and from the tank.
- Use a suitable tank.
- Treat residues and components according to national regulations.
- Take off soiled clothing immediately and dispose of them according to the national regulations.

Visually inspecting the genset for yellow residue:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)
1. Yellow residue is visible on the protective cover or exhaust system.
 - Yellow residue (arrows) on a protective cover of the exhaust system.
 - Yellow residue (arrows) on an exhaust system.
 2. Photograph residue.
 3. Document appraisal as follows:
 - Engine serial number.
 - Engine series.
 - Engine operation location/region.
 - Engine operating hours.
 - Engine construction site.
 - Where was residue found.
 - If applicable, part/area of the engine/etc.

Remove yellow residue:

1. Put on personal protective equipment.
 - Single-use protective suit (Tyvek brand).
 - Single-use nitril gloves according to standard EN 374-1.
 - Eye protection EN 166.
 - Breathing protection FFP3 or maintenance-free half-mask with FFP3 filter.
2. Close off work area against unauthorized access.

-
3. Dampen yellow residue (arrows) with lube oil (WD-40).
 4. Remove yellow residue (arrows).
 - Scrape off residue and collect with suitable equipment.
 - Wipe off residue with a cleaning cloth.
 5. Dispose of residue according to the national regulations.
 6. Take off protective equipment.
 - Store protective equipment in a suitable container for hazardous waste and dispose of in accordance with national regulations.
 7. Clean face and hands with water and soap.
 8. For further assistance, please contact your responsible service partner.
 - Requests are forwarded by the service center to the technical support and to CES Service EHS.

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Checking the crankcase chamber pressure

Valid for:

TCG 2020

Technical data

Crankcase chamber pressure	
On commissioning	-2 mbar to -4 mbar

General information



Risk of destruction of components

Risk of destruction of components

The engine can be destroyed due to incorrect crankcase chamber pressure.

- If the TEM shuts down the genset and displays the P145 Crankcase chamber fault message, do not restart the genset.
- Do not acknowledge the fault message.
- Contact service partner.

Check the crankcase chamber pressure:

The screenshot shows the TEM software interface with several functional groups listed on the right side:

- 1. Data
- 2. Overview
- 3. Engine
- Heating/cooling circuits
- Gas/mixture
- Air/Generator
- Ignition energy
- Wastegate
- Data/counterd measurements
- Operating information
- Screenshot

Callouts indicate the following:

- Callout 1 points to the "Data" button in the top menu bar.
- Callout 2 points to the "Engine" button in the functional group list.
- Callout 3 points to the "P145 Crankcase" parameter in the "Measured values" section of the main data table.

Key data visible in the main table include:

Comb. chamber	Side A	Side B	Speed, power
Cylinder 1	123 °C	125 °C	Operation mode Mains
Cylinder 2	166 °C	172 °C	E199.7 Demand active 0.0%
Cylinder 3	150 °C	150 °C	E198.3 Internal set power 0.0%
Cylinder 4	133 °C	134 °C	Power switch 0 ↘
Cylinder 5	141 °C	140 °C	E198.6 Power limit 110.0%
Cylinder 6	161 °C	145 °C	E198.4 Set power 0.0%
Cylinder 7	148 °C	132 °C	E198.2 Actual power 0.0%
Cylinder 8	156 °C	158 °C	S200 Engine speed 0.01/min
Throttle valve 0.0%			
Average value 145 °C 142 °C			
Gas mixer	-715 Steps	-65 Steps	Lube oil
T200 Lube oil 48.8 °C			
P198 Lube oil before filter 6.44 bar			
Lube oil after filter 6.12 bar			
L234.1 Lube oil level 78.2%			
Measured values			
Intake air	35.3 °C	35.3 °C	Exhaust gas
Receiver	47.8 °C	48.0 °C	Speed ATL 0 t/s 0 t/s
T202 Jacket water GK inlet	44.7 °C		T206 Exhaust after engine 542 °C
T207 Jacket water engine inlet	59.7 °C		Exhaust after CAT 204 °C
T206 Jacket water engine outlet	54.4 °C		
P145 Crankcase	-2.7 mbar		
P371 Start air	33.75 bar		

At the bottom of the screen, there is a footer bar with various status indicators and system information.

2617793291

1. Tap the Data button (1) in the menu.
– The Functional group "Data" group opens.

2. Tap the Engine button (2) in the menu.
 - The Engine group opens.
 - Parameter P145 Crankcase (3) is displayed in the measured values.
3. In the menu, read the measured value (3) for the crankcase chamber pressure in parameter P145 Crankcase.
 - The displayed measured value is 0.00 mbar, service the crankcase ventilation.
 - Above a measured value of -4 mbar, contact service partner and service the gas pressure controller.

Checking the crankcase ventilation (model UPF)

Tools:



- Standard tools
- Special tool
 - Measuring instrument for differential pressure measurement (e.g. ecom DP-Engine)
 - Measuring instrument for separating quality (e.g. DusTTRAK model 8520)

Spare parts:



- Seal for screw plugs

Technical data

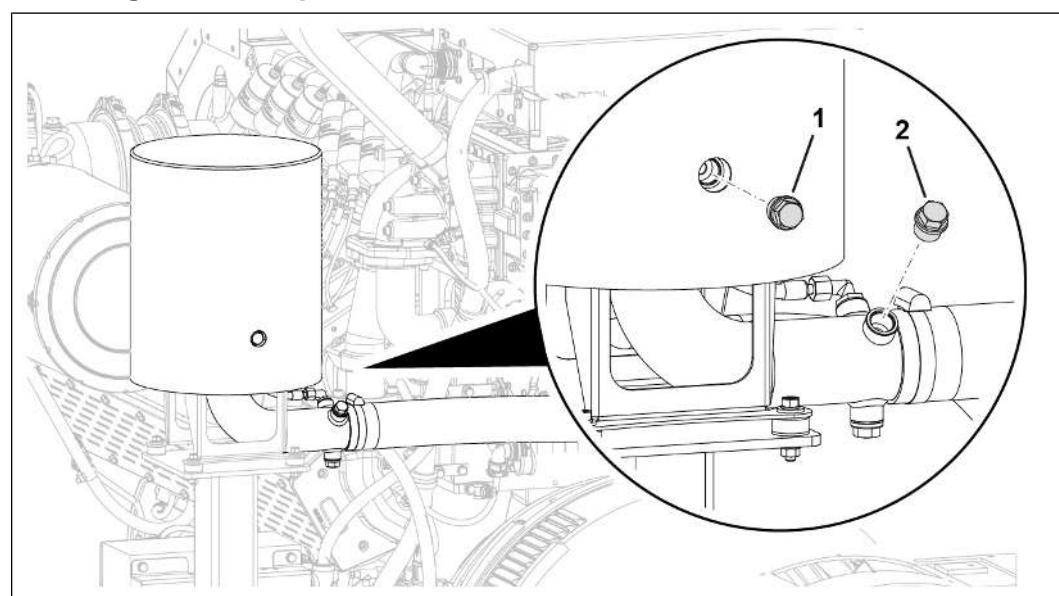
Notes

The measurements can only be performed when the genset is in operation.

The pressure controller is set to a fixed value and sealed at the factory. Modifications to the pressure controller are not permissible.

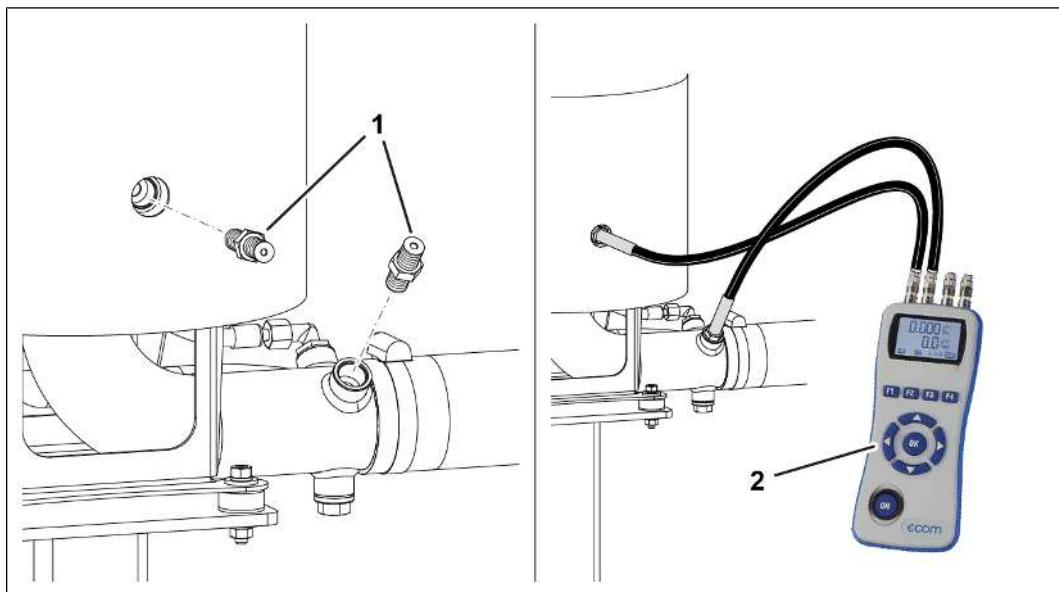
The filter insert must be replaced after a coolant leak in the lube oil system.

Measuring differential pressure



1960730251

1. Unscrew screw plug (1) and remove sealing ring.
2. Unscrew screw plug (2) and remove sealing ring.



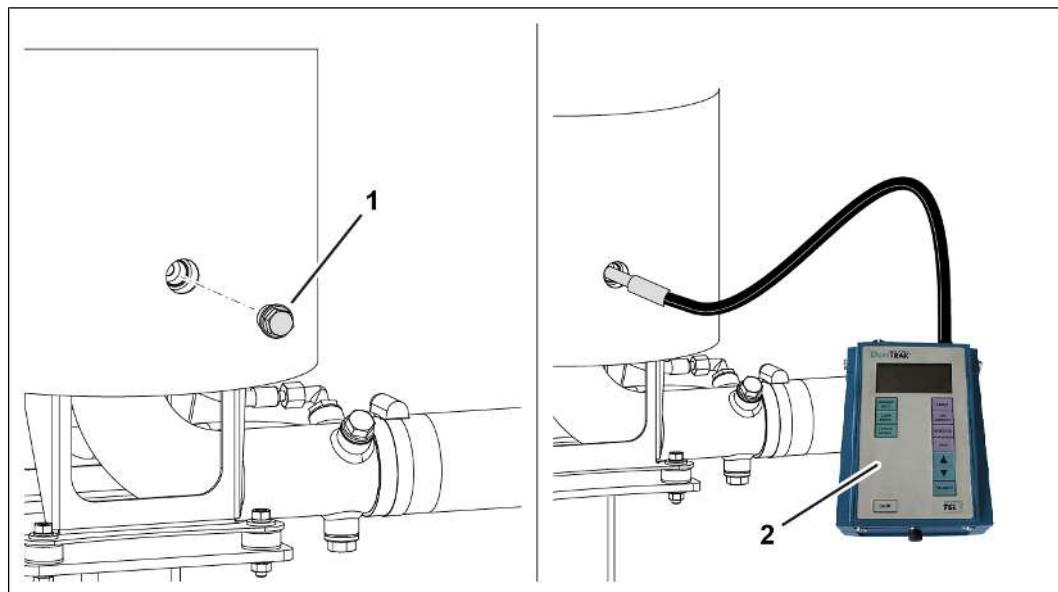
1960730763

3. Screw in fitting (1).
4. Connect measuring instrument (2, e.g. ecom-DP-Engine).
5. Perform differential pressure measurement.
6. Dismantle measuring instrument.
7. Unscrew fitting.
8. Tighten screw plugs with new sealing ring.

Measuring the separating quality

NOTE

Measurement of the lube oil content in the blow-by in front of the crankcase ventilation is not possible due to insufficient measuring range of the Measuring instrument.



1960731275

1. Unscrew screw plug (1) and remove sealing ring.
2. Connect measuring instrument (2, e.g. DusTTRAK model 8520).
3. Measure separating quality.
4. Dismantle measuring instrument.
5. Tighten screw plug with new sealing ring.

Servicing the crankcase ventilation (Dynapure model)

Valid for:

TCG 2020



Tools:

- Standard tools
- If required, measuring device for separating quality
- Special tool
 - Assembly tool, Order No. 909-190500
 - Disassembly tool, Order No. 909-190501
 - Vibration measurement device for imbalance monitoring



Auxiliary media:

- Cleaning fluid
- Acid-free grease
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Filter insert
- Filter insert
- Base filter
- Filter disc
- Aluminum grating
- Cover gasket
- Engine seal

Technical data

Imbalance of the drum		
50 Hz	2810 rpm	Max. 7.0 mm/s
60 Hz	3340 rpm	Max. 8.0 mm/s

General information

The drawn in mixture is swirled and accelerated by a rotating drum so strongly that the micro-fine lube oil mist particles develop into small droplets.

These are separated from the air by means of the sieve and inertia effect in the rotating filter drum.

- The lube oil regained in this way flows via the drain back into the genset room or lube oil tank

NOTE

Special tools required

The special tools required for the work process can be obtained from:

- Umwelt Technik 99 AG, Sunnehof, CH-8493 Saland, Switzerland
-

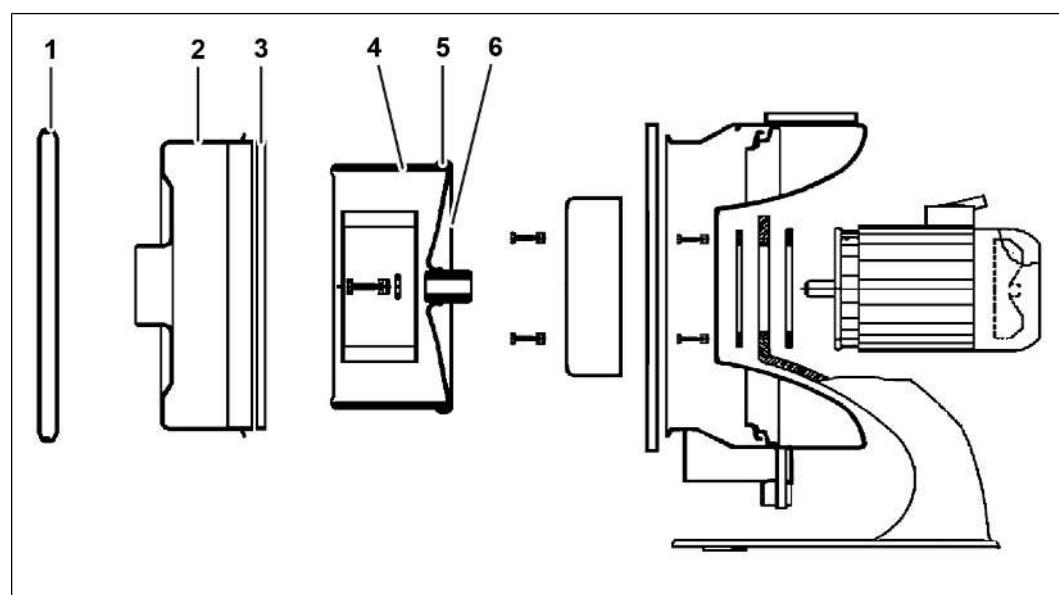
NOTE

Incorrect use of special tools

Observe the manufacturer's instructions when handling the special tools.

Removing the filter insert and base filter:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]

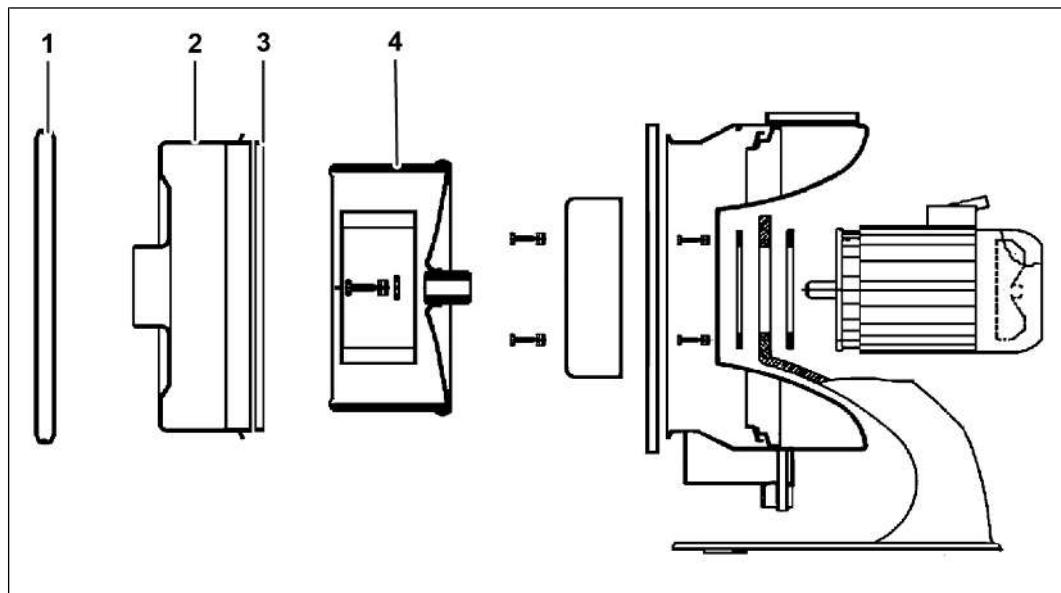


3011602059

1. Loosen clamping ring (1).
2. Remove cover (2).
3. Remove seal (3).
4. Mark the interfaces of the filter insert (4 and 5) in the drum.

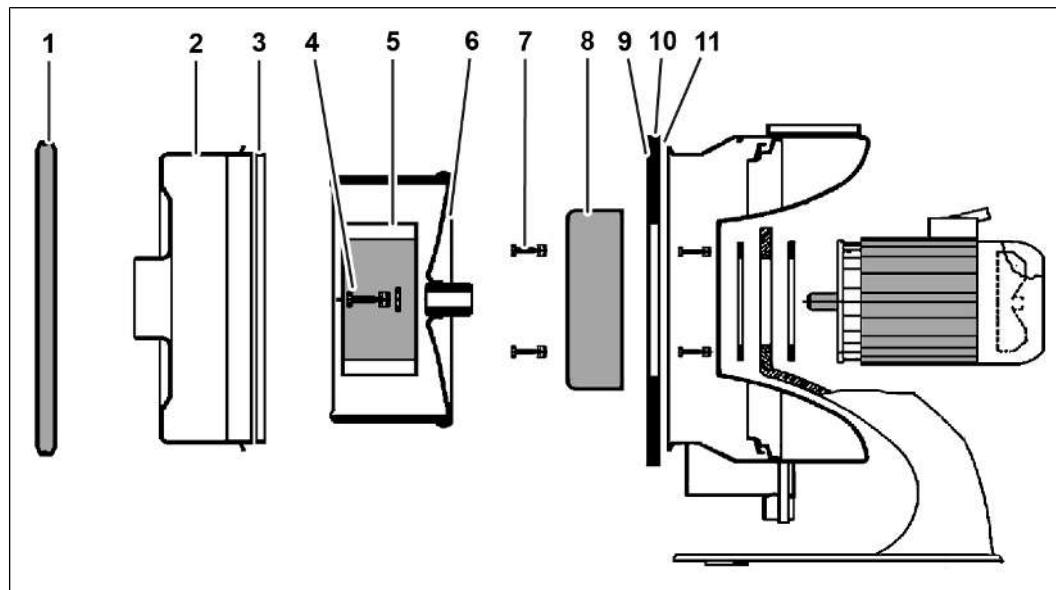
5. Remove filter insert.
6. Check base filter (6).
 - Renew base filter, if necessary.

Installing the filter insert and base filter:



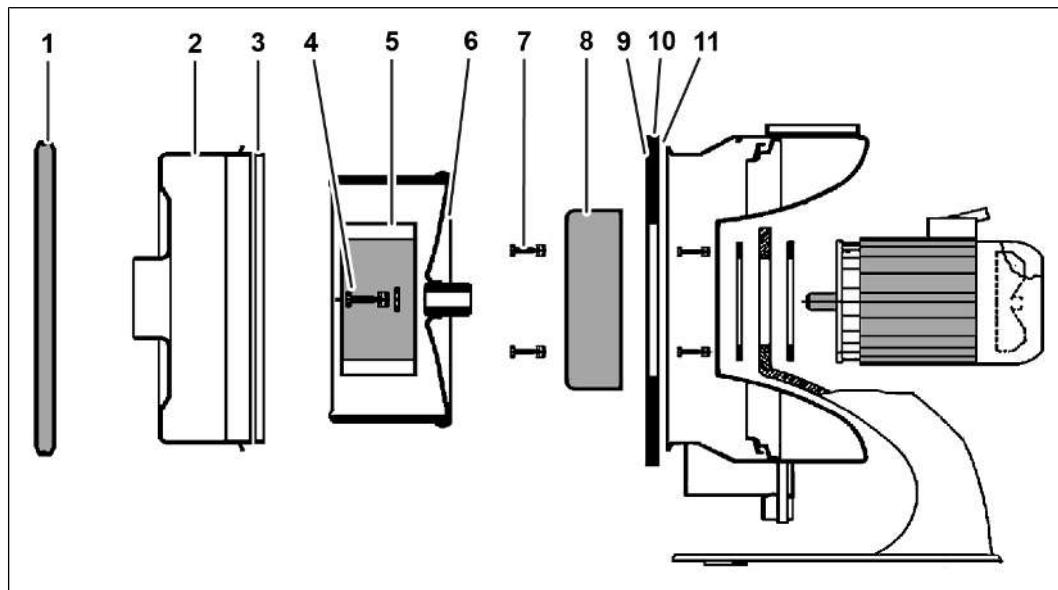
3011604491

1. Insert filter insert (4).
 2. Observe markings in the drum.
 - Mark the interfaces of the filter insert.
 3. Attach seal (3).
 4. Set down housing cover (2).
 5. Fasten clamping ring (1).
 6. Balance drum.
- ⇒ Commission the genset, see [Start the genset \[▶ 136\]](#)

Removing the filter disc with aluminum grating:

3011606923

1. Decommission the genset, see [Stopping the genset \[▶ 163\]](#).
2. Loosen clamping ring (1).
3. Remove housing cover (2).
4. Remove seal (3).
5. Unscrew screws (4).
6. Remove turbo wheel (5).
7. Remove drum (6).
 - Remove from the shaft with disassembly tool.
8. Unscrew screws (7).
9. Remove retention drum (8).
10. Remove filter disc (10) and aluminum grid (11).
11. Check wire grating (9).
 - Renew wire grating, if necessary.

Installing the filter disc with aluminum grating:


3011606923

1. Insert wire grating (9), aluminum grating (11), and filter disc (10).
2. Insert retention drum (8).
3. Tighten screws (7).
4. Install drum (6).
 - Push onto the shaft as far as it will go using the assembly tool.
5. Insert turbo wheel (5).
6. Tighten screws (4).
7. Attach seal (3).
8. Set down housing cover (2).
9. Fasten clamping ring (1).
10. Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).
11. Check crankcase ventilation for function and leaks.

Servicing the crankcase ventilation (UPF model)

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Measuring instrument for separating quality
- Bottle brush
- If required, hose for water column
- If required, measuring instrument for blow-by quantity
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



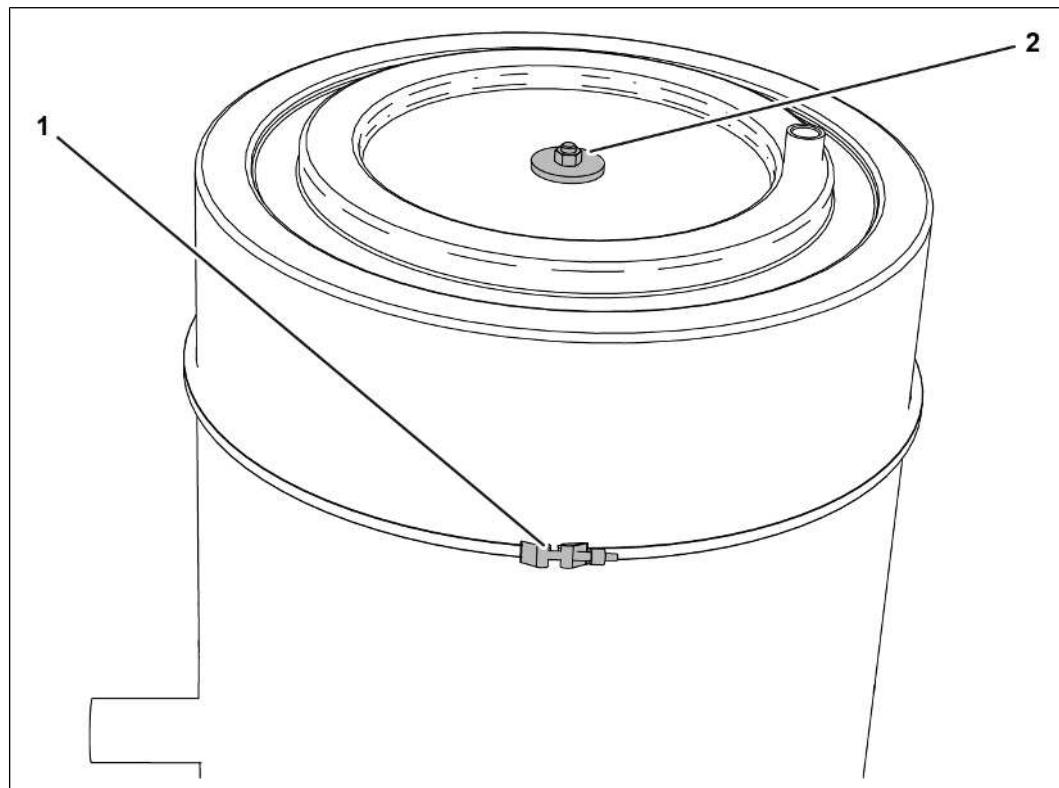
Auxiliary media:

- Cleaning fluid
- Acid-free grease
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Inner filter insert
- Outer filter insert
- Seals, if necessary

Technical data


3011493387

Crankcase ventilation		
Clamping clip on filter housing		
1.	Screw	M8 x 60 Hand tight
Filter cover on housing		
2.	Nut	M10 10 Nm
Differential pressure at full load		
Inner filter insert	Stage 1	35 to 80 mm WS
Outer filter insert	Stage 2	0 to 1 mm WS
WS=water column		

Limit values for separating quality		
Inner filter insert	Stage 1	Max. 5 mg/m ³
Outer filter insert	Stage 2	Max. 0.1 mg/m ³

General information

Note the determined values (measured values) on the measurement sheet.

- The form for documenting the test values can be found in the Service Library [OL-MRA10 01-01-01 Crankcase ventilation measurement sheet](#).



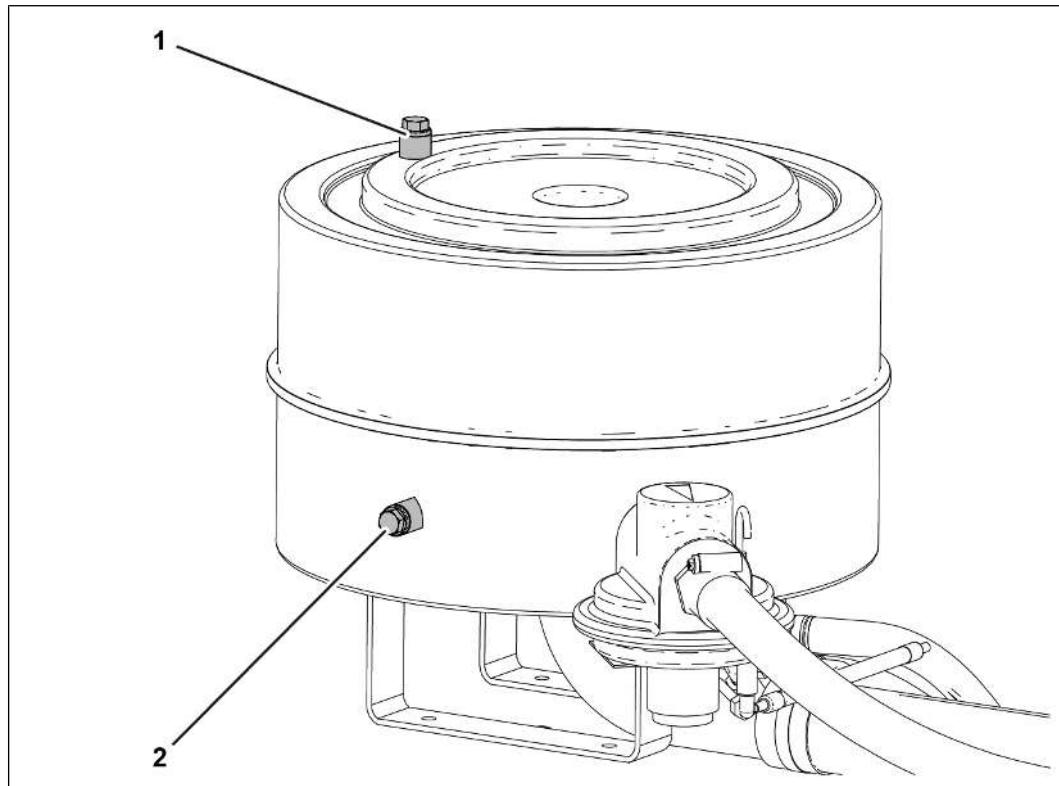
Danger to the environment

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
- Collect escaping operating media and soak it up with thickeners if necessary.
- Always store operating media separately and in tightly sealed tanks intended for those materials.
- Properly dispose of operating media and components in accordance with national regulations.

Measuring the separating quality:



3011615115

NOTE

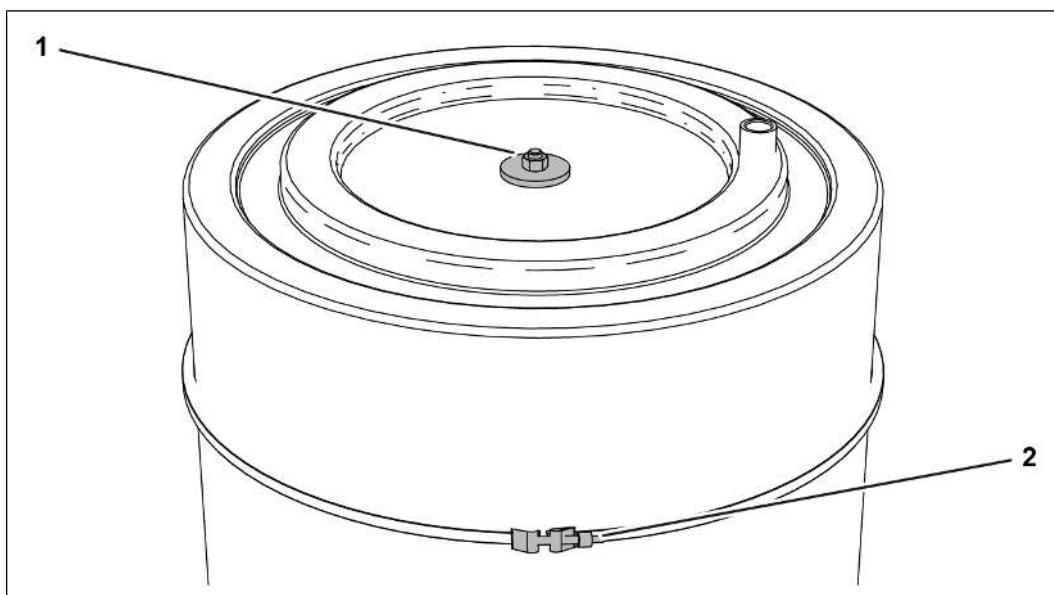
Incorrect measurement

Observe the manufacturer's instructions when handling the measuring instrument.

1. Measure the lube oil content using the measuring instrument after the first stage (inner filter insert) (1).
2. Note the determined values (measured values) on the measurement sheet.
 - The form for documenting the values can be found in the Service Library [OL-MRA10 01-01-01 Crankcase ventilation measurement sheet](#).
3. Measure the lube oil content using the measuring instrument after the second stage (outer filter insert) (2).
4. Note the determined values (measured values) on the measurement sheet.
 - The form for documenting the values can be found in the Service Library [OL-MRA10 01-01-01 Crankcase ventilation measurement sheet](#).
5. If the measured value exceeds the limit value, renew the filter insert.

Removing the filter inserts:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



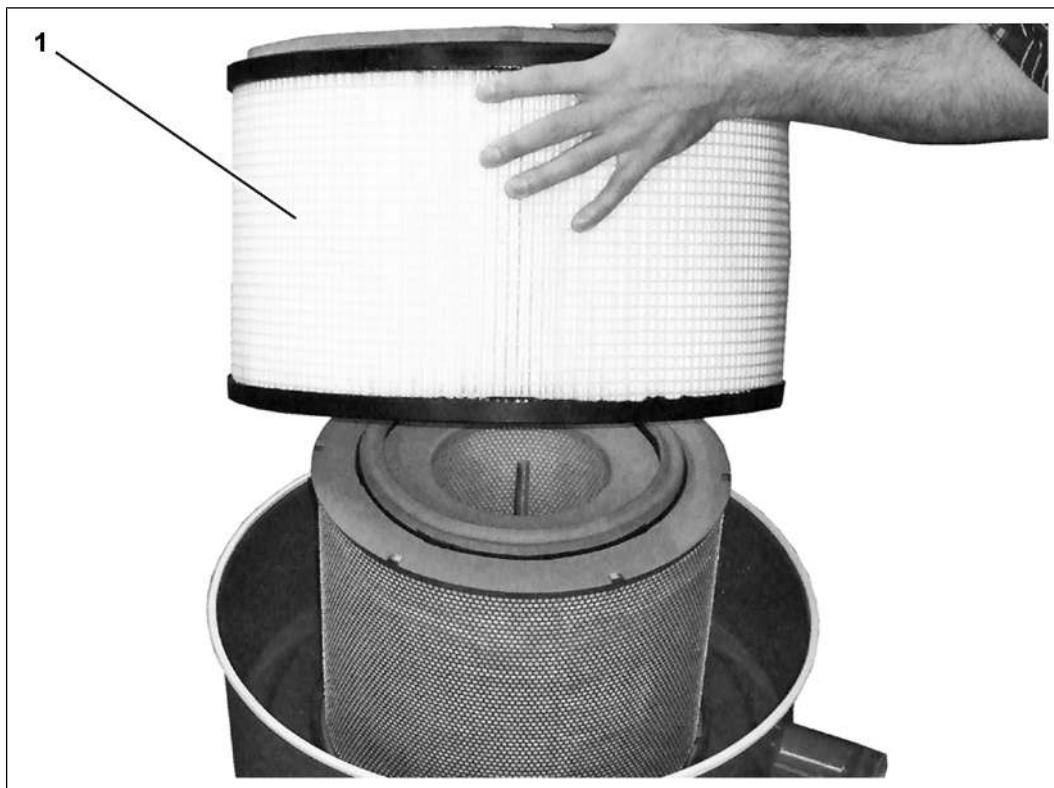
3011528331

1. Unscrew nut (1).
2. Dismantle clamping clip.
 - Unscrew screw (2).
 - Unscrew the screw (2) on the opposite side.
 - Remove clamping clip.



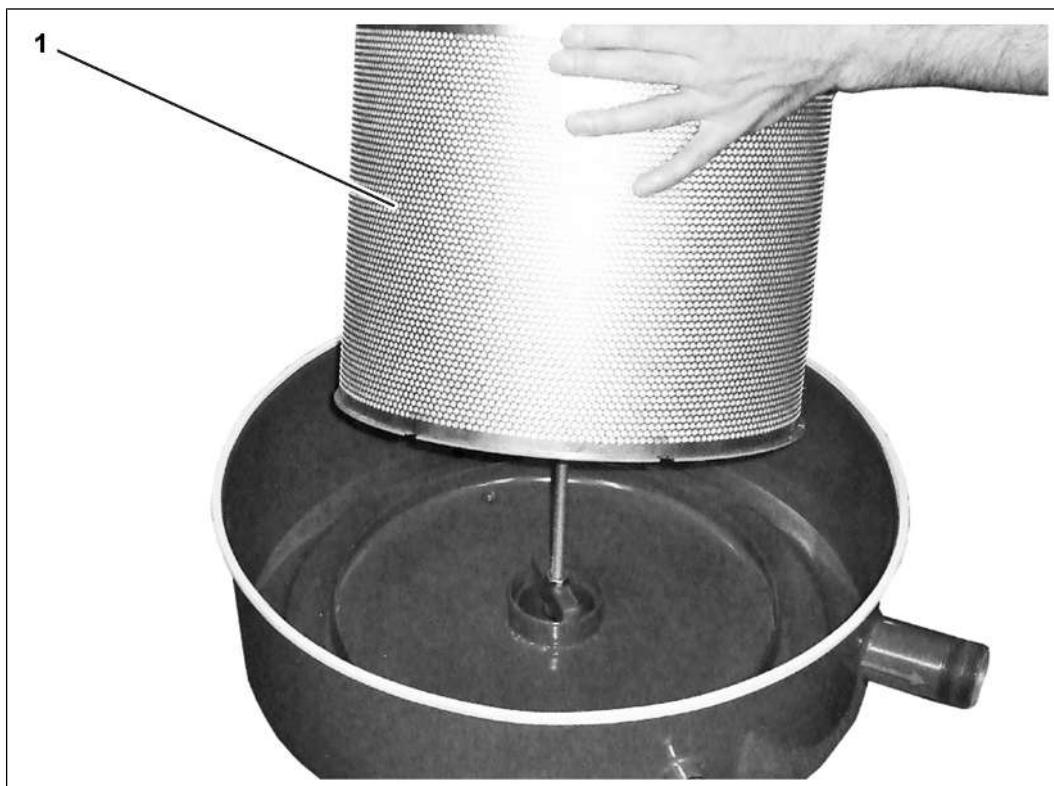
3011537675

3. Remove cover (1).
 - Remove rubber seal (2).



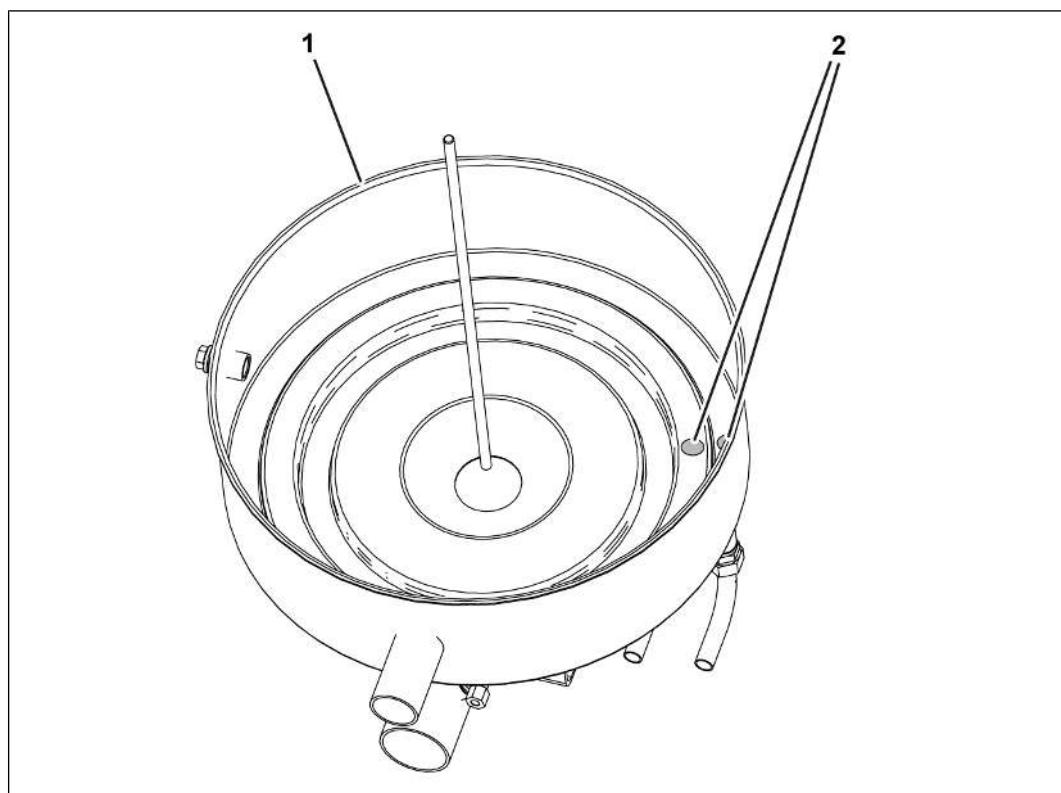
3011547019

4. Remove outer filter cartridge (1).



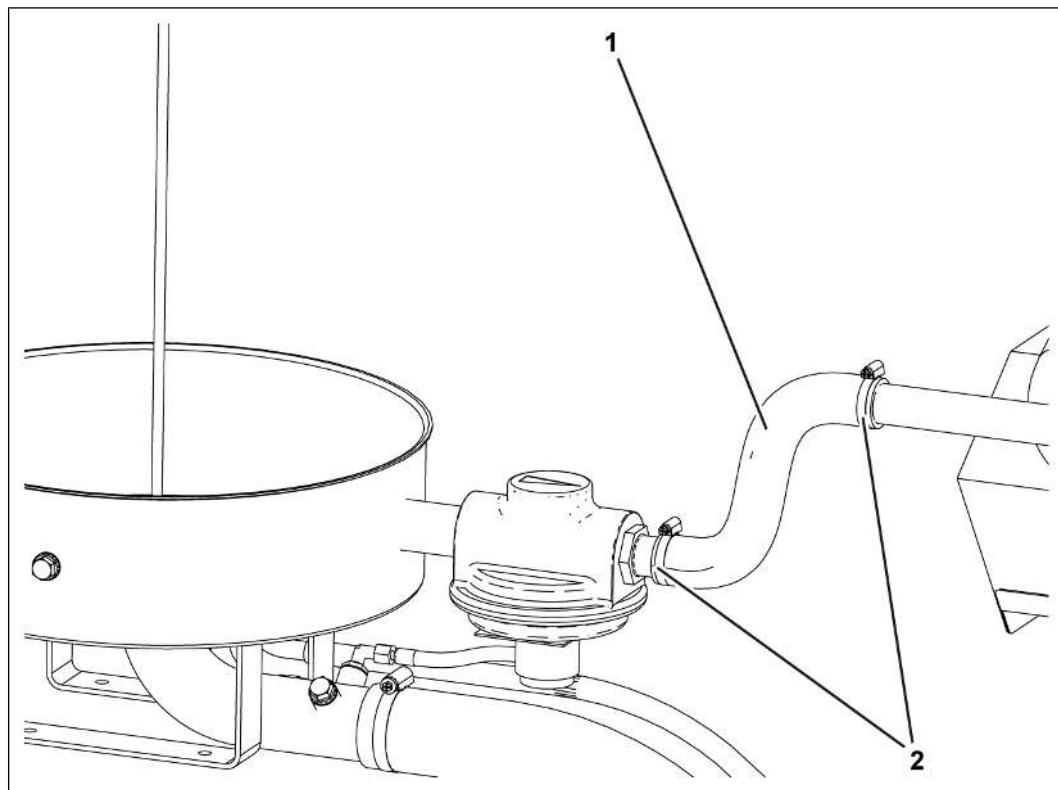
3011556363

5. Remove inner filter cartridge (1).



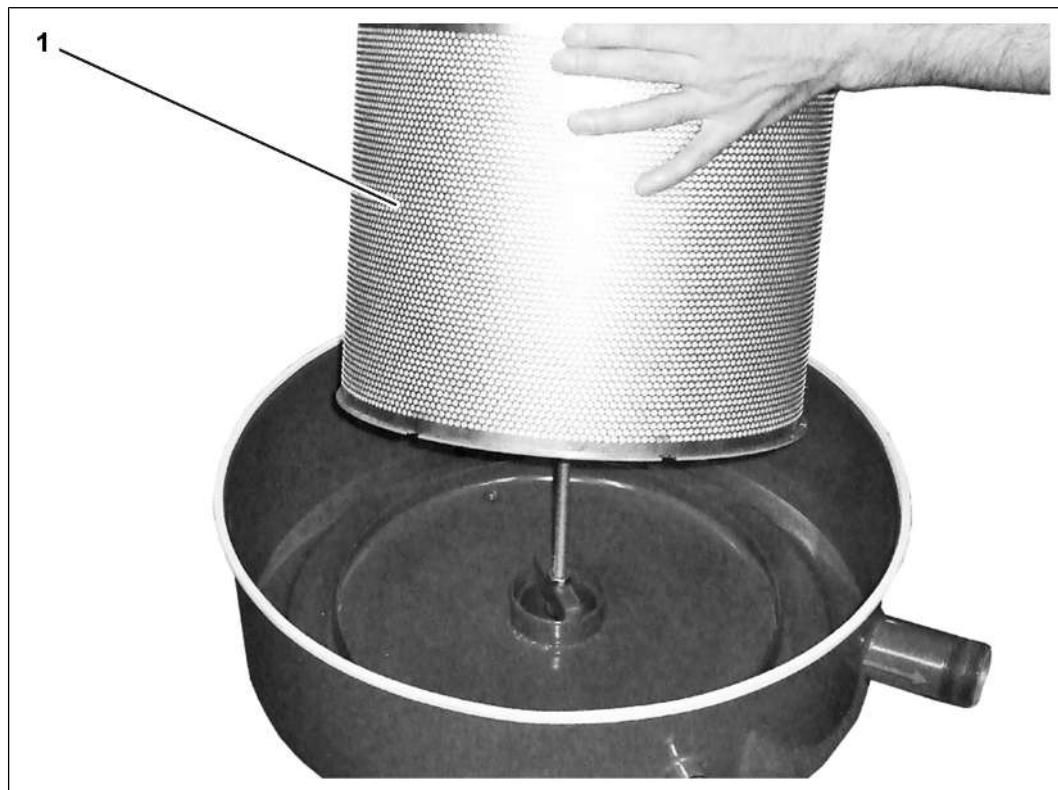
3011565707

6. Check rubber seal (1) for damage.
 - Renew the rubber seal if necessary.
7. Clean the drain holes (2).
 - Ensure no dirt or cleaning liquid gets into the drain holes.



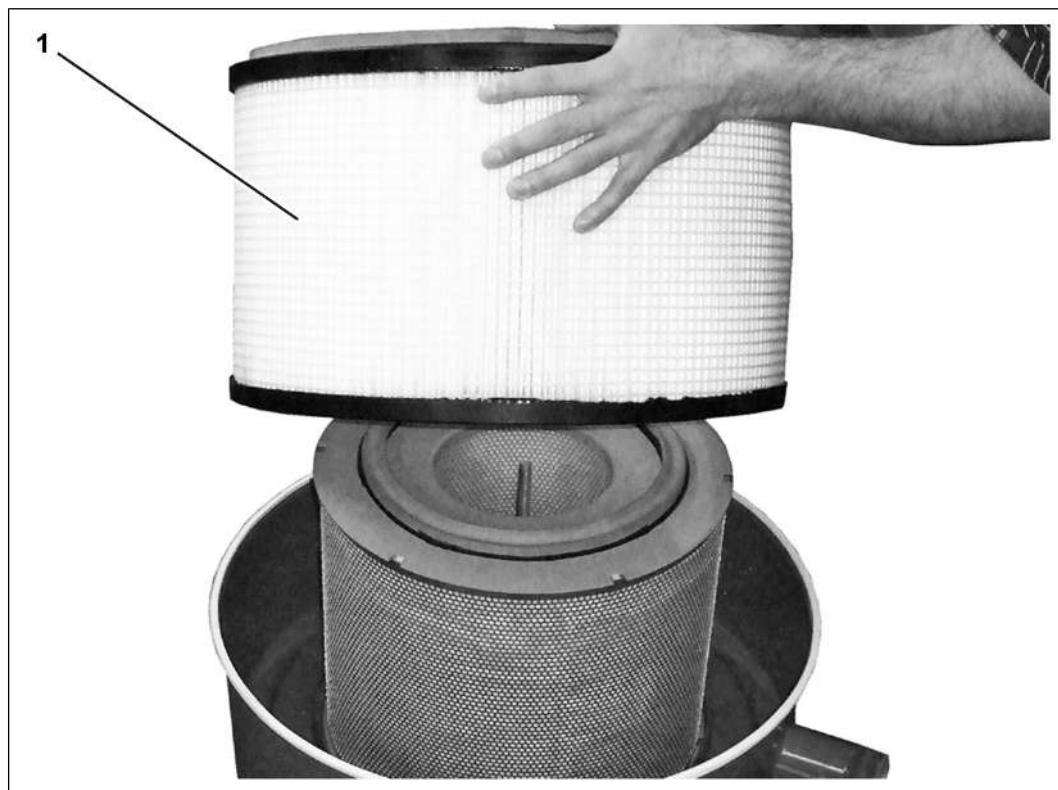
3011575051

8. **CAUTION! Contamination of the environment!** If there is lube oil or condensate in the filter housing, clean the hose (1) between the gas pressure controller and engine.
 - Place the collecting tray underneath.
 - Loosen hose clamps (2) and remove the hose (1).
 - Clean hose (1) with a bottle brush.
 - Attach hose (1) and fasten hose clamps (2).
 - Remove the collecting tray and properly dispose of collected operating medium.

Install filter inserts:

3011556363

1. Insert inner filter cartridge (1).



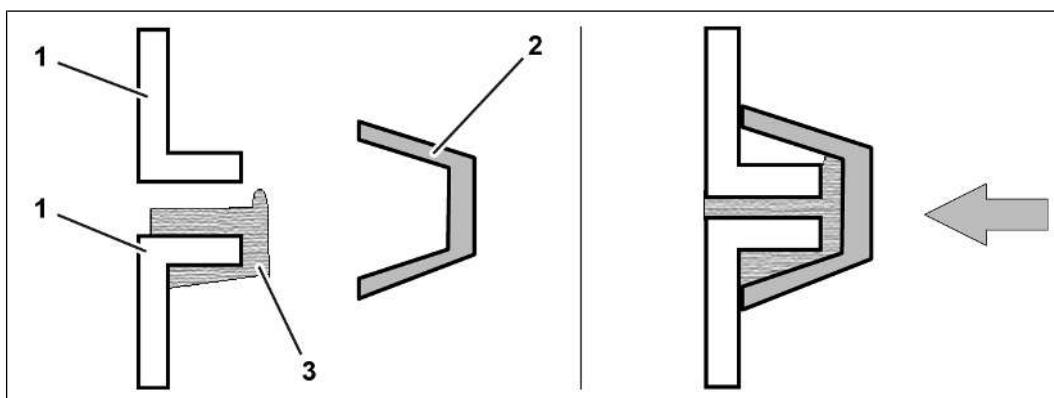
3011547019

2. Insert outer filter cartridge (1).



3011537675

3. Wet rubber seal (2) with acid-free grease.
4. Attach rubber seal (2) and check for correct fit.
5. Attach and position the cover (1).
6. Mount clamping clip.



3011583115

**Risk of destruction of components**

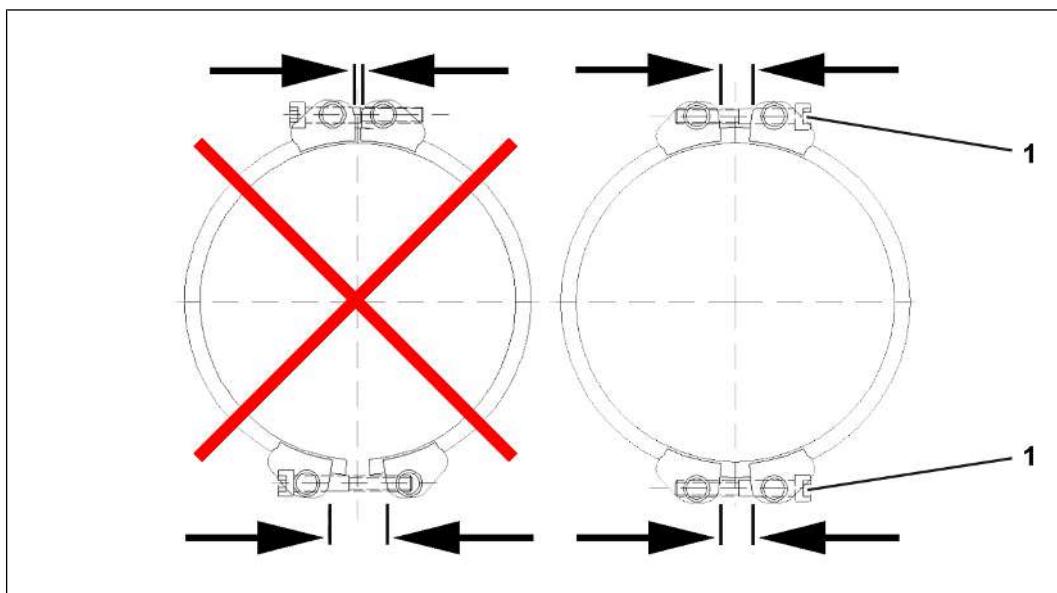
Improperly mounted clamping clip

Risk of destruction of components.

If the clamping clip (2) does not enclose the rubber seal (3) completely, the filter housing (1) is not leak-proof.

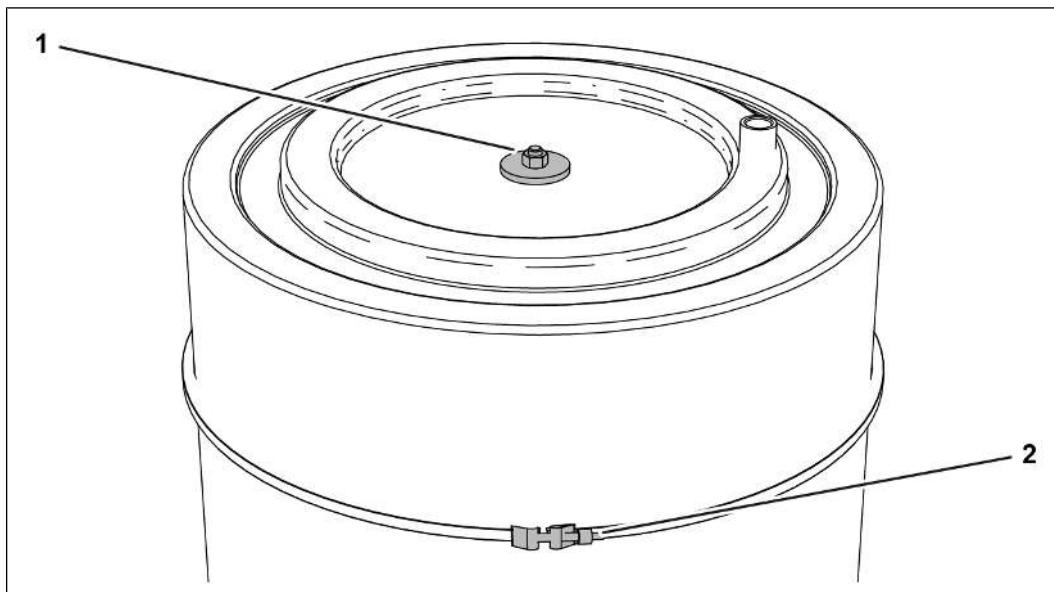
The underpressure filter does not work correctly and the UPF filter does not separate or only partially separates the lube oil.

- Ensure that the clamping clip encloses the rubber seal completely.



3011592459

- Attach clamping clip.
- Tighten screws (1) of the clamping clip evenly on both sides.
- Make sure that the screws (1) of the clamping clip are evenly tightened and the rubber seal is positioned evenly.



3011528331

- Tighten screw (2) on both sides.
- 7. Tighten nut (1).
 - Visually inspect the fit of the cover.
- 8. Perform a control measurement of the separating quality.
 - Note the determined values (measured values) on the measurement sheet.
 - Document the maintenance and renewal of the filter elements.

⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Performing lube oil change (without lube oil tank in base frame)

Valid for:
TCG 2020 K, TCG 2020

Tools:

- Standard tools

Auxiliary media:

- Binding agent
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)) [Specification for auxiliary media](#)

Spare parts:

- Lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil](#).

General information

The entire amount of lube oil must be replaced when performing a lube oil change.

- The remaining lube oil volume in the engine and add-on parts should be kept as low as possible.

Use the TEM to change the lube oil when the engine is at operating temperature (lube oil temperature is at least 60 °C).

- The lube oil change is menu-guided via the TEM.

Depending on the design of the plant, there is the option of an Oil change remote (OWF).

- The TEM controls two solenoid valves and enables the lube oil to be changed by modem.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

**Danger to the environment**

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

**Danger to the environment**

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
- Collect escaping operating media and soak it up with thickeners if necessary.
- Always store operating media separately and in tightly sealed tanks intended for those materials.
- Properly dispose of operating media and components in accordance with national regulations.

**Risk of destruction of components**

The prelubrication pump can run dry

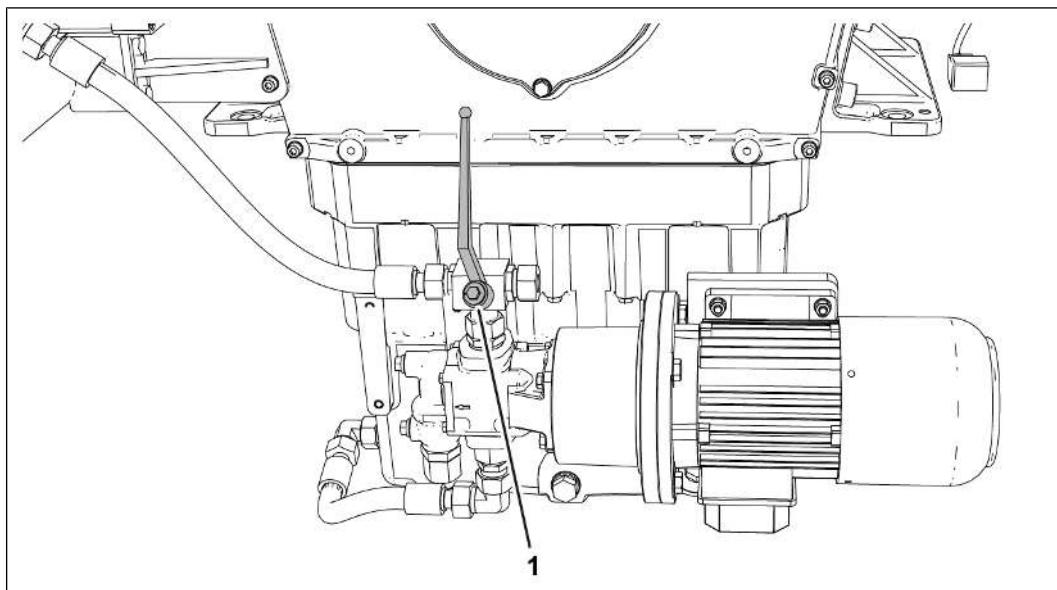
Damage to or destruction of the prelubrication pump

- Do not leave the genset unattended when performing a lube oil change.
- Stop the prelubrication pump immediately if it runs dry.

Pumping out lube oil:**NOTE**

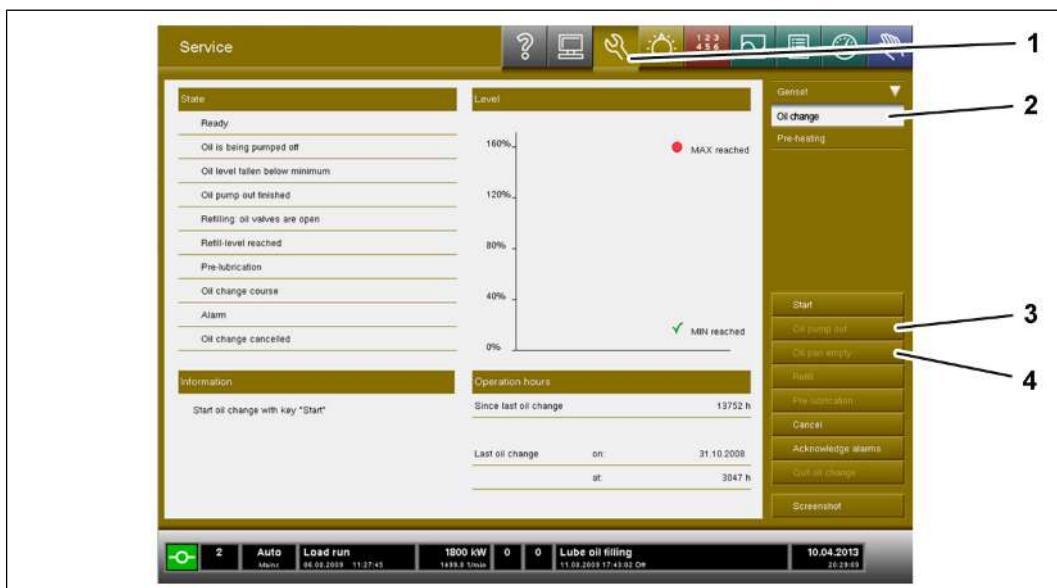
The genset runs in idle mode!

The genset is in manual operation see Commissioning/Genset [Start the genset \[▶ 136\]](#).



3024615947

1. Drain the lube oil from the lube oil sump.
 - Switch the prelubrication pump to pump out.
 - Move the ball valve (1) upwards.

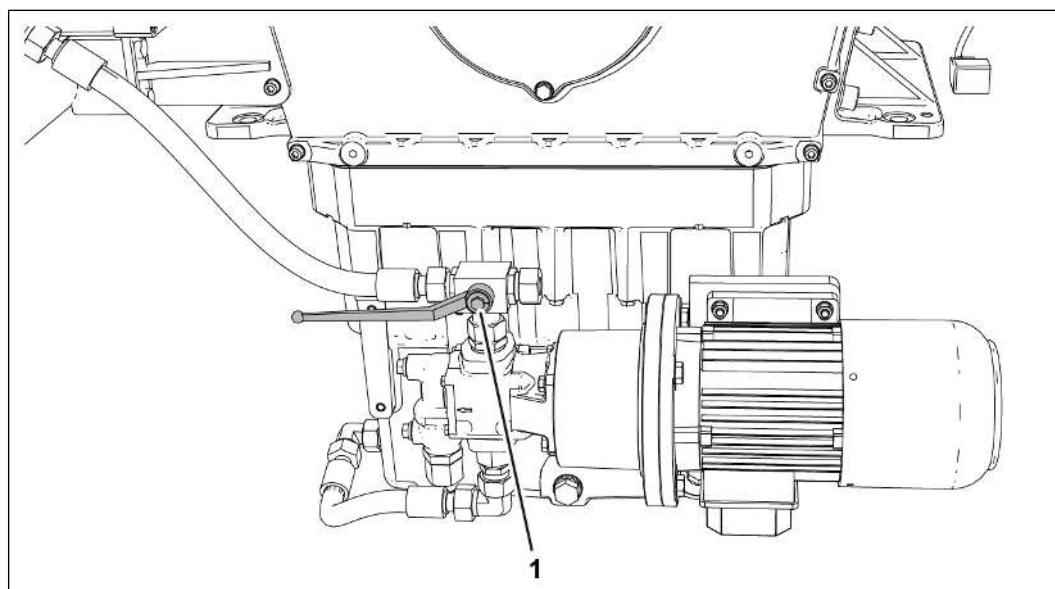


3027171595

2. Touch the Service button (1).
3. Press the Oil change button (2)
4. Press the Oil pump out button (3).
 - The pumping out process lasts until the time period programmed in the TEM has expired.
 - If the lube oil sump is not empty after the programmed time, press the Oil pump out button (3) again and restart the pumping out process.

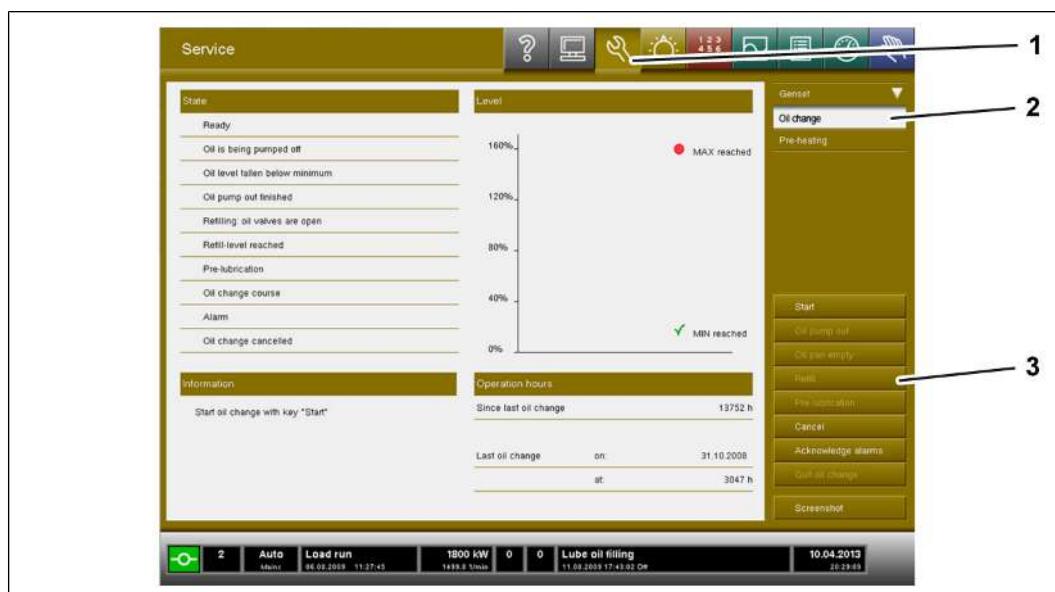
- If the lube oil sump is empty before the programmed time, press the Oil pan empty button (4).

Replenishing the lube oil:



3024618379

1. Fill the lube oil sump with lube oil.
 - Switch the prelubrication pump to pump in.
 - Position the ball valve (1) horizontally.

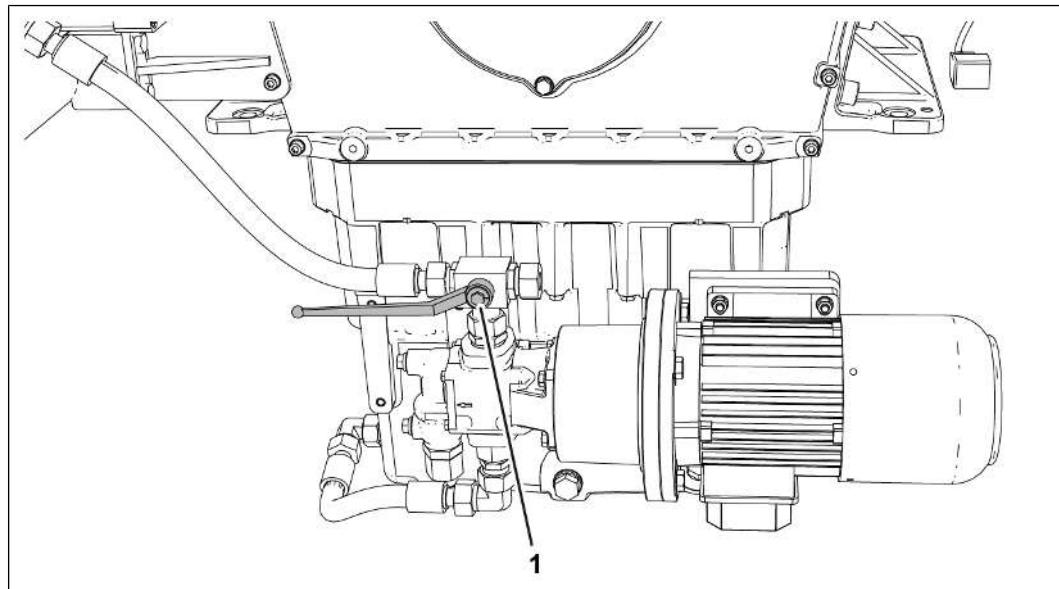


3027176331

2. Touch the Service button (1).
3. Press the Oil change button (2).

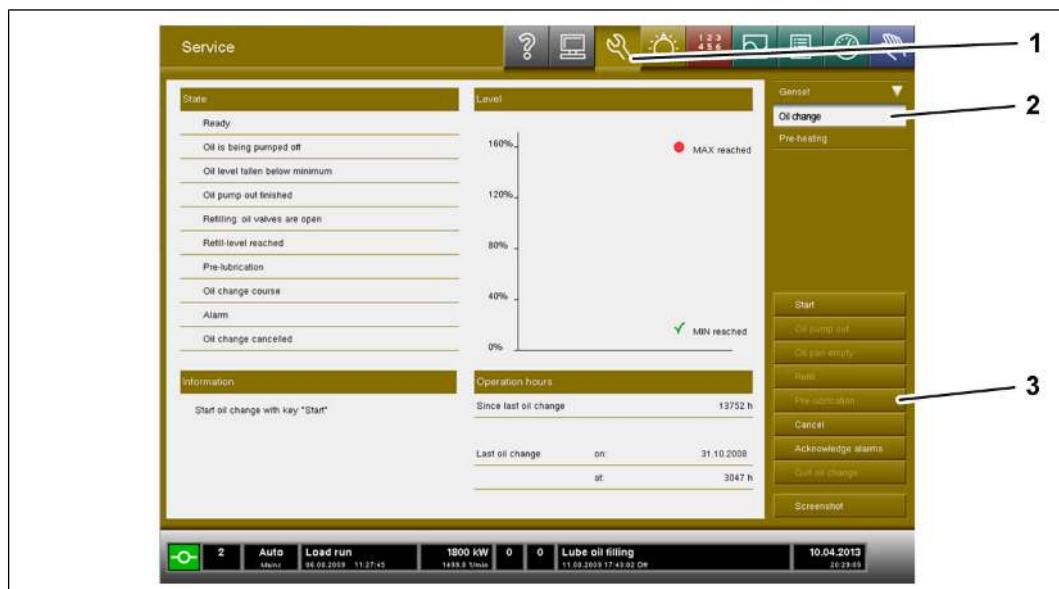
4. Press the Refill button (3).
 - The TEM starts the filling process.
5. The lube oil level sensor reports to the TEM when the required filling level is reached and ends the filling

Starting the prelubrication:



3024825611

1. Start the prelubrication.
 - Position the ball valve (1) horizontally.



3027197835

2. Touch the Service button (1).
3. Press the Oil change button (2).

-
4. Press the Pre-lubrication button (3).
 - The TEM starts and stops the pre-lubrication automatically.
 - **NOTE! The engine can only be started once the prelubrication is complete!**
The prelubrication lasts up to 20 minutes.
 5. Reset the ball valve to engine operation.
1. Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).
 2. Check the lube oil level, top up if necessary.
 3. Properly dispose of the collected lube oil.

Performing lube oil change (lube oil tank in base frame)

Valid for:
TCG 2020 K, TCG 2020

Tools:

- Standard tools

Auxiliary media:

- Binding agent
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)) [Specification for auxiliary media](#)

Spare parts:

- Lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil](#).

General information

The entire amount of lube oil must be replaced when performing a lube oil change.

- The remaining lube oil volume in the engine and add-on parts should be kept as low as possible.

Use the TEM to change the lube oil when the engine is at operating temperature (lube oil temperature is at least 60 °C).

- The lube oil change is menu-guided via the TEM.

Depending on the design of the plant, there is the option of an Oil change remote (OWF) .

- The TEM controls two solenoid valves and enables the lube oil to be changed by modem.

NOTE

The TEM switches off the prelubrication pump.

Always empty the lube oil tank in the base frame first.

- Otherwise, the lube oil level sensor signals to the TEM that the lube oil sump is empty.

**CAUTION**

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

**Danger to the environment**

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

**Danger to the environment**

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
- Collect escaping operating media and soak it up with thickeners if necessary.
- Always store operating media separately and in tightly sealed tanks intended for those materials.
- Properly dispose of operating media and components in accordance with national regulations.

**Risk of destruction of components**

The prelubrication pump can run dry

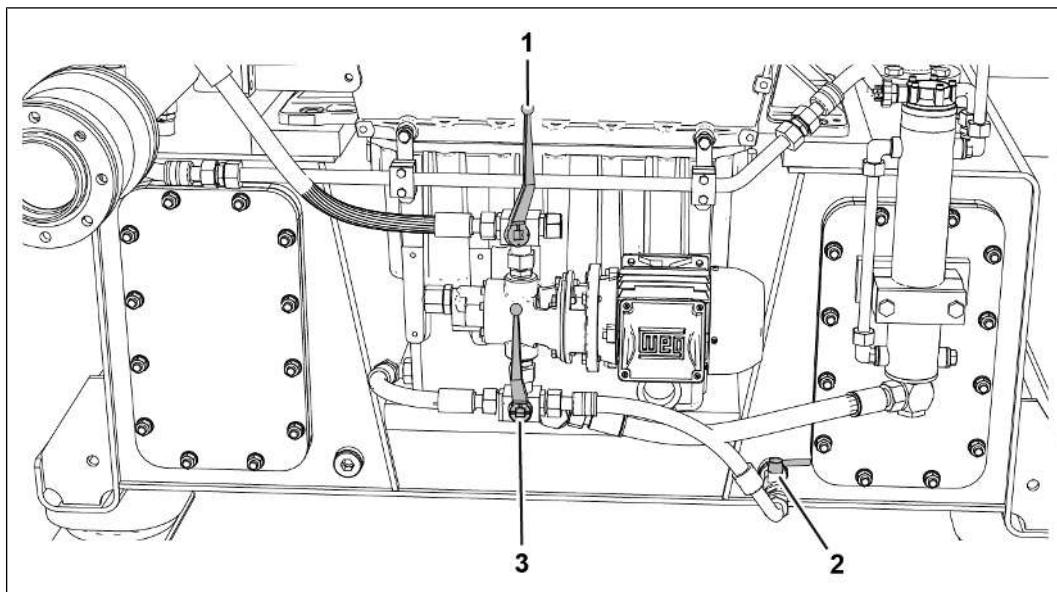
Damage to or destruction of the prelubrication pump

- Do not leave the genset unattended when performing a lube oil change.
- Stop the prelubrication pump immediately if it runs dry.

Emptying the base frame:**NOTE**

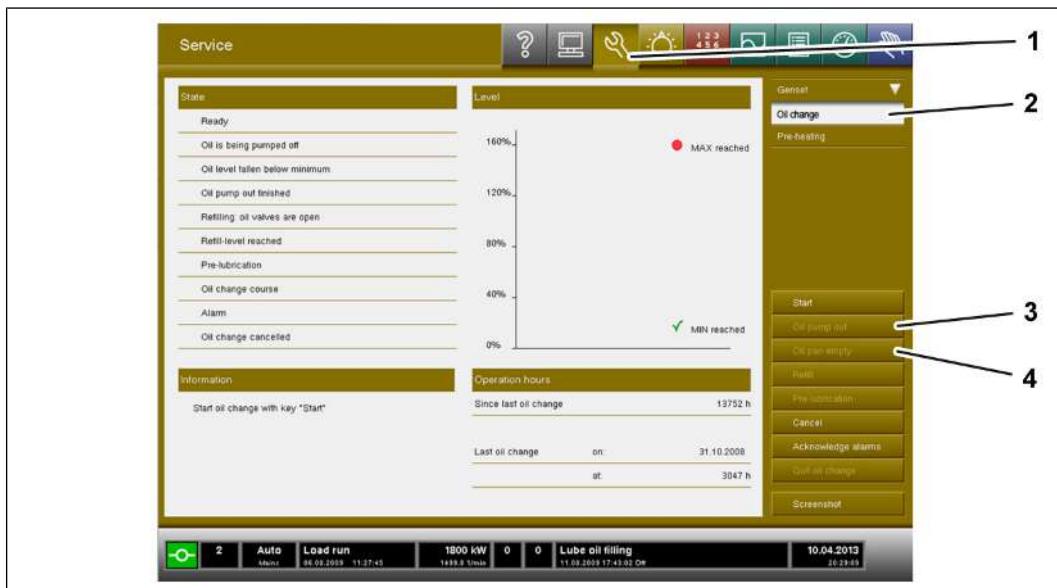
The genset runs in idle mode!

The genset is in manual operation see Commissioning/Genset [Start the genset](#) [▶ 136].



3027129739

1. Drain the lube oil from the base frame.
 - Switch the prelubrication pump to pump out.
 - Move the ball valve (1) upwards.
 - Position the ball valve (2) horizontally.
 - Move the ball valve (3) upwards.



3027171595

2. Touch the Service button (1).
3. Press the Oil change button (2)
4. Press the Oil pump out button (3).
 - The pumping out process lasts until the time period programmed in the TEM has expired.

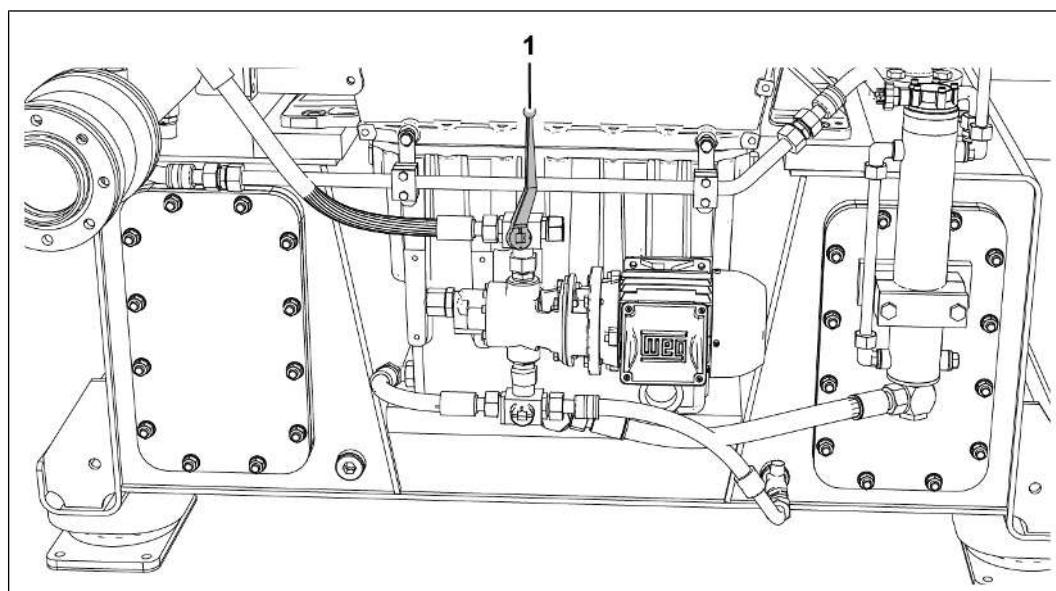
- If the base frame is not empty after the programmed time, press the Oil pump out button (3) again and restart the pumping out process.
- If the base frame is empty before the programmed time, press the Oil pan empty button (4).

Emptying the lube oil sump:

NOTE

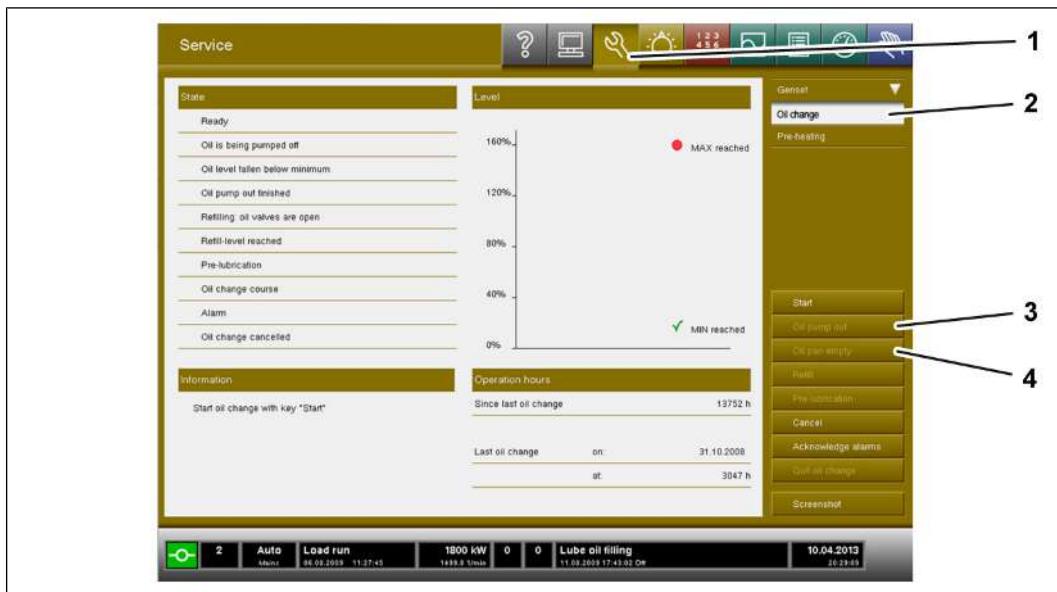
The genset runs in idle mode!

The genset is in manual operation see Commissioning/Genset [Start the genset \[▶ 136\]](#).



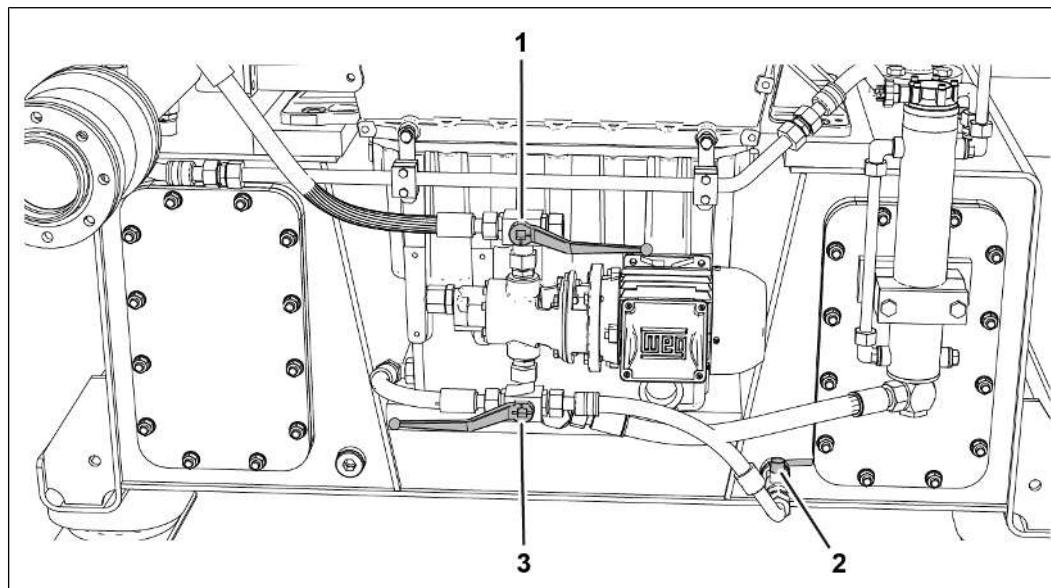
3027134091

1. Drain the lube oil from the lube oil sump.
 - Switch the prelubrication pump to pump out.
 - Move the ball valve (1) upwards.



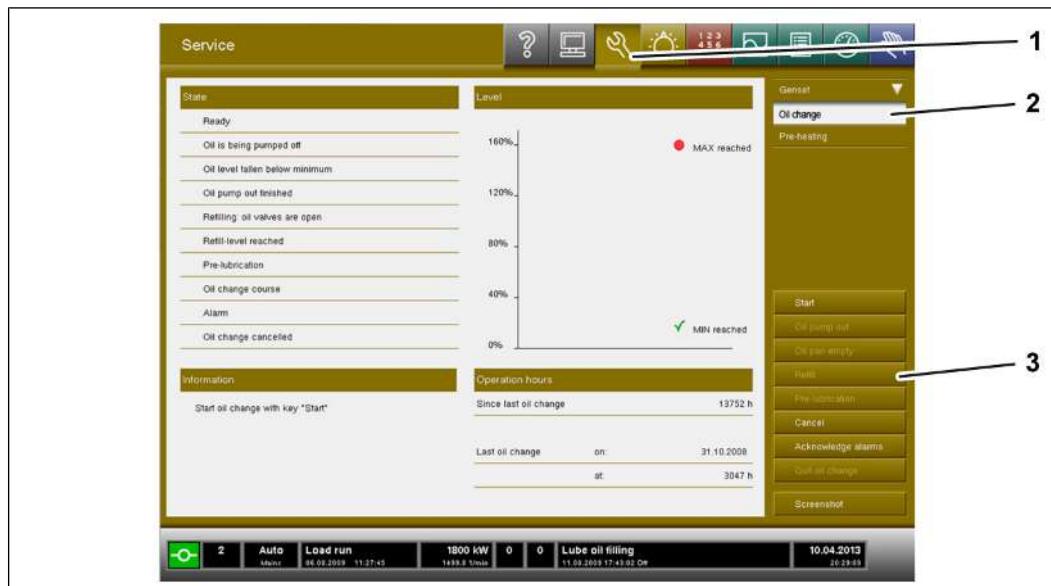
3027171595

2. Touch the Service button (1).
3. Press the Oil change button (2)
4. Press the Oil pump out button (3).
 - The pumping out process lasts until the time period programmed in the TEM has expired.
 - If the lube oil sump is not empty after the programmed time, press the Oil pump out button (3) again and restart the pumping out process.
 - If the lube oil sump is empty before the programmed time, press the Oil pan empty button (4).

Filling the base frame:

3027138443

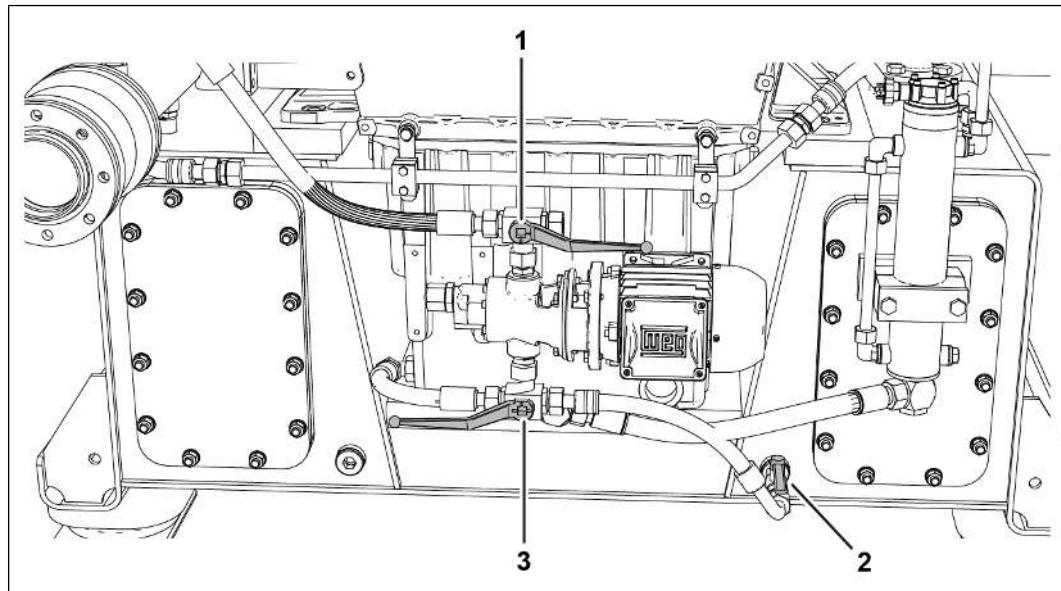
1. Fill the base frame with lube oil.
 - Switch the prelubrication pump to pump in.
 - Position the ball valve (1) horizontally.
 - Position the ball valve (2) horizontally.
 - Position the ball valve (3) horizontally.



3027176331

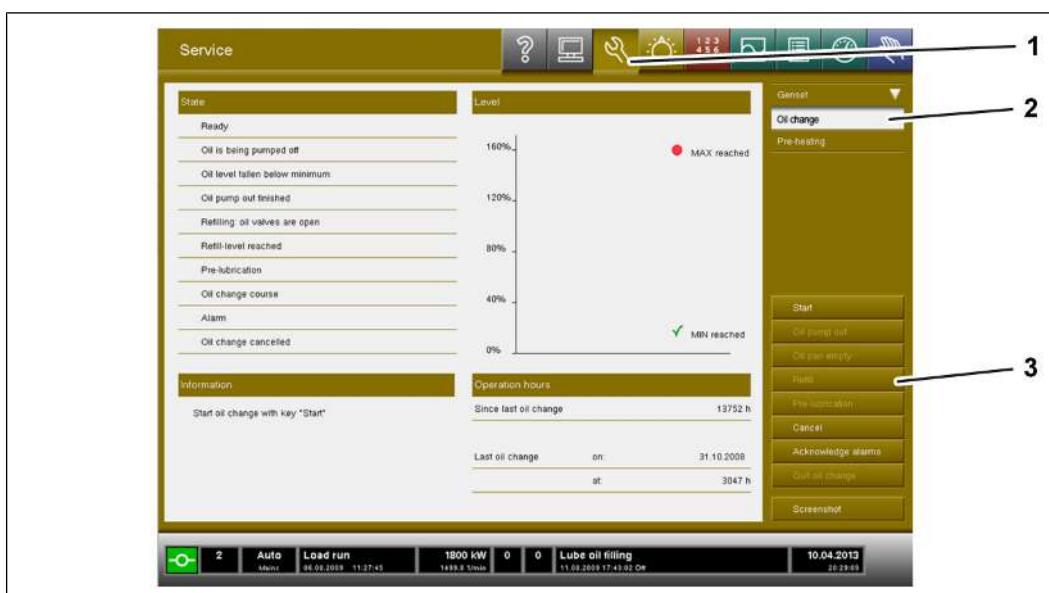
2. Touch the Service button (1).
3. Press the Oil change button (2).

4. Press the Refill button (3).
 - The TEM starts the filling process.
5. The lube oil level sensor reports to the TEM when the required filling level is reached and ends the filling

Filling the lube oil sump:

3027155595

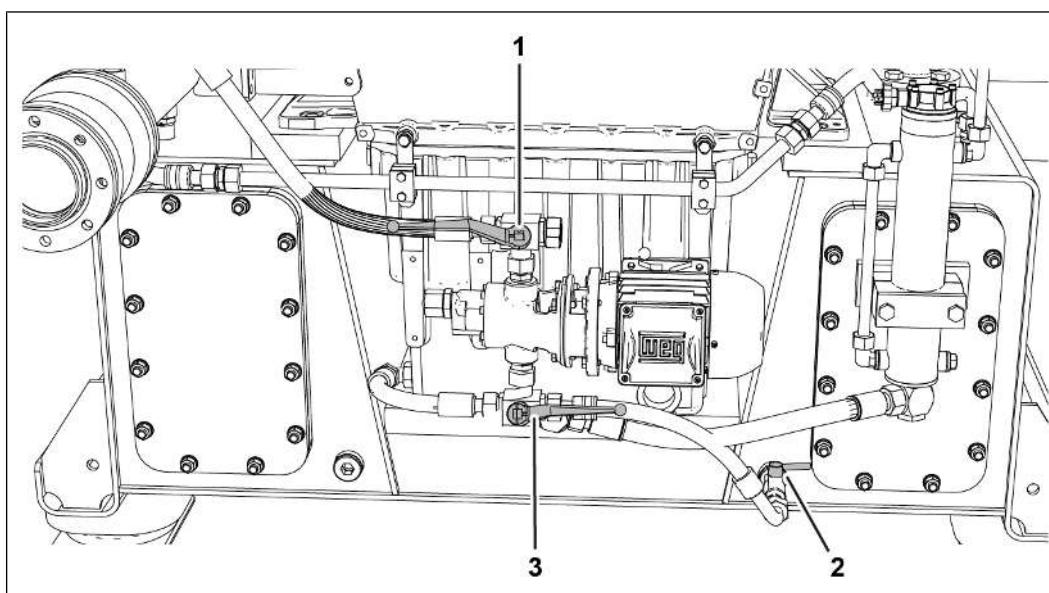
1. Fill the lube oil sump with lube oil.
 - Switch the prelubrication pump to pump in.
 - Position the ball valve (1) horizontally.
 - Move the ball valve (2) forwards.
 - Position the ball valve (3) horizontally.



3027176331

2. Touch the Service button (1).
3. Press the Oil change button (2).
4. Press the Refill button (3).
 - The TEM starts the filling process.
5. The lube oil level sensor reports to the TEM when the required filling level is reached and ends the filling

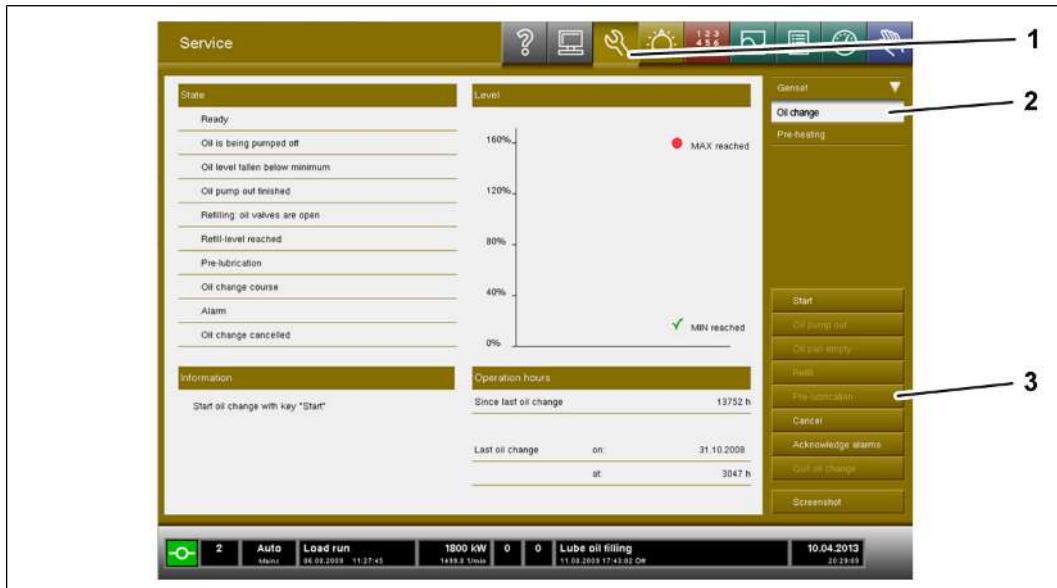
Starting the prelubrication:



3027193483

1. Start the prelubrication.
 - Position the ball valve (1) horizontally.

- Position the ball valve (2) horizontally.
- Position the ball valve (3) horizontally.



3027197835

2. Touch the Service button (1).
 3. Press the Oil change button (2).
 4. Press the Pre-lubrication button (3).
 - The TEM starts and stops the pre-lubrication automatically.
 - **NOTE! The engine can only be started once the prelubrication is complete!**
The prelubrication lasts up to 20 minutes.
 5. Reset the ball valve to engine operation.
1. Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).
 2. Check the lube oil level, top up if necessary.
 3. Properly dispose of the collected lube oil.

Performing lube oil change (V20 engine without lube oil tank in base frame)

Valid for:
TCG 2020, TCG 2020 K

Tools:

- Standard tools

Auxiliary media:

- Binding agent
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)) [Specification for auxiliary media](#)

Spare parts:

- Lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil.](#)

General information

The entire amount of lube oil must be replaced when performing a lube oil change.

- The remaining lube oil volume in the engine and add-on parts should be kept as low as possible.

Use the TEM to change the lube oil when the engine is at operating temperature (lube oil temperature is at least 60 °C).

- The lube oil change is menu-guided via the TEM.

Depending on the design of the plant, there is the option of an Oil change remote (OWF).

- The TEM controls two solenoid valves and enables the lube oil to be changed by modem.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.



Danger to the environment

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.



Danger to the environment

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
- Collect escaping operating media and soak it up with thickeners if necessary.
- Always store operating media separately and in tightly sealed tanks intended for those materials.
- Properly dispose of operating media and components in accordance with national regulations.



Risk of destruction of components

The prelubrication pump can run dry

Damage to or destruction of the prelubrication pump

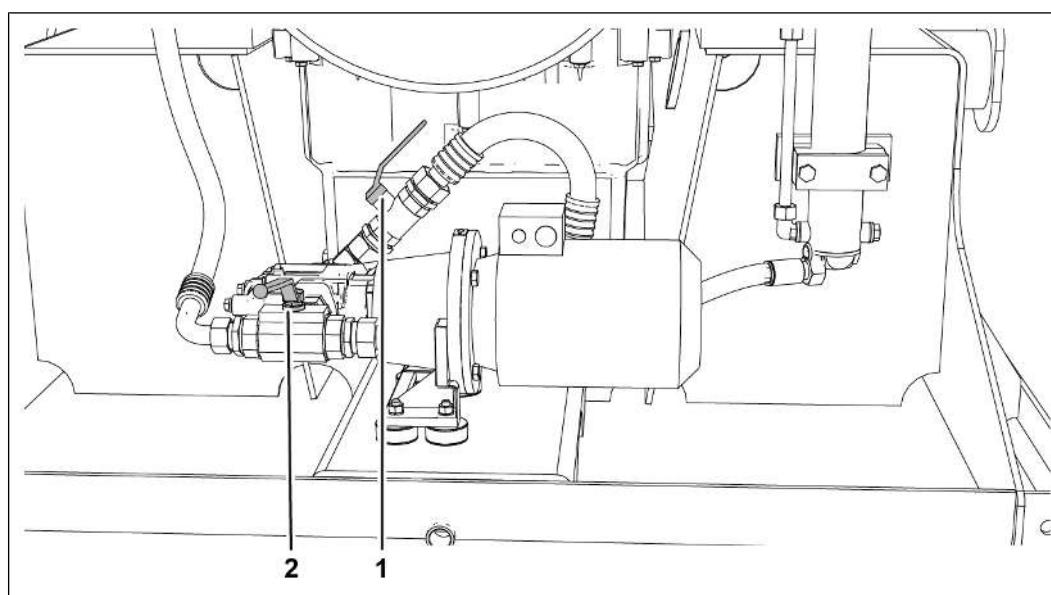
- Do not leave the genset unattended when performing a lube oil change.
- Stop the prelubrication pump immediately if it runs dry.

Pumping out lube oil:

NOTE

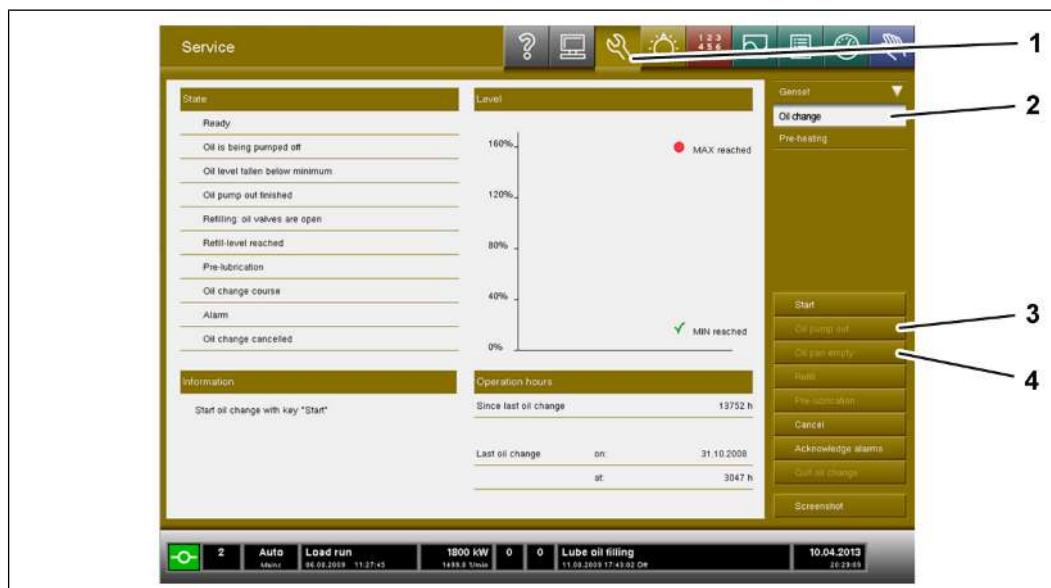
The genset runs in idle mode!

The genset is in manual operation see Commissioning/Genset [Start the genset \[▶ 136\]](#).



3024833803

1. Drain the lube oil from the lube oil sump.
 - Switch the prelubrication pump to pump out.
 - Move the ball valve (1) upwards.
 - Move the ball valve (2) forwards.

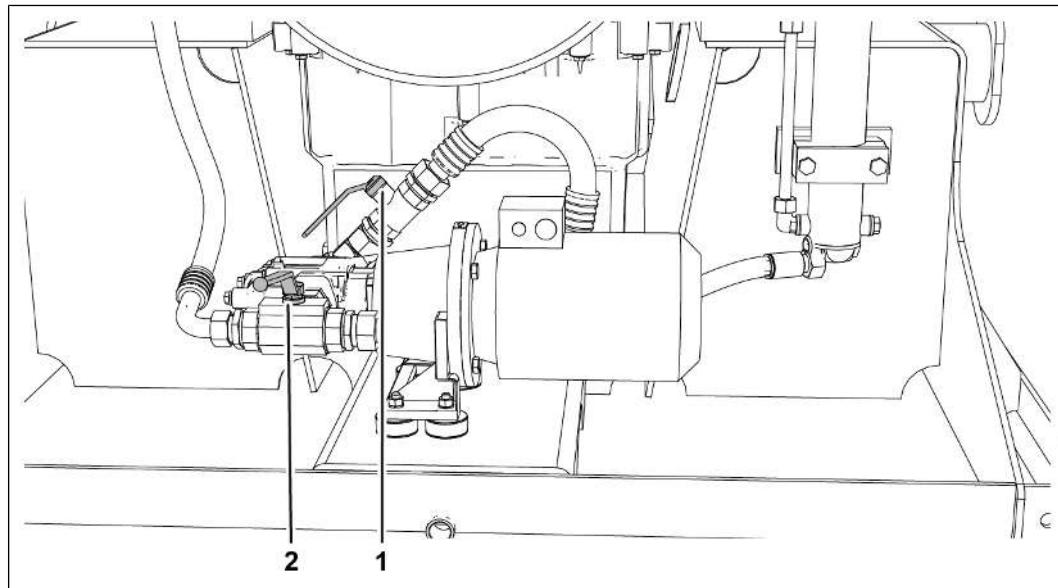


3027171595

2. Touch the Service button (1).
3. Press the Oil change button (2)
4. Press the Oil pump out button (3).
 - The pumping out process lasts until the time period programmed in the TEM has expired.

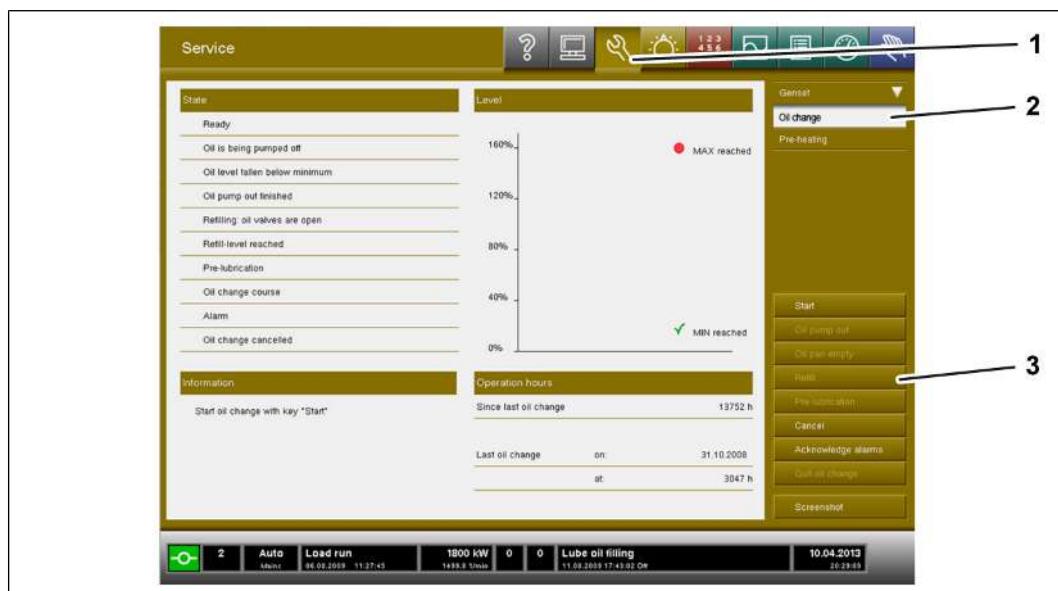
- If the lube oil sump is not empty after the programmed time, press the Oil pump out button (3) again and restart the pumping out process.
- If the lube oil sump is empty before the programmed time, press the Oil pan empty button (4).

Replenishing the lube oil:



3024836235

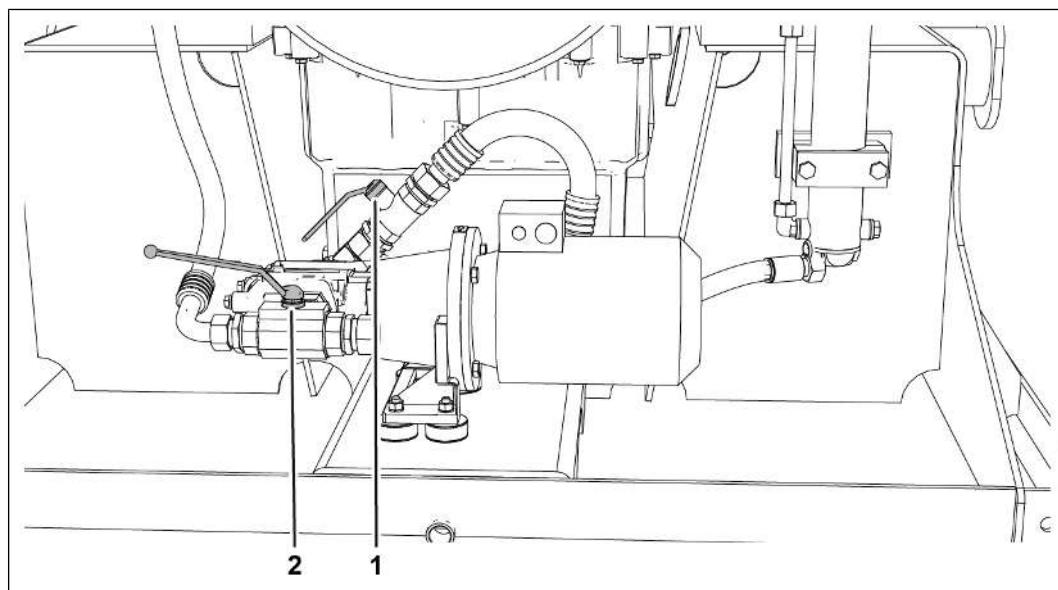
1. Fill the lube oil sump with lube oil.
 - Switch the prelubrication pump to pump in.
 - Move the ball valve (1) downwards.
 - Move the ball valve (2) forwards.



3027176331

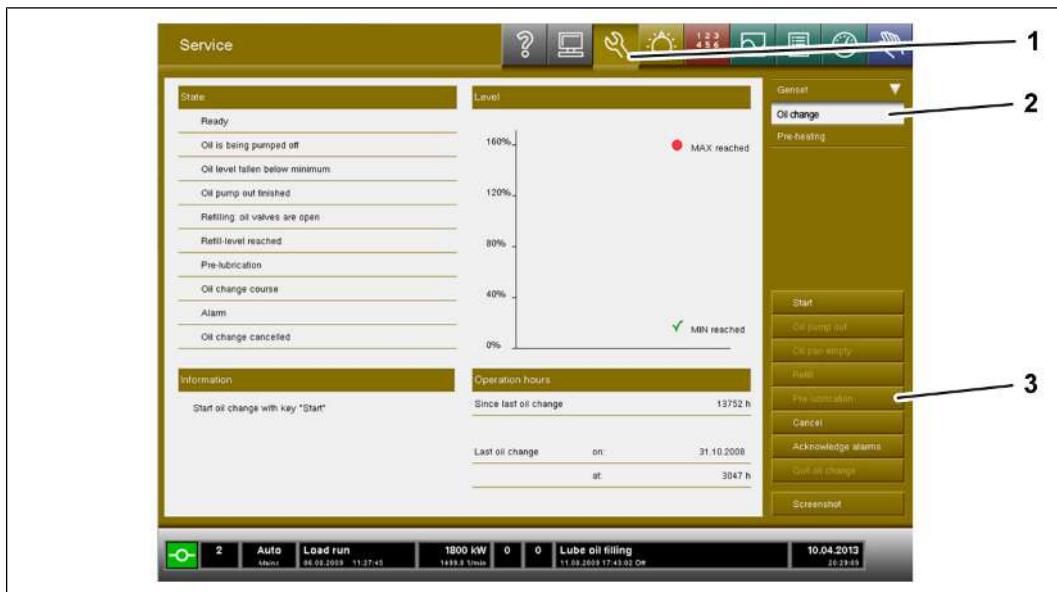
2. Touch the Service button (1).

3. Press the Oil change button (2).
4. Press the Refill button (3).
 - The TEM starts the filling process.
5. The lube oil level sensor reports to the TEM when the required filling level is reached and ends the filling

Starting the prelubrication:

3024838667

1. Start the prelubrication.
 - Move the ball valve (1) downwards.
 - Position the ball valve (2) horizontally.



3027197835

2. Touch the Service button (1).
3. Press the Oil change button (2).
4. Press the Pre-lubrication button (3).
 - The TEM starts and stops the pre-lubrication automatically.
 - **NOTE! The engine can only be started once the prelubrication is complete!**
The prelubrication lasts up to 20 minutes.
5. Reset the ball valve to engine operation.
 1. Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163].
 2. Check the lube oil level, top up if necessary.
 3. Properly dispose of the collected lube oil.

Checking the lube oil (transmission)

Valid for:

TCG 2020, TCG 2020 K

60 Hz

A visual inspection and odor evaluation can provide essential information on the suitability for use of the lube oil filling as well as the causes of ascertained impurities and lube oil changes.

Checking the lube oil:

Component and fault	Possible cause	Troubleshooting
Intense darkening	Overheating, Missed lube oil change	Purge transmission Replace lube oil
Cloudiness	Water ingress, Air inlet	Identify cause and rectify Replace lube oil
Formation of foam	Contaminated lube oil, Unsuitable lube oil, Mixed lube oil	Identify cause and rectify Purge transmission Replace lube oil
Air bubbles	Air ingress, e.g. due to lack of lube oil or leaking suction line	Identify cause and rectify

Replenishing the lube oil (transmission)

Valid for:

TCG 2020, TCG 2020 K

60 Hz

Tools:

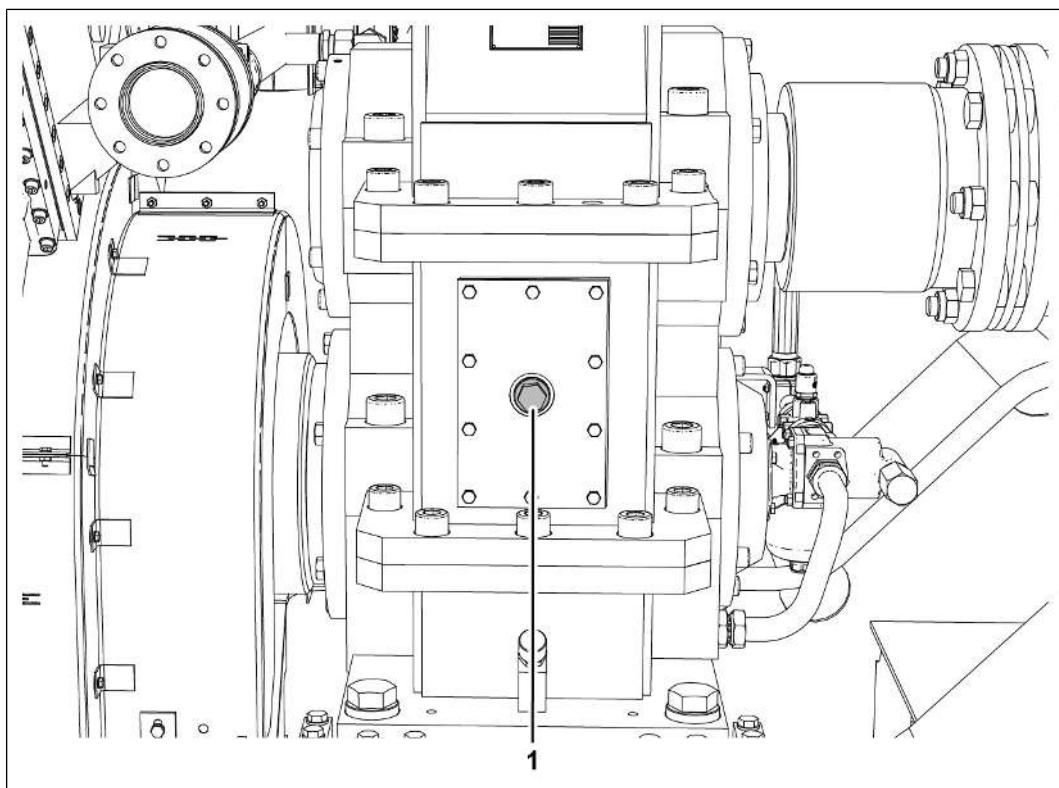
- Standard tools

Spare parts:

- Lube oil for transmission

– See Service Library, Technical Bulletin ([TR 2147](#)), **Specification for auxiliary media**.

Technical data



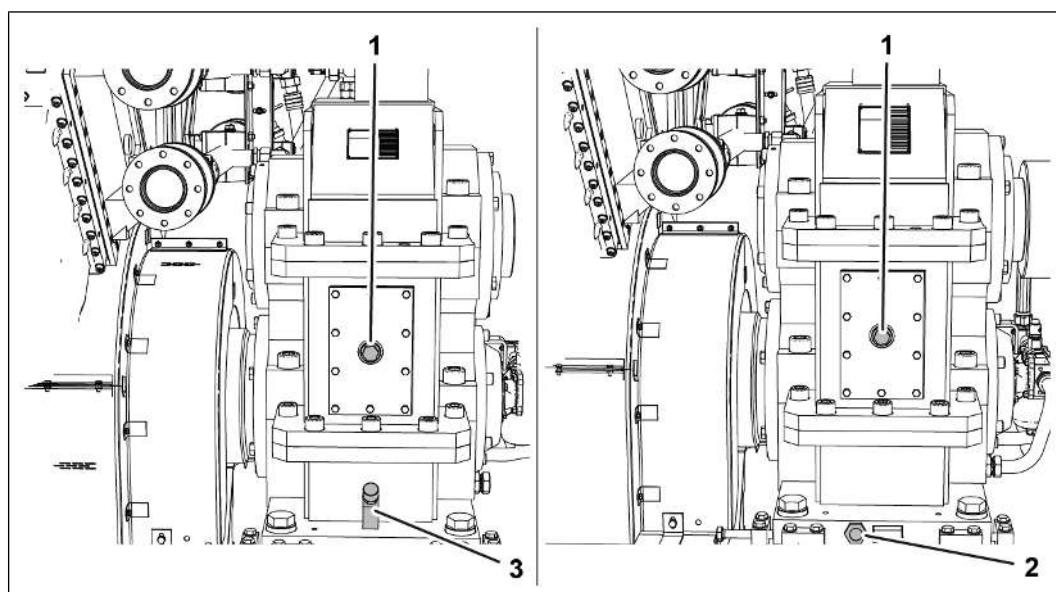
2022317579

Filler screw on inspection hole cover	
1.	Screw ¹⁾ Hand tight
¹⁾ Renew sealing ring.	

General information:

Please note the following:

- Only use approved lube oils, see Technical Bulletin "Specification for auxiliary media" **TR 2147**.
- Lube oils of different types and from different manufacturers may not be mixed.
- The transmission must be replenished with the same type of lube oil as the one with which it is already filled.
- Lube oils based on mineral oil are not permissible.
- The transmission must not be operated if the lube oil foams.
- The amount of lube oil specified on the rating plate is only a guide. The markings of the dipstick or inspection glass are decisive for the amount of lube oil to be filled.



2001305483

- 1 Inspection hole cover with filler screw
- 2 Inspection glass
- 3 Dipstick

Different transmission designs are used.

- The crucial difference is the facility for checking the lube oil level.

The lube oil level can only be checked when the genset is at a standstill.

- Check the lube oil level when lube oil has cooled down.

**CAUTION**

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

**Danger to the environment**

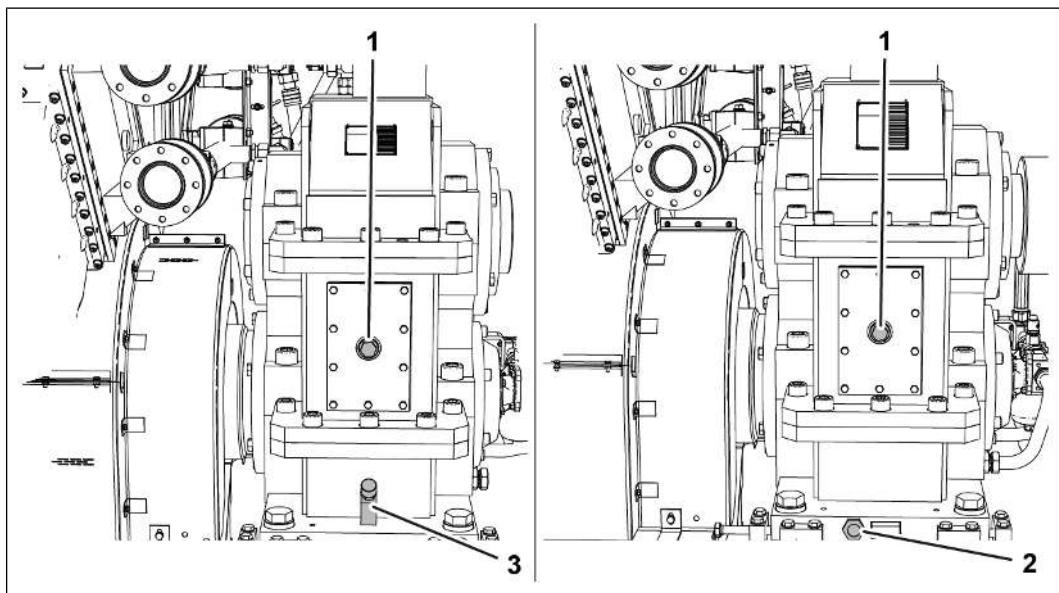
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

Replenishing lube oil:

- ✓ Lube oil level checked, see OL-MRA10 / 03-03-01 [Checking the lube oil level \(transmission\) \[▶ 369\]](#)



2001305483

1. CAUTION! Risk of burns from touching hot operating media or hot components!

Unscrew filler screw (1).

– Remove sealing ring.

2. NOTE! Leaking operating media can be released into the environment! Replenish lube oil.

– The inspection glass (2) must be filled with lube oil up to the OIL LEVEL arrow marking.

-
- The lube oil level must be between the minimum marking and the maximum marking on the dipstick (3).
3. Tighten filler screw (1).
 - Replace sealing ring.

Performing lube oil change (transmission)

Valid for:

TCG 2020, TCG 2020 K

60 Hz

Tools:

- Standard tools

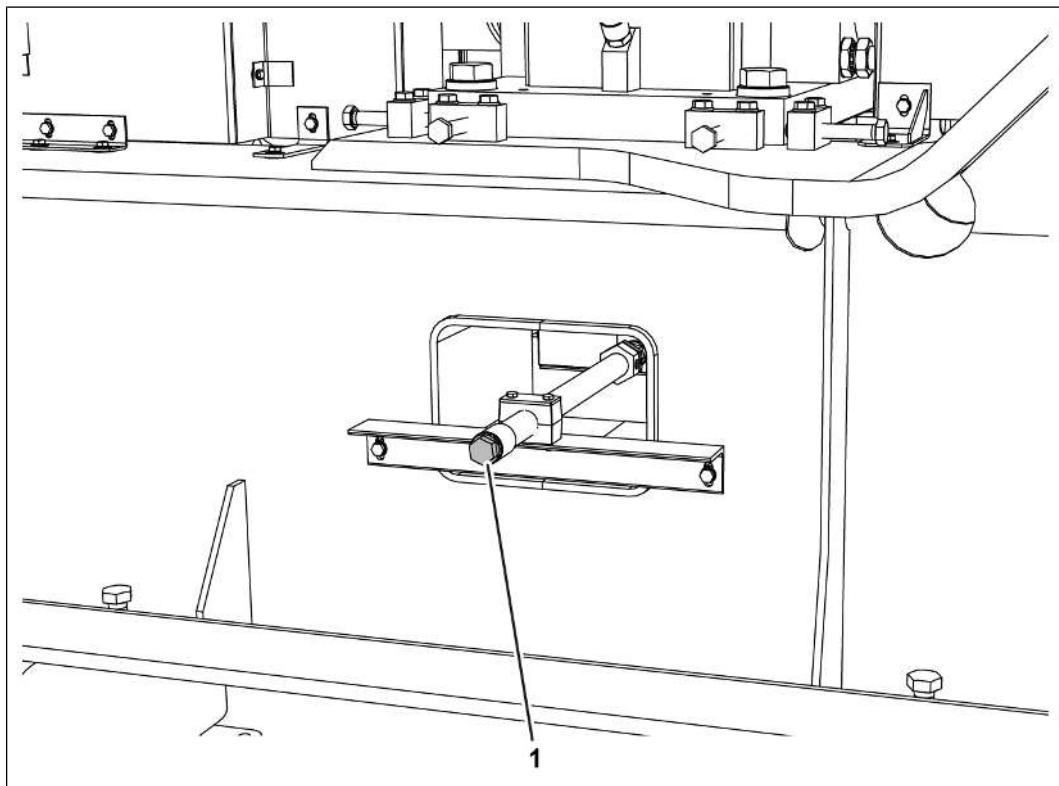
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

Spare parts:

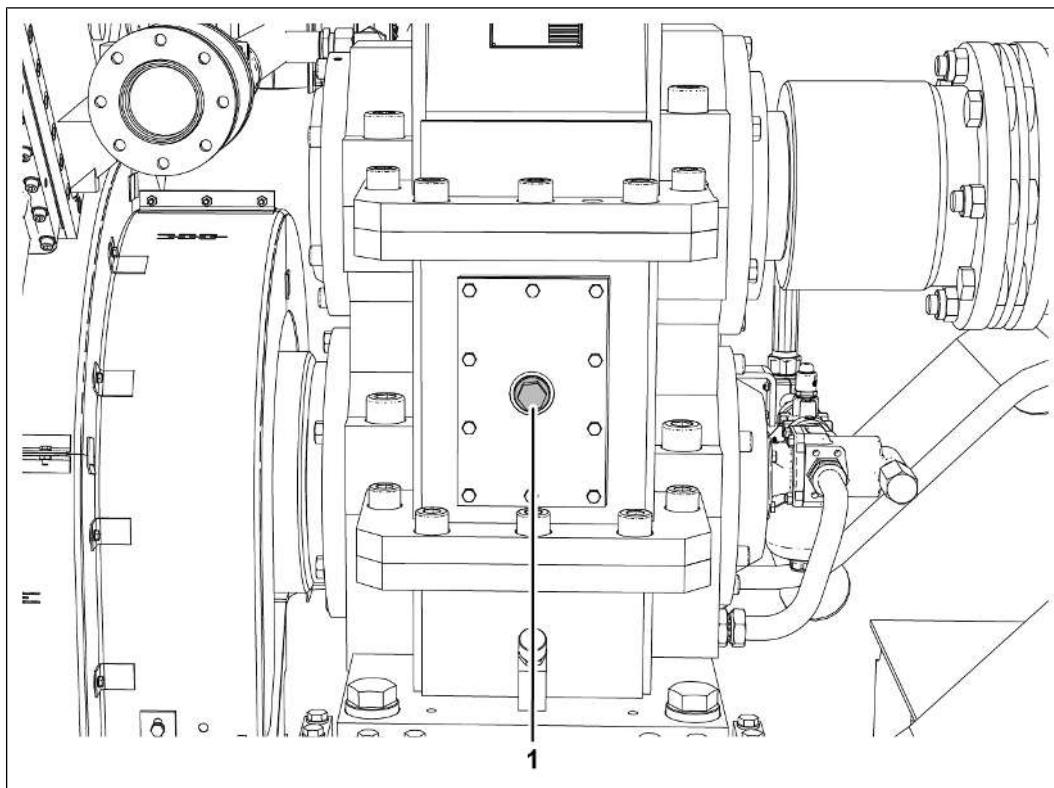
- Lube oil for transmission
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Lube oil filter, if necessary

Technical data



2022315147

Drain screw on lube oil pipe		
1.	Screw ¹⁾	Hand tight
¹⁾ Renew sealing ring.		



2022317579

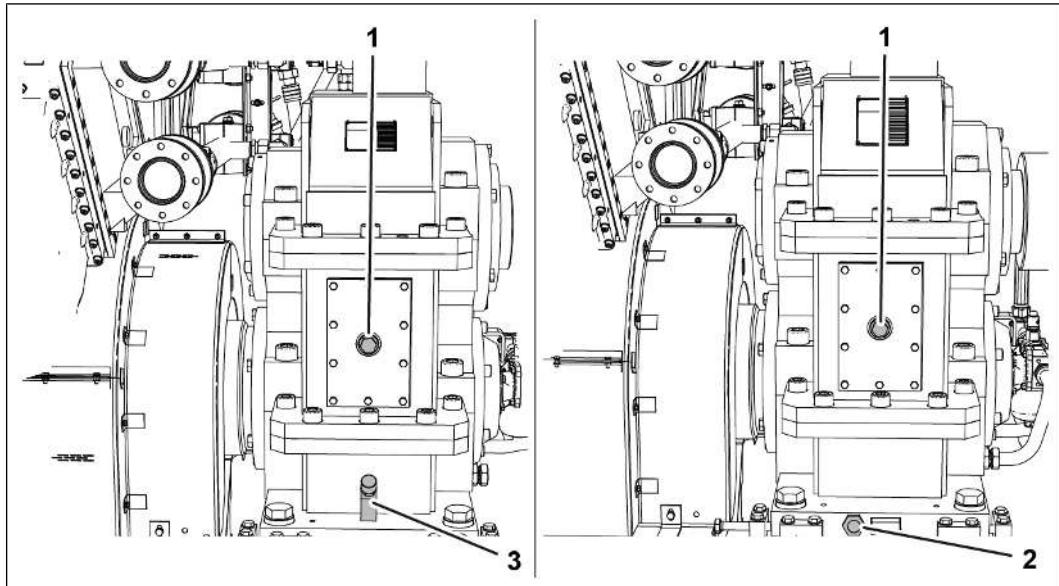
Filler screw on inspection hole cover	
1.	Screw ¹⁾ Hand tight
¹⁾ Renew sealing ring.	

General information:

Please note the following:

- The lube oil may only be changed when the genset is at a standstill.
- Only use approved lube oils, see Service Library, Technical Bulletin ([TR 2147 Specification for auxiliary media](#)).
- Lube oils of different types and from different manufacturers may not be mixed.
- It is recommended that transmission is filled with the same type of lube oil previously used when changing the lube oil.
- When converting to another type of lube oil, the transmission must be flushed with the new lube oil type, see OL-MRA10 / 03-10-28 [Purging the transmission](#) [▶ 377].
- In order to avoid foamy lube oil, purging the transmission is recommended each time when replacing the lube oil.

- The amount of lube oil specified on the rating plate is only a guide. The markings of the dipstick or inspection glass are decisive for the amount of lube oil to be filled.
- The lube oil filter must be cleaned, and if necessary replaced, each time the lube oil is changed.



2001305483

- 1 Inspection hole cover with filler screw
- 2 Inspection glass
- 3 Dipstick

Different transmission designs are used.

- The crucial difference is the facility for checking the lube oil level.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

Danger to the environment



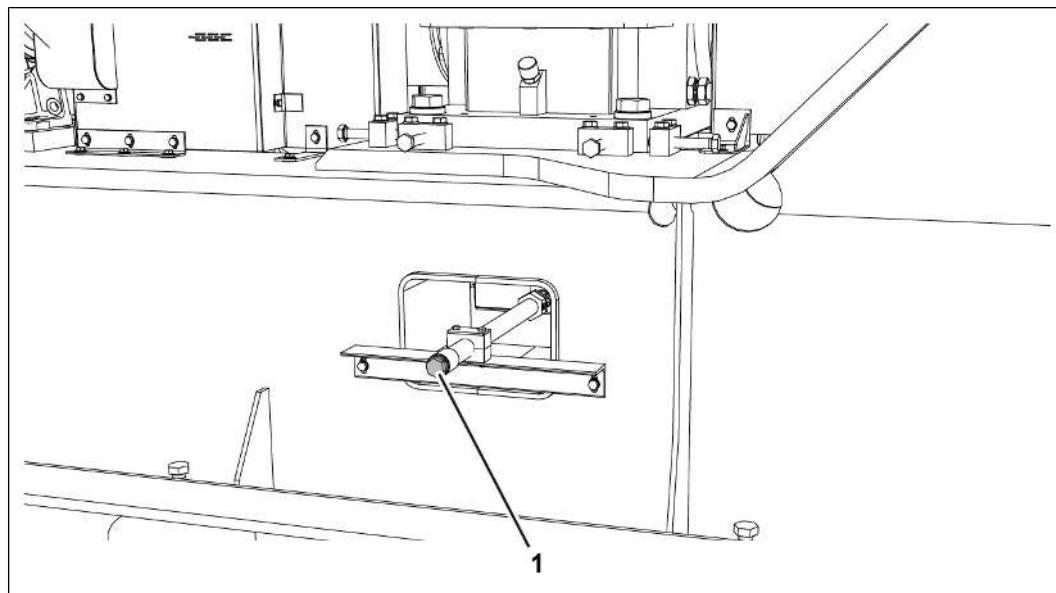
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

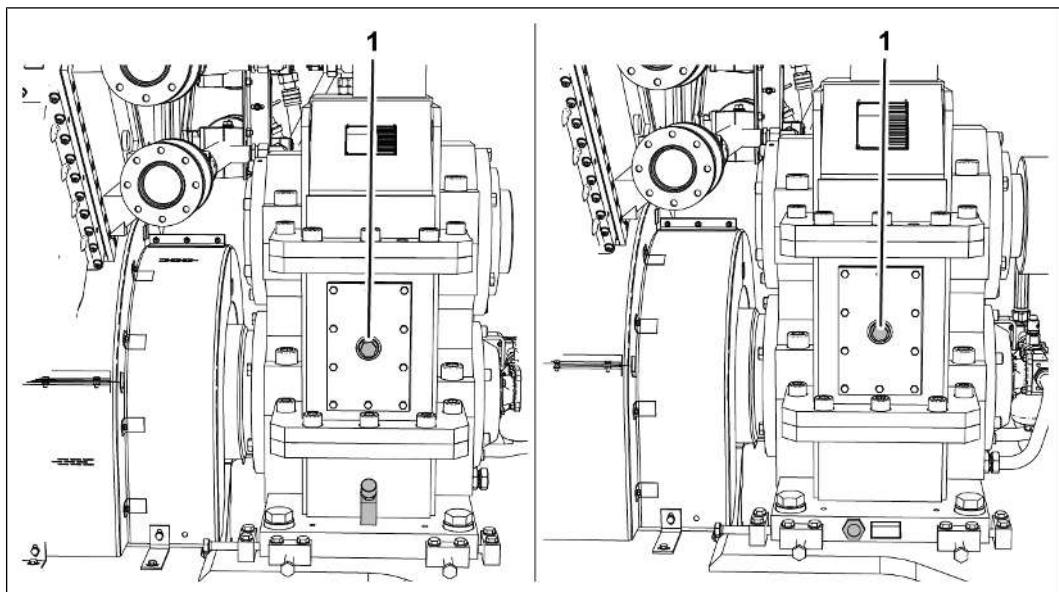
Changing the lube oil:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2015777163

1. Place the collecting tray underneath.
2. **CAUTION! Risk of burns from touching hot operating media or hot components!**
Unscrew drain screw (1).
 - Remove sealing ring.
 - **NOTE! Leaking operating media can be released into the environment!** Collect lube oil and transport, store and dispose of lube oil properly according to national regulations.
3. Check lube oil condition, see OL-MRA10 / 03-01-01 [Checking the lube oil \(transmission\) \[▶ 359\]](#).
4. Tighten drain screw (1).
 - Replace sealing ring.



2015779595

5. Unscrew filler screw (1).
 - Remove sealing ring.
 6. Replenish lube oil.
 - Check the lube oil level, see OL-MRA10 / 03-03-01 [Checking the lube oil level \(transmission\)](#) [▶ 369].
 7. Tighten filler screw (1).
 - Replace sealing ring.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 136]

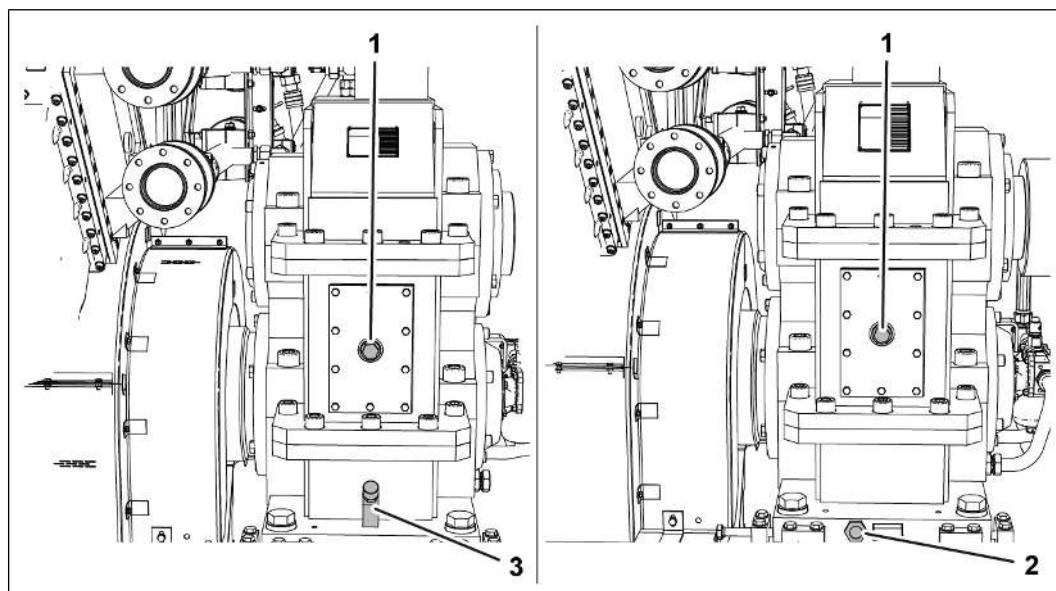
Checking the lube oil level (transmission)

Valid for:

TCG 2020, TCG 2020 K

60 Hz

General information:



2001305483

- 1 Inspection hole cover with filler screw
- 2 Inspection glass
- 3 Dipstick

Different transmission designs are used.

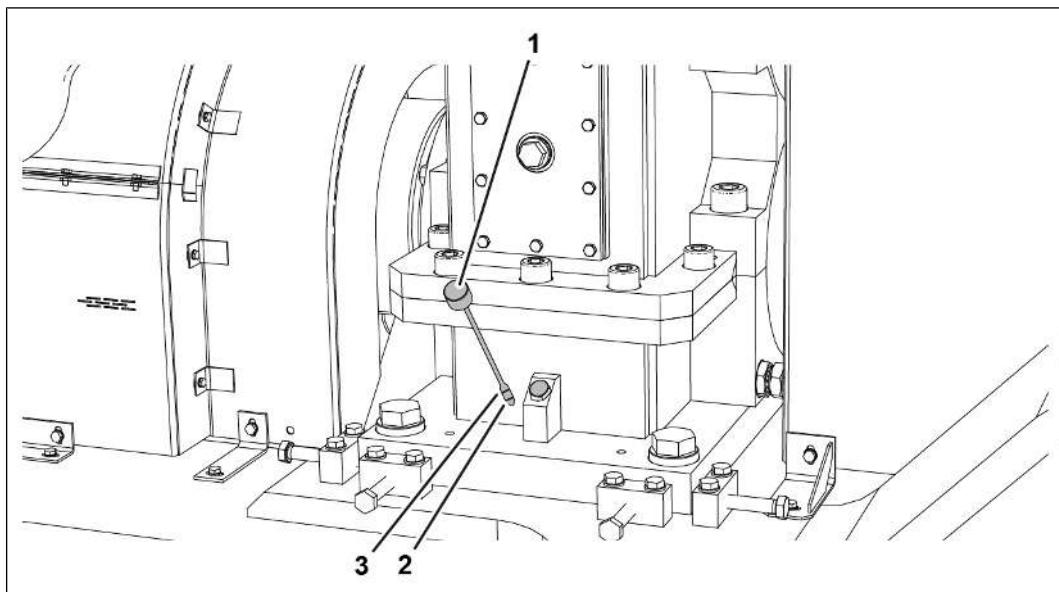
- The crucial difference is the facility for checking the lube oil level.

The lube oil level can only be checked when the genset is at a standstill.

- Check the lube oil level in the transmission at operating temperature.

Checking the lube oil level with dipstick:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 163](#)

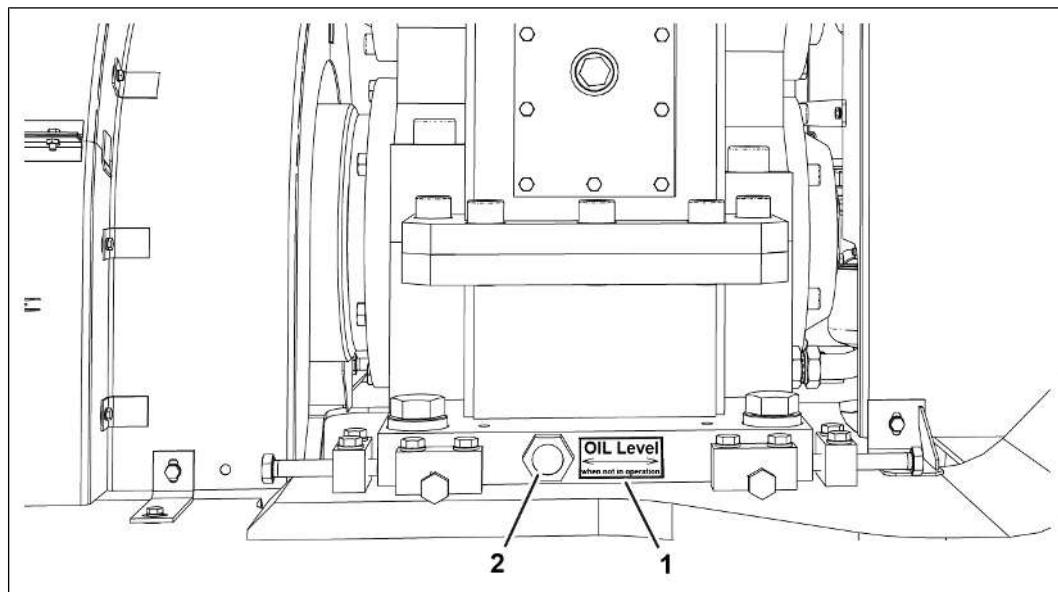


2021584395

1. Unscrew dipstick (1).
 2. Clean and reinsert dipstick.
 3. Unscrew dipstick (1).
 4. Check the lube oil level.
 - The lube oil level must be between the minimum marking (2) and the maximum marking (3).
 - If the lube oil falls below the minimum marking (2), the lube oil must be replenished.
 5. Insert dipstick (1).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Checking the lube oil level using inspection glass:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 163](#)



2021586827

1. Check lube oil level using inspection glass (2).
 - The inspection glass must be filled with lube oil up to the OIL LEVEL (1) arrow marking.
 - If the lube oil falls below the OIL LEVEL (1) arrow marking, the lube oil must be replenished.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Removing and installing the lube oil filter (transmission)

Removing the lube oil filter

Valid for:

TCG 2020, TCG 2020 K

60 Hz



Tools:

- Standard tools
- Special tool
 - Lube oil filter key 1215 8153 [▶ 206]

General information:

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

Danger to the environment



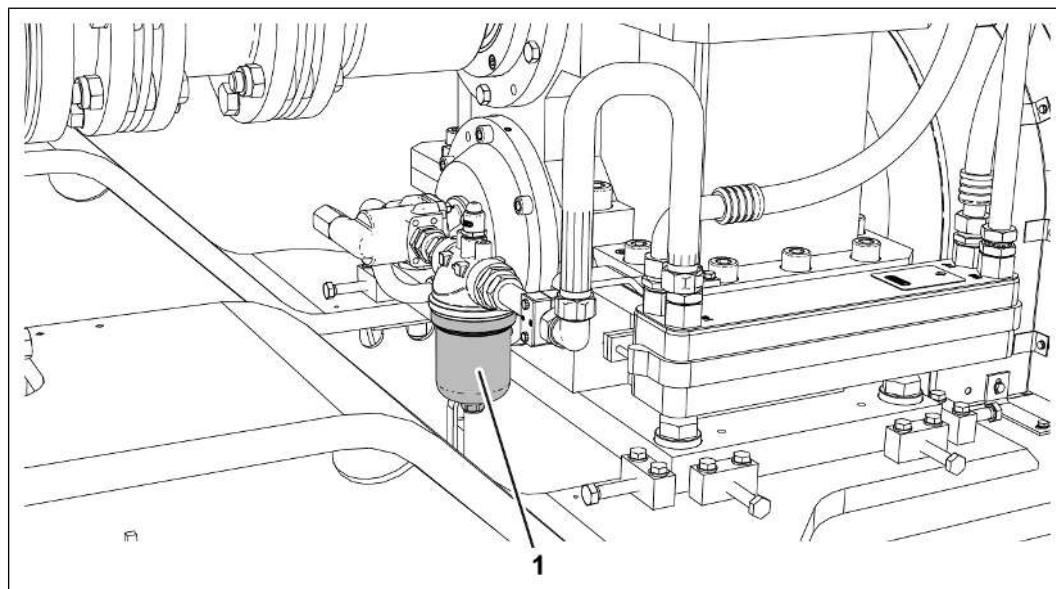
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the lube oil filter:

1. Protective cover dismantled, see OL-MRA10 / 03-19-12 [Dismantling complete protective cover \[▶ 384\]](#).



2021625867

2. Place the collecting tray underneath.
3. **CAUTION! Risk of burns from touching hot operating media or hot components!**
Unscrew lube oil filter housing (1).
 - **NOTE! Leaking operating media can be released into the environment!** Collect lube oil and transport, store, and dispose of lube oil properly according to national regulations.
4. Remove lube oil filter.
5. Clean lube oil filter housing.

Installing the lube oil filter

Valid for:

TCG 2020, TCG 2020 K

60 Hz



Tools:

- Standard tools
- Special tool
 - [Lube oil filter key 1215 8153 \[▶ 206\]](#)

Auxiliary media:

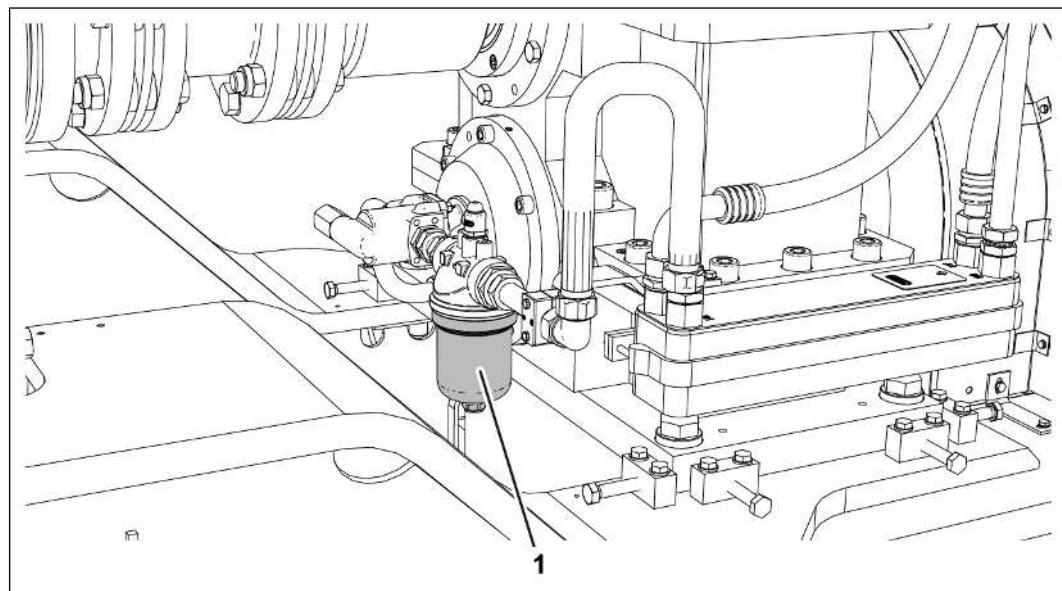
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Lube oil filter

Installing the lube oil filter:



2021625867

1. Insert lube oil filter.
2. Tighten lube oil filter housing (1).
3. Mount protective cover, see OL-MRA10 / 03-19-12 [Mounting complete protective cover](#) [▶ 385].

Cleaning the lube oil filter (transmission)

Valid for:

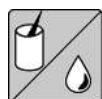
TCG 2020, TCG 2020 K

60 Hz



Tools:

- Standard tools



Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Lube oil filter, if necessary

General information:

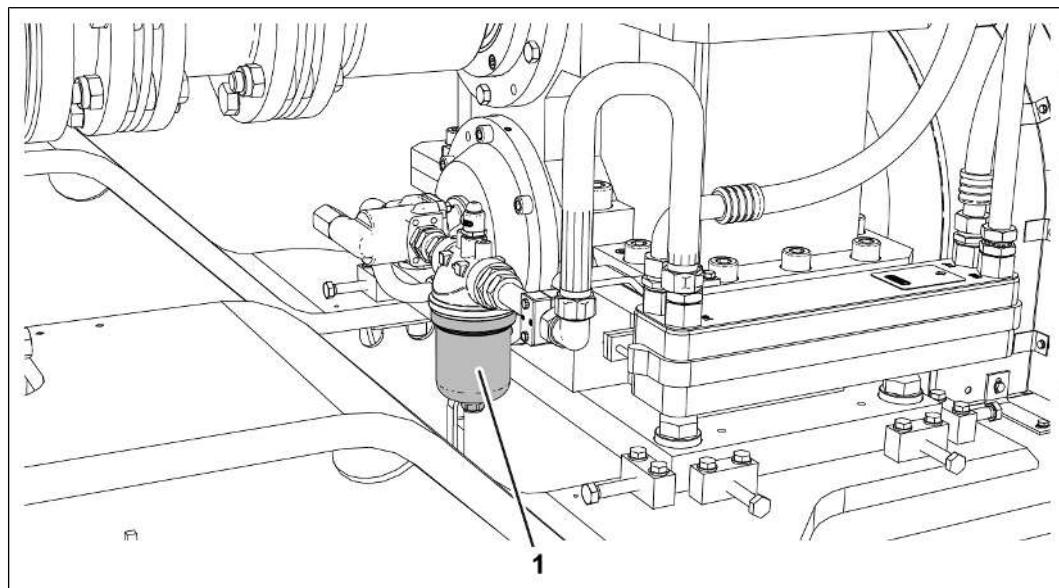


CAUTION

Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.

Cleaning the lube oil filter:

2021625867

1. Lube oil filter dismantled, see OL-MRA10 / 03-05-10 [Removing the lube oil filter](#) [▶ 372].
2. Clean lube oil filter.
 - **CAUTION! Injury due to particles of dirt!** Blow out the lube oil filter with compressed air from the inside to the outside.
 - Replace heavily soiled lube oil filters.
3. Install lube oil filter, see OL-MRA10 / 03-05-10 [Installing the lube oil filter](#) [▶ 373].

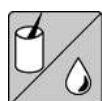
Purging the transmission

Valid for:
TCG 2020, TCG 2020 K
60 Hz



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



Auxiliary media:

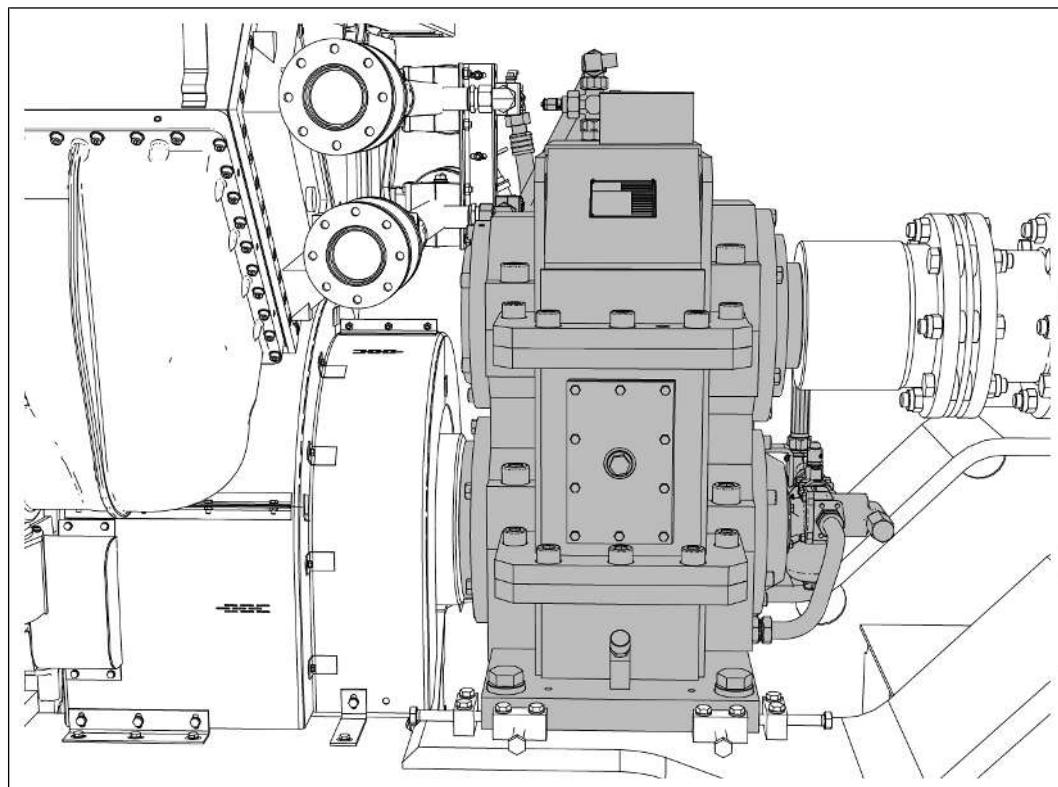
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Lube oil for transmission
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Seal

Technical data



2022957963

Standard values			
M12	Screw	Value to add	78 Nm
M16	Screw	Value to add	190 Nm
M20	Screw	Value to add	370 Nm
M24	Screw	Value to add	640 Nm
M30	Screw	Value to add	1280 Nm
M36	Screw	Value to add	2220 Nm
M42	Screw	Value to add	3560 Nm
M48	Screw	Value to add	5370 Nm

General information:

NOTE

Purging the transmission

It is not permitted to purge the transmission with paraffin or other cleaning agents.

Only purge the transmission with approved lube oil.

- Use new lube oil for each purging procedure.
-

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

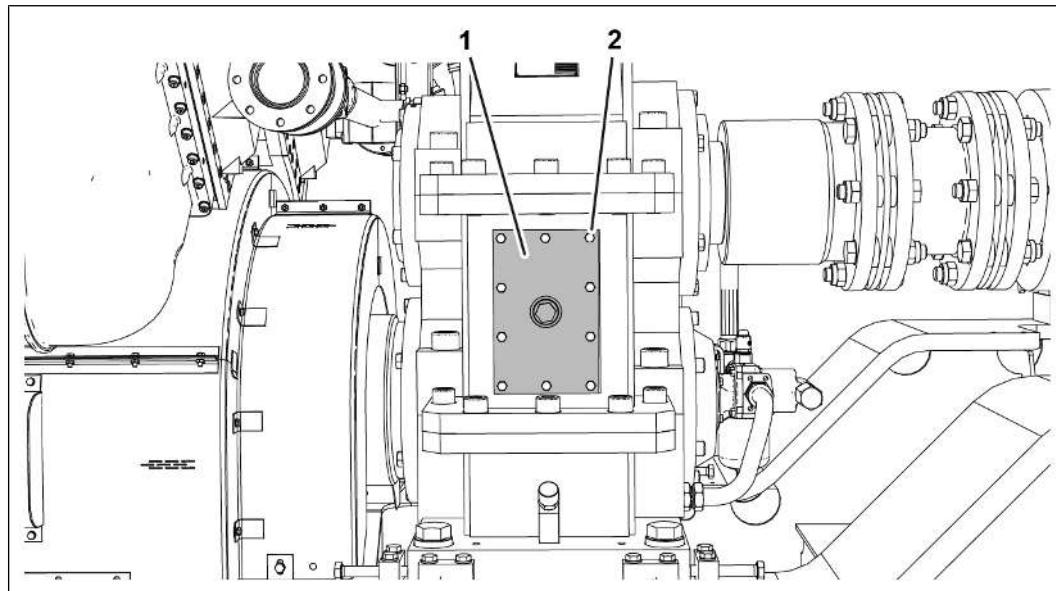
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

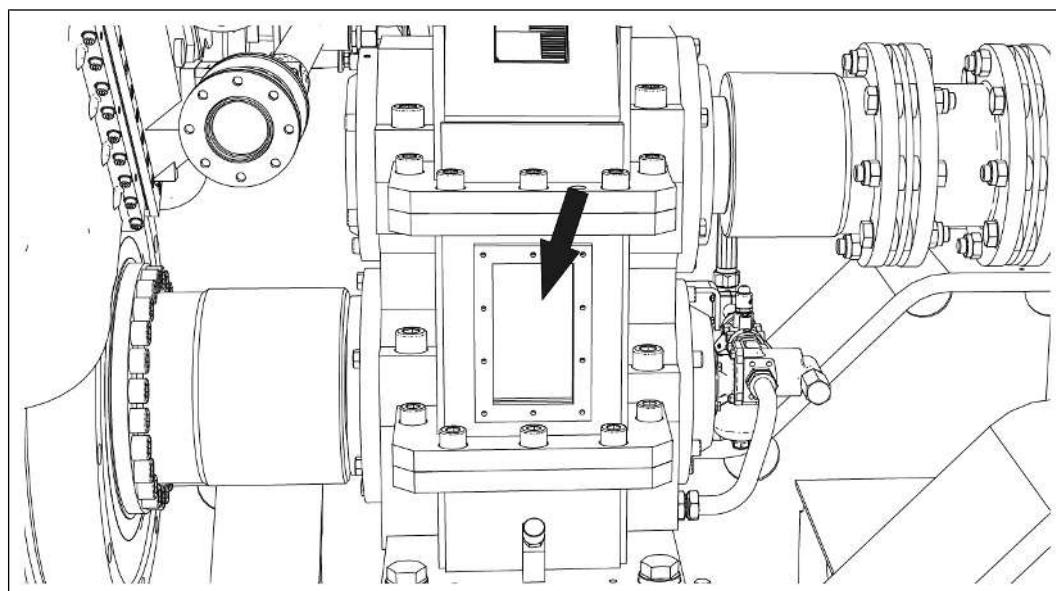
Purging the transmission:

1. The lube oil has drained away, see OL-MRA10 / 03-01-22 [Performing lube oil change \(transmission\) \[▶ 364\]](#).
2. The lube oil filter is cleaned or replaced, see OL-MRA10 / 03-05-10 [Cleaning the lube oil filter \(transmission\) \[▶ 375\]](#).



2023030411

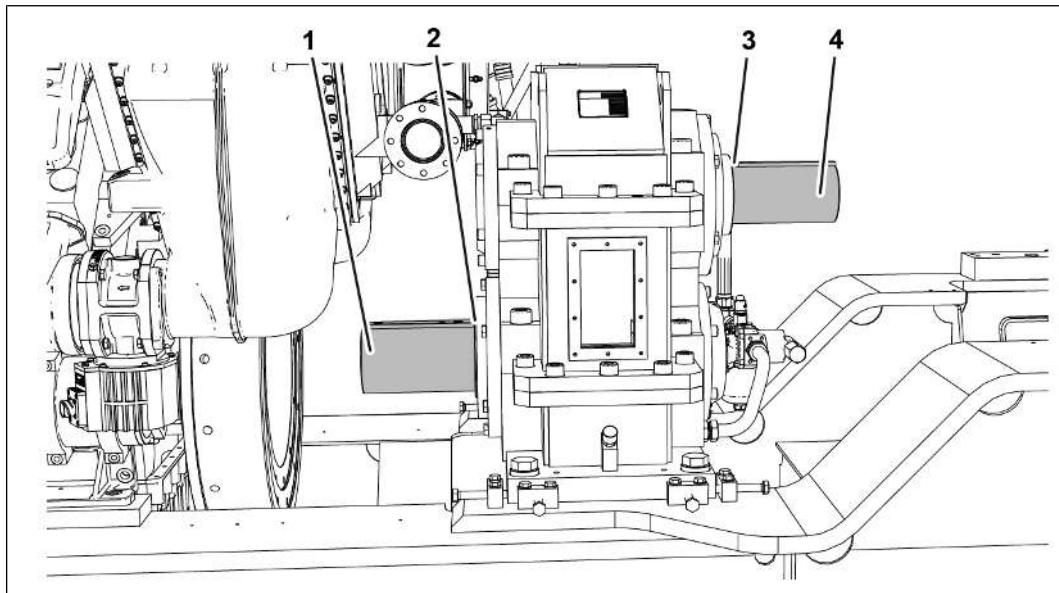
3. Dismantle inspection hole cover (1).
 - Unscrew screws (2).
 - Remove inspection hole cover.
 - Remove seal.



2023109643

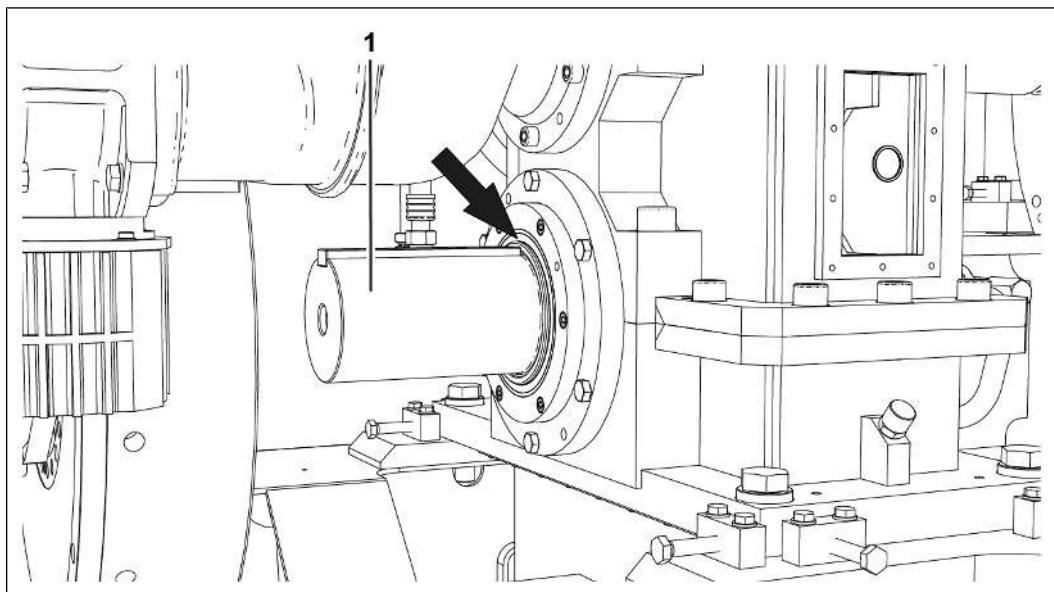
4. Completely remove remaining lube oil as far as is possible.

5. Clean inside of transmission (arrow) with a non-fraying rag.
6. Check inside of transmission (arrow) for deposits and residues.



2023112075

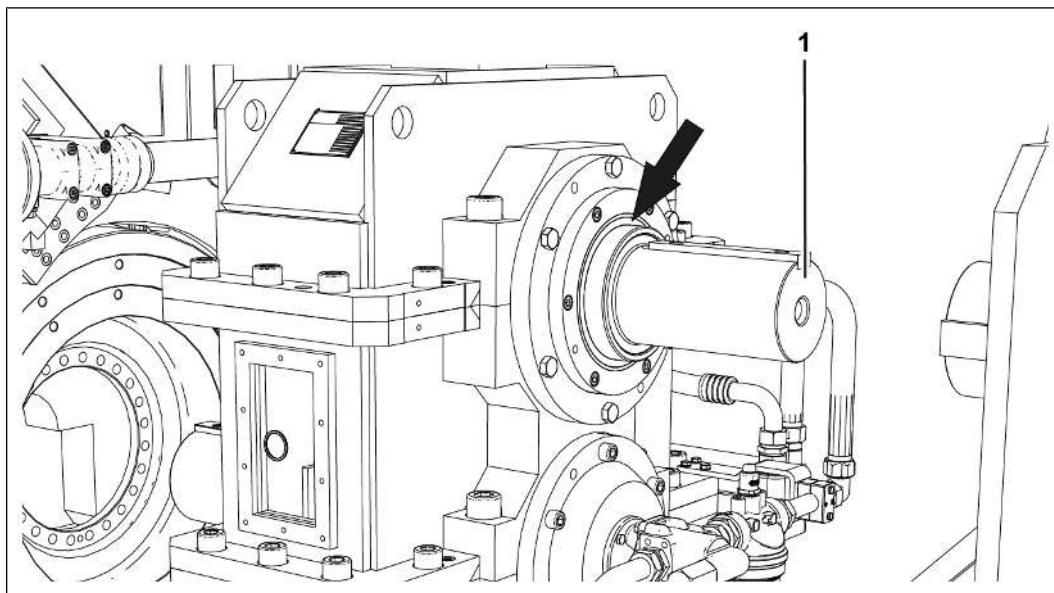
- 1 Drive shaft
 - 2 Labyrinth sealing ring of the drive shaft
 - 3 Output shaft
 - 4 Labyrinth sealing ring of the output shaft
7. Dismantle the protective cover (flywheel), see OL-MRA10 / 52-90-12 [Dismantling the protective cover](#) [▶ 573].
 8. Dismantle the protective cover (transmission), see OL-MRA10 / 03-19-12 [Dismantling complete protective cover](#) [▶ 384].



2023114507

9. Clean labyrinth sealing ring of the drive shaft (1).

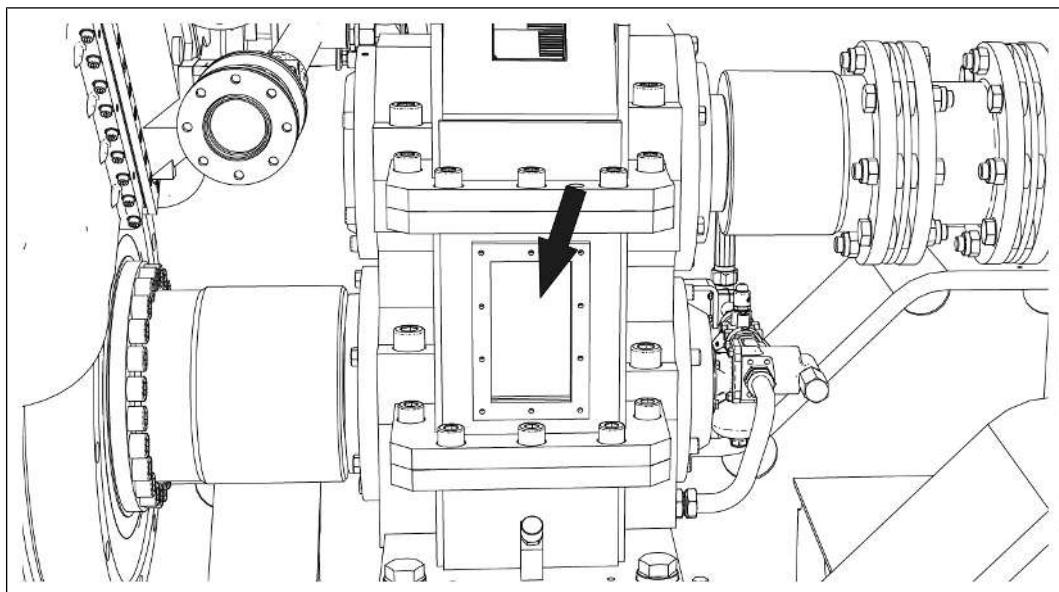
- Blow out labyrinth sealing ring all around with compressed air through the gap (arrow).



2023116939

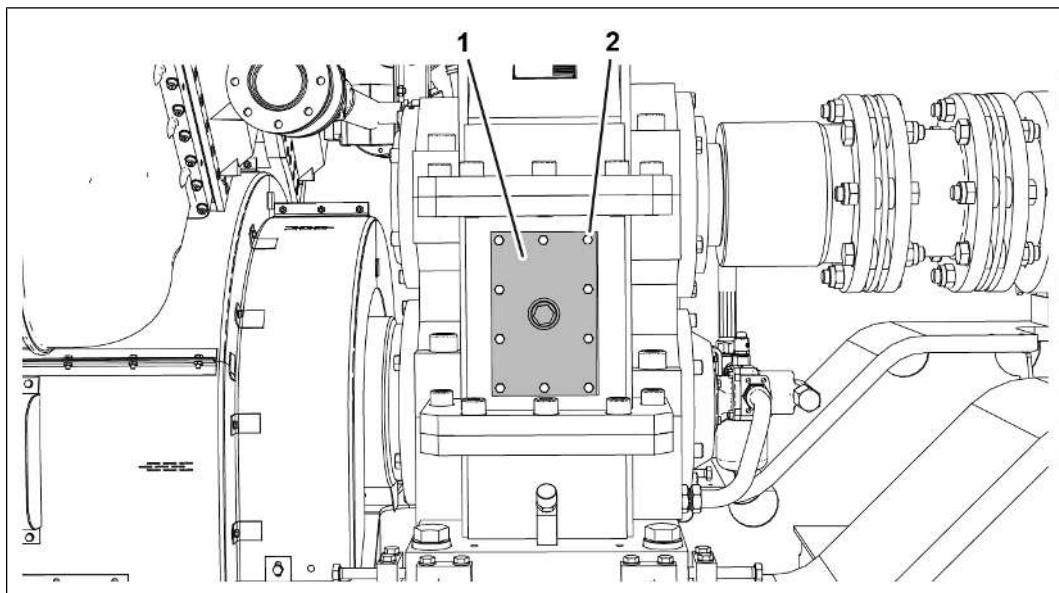
10. Clean labyrinth sealing ring of the output shaft (1).

- Blow out labyrinth sealing ring all around with compressed air through the gap (arrow).



2023109643

11. Clean inside of transmission (arrow) with a non-fraying rag.
12. Pour in lube oil, see OL-MRA10 / 03-01-22 [Replenishing the lube oil \(transmission\)](#)
[▶ 360].



2023030411

13. Mount inspection hole cover (1).
 - Replace seal.
 - Attach inspection hole cover.
 - Tighten screws (2).
14. Mount the protective cover (flywheel), OL-MRA10 / 52-90-12 [Mounting the protective cover](#) [▶ 578].

-
15. Mount the protective cover (transmission), see OL-MRA10 / 03-19-12 [Mounting complete protective cover \[▶ 385\]](#).
 16. Perform sampling without a load, see OL-MRA10 / 00-10-30 [Performing a test run \[▶ 218\]](#).
 17. Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).
 18. **CAUTION! Risk of burns from touching hot operating media or hot components!**
Dismantle inspection hole cover (1).
 - Unscrew screws (2).
 - Remove inspection hole cover.
 - Remove seal.



Risk of destruction of components

Risk of destruction due to foaming lube oil

Risk of destruction of components.

- The transmission must not be operated with foamy lube oil.
- If foam has formed, repeat purging procedure with new lube oil.
- If foam continues to form after repeatedly purging the transmission, find and eliminate the cause.
 - If necessary, contact service partner.

-
19. Check transmission and lube oil for formation of foam.
 20. Replace the lube oil, see OL-MRA10 / 03-01-22 [Performing lube oil change \(transmission\) \[▶ 364\]](#).
 - **NOTE! Leaking operating media can be released into the environment!** Drain lube oil completely.
 - Pour in new lube oil.
 21. Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Dismantling and mounting the protective cover (generator)

Dismantling complete protective cover

Valid for:

TCG 2020, TCG 2020 K

60 Hz

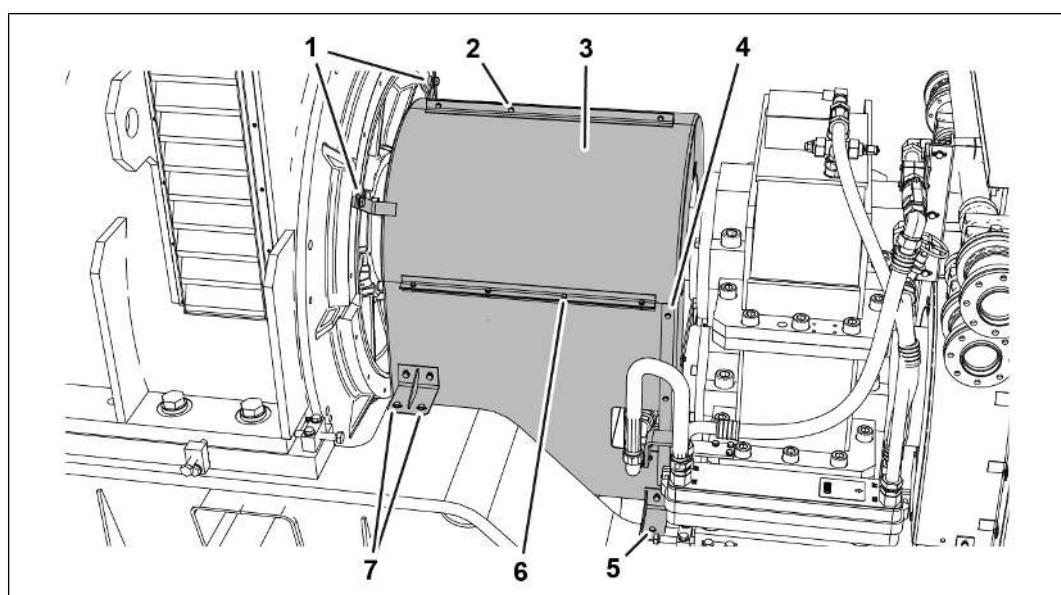


Tools:

- Standard tools

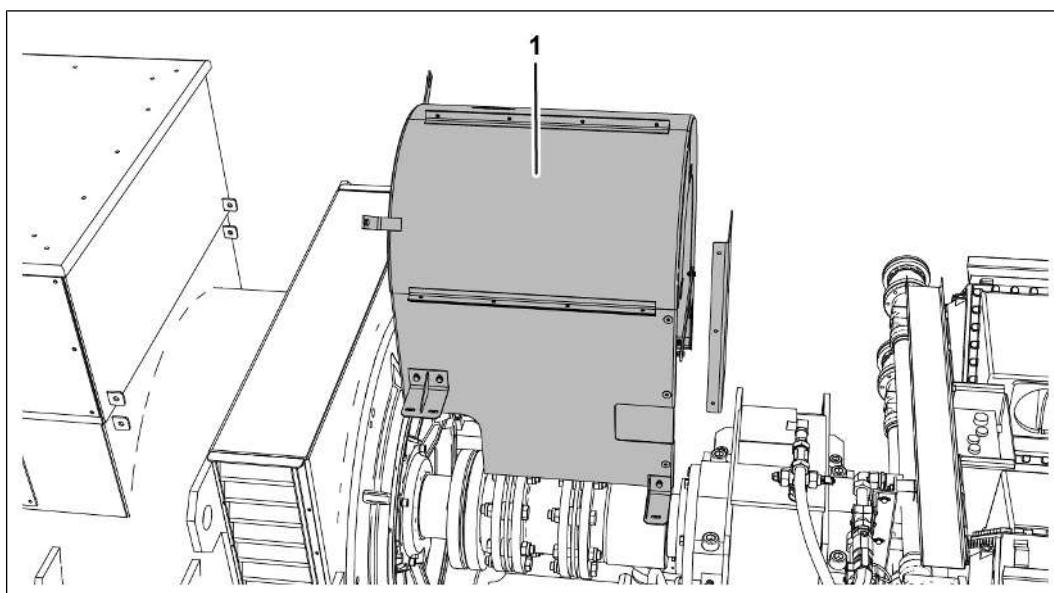
Dismantling the protective cover:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 163](#)



2022432139

1. Dismantle protective cover (3).
 - Unscrew screws (1).
 - Unscrew screws (2).
 - Unscrew screws (4).
 - Remove the protective cover from the side.
 - Unscrew screw (5).
 - Unscrew screws (6).
 - Unscrew screws (7).
 - Set aside the screws, nuts and washers.



2022434571

2. Remove protective cover (1).

Mounting complete protective cover

Valid for:

TCG 2020, TCG 2020 K

60 Hz



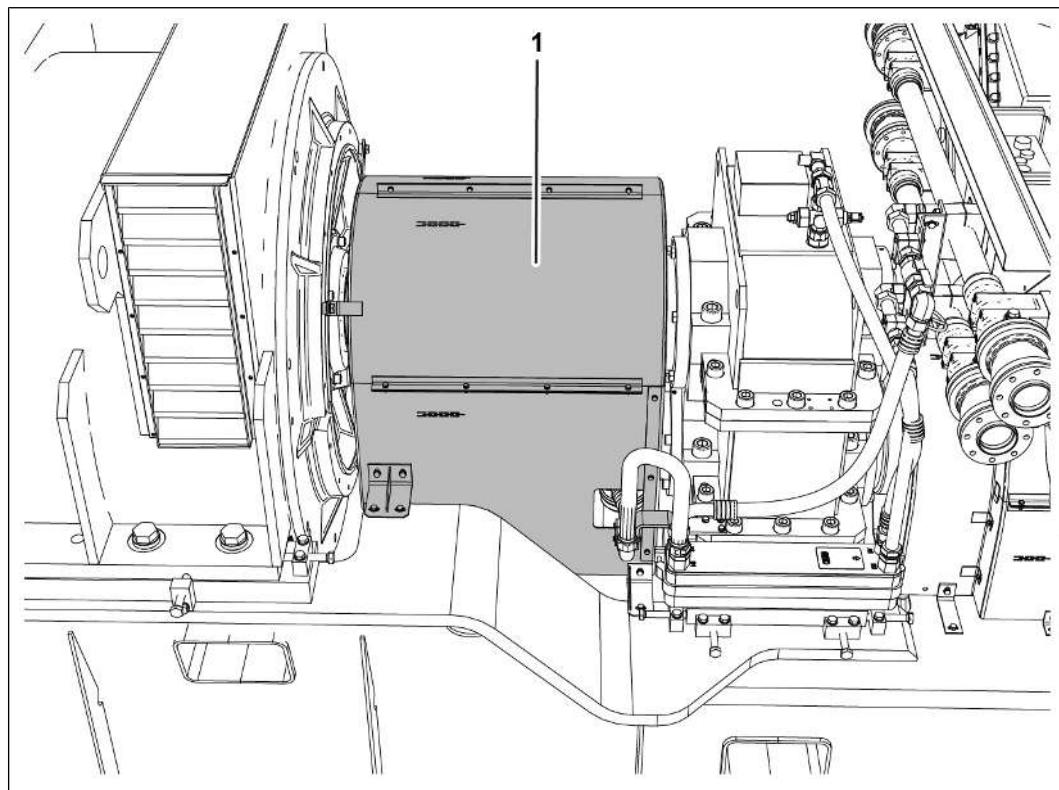
Tools:

- Standard tools

Auxiliary media:

- Cleaning agent

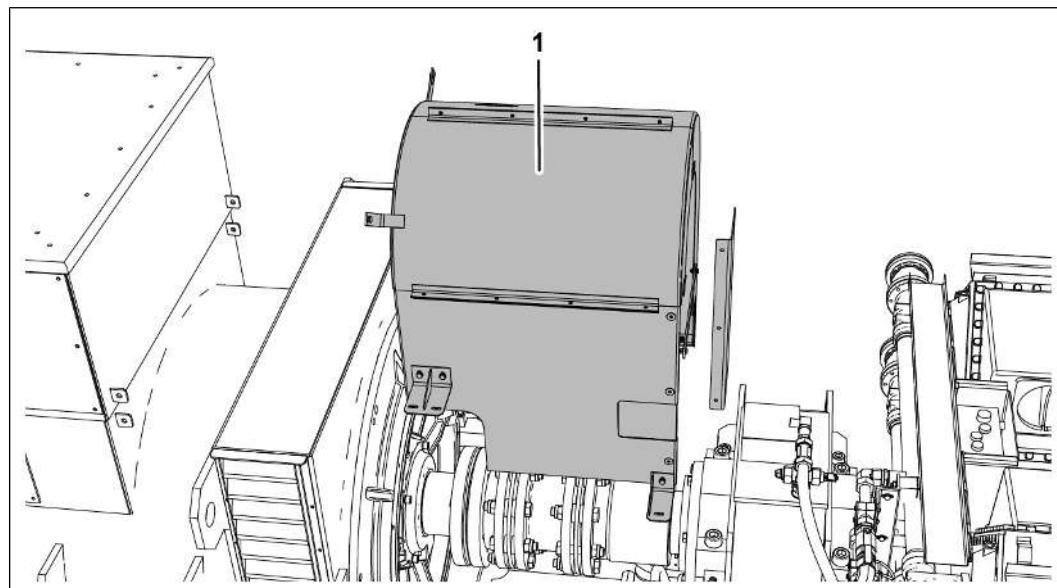
– See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

Technical data

2022955531

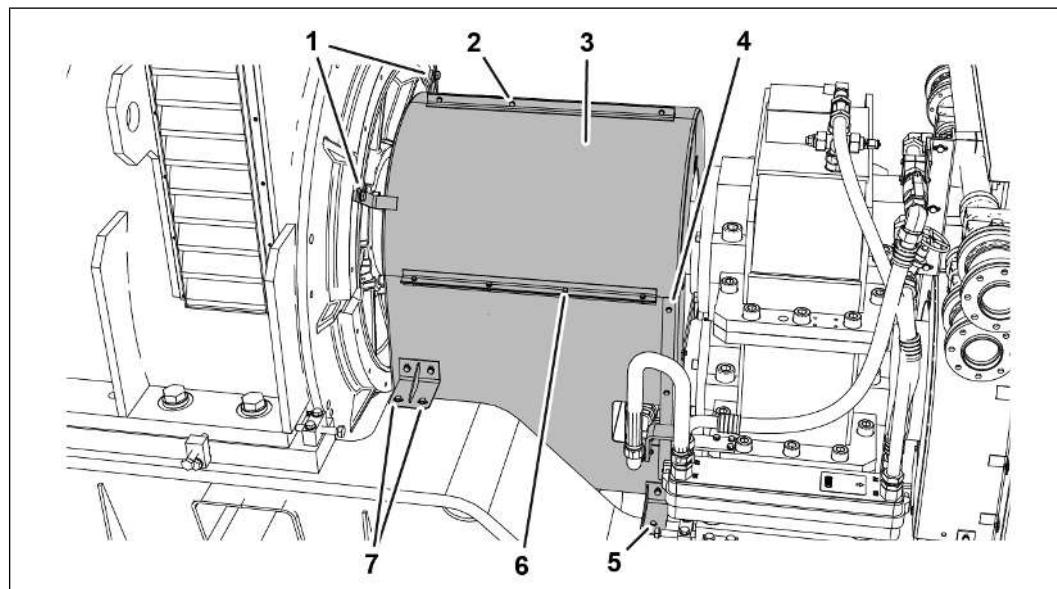
Protective cover (1) on genset

All	Screws	Hand tight
-----	--------	------------

Mounting the protective cover:

2022434571

1. Clean all components.
2. Attach protective cover (1).



2022432139

3. Mount protective cover (3).
 - Tighten screws (7).
 - Tighten screws (6).
 - Tighten screw (5).
 - Attach the protective cover on the side.
 - Tighten screws (4).
 - Tighten screws (2).

-
- Tighten screws (1).
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Checking the valve clearance

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Feeler gauge

Special tools

- [Engine turning gear 1244 1150 \[▶ 205\]](#)
- Alternative: [Engine turning rod 1242 0844 \[▶ 205\]](#)
- [Torque wrench 1203 0350 \[▶ 203\]](#)
- [Key for the setting screw of the valve crosshead 1230 3225 \[▶ 204\]](#)



Spare parts:

- If necessary, seal for cylinder head cover

Technical data

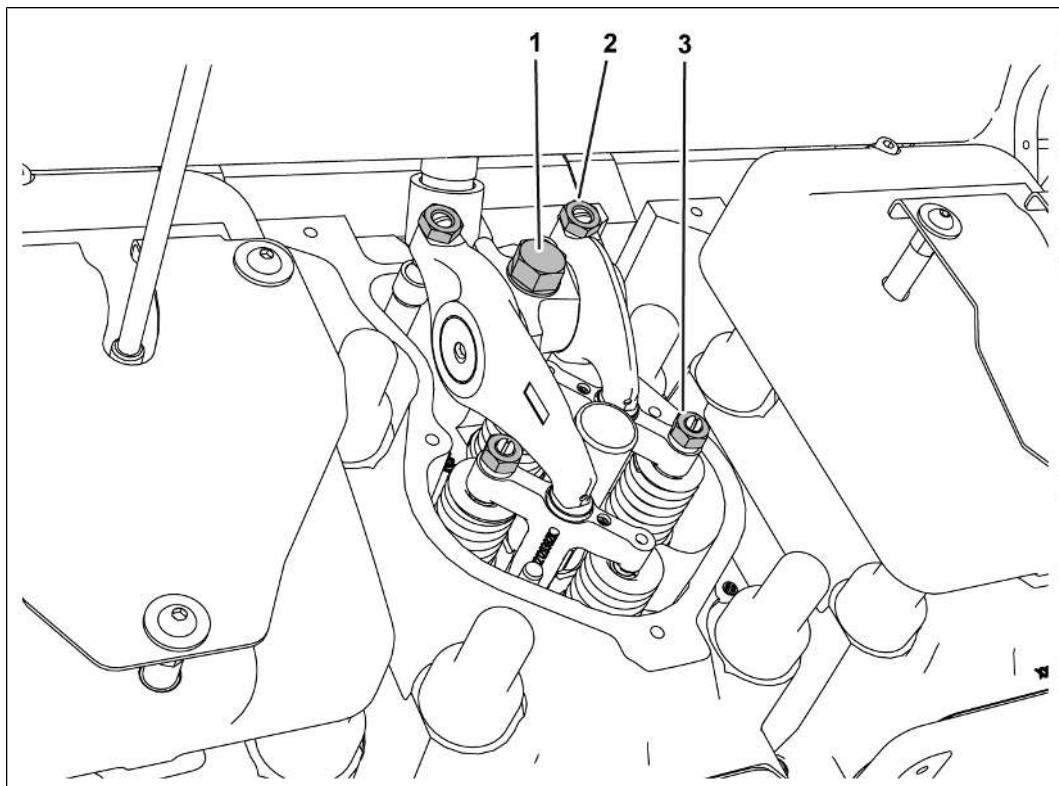
Valve clearance		
Inlet valve	Setting value	0.3 mm
Outlet valve	Setting value	0.7 mm

Rocker arm jack		
Valve crosshead	Setting value	0.05 mm

V12 engine valve setting		
Ignition TDC		A1 B2 A5 B4 A3 B1 A6 B5 A2 B3 A4 B6
Overlap		A6 B5 A2 B3 A4 B6 A1 B2 A5 B4 A3 B1
V16 engine valve setting		
Ignition TDC		A1 B2 A6 B5 A8 B7 A3 A7 B6 A4 B8 A2 B3 A5 B1 B4
Overlap		B6 A4 B8 A2 B3 A5 B1 B4 A1 B2 A6 B5 A8 B7 A3 A7

V20 engine valve setting

	Ignition TDC	A1 B7 A2 B5 A4 B3 A6 B1 A8 B2 A10 B4 A9 B6 A7 B8 A5 B10 A3 B9
	Overlap	A10 B4 A9 B6 A7 B8 A5 B10 A3 B9 A1 B7 A2 B5 A4 B3 A6 B1 A8 B2



473350667

Rocker arm jack on cylinder head

1.	Screw	M16 x 80 - 10.9	30 Nm
		Stage 2	+120°

Lock nut on valve crosshead

2.	Nut	M12	45 Nm
3.	Nut	M10	40 Nm

General information



Risk of destruction of components

Improper adjustment of valve clearance

The engine can be damaged.

- Only check and adjust valve crosshead and valve clearance when engine is cold.
 - When measuring, ensure that the valves are completely closed.
-

Maintain the valve clearance exactly to ensure operating safety and a long service life of the genset.

An overly large valve clearance is an indication of wear on the valve train.

- If the test value of the cylinder is outside the desired value, check the valve clearance and eliminate the cause.
 - The form for documenting the test values can be found in the digital document as an attachment.
-

NOTE

The work described below is carried out on one valve crosshead and one valve.

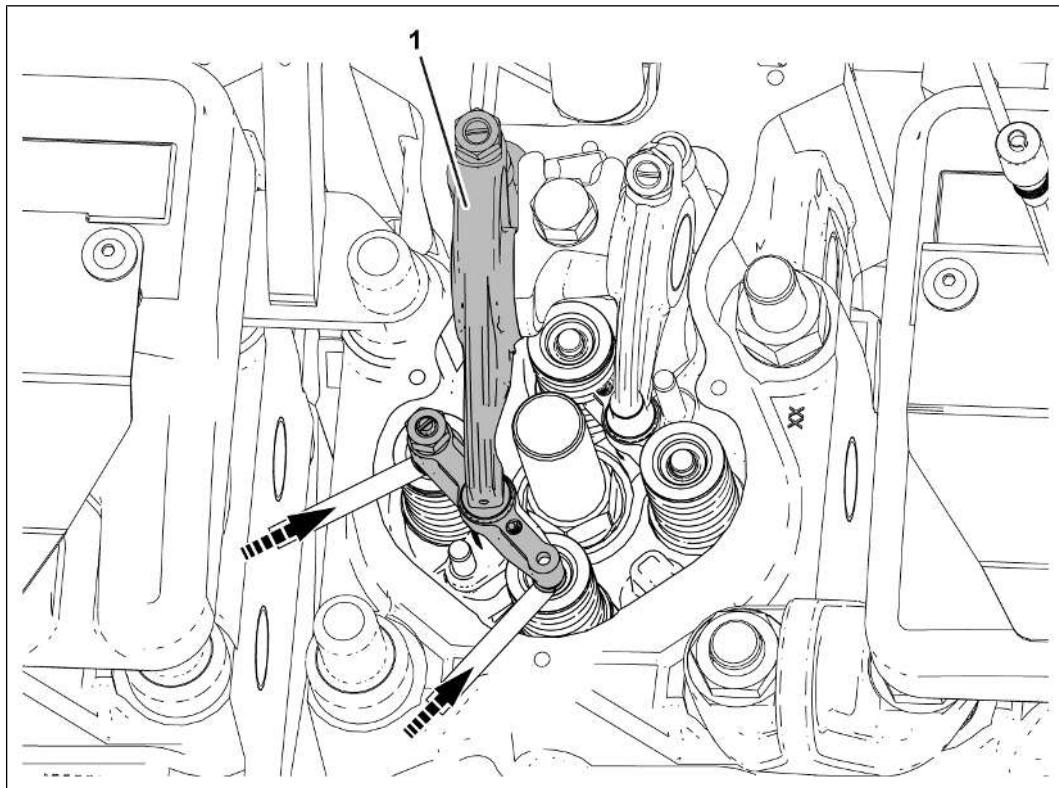
Proceed in the same way for all others.

Perform valve crosshead and valve clearance checks on all cylinder heads.

Check the valve crosshead:

- ✓ Cylinder cover dismantled, see OL-MRA10 / 08-50-12 [Dismantling the cylinder head cover \[▶ 399\]](#)
- ✓ Engine turning device mounted, see OL-MRA10 / 49-01-12 [Mounting the engine turning gear \[▶ 565\]](#)

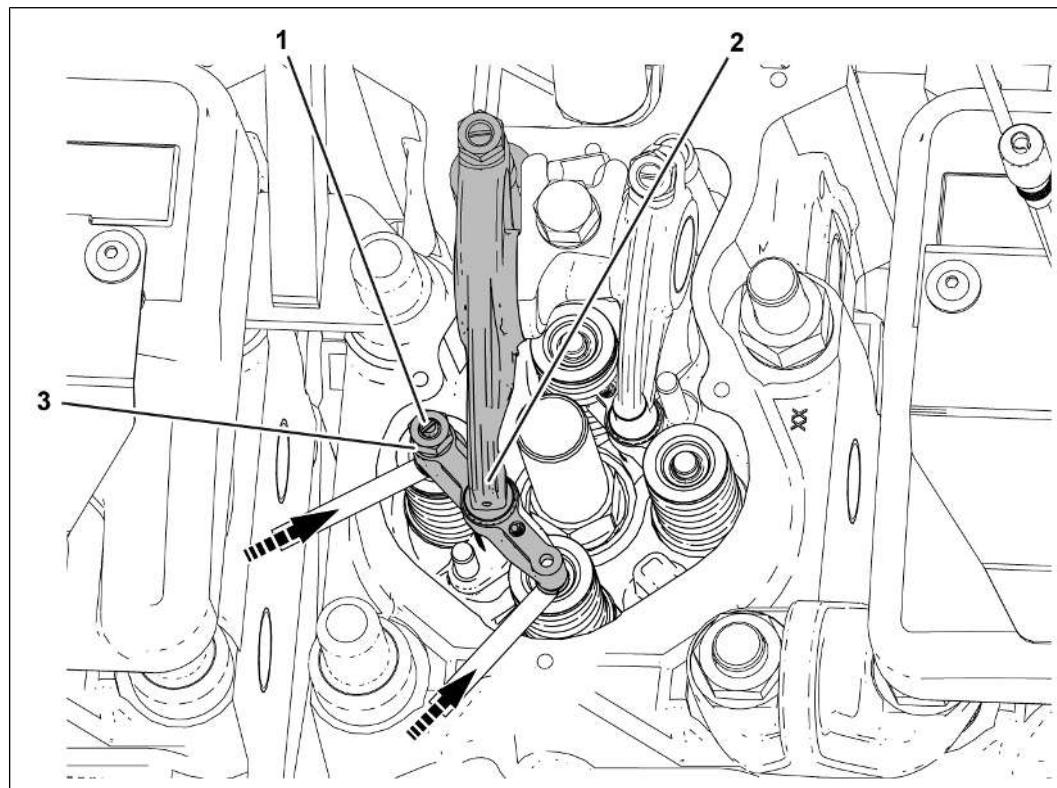
1. Turn crankshaft in direction of rotation until cylinder A1 is in the ignition TDC



486111755

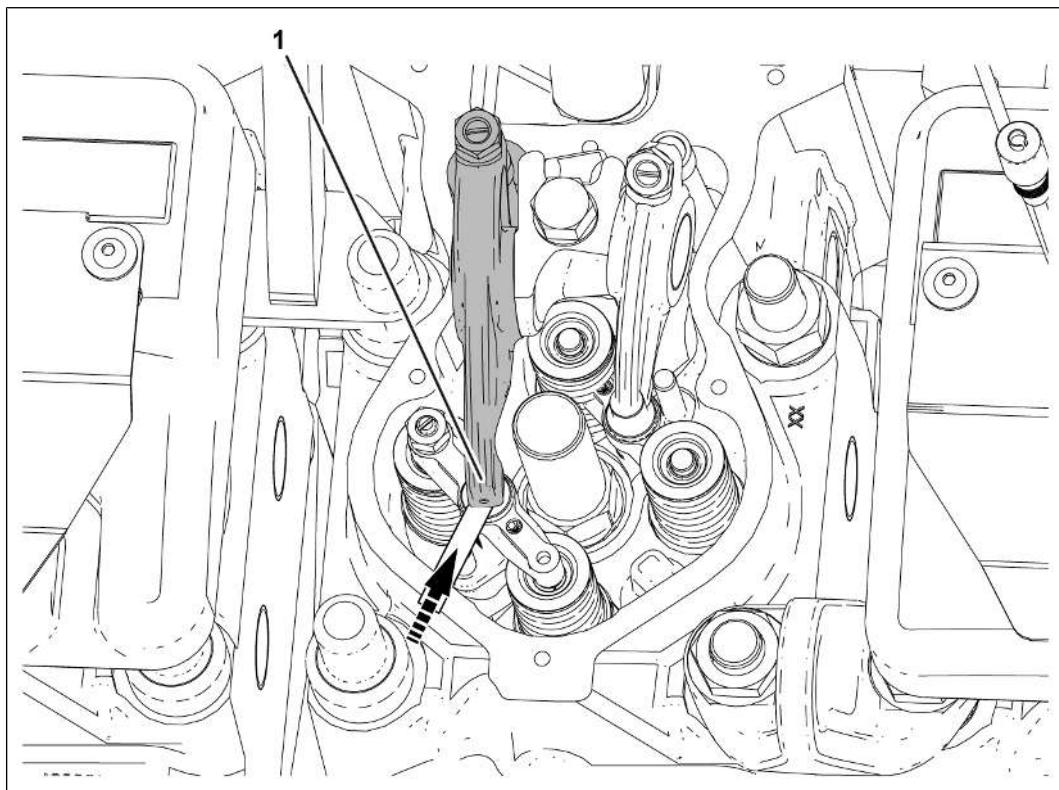
2. Check the clearance of the valve crosshead.

- Push in feeler gauges between valve shaft and valve crosshead (arrows) on both valves of the valve crosshead at the same time.
- Using a finger, press the rocker arm (1) on the valve crosshead.
- It must be possible to pull the feeler gauges out evenly without much resistance.
- If necessary, adjust the clearance of the valve crosshead.

Adjust the valve crosshead:

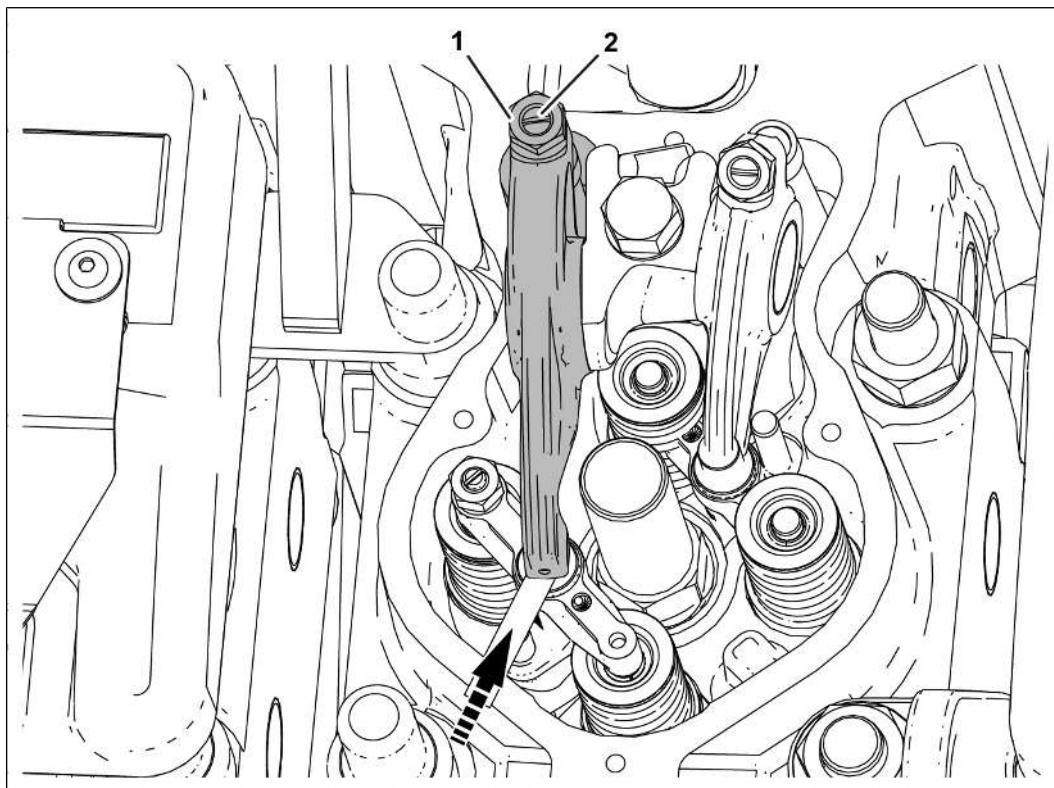
486115467

1. Unscrew nut (3).
2. Push in feeler gauges.
 - At the same time on both valves of a valve crosshead between valve shaft and valve crosshead (arrows).
3. Unscrew or screw in a setting screw (1) until the correct valve clearance is set.
4. Using a finger, press the rocker arm (2) on the valve crosshead.
5. Adjust the valve crosshead with the setting screw (1).
 - It must be possible to pull the feeler gauges out evenly without much resistance.
6. Tighten nut (3).
 - Counter at the setting screw (1).
7. Check the valve crosshead with the feeler gauge again.
 - It must be possible to pull the feeler gauges out evenly without much resistance.
 - Adjust the valve crosshead again, if necessary.

Checking the valve clearance

486106379

1. Push the feeler gauge between valve crosshead and rocker arm (arrow).
 - It must be possible to pull the feeler gauge out evenly without much resistance.
 - If necessary, adjust the valve clearance.

Adjusting the valve clearance

486273547

1. Unscrew nut (1).
 2. Push the feeler gauge between valve crosshead and rocker arm (arrow).
 3. Unscrew or screw in a setting screw (2) until the correct valve clearance is set.
 4. Tighten nut (1).
 - Counter at the setting screw (2).
 5. Check the valve clearance with the feeler gauge again.
 - It must be possible to pull the feeler gauge out evenly without much resistance.
 - Adjust valve clearance again, if necessary.
- ⇒ Dismantle engine turning device, see OL-MRA10 / 49-01-12 [Dismantle the engine turning gear \[▶ 570\]](#)
- ⇒ Mount cylinder cover, see OL-MRA10 / 08-50-12 [Mounting the cylinder head cover \[▶ 400\]](#)

Checking the valve recession (cylinder head mounted)

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - Depth caliper gauge for valve wear 1221 7475 [▶ 204]
 - Measuring device for valve wear 1221 7445 [▶ 204]



Spare parts:

- Spare part
 - If necessary, sealing ring for spark plug

Technical data

V12 engine valve setting		
	Ignition TDC	A1 B2 A5 B4 A3 B1 A6 B5 A2 B3 A4 B6
	Overlap	A6 B5 A2 B3 A4 B6 A1 B2 A5 B4 A3 B1
V16 engine valve setting		
	Ignition TDC	A1 B2 A6 B5 A8 B7 A3 A7 B6 A4 B8 A2 B3 A5 B1 B4
	Overlap	B6 A4 B8 A2 B3 A5 B1 B4 A1 B2 A6 B5 A8 B7 A3 A7
V20 engine valve setting		
	Ignition TDC	A1 B7 A2 B5 A4 B3 A6 B1 A8 B2 A10 B4 A9 B6 A7 B8 A5 B10 A3 B9
	Overlap	A10 B4 A9 B6 A7 B8 A5 B10 A3 B9 A1 B7 A2 B5 A4 B3 A6 B1 A8 B2

Valve residue with mounted cylinder head			
	Inlet/Outlet	Nominal value	74.7 mm
	Inlet/Outlet	Wear limit	71.2 mm

Valve residue with removed cylinder head			
Inlet/Outlet ¹⁾	Nominal value	0 to 0.4 mm	
¹⁾ Measured from middle of the valve plate to the cylinder head sealing surface.			

General information

Regular measurement of the valve recession allows conclusions to be drawn concerning the wear of the valve cones and valve seats.

- When measuring, the valves must be completely closed.
- If the maximum permissible valve recession value is exceeded, replace all valves and valve seat rings of the relevant cylinder head.
- Before installing the measuring equipment, remove the cylinder head cover seal in order to avoid incorrect measurement results.
- See the appendix for the check value documentation form.

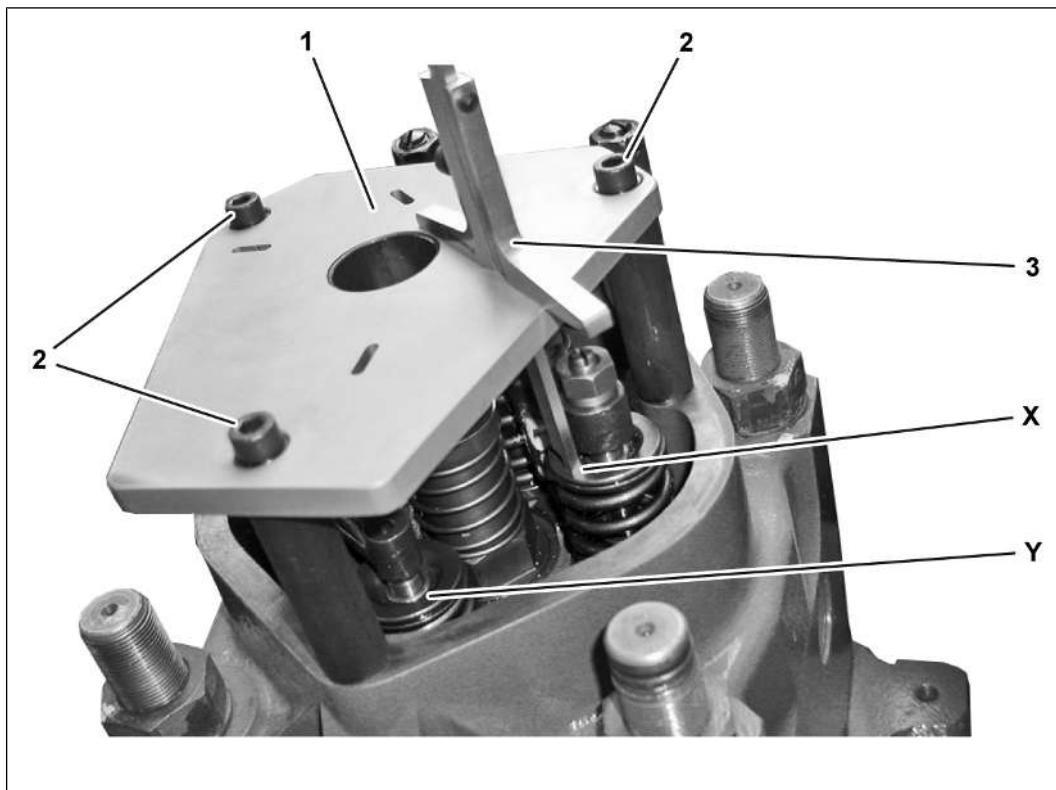
NOTE

The work described below is performed on one valve.

Proceed in the same way for all other valves.

Checking the valve recession (cylinder head mounted)

- ✓ Cylinder head cover dismantled, see OL-MRA10 / 08-50-12 [Dismantling the cylinder head cover \[▶ 399\]](#)
 - ✓ Engine turning device dismantled, see OL-MRA10 / 49-01-13 [Mounting the engine turning gear \[▶ 565\]](#)
1. Remove the cylinder head cover seal.
 2. Only turn the crankshaft in the direction of rotation until all valves are closed.



490778635

3. Attach the measuring device (1).
4. Tighten the screws (2).
5. Measure the valve recession.
 - Insert the depth caliper gauge (3) into the measuring device (1) one after the other in the specified points.
 - Measure on every inlet valve and on every outlet valve in positions (X) and (Y) from the upper side of the valve spring plate to the measuring device.
6. Note the measured values.
 - The form for documentation can be found in the Service Library [OL-MRA10 08-03-01 Valve recession measurement sheet](#).
7. If the maximum permissible valve recession value is reached, contact service partner.
8. Repeat the measurement for all cylinders.
 - ⇒ Dismantle engine turning device, see [OL-MRA10 / 49-01-13 Dismantle the engine turning gear \[▶ 570\]](#)
 - ⇒ Mount the cylinder head cover, see [OL-MRA10 / 08-50-12 Mounting the cylinder head cover \[▶ 400\]](#)

Dismantling and mounting the cylinder head cover

Dismantling the cylinder head cover

Valid for:

TCG 2020, TCG 2020 K

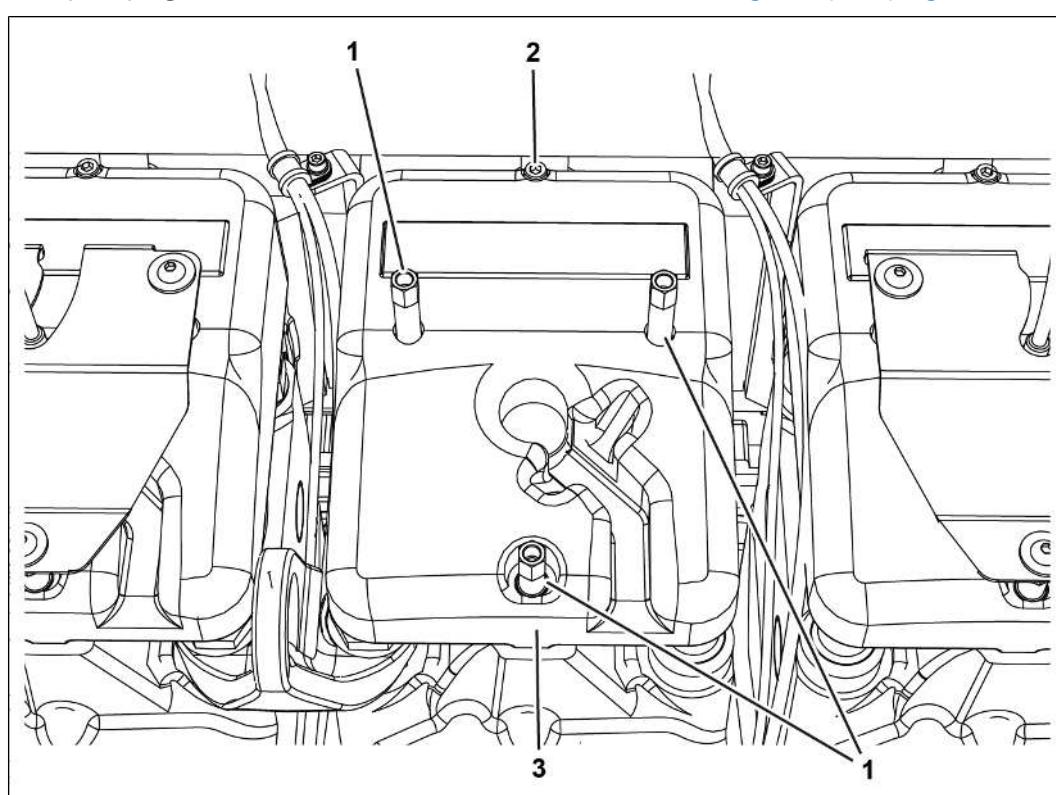


Tools:

- Standard tools

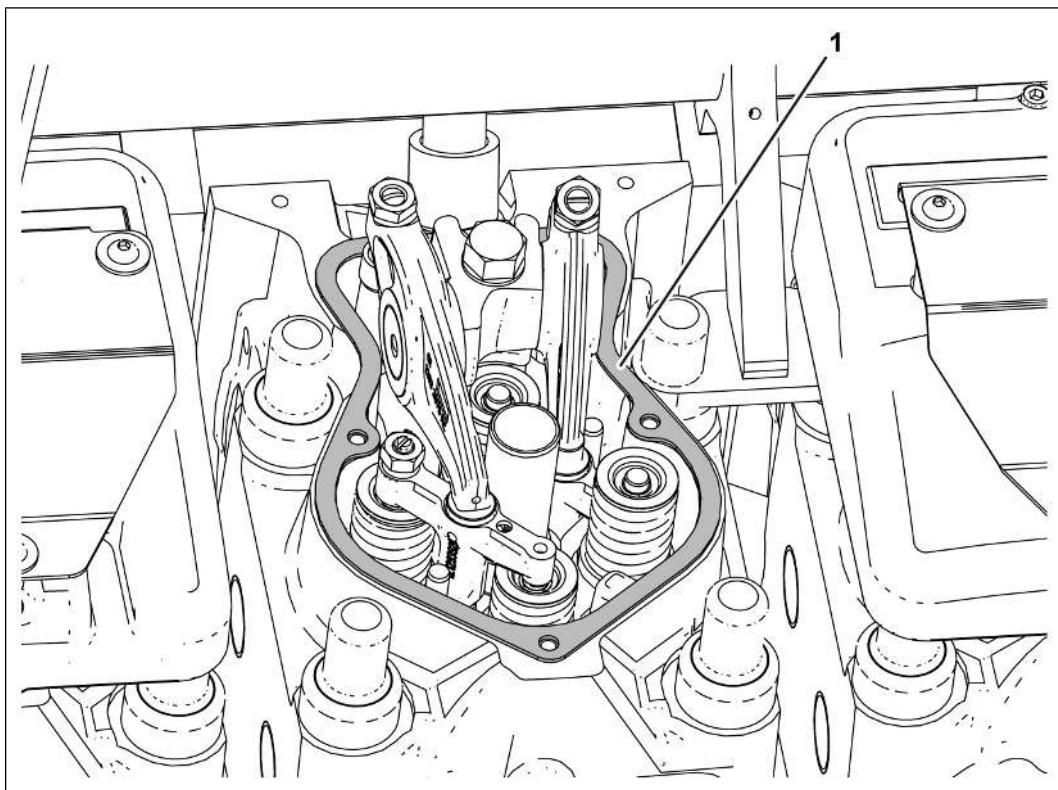
Dismantling the cylinder head cover:

- ✓ Spark plug dismantled, see OL-MRA10 / 26-10-10 Removing the spark plug [▶ 442]



601966987

1. Unscrew screw (2).
2. Unscrew screws (1).
3. Remove the cylinder head cover (3).



601969419

4. Check the seal (1) for cracks and wear.
 - Remove seal (1) if necessary.

Mounting the cylinder head cover

Valid for:

TCG 2020, TCG 2020 K



Tools:

- Standard tools

Special tools

- [Torque wrench 1203 0350 \[► 203\]](#)

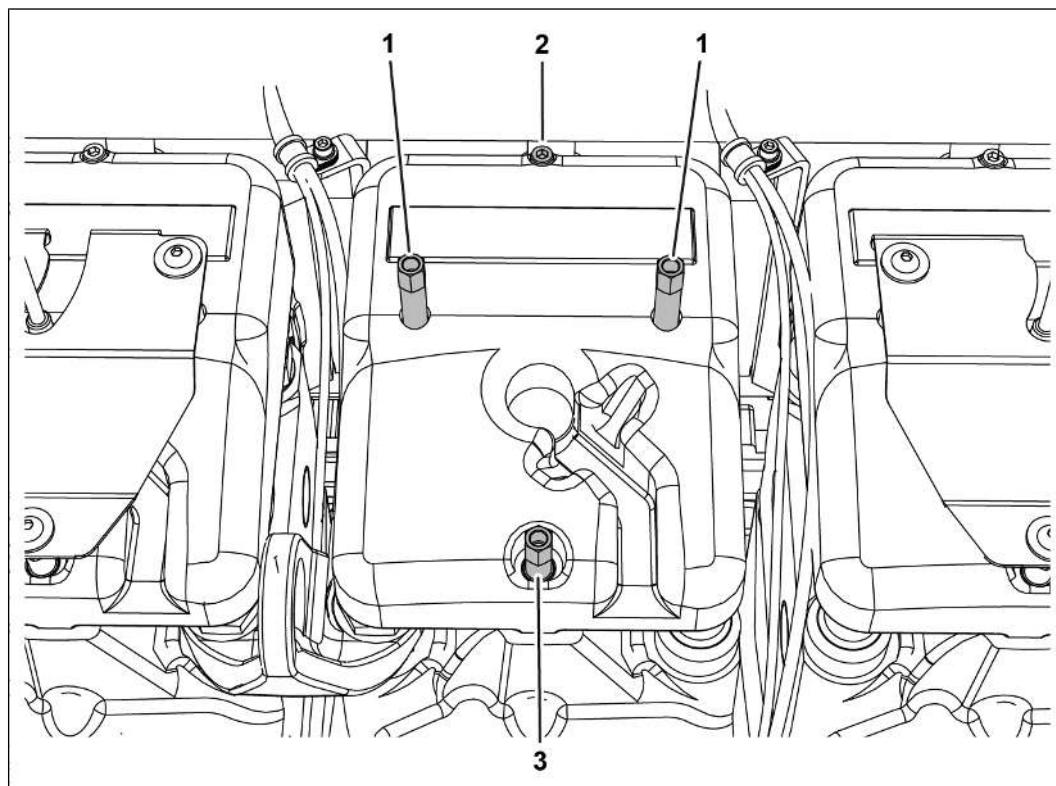
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

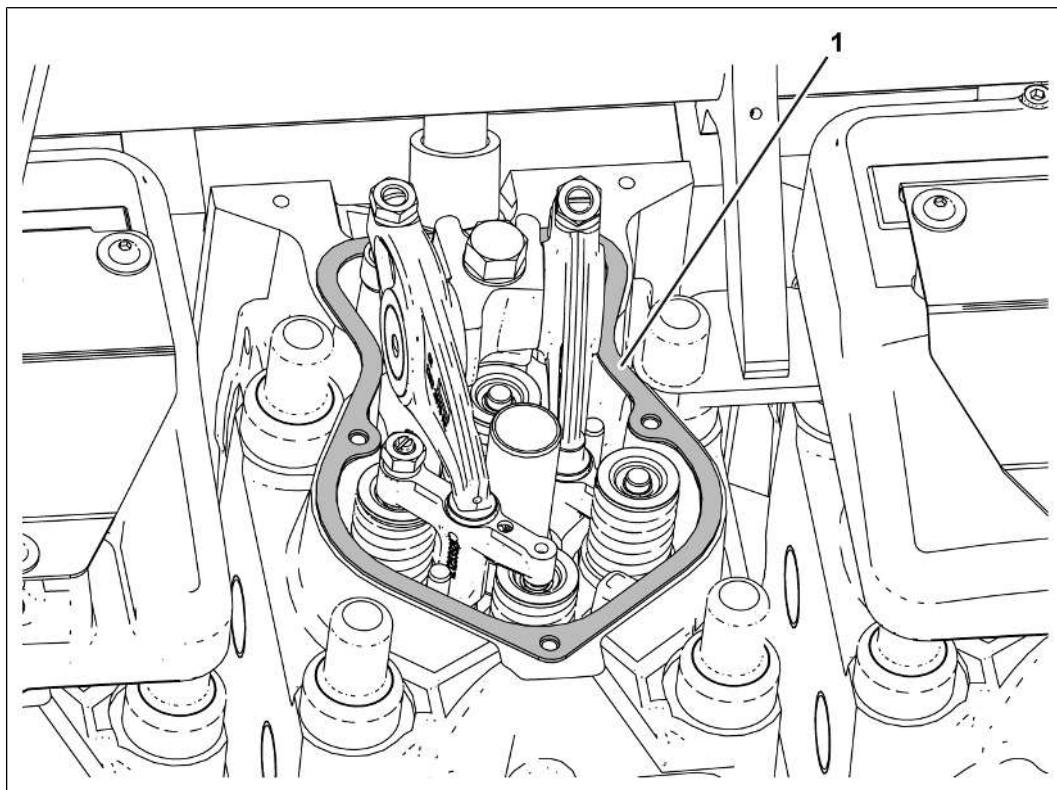
- If necessary, seal for cylinder head cover

Technical data**Technical data**

601964555

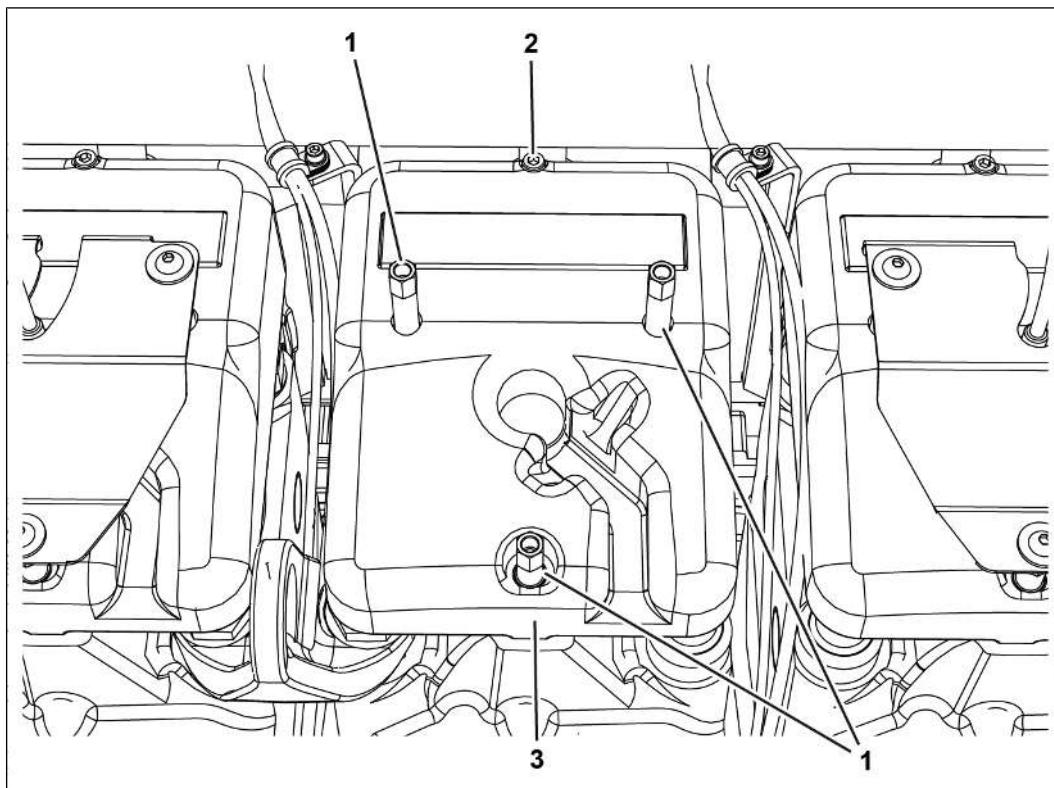
Cylinder head cover on cylinder head

1	Screw	M8 x 85 - 10.9	25 Nm
2	Screw	M8 x 85 - 10.9	25 Nm
3	Screw	M8 x 55 - 10.9	25 Nm

Mounting the cylinder head cover:

601969419

1. Clean components.
2. Replace seal (1).
 - Clean the sealing surface if necessary.
 - Fit seal (1).



601966987

3. Mount the cylinder head cover (3).
 4. Tighten screws (1).
 5. Tighten screw (2).
- ⇒ Install spark plug, see OL-MRA10 / 26-10-10 [Installing the spark plug \[▶ 445\]](#)

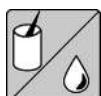
Overhauling the pressure control valve of the prelubrication pump

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Caliper gauge
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



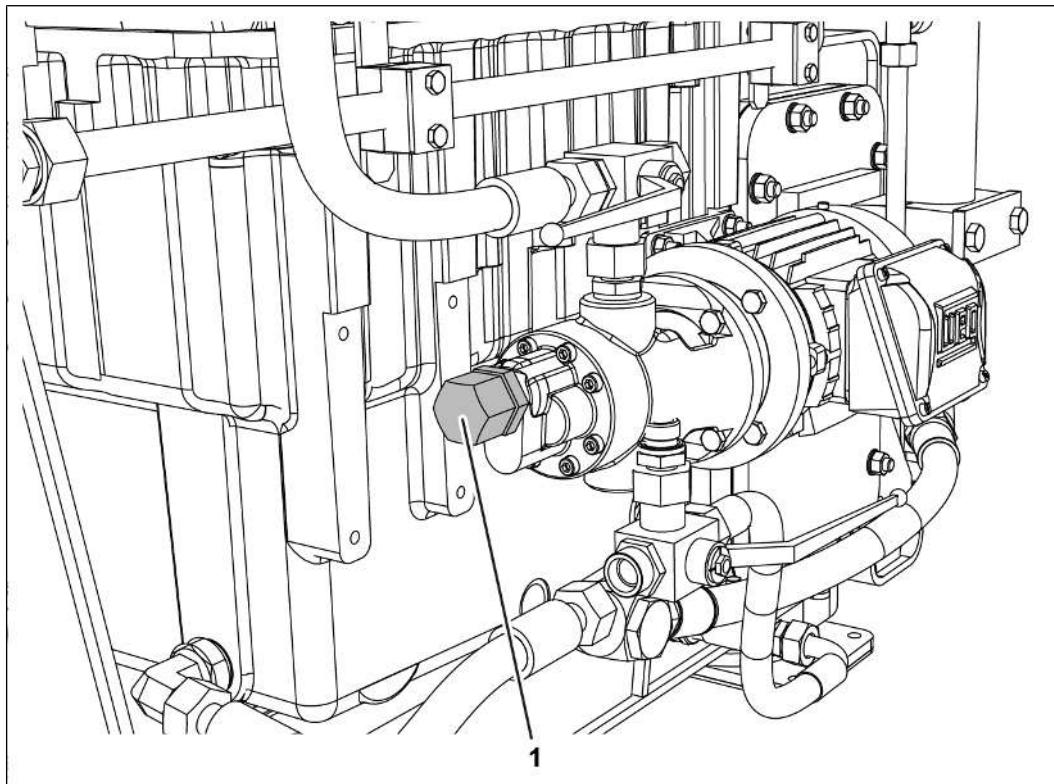
Auxiliary media:

- Binding agent
- Cleaning fluid
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- If applicable, control pistons
- If applicable, compression springs

Technical data

2635507083

Pressure limiting valve on prelubrication pump

1.	Cap nut	M8	70 Nm

General information

Dirt particles can settle on the control piston of the pressure limiting valve.

- As a result, the control piston no longer rests completely on the piston seat and starts to leak.
- The lube oil pressure required for prelubrication is not achieved if the control piston no longer seals completely.

**Danger to the environment**

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

**CAUTION**

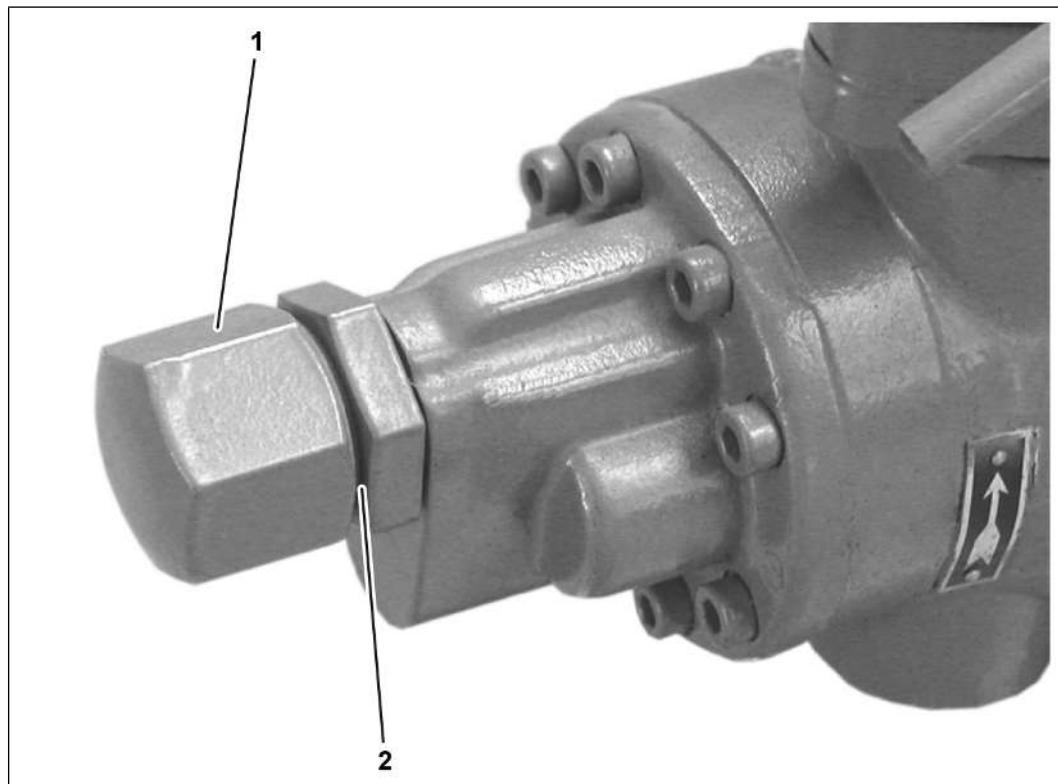
Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

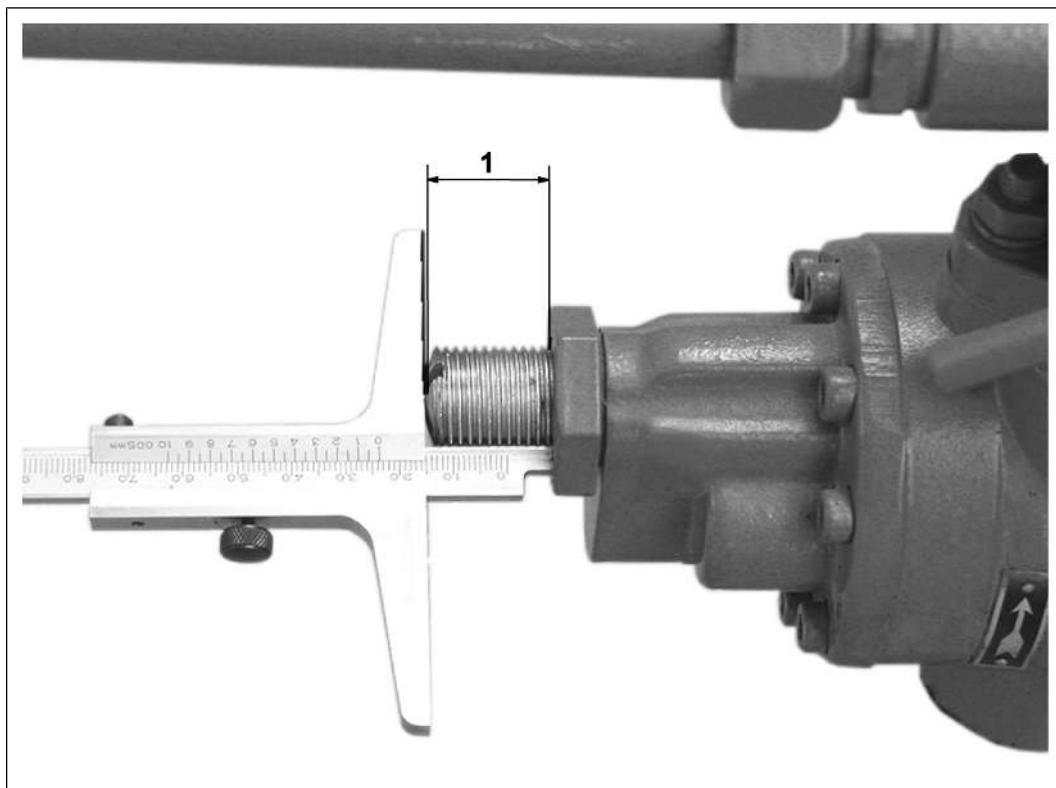
Overhauling the pressure control valve of the prelubrication pump:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).



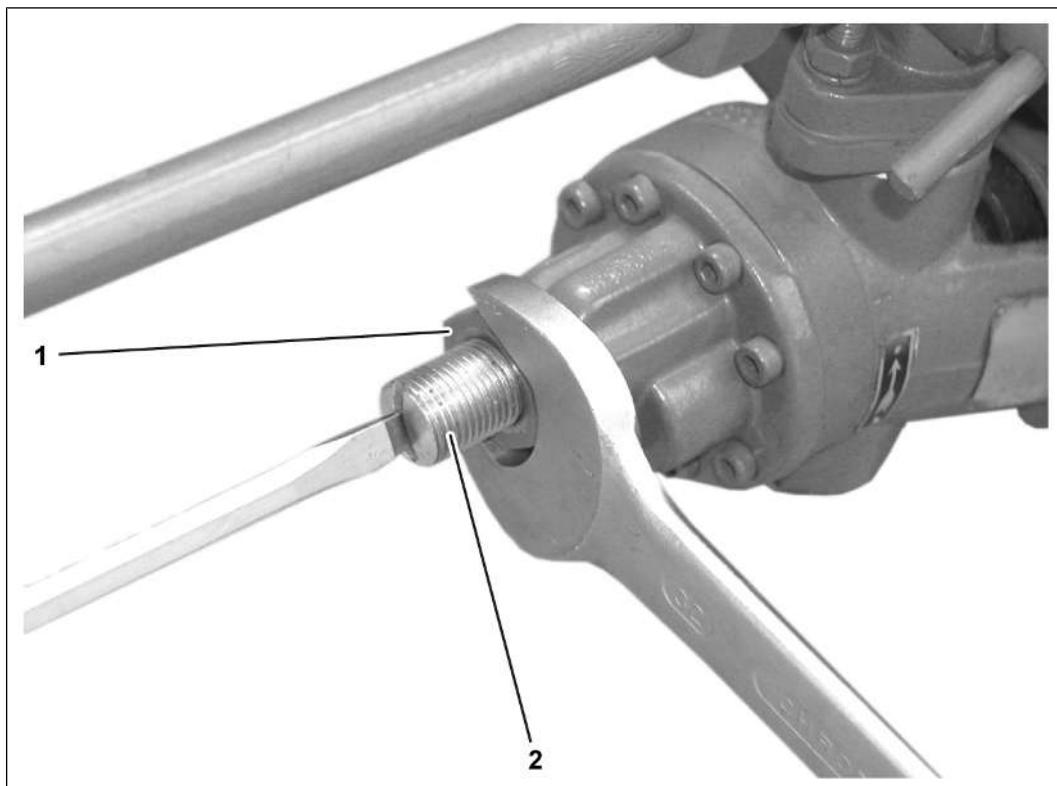
2635509515

1. Place the collecting tray underneath.
2. Unscrew cap nut (1).
3. Remove the sealing ring (2) from the setting screw.



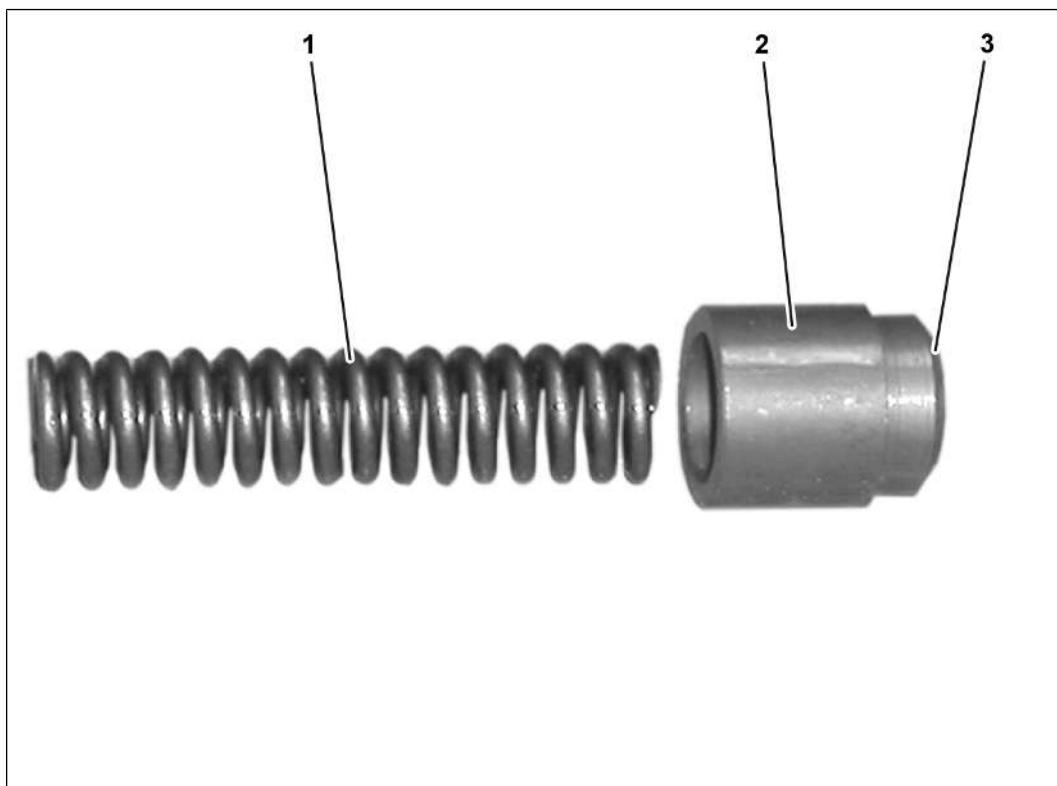
2635511947

4. Measure the setting dimension (1) from the upper side of the setting screw to the lock nut.
 - Note down the measured value for the subsequent installation.



2635539979

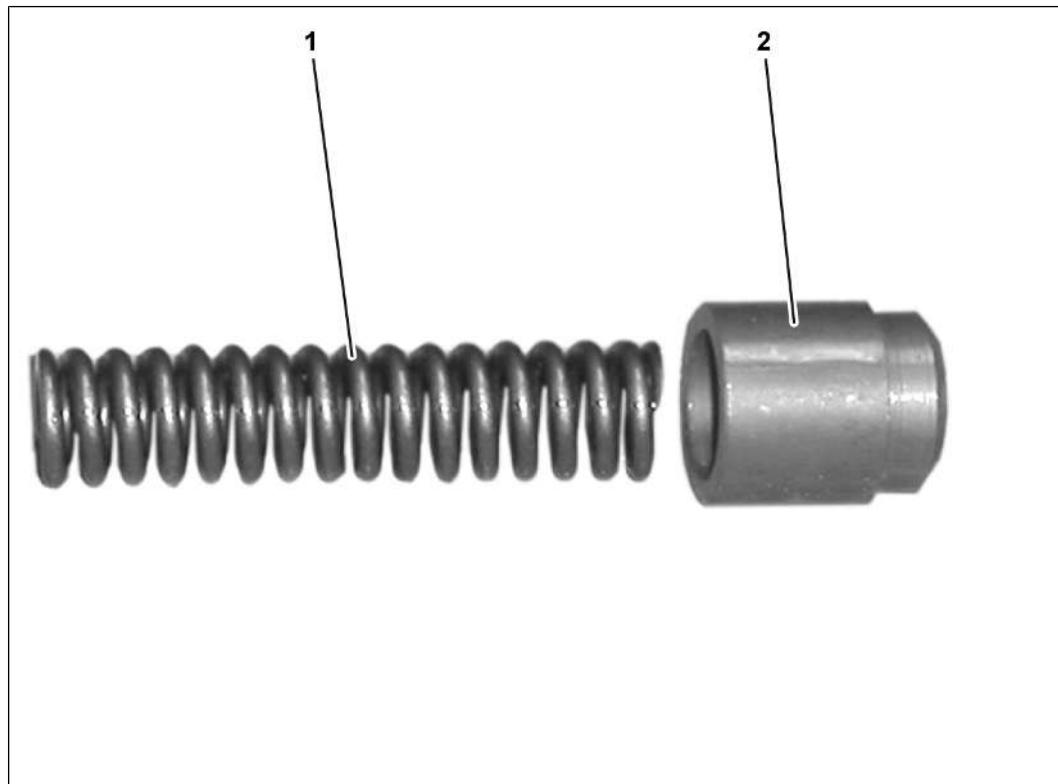
5. **NOTE! Component is under spring pressure!** Unscrew lock nut (1) and setting screw (2)



2635542411

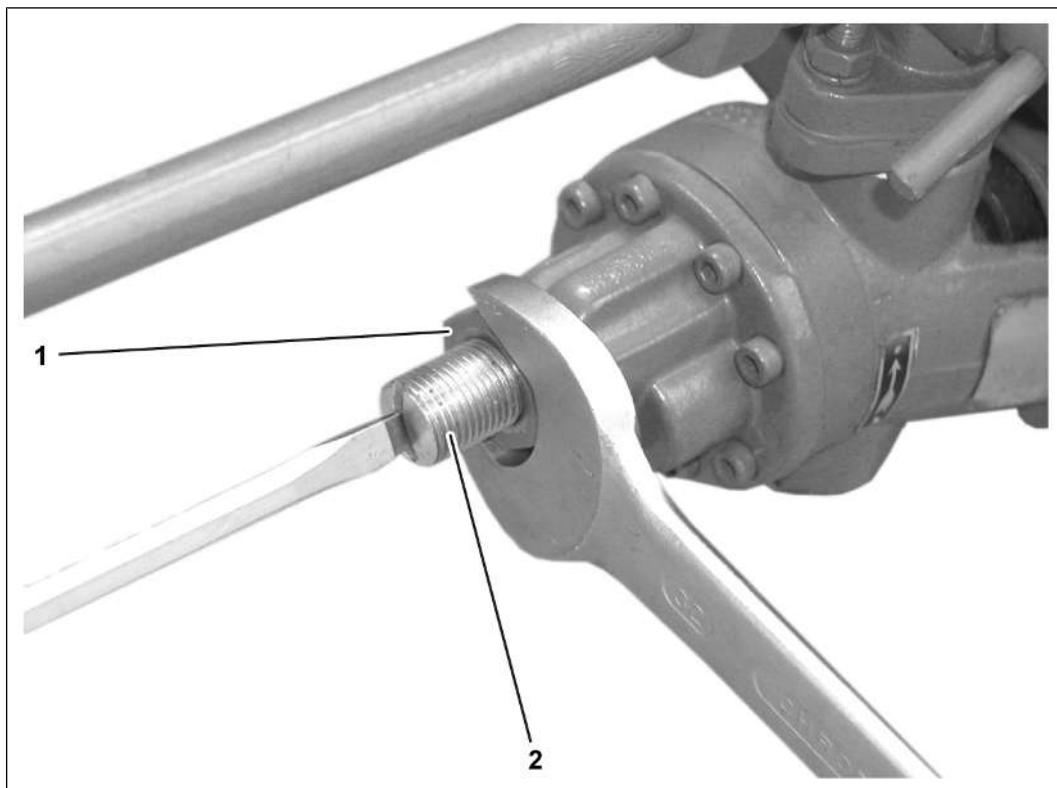
6. Remove compression spring (1) and control piston (2).

7. Clean seating surface (3) on the control piston (2).
8. Clean the piston seat of the control piston (2) in the housing.
9. Check the compression spring (1) and control piston (2) for wear.
 - Renew worn components.



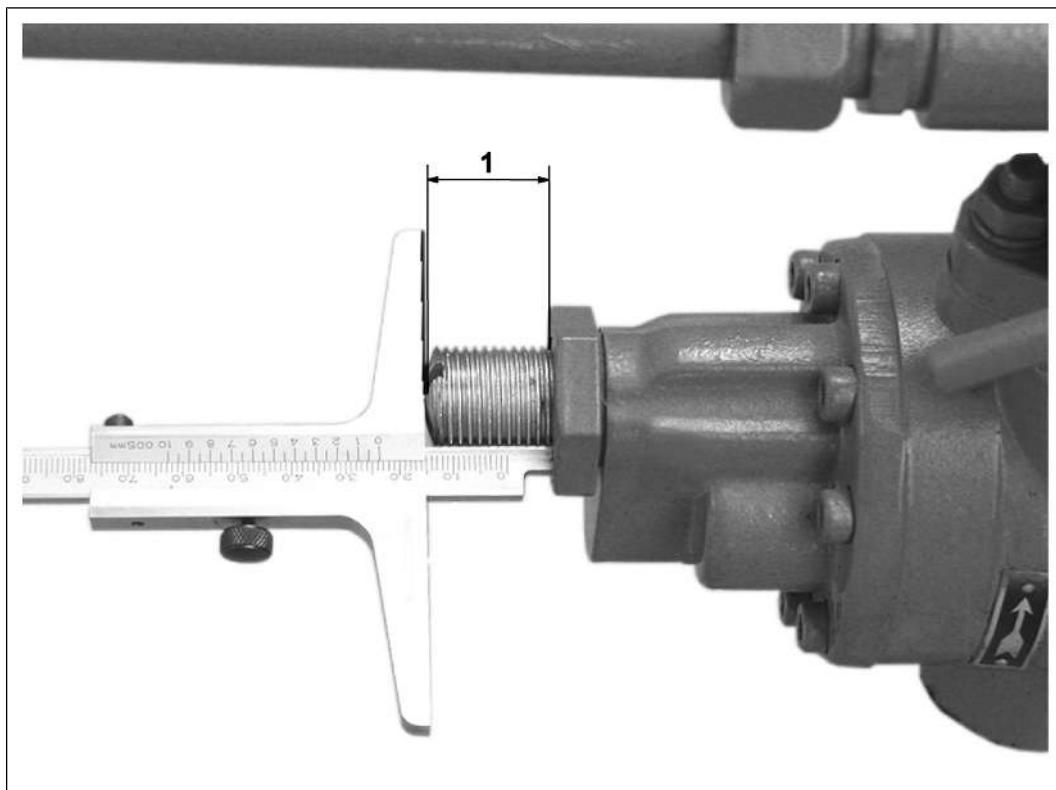
2635544843

10. Insert the compression spring (1) and control piston (2) into the prelubrication pump.



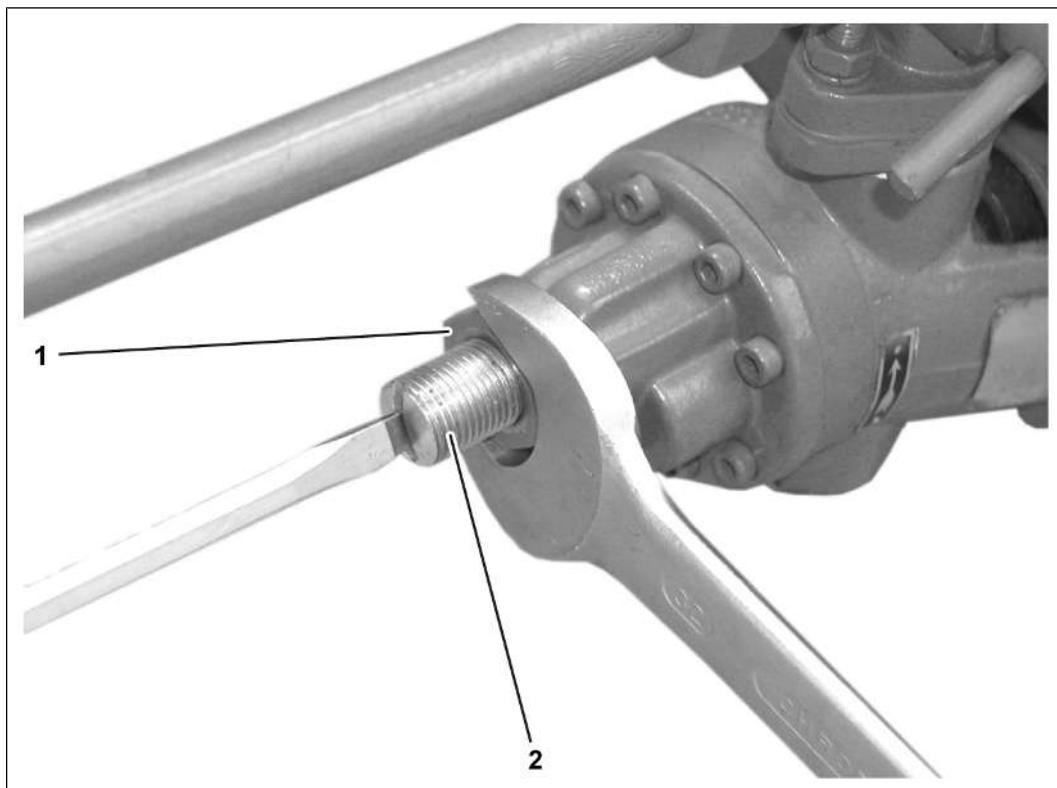
2635539979

11. Screw in the setting screw (2) with the lock nut (1).
 - Replace sealing ring.



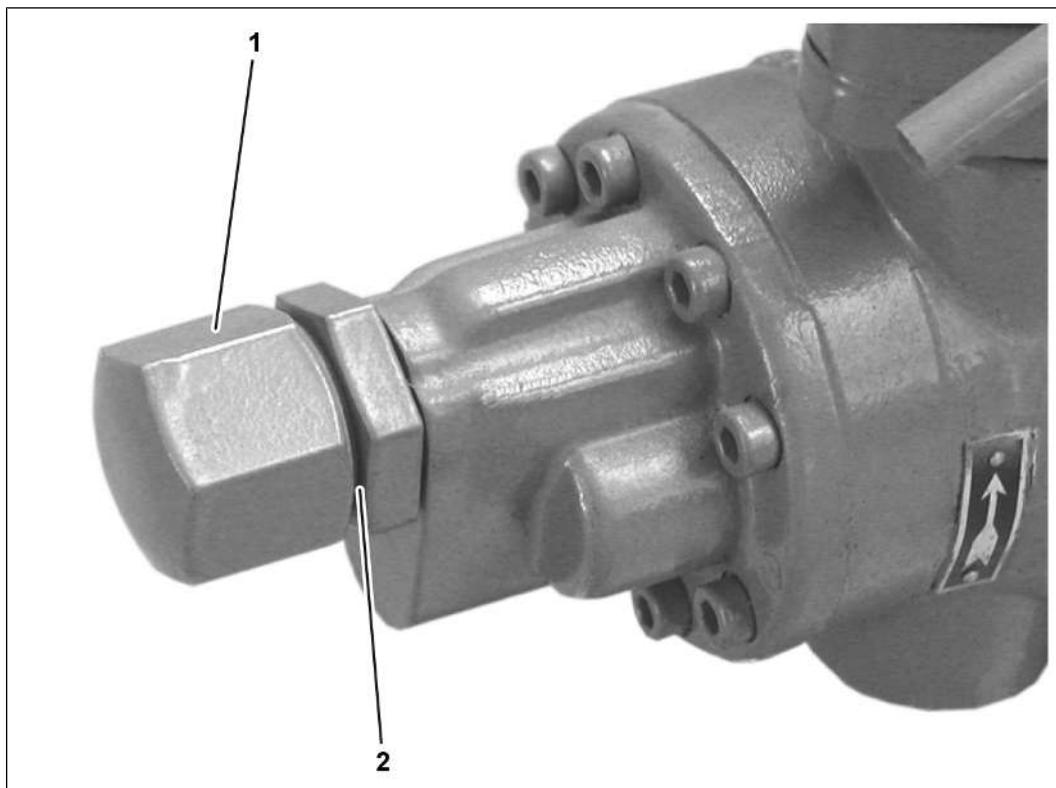
2635511947

12. Check the setting dimension (1) from the upper side of the setting screw to the lock nut.
 - Adjust to the dimension (1) noted during removal.



2635539979

13. Tighten lock nut (1).
 - Counter at the setting screw (2).
14. Re-check the setting dimension using the caliper gauge.
 - Loosen the lock nut again and adjust the setting dimension, if necessary.



2635509515

15. Replace sealing ring (2).
 16. Tighten cap nut (1).
 17. Remove the collecting tray.
 - Properly dispose of the collected lube oil.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the lube oil filter

Removing the lube oil filter

Valid for:

TCG 2020 K, TCG 2020



Tools:

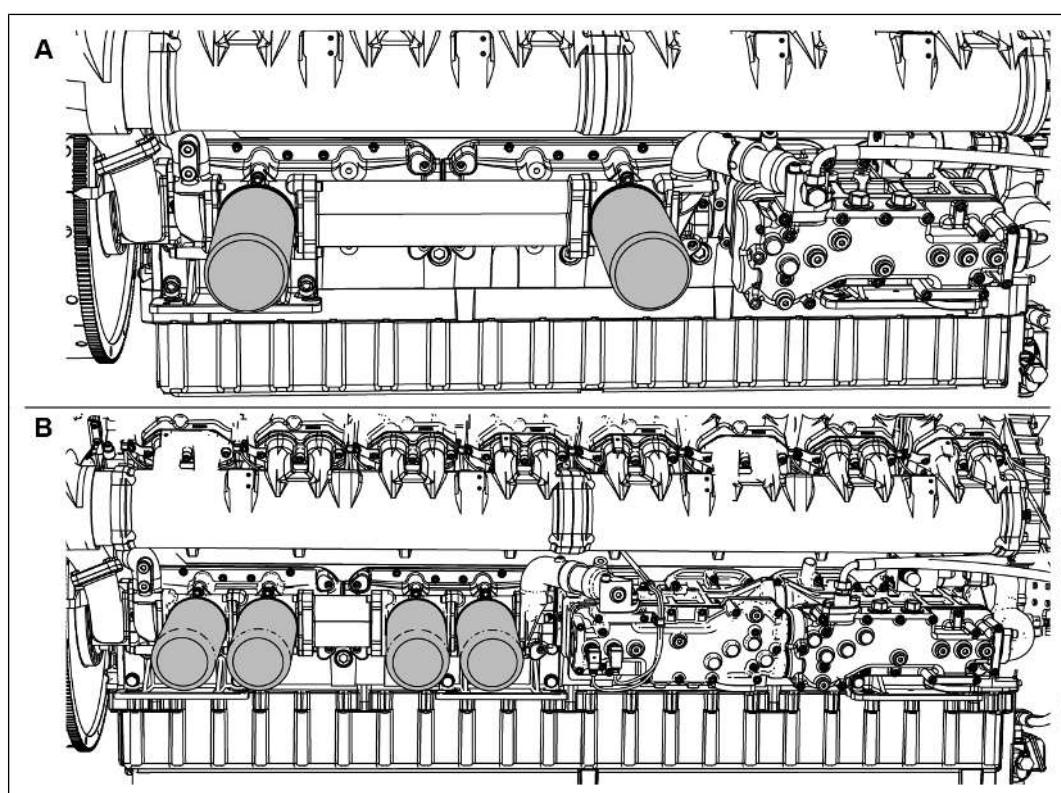
- Standard tools
- Special tool
 - Lube oil filter key 1215 8153 [▶ 206]



Auxiliary media:

- Binding agent

General information



2623104907

Engines with 2 lube oil filters and 4 lube oil filters are used.

- A. 2 lube oil filters
- B. 4 lube oil filters

NOTE

The work described below is carried out on one lube oil filter.

Proceed in the same way for all others.

CAUTION

Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

**Danger to the environment**

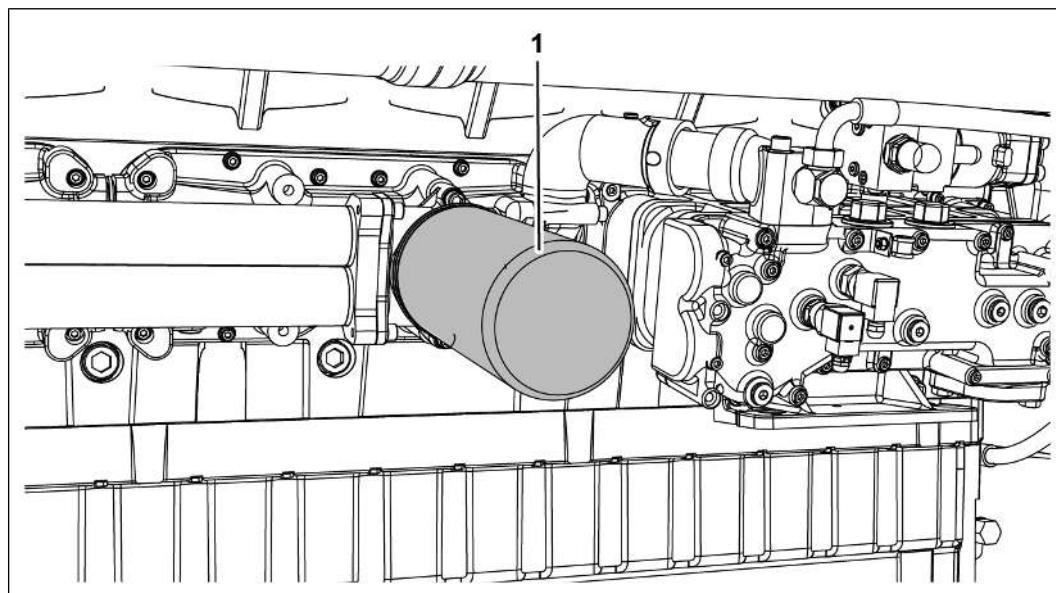
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the lube oil filter:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).
- 1. Wait for re-lubrication procedure.
- 2. Activate the emergency stop button.



2623107339

3. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.

4. **CAUTION! Risk of burns** Unscrew lube oil filter (1) with the lube oil filter key
5. Remove lube oil filter.
 - Dispose of the lube oil filter properly.

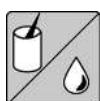
Installing the lube oil filter

Valid for:
TCG 2020, TCG 2020 K



Tools:

- Standard tools
- Special tool
 - [Lube oil filter key 1215 8153 \[▶ 206\]](#)



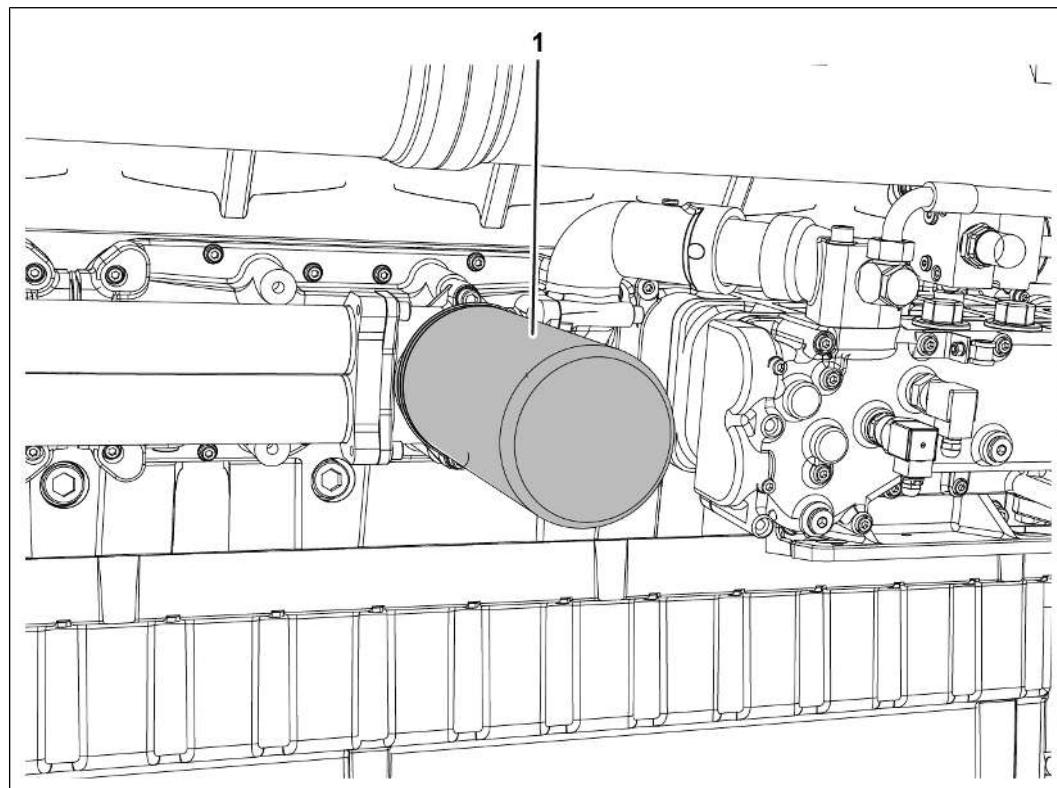
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil](#).



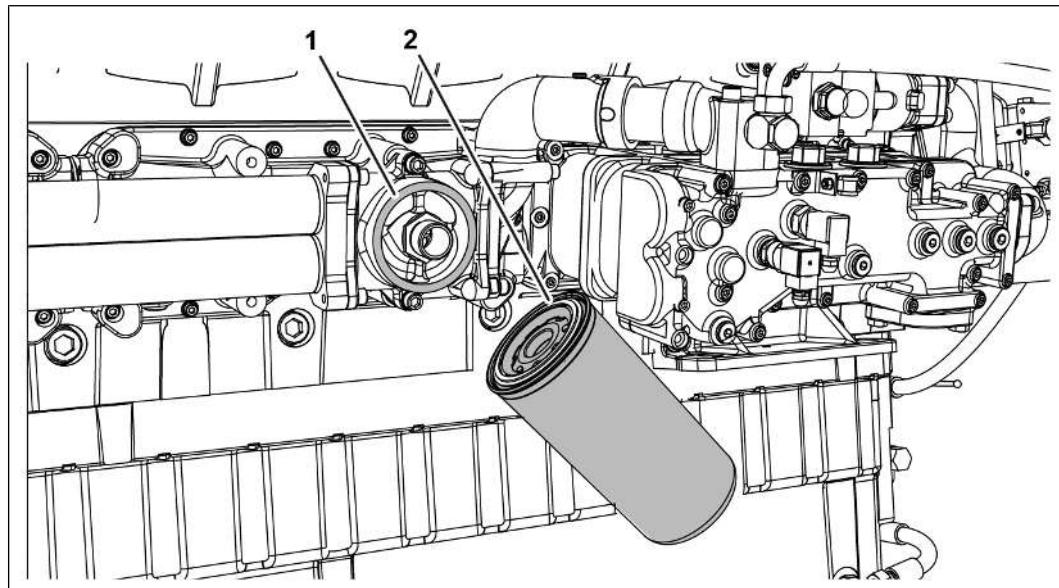
Spare parts:

- Lube oil filter

Technical data

2623375755

Lube oil filter on holder			
1	Lube oil filter	Attach	Hand-tight until in contact with the seal
		Screw tight	Plus 1 turn
Wet the lube oil filter seal with lube oil.			

Installing the lube oil filter:

2623371275

1. Clean the sealing surface (1).
 2. Tighten the lube oil filter (2) using the lube oil filter key.
 - Wet the lube oil filter seal with lube oil.
 3. Reset emergency stop button.
 - Acknowledge fault message in the control, see the Troubleshooting chapter, Fault displays section.
 4. Start prelubrication, see OL-MRA10 / 02-01-22 Changing the lube oil.
 - With or without lube oil tank in the base frame.
 5. Check the lube oil filter for leaks and tighten, if necessary.
 6. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).

Checking the flexible lube oil line

Valid for:
TCG 2020 K, TCG 2020

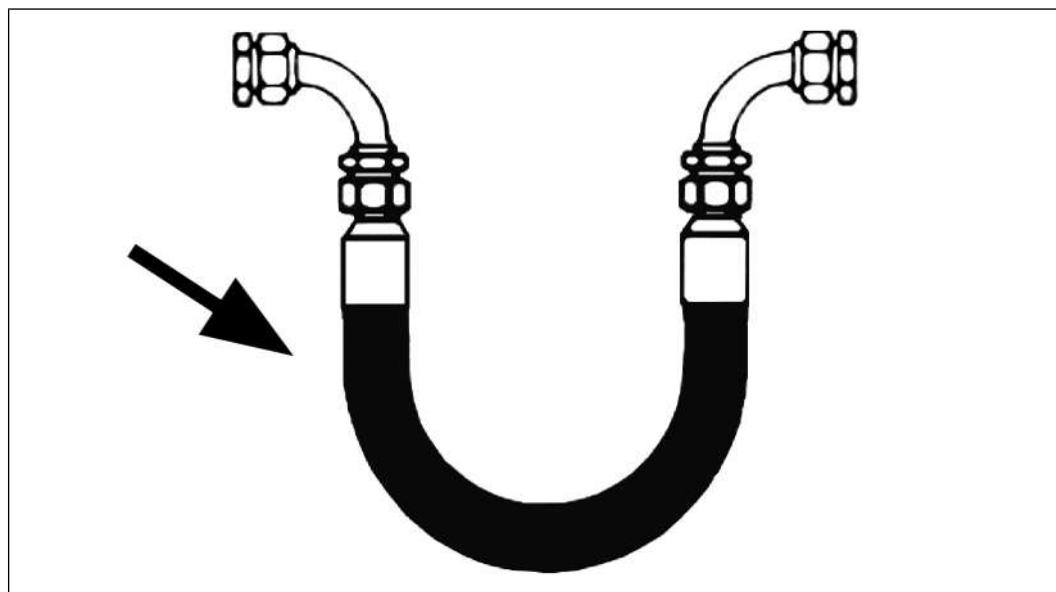


- Tools:
- Standard tools

General information

Due to the plurality of applications and variants, not every single version will be described here.

If leaks, cracks, porosity, or other damage is detected, renew the component.



515805707

NOTE

Improperly installed lube oil line

Always avoid an arrangement with a siphon effect (arrow).

- Correct the routing of the lube oil line if necessary.
-



CAUTION

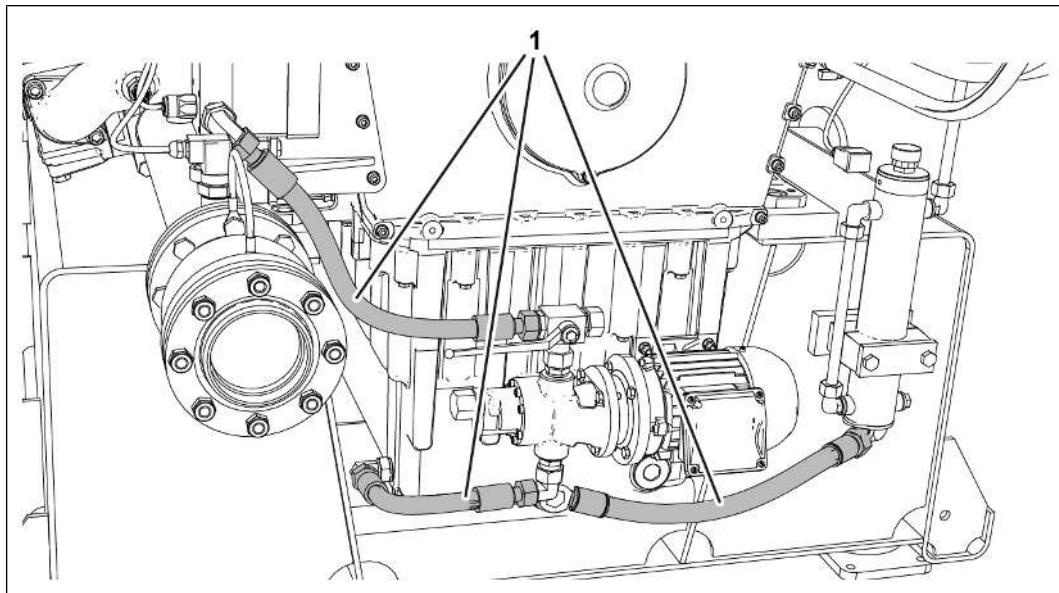
Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

Checking the flexible lube oil line:

- ✓ Decommission the genset, see [Decommissioning/Genset Stopping the genset ▶ 163](#)



2623630347

1. Visually inspect the flexible lube oil line (1).
 2. Check that the flexible lube oil line is fastened tightly.
- ⇒ Commission the genset, see [Commissioning/Genset Start the genset ▶ 136](#)

Checking the lube oil line

Valid for:
TCG 2020, TCG 2020 K

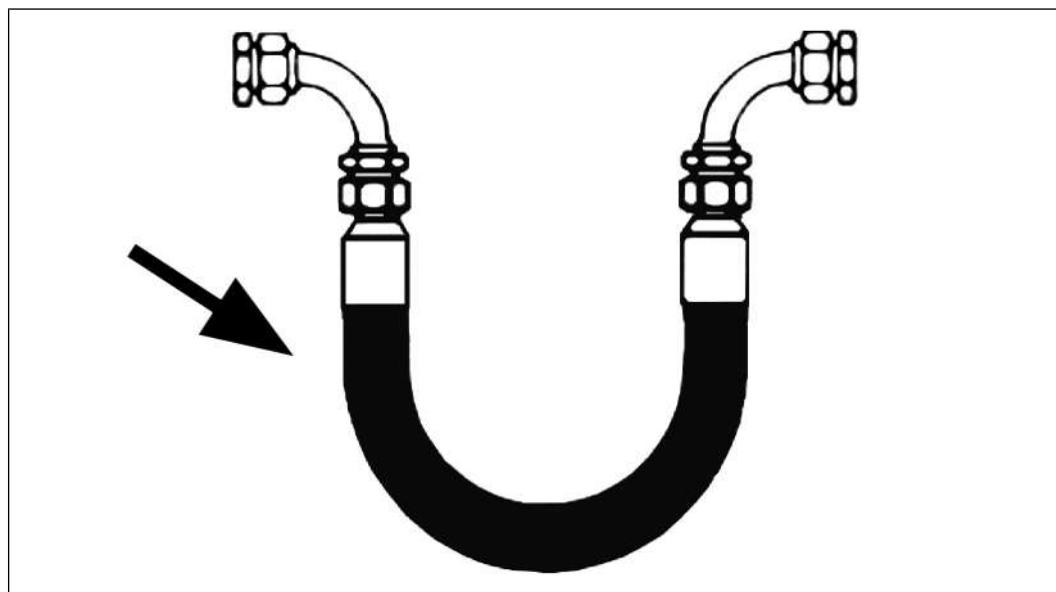


- Tools:
- Standard tools

General information

Due to the plurality of applications and variants, not every single version will be described here.

If leaks, cracks, porosity, or other damage is detected, renew the component.



515805707

NOTE

Improperly installed lube oil line

Always avoid an arrangement with a siphon effect (arrow).

- Correct the routing of the lube oil line if necessary.
-



CAUTION

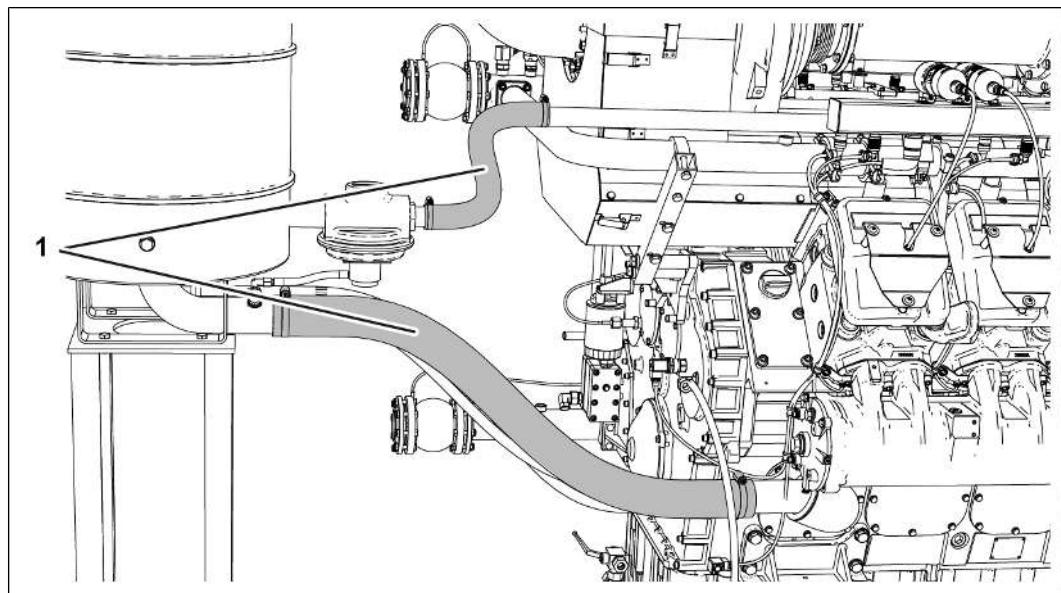
Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

Checking the lube oil line:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2623826955

1. Visually inspect lube oil line (1).
 2. Check the lube oil line is tight.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Removing and installing the intake air filter

Removing the intake air filter

Valid for:

TCG 2020 K, TCG 2020

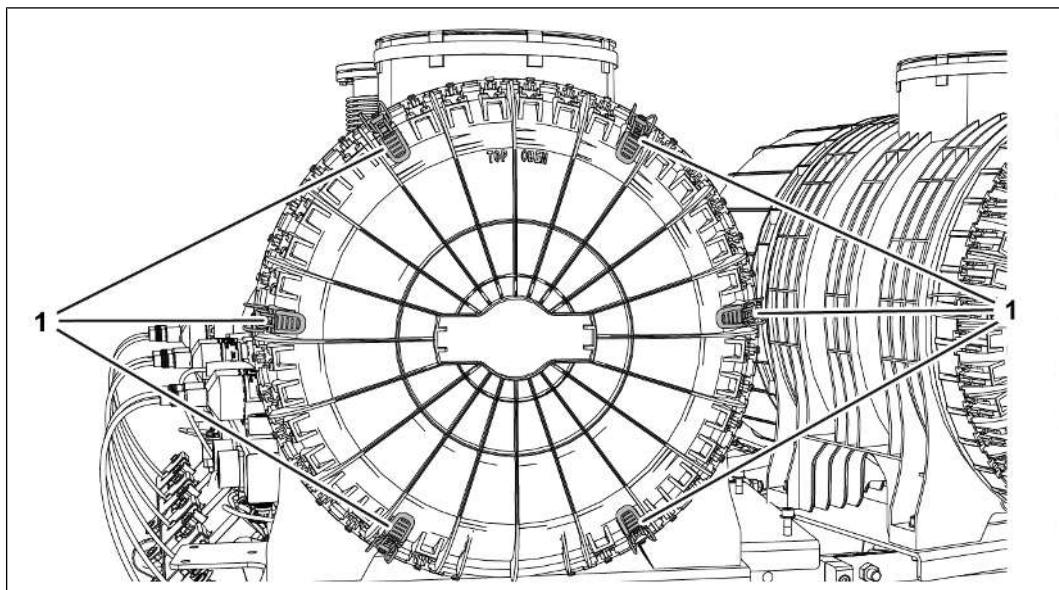


Tools:

- Standard tools

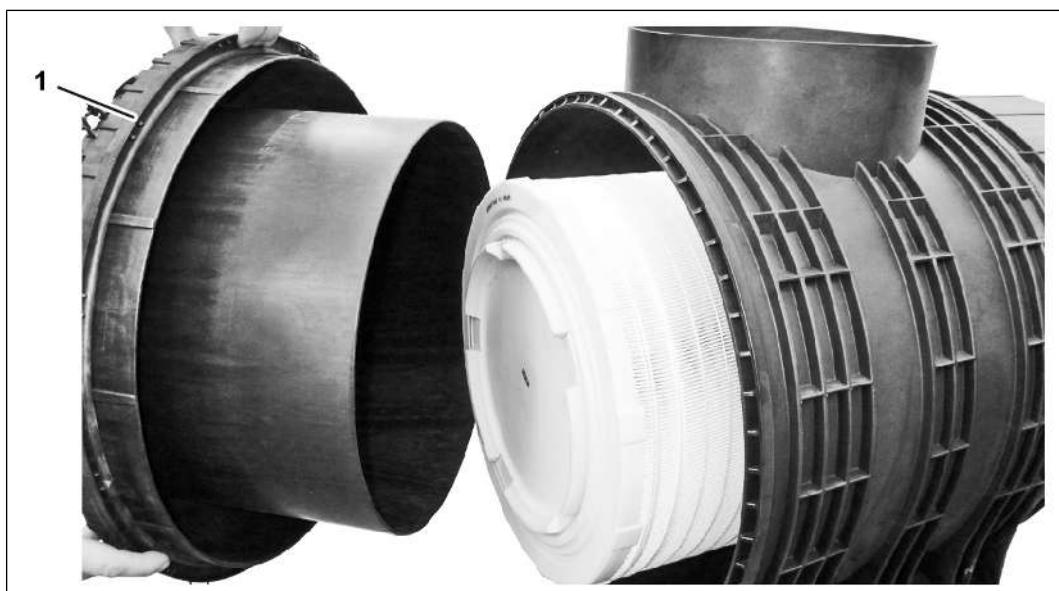
Removing the intake air filter:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).



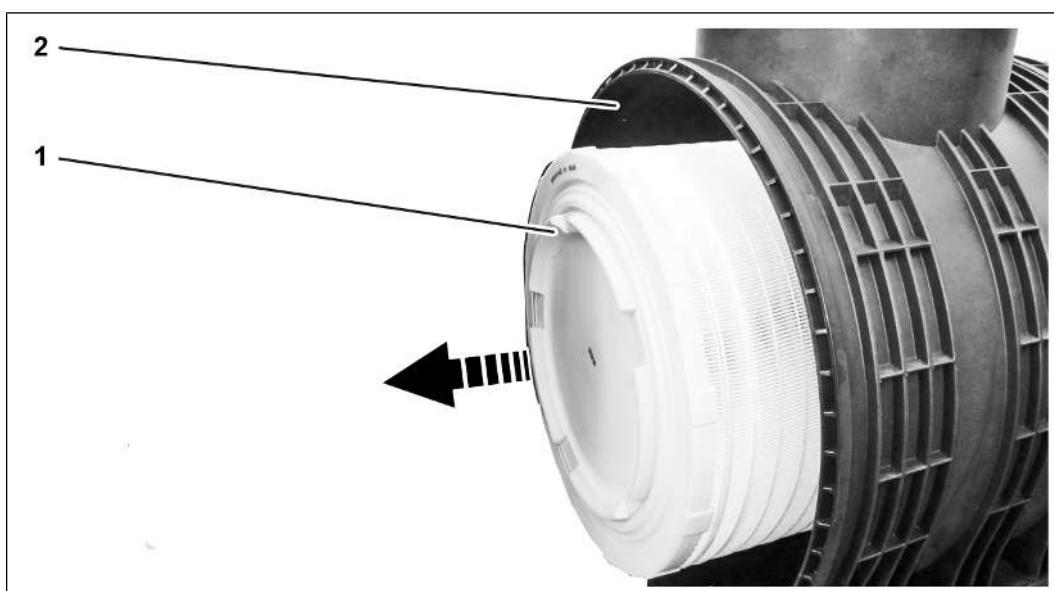
2636335371

1. Open fixing clamps (1).



2636337803

2. Remove cover (1).



2636340235

3. Remove filter (1) from housing (2) in the direction of the arrow.
4. Clean all components.

Installing the intake air filter

Valid for:
TCG 2020 K, TCG 2020



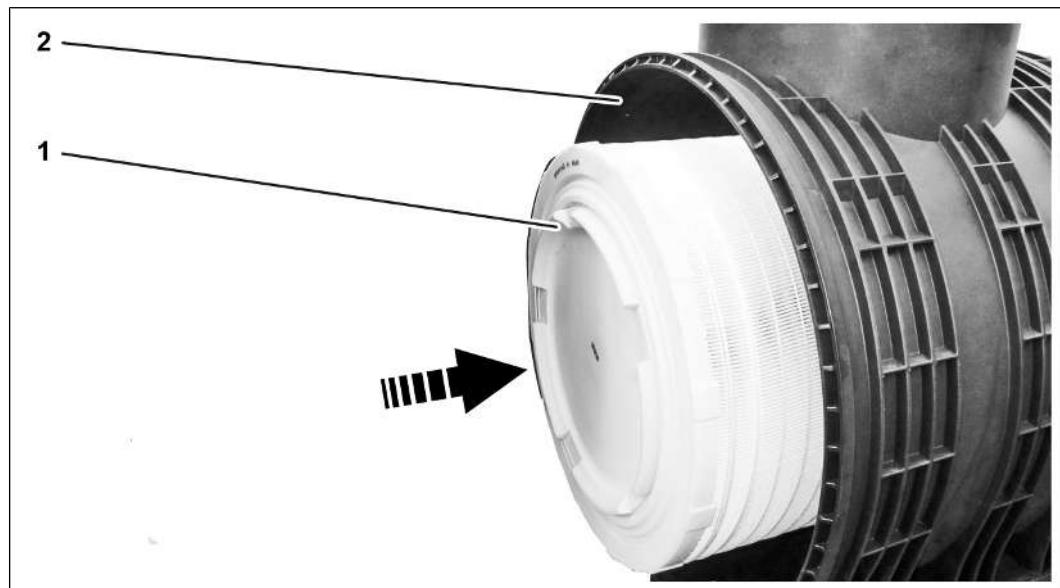
Tools:

- Standard tools



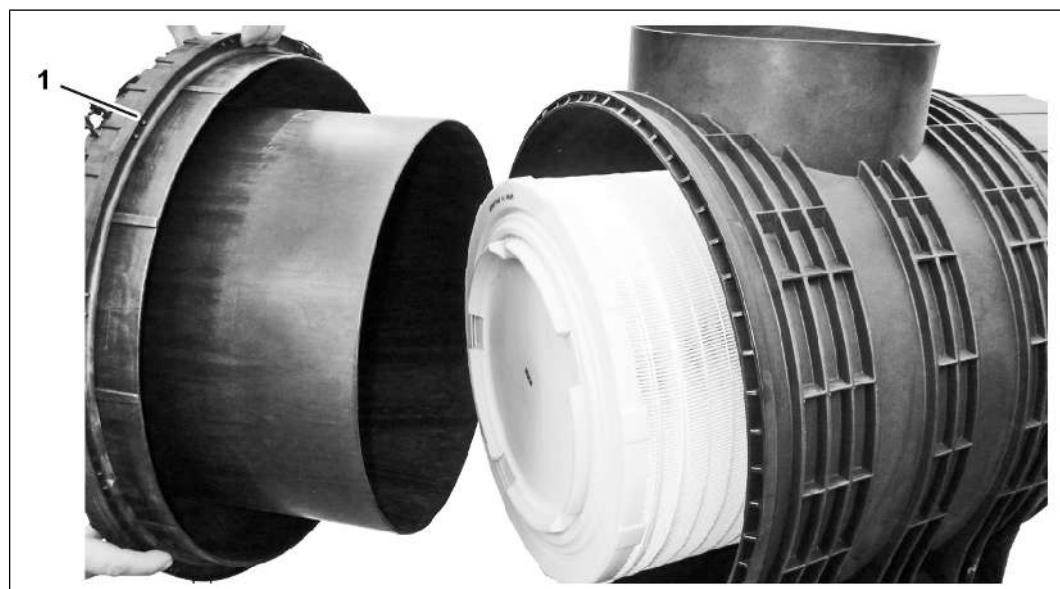
Spare parts:

- If necessary, intake air filter

Installing the intake air filter:

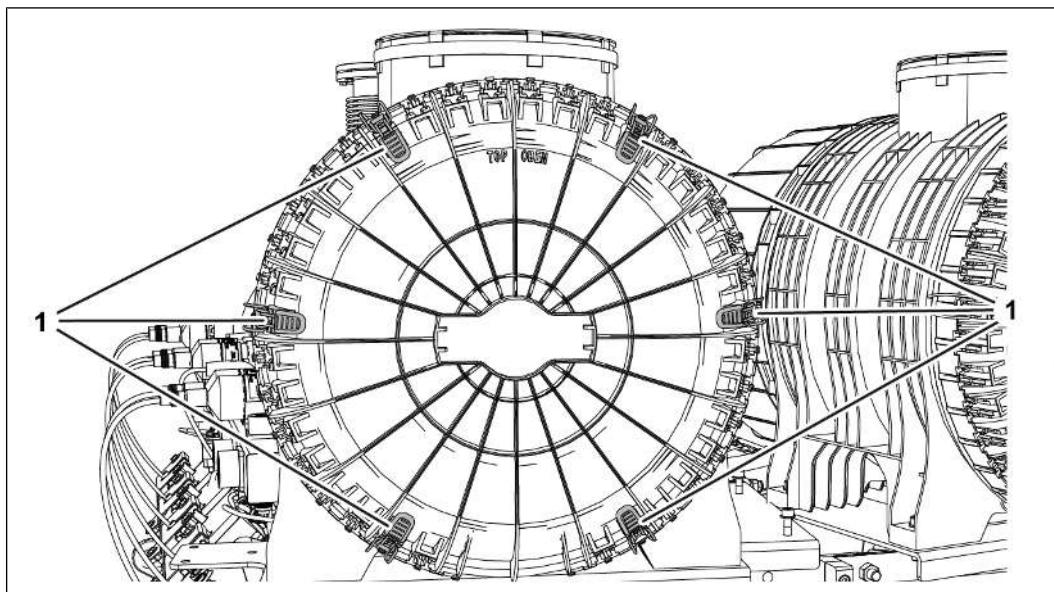
2636342667

1. Insert filter (1) into housing (2) in the direction of the arrow.
 - The intake air filter must engage noticeably in the groove in the housing.



2636337803

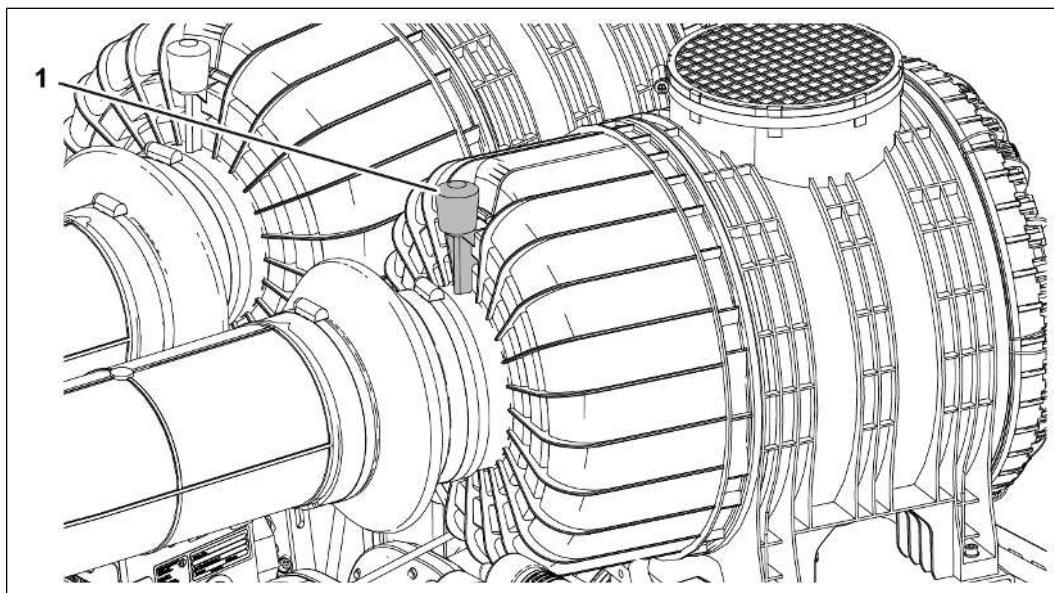
2. Mount cover (1).



2636335371

3. Close fixing clamps (1).

- **NOTE! Observe position!** The lettering on the cover points upwards.



2636357899

4. Check service indicator (1).

- If necessary, press the release button and reset the service indicator.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Dismantling and mounting the intake air filter housing

Dismantling the intake air filter housing

Valid for:

TCG 2020 K, TCG 2020

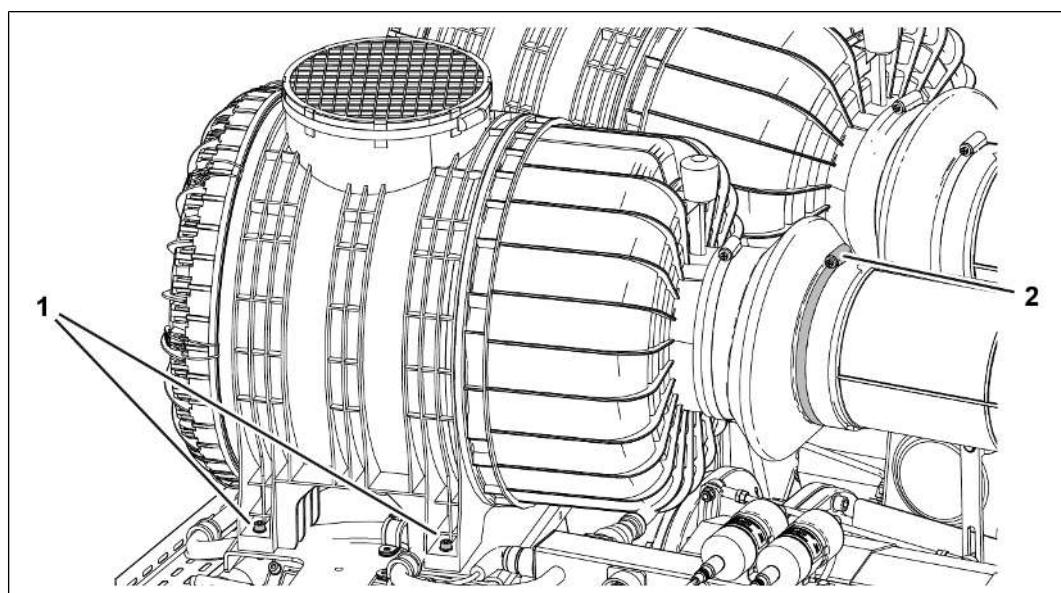


Tools:

- Standard tools

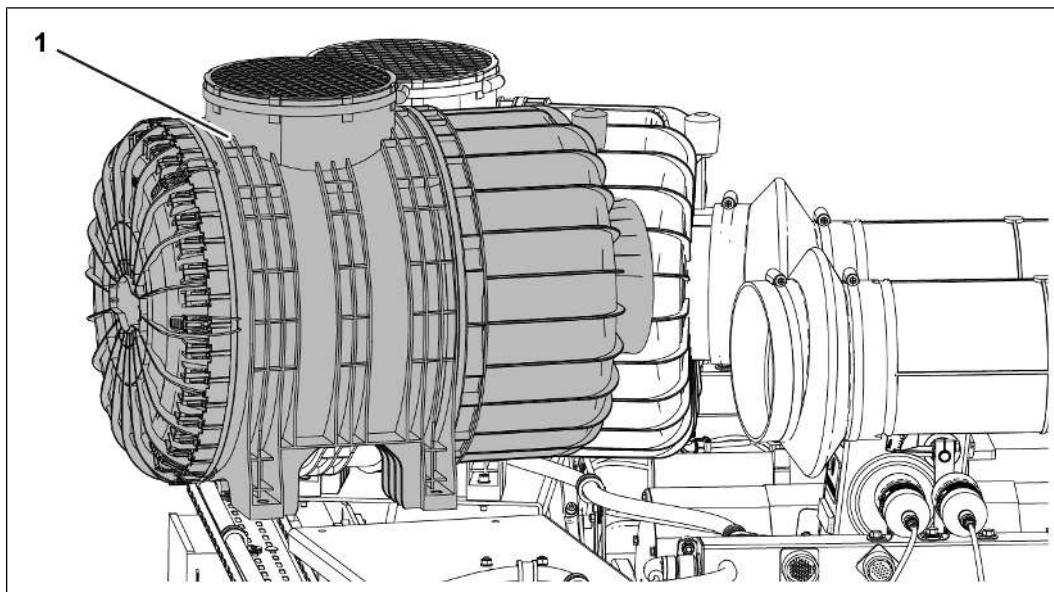
Dismantling the intake air filter housing:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 163](#).



2636371339

1. Unscrew screws (1).
2. Open clamping clip (2).



2636373771

3. Remove intake air filter housing (1).
 - Work in pairs, if necessary.
4. Remove and install the intake air filter if necessary, see OL-MRA10 / 22-10-12 [Removing and installing the intake air filter \[▶ 423\]](#).

Mounting the intake filter housing

Valid for:

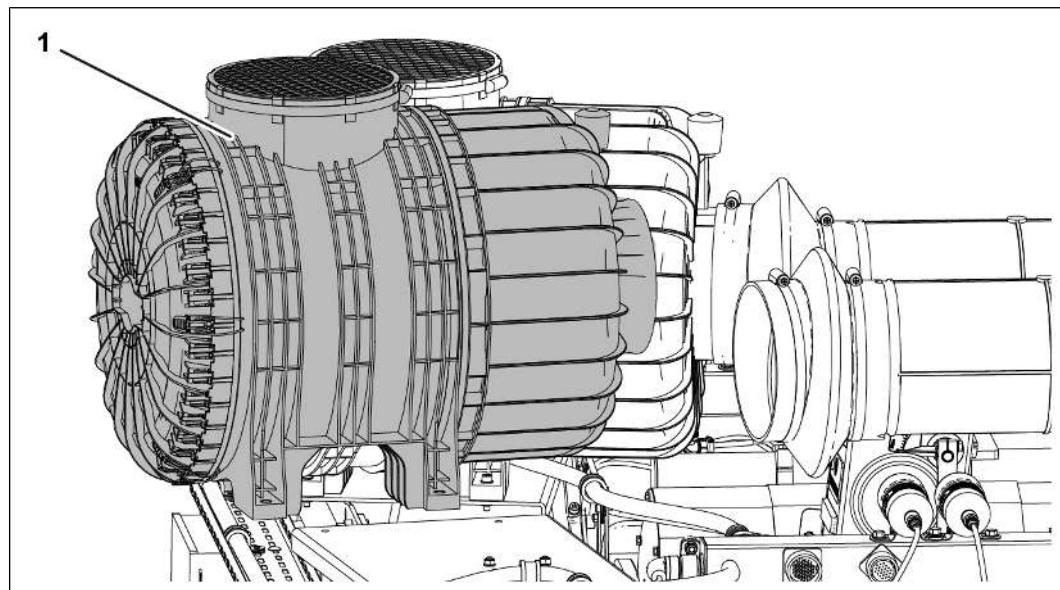
TCG 2020 K, TCG 2020



Tools:

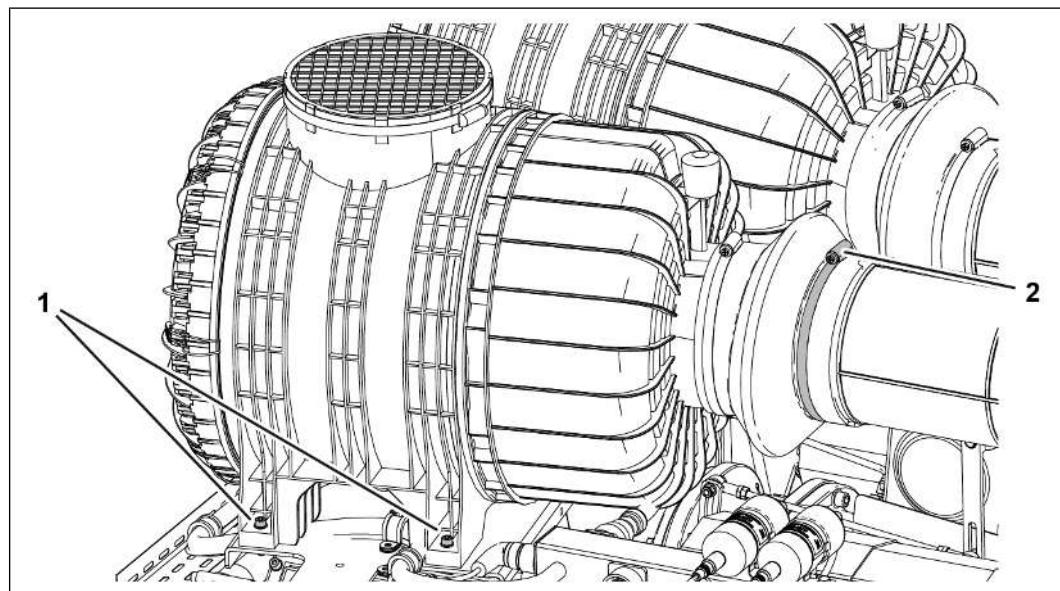
- Standard tools

Mounting the intake air filter housing:



2636373771

1. Attach intake air filter housing (1).
 - Work in pairs, if necessary.



2636371339

2. Fasten clamping clip (2).
 3. Tighten screws (1).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

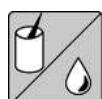
Checking the ignition timing

Valid for:
TCG 2020, TCG 2020 K



Tools:

- Standard tools
- Special tool
 - [Timing light 1221 7826 \[▶ 207\]](#)



Auxiliary media:

- If necessary external power supply, e.g. battery
- Grease pencil

Technical data

Ignition angle		
According to TEM	Parameters	11304
Ignition timing		
According to TEM	Parameters	11304

Calculate the firing angle markings for the flywheel according to the following formula:

- $d \times \pi \times {}^\circ \text{KW} / 360^\circ = L$

Formula symbols	Explanation
d	Flywheel diameter in mm, e.g. 750 mm
π	pi 3.14
${}^\circ \text{KW}$	Ignition angle in degrees of the crankshaft, e.g. 25° ⇒ 11301 ZA default ignition timing parameter
L	Calculated radian on the flywheel in mm, e.g. $750 \times 3.14 \times 25^\circ \text{ KW} / 360^\circ = 163.54 \text{ mm}$

General information

The control shows the preset ignition timing, which depends on the gas type, as a standard ignition angle in degrees of the crank angle.

- This value specifies how many degrees before the top dead center (TDC) the ignition occurs.

The control provides the Ignition check function.

- If the Ignition check function is activated, the control freezes the ignition angle at a constant value for a fixed period of time.

The ignition timing is dependent on several parameters, which are adapted by the control to the combustion characteristic curve during operation.

- For this purpose, the control continuously calculates the required ignition angle adjustment.
- Depending on the ignition angle adjustment made, ignition takes place a few degrees before or after the top dead center (TDC).

In order to determine the actual ignition timing on cylinder B1, change the parameters so that neither the anti-knock control nor the automatic ignition angle adjustment react during rebuffing.

- See the technical data, test values and setting values



Risk of destruction of components

Incorrectly set camshaft offset

The engine or components can be destroyed.

- Only change the camshaft offset when the engine is switched off by the TEM.
- If in doubt, contact service partner.



Risk of destruction of components

Incorrect ignition angle markings

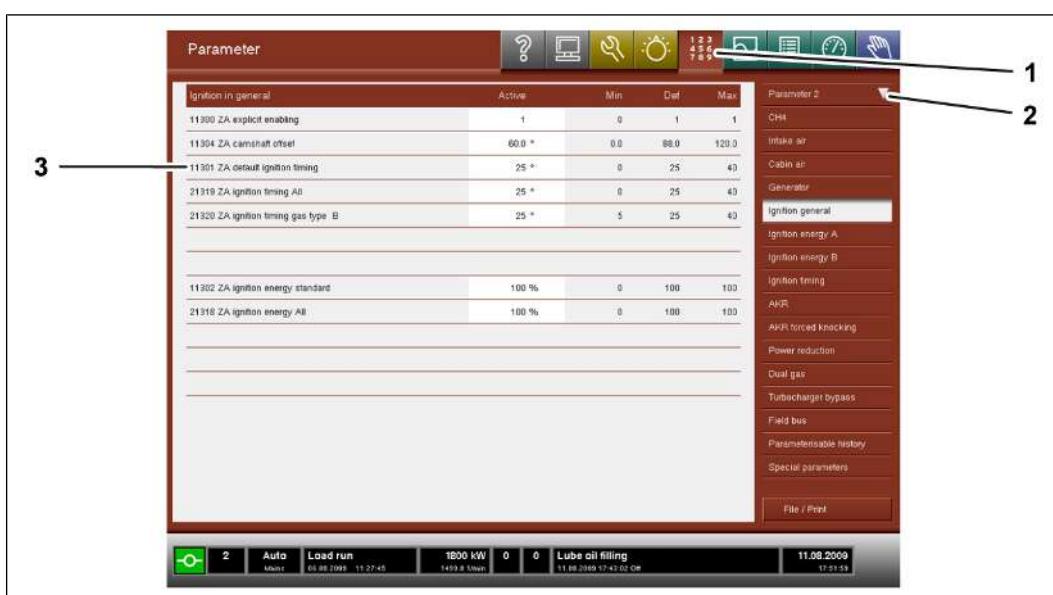
Result in incorrect ignition timing.

Can cause engine damage.

- Always measure ignition angle markings from the TDC marking in the BEFORE TDC direction.

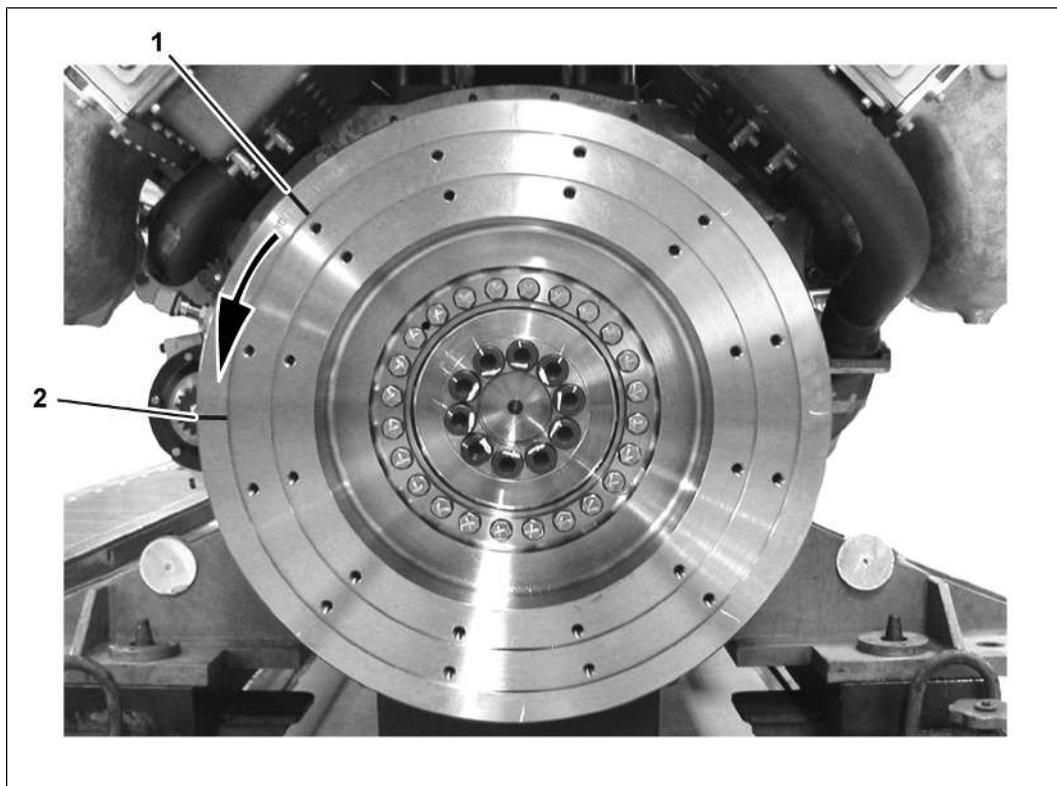
Checking the ignition timing:

- ✓ The Programmable Logic Controller (PLC) version 2.50.11 or higher is installed.
- ✓ The TEM-Evo operating terminal version 2.7.4 or higher is installed.
- ✓ A dongle with the level 100 is present.
- ✓ The genset runs in island operation with 70 % load.
- ✓ The genset has reached the nominal speed at least once since the start (see parameter 11108 DZR Nominal speed).
- ✓ The MANUAL operating mode is activated.
- ✓ The test of the ignition timing is agreed with the user of the plant.



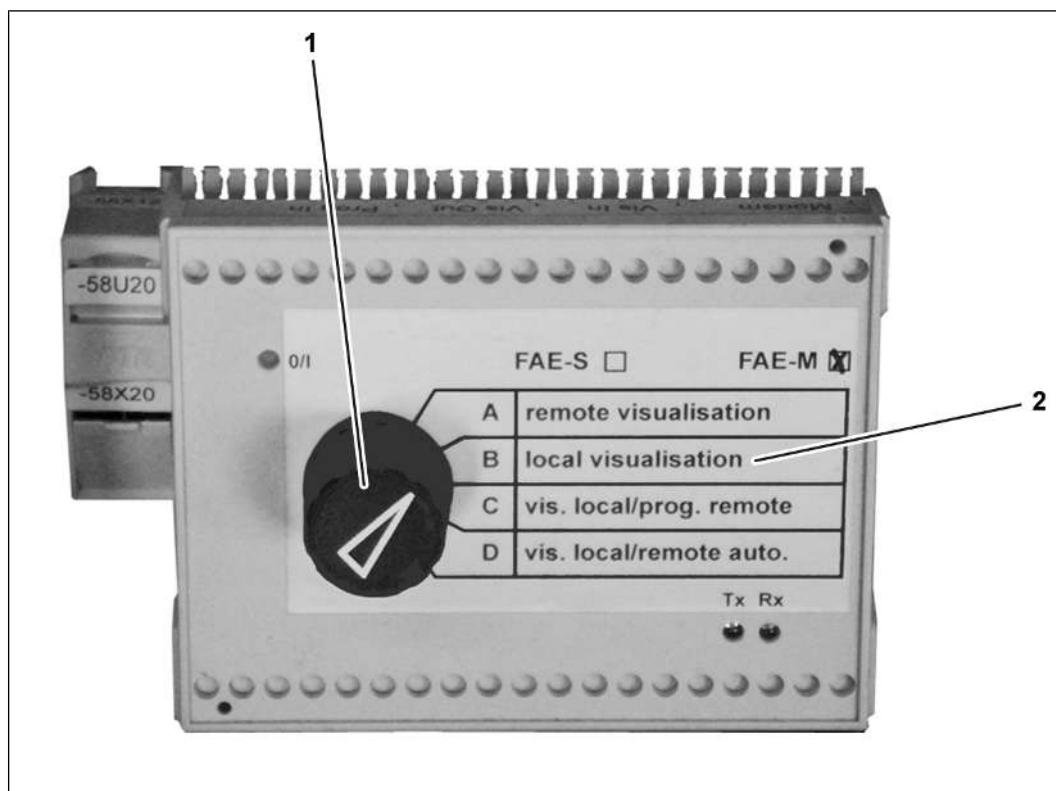
2637239435

1. Determine the current ignition angle.
 - Press the Functional group "Parameters" button (1).
 - Press the Parameter 2 button (2).
 - The Ignition general mask opens and parameter 11301 ZA default ignition timing (3) appears in the dialog area.
2. Calculate ignition angle markings for the flywheel.
 - Calculate the marking for the default ignition angle.
 - Calculate other ignition angle markings in 1° steps in addition to the marking of the default ignition angle (at least ± 3° from each default ignition angle).
 - Perform the calculations using the following formula: [Checking the ignition timing \[▶ 431\]](#).
3. Dismantle the protective cover on the flywheel, see OL-MRA10 / 52-90-12 [Dismantling the protective cover \[▶ 573\]](#)
 - Decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 163\]](#).



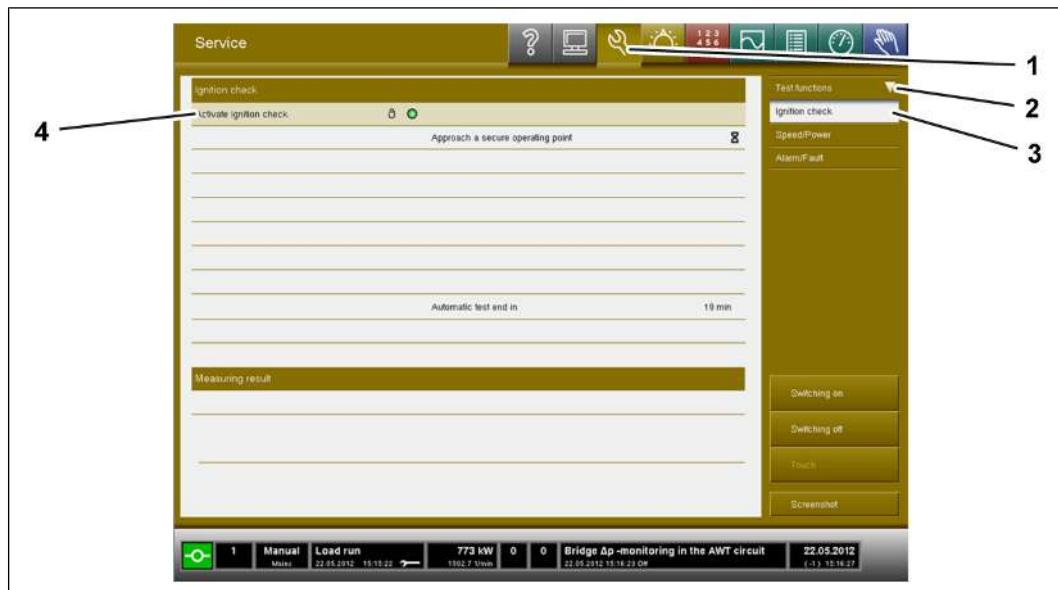
2637247883

4. **NOTE! Incorrect ignition angle markings can cause engine damage!** Measure the calculated radians one after each other starting from the TDC marking (1) with a measuring tape.
 - Use a grease pencil to apply the respective ignition angle markings (2) to the flywheel.
5. Establishing uninterrupted access of the operating software to the TEM.



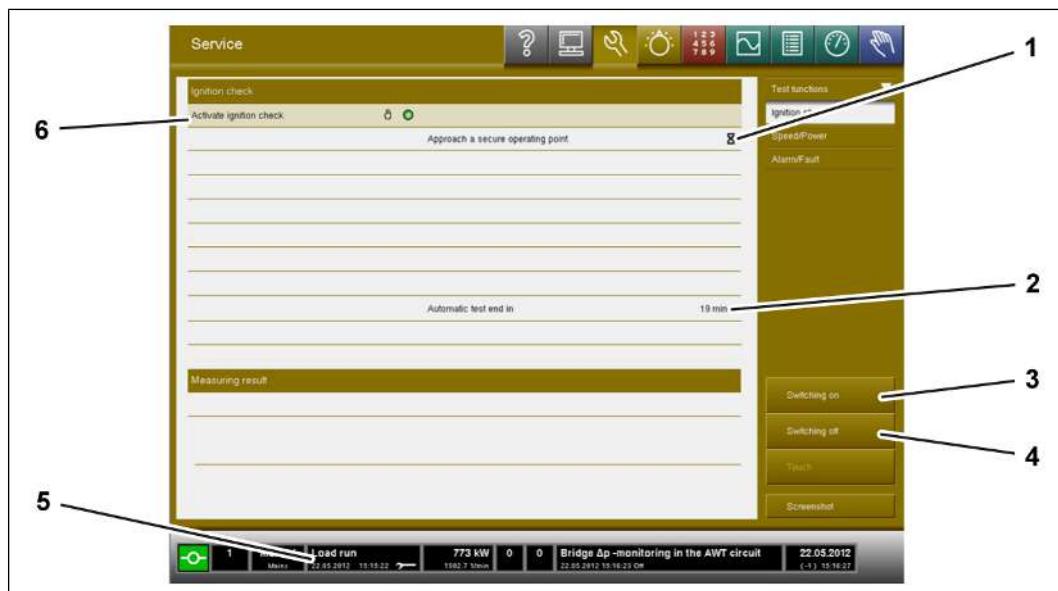
2637251979

- Open the genset control cabinet.
 - Turn switch (1) of the function selection (FAE) to position B: local Visualisation (2).
 - The Ignition check function starts in secured mode.
 - The system control prevents access to other visualisations and executes the Ignition check function without interruption.
 - Close the genset control cabinet.
6. Start the Ignition check function.
- Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).



2637265419

- Press the Functional group Service button (1).
- Press the Test functions button (2).
- Press the Ignition check button (3).
- The Ignition check dialog area (4) opens.



2637258891

- Tap the Ignition check line (6) in the Ignition check dialog area.
- Touch the Switch on button (3).
- The display changes to green and a hand symbol appears in the Activate ignition check line (6).
- An hourglass symbol appears in the Approach a secure operating point line (1).

- A minute display appears in the Automatic test end in line (2).
- A wrench symbol appears in the status bar (5).
- To interrupt or end the Ignition check function, press the Switching off button (4).



2637271947

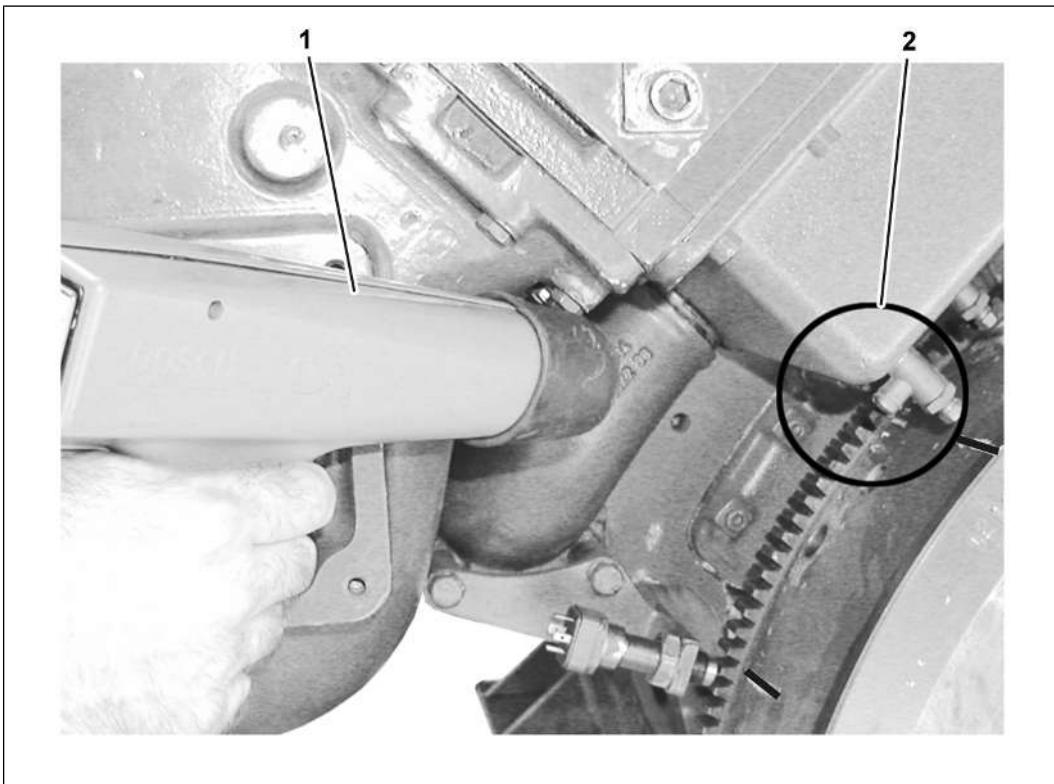
- Start with the rebuffering the ignition angle when a green checkmark appears in the Ignition check now possible line (1) (see *Rebuffering ignition angle*).

NOTE

The TEM ends the Ignition check function automatically after a fixed time.

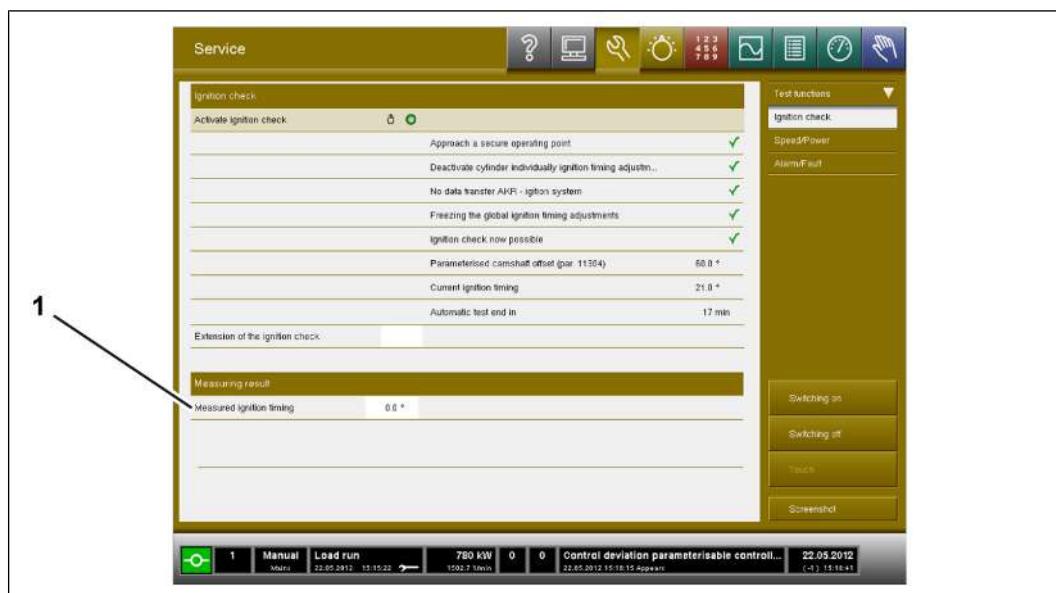
- The TEM displays the remaining time in the Automatic test end line (2).
7. Extend the period for the automatic test end.
 - In the Extension of the ignition check dialog area (4), tap the white area to extend the time for the ignition check.
 - The Extension of the ignition check dialog is activated.
 - Touch the Touch button (3).
 - The reset minute display appears in the Automatic test end in line (2).
 - Press down the Touch button (3) until the desired time is displayed in the minute display.
 8. Test ignition angle with timing light.
 - Decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 163\]](#).
 - Connect the timing light to the ignition cable on cylinder A1.

- Check whether the voltage values of the power supply and the permissible operating voltage of the timing light match.
- Switch off the adjustment of the timing light.
- Connect timing light to the power supply.
- If necessary use an external power source (e.g. battery).
- Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#).



2637279115

- Rebuff the timing light (1) at the marking for the default ignition angle (2).
- The marking for the default ignition angle (2) and the TDC marking must be aligned.
- If the markings for the default ignition angle (2) and the TDC differ from one another, correct the camshaft offset.



2637283211

- If the measured value and the preset value (1) differ from each other for the ignition angle, correct the camshaft offset. Replace the camshaft sensor if necessary, also contact service partner.

NOTE

If the camshaft offset is corrected or the camshaft sensor is exchanged, a new measurement is required.

- Repeat the procedure described above.
 - Decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 163\]](#).
 - Disconnect the timing light from the power supply.
 - Disconnect the timing light from the ignition cable on cylinder A1.

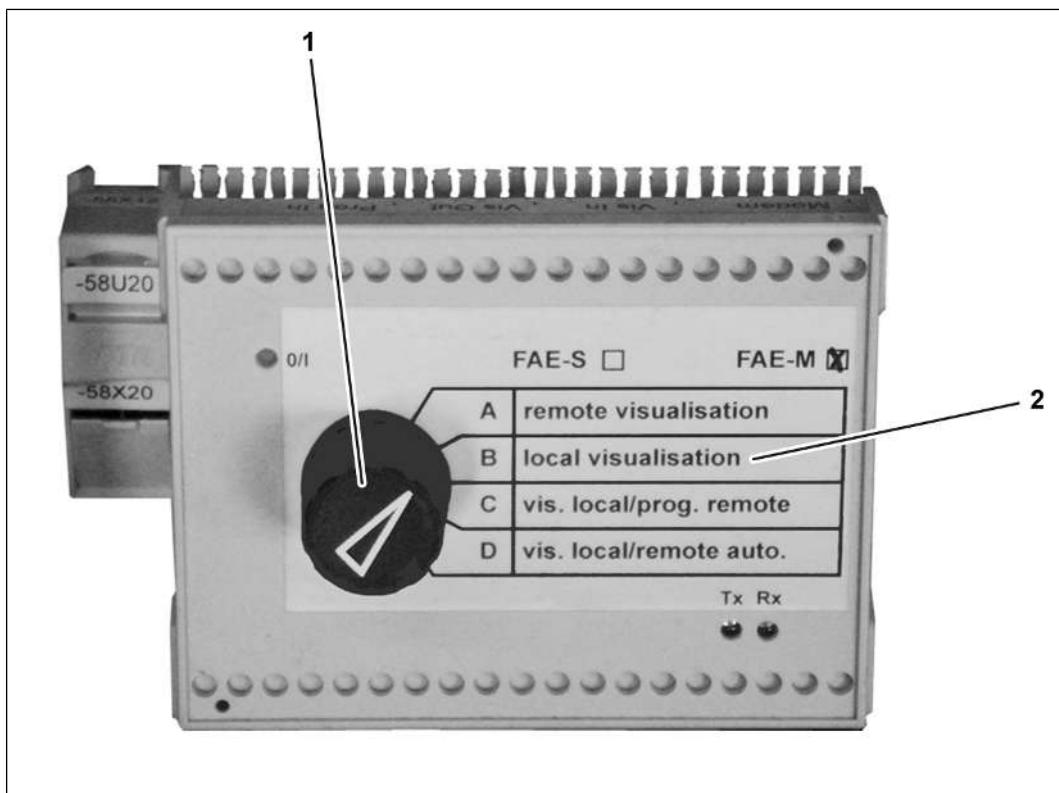


2637289355

9. **NOTE! Risk of destruction due to incorrectly set camshaft offset!** Determine the camshaft offset.

- Tap the Measured ignition timing dialog field (1).
- Enter the value of the rebuffed ignition angle.
- The TEM displays the value of the associated camshaft offset in the Resulting camshaft offset dialog field (2).

10. Ending uninterrupted access of the operating software to the TEM system.



2637251979

- Open the genset control cabinet.
- Turn switch (1) of the function selection (FAE) to position D: vis. local/remote auto. (2).

-
- The system control enables access for other visualisations.
 - Close the genset control cabinet.
 - ⇒ Mount the protective cover on the flywheel, see OL-MRA10 / 52-90-12 [Mounting the protective cover](#) [▶ 578]
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 136]

Removing and installing the spark plug

Removing the spark plug

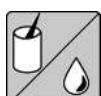
Valid for:

TCG 2020, TCG 2020 K



Tools:

- Standard tools
- Special tool
 - [Socket wrench insert for spark plug \(prechamber spark plug\) 1230 1538 \[▶ 206\]](#)



Auxiliary media:

- Compressed air
 - To clean the spark plug shaft
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

General information

NOTE

The work described below is carried out on one spark plug.

Proceed in the same way for all others.



Risk of destruction of components

Dirt can enter the combustion chamber

The cylinder liner can be damaged.

- Blow out spark plug shaft only with the spark plug installed.
-



CAUTION

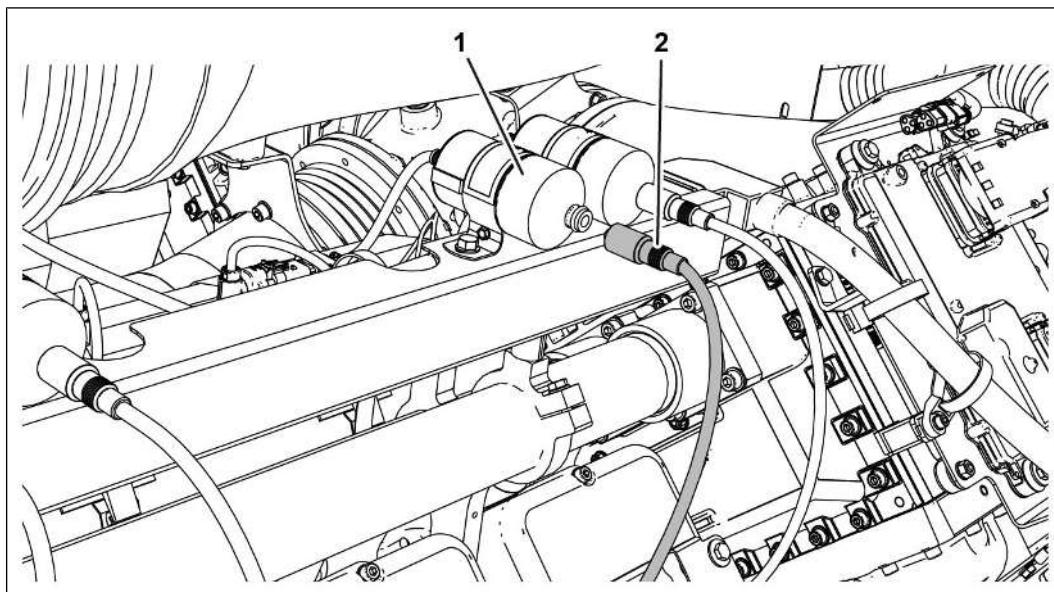
Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.
-

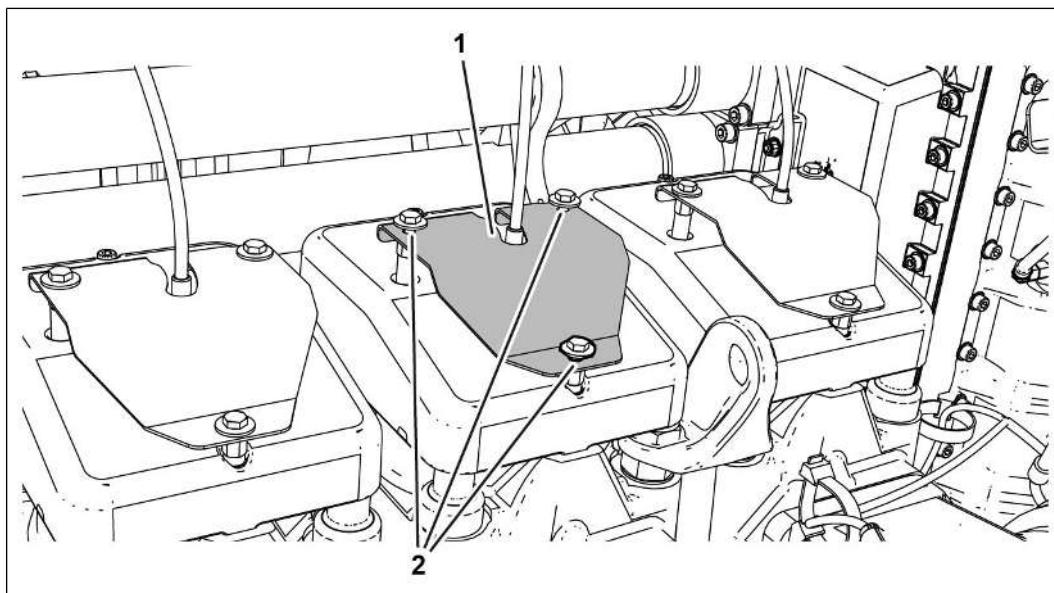
Removing the spark plug:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



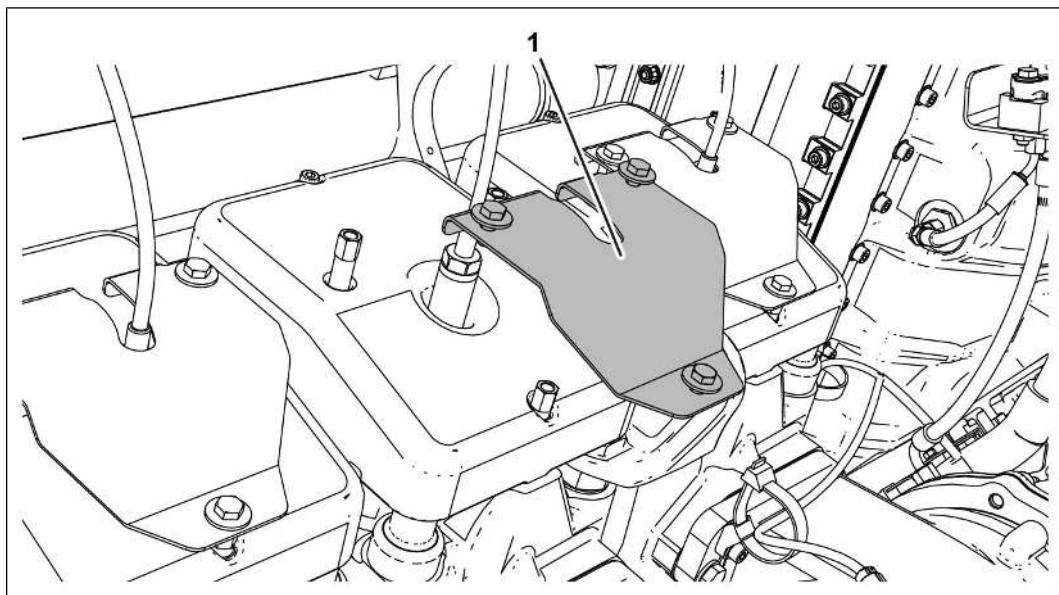
501702795

1. Disconnect ignition cable (2) from ignition coil (1).



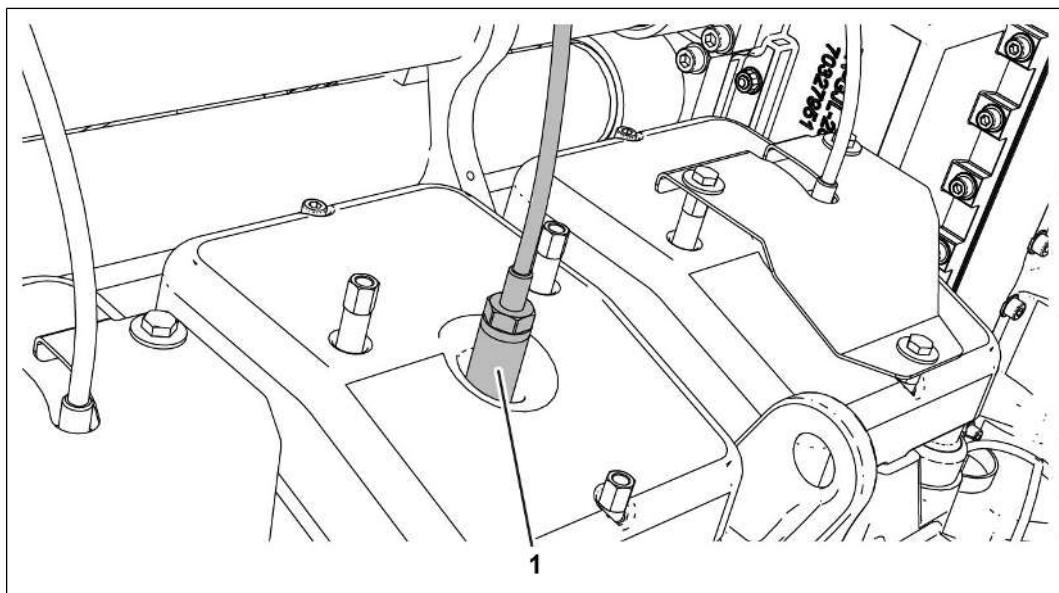
501704715

2. Dismantle spark plug cover (1).
 - Unscrew screws (2).



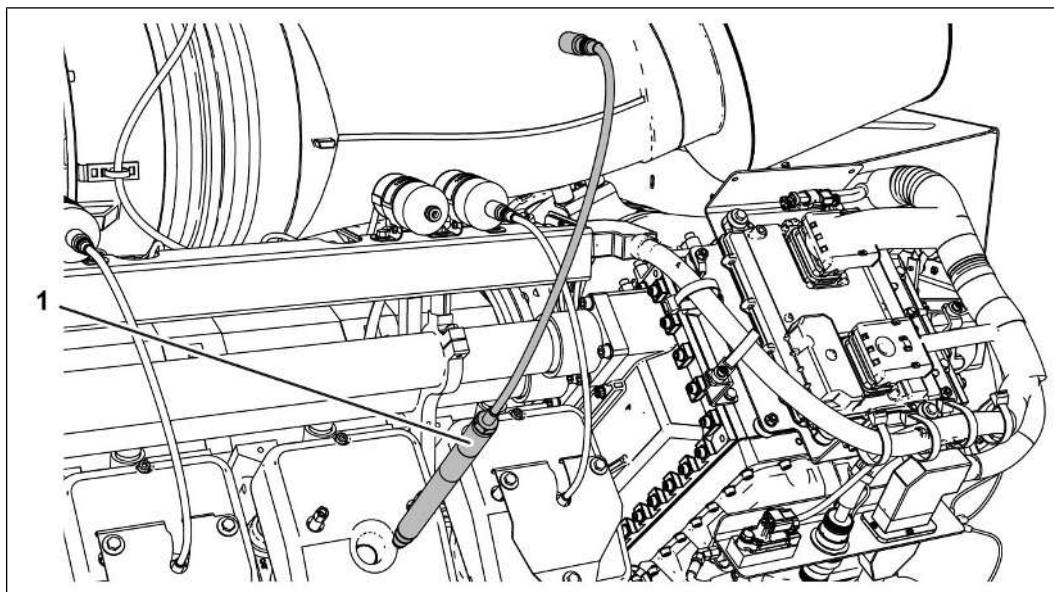
501706635

- Remove spark plug cover (1).



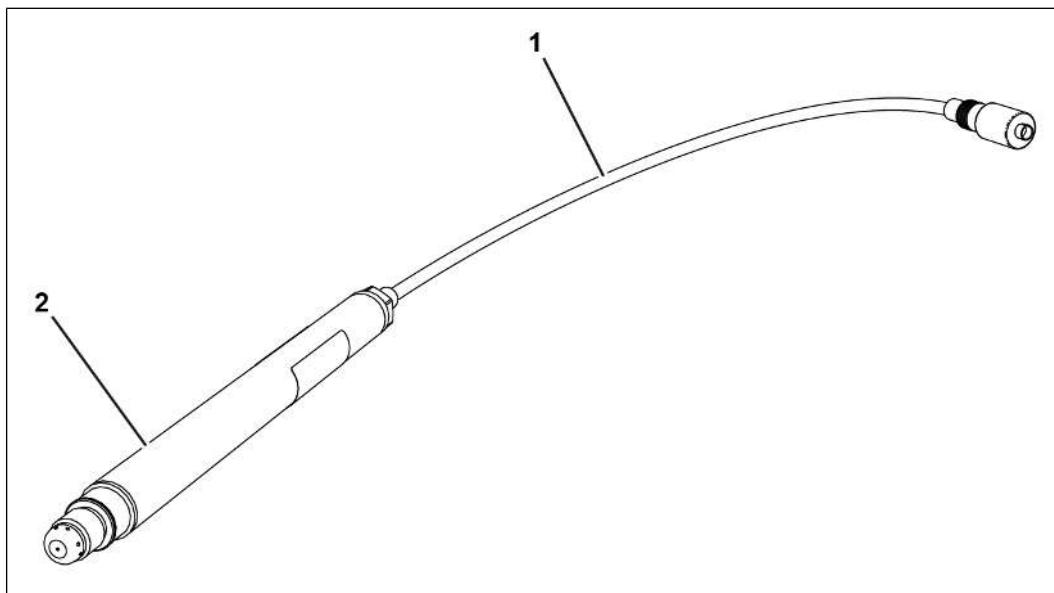
501708555

3. Remove spark plug (1).
 - **NOTE! Blow out spark plug shaft only with the spark plug installed as dirt can enter the combustion chamber.** Blow out the spark plug shaft with compressed air.
 - Unscrew spark plug (1).



501710475

- Remove spark plug (1) with ignition cable.
- Clean components.



501712395

4. Check the spark plug (2) and ignition cable (1), see OL-MRA10 / 26-13-01 [Checking the spark plug and ignition cable \[▶ 458\]](#).

Installing the spark plug

Valid for:
TCG 2020, TCG 2020 K



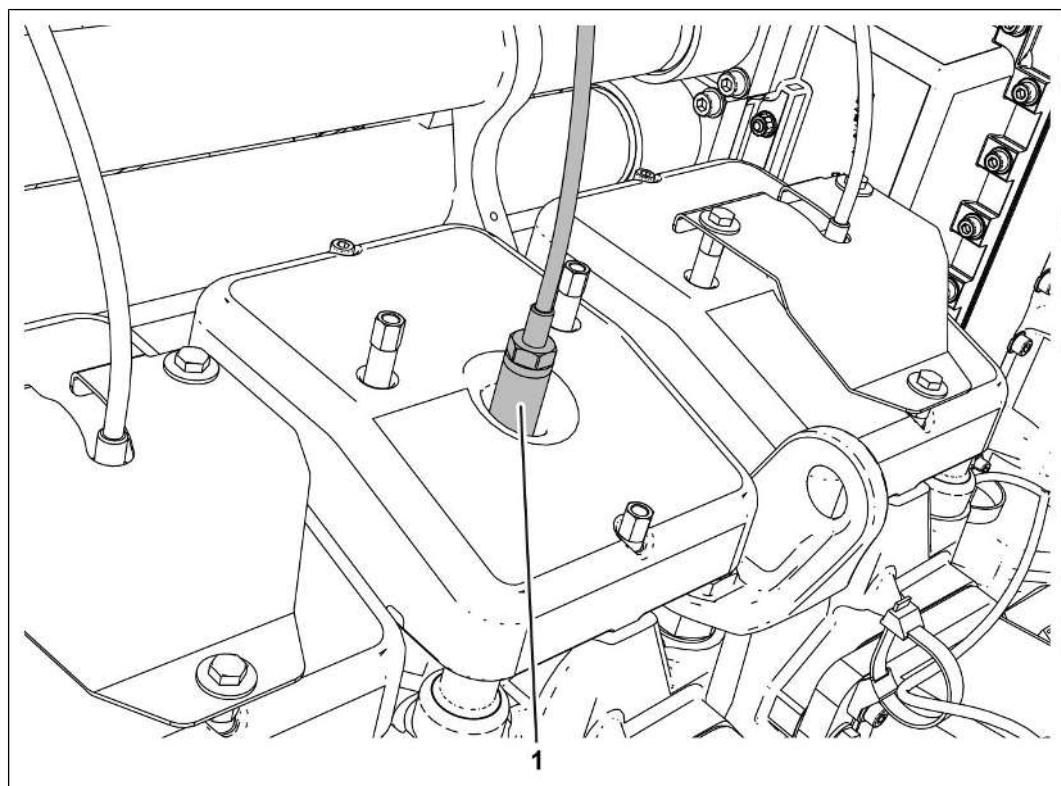
Tools:

- Standard tools
- Special tool
 - Socket wrench insert for spark plug (prechamber spark plug) 1230 1538 [▶ 206]
 - Torque wrench 1203 0350 [▶ 203]
 - Spark plug thread cleaner 1251 5557 [▶ 207]



Spare parts:

- If necessary, spark plug

Technical data

9007199756441867

Spark plug on cylinder head

1.	Spark plug	M18 x 1.5	50 Nm
----	------------	-----------	-------

Replace sealing ring.

When the engine is at operating temperature, re-tighten the spark plug to its specified torque.

General information



Risk of destruction of components

Destruction of the spark plug

An insufficiently pressed sealing ring can cause the spark plug to be thermally overloaded and fail.

- Do not install the spark plug if the sealing ring is screwed into the spark plug thread.



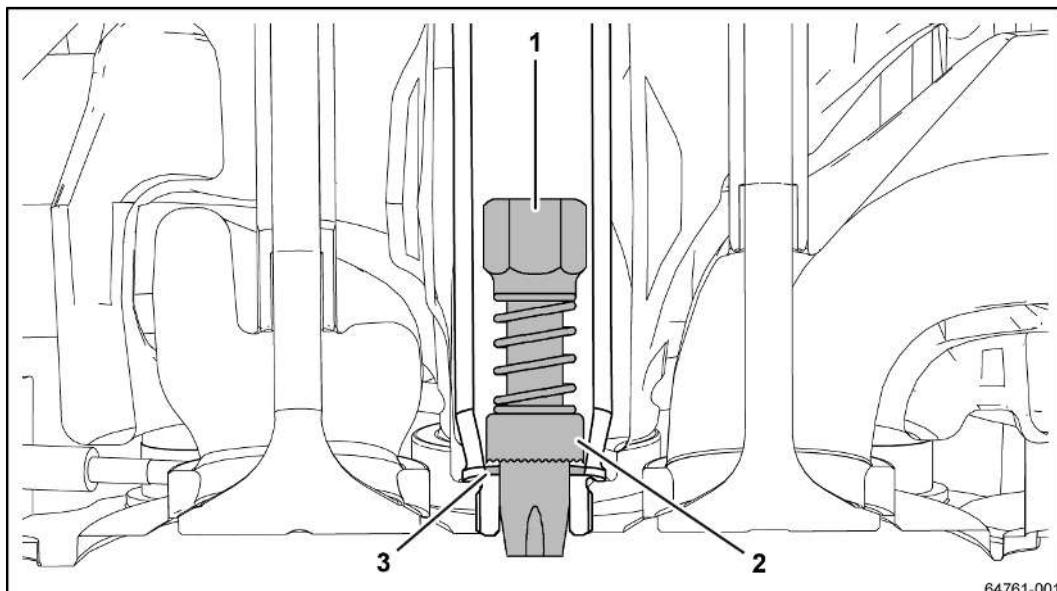
CAUTION

Improperly assembled spark plug

This can lead to minor or severe injuries and property damage.

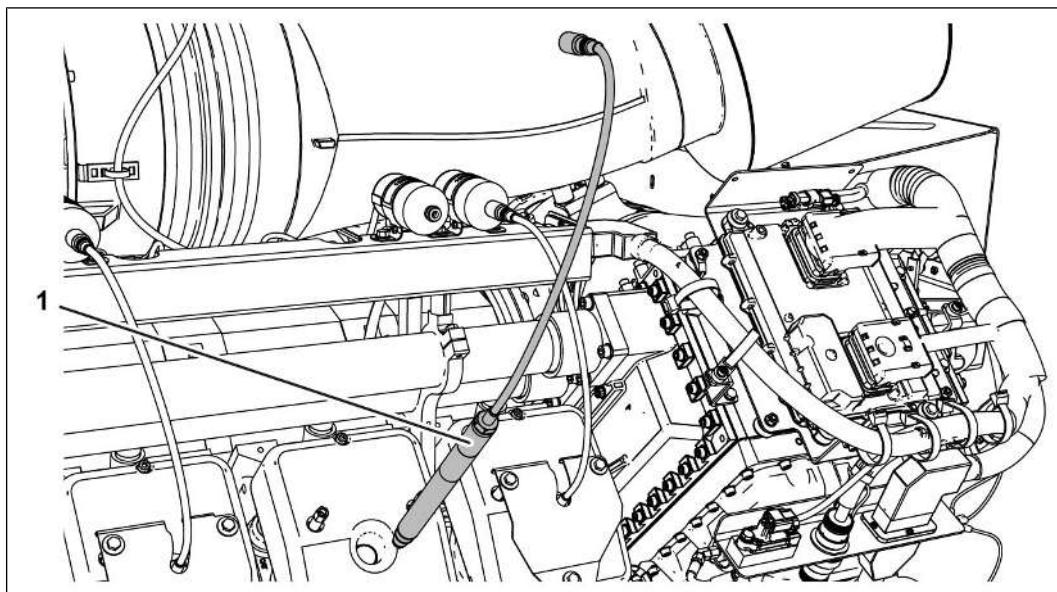
- Stop the engine after the test run and function run.
- Tighten spark plugs with 50 Nm on the engine at operating temperature.

Installing the spark plug:



501697035

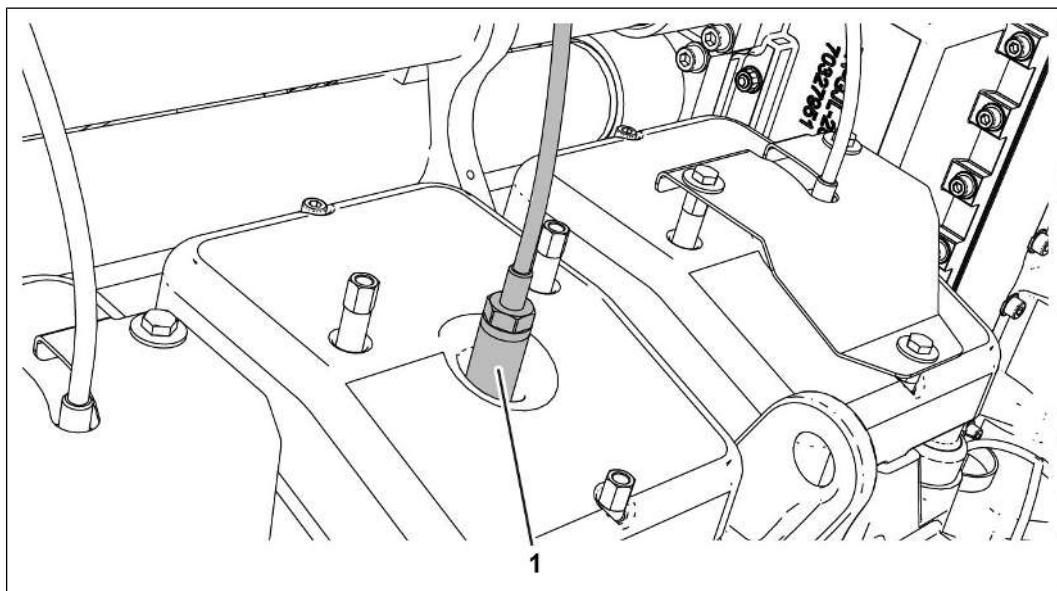
1. Clean screw thread.
 - Screw spark plug thread cleaner (1) hand-tight into the screw thread.
 - The cleaning bushing (2) of the spark plug thread cleaner (1) must be in contact with the seating surface (3).
 - To remove dirt on the seating surface (3), screw in spark plug thread cleaner (1) a further one to two turns.
 - Unscrew spark plug thread cleaner (1) until the cleaning bushing (2) is no longer in contact with the seating surface (3).



501710475

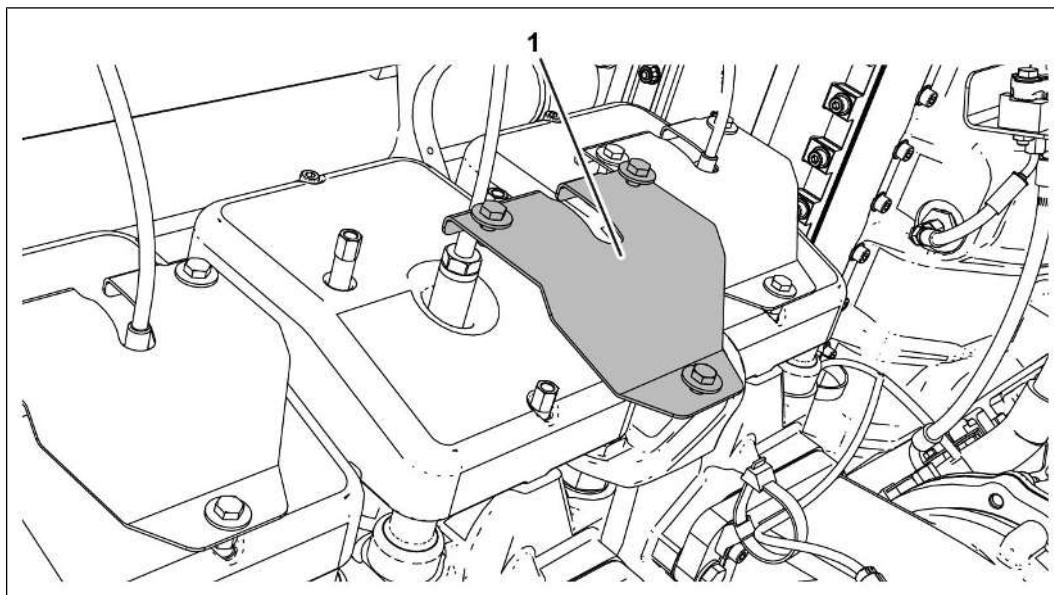
2. **CAUTION! Tighten spark plug and check for correct fit!** Install spark plug (1)

- Replace sealing ring.
- Check that movement of the sealing ring is unobstructed.
- Insert spark plug with ignition cable.



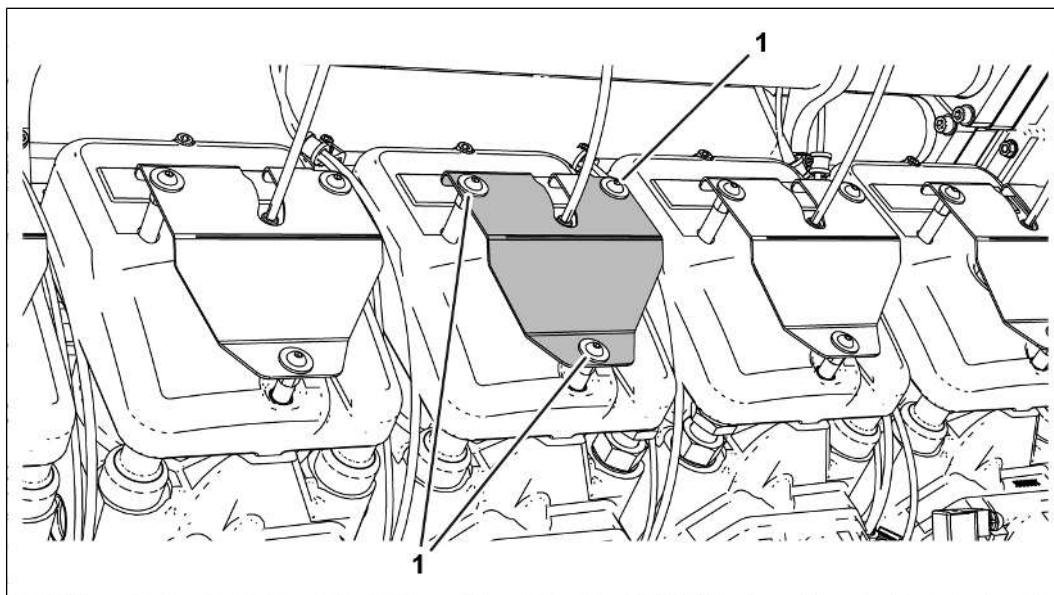
501708555

- Tighten spark plug (1).



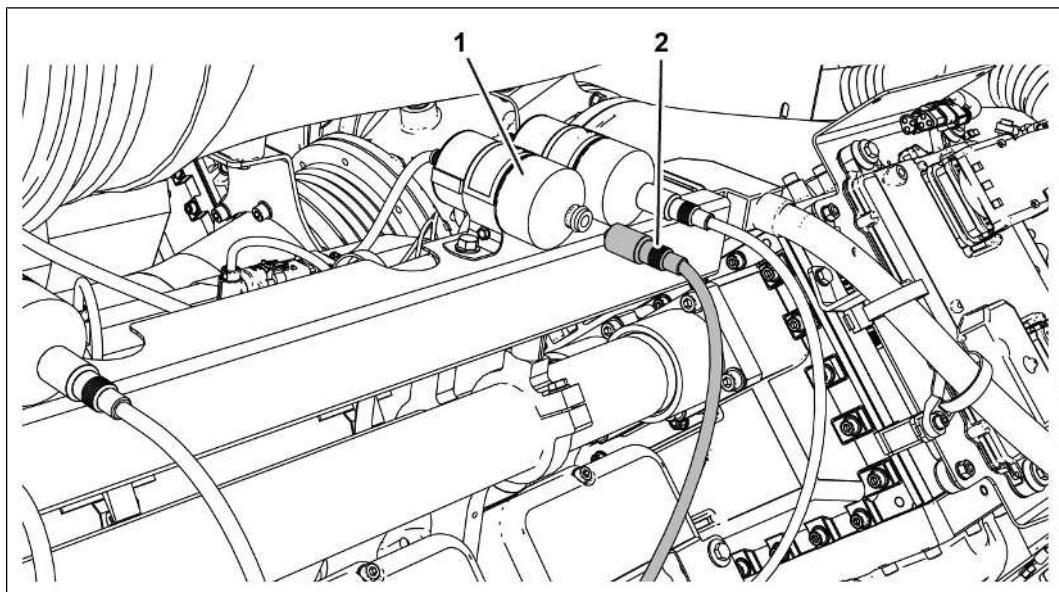
501706635

3. Mount spark plug cover (1).
 - Attach spark plug cover.



501894923

- **NOTE! If the catch guard cannot be fitted correctly, it is possible that the spark plug is not screwed in correctly!** Tighten screws (1).



501702795

4. Connect ignition cable (2) to ignition coil (1).
 5. Perform test run and function run, see [Performing test run and function run \[▶ 220\]](#).
 - Check the spark plug for tight fit.
- ⇒ Commission the genset, see [Commissioning/Genset Start the genset \[▶ 136\]](#)

Removing and installing the spark plug (socket)

Removing the spark plug

Valid for:

TCG 2020



Tools:

- Standard tools
- Special tool
 - [Socket for spark plug \(hooked spark plug\) 1214 1853 \[▶ 206\]](#)



Auxiliary media:

- Compressed air
 - To clean the spark plug shaft
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

General information

NOTE

The work described below is carried out on one spark plug.

Proceed in the same way for all others.



Risk of destruction of components

Dirt can enter the combustion chamber

The cylinder liner can be damaged.

- Blow out spark plug shaft only with the spark plug installed.
-



CAUTION

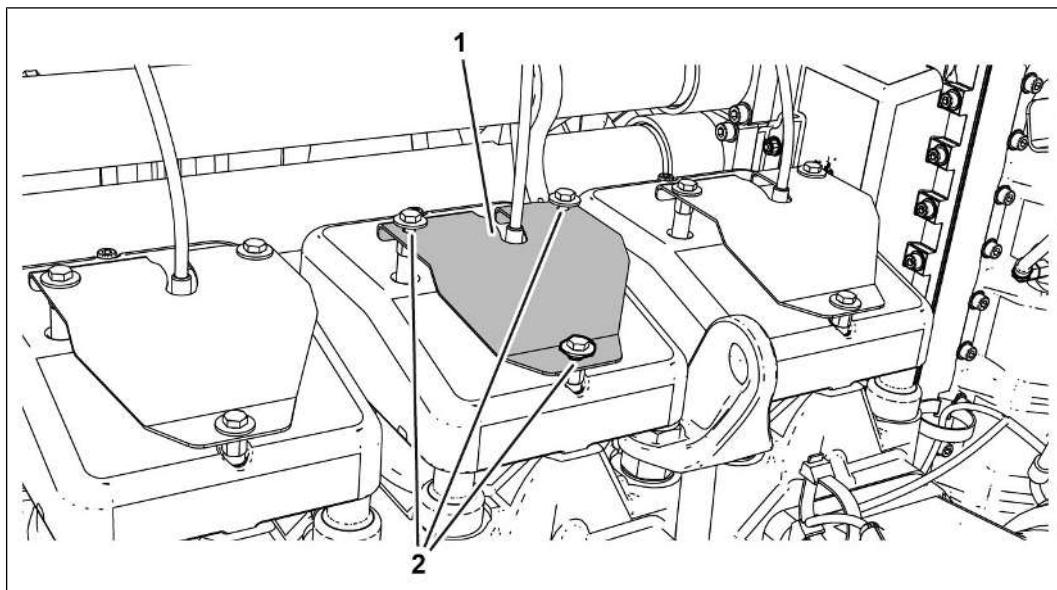
Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.
-

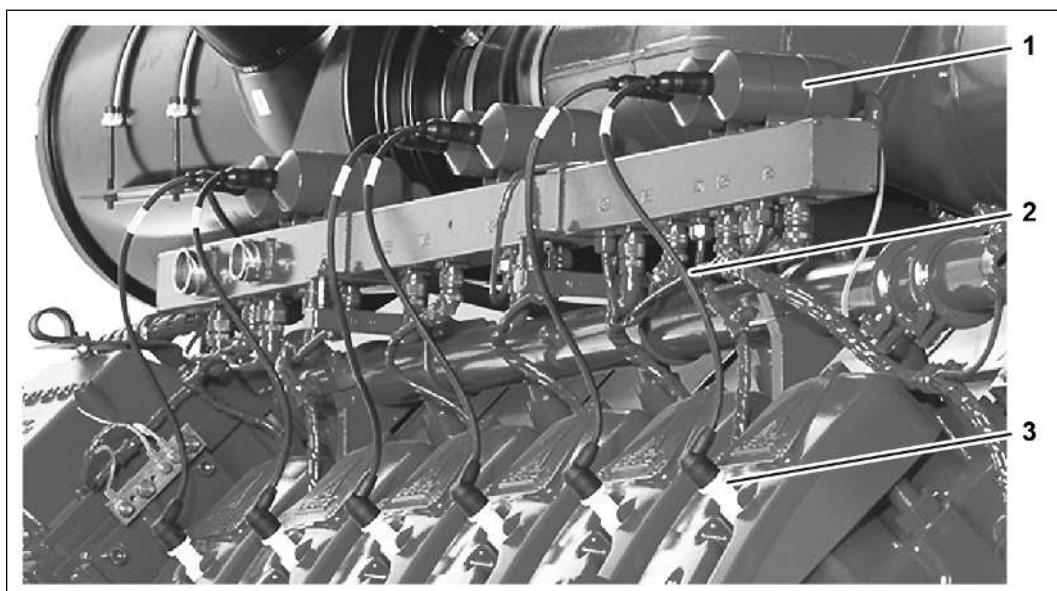
Removing the spark plug:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



501704715

1. Dismantle spark plug cover (1).
 - Unscrew screws (2).
 - Remove spark plug cover (1).



2848621067

2. Remove spark plug.
 - **NOTE! Blow out spark plug shaft only with the spark plug installed as dirt can enter the combustion chamber.** Blow out the spark plug shaft with compressed air.
 - Disconnect ignition cable (2) from ignition coil (1).
 - Disconnect the ignition cable (2) from the spark plug (3).
 - Blow out the spark plug shaft with compressed air.

- Unscrew spark plug (3).
 - Clean components.
3. Check the spark plug (2) and ignition cable (1), see OL-MRA10 / 26-13-01 [Checking the spark plug and ignition cable \[▶ 458\]](#).

Installing the spark plug

Valid for:

TCG 2020



Tools:

- Standard tools
- Feeler gauge 0.25 mm
- Special tool
 - [Socket for spark plug \(hooked spark plug\) 1214 1853 \[▶ 206\]](#)
 - [Torque wrench 1203 0350 \[▶ 203\]](#)
 - [Spark plug thread cleaner 1251 5557 \[▶ 207\]](#)



Spare parts:

- If applicable, spark plug
- Sealing ring

Technical data

Spark plug on cylinder head (socket)	
1.	Spark plug 50 Nm
Renew sealing ring. Tighten the spark plugs with torque on the engine at operating temperature.	



2848618635

Electrode spacing (socket)		
1.	Electrode spacing	0.25 mm

General information

If the electrode spacing is greater than the measuring variable during the test, the spark plug can be adjusted.

- As the spacing of the earth electrode may only be adjusted twice, the correction of the electrode spacing should be documented in the operational inspection booklet.

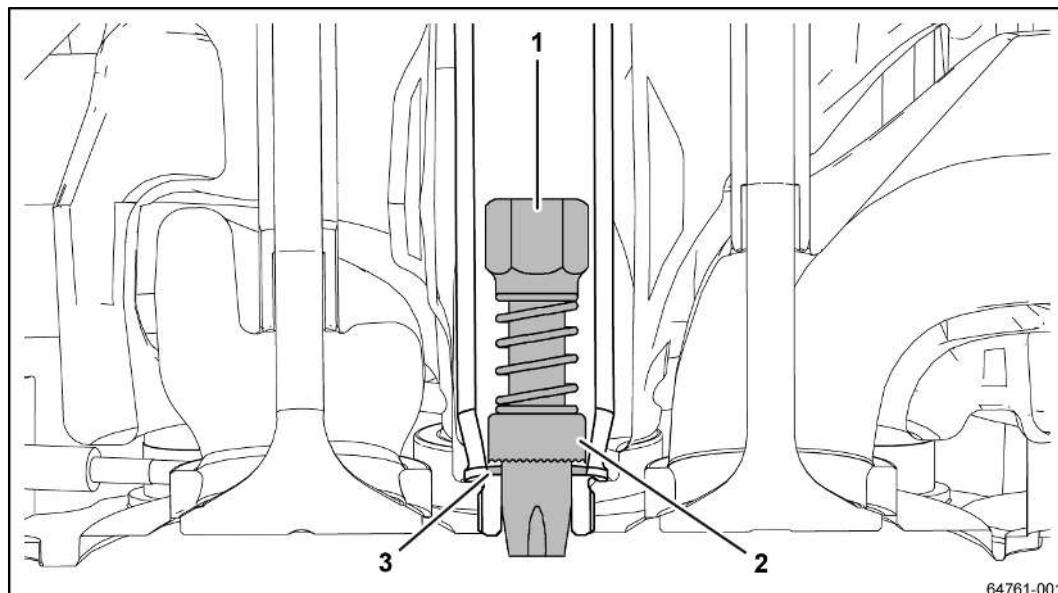
CAUTION



Improperly assembled spark plug

This can lead to minor or severe injuries and property damage.

- Stop the engine after the test run and function run.
 - Tighten spark plugs with 50 Nm on the engine at operating temperature.
-

Installing the spark plug:

501697035

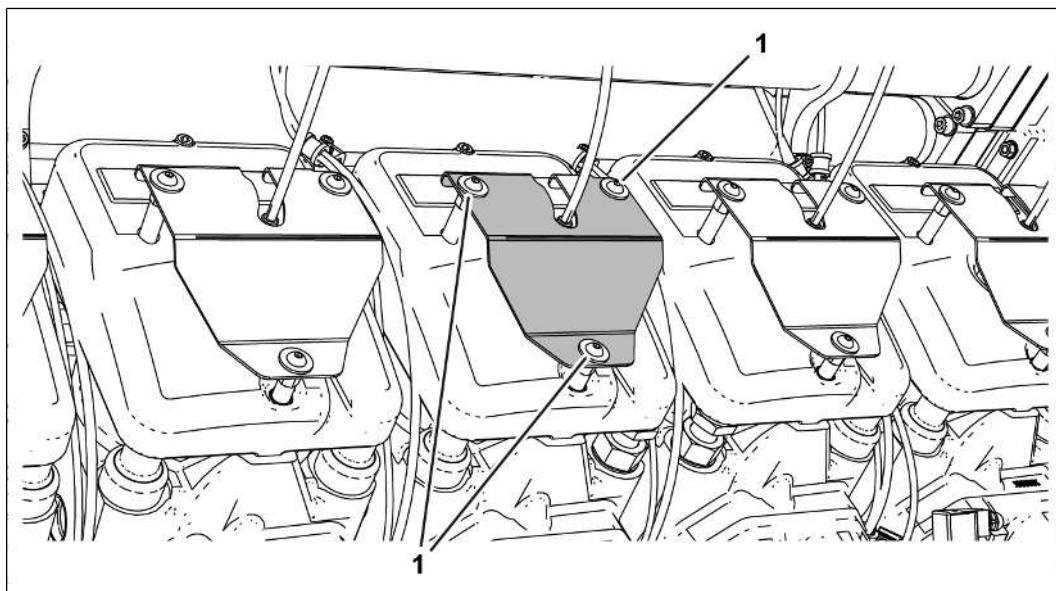
1. Clean screw thread.
 - Screw spark plug thread cleaner (1) hand-tight into the screw thread.
 - The cleaning bushing (2) of the spark plug thread cleaner (1) must be in contact with the seating surface (3).
 - To remove dirt on the seating surface (3), screw in spark plug thread cleaner (1) a further one to two turns.
 - Unscrew spark plug thread cleaner (1) until the cleaning bushing (2) is no longer in contact with the seating surface (3).



2848621067

2. Install spark plug.

- Tighten spark plug (3).
- Visually inspect the ignition cable for damage and renew, if necessary.
- Connect ignition cable (2) to ignition coil (1).
- Connect ignition cable (2) to spark plug (3).



501894923

3. Mount spark plug cover (1).

- Attach spark plug cover.
- Tighten screws (1).

4. Perform test run and function run, see [Performing test run and function run \[▶ 220\]](#)

- Check the spark plug for tight fit.

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Checking the spark plug and ignition cable

Valid for:
TCG 2020



Tools:

- Measuring instrument (ohmmeter)



Spare parts:

- Spark plug with ignition cable, if necessary

Technical data

Spark plug (short-circuit test)	
Spark plug socket against spark plug body	Infinite kOhm

General information

Spark plugs and ignition cables are one component and cannot be separated.

NOTE

Combustion residues deposit at the outlets of the spark plugs.

These block the outlets for the flame jet igniters, which can lead to faulty ignition and engine failure.

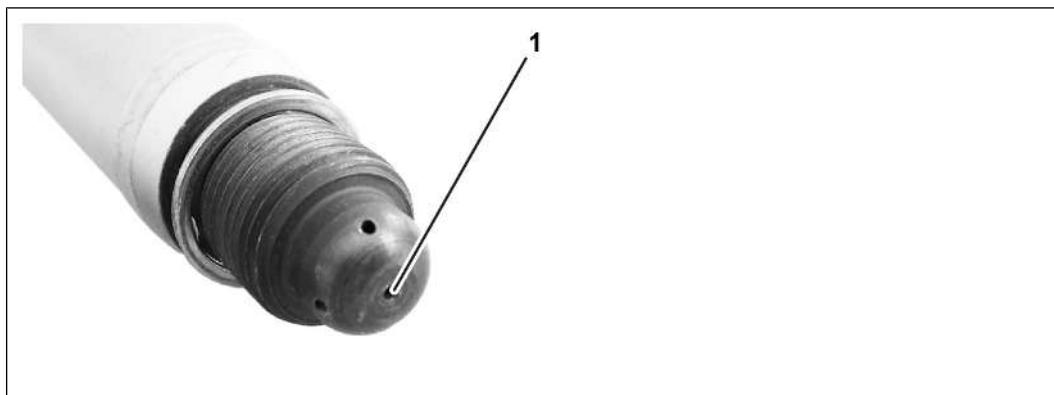
NOTE

The work described below is carried out on one spark plug.

Check all spark plugs in the same way.

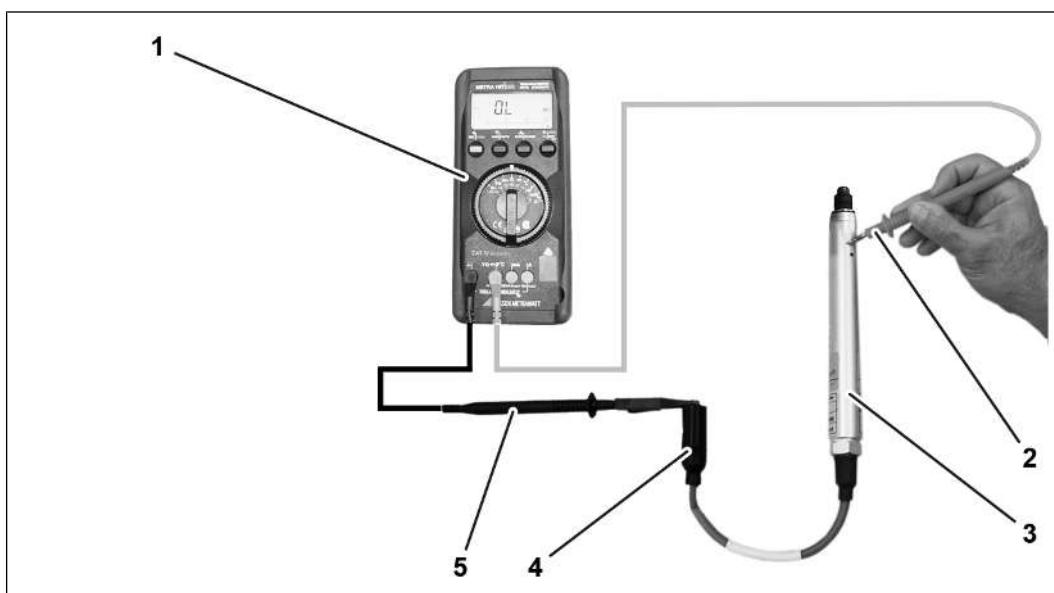
Checking the spark plug and ignition cable:

- ✓ Spark plug dismantled, see OL-MRA10 / 26-10-10 Removing the spark plug [▶ 442]



521695883

1. Check spark plug.
 - Check the spark plug and ignition cable for mechanical damage.
 - **NOTE! Renew any spark plug with clogged bores.** Check the bores (1) of the spark plug for deposits.
 - Renew a damaged spark plug and spark plug with damaged ignition cables.



521700235

2. Connect the measuring device (1) for the electrical test (short-circuit test) to the spark plug.
 - Connect the plug (5) of the measuring device to the plug (4) of the ignition cable.
 - **NOTE! If necessary, remove the protective coating at this point.** Place the measuring tip (2) on an electrically conductive point of the spark plug.
 - Read the measured value.
3. Compare the measured value with the minimum limit value in the TPEM system.
 - Select the Controller function group.
 - The Controller mask opens.

- Tap the Ignition button.
 - The minimum limit values for the cylinder row A and cylinder row B appear in the Diagnostics dialog area.
 - **NOTE! If the minimum limit value has been reached, renew the spark plug.** Compare the displayed minimum limit value of the corresponding cylinder with the measured value in the Diagnostics dialog area.
4. Turn off and disconnect the measuring device.
- ⇒ Install spark plug, see OL-MRA10 / 26-10-10 [Installing the spark plug \[▶ 445\]](#)

Checking the throttle valve (V12/V16 engine)

Valid for:
TCG 2020 K, TCG 2020



- Tools:
- Standard tools

General information

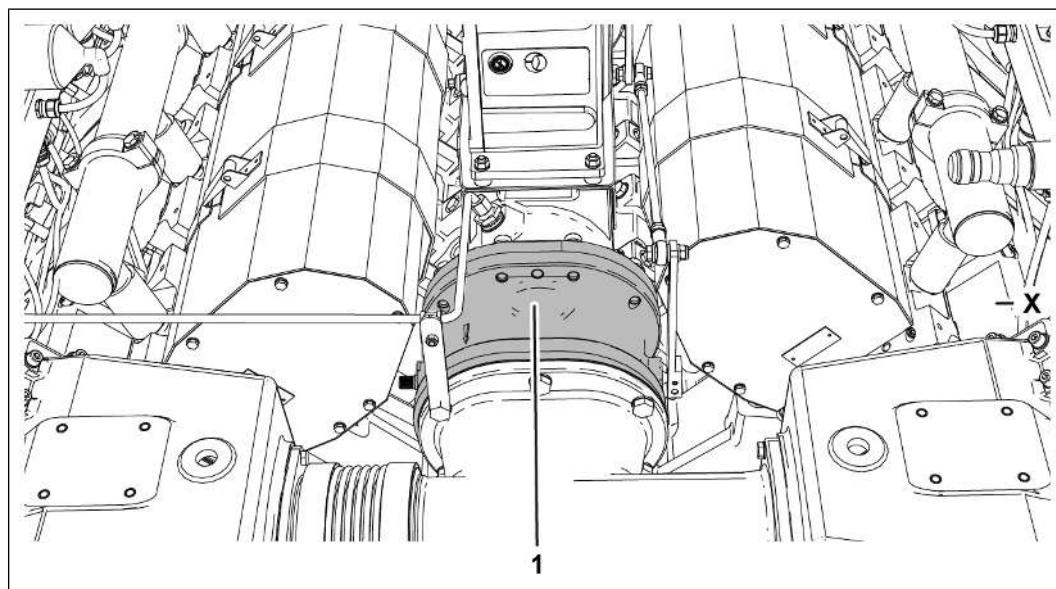
The genset was operated at operating temperature.

Also check during the test:

- Speed controller linkage
- Actuator

Checking the throttle valve:

- ✓ Intake air filter housing dismantled, see OL-MRA10 / 22-14-12 [Dismantling the intake air filter housing](#) [▶ 428].



2639795211

1. Check the throttle valve (1) for leaks.
 - If leakage is visible, contact service partner.
2. Check the actuator, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \(V12/V16 engine\)](#) [▶ 464].
3. Check the speed controller linkage, see OL-MRA10 / 27-20-01 [Checking the speed controller linkage](#) [▶ 468].
 - ⇒ Mount the intake air filter housing, see OL-MRA10 / 22-14-12 [Mounting the intake filter housing](#) [▶ 429].

Checking the throttle valve (V20 engine)

Valid for:

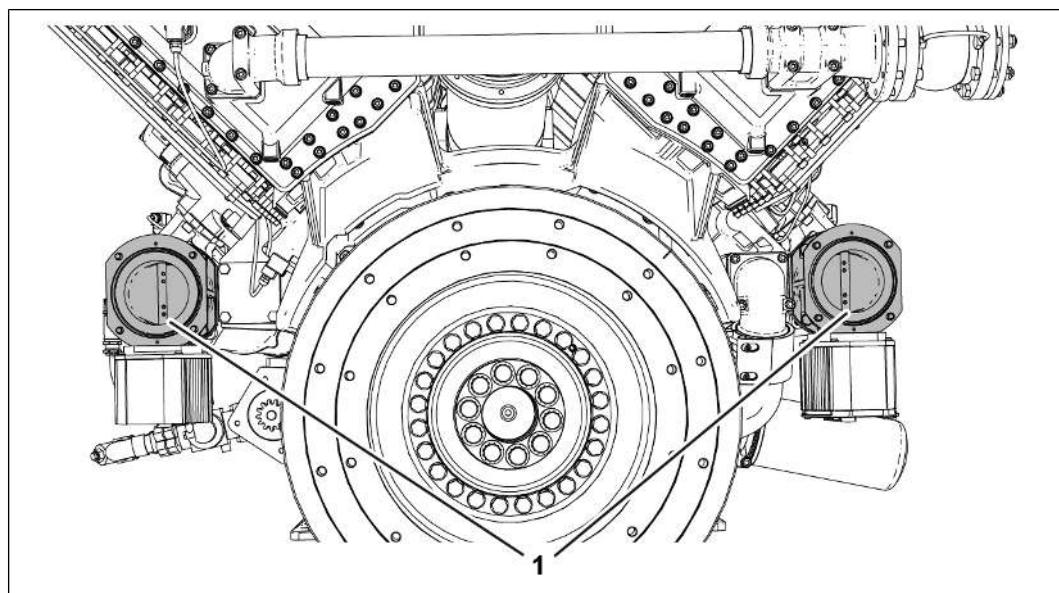
TCG 2020



Tools:

- Standard tools

General information



2642804491: Mixture manifold and mixture cooler cover removed

The engine is equipped with two throttle valves (1). A throttle valve is installed on each side of the cylinder. The throttle valve is located in the mixture pipe directly behind the respective mixture cooler.

- (For better visualization, the mixture manifold and mixture cooler cover are removed in the diagram.)

NOTE

The housing with the throttle valve and actuator form a unit.

They may not be disconnected from each other.

NOTE

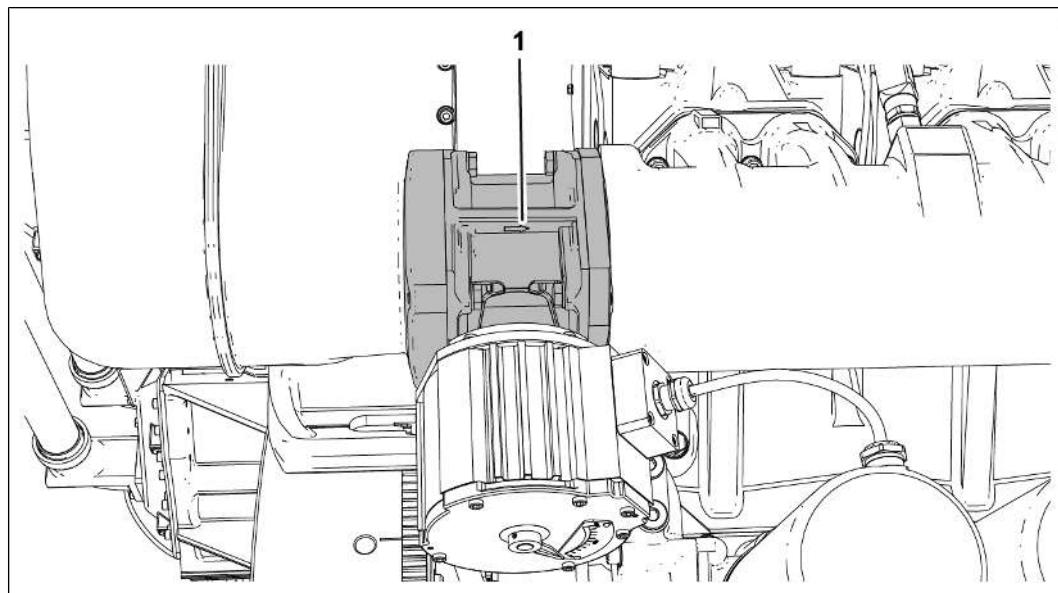
The work described below is carried out on one throttle valve.

Proceed in the same way for the second one.

When checking the throttle valve, always check that the actuator is functioning, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \(V20 engine\) \[▶ 466\]](#).

Checking the throttle valve:

- ✓ The genset is operating and has reached the operating temperature.



2642806923

1. **CAUTION! Risk of burns from touching hot components.** Check the throttle valve (1) for sucking noises and leakages.
 - Check the throttle valve on the other cylinder side in the same way.
 - If the sucking noises can be heard or leakages are visible, contact service partner.

Checking the speed control actuator (V12/V16 engine)

Valid for:
TCG 2020, TCG 2020 K



- Tools:
- Standard tools

General information

The genset was operated at operating temperature.

Do not disconnect the speed controller linkage.

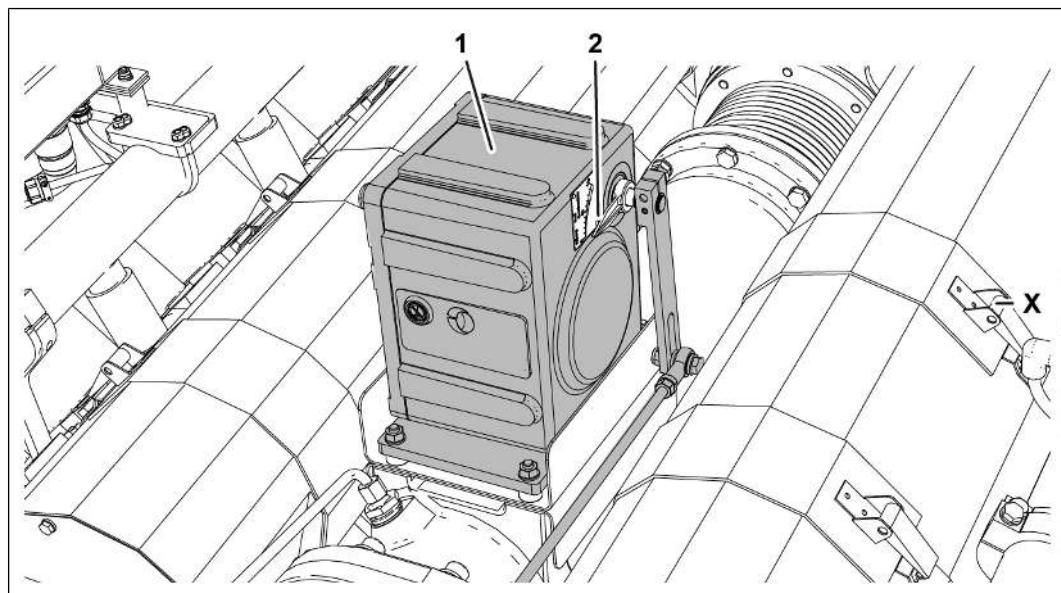
- If the speed controller linkage has been disconnected, the setting must be corrected, contact service partner.

Also check during the test:

- Throttle valve
- Speed controller linkage

Checking the speed control actuator:

- ✓ Intake air filter housing dismantled, see OL-MRA10 / 22-14-12 [Dismantling the intake air filter housing \[▶ 428\]](#).



2639790347

1. Check actuator (1) with throttle valve for ease of movement.
 - Rotate needle (2) manually to the limit stop 100 % and then back again.
 - The needle must be able to rotate against consistent resistance without jolting.
 - When released, the needle automatically goes back to the zero position.

-
- In case of a negative test, contact service partner.
 - 2. Check the throttle valve, see OL-MRA10 / 27-10-01 [Checking the throttle valve \(V12/V16 engine\)](#) [▶ 461]
 - 3. Check the speed controller linkage, see OL-MRA10 / 27-20-01 [Checking the speed controller linkage](#) [▶ 468].
 - ⇒ Mount the intake air filter housing, see OL-MRA10 / 22-14-12 [Mounting the intake filter housing](#) [▶ 429].

Checking the speed control actuator (V20 engine)

Valid for:

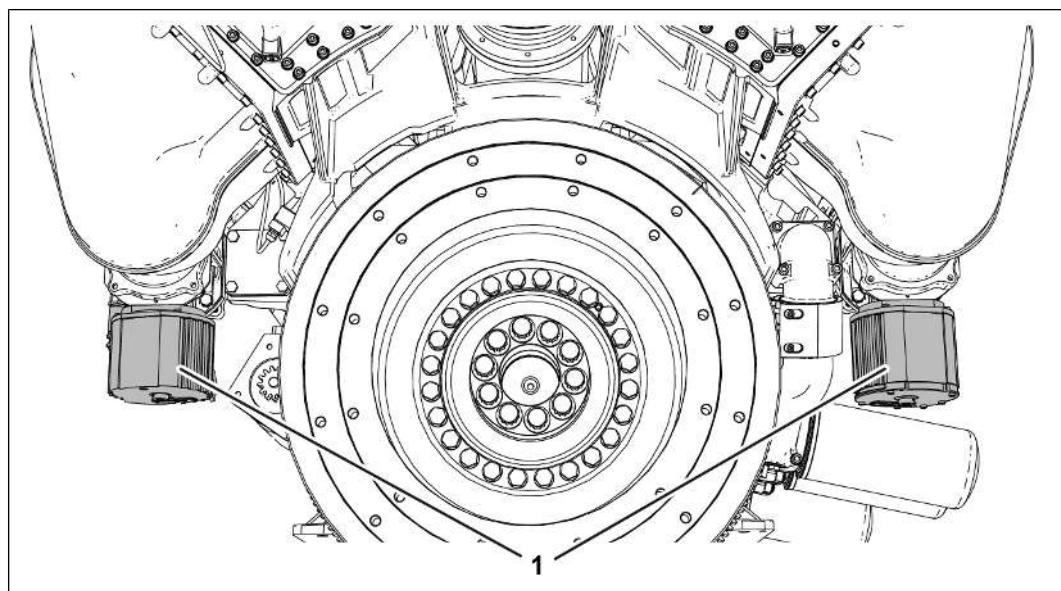
TCG 2020



Tools:

- Standard tools

General information



2642799627

The engine is equipped with two actuators (1). An actuator is installed on each side of the cylinder. The actuator is located in the mixture pipe directly behind the respective mixture cooler.

NOTE

The housing with the throttle valve and actuator form a unit.

They may not be disconnected from each other.

NOTE

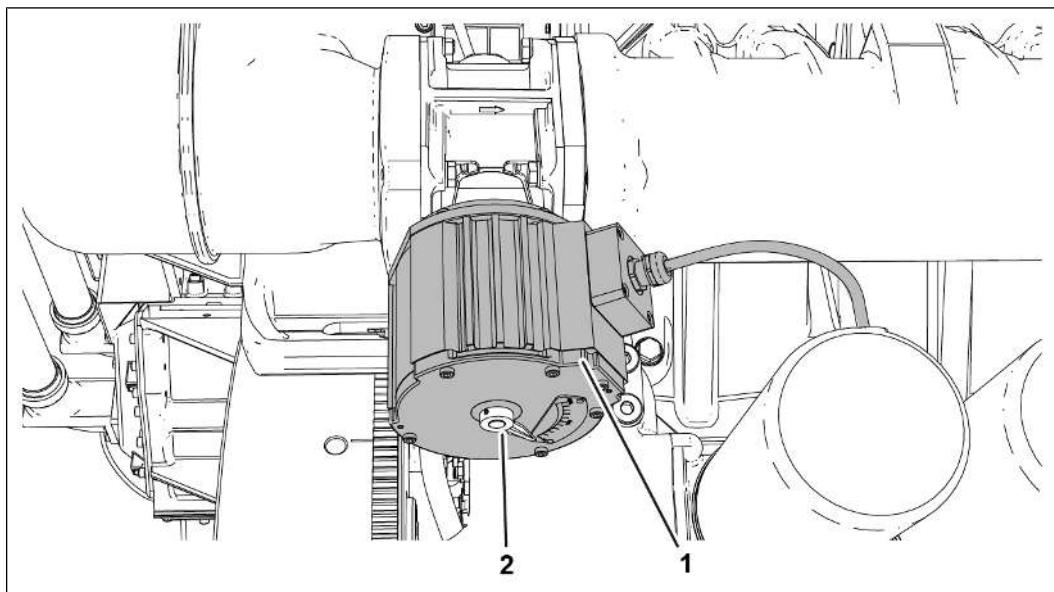
The work described in the following is carried out on one actuator.

Proceed in the same way for the second one.

Always check the throttle valve for leaks while checking the actuator, see OL-MRA10 / 27-10-01 [Checking the throttle valve \(V20 engine\) \[▶ 462\]](#).

Checking the speed control actuator:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2642802059

1. Check the actuators (1) for ease of movement.
 - Rotate needle (2) manually to the limit stop 100 % and then back again.
 - The controller output shaft must be able to rotate against consistent resistance without jolting.
 - In case of a negative test, contact service partner.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Checking the speed controller linkage

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools



Auxiliary media:

- Acid-free grease

General information

Do not disconnect the speed controller linkage.

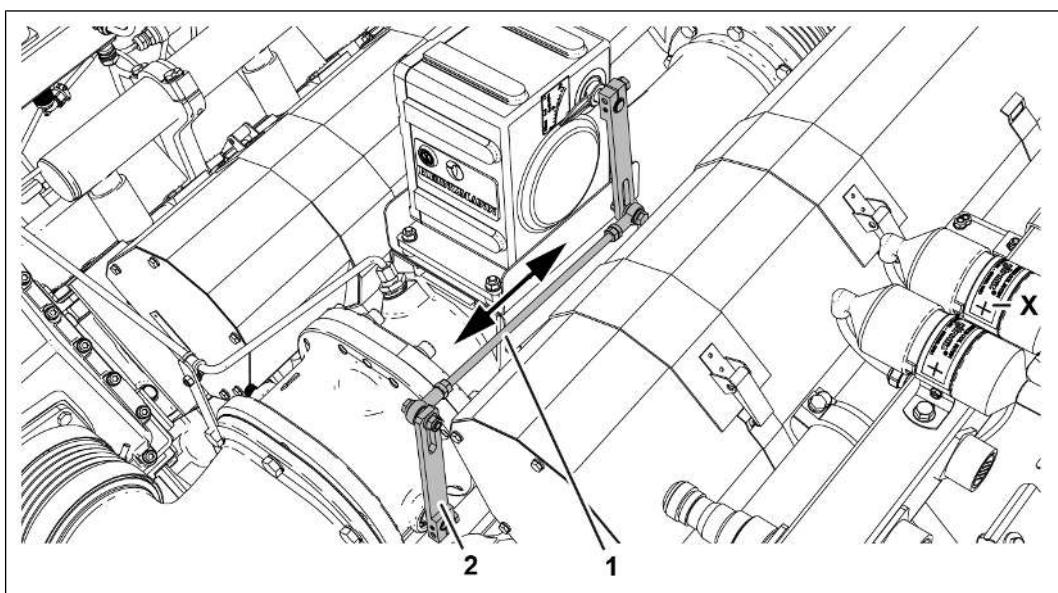
- If the speed controller linkage has been disconnected, the setting must be corrected, contact service partner.

Also check during the test:

- Throttle valve
- Actuator

Checking the speed controller linkage:

- ✓ Intake air filter housing dismantled, see OL-MRA10 / 22-14-12 [Dismantling the intake air filter housing \[▶ 428\]](#).



2639792779

1. Press lever (2) to the full-load stop.
 - The lever (2) must be able to push against consistent resistance without jolting.
 - When released, the actuator automatically goes back to the zero position.

-
- Contact service partner in case of stiffness.
 - 2. Move the connection rod (1) back and forth in the direction of the arrow.
 - Check the swivel heads clearance.
 - Coat the swivel heads with acid-free grease.
 - 3. Check the throttle valve, see OL-MRA10 / 27-10-01 [Checking the throttle valve \(V12/V16 engine\)](#) [▶ 461]
 - 4. Check the actuator, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \(V12/V16 engine\)](#) [▶ 464]
 - ⇒ Mount the intake air filter housing, see OL-MRA10 / 22-14-12 [Mounting the intake filter housing](#) [▶ 429].

Cleaning dirt trap of the compressed air line

Valid for:

TCG 2020



Tools:

- Standard tools



Spare parts:

- Sealing ring
- Dirt trap, if necessary



Auxiliary media:

- Compressed air
 - To clean the dirt trap

General information



WARNING

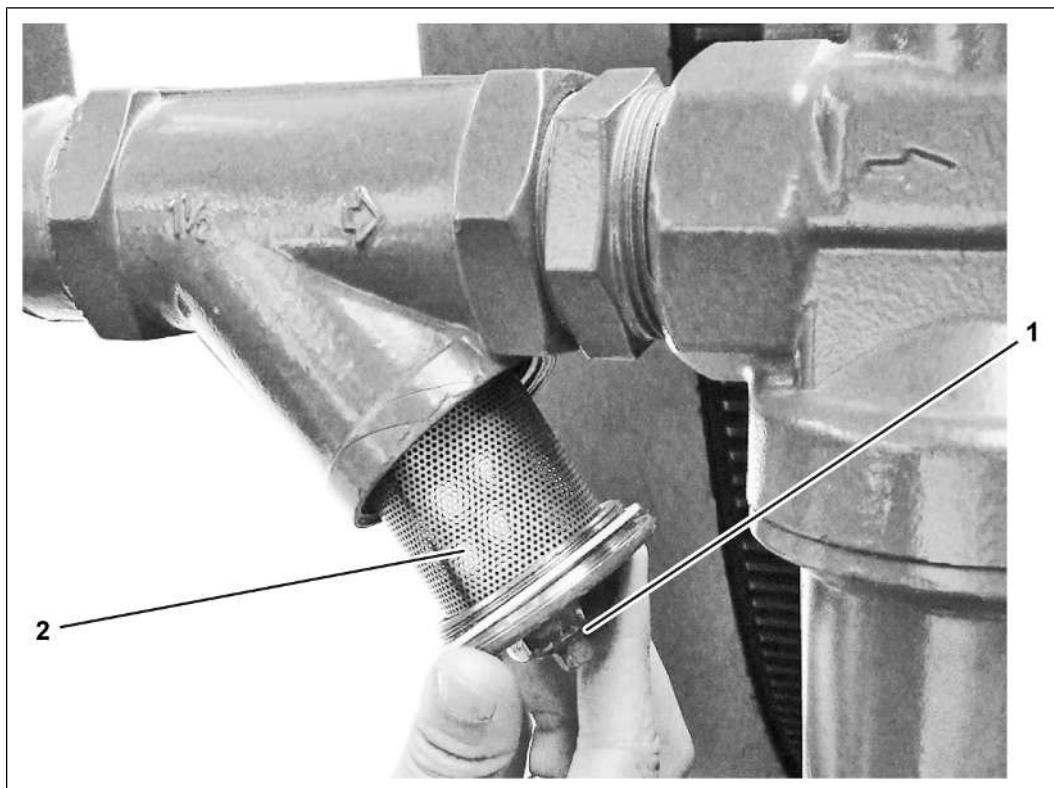
Injury due to particles of dirt

This can lead to minor or severe injuries.

- Wear personal protective equipment.

Cleaning dirt trap of the compressed air line:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)
- ✓ Compressed air supply is disconnected and line pressure relieved



527657995

1. Unscrew cover (1).
2. Remove dirt trap (2).
3. Clean dirt trap (2).
 - **CAUTION! Dirt particles can become detached.** Blow out with compressed air from inside to outside.
4. Insert dirt trap (2).
 - Replace sealing ring.
5. Screw cover (2) tight.
 - ⇒ Reestablish the compressed air supply
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Emptying and filling the cooling system

Emptying the cooling system

Valid for:

TCG 2020 K, TCG 2020

Tools:

- Standard tools
- Pump
- Collecting vessel

Auxiliary media:

- Binding agent

General information

For various work, it is necessary to drain the coolant partially or fully.

- For this work, there are multiple draining points on the engine.

Mixture cooling circuit and engine cooling circuit are completely separated from one another and can be drained individually.

- When working on the engine the mixture cooling circuit may under some circumstances remain full.
- When working on the plant, the engine cooling circuit may remain full under some circumstances.

Check coolant.

- Treat the coolant if necessary, see Service Library, Technical Bulletin ([TR 2091](#)), [Specification for coolant](#).
- If the coolant no longer needs to be treated, empty the cooling system completely.
- Dispose of the coolant properly.

DANGER



Risk of falling as a result of unsecured work at great height.

Severe injury or death can result.

- Wear personal protective equipment.
- Use a scaffold or fall protection for carrying out work at a height of 1.70 m or higher.
- Secure components and tools from falling down.

**WARNING**

Due to pressurized hot operating media

This may result in medium to severe burns.

- Wear personal protective equipment.
- Allow the operating media and components to cool down to ambient temperature.
- Open the nozzles carefully and allow the pressure to escape slowly.

**Danger to the environment**

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

**Danger to the environment**

When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
- Collect escaping operating media and soak it up with thickeners if necessary.
- Always store operating media separately and in tightly sealed tanks intended for those materials.
- Properly dispose of operating media and components in accordance with national regulations.

Emptying the cooling system:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)

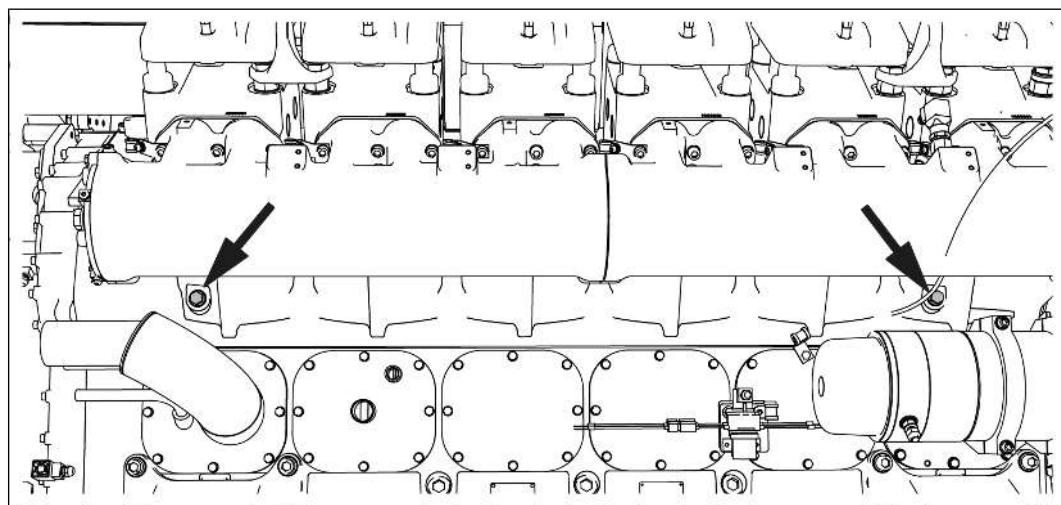
NOTE

Empty the engine completely

Drain coolant at various points of the cooling system in order to empty the engine completely.

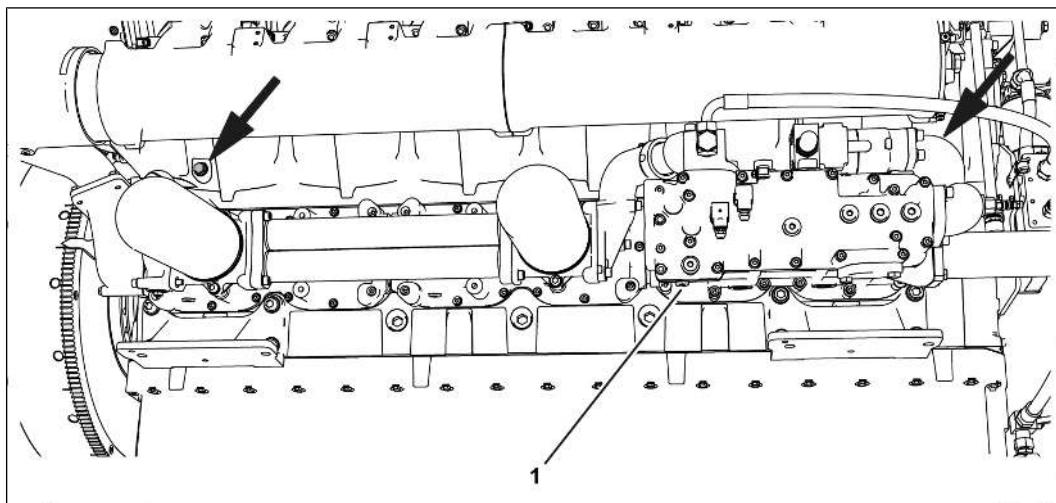
- Collect leaking coolant.
- Place the collecting vessel underneath or connect it to the respective drain point.

1. Connect the collecting vessel to the drain valve in the plant.
 - ⇒ Check the quality of the drained coolant, see OL-MRA10 / 38-03-01 [Checking the cooling system protection agent \[▶ 485\]](#)

Emptying the engine cooling circuit:

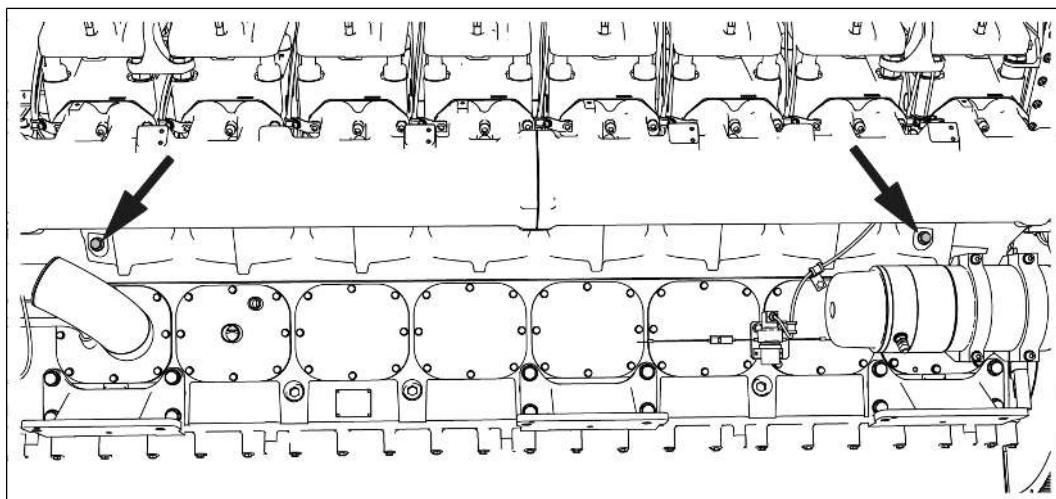
2850736779: Drain points V12 engine cylinder side A

1. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



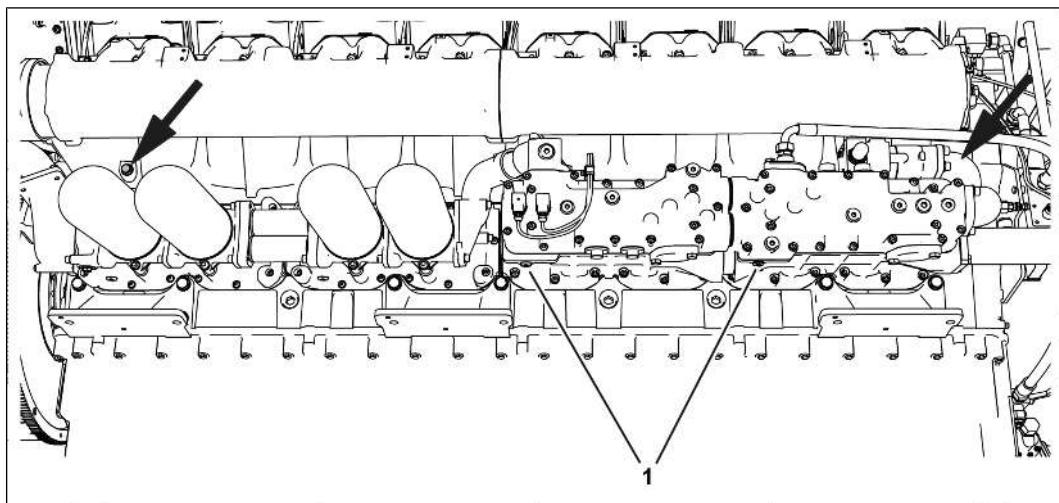
2850739211: Drain points V12 engine cylinder side B

2. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



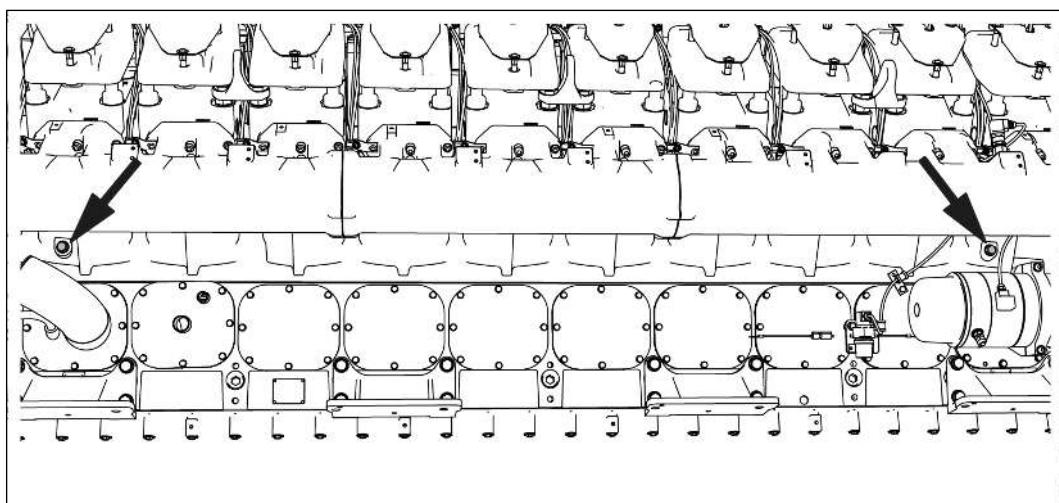
2850741643: Drain points V16 engine cylinder side A

3. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



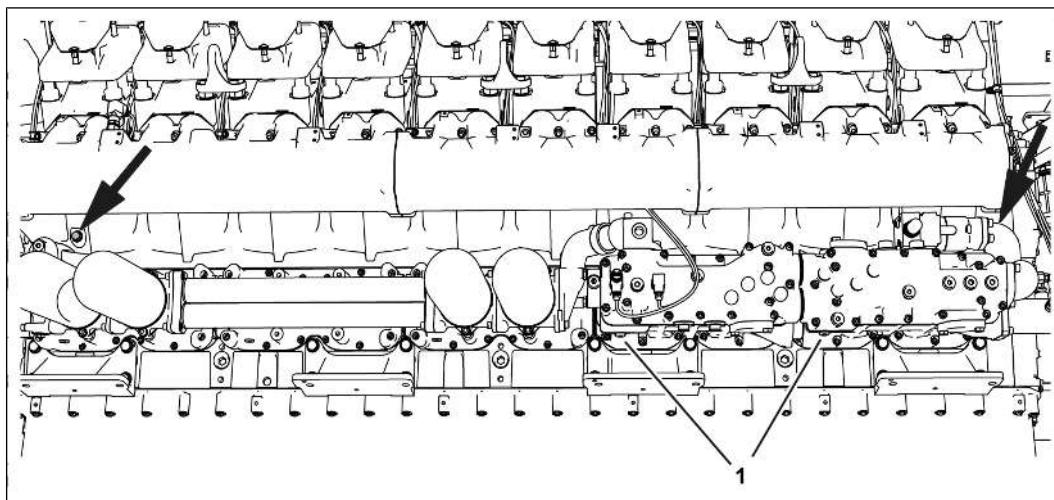
2850744075: Drain points V16 engine cylinder side B

4. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



2850746507: Drain points V20 engine cylinder side A

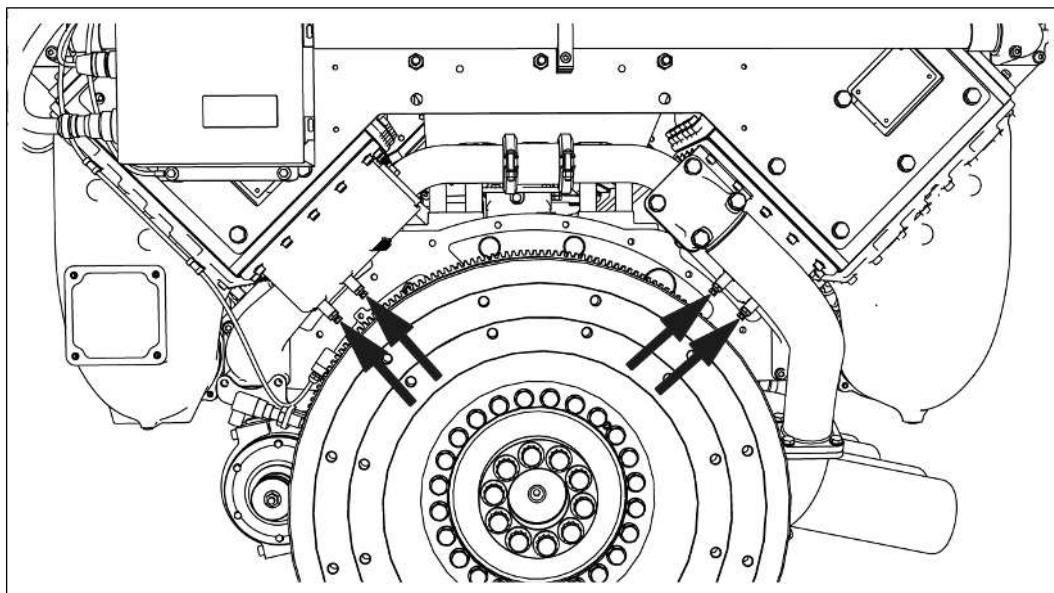
5. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



2850761739: Drain points V20 engine cylinder side B

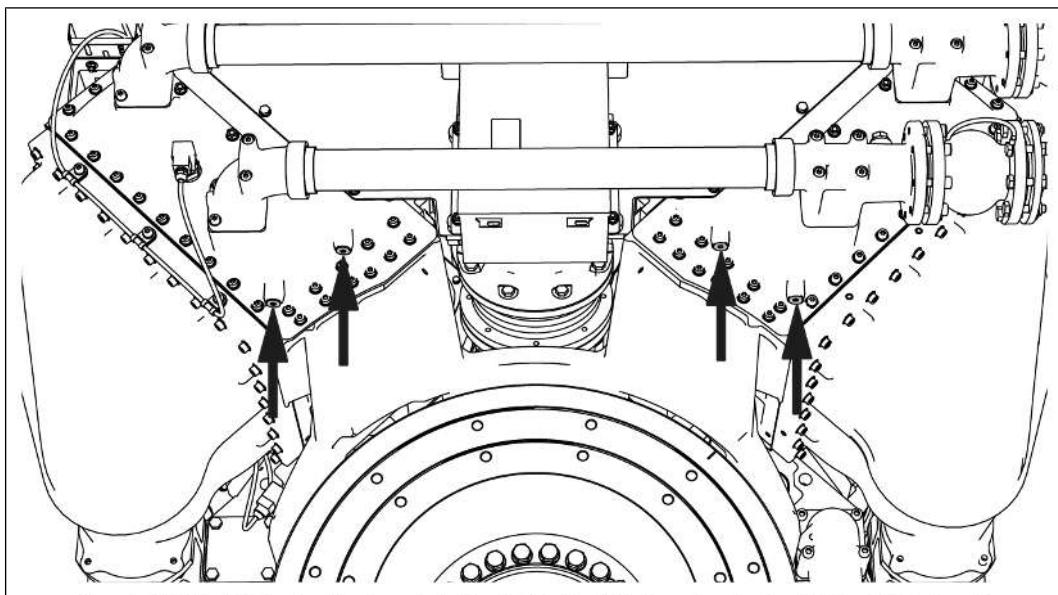
6. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.
7. Drain the coolant completely.
8. Check the coolant chambers.
 - Clean the coolant chambers, if necessary. For assistance, contact service partner.
 - Clean the cooling system, see also Technical Bulletin (TR) 2091 [Specification for coolant](#).
9. Tighten all drain screws with new seals.

Emptying the mixture cooling circuit:



2850764171: Drain points V12/V16 engine mixture cooler

1. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.



2850766603: Drain points V20 engine mixture cooler

2. Unscrew drain screw (arrow) on the crankcase.
 - Collect leaking coolant.
3. Drain the coolant completely.
4. Check the coolant chambers.
 - Clean the coolant chambers, if necessary. For assistance, contact service partner.
 - Clean the cooling system, see also Service Library, Technical Bulletin ([TR 2091](#)), [Specification for coolant](#).
5. Tighten all drain screws with new seals.

Filling the cooling system

Valid for:
TCG 2020 K, TCG 2020

Tools:

- Standard tools
- Pump
- Collecting vessel

Auxiliary media:

- Coolant
 - See Service Library, Technical Bulletin ([TR 2091](#)), [Specification for coolant](#)

Spare parts:

- Seals
- Sealing rings

General information

Before filling coolant, check that all drain valves and drain screws in the cooling system are firmly closed.

The mixture cooling circuit and engine cooling circuit are completely separated from one another and can be filled individually.

Under some circumstances, only one cooling circuit must be filled.

- In this case, adjust the required amount of coolant to the cooling circuit to be filled.

Filling the cooling system:

1. Mount the coolant tank with external pump to the plant coolant supply.
 - Attach the coolant supply line to the coolant connection.
 - Connect external pump.
2. Open all valves to and from the genset.
 - Check whether all drain valves are closed in the plant and on the genset.
 - Check whether all drain screws are screwed tight on the genset.
3. Open inlet valve on genset.
 - Place or connect the collecting vessel.
4. Open the bleed screw at the highest point in the cooling system.

NOTE

The external pump is operating against pressure

If the running noises of the external pump audibly change, the external pump stops immediately.

Wait for the pump overrun.

-
5. Switch on external pump.
 - Fill the cooling system until the specified coolant level is reached.
 6. Switch off external pump.
 7. Close the bleed screw.
 8. Check the coolant level and coolant system pressure, see [Checking coolant level and coolant system pressure \[▶ 480\]](#).
- ⇒ Commission the genset, see [Commissioning/Genset Start the genset \[▶ 136\]](#)

Checking coolant level and coolant system pressure

Valid for:
TCG 2020 K, TCG 2020

Tools:

- Standard tools

Auxiliary media:

- Binding agent
- Coolant
 - See Service Library, Technical Bulletin (TR 2091), [Specification for coolant](#)

Spare parts:

- Seals
- Sealing rings

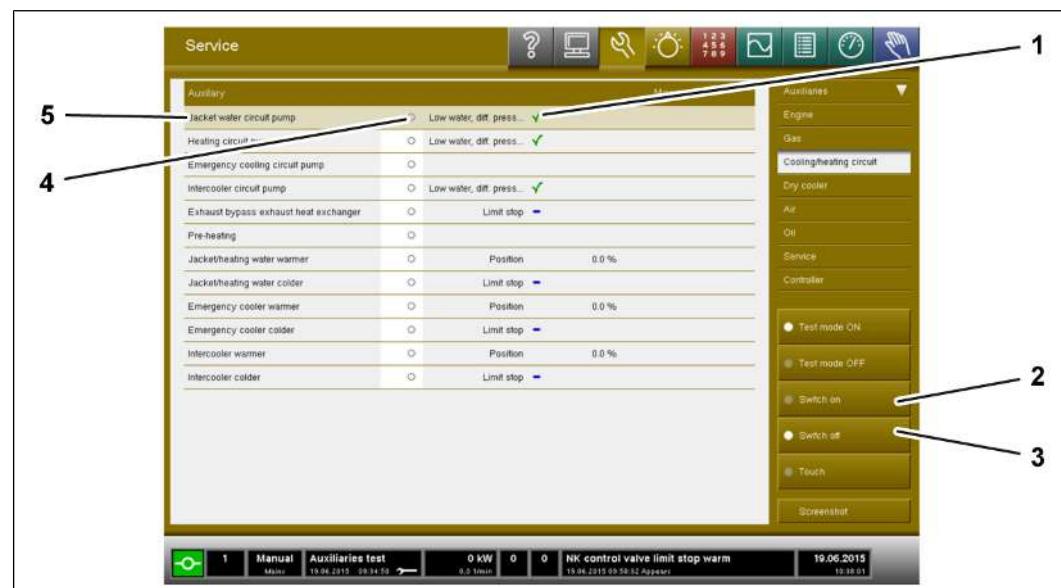
General information

The mixture cooling circuit and engine cooling circuit are completely separated from one another and can be filled and vented individually.

Under some circumstances, only one cooling circuit must be filled.

- In this case, adjust the required amount of coolant to the cooling circuit to be filled.

Checking the coolant level and coolant system pressure:



2849317771

1. Check the coolant level and coolant system pressure.
 - Press the Functional group "Service" button.

- Activate the Jacket water circuit pump auxiliary drive (5) in the Cooling/heating circuit dialog area.
- Tap the white area (4) in the Jacket water circuit pump dialog area.
- The "Red lightning bolt" symbol (coolant level too low) or the "Green checkmark" symbol (coolant level is OK) appears in the Low water, diff. press... (1) dialog area.

NOTE

The "Red lightning bolt" symbol appears in the dialog area

Top up coolant.

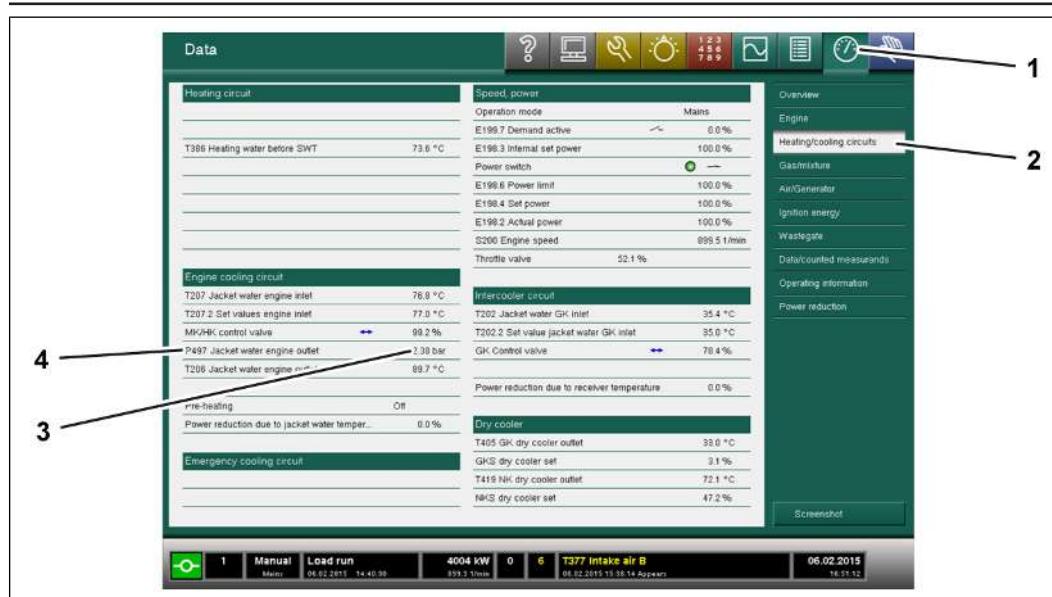
- Touch the Switch on button (3).
- A second green checkmark is shown in the Low water, diff. press... dialog area (1).
- Allow the coolant pump to run for approx. ten minutes.
- Press the Switch off button (2) to switch off the coolant pump.
- Both symbols disappear from the Low water, diff. press... dialog area (1) when the coolant pump shuts down.

2. Vent the cooling system, if necessary.

NOTE

The "Red lightning bolt" symbol appears in the dialog area

Check the automatic vent for contamination.

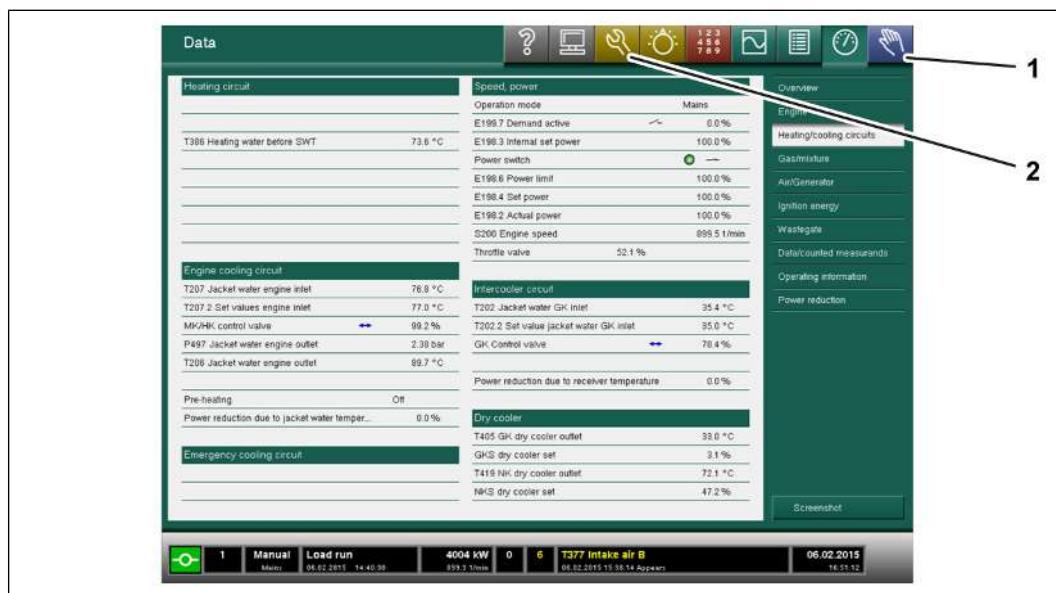


2849320203

3. Check coolant level and top up, if necessary.

- Press the Functional group "Data" button (1).

4. Press the Cooling/heating circuit button (2).
 - The P497 Jacket water engine outlet parameter appears in the dialog area.
5. Read the value (3) of the cooling system pressure in the P497 Jacket water engine outlet dialog area (4).
 - The value (3) must be greater than 1.5 bar.
 - Verify the value (3) on the pressure gauge in the plant if necessary.
6. If the cooling system pressure is less than 1.5 bar, top up the coolant, see [Filling the cooling system \[► 478\]](#).
7. Venting the cooling system
 - Check the lines, connecting elements and engine for leaks.
 - Renew defective components.
 - Top up the coolant and check the cooling system pressure, if necessary.



2849322635

8. Press the Operation button (1) to start the genset.
9. Press the Service button (2) to return to the Service mask.

Venting the cooling system:**NOTE**

Component of the cooling water monitoring group

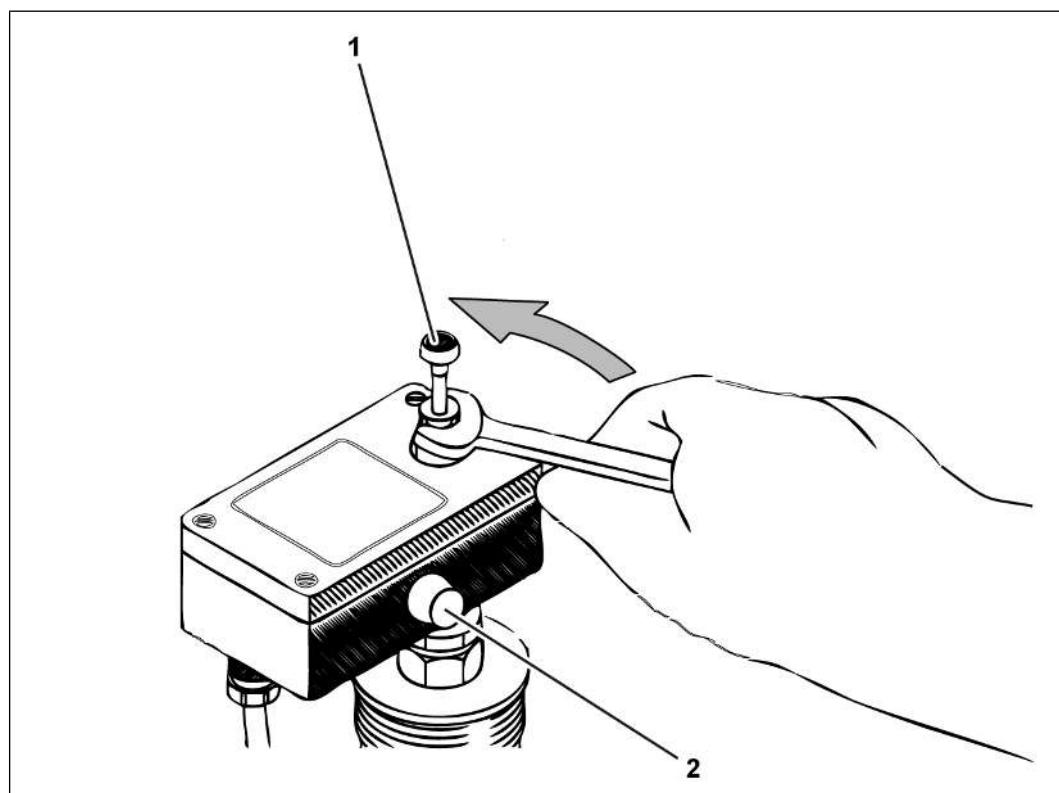
Automatic vent and optional fill level limiter

The cooling water monitoring group is installed at the highest point of the cooling system in the plant.

If the TEM system repeatedly indicates that the coolant level is too low, check the automatic vent for contamination.

- Then refill additional coolant.

1. Check automatic vent in the plant and vent it by hand, if necessary.



966905611

- If present, vent the fill level limiter.
 - Open the nut (1) and vent until coolant emerges.
 - Tighten nut (1).
 - If necessary, operate the unlocking button (2).
2. Vent cooling system.
 - Open the coolant lines at the highest point and vent until the coolant emerges without bubbles.

3. Check coolant level and refill, if necessary.
 - Read the value of the cooling system pressure from the pressure gauge in the plant.
 - The value must be greater than 2.6 bar.
 - If the value is smaller than 2.6 bar, top up coolant.
4. Dismantle the coolant tank with external pump from the coolant supply in the plant
 - Close all valves to and from the genset.
 - Dismantle the coolant supply line from the coolant connection.
 - Disconnect external pump.
5. Dispose of the collected coolant properly.
6. Check the cooling system pressure again if necessary.
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 136\]](#)

Checking the cooling system protection agent

Valid for:
TCG 2020 K, TCG 2020

Tools:

- Standard tools
- Closable collecting container (50 to 100 ml)
- Special tool
 - Test set for the coolant

Auxiliary media:

- Binding agent

General information

NOTE

Limit value for coolant

The Technical Bulletin (TR 2091) [Specification for coolant](#) specifies the limit values for the coolant in the engine cooling circuit.

- These limit values also apply to the coolant in the mixture cooling circuit.
-



Danger to the environment

Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Checking the cooling system protection agent:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]
1. Extract coolant from the mixture cooling circuit.
 - Open the drain valve of the mixture cooling circuit.
 - Drain coolant into a collecting container.
 - Mark the collecting container.
 2. Extract coolant from the engine cooling circuit.
 - Open the drain valve of the engine cooling circuit.
 - Drain coolant into a collecting container.

-
- Mark the collecting container.
 - 3. Check the quality of the extracted coolant.
 - Treat the coolant if necessary, see Service Library, Technical Bulletin ([TR 2091](#)), [Specification for coolant](#).
 - Adjust the cooling system protection agent to the system-specific value on the genset data sheet.
 - If the coolant can no longer be treated, empty the cooling system completely and refill it, see [Emptying and filling the cooling system](#) [▶ 472].
 - Dispose of the coolant sample properly.
 - ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 136]

Dismantling and mounting the exhaust turbocharger cover

Dismantling the exhaust turbocharger cover

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

CAUTION



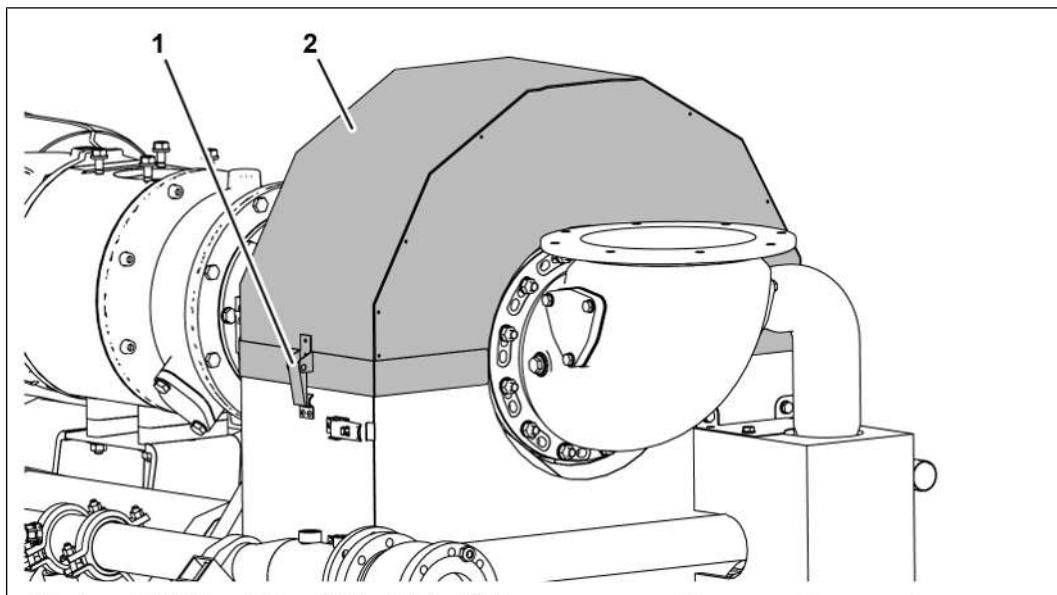
Injury when touching sharp edges

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Handle sharp-edged components carefully.
-

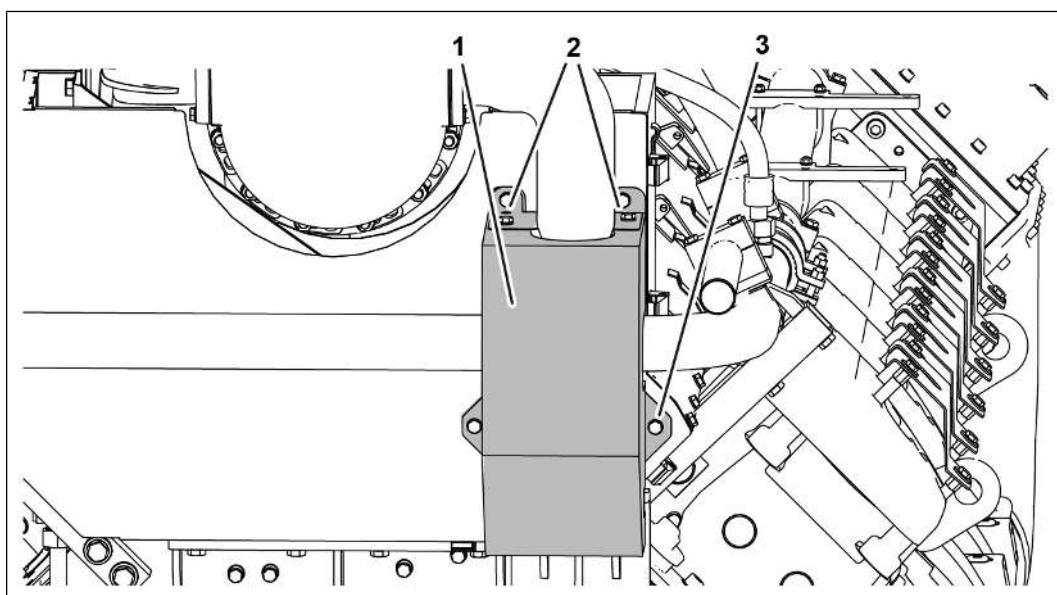
Dismantling the exhaust turbocharger cover (V12/V16 engine):

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



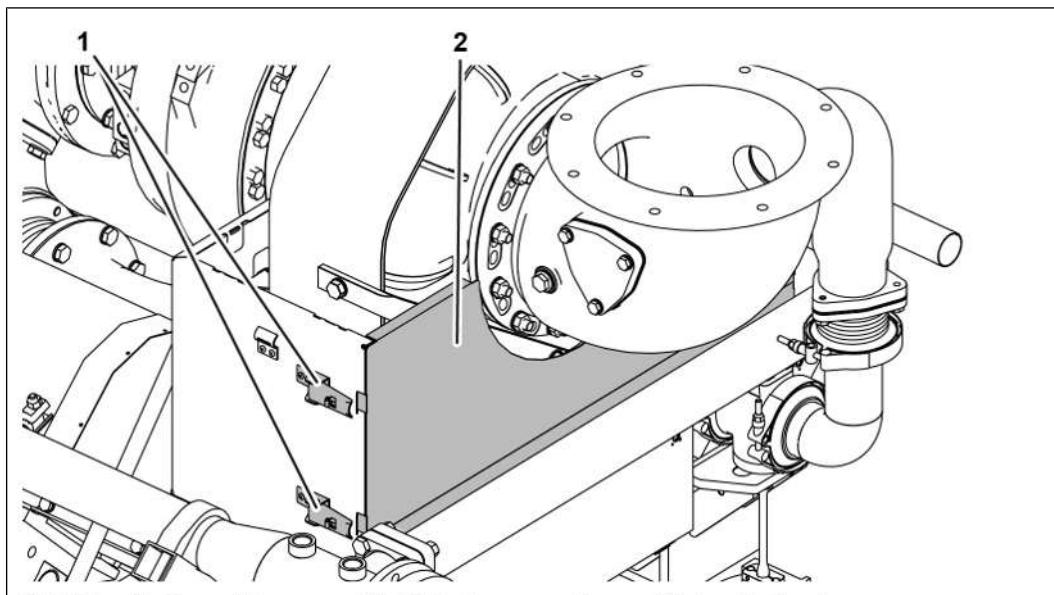
2651080331

1. Dismantle cover from exhaust turbocharger (2).
 - Open locks (1).
 - Remove cover.



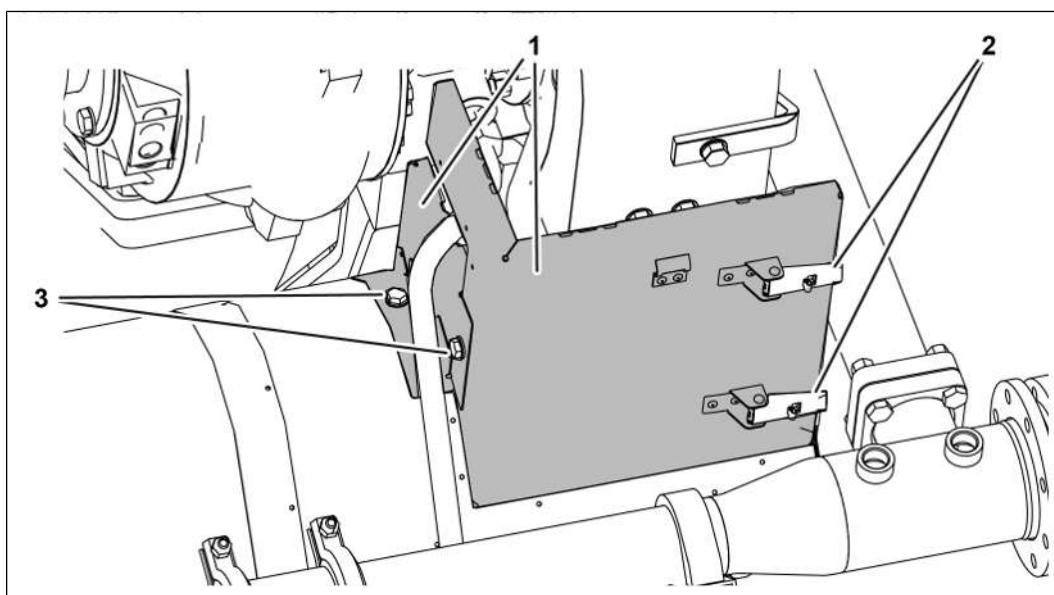
2651082763

2. Dismantle cover (1).
 - Unscrew screws (2).
 - Unscrew screws (3).
 - Remove cover.



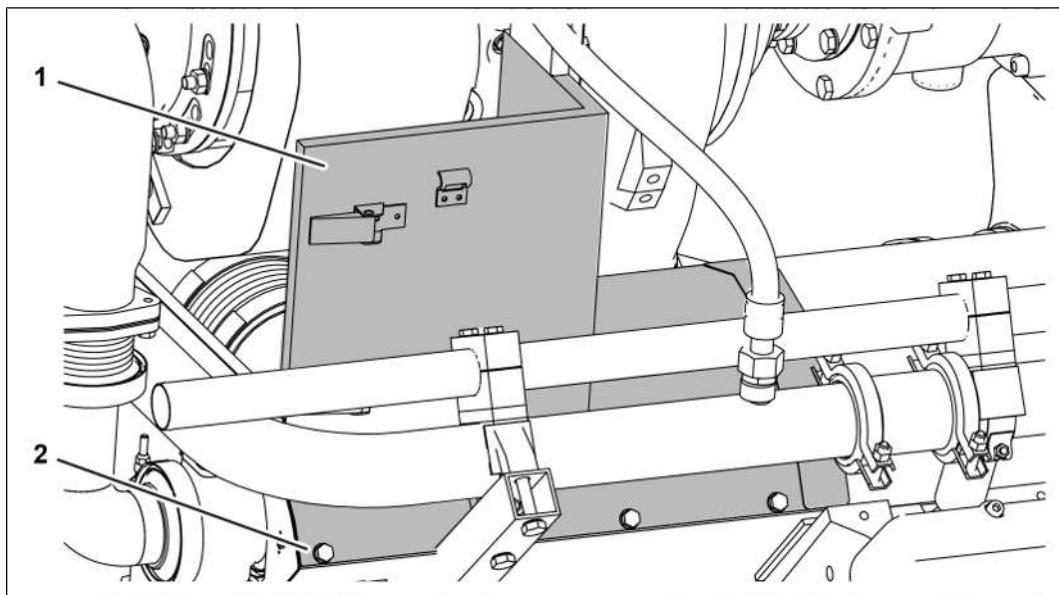
2651085195

3. Dismantle cover (2) from exhaust turbocharger.
 - Open locks (1).
 - Remove cover.



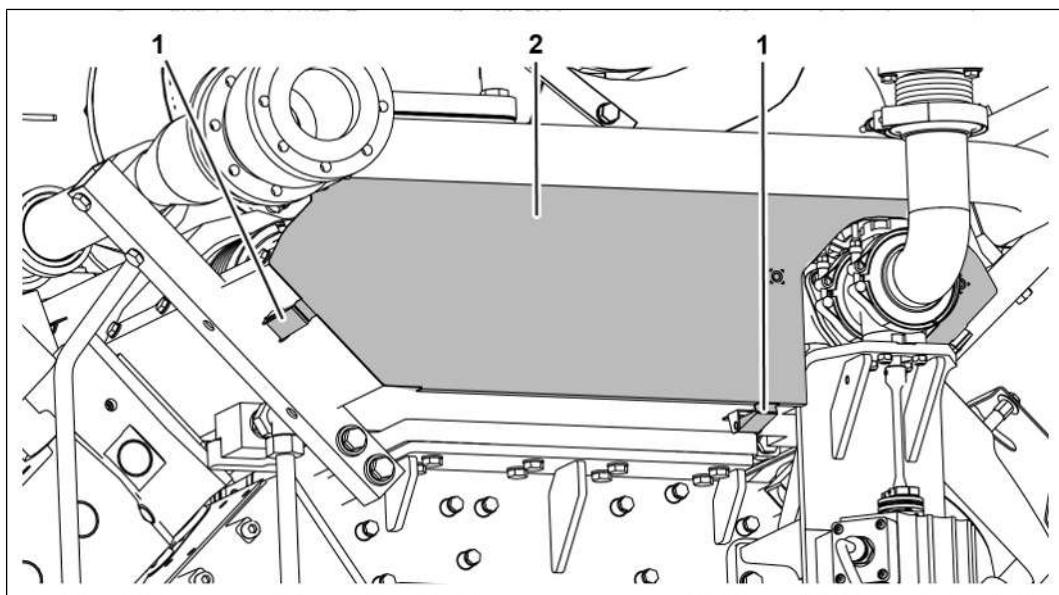
2651087627

4. Dismantle cover (1).
 - Open locks (2).
 - Unscrew screws (3).
 - Remove cover.



2651090059

5. Dismantle cover (1).
 - Unscrew screws (2).
 - Remove cover.

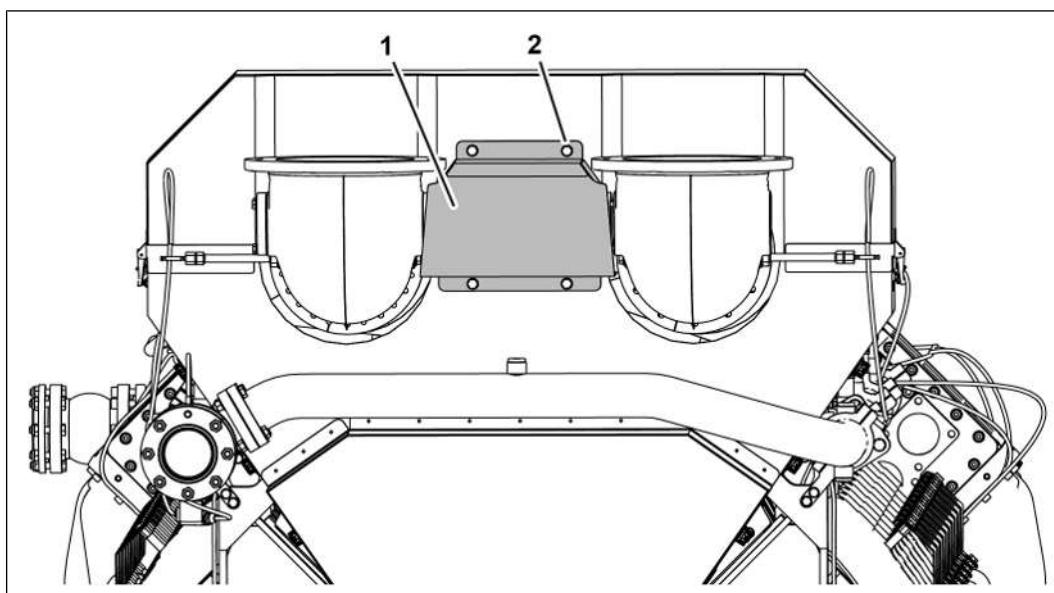


2651745291

6. Dismantle cover (2).
 - Open locks (1).
 - Remove cover.

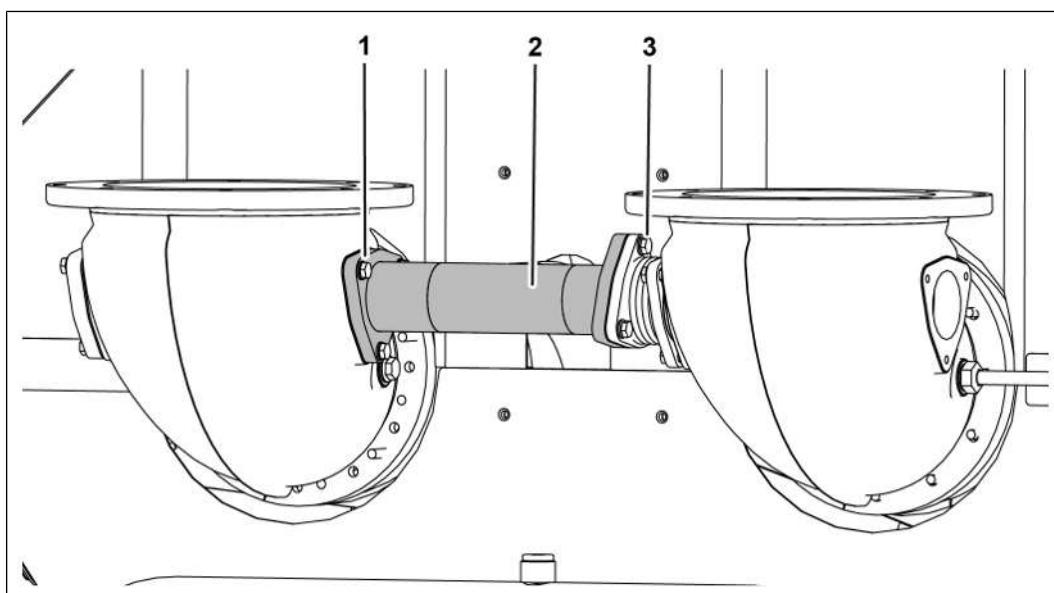
Dismantling the exhaust turbocharger cover (V16/V20 engine):

- ✓ Decommission the genset, see [Stopping the genset \[▶ 163\]](#).



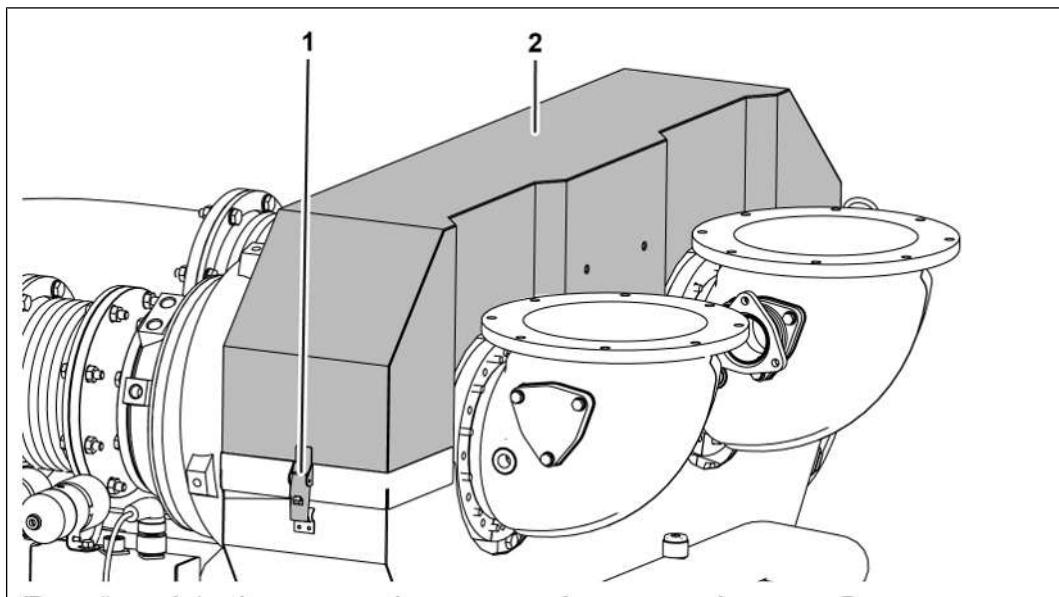
2651772043

1. Dismantle cover (1) from exhaust turbocharger.
 - Unscrew screws (2).
 - Remove cover.



2651774475

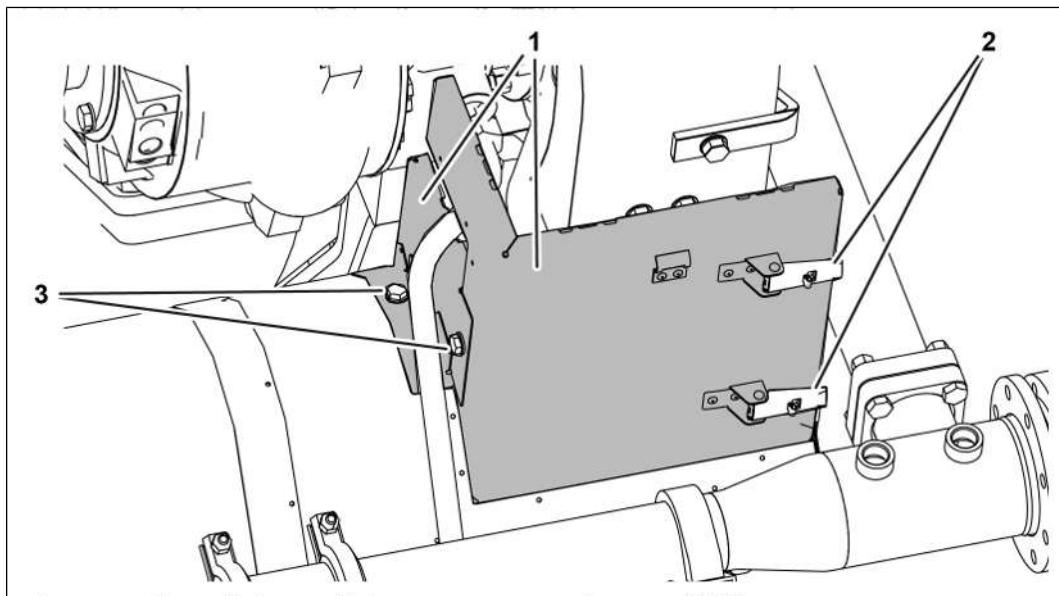
2. Remove connection pipe (2).
 - Unscrew screws (1).
 - Unscrew screws (3).
 - Take off connection pipe (2).
 - Remove seals.



2651776907

3. Dismantle cover (2).

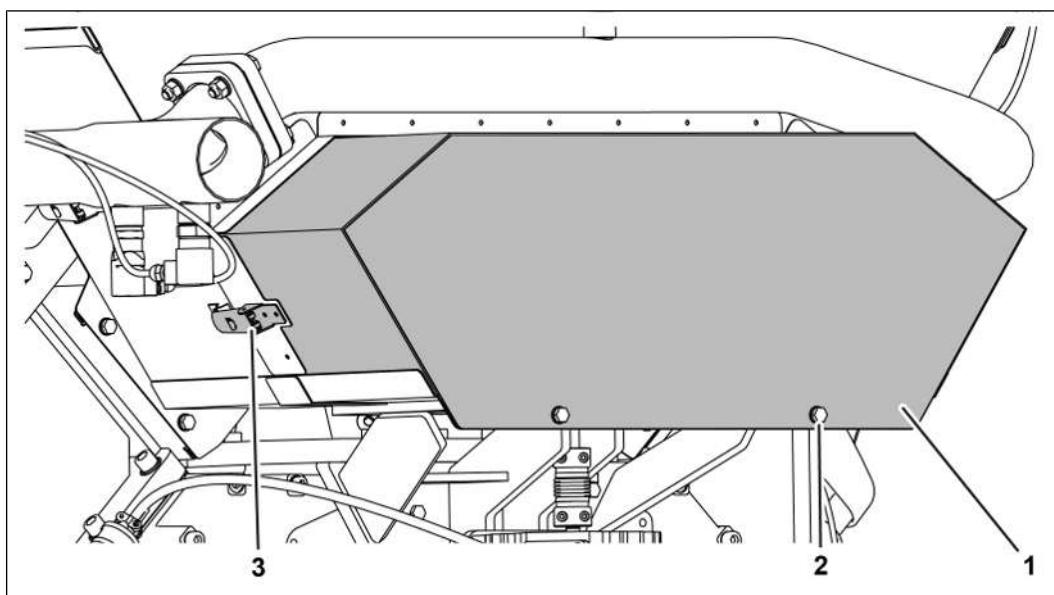
- Open locks (1).
- Remove cover.



2651779339

4. Dismantle cover (1).

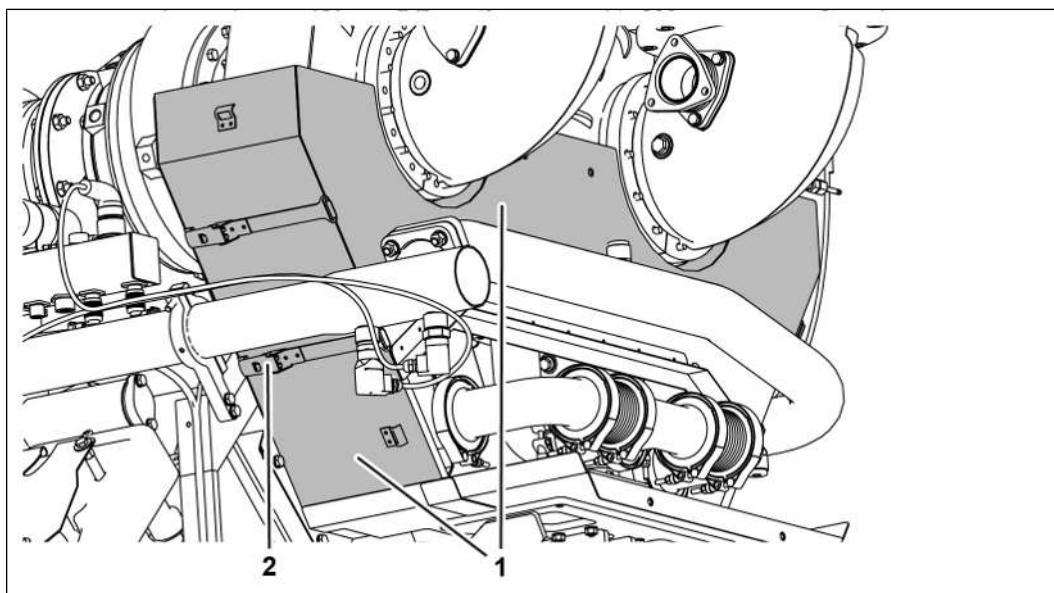
- Open locks (2).
- Unscrew screws (3).
- Remove cover.



2651781771

5. Dismantle cover (1).

- Open locks (3).
- Unscrew screws (2).
- Remove cover.



2652283403

6. Dismantle cover (1) from exhaust turbocharger.

- Open locks (2).
- Remove cover from exhaust turbocharger.

Mounting the exhaust turbocharger cover

Valid for:
TCG 2020, TCG 2020 K



Tools:

- Standard tools

Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

General information

CAUTION



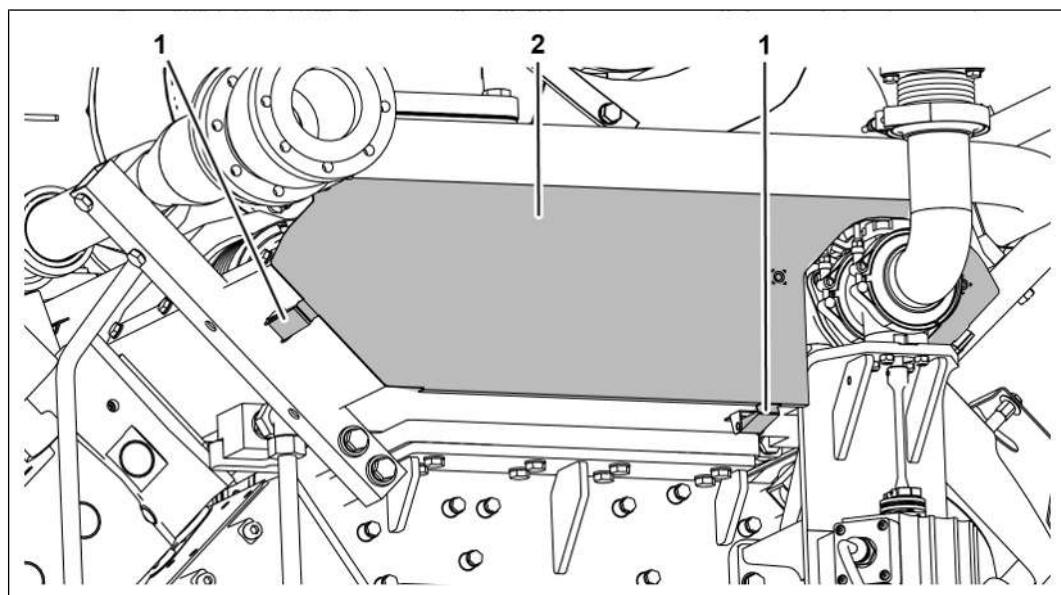
Injury when touching sharp edges

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Handle sharp-edged components carefully.

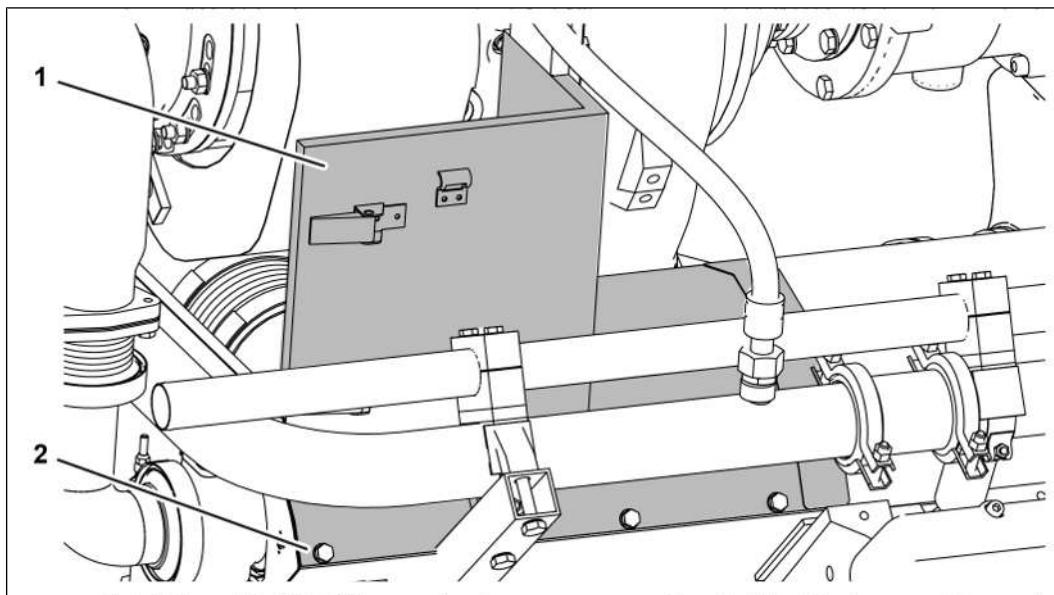
Mounting the exhaust turbocharger cover (V12 engine):

1. Clean and visually inspect all components.



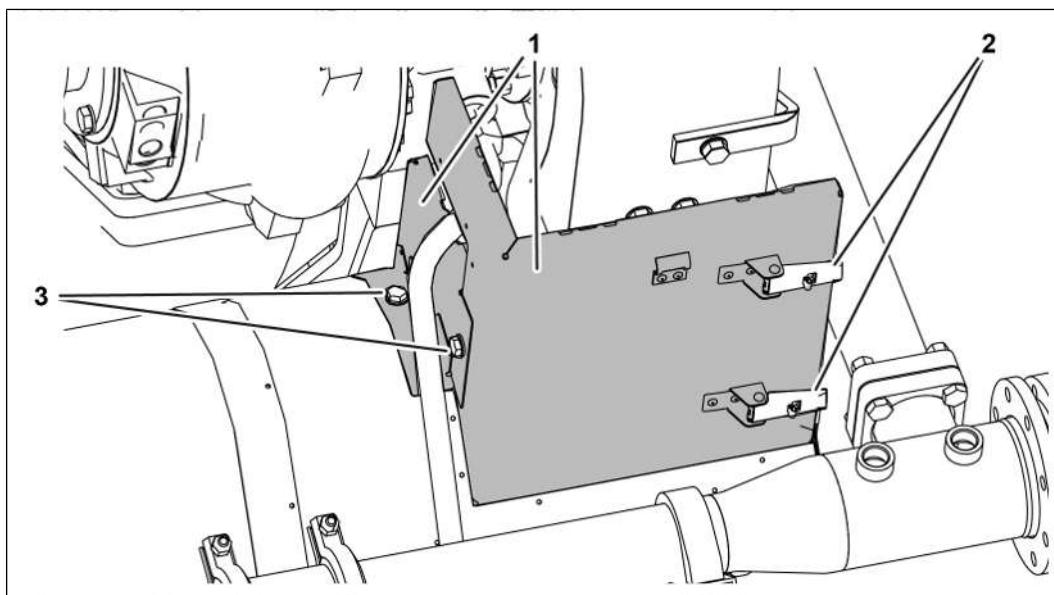
2651745291

1. Mount cover (2) on exhaust turbocharger.
 - Attach cover.
 - Close locks (1).



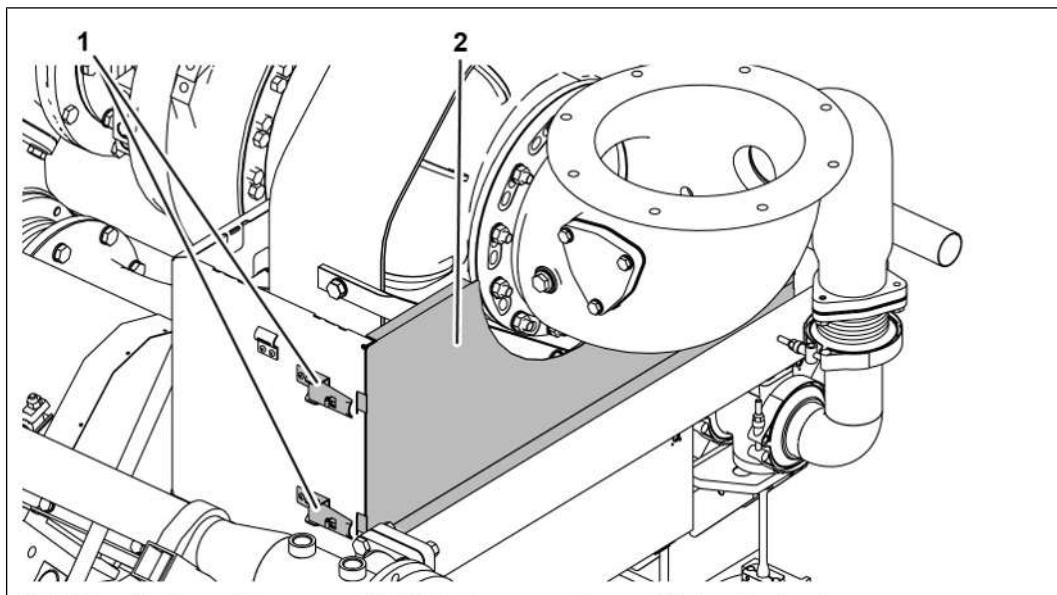
2651090059

2. Mount cover (1).
 - Attach cover.
 - Tighten screws (2).



2651087627

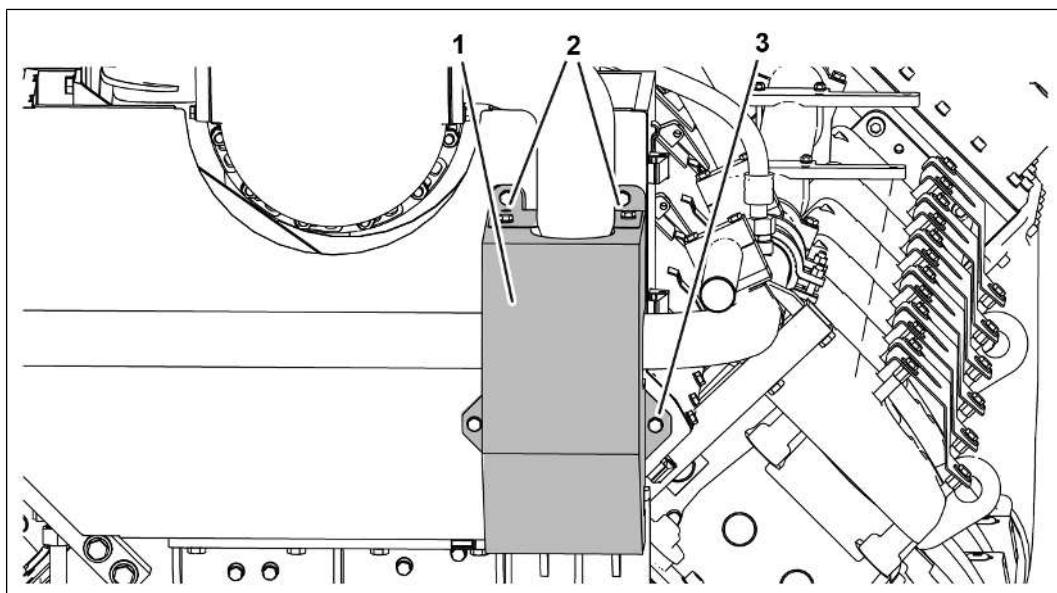
3. Mount cover (3) on exhaust turbocharger.
 - Attach cover to exhaust turbocharger.
 - Close locks (2).
 - Tighten screws (3).



2651085195

4. Mount cover (2) on exhaust turbocharger.

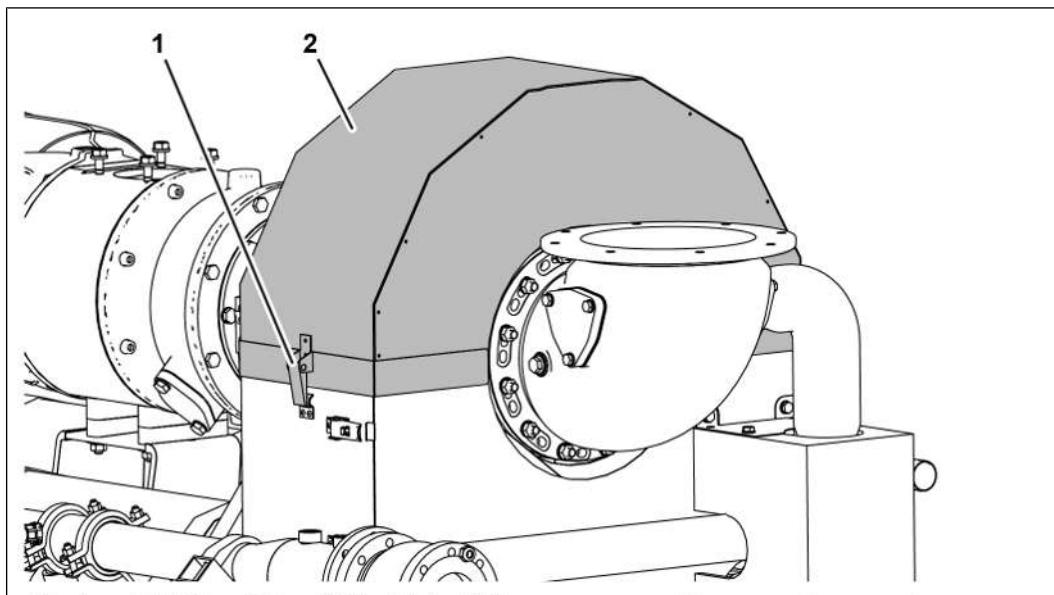
- Attach cover.
- Close locks (1).



2651082763

5. Mount cover (1).

- Attach cover.
- Tighten screws (3).
- Tighten screws (2).

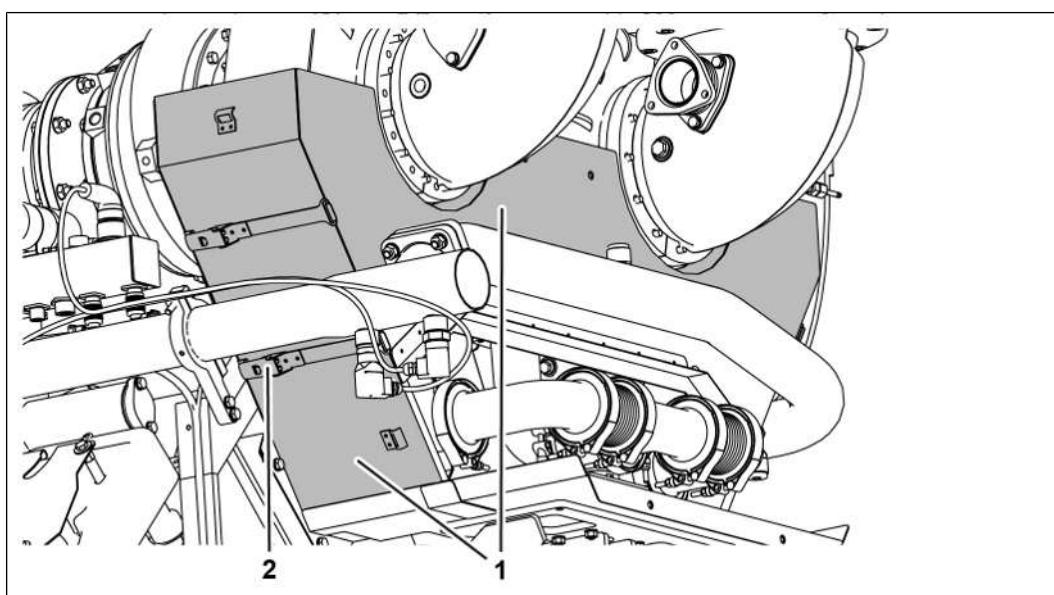


2651080331

6. Mount cover on exhaust turbocharger (2).
 - Attach cover.
 - Close locks (1).
- ⇒ Commission the genset, see [Start the genset \[▶ 136\]](#)

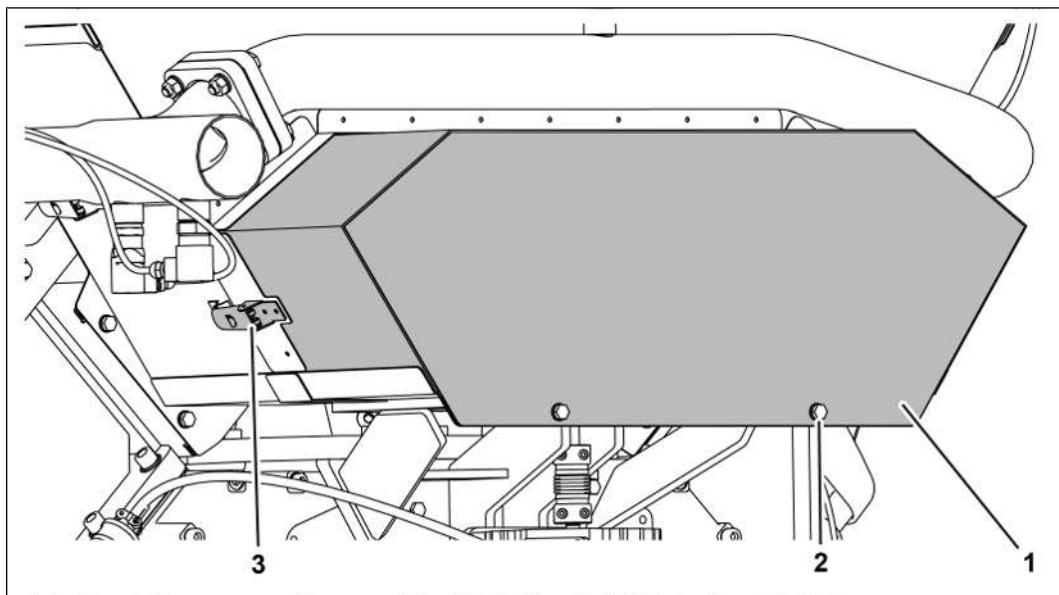
Dismantling the exhaust turbocharger cover (V16/V20 engine):

1. Clean and visually inspect all components.



2652283403

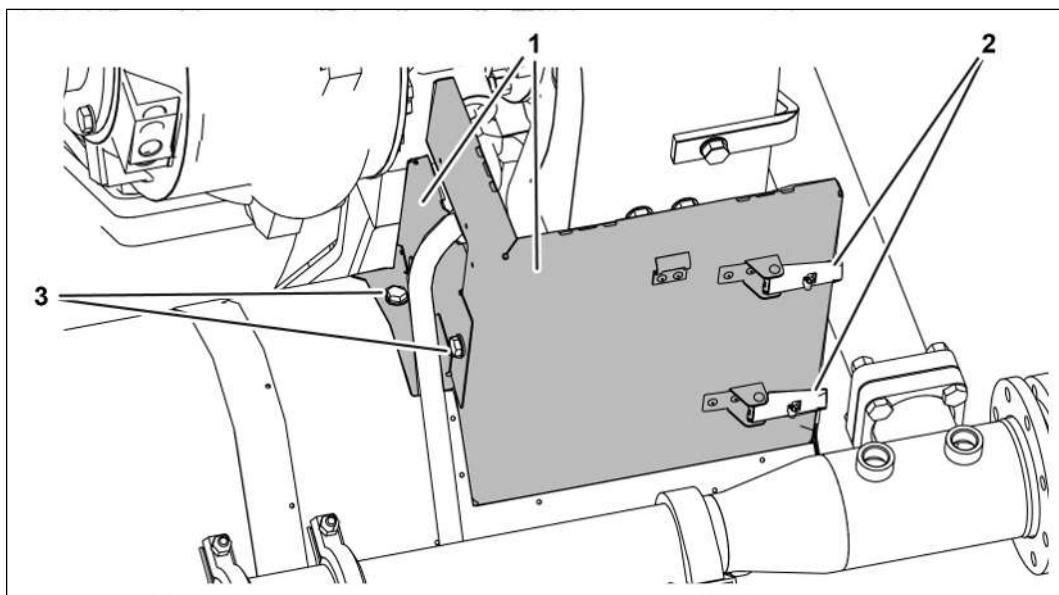
2. Mount the cover (1) on exhaust turbocharger.
 - Attach cover to exhaust turbocharger.
 - Close locks (2).



2651781771

3. Mount cover (1).

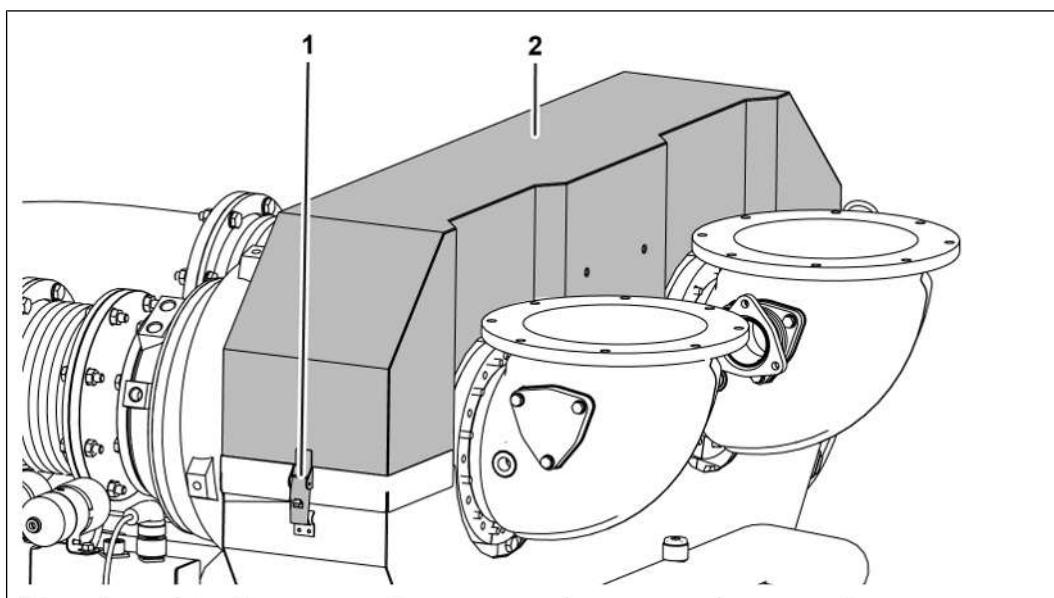
- Attach cover.
- Tighten screws (2).
- Close locks (3).



2651779339

4. Mount cover (1).

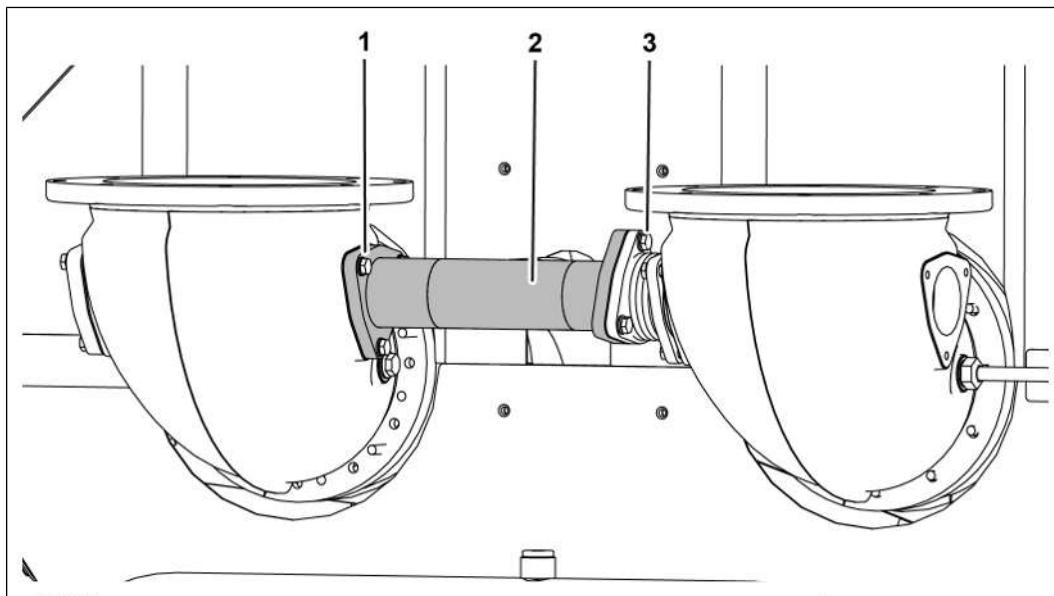
- Attach cover.
- Tighten screws (3).
- Close locks (2).



2651776907

5. Mount cover (2).

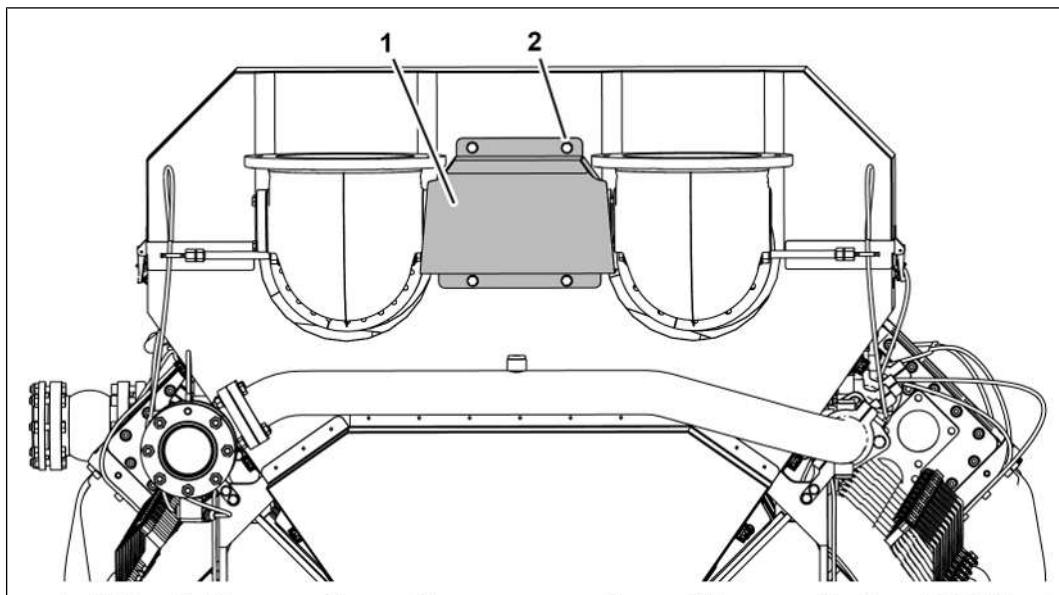
- Attach cover.
- Close locks (1).



2651774475

6. Install connection pipe (2).

- Renew the seals.
- Insert connection pipe (2).
- Tighten screws (3).
- Tighten screws (1).



2651772043

7. Mount cover (1) on exhaust turbocharger.
 - Attach cover.
 - Tighten screws (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 136]

Checking the wastegate

Valid for:

TCG 2020



Tools:

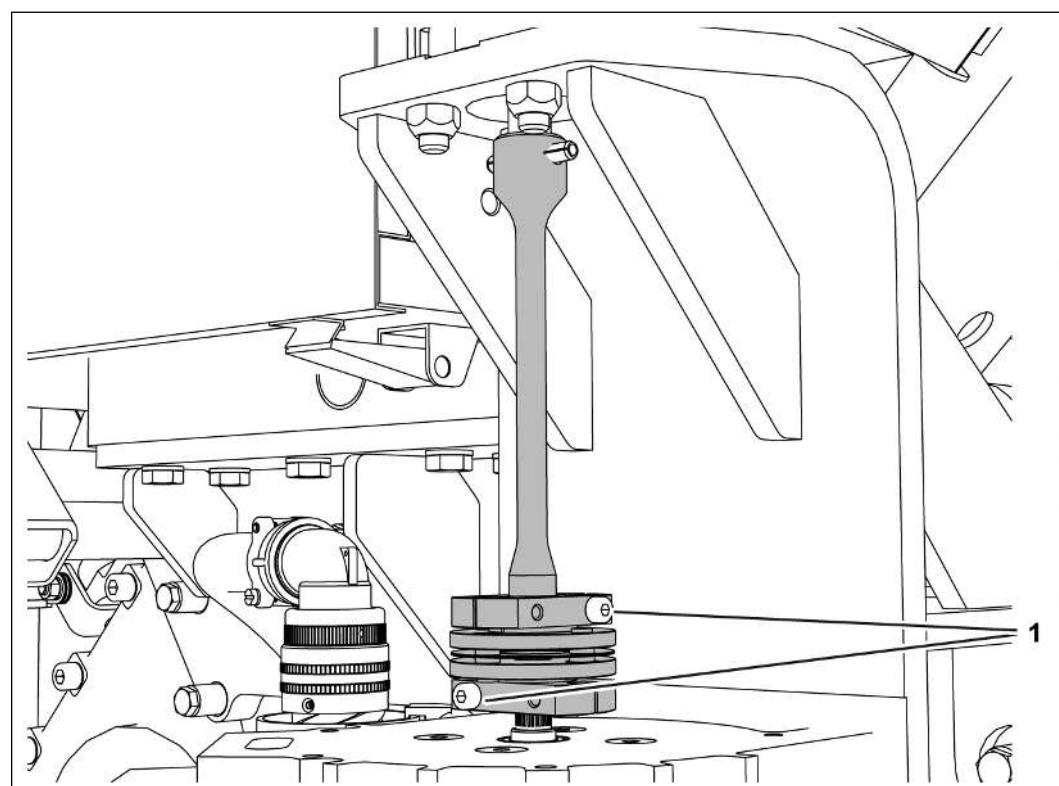
- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

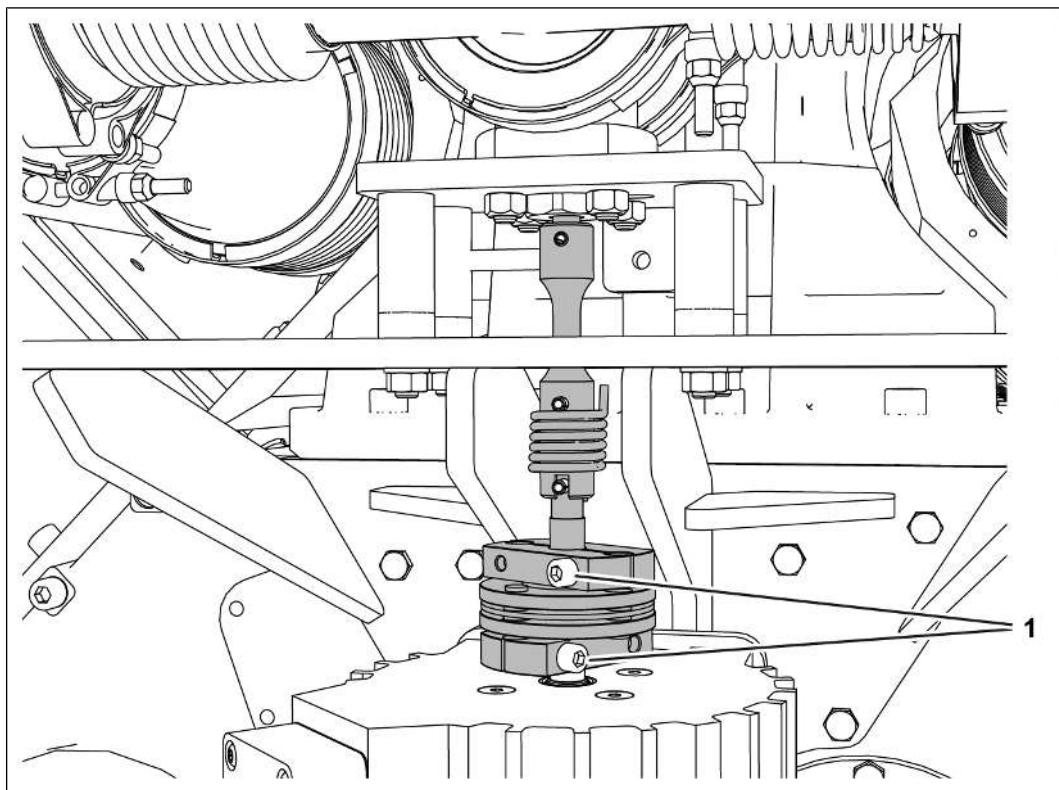
Technical data



572637451

Wastegate drive shaft to coupling (V12 engine)

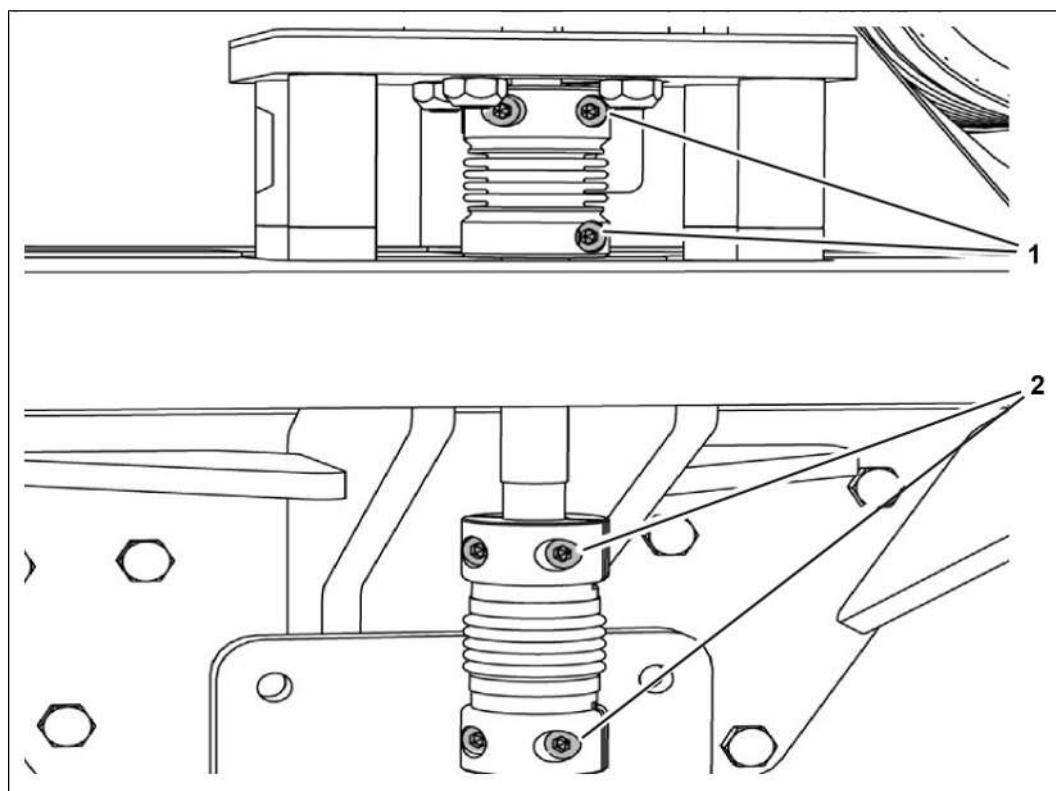
1.	Screw	M4 x 20 - 10.9	4.5 Nm



3043270411

Wastegate drive shaft on coupling (V12 engine with torsion spring)

1.	Screw	M6 × 30 - 8.8	10 Nm

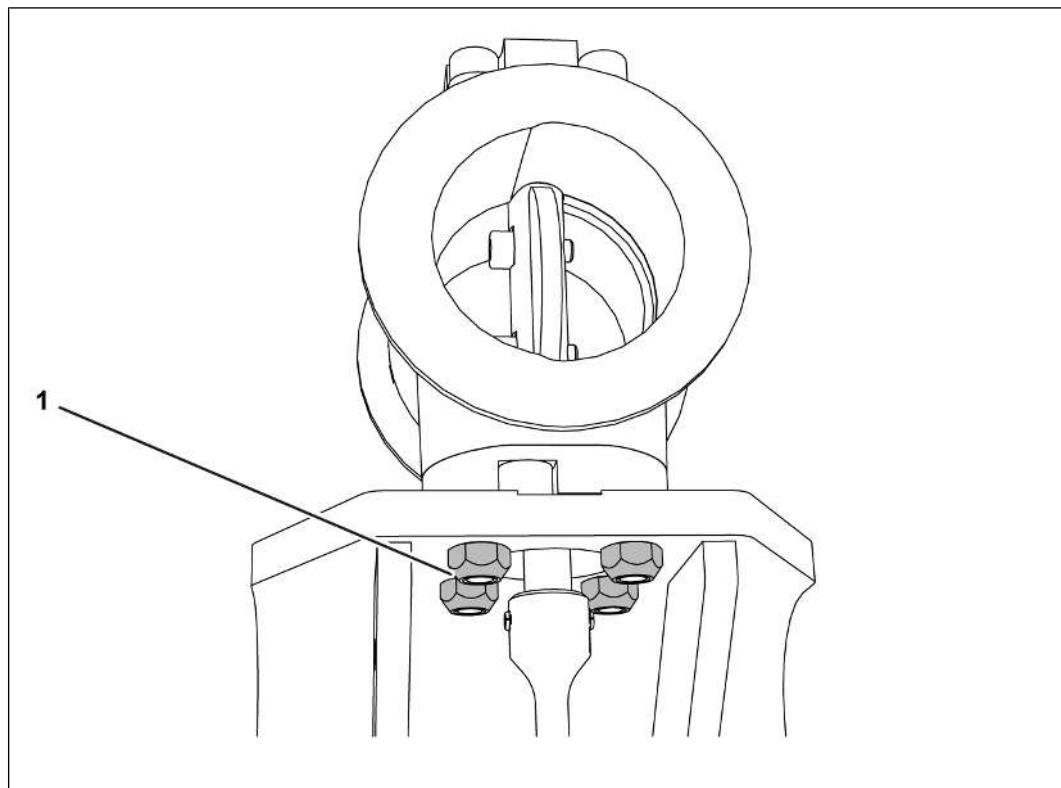


3123624459

Wastegate drive shaft on coupling (V12 engine without torsion spring)

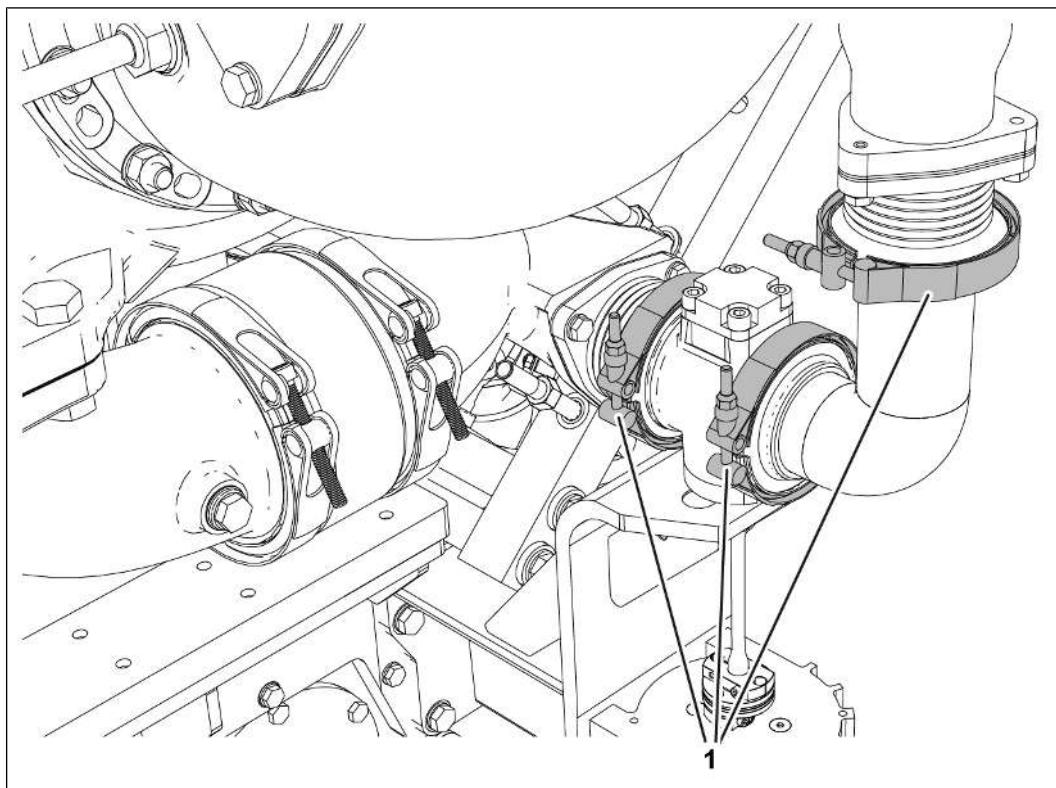
Variant 1:

1.	Screw	M5 × 16 - 12.9	10 Nm
2.	Screw	M5 × 16 - 12.9	8 Nm



572641803

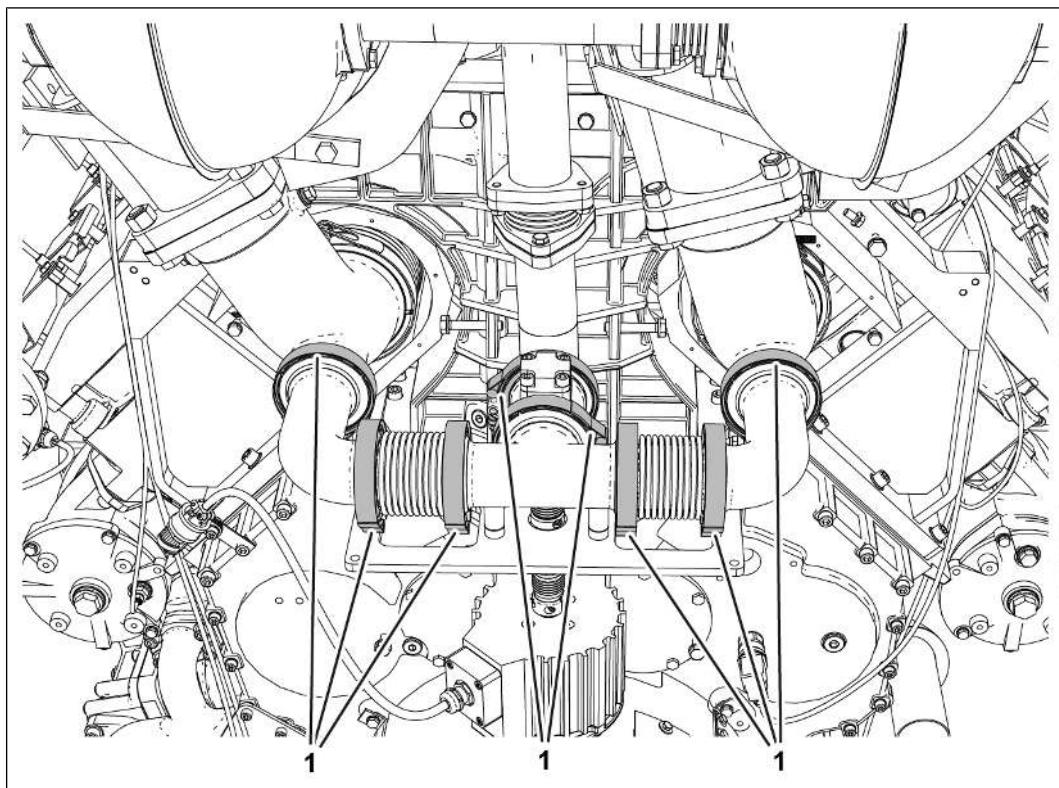
Wastegate exhaust flap on holder			
1.	Nut	M8	20 Nm



2834306443

Wastegate clamping clip (V12 engine)

1.	Clamping clip	5 Nm



2834308875

Wastegate clamping clip (V20 engine)

1.	Clamping clip	5 Nm

General information

All components must be visually inspected.

- Renew worn or damaged components.

CAUTION



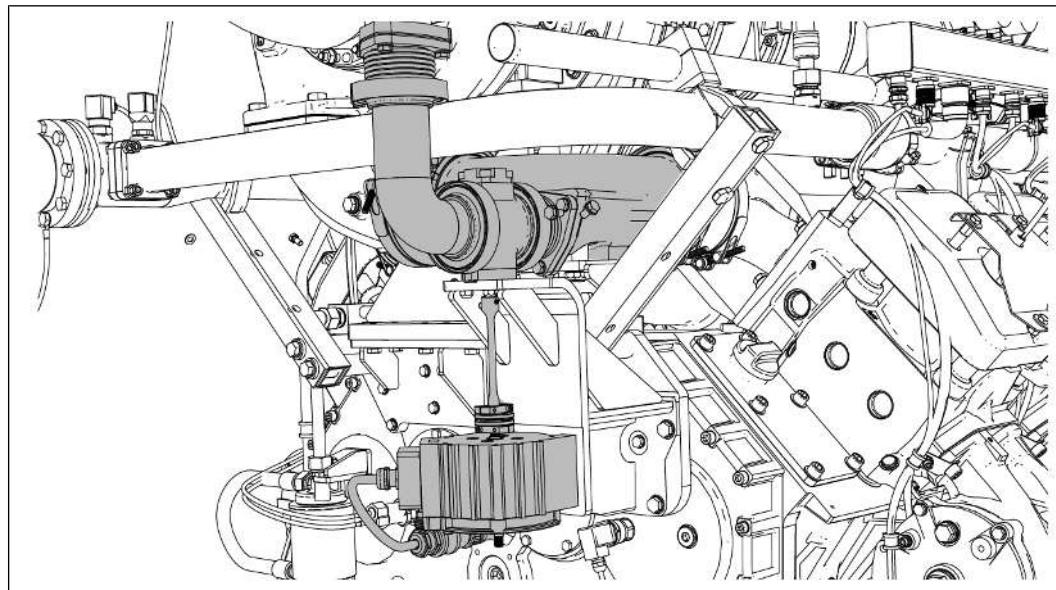
Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

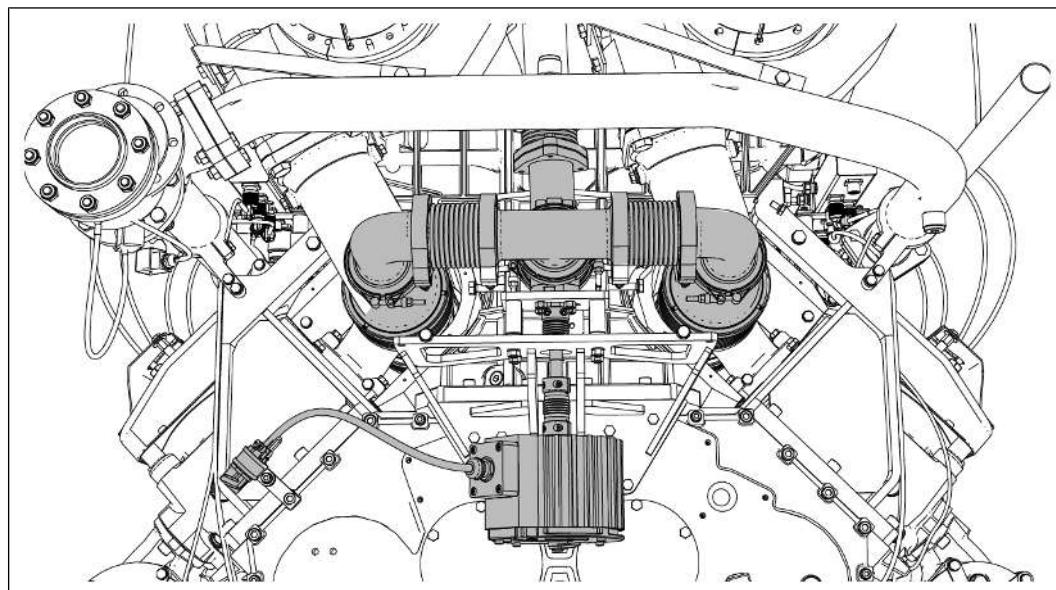
Checking the wastegate:

- ✓ Dismantle the exhaust turbocharger cover, see OL-MRA10 / 43-12-12 [Dismantling the exhaust turbocharger cover \[▶ 487\]](#)

1. Check wastegate (V12 engine).

2661145995

- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Retighten screw connections if necessary.
- Check cable bundle and connections.
- Renew worn or damaged components; contact service partner if necessary

2. Check wastegate (V20 engine).

2661148427

- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Retighten screw connections if necessary.

- Check cable bundle and connections.
 - Renew worn or damaged components; contact service partner if necessary
- ⇒ Mount the exhaust turbocharger cover, see OL-MRA10 / 43-12-12 [Mounting the exhaust turbocharger cover \[▶ 494\]](#)

Visually inspecting the wastegate

Valid for:
TCG 2020



Tools:

- Standard tools



Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), **Specification for auxiliary media**

General information

All components must be visually inspected.

- Renew worn or damaged components.



CAUTION

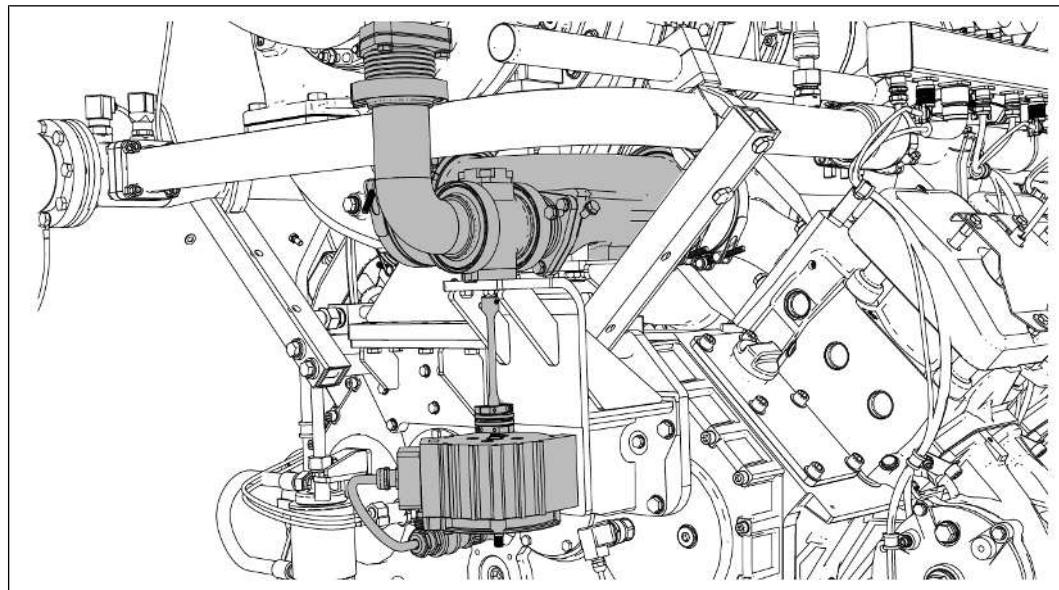
Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Allow the operating media or components to cool down to ambient temperature.

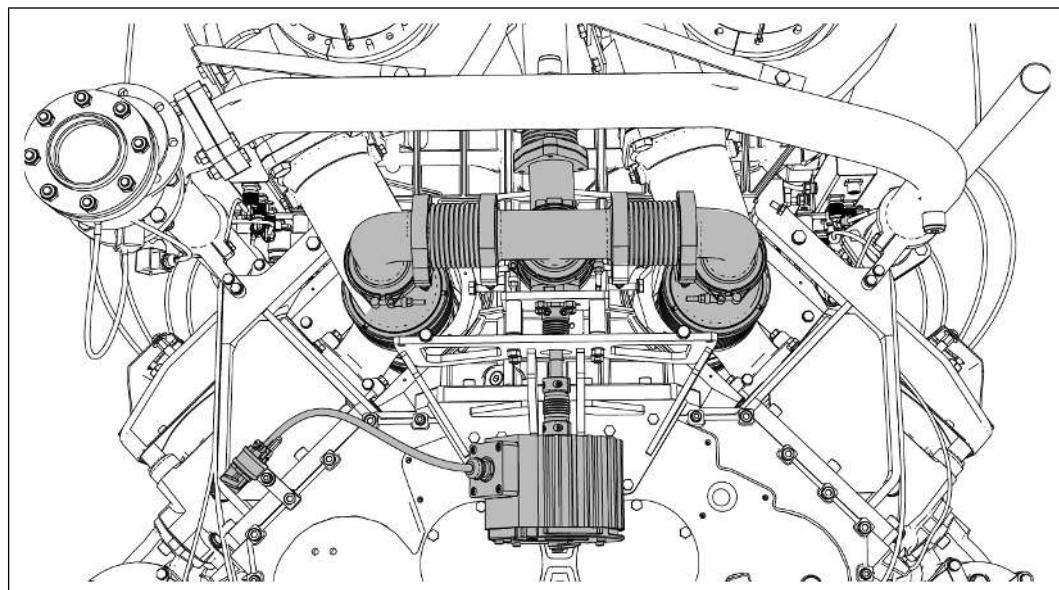
Visually inspect the wastegate connecting parts:

- ✓ Dismantle the exhaust turbocharger cover, see OL-MRA10 / 43-12-12 **Dismantling the exhaust turbocharger cover** [▶ 487]

1. Visually inspect wastegate (V12 engine).

2661145995

- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Visually inspect cable bundle and connections.
- Renew worn or damaged components, also contact service partner

2. Visually inspect wastegate (V20 engine).

2661148427

- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Visually inspect cable bundle and connections.
- Renew worn or damaged components, also contact service partner

-
- ⇒ Mount the exhaust turbocharger cover, see OL-MRA10 / 43-12-12 [Mounting the exhaust turbocharger cover \[▶ 494\]](#)

Checking the lug

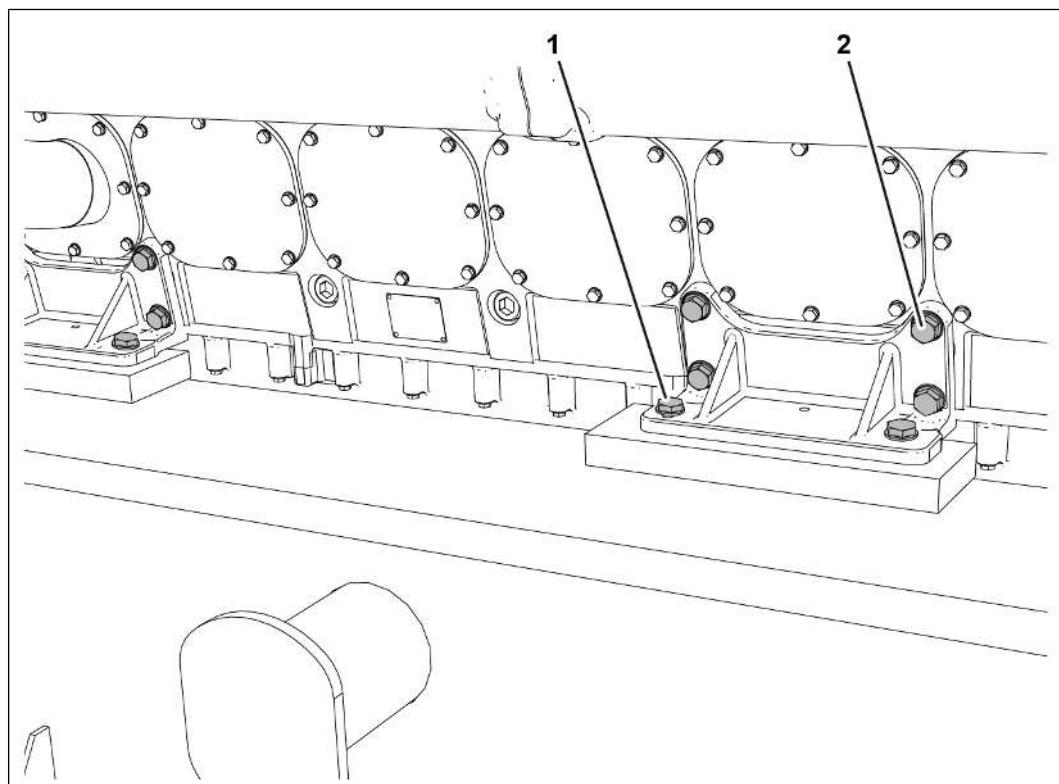
Valid for:
TCG 2020, TCG 2020 K



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)

Technical data



2663808139

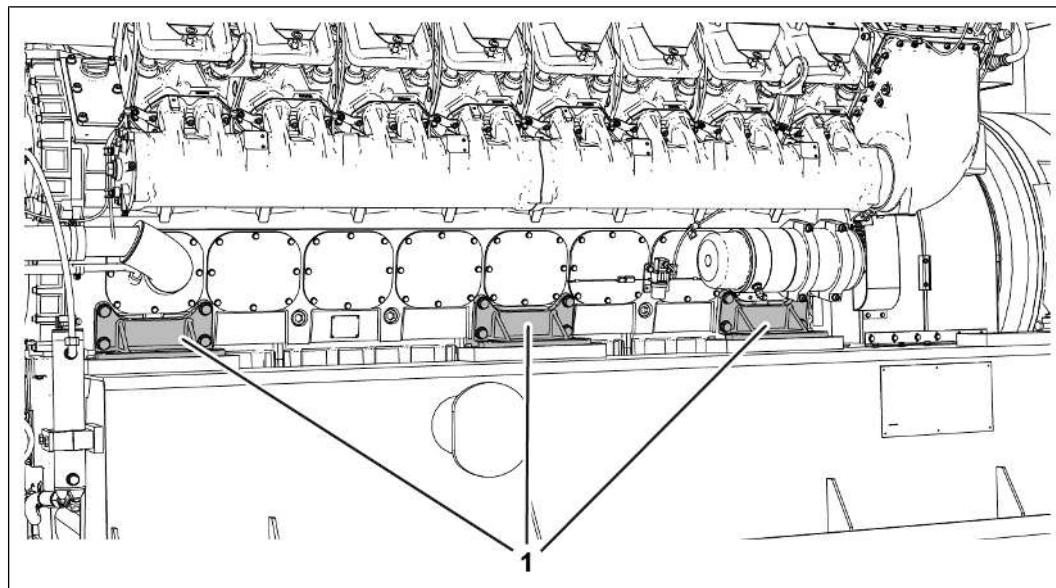
Lug on crankcase			
1.	Screw	M16 x 40 - 10.9	180 Nm
Lug on base frame			
2.	Screw	M16 x 40 - 8.8	210 Nm

General information

The metallic sound when tapping is indicative of a tight screw connection.

- Check the screw connections with a torque wrench.

Checking the lug:



2663810571

1. Check the lug (1).
 - Check the screws of the lug.
 - Tap the adapters of the mount or attachments (including those that are difficult to access).
 - Retighten the screw connections based on the specifications of the tightening instructions.

Removing and installing the intake air temperature sensor (V12/V16 engine)

Removing the intake air temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

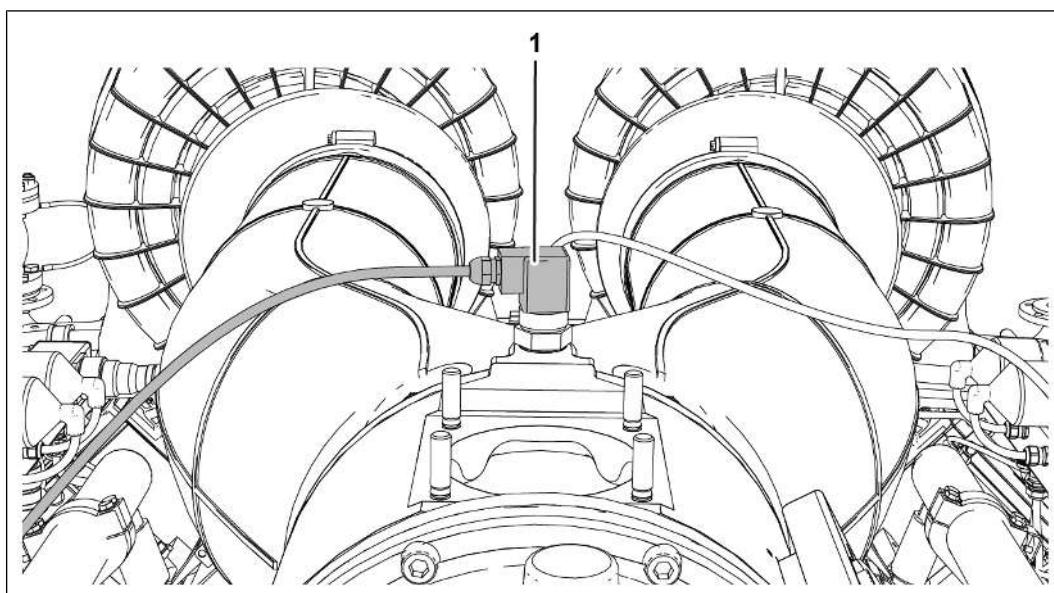
General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

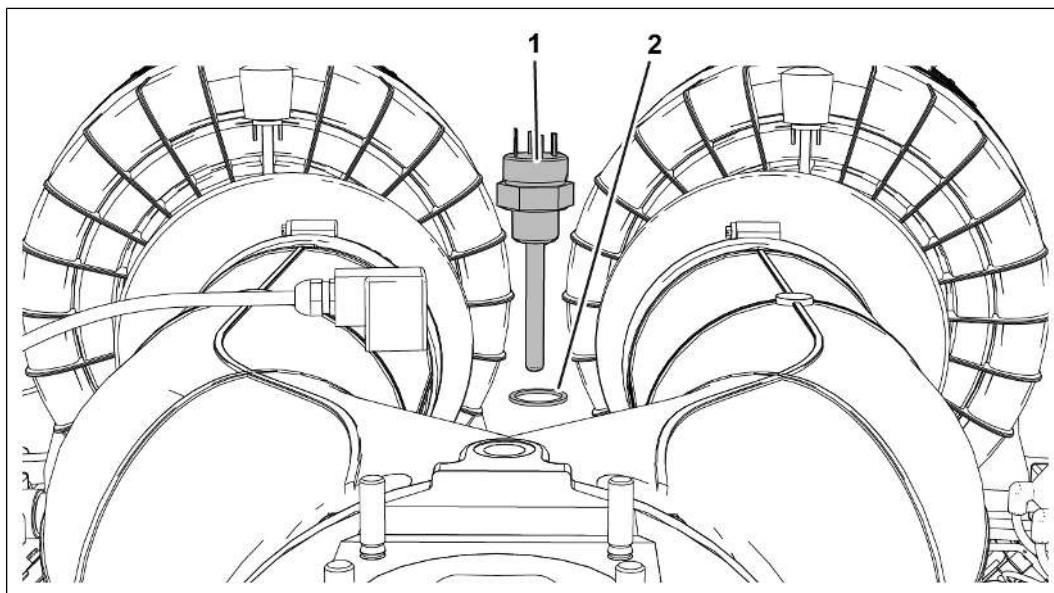
Removing the intake air temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#).



2665852683

1. Dismantle connector (1) from sensor.



2665855115

2. Remove sensor (1).
3. Remove sealing ring (2).

Installing the intake air temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



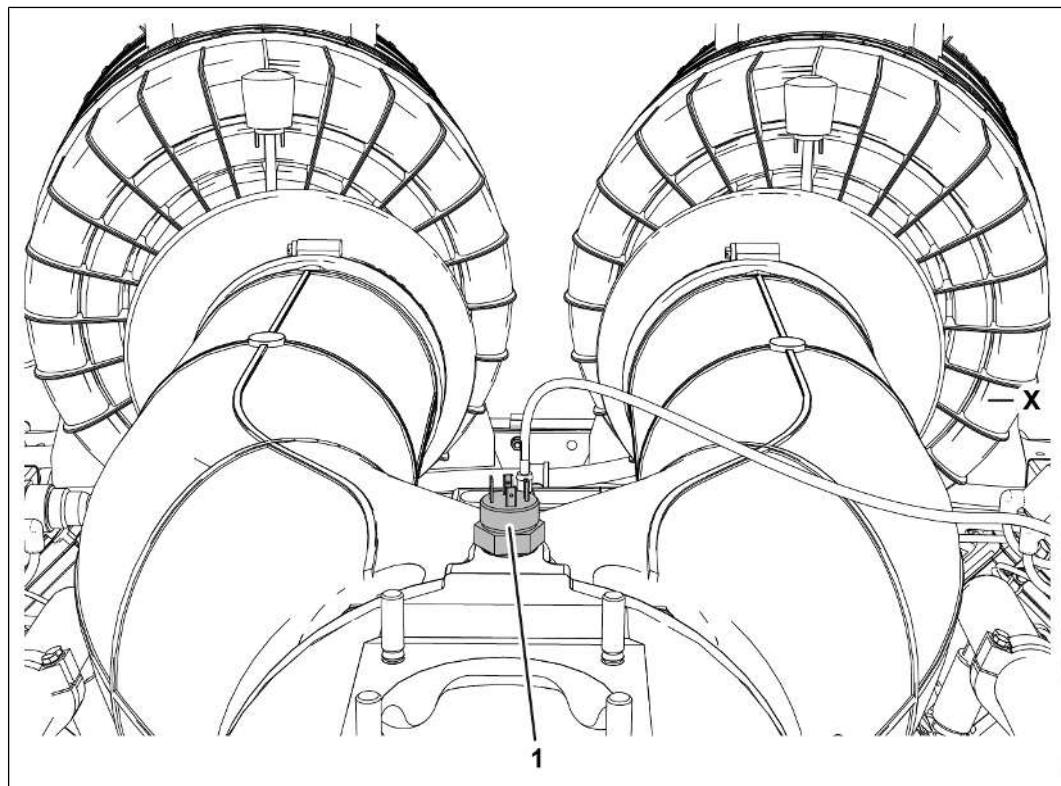
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

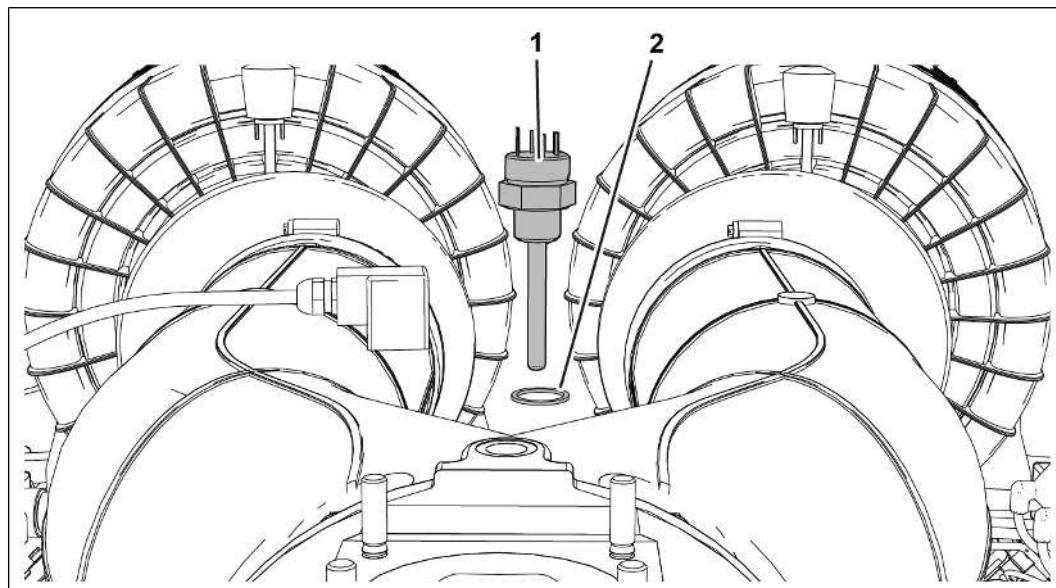
Technical data

2665850251

Intake air temperature sensor on manifold

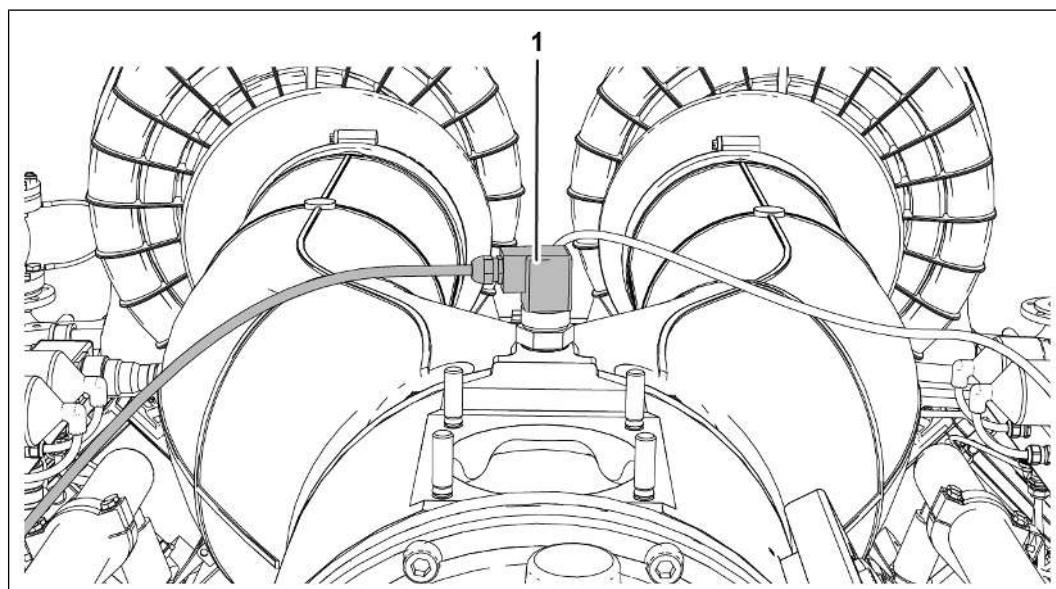
1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Renew sealing ring.

Installing the intake air temperature sensor:

2665855115

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2665852683

3. Visually inspect the connector (1).
4. Mount connector (1) on sensor.
⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the crankcase pressure sensor

Removing the crankcase pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

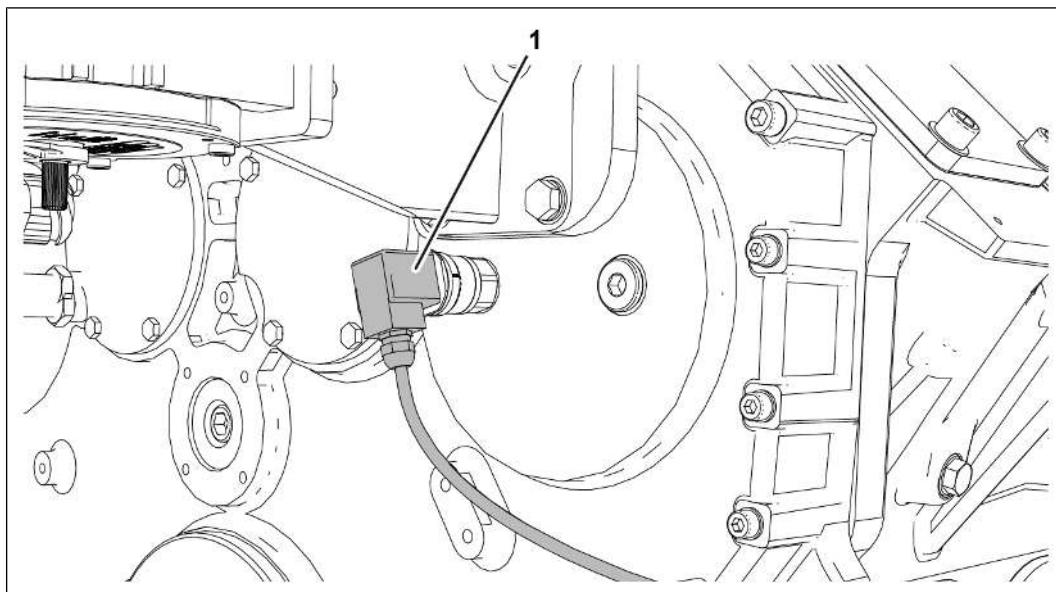
General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

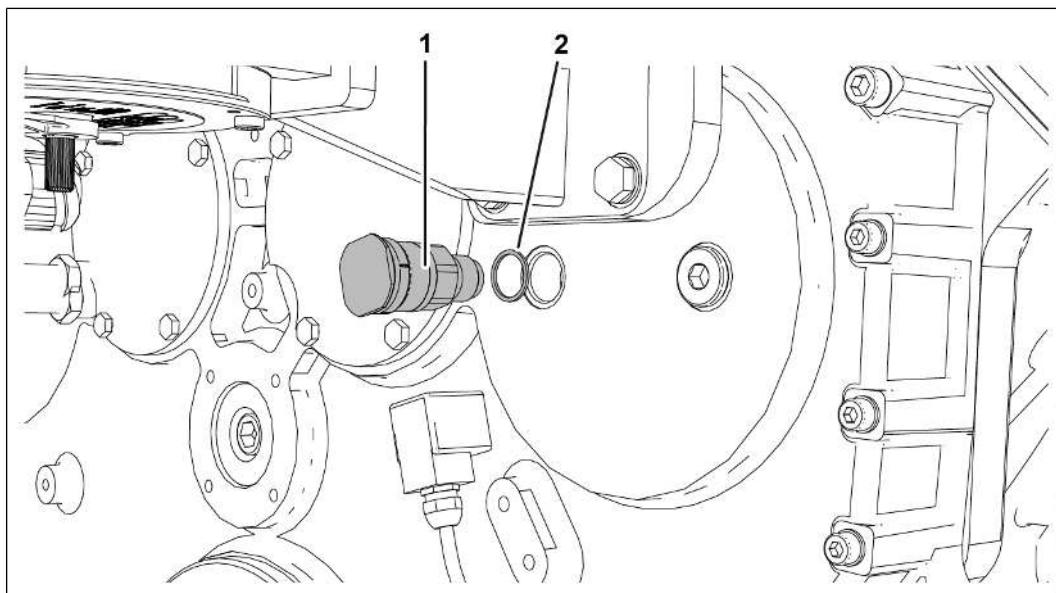
Removing the crankcase pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2665836299

1. Dismantle connector (1) from sensor.



2665838731

2. Remove sensor (1).
3. Remove sealing ring (2).

Installing the crankcase pressure sensor

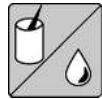
Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



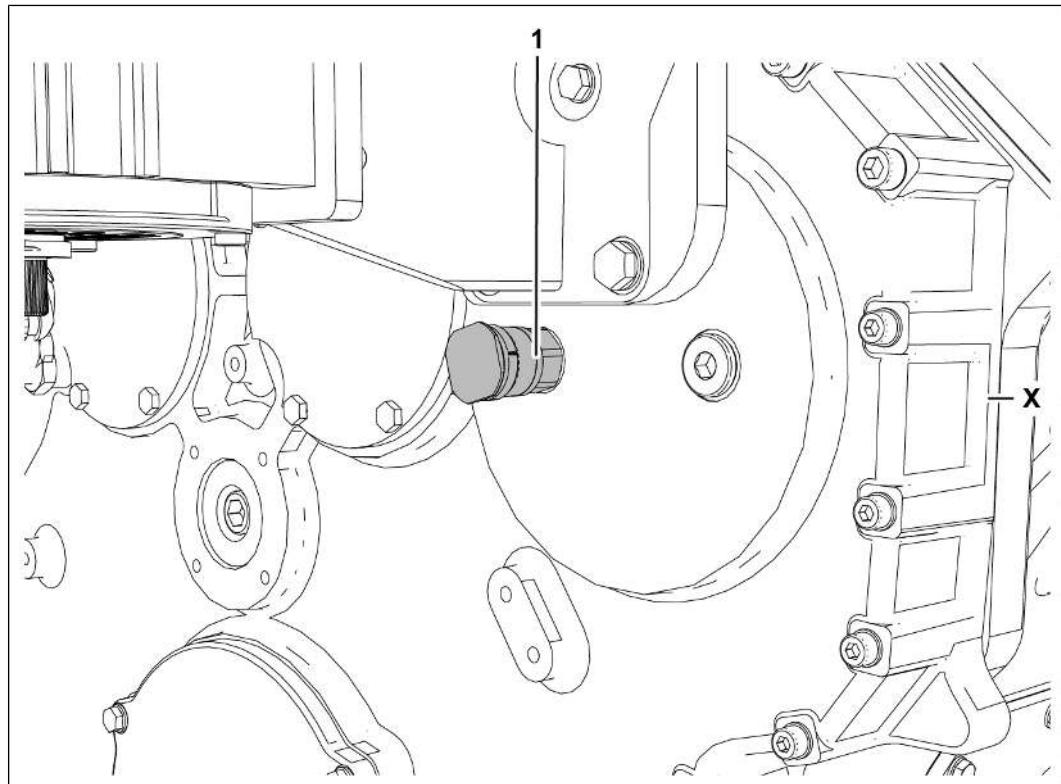
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

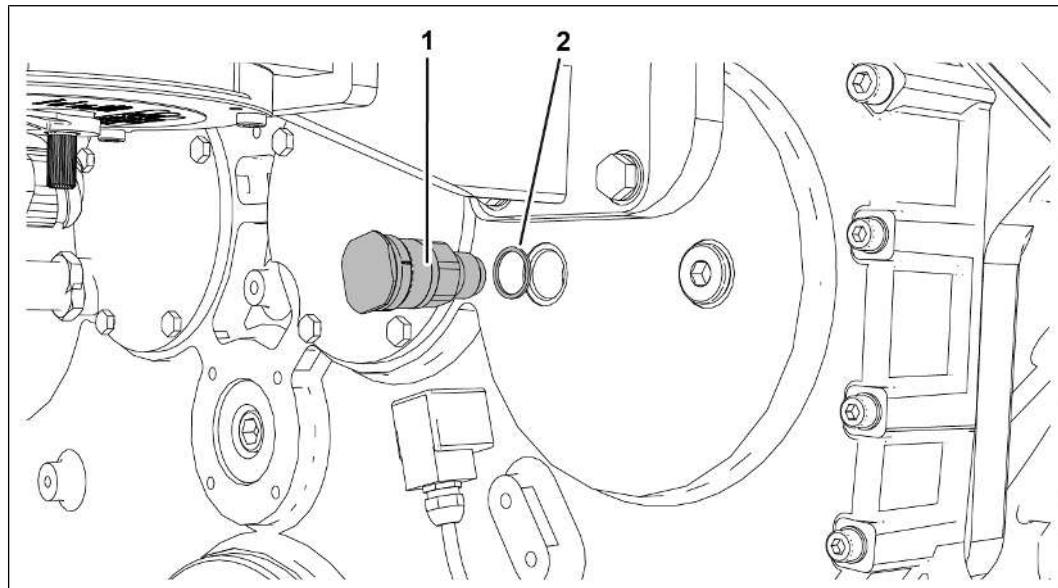
Technical data

2665808267

Crankcase pressure sensor on cover

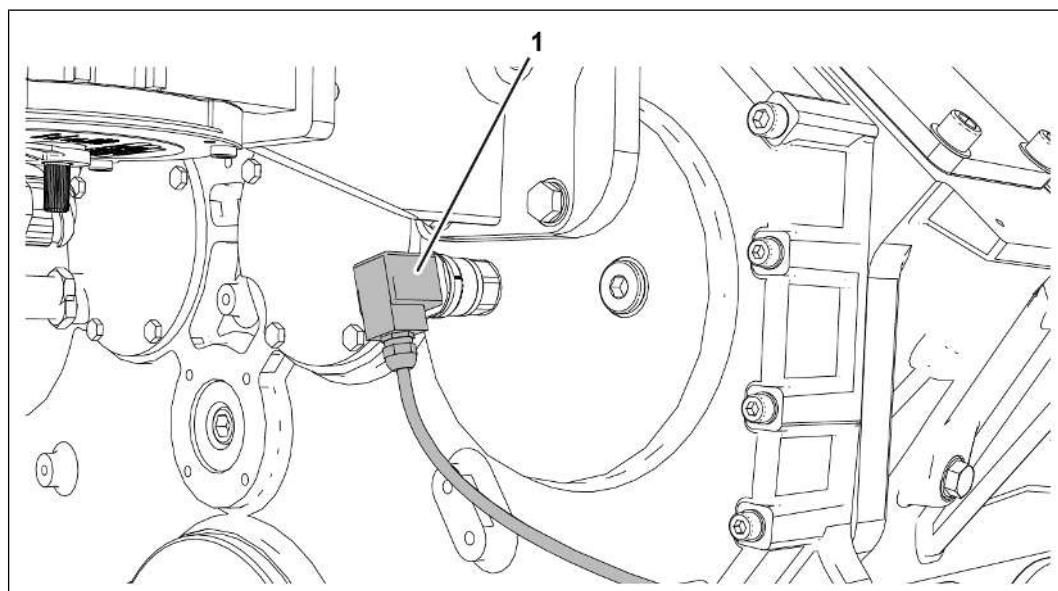
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the crankcase pressure sensor:

2665838731

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2665836299

3. Visually inspect the connector (1).
4. Mount connector (1) on sensor.
⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the mixture temperature sensor (mixture pipe)

Removing the mixture temperature sensor

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools

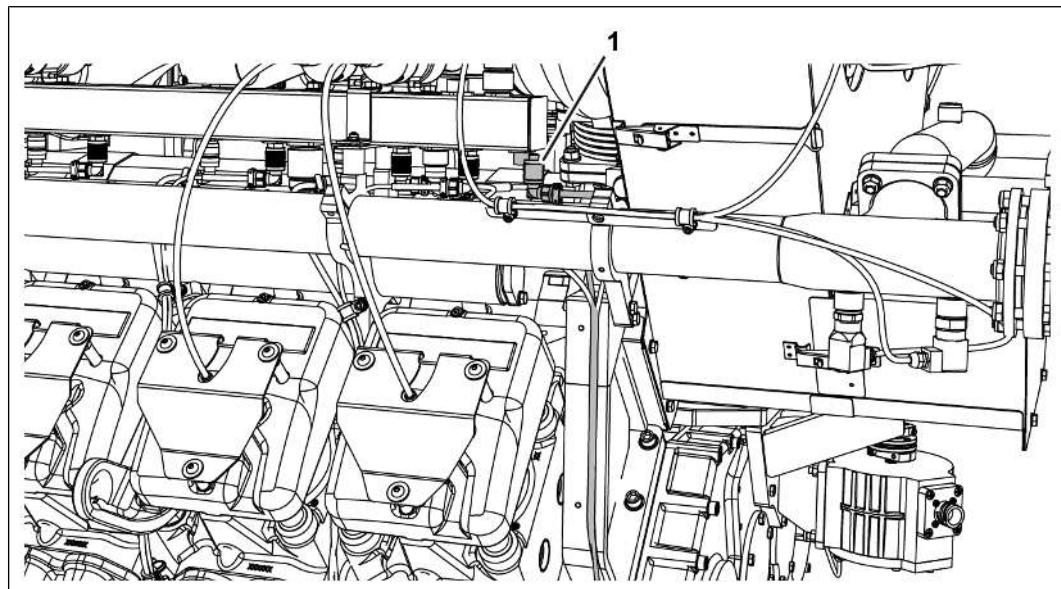
General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

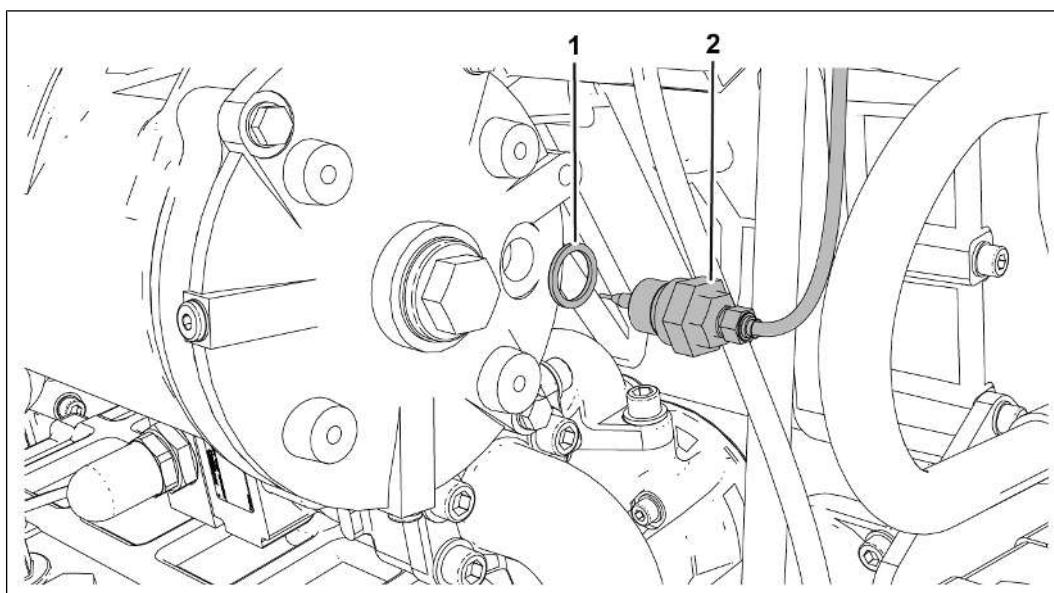
Removing the mixture temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2665891339

1. Dismantle connector (1) from multifunction rail.
 - Uncover cable.



2665893771

2. Remove sensor (2).
3. Remove sealing ring (1).

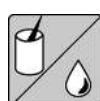
Installing the mixture temperature sensor

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



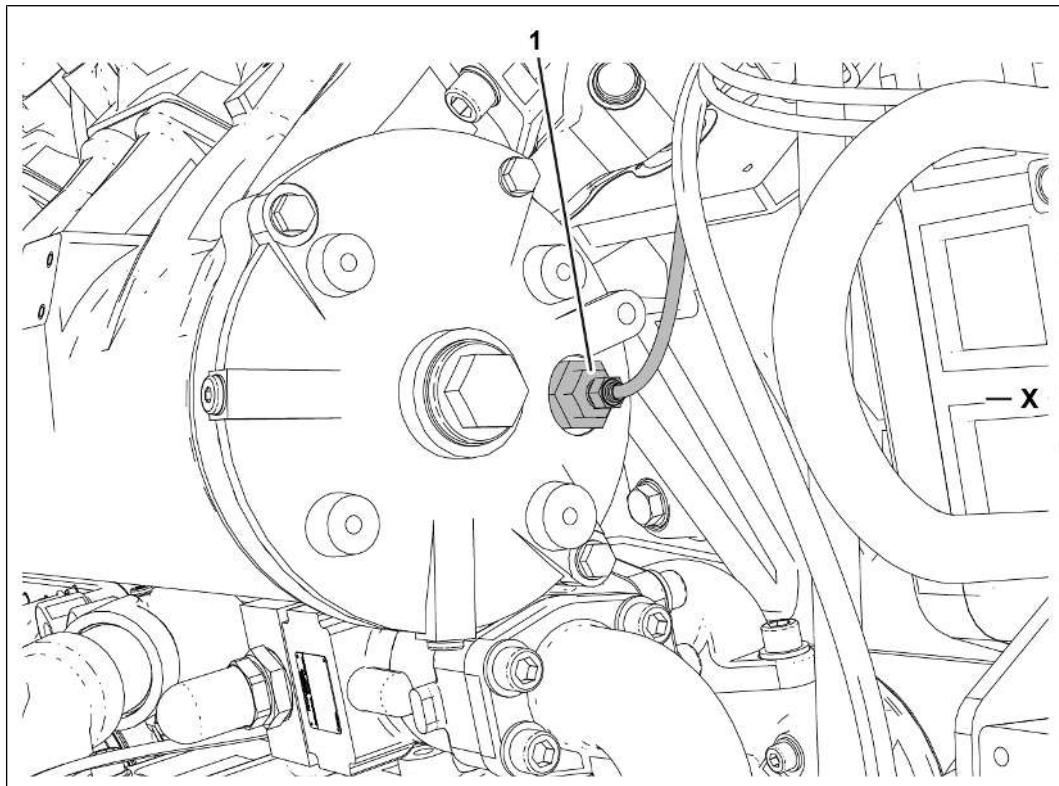
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

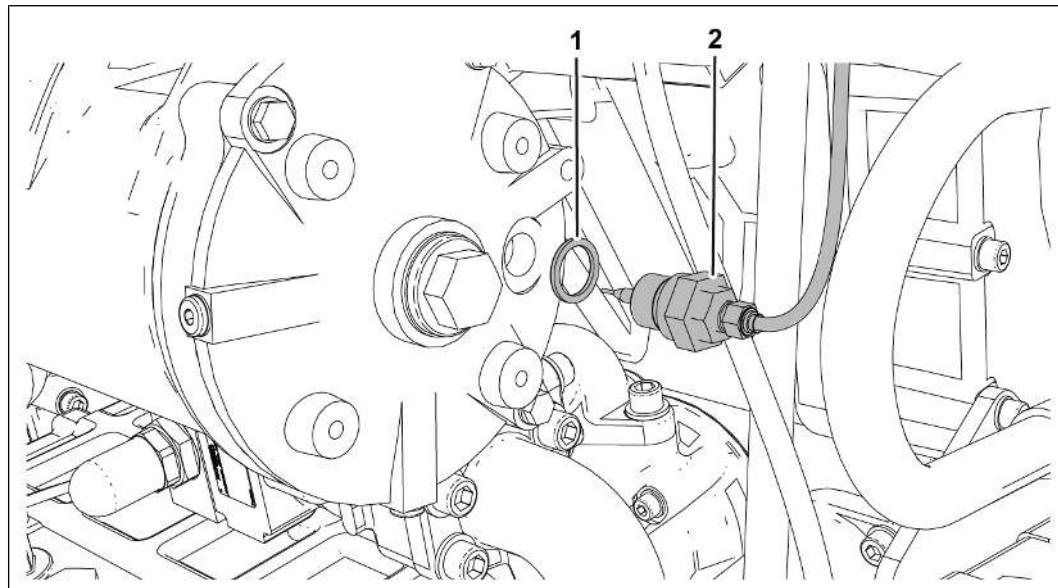
- Sealing ring
- If necessary, temperature sensor

Technical data

2665888907

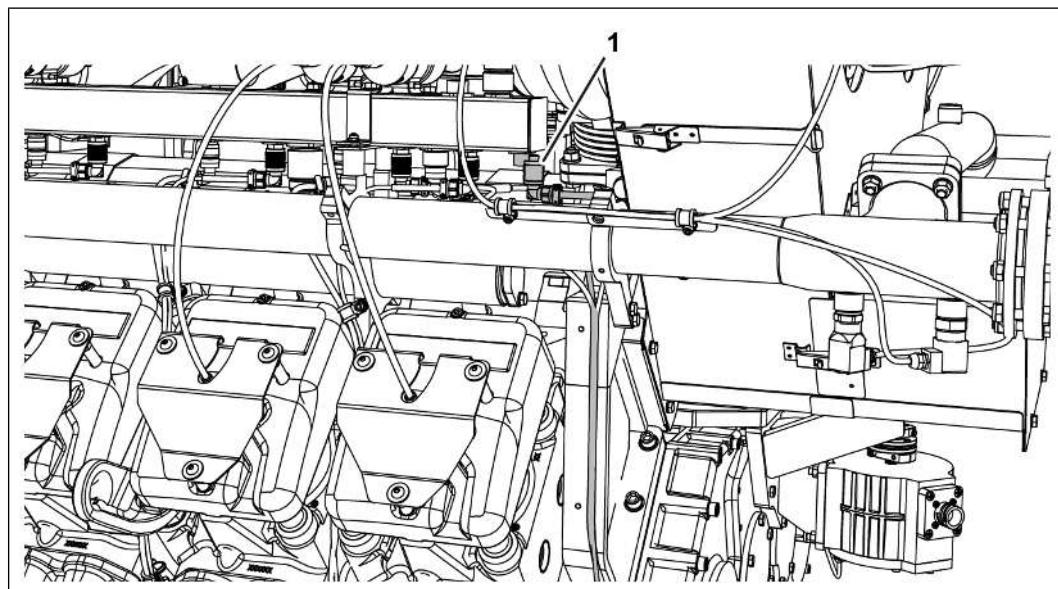
Mixture temperature sensor on cover
1. Temperature sensor ¹⁾ M12 x 1 15 Nm
¹⁾ Renew sealing ring.

Description

Installing the mixture temperature sensor:

2665893771

1. Clean components.
2. Insert sensor (2) with new sealing ring (1) and tighten it.



2665891339

3. Mount connector (1) on multifunction rail.
 - Fasten the cable.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the mixture temperature sensor (V20 engine)

Removing the mixture temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

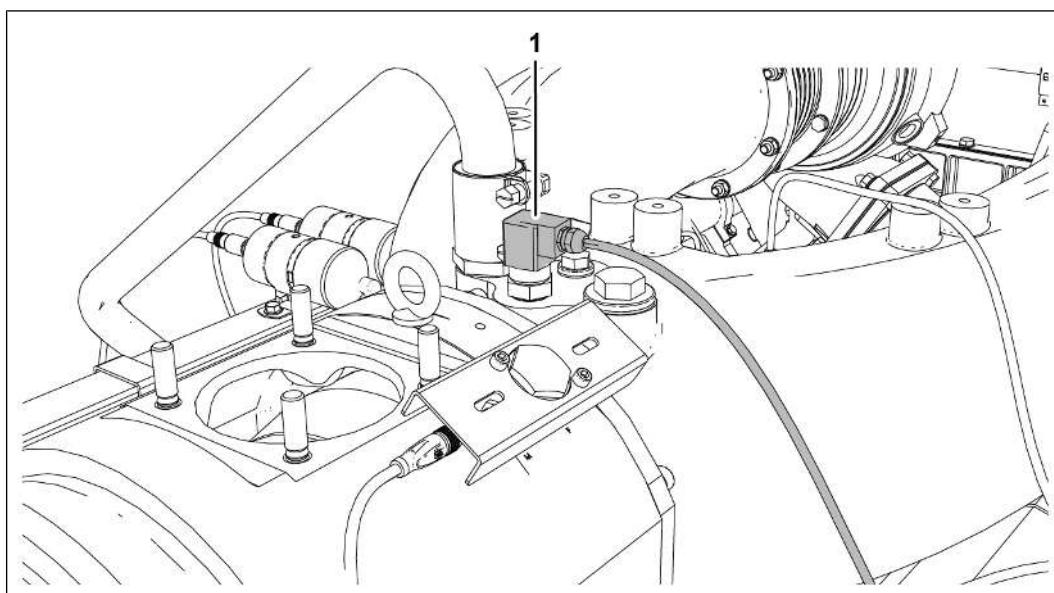
General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

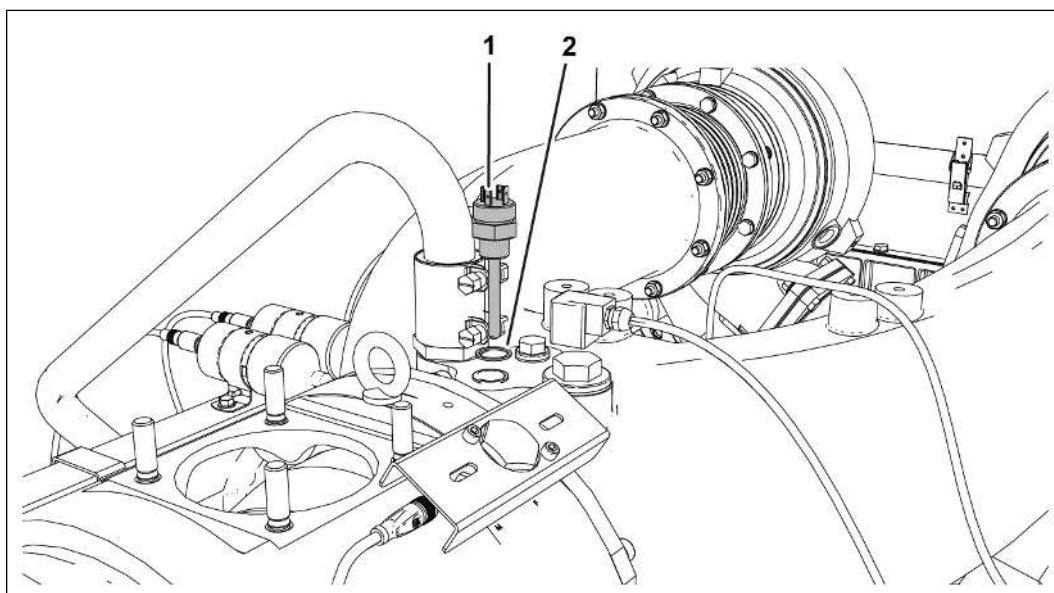
Removing the mixture temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2666456459

1. Dismantle connector (1) from sensor.



2666458891

2. Remove sensor (1).
3. Remove sealing ring (2).

Installing the mixture temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



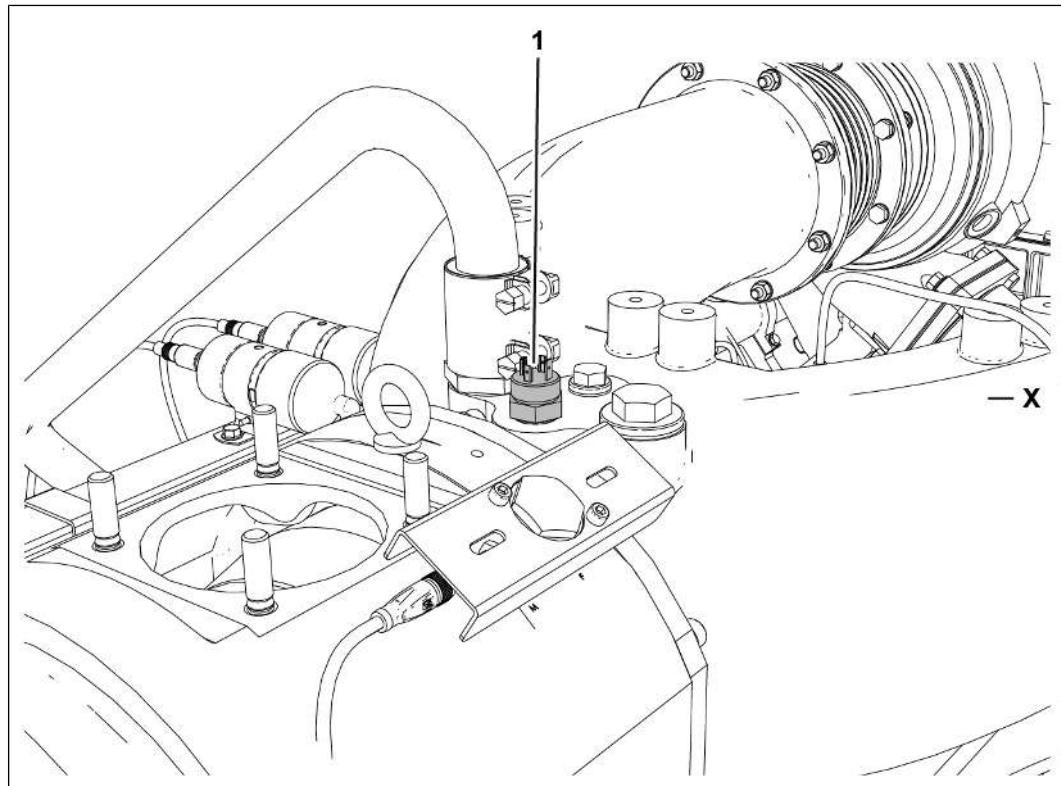
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

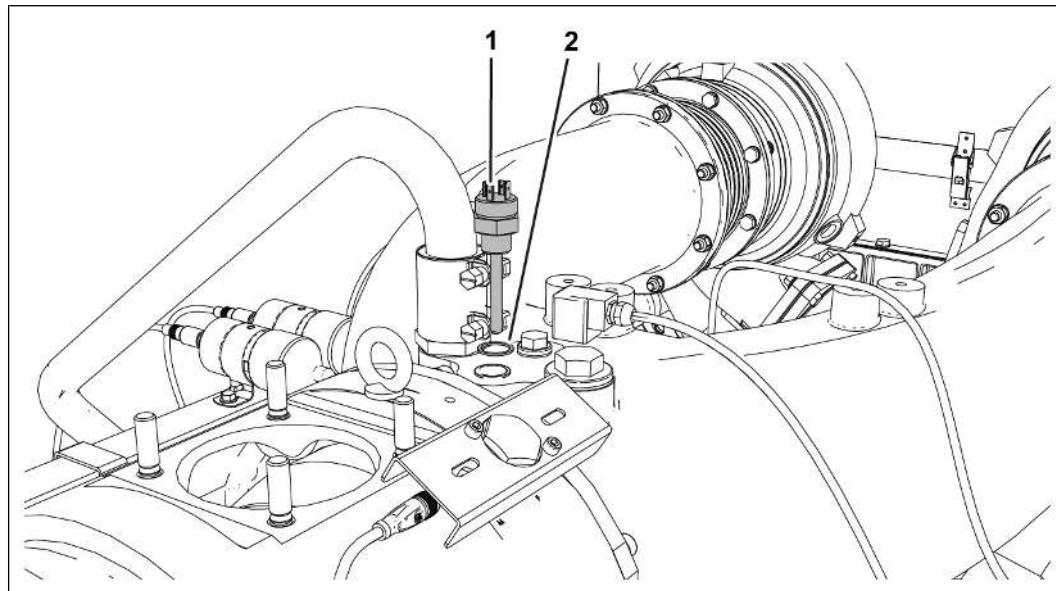
Technical data

2666454027

Mixture temperature sensor on manifold

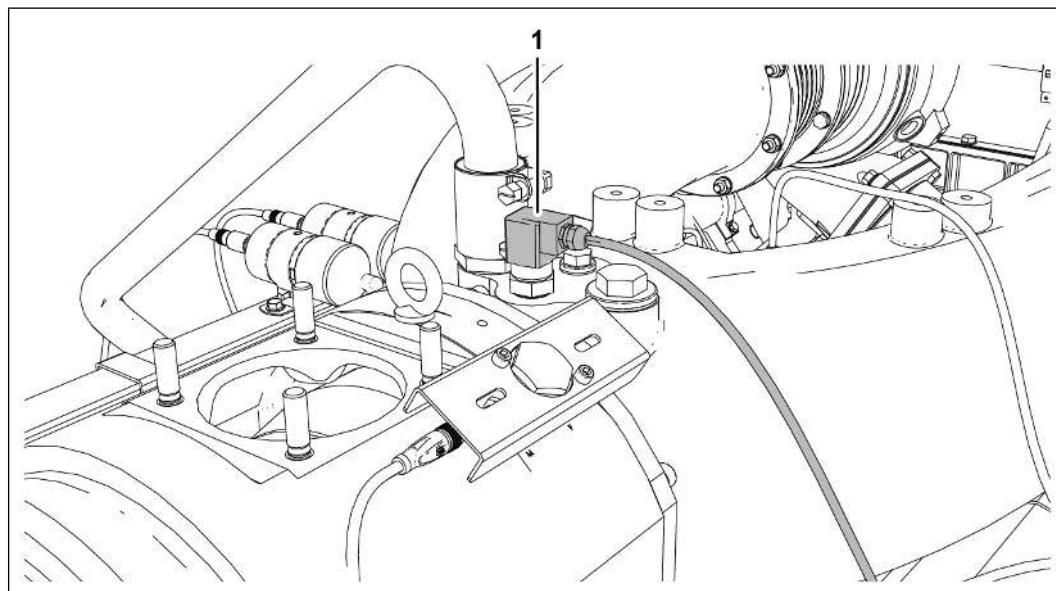
1.	Temperature sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the mixture temperature sensor:

2666458891

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2666456459

3. Mount connector (1) on sensor.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 136]

Removing and installing the mixture pressure sensor

Removing the mixture pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

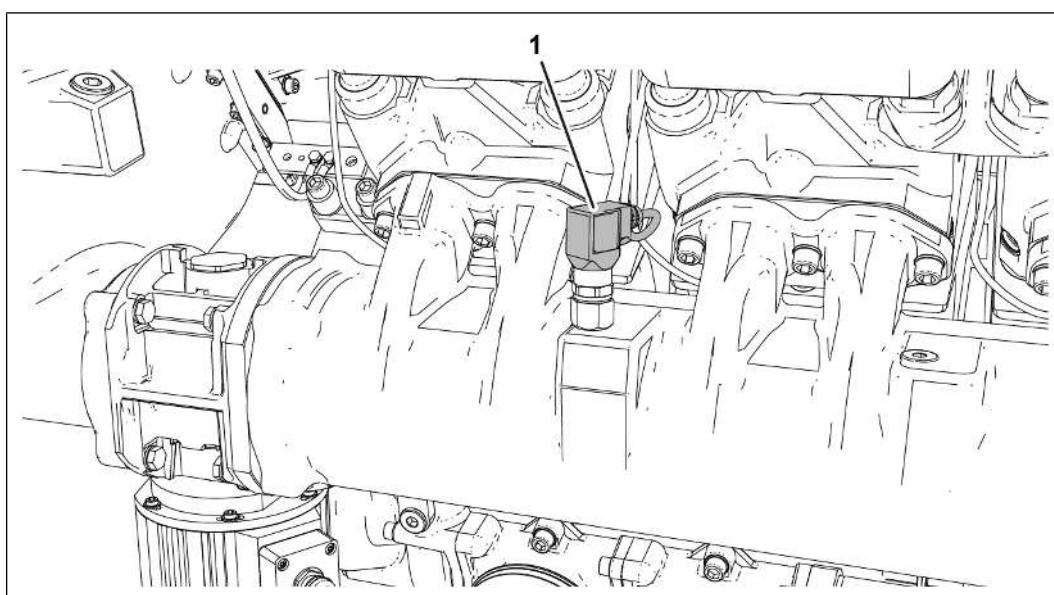
General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

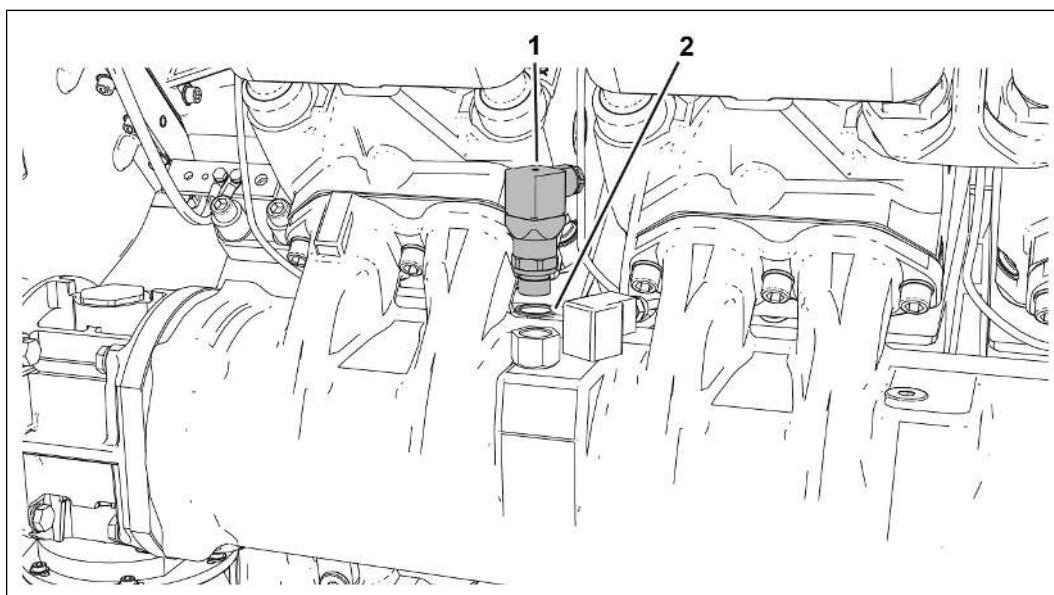
Removing the mixture pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



2666327563

1. Dismantle connector (1) from sensor.



2666329995

2. Remove sensor (1).
3. Remove sealing ring (2).

Installing the mixture pressure sensor

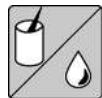
Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



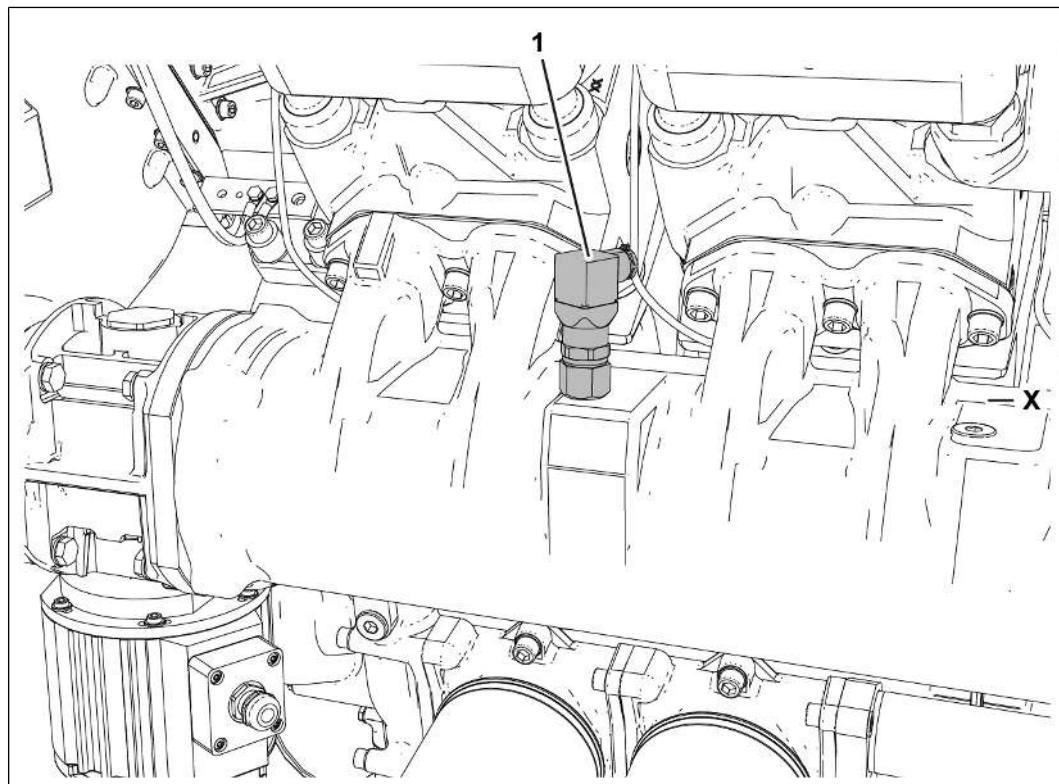
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

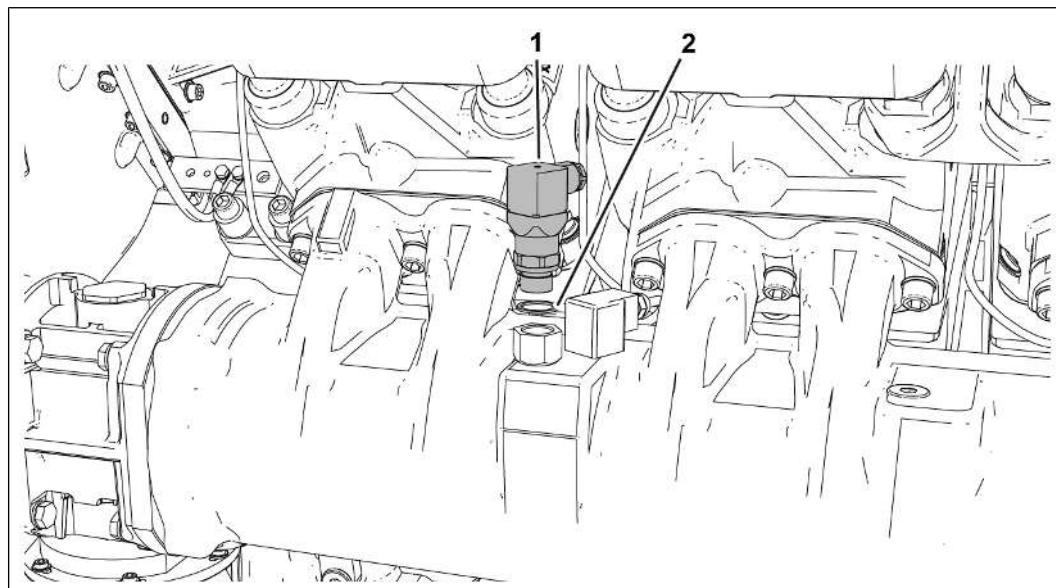
Technical data

2666325131

Mixture pressure sensor on mixture pipe

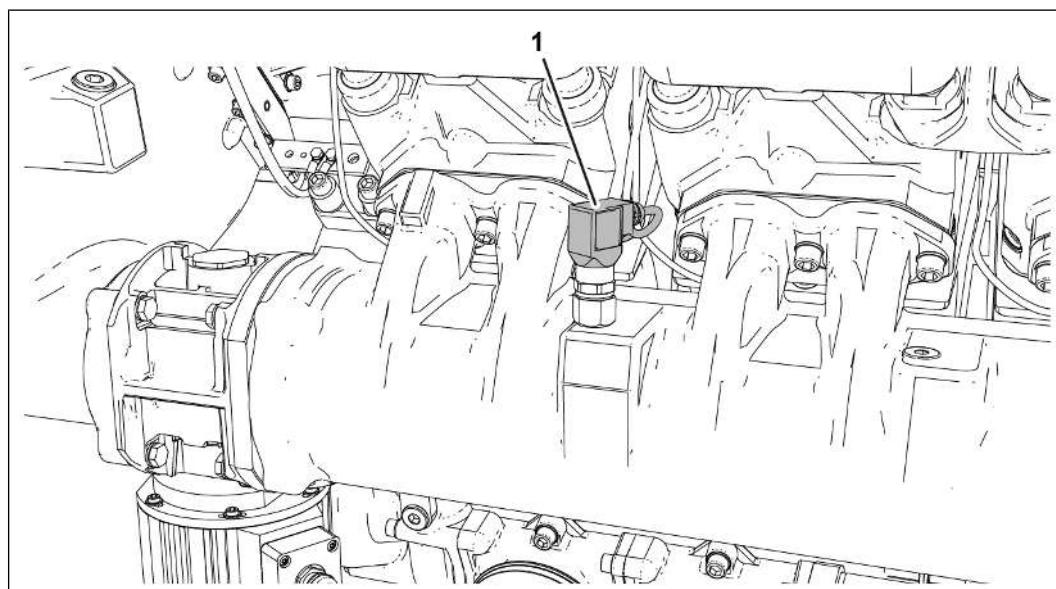
1.	Pressure sensor ¹⁾	M14 x 1.5	10 Nm
----	-------------------------------	-----------	-------

¹⁾ Renew sealing ring.

Installing the mixture pressure sensor:

2666329995

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2666327563

3. Visually inspect the connector (1).
4. Mount connector (1) on sensor.
⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the mixture pressure sensor (V12 engine with wastegate)

Removing the mixture pressure sensor

Valid for:
TCG 2020



Tools:

- Standard tools

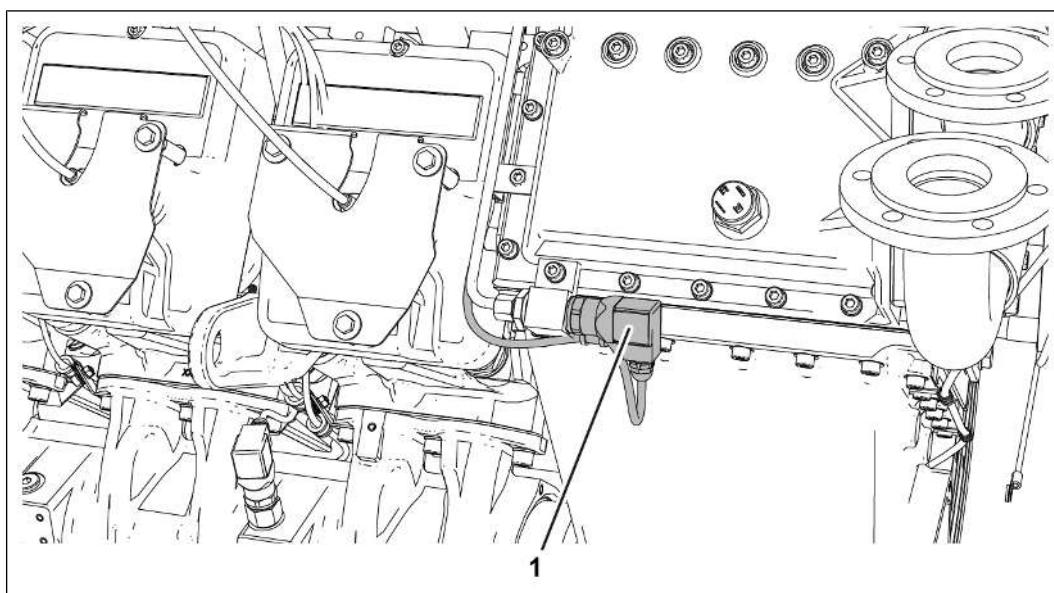
General information

The component must be visually inspected.

- Renew worn or damaged component.
- Renew sealing ring.

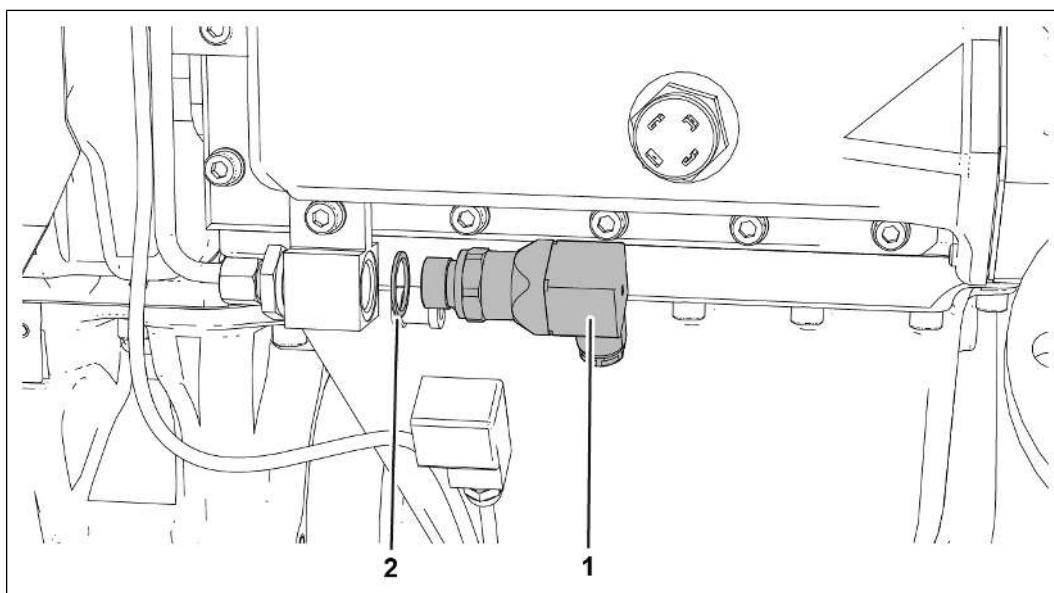
Removing the mixture pressure sensor:

- ✓ Decommission the genset, see [Stopping the genset \[▶ 163\]](#).



3151920651

1. Remove connector (1) from sensor.



3151928203

2. Remove sensor (1).
3. Remove sealing ring (2).

Installing the mixture pressure sensor

Valid for:

TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



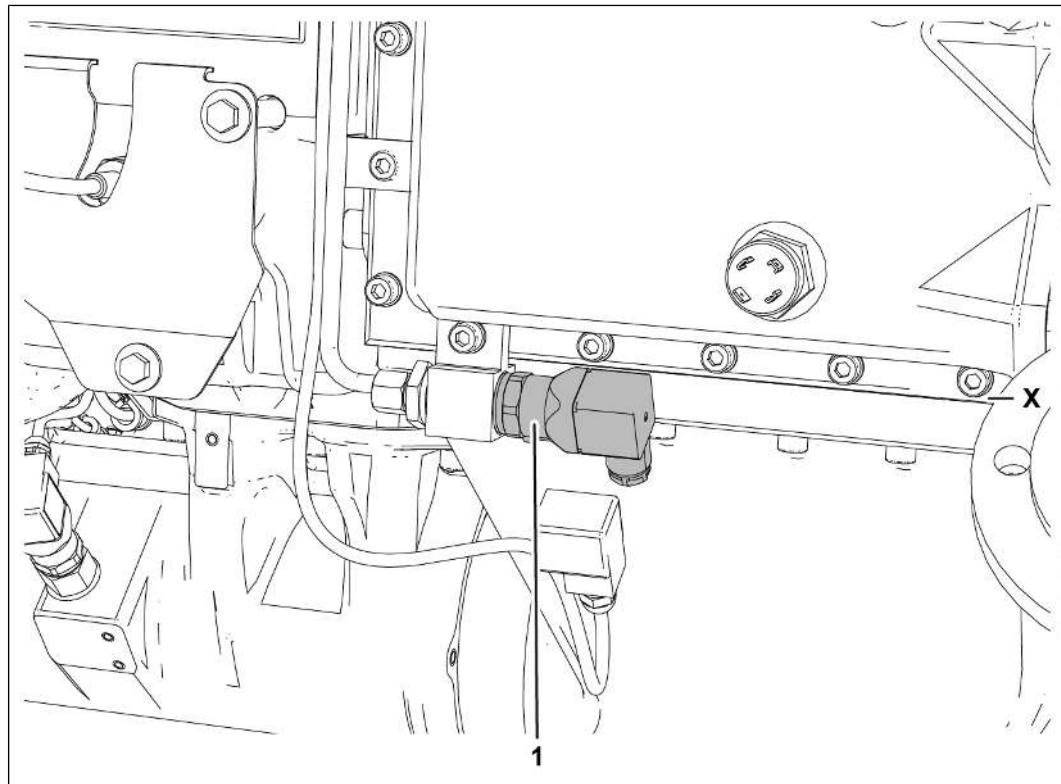
Auxiliary media:

- Cleaning agents
 - See Technical Bulletin (TR) 2147 [Specification for auxiliary media.](#)



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

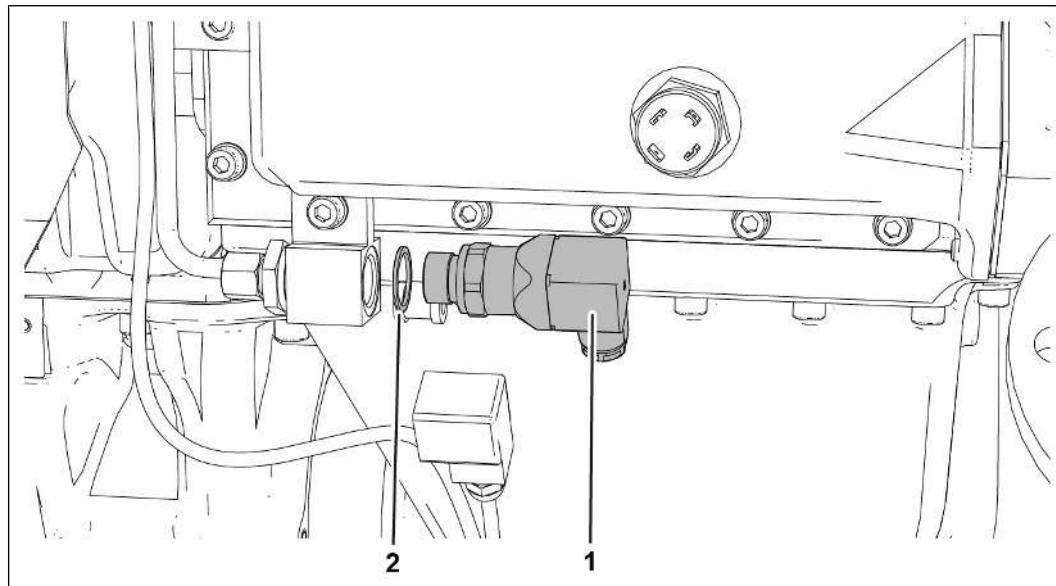
Technical data

3151413515

Mixture pressure sensor on line

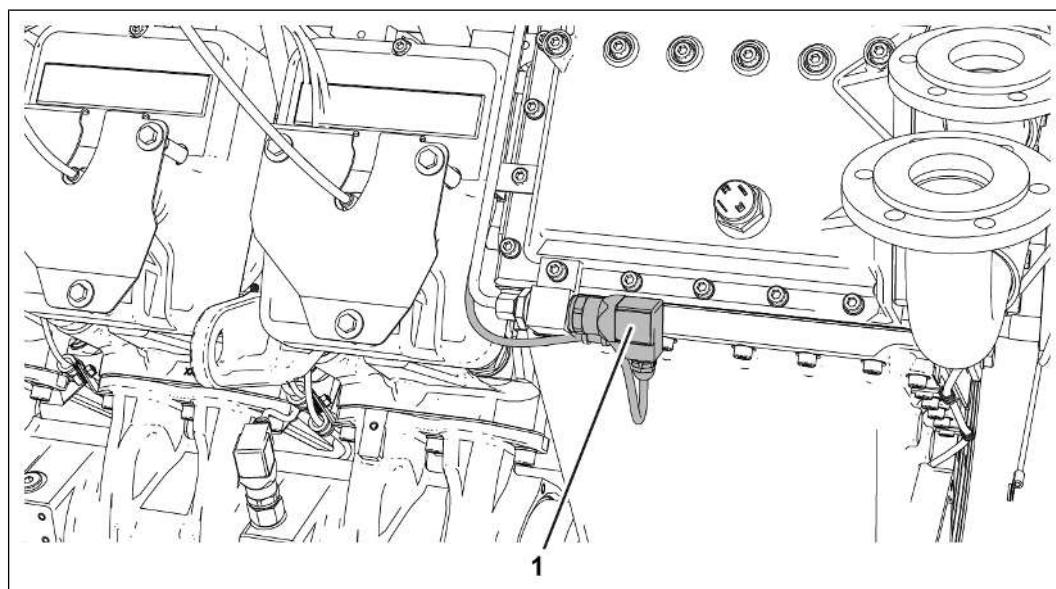
1.	Pressure sensor ¹⁾	M14 × 1.5	10 Nm
----	-------------------------------	-----------	-------

¹⁾ Replace sealing ring.

Installing the mixture pressure sensor:

3151928203

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



3151920651

3. Visually inspect the connector (1).
4. Mount connector (1) on sensor.
⇒ Commission the genset, see [Start the genset \[▶ 136\]](#).

Removing and installing the lube oil temperature sensor

Removing the lube oil temperature sensor

Valid for:

TCG 2020, TCG 2020 K



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

Danger to the environment



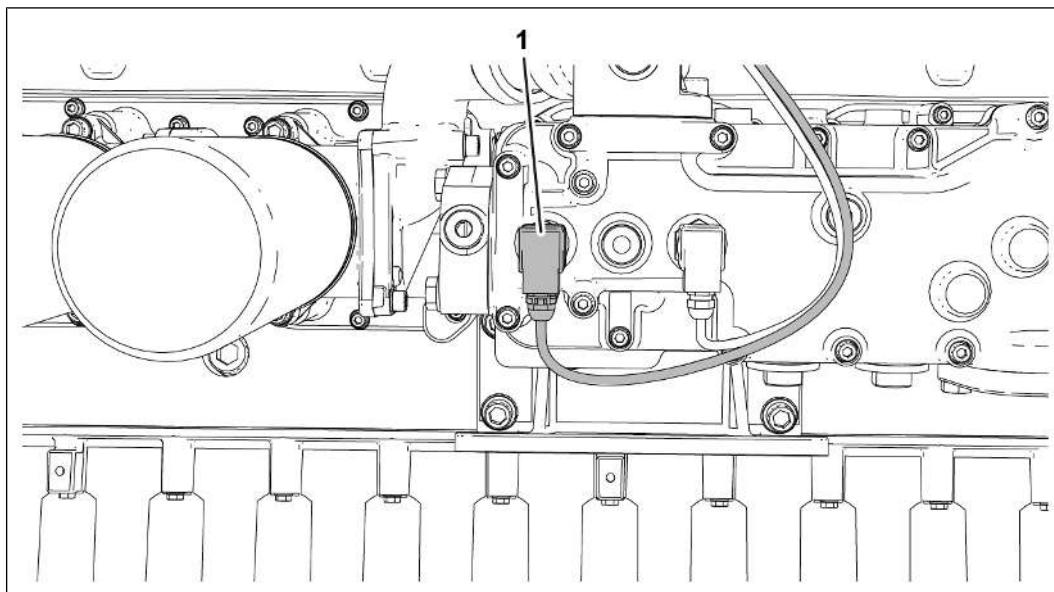
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

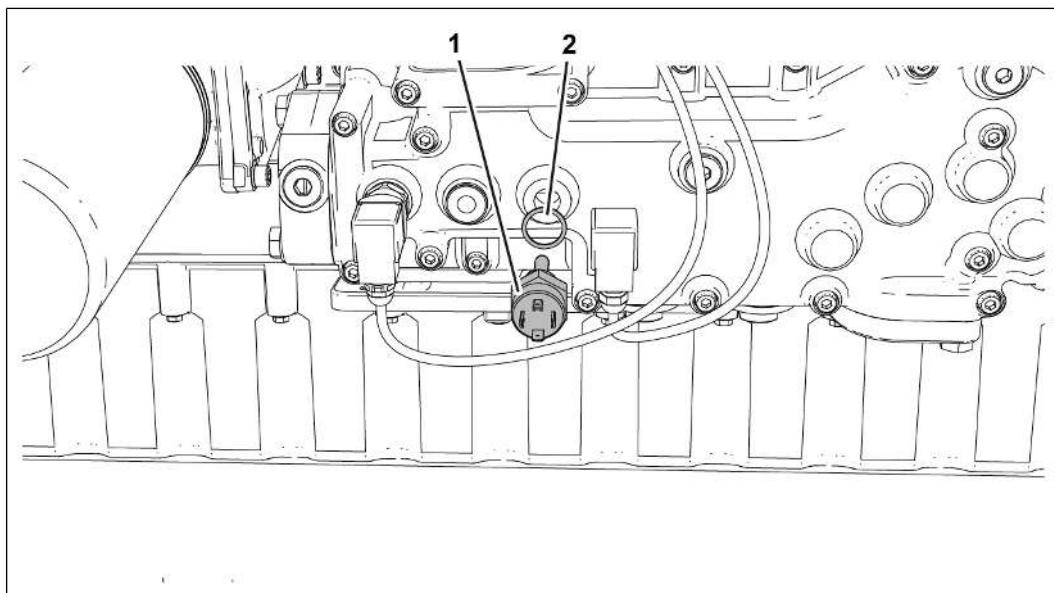
Removing the intake air temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2666482315

1. Dismantle connector (1) from sensor.



2666484747

2. Place the collecting tray underneath.
3. Remove sensor (1).
4. Remove sealing ring (2).

Installing the lube oil temperature sensor

Valid for:

TCG 2020, TCG 2020 K



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



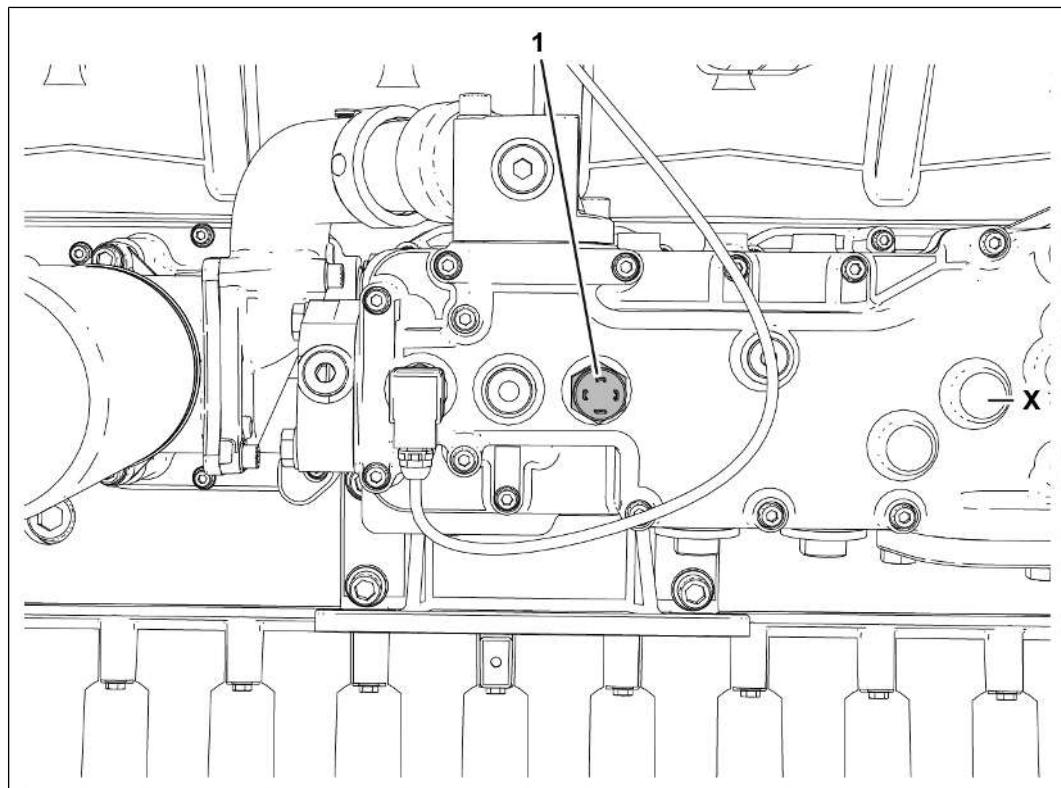
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

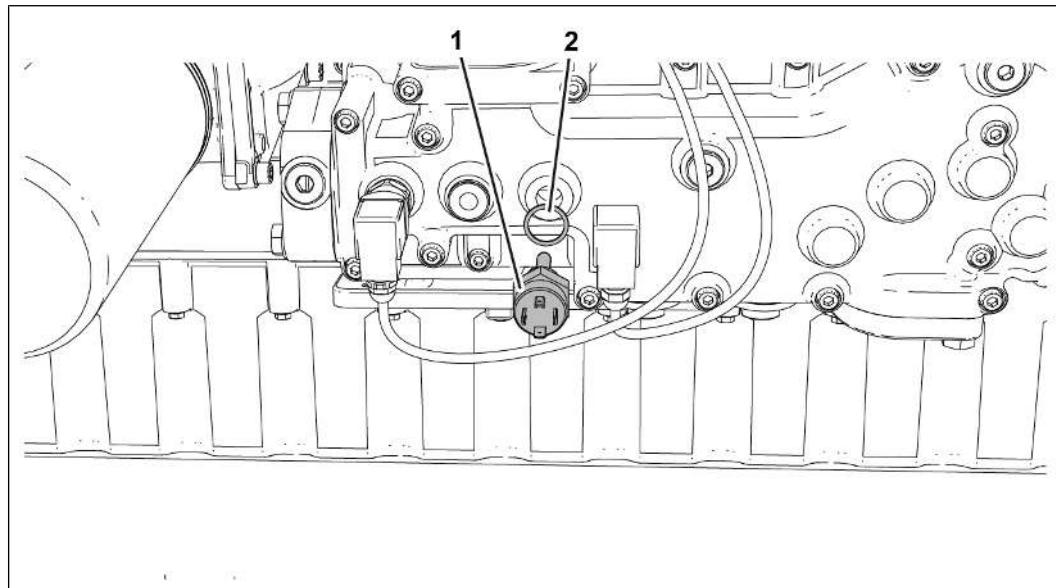
Technical data

2666479883

Lube oil temperature sensor on lube oil cooler

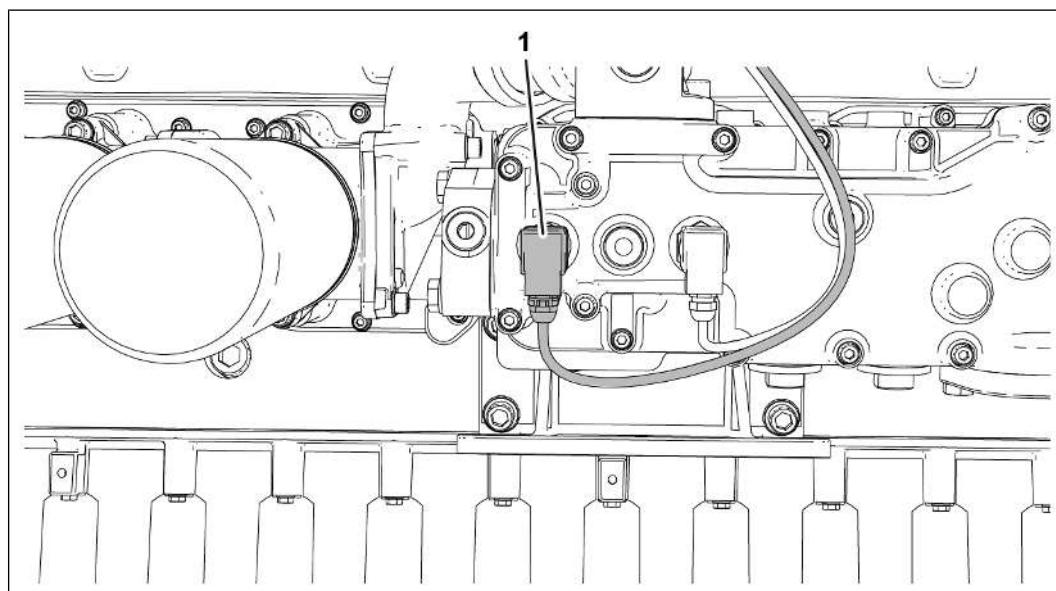
1.	Temperature sensor ¹⁾	G1/2	20 Nm
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¹⁾ Replace sealing ring.

Installing the lube oil temperature sensor:

2666484747

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2666482315

3. Visually inspect the connector (1).
 4. Mount connector (1) on sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the lube oil pressure sensor

Removing the lube oil pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

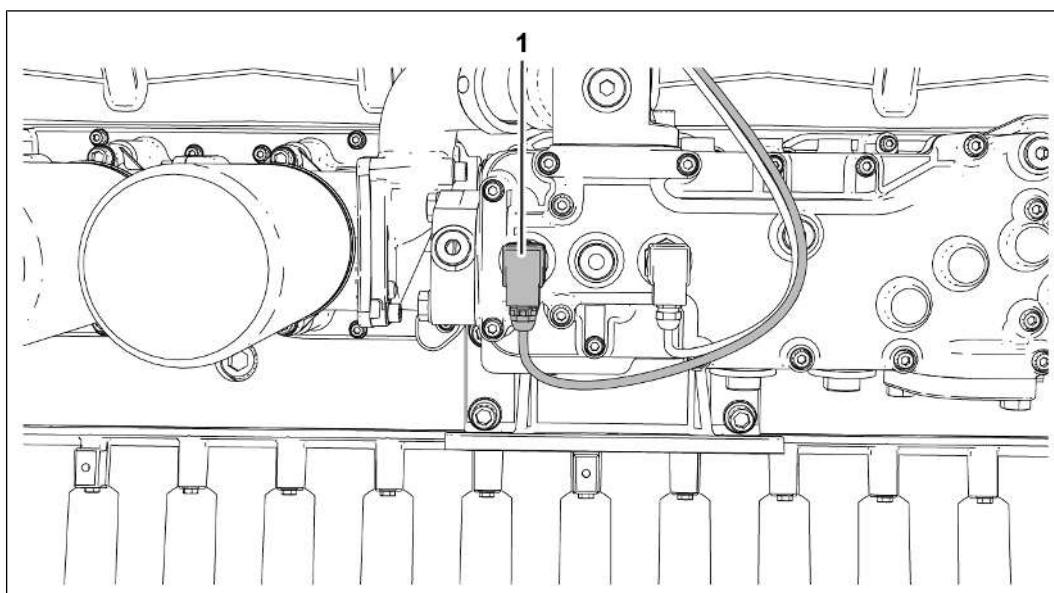
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

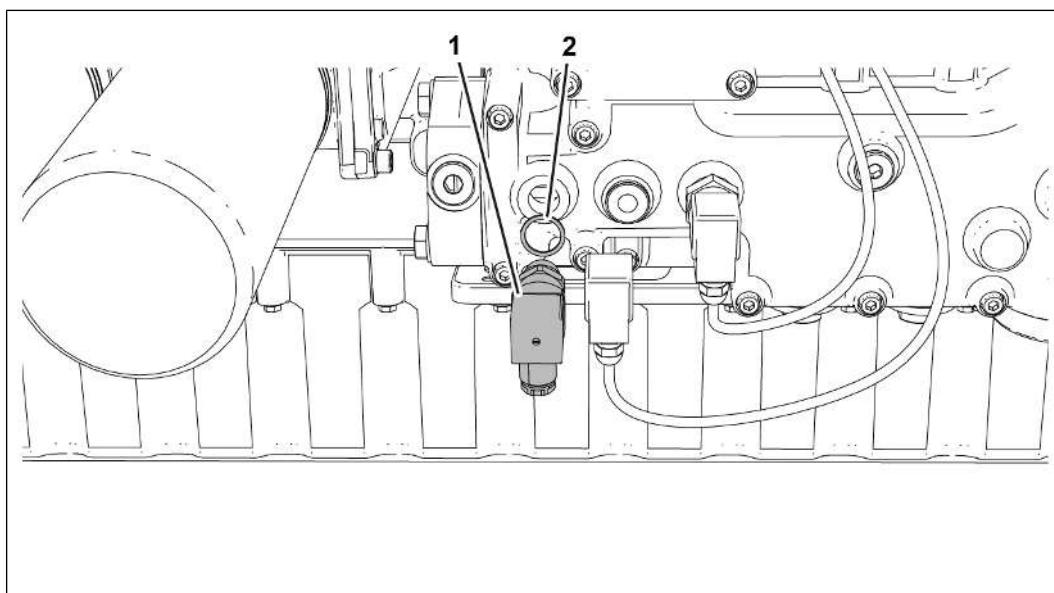
Removing the lube oil pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2666443403

1. Dismantle connector (1) from the sensor.



2666445835

2. Place the collecting tray underneath.
3. Remove the sensor (1).
4. Remove sealing ring (2).

Installing the lube oil pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[► 203\]](#)



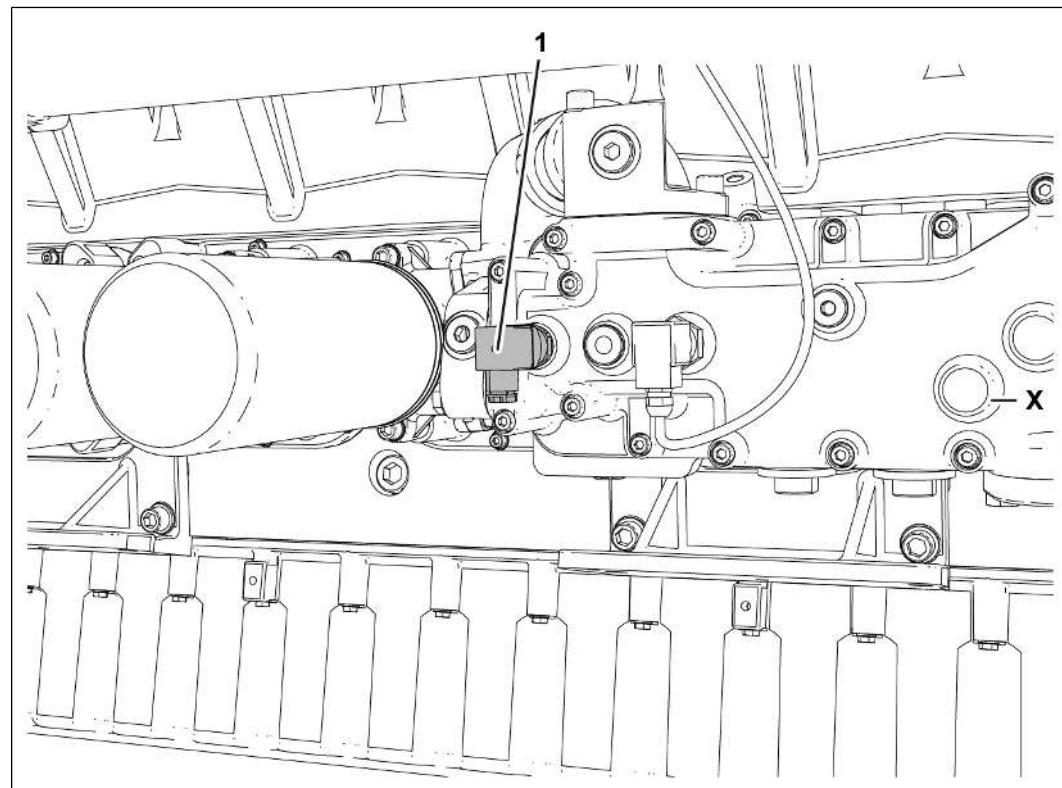
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

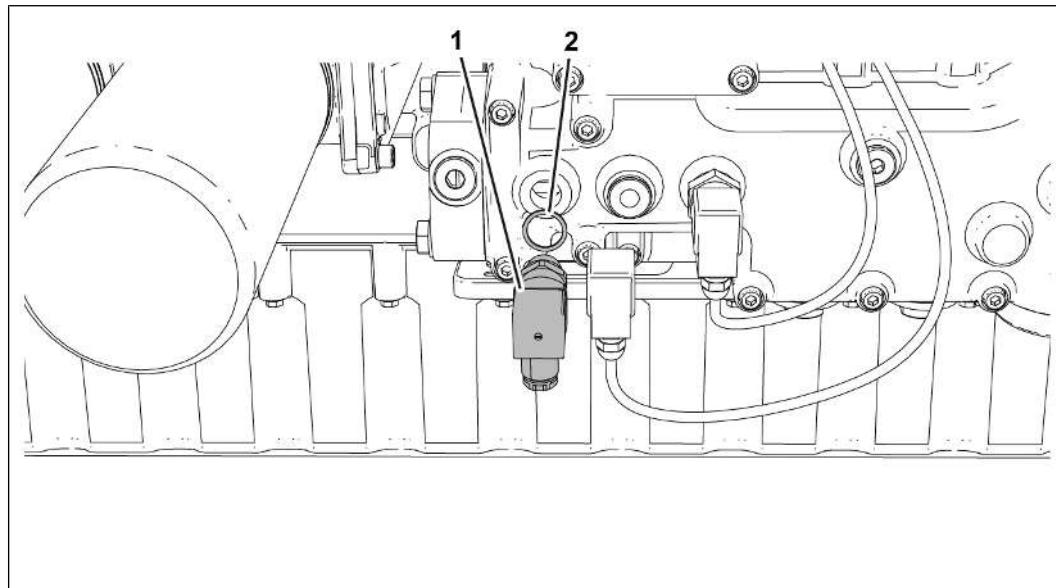
Technical data

2666440971

Lube oil pressure sensor on lube oil cooler

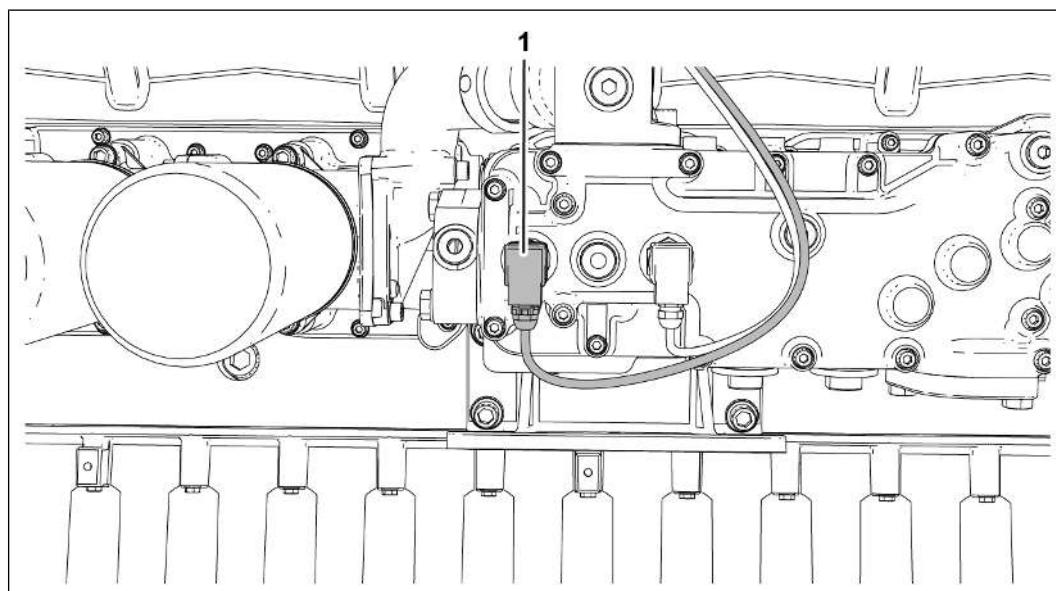
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the lube oil pressure sensor:

2666445835

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2666443403

3. Visually inspect the connector (1).
 4. Mount connector (1) on the sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the coolant temperature sensor

Removing the coolant temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

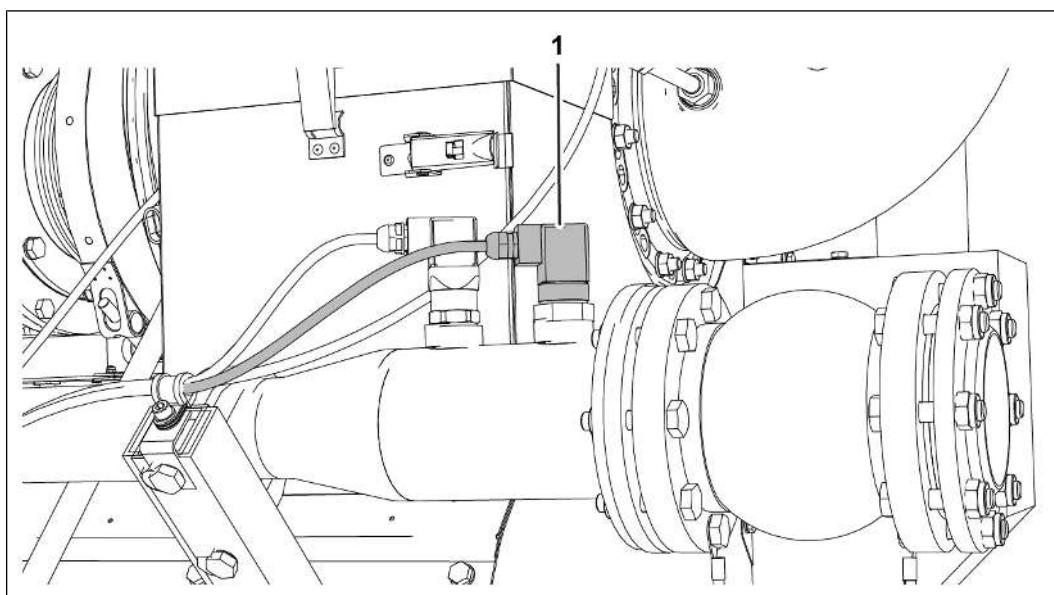
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

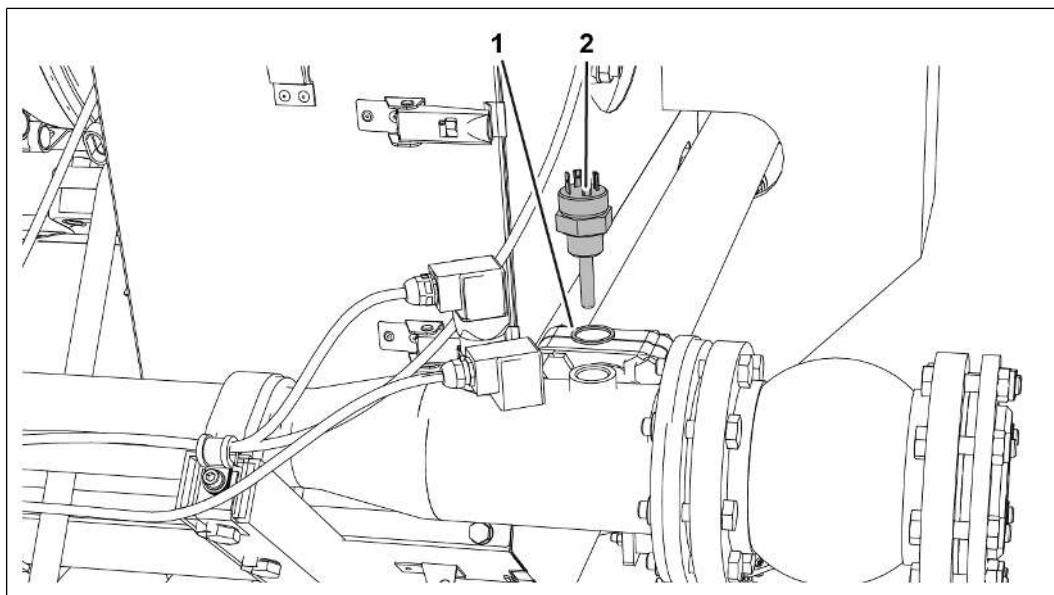
Removing the coolant temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2671729163

1. Dismantle connector (1) from sensor.



2671731595

2. Place the collecting tray underneath.
3. Remove sensor (2).
4. Remove sealing ring (1).

Installing the coolant temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



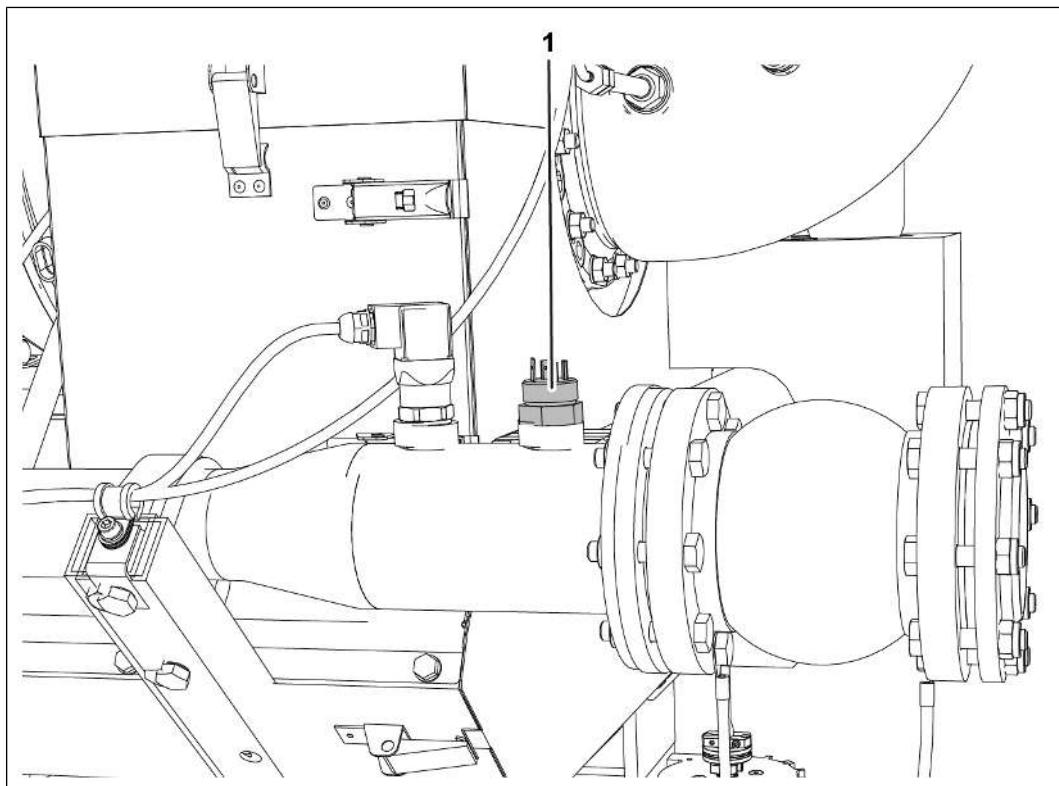
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

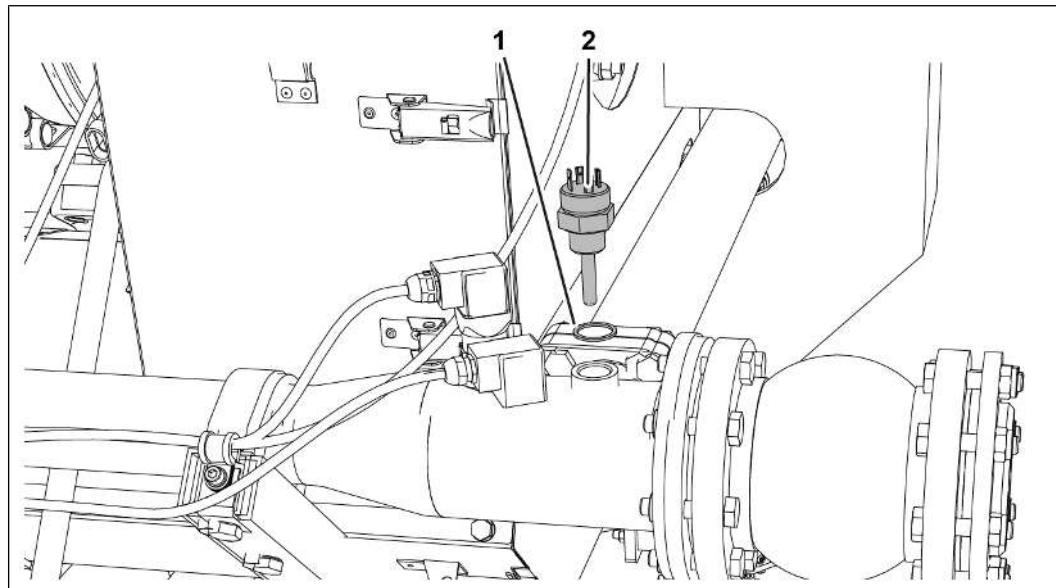
Technical data

2671724811

Coolant temperature sensor on coolant pipe

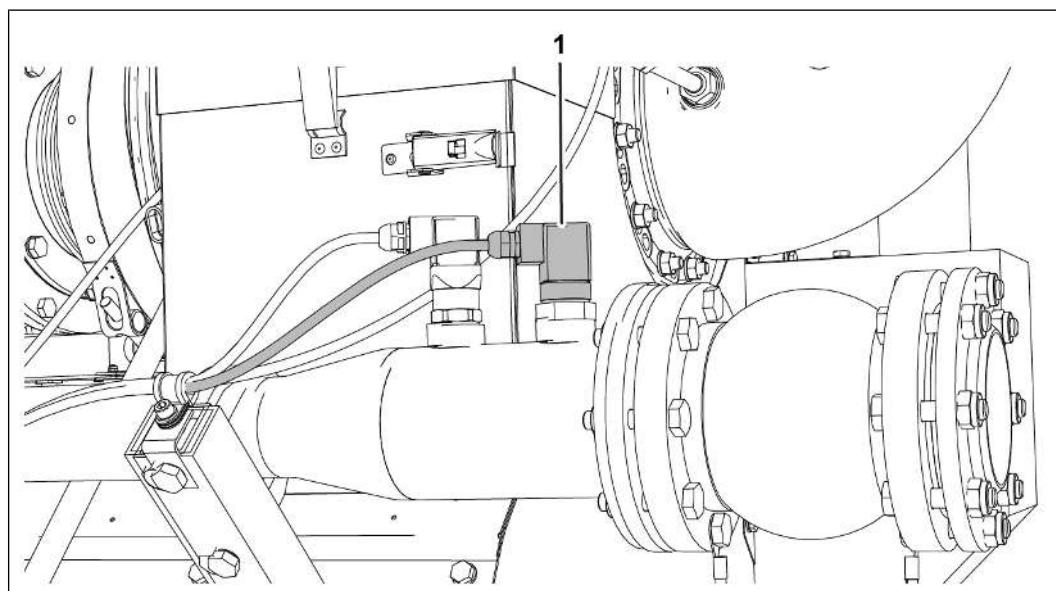
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
----	-------------------------------	-------	-------

¹⁾ Renew sealing ring.

Installing the coolant temperature sensor:

2671731595

1. Clean components.
2. Insert sensor (2) with new sealing ring (1) and tighten it.



2671729163

3. Visually inspect the connector (1).
 4. Mount connector (1) on sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the coolant temperature sensor (mixture cooler)

Removing the coolant temperature sensor

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-

Danger to the environment



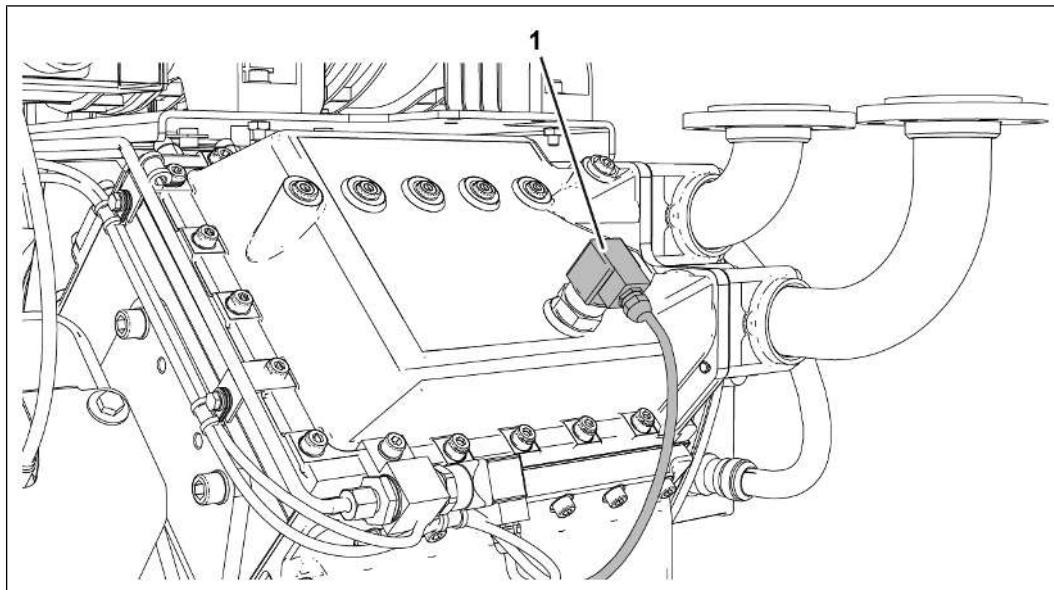
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

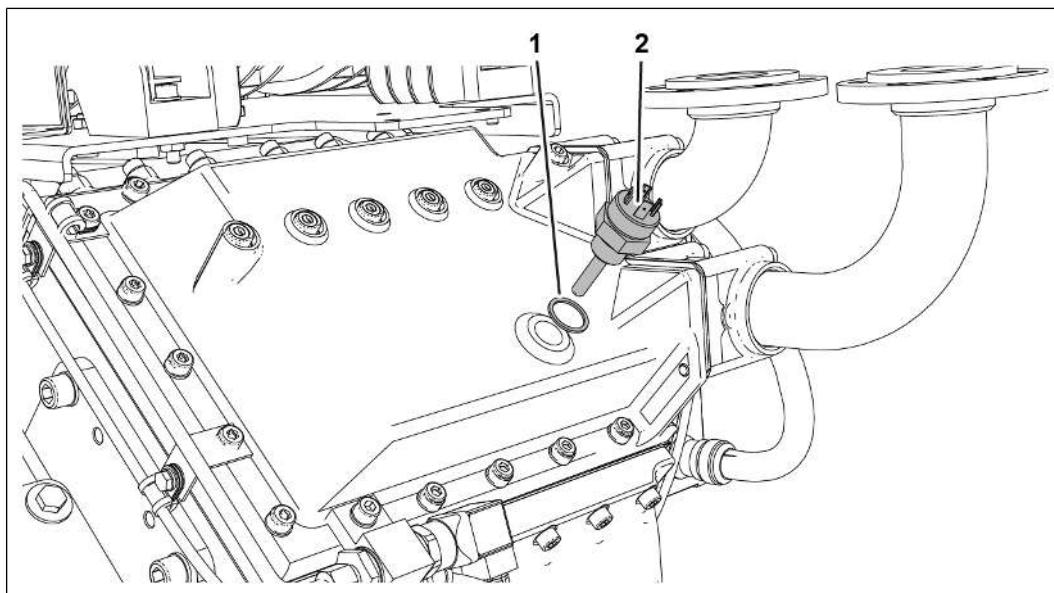
Removing the coolant temperature sensor (V12/V16 engine):

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2671819275

1. Dismantle connector (1) from the sensor.

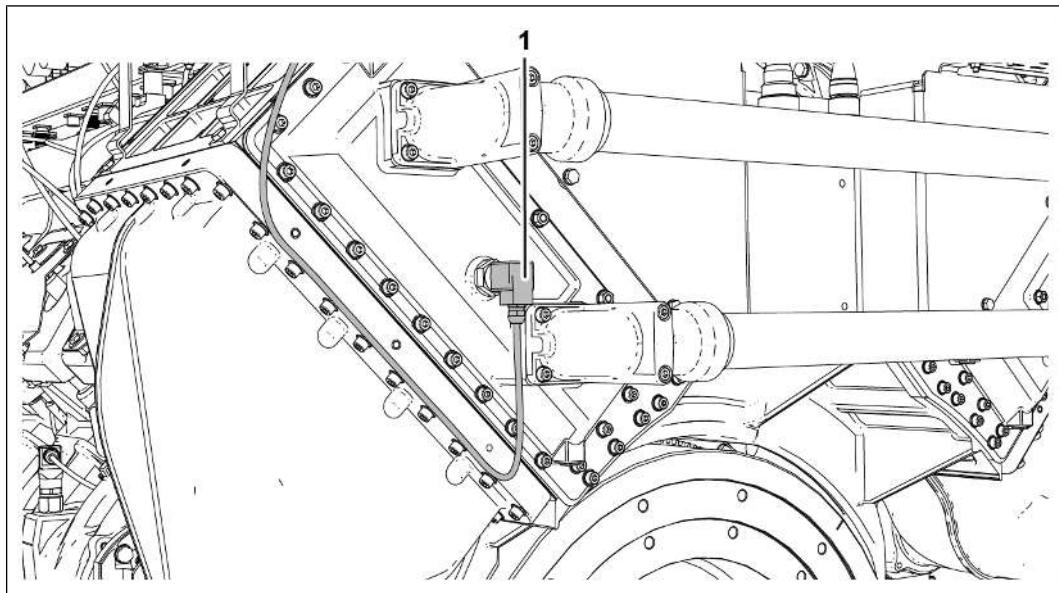


2671821707

2. Place the collecting tray underneath.
3. Remove the sensor (2).
4. Remove sealing ring (1).

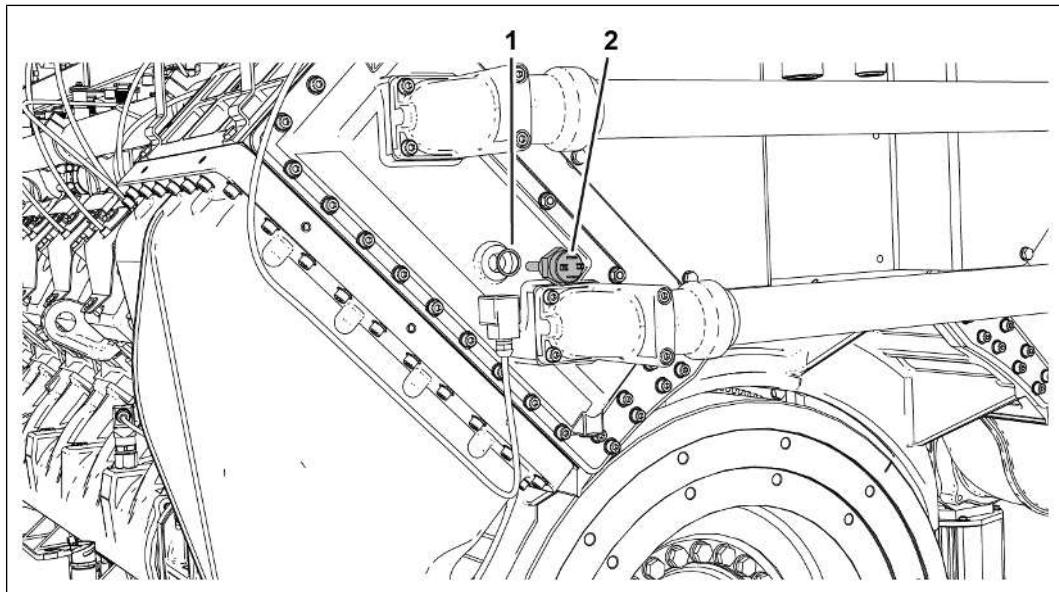
Removing the coolant temperature sensor (V20 engine):

- ✓ Decommission the genset, see [Stopping the genset \[▶ 163\]](#).



2672589067

1. Dismantle connector (1) from the sensor.



2672591499

2. Place the collecting tray underneath.
3. Remove the sensor (2).
4. Remove sealing ring (1).

Installing the coolant temperature sensor

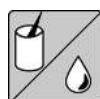
Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



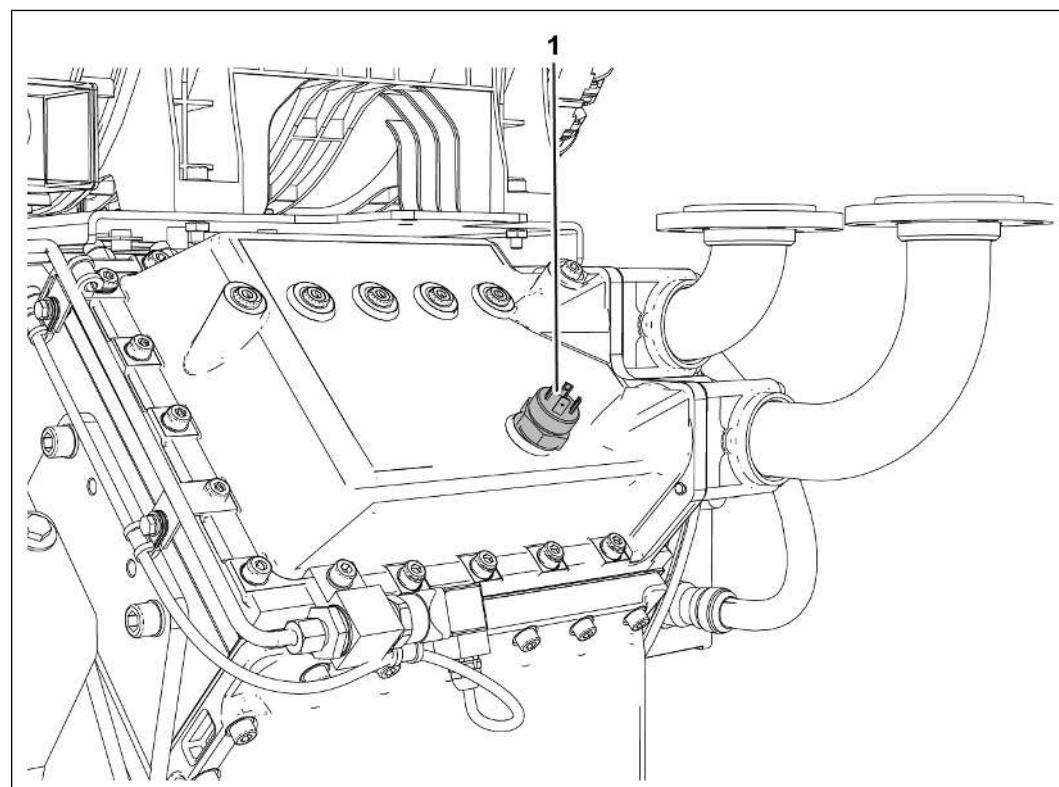
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

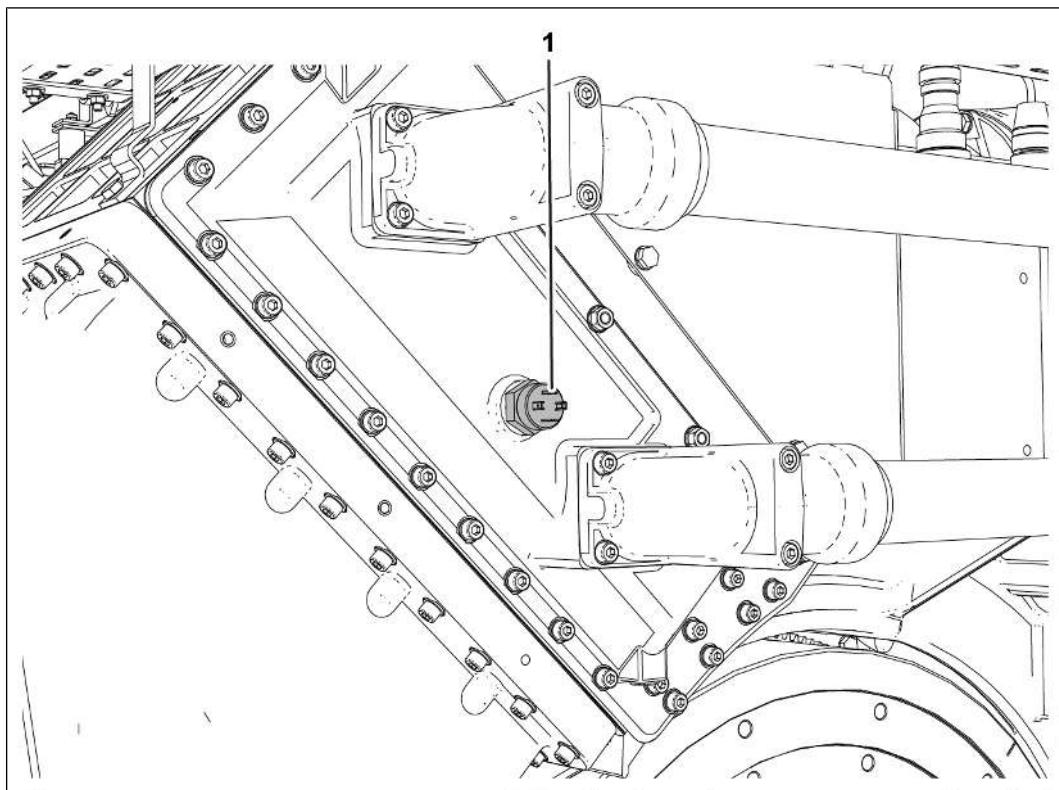
Technical data

2671814923: V12/V16 engine

Coolant temperature sensor on mixture cooler (V12/V16 engine)

1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

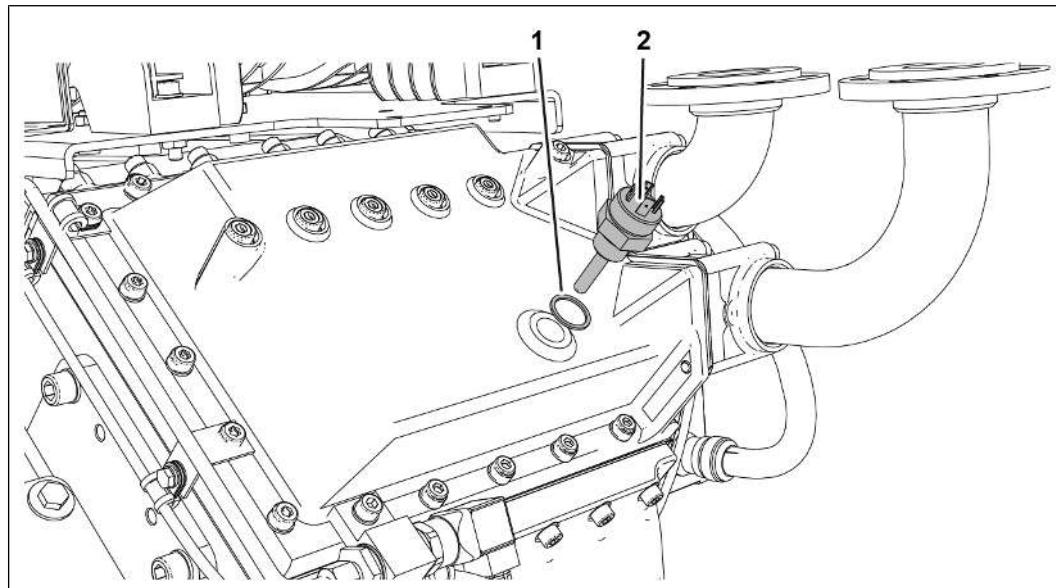


2672502411: V20 engine

Coolant temperature sensor on mixture cooler (V20 engine)

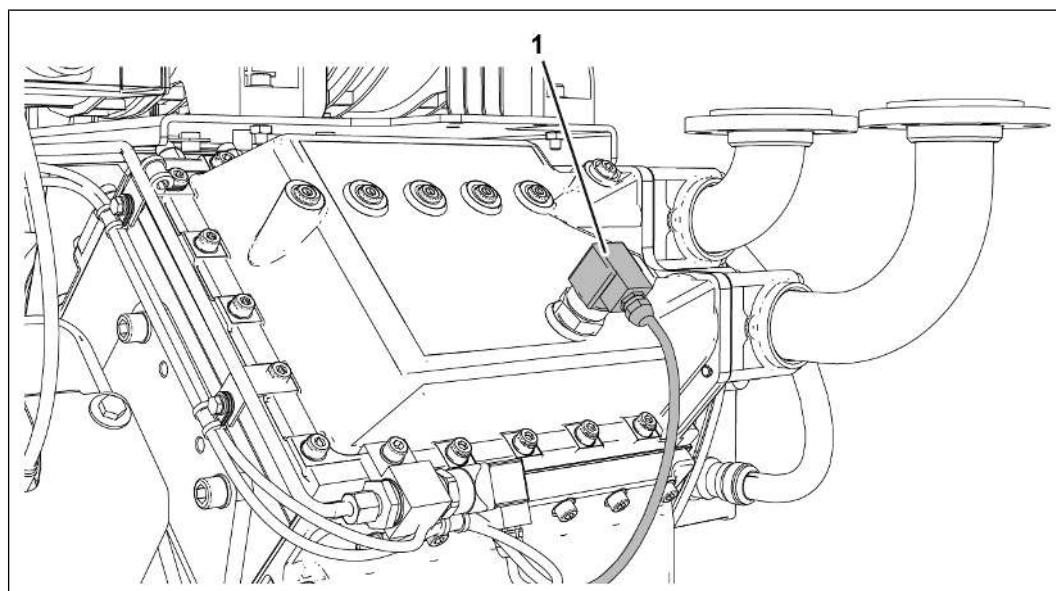
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the coolant temperature sensor (V12-/V16 engine):

2671821707

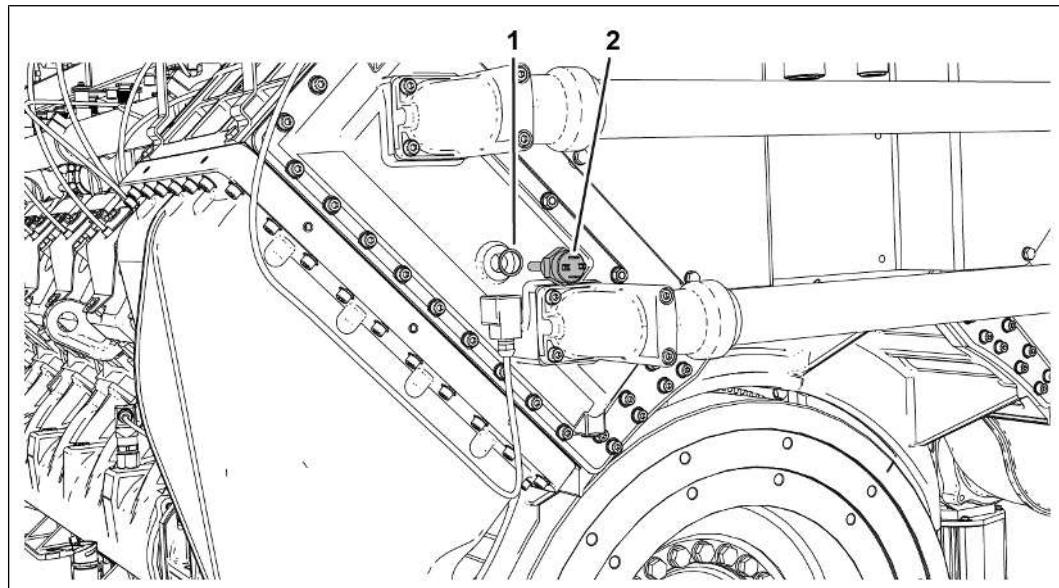
1. Clean components.
2. Insert sensor (2) with new sealing ring (1) and tighten it.



2671819275

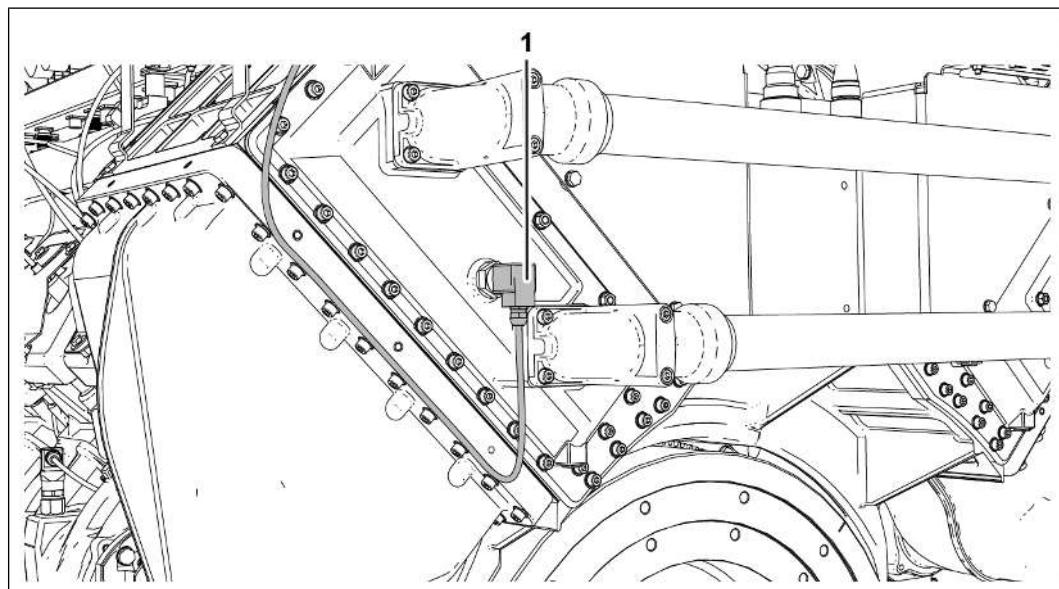
3. Visually inspect the connector (1).
 4. Mount connector (1) on the sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see [Start the genset \[▶ 136\]](#).

Installing the coolant temperature sensor (V20 engine):



2672591499

1. Clean components.
2. Insert sensor (2) with new sealing ring (1) and tighten it.



2672589067

3. Visually inspect the connector (1).
 4. Mount connector (1) on the sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the coolant temperature sensor (engine inlet)

Removing the coolant temperature sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

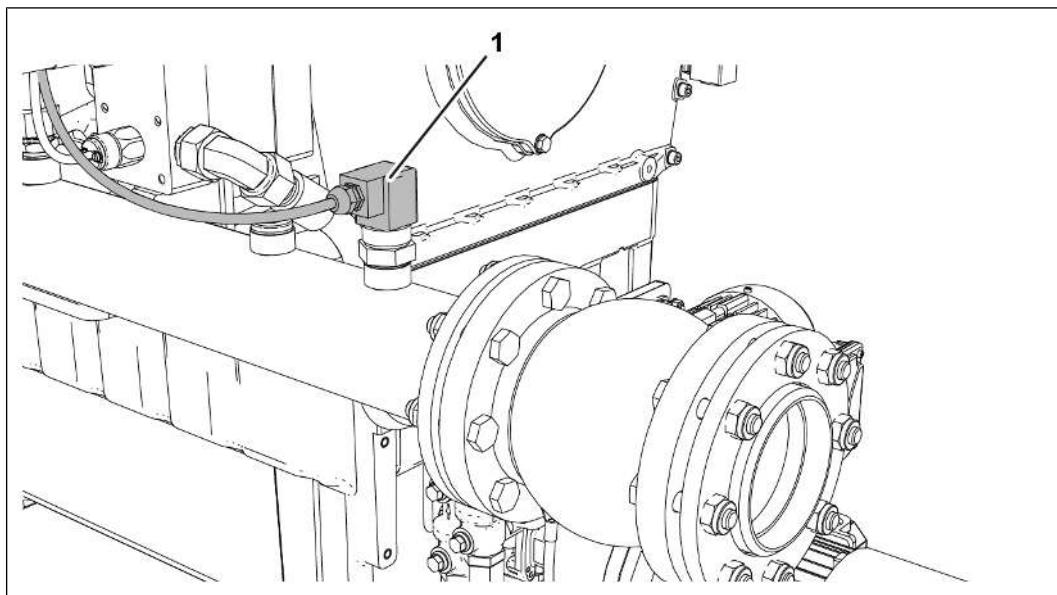
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

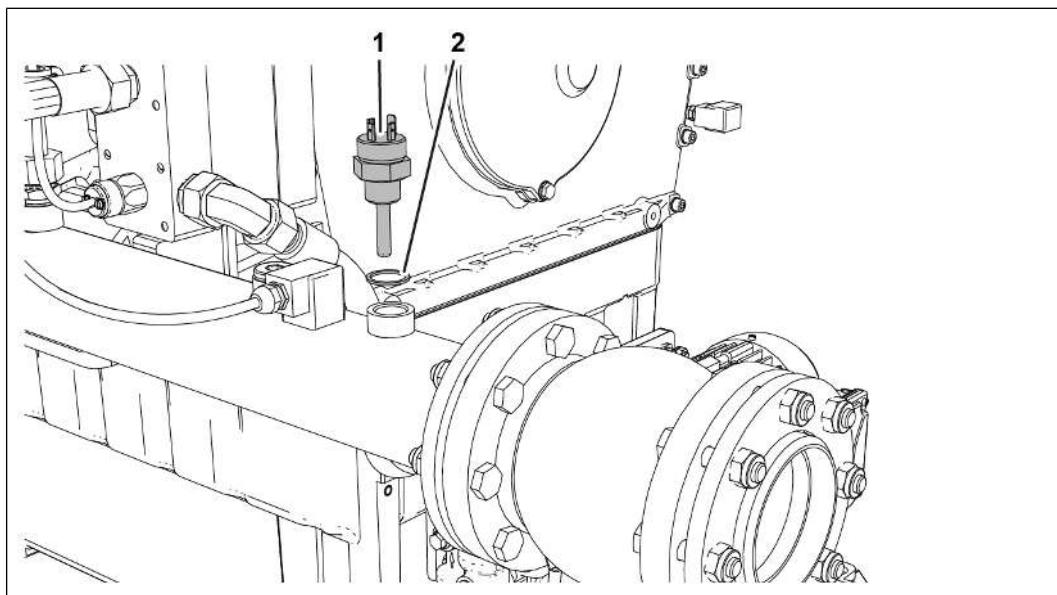
Removing the coolant temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2671778699

1. Dismantle connector (1) from sensor.
2. Place the collecting tray underneath.



2671781131

3. Remove sensor (1).
4. Remove sealing ring (2).

Installing the coolant temperature sensor

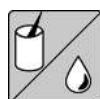
Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



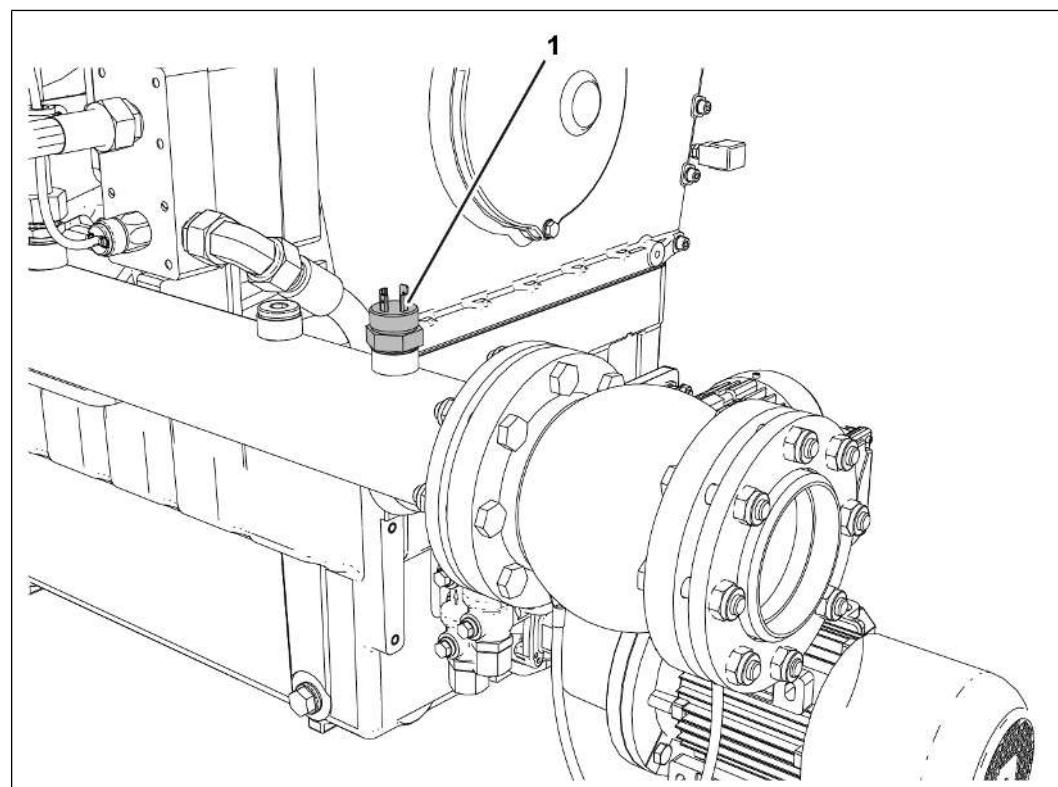
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- If necessary, temperature sensor

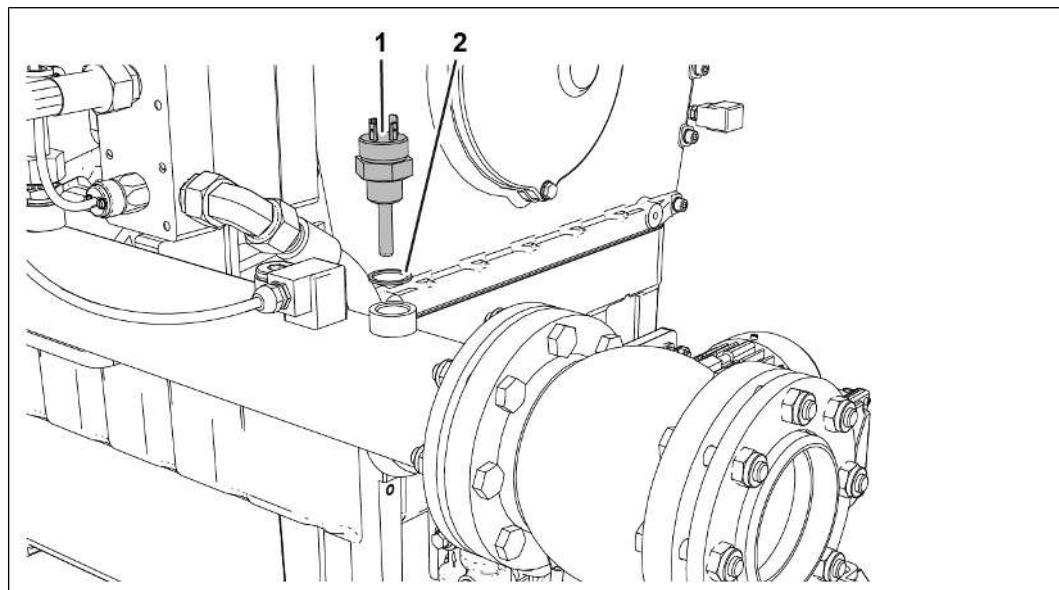
Technical data

2671776267

Coolant temperature sensor on coolant pipe

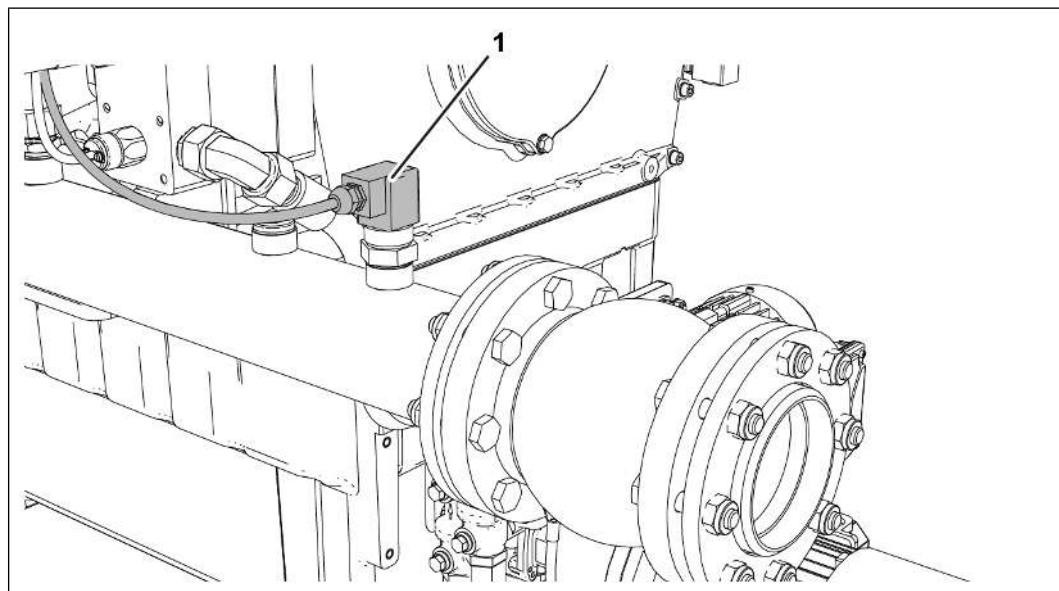
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the coolant temperature sensor:


2671781131

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2671778699

3. Visually inspect the connector (1).
 4. Mount connector (1) on sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Removing and installing the coolant pressure sensor

Removing the coolant pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace any worn or damaged components.
- Replace sealing ring.

CAUTION



Risk of burns from touching hot operating media or hot components

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Allow the operating media or components to cool down to ambient temperature.
-



Danger to the environment

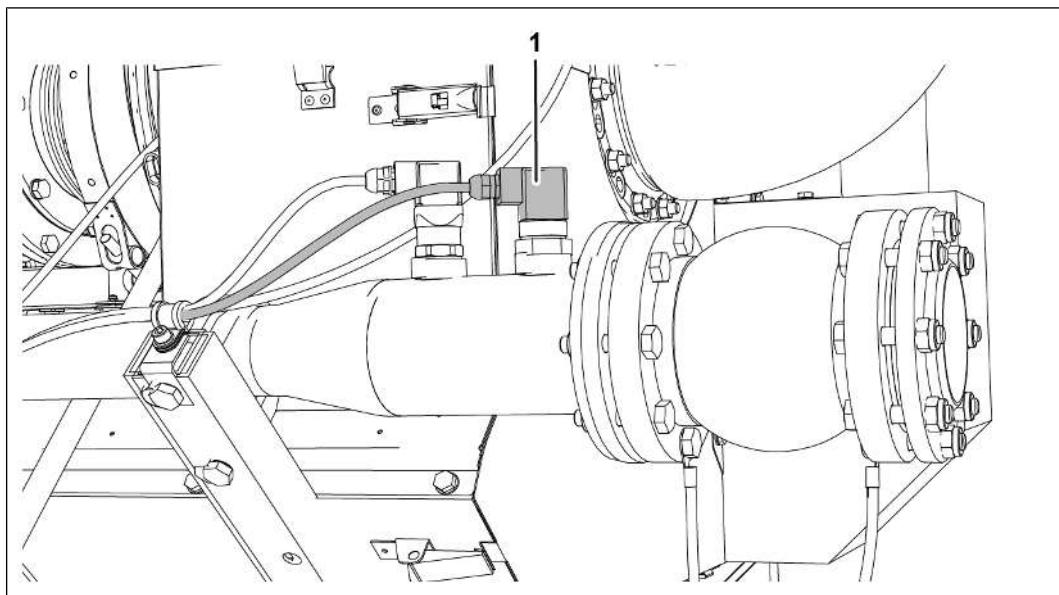
When components or operating media which are transported, stored or disposed of incorrectly.

Contamination of the environment.

- Store operating materials and components so that they do not enter the environment or damage the environment.
 - Collect escaping operating media and soak it up with thickeners if necessary.
 - Always store operating media separately and in tightly sealed tanks intended for those materials.
 - Properly dispose of operating media and components in accordance with national regulations.
-

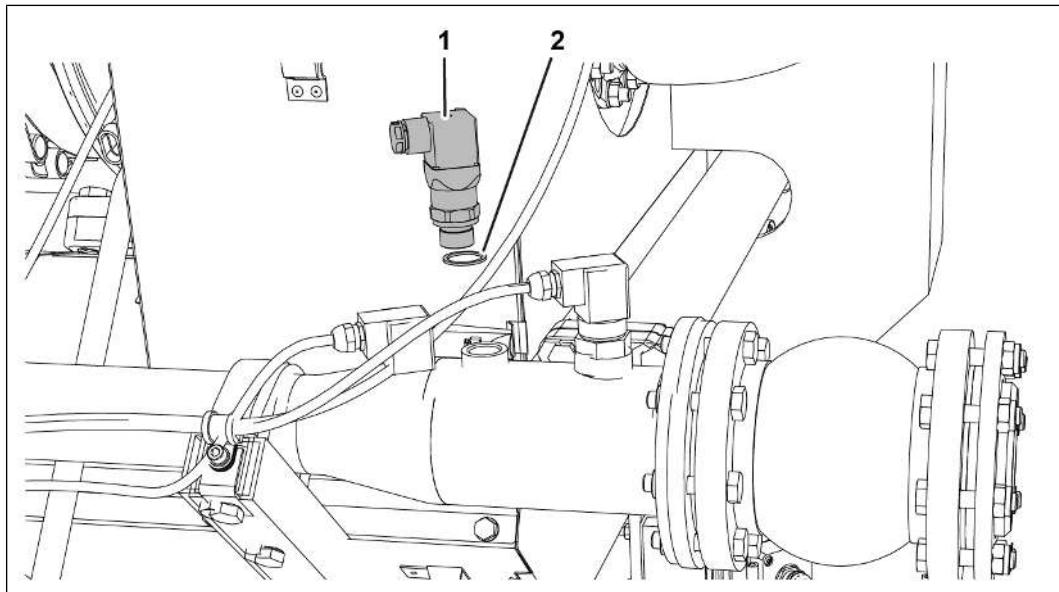
Removing the coolant pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 163]



2671701387

1. Dismantle connector (1) from sensor.



2671703819

2. Place the collecting tray underneath.
3. Remove sensor (1).
4. Remove sealing ring (2).

Installing the coolant pressure sensor

Valid for:

TCG 2020 K, TCG 2020



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



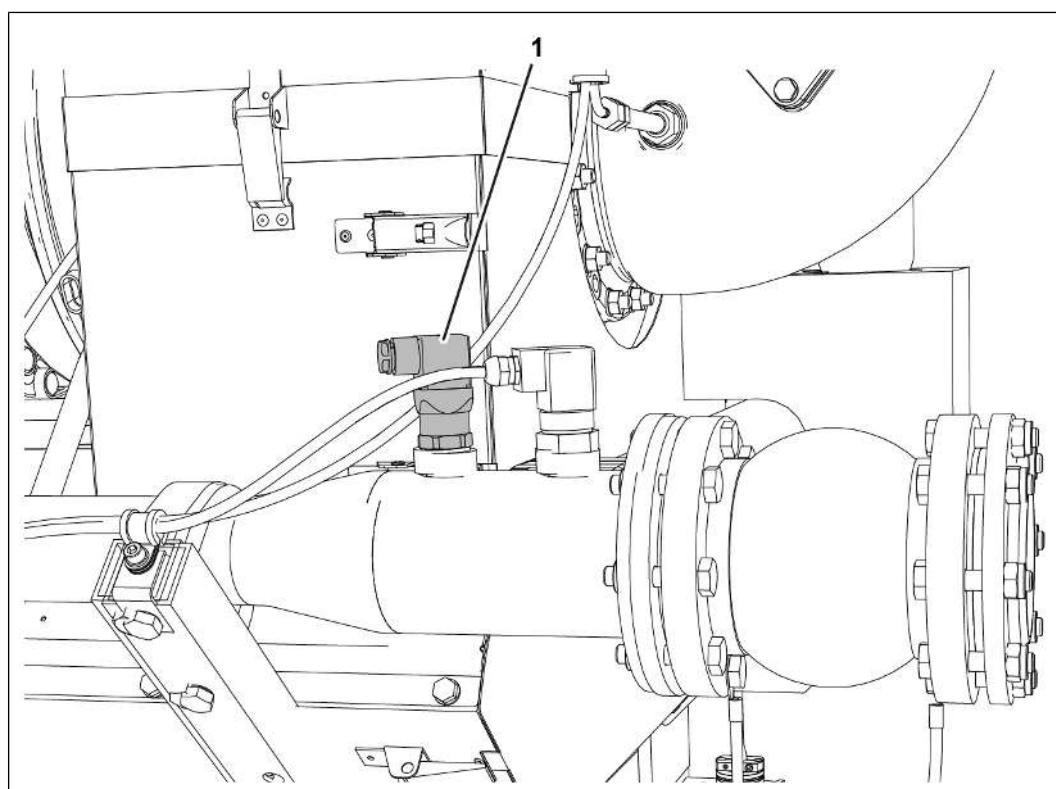
Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

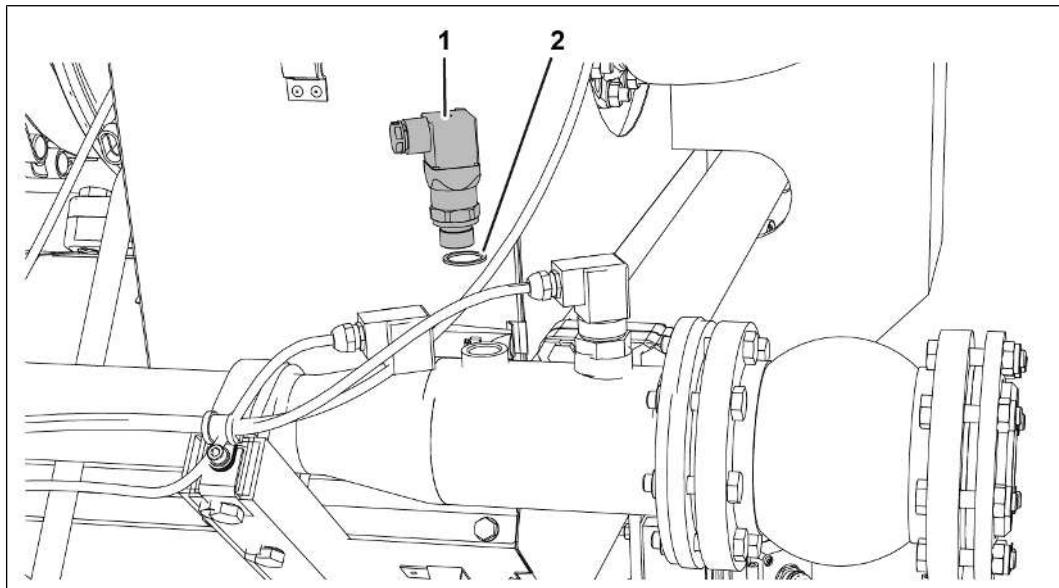
Technical data

2671698955

Coolant pressure sensor on coolant pipe

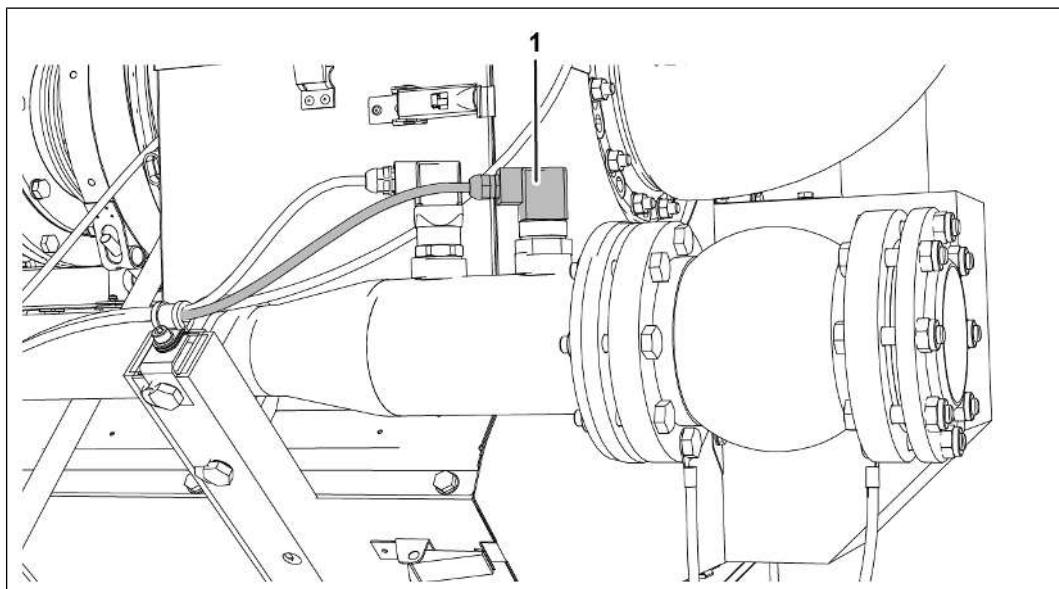
1.	Pressure sensor ¹⁾	G 1/2	20 Nm
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¹⁾ Renew sealing ring.

Installing the coolant pressure sensor:


2671703819

1. Clean components.
2. Insert sensor (1) with new sealing ring (2) and tighten it.



2671701387

3. Visually inspect the connector (1).
 4. Mount connector (1) on sensor.
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

Mounting and dismantling the engine turning gear

Mounting the engine turning gear

Valid for:

TCG 2020, TCG 2020 K, TCG 3020



Tools:

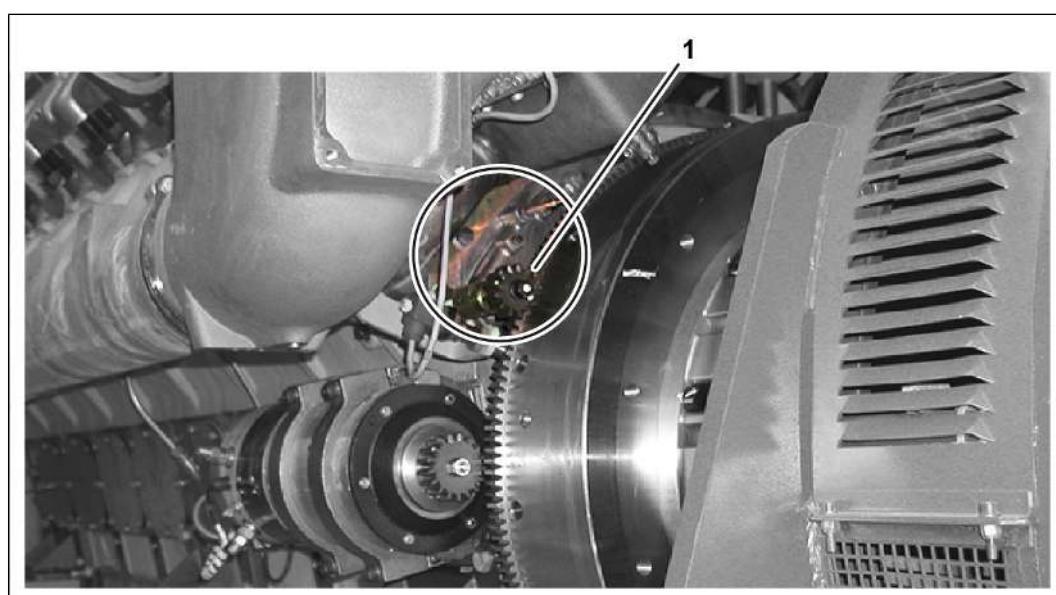
- Standard tools
- Special tool
 - [Engine turning gear 1244 1150 \[▶ 205\]](#)

General information

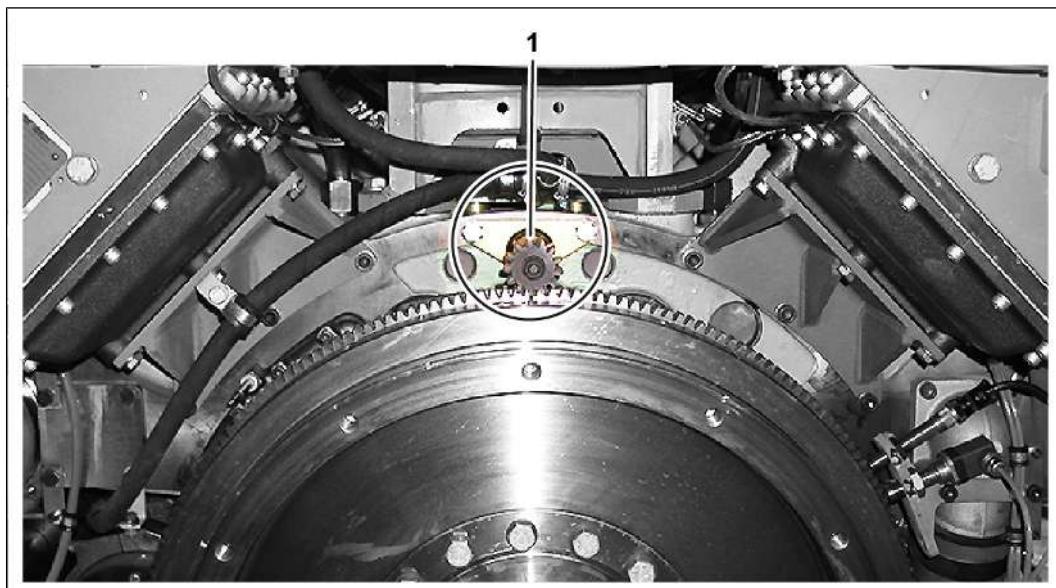
Alternatively, the engine turning rod can also be used for turning.

The installation position of the engine turning gear depends on the number of cylinders.

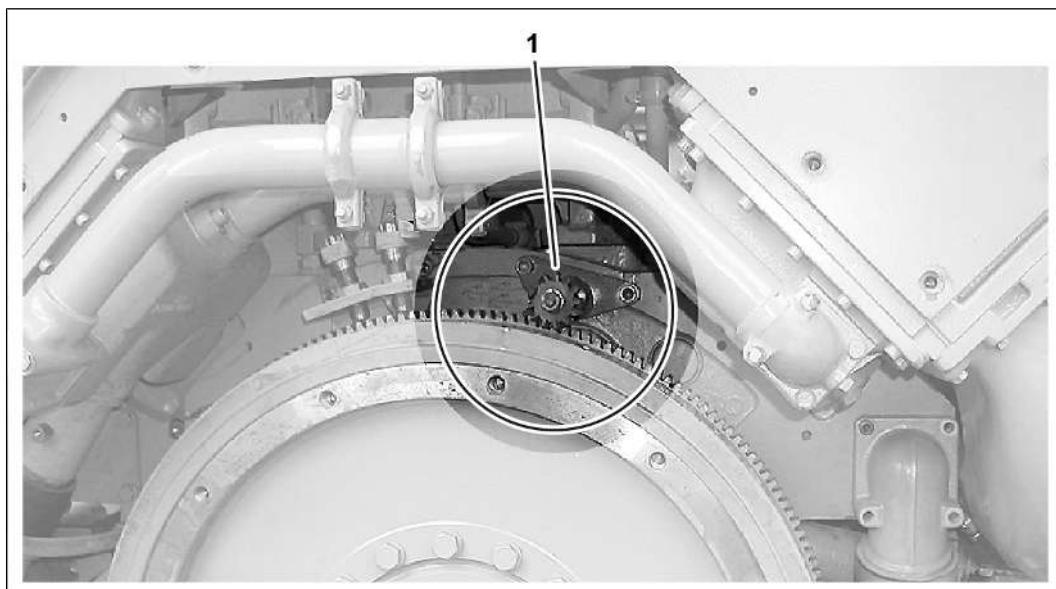
- The different installation situations are described below.



532870411: Variant 1 for mounting the engine turning gear (1)

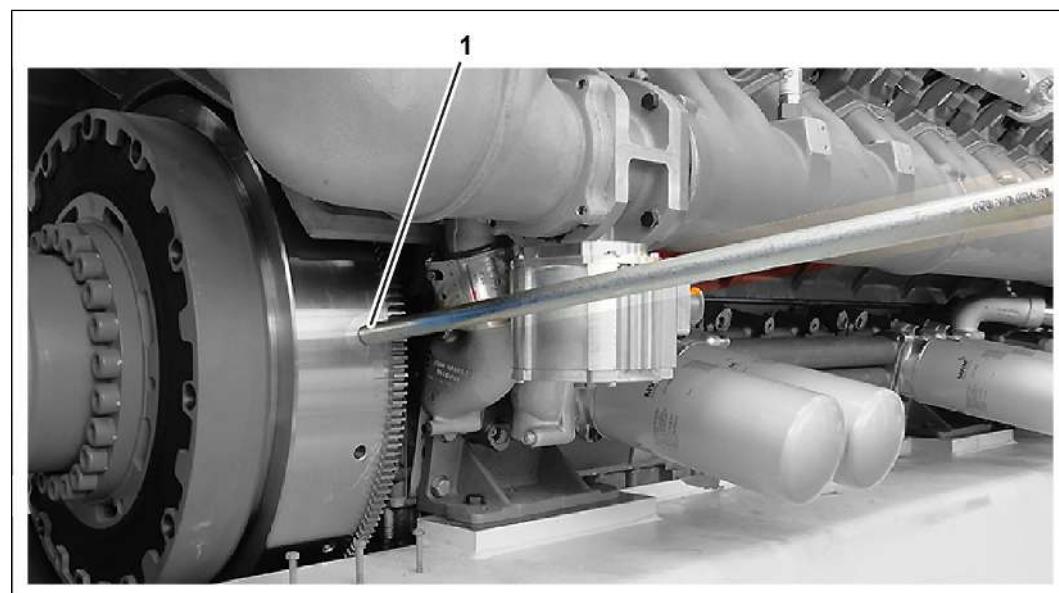


532872843: Variant 2 for mounting the engine turning gear (1)



532875275: Variant 3 for mounting the engine turning gear (1)

The work described was carried out on the basis of the respective installation situation.



532877707: Working with the engine turning rod

NOTE

Working with the engine turning rod

If an engine turning gear is not available, the crankshaft can be turned at the flywheel with the engine turning rod (1).

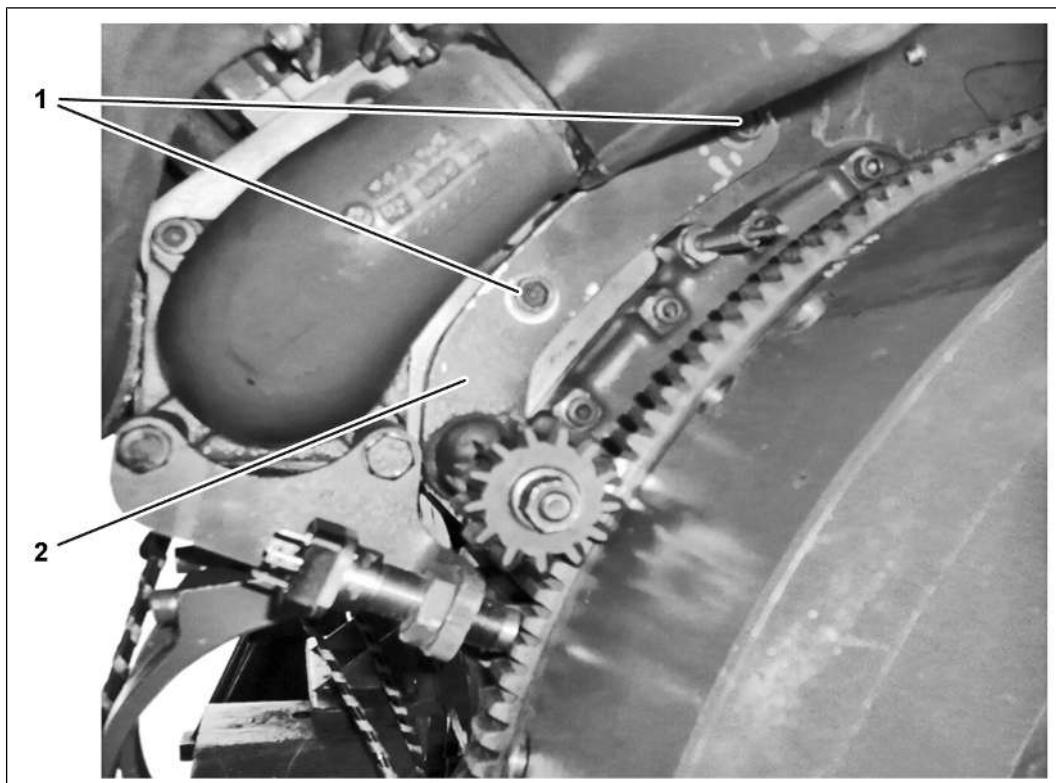
To turn it with the engine turning rod, the terminal box must be loosened and moved in the slotted holes.

Dismantle the protective cladding before turning the crankshaft with the engine turning rod and remove all spark plugs.

- Proceed in the same way for all other installation situations.

Mounting the engine turning gear:

- ✓ All spark plugs are removed, see OL-MRA10 / 26-10-10 [Removing the spark plug \[▶ 442\]](#)
- ✓ The protective cover is dismantled from the flywheel, see OL-MRA10 / 52-90-12 [Dismantling the protective cover \[▶ 573\]](#)



532892939

1. Attach engine turning gear (2).
2. Tighten screws (1).

Working with the engine turning gear

Valid for:

TCG 2020, TCG 2020 K, TCG 3020



Tools:

- Special tool
 - Engine turning gear 1244 1150 [► 205]

General information



Risk of destruction of components

Destruction of components

The engine turning gear and components can be damaged or destroyed due to incorrect turning of the crankshaft.

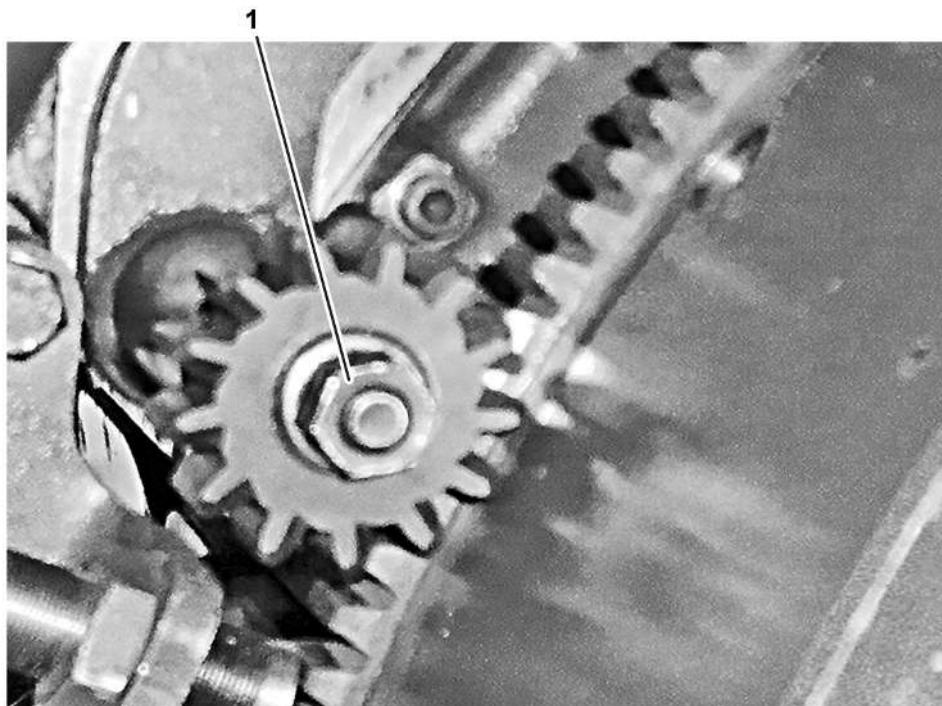
- Only turn the crankshaft in the direction of rotation of the engine.
- Remove all spark plugs before turning.

**DANGER**

From rotating components.

Severe injury or death can result.

- Only perform assembly work when the genset is switched off.
 - Secure against reconnection.
- Only begin assembly when rotating components have come to a complete stop.
- Reattach dismantled protective covers and protective claddings after assembly.

Procedure to follow:

532895371

1. To turn the crankshaft, press in the hexagon screw (1).

NOTE

Warning of property damage

Only ever turn the crankshaft in the direction of rotation of the engine.

2. Turn the hexagon screw (1) until the desired position of the crankshaft is reached.

Dismantle the engine turning gear

Valid for:

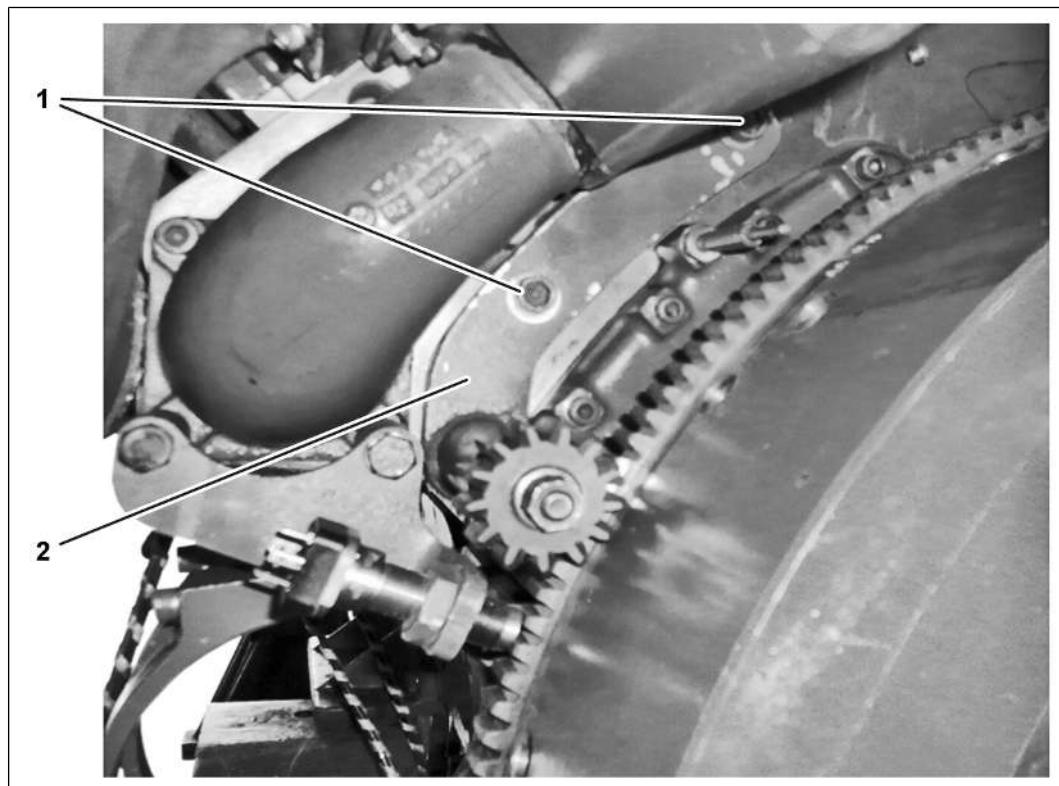
TCG 2020, TCG 2020 K, TCG 3020



Tools:

- Standard tools
- Special tool
 - Engine turning gear 1244 1150 [▶ 205]

Dismantle the engine turning gear:



532892939

1. Unscrew screws (1).
2. Remove engine turning gear (2).
 - ⇒ Mount the protective cover of the flywheel, see OL-MRA10 / 52-90-12 [Mounting the protective cover](#) [▶ 578]
 - ⇒ Install all spark plugs, see OL-MRA10 / 26-10-10 [Installing the spark plug](#) [▶ 445]

Visually inspecting the coupling

Valid for:
TCG 2020 K, TCG 2020



Tools:

- Standard tools



Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

General information

NOTE

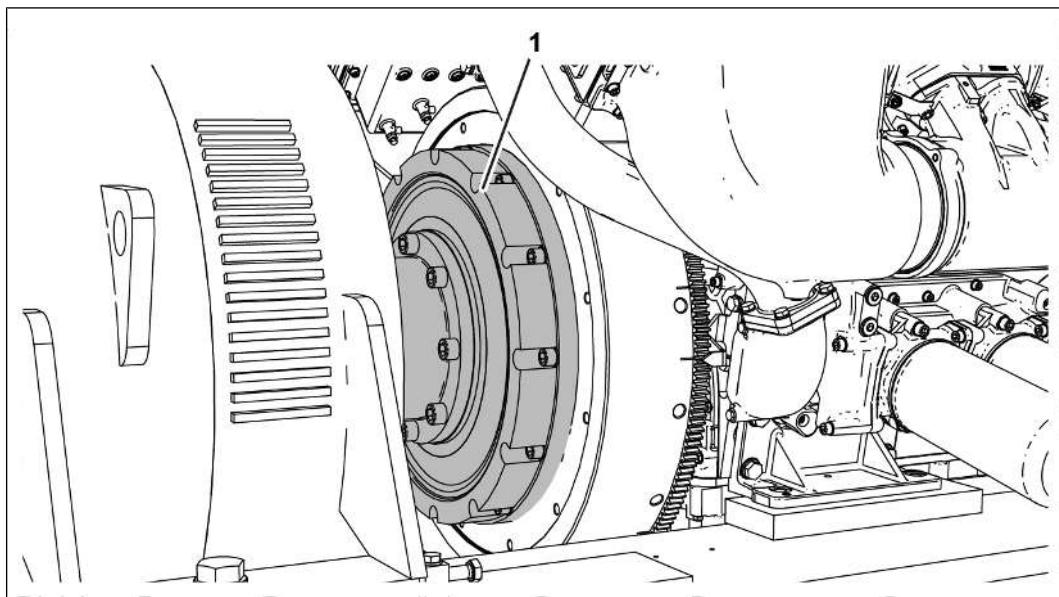
For all the information on checking the elastic coupling, see
Operating manual - Maintenance information - Genset add-on parts - Coupling

All components must be visually inspected.

- Replace worn or damaged components.
- Contact service partner if necessary.

Visually inspecting the coupling:

- ✓ Protective cover dismantled from flywheel, see OL-MRA10 / 52-90-12 [Dismantling the protective cover](#) [▶ 573]



2671894795

1. Clean components.
2. Visually inspect the coupling.
 - Visually inspect the surface for cracks, brittleness, and wear.
 - Visually inspect components for signs of aging and corrosion.
3. Use the color marking on the screws to check whether screw connections have come loose.
 - Tighten loose screw connections. For assistance, contact service partner.
4. Replace worn and damaged components. For assistance, contact service partner.
⇒ Mount protective cover, see OL-MRA10 / 52-90-12 [Mounting the protective cover](#)
[▶ 578]

Dismantling and mounting the protective cover (flywheel)

Dismantling the protective cover

Valid for:

TCG 2020, TCG 2020 K



Tools:

- Standard tools

General information

Do not individually exchange the captive screws.

- If a captive screw is damaged, the component must be renewed including the captive screws.

CAUTION



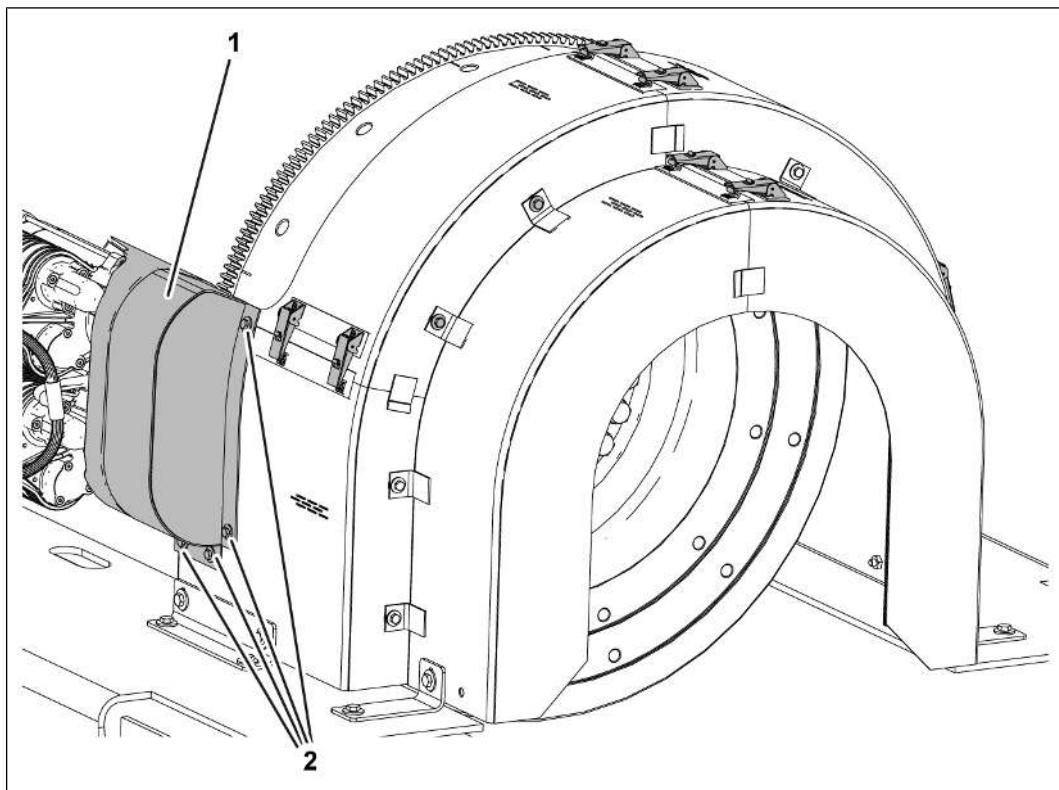
Injury when touching sharp edges

This can lead to minor or severe injuries.

- Wear personal protective equipment.
 - Handle sharp-edged components carefully.
-

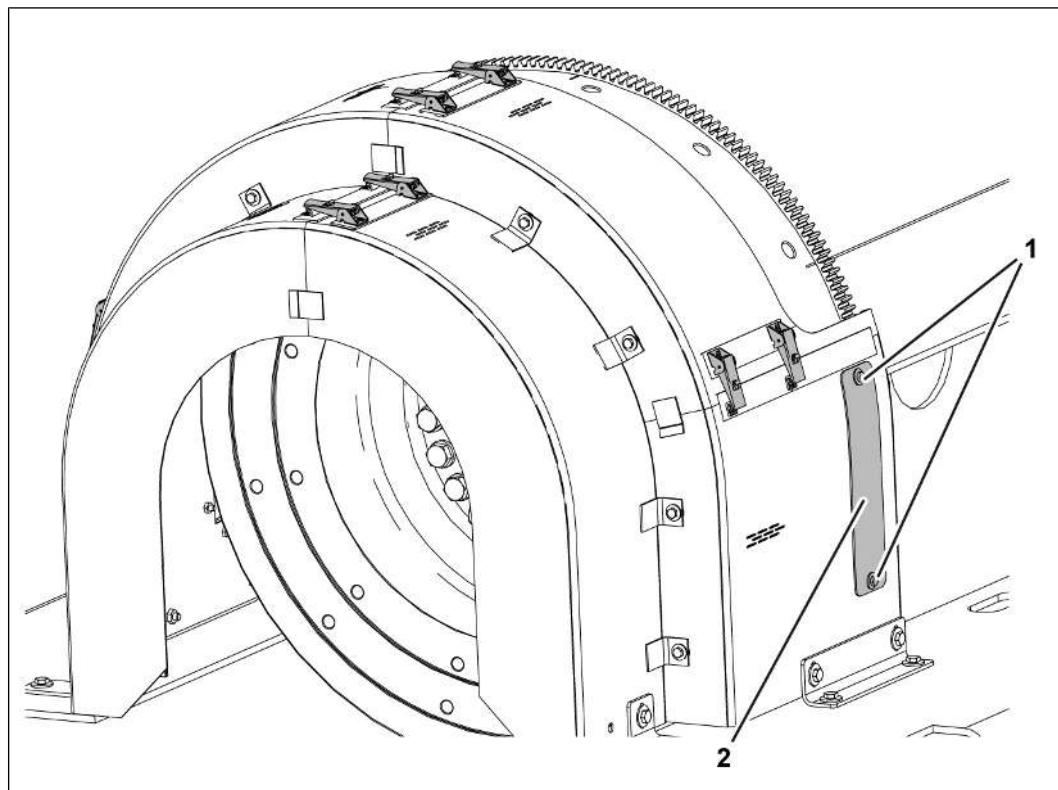
Dismantling the protective cover:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 163\]](#)



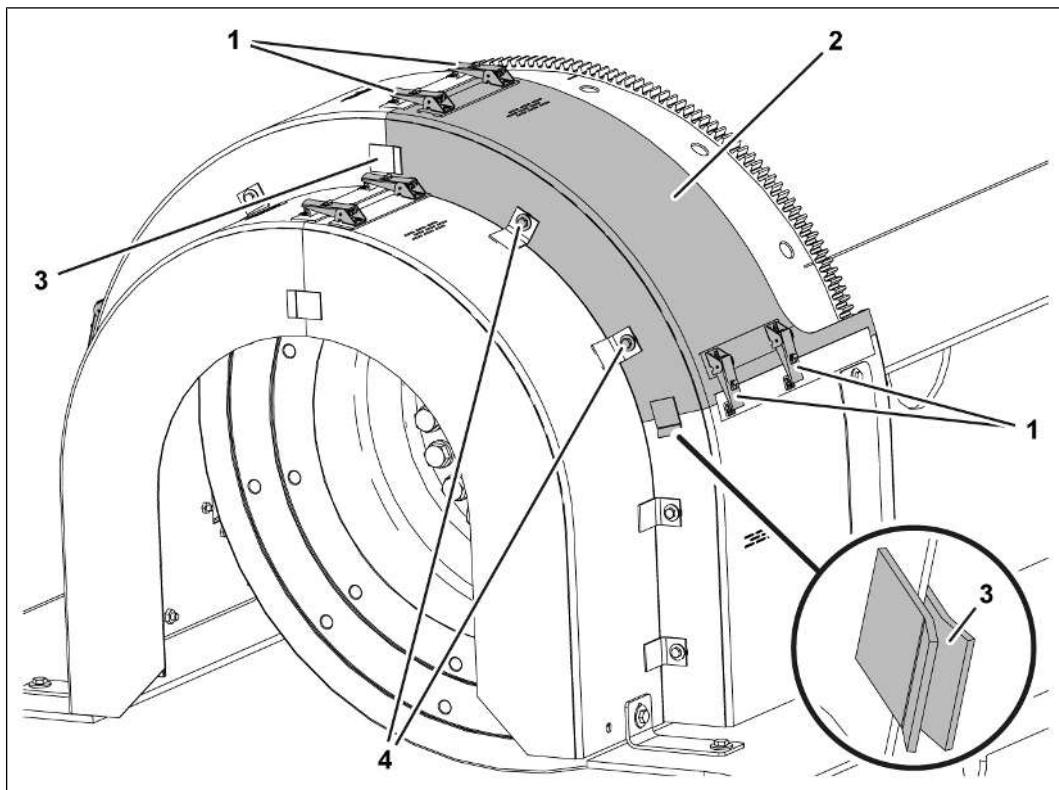
2672624395

1. Dismantle starter pinion guard cover (1).
 - Unscrew screw connections (2).
 - Remove starter pinion guard cover.



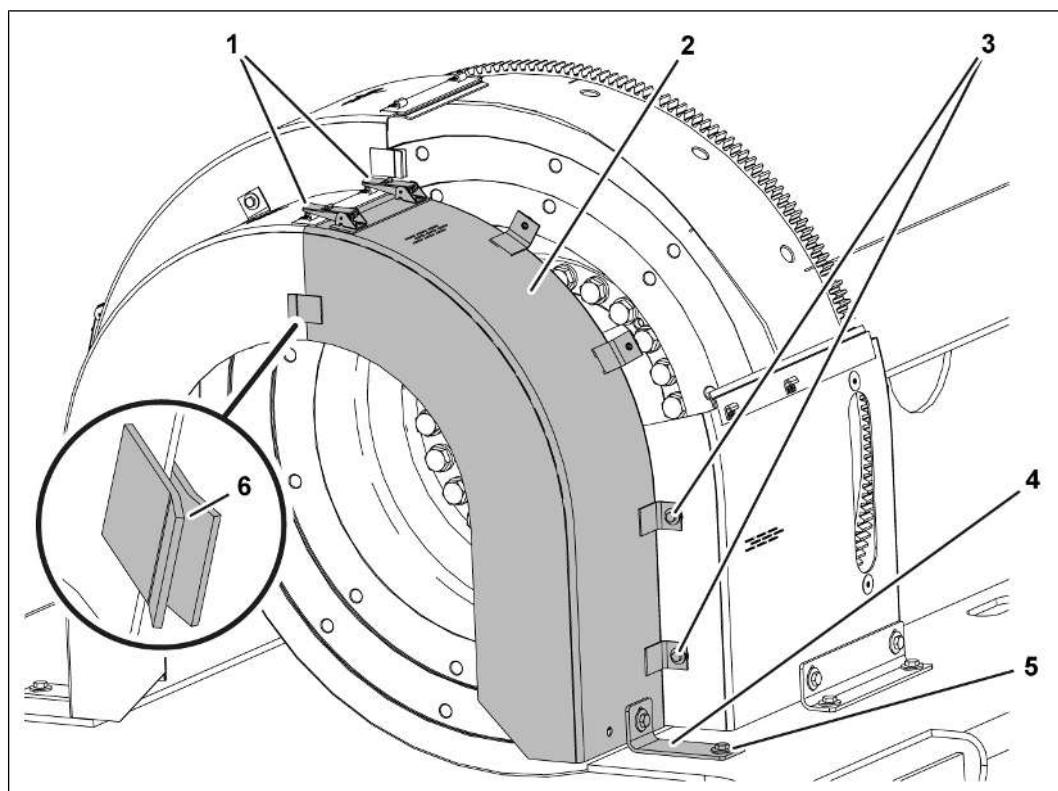
2672626827

2. Dismantle engine turning rod cover (2).
 - Unscrew screw connections (1).
 - Remove the engine turning rod cover.



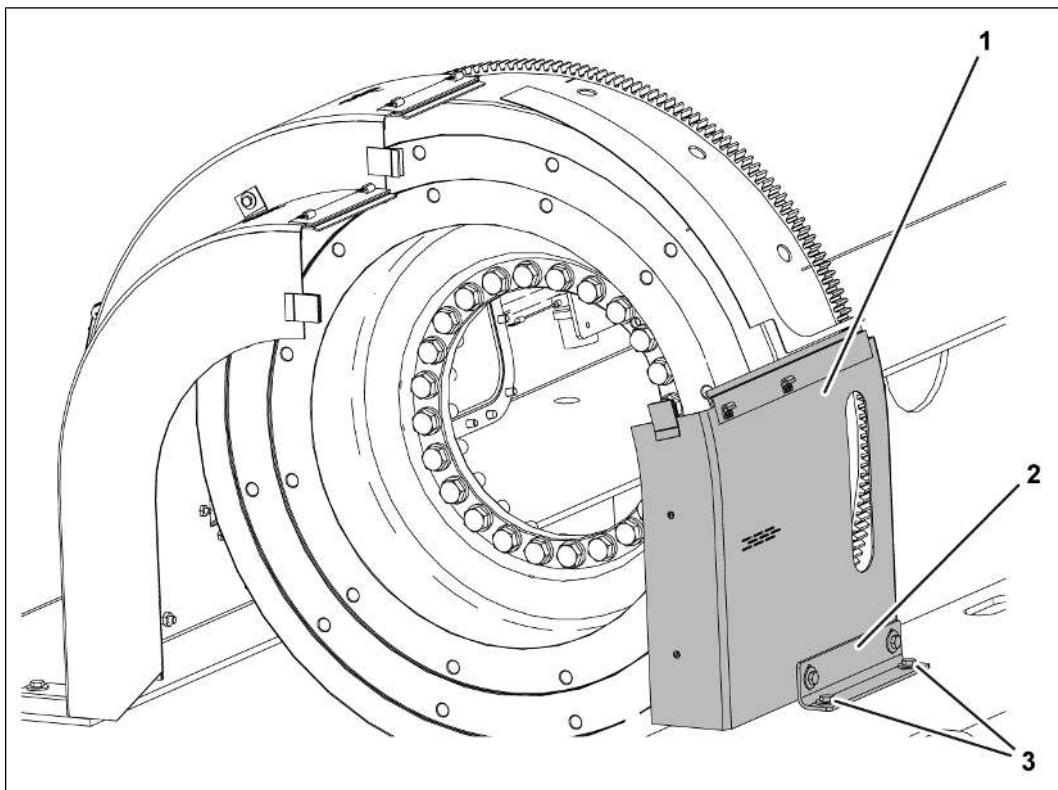
2672629259

3. Dismantle the upper flywheel guard cover (2).
 - Open clamping clips (1).
 - Unscrew screw connections (4).
 - Pull out the flywheel guard cover from the guides (3) and remove.
 - Proceed in the same way on the opposite side.



2672631691

4. Dismantle the front flywheel guard cover (2).
 - Open all clamping clips (1).
 - Unscrew screw connections (3).
 - Unscrew the screw connection (5) from the bracket (4).
 - Pull the flywheel guard cover out of the guide (6) and remove.
 - Proceed in the same way on the opposite side.



2672774923

5. Dismantle the lower flywheel guard cover (1).
 - Unscrew screw connections (3) on the rail (2).
 - Remove the flywheel guard cover.
 - Proceed in the same way on the opposite side.

Mounting the protective cover

Valid for:
TCG 2020, TCG 2020 K



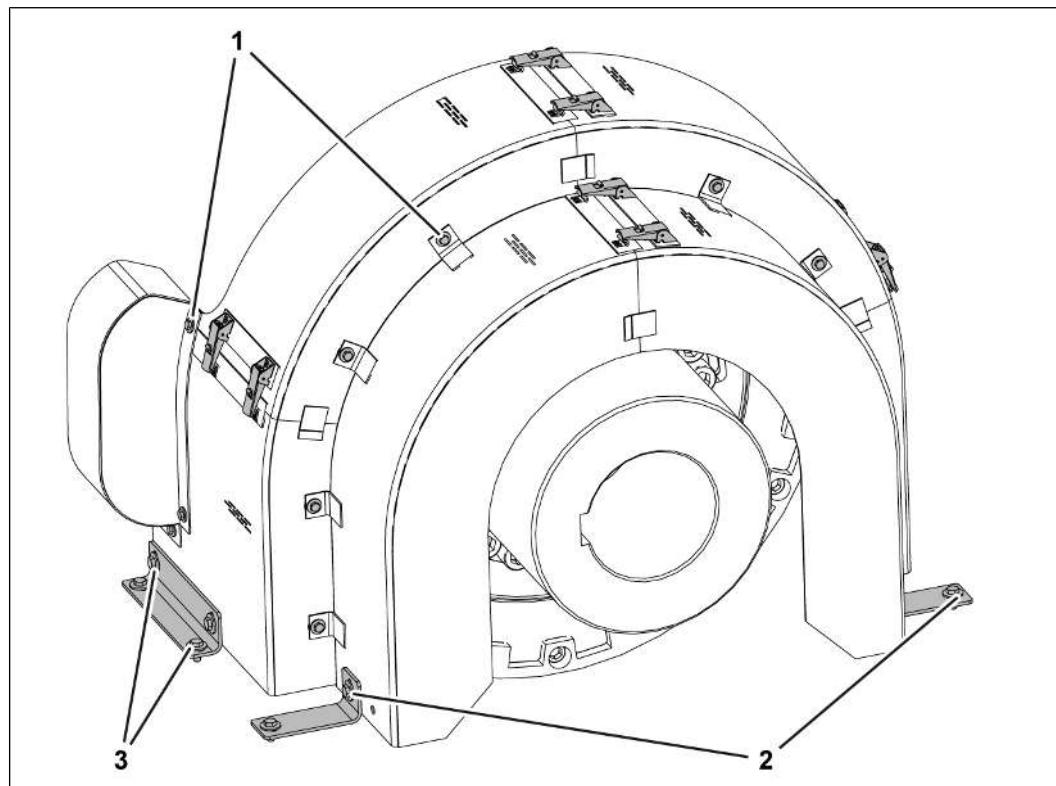
Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 203\]](#)



Auxiliary media:

- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)

Technical data

2672621963

Protective cover assembly			
1.	Screw	M6 x 16 - 8.8	10 Nm
2.	Screw	M8 x 20 - A4 - 70	10 Nm
Holder protective cover on base frame			
3.	Screw	M8 x 20 - A4 - 70	10 Nm

General information

Do not individually exchange the captive screws.

- If a captive screw is damaged, the component must be renewed including the captive screws.

**CAUTION**

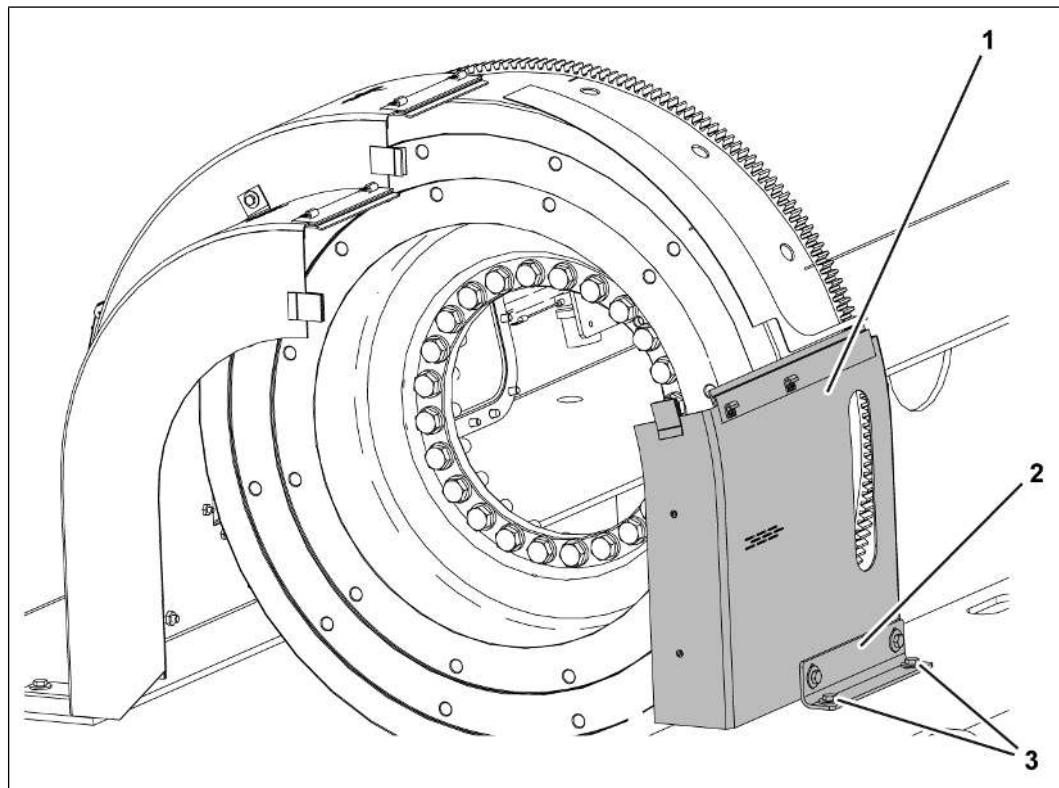
Injury when touching sharp edges

This can lead to minor or severe injuries.

- Wear personal protective equipment.
- Handle sharp-edged components carefully.

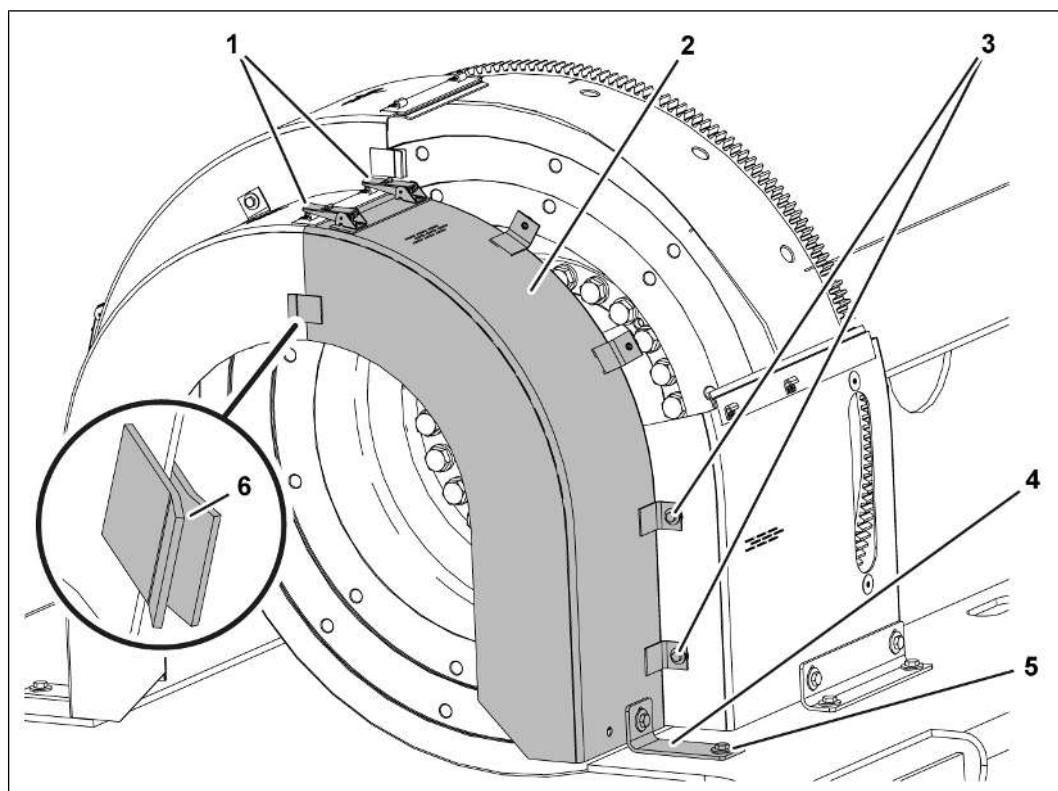
Mounting the protective cover:

1. Clean and visually inspect all components.



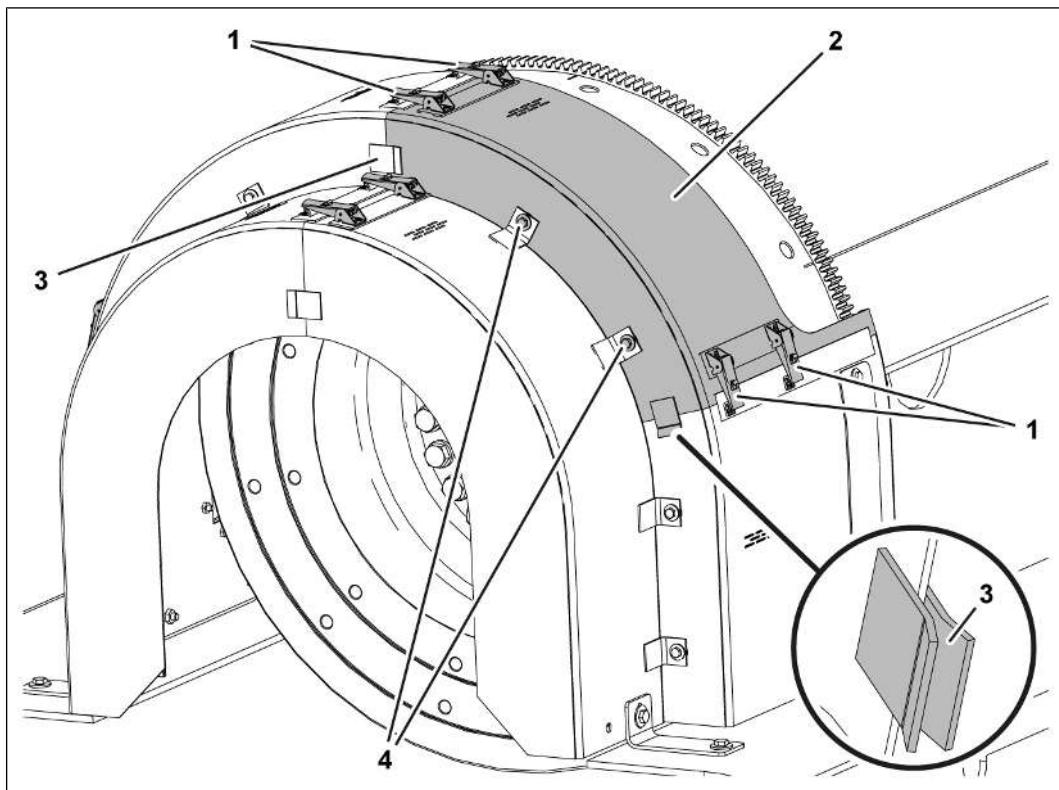
2672774923

2. Mount the lower flywheel guard cover (1).
 - Attach flywheel guard cover.
 - Tighten screw connections (3) on the rail (2).
 - Proceed in the same way on the opposite side.



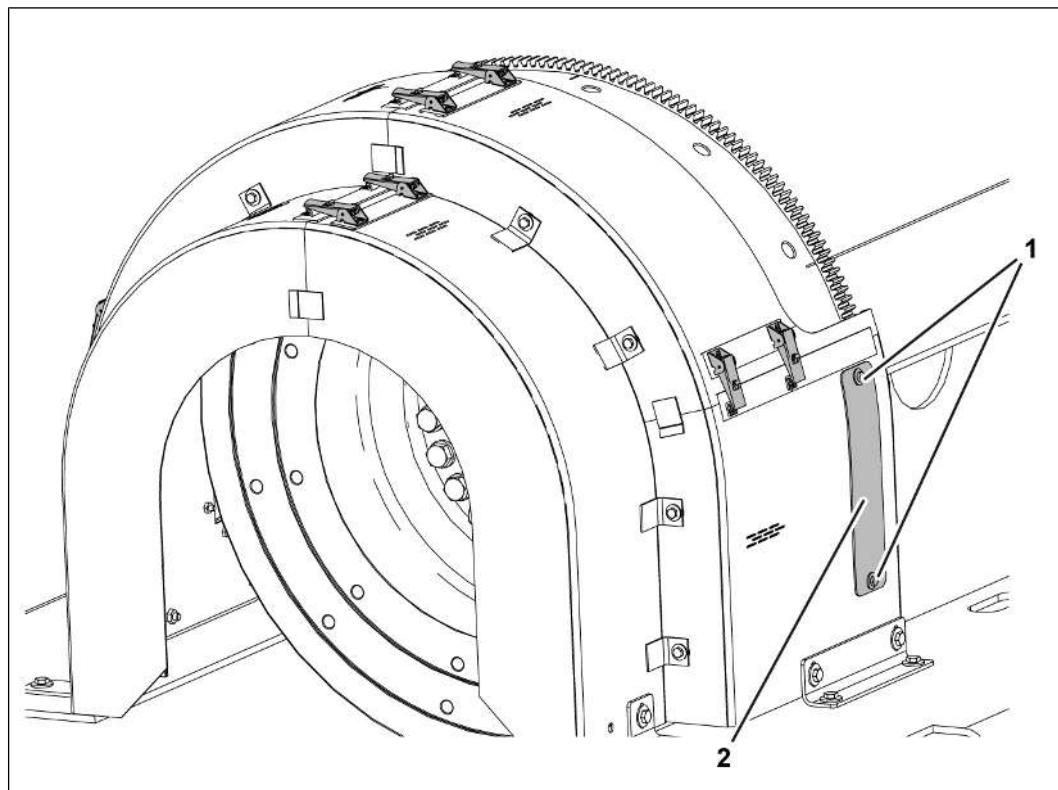
2672631691

3. Mount the front flywheel guard cover (2).
 - Position the flywheel guard cover in the guide (6).
 - Tighten the screw connections (3).
 - Tighten the screw connection (5) on the bracket (4).
 - Close all clamping clips (1).
 - Proceed in the same way on the opposite side.



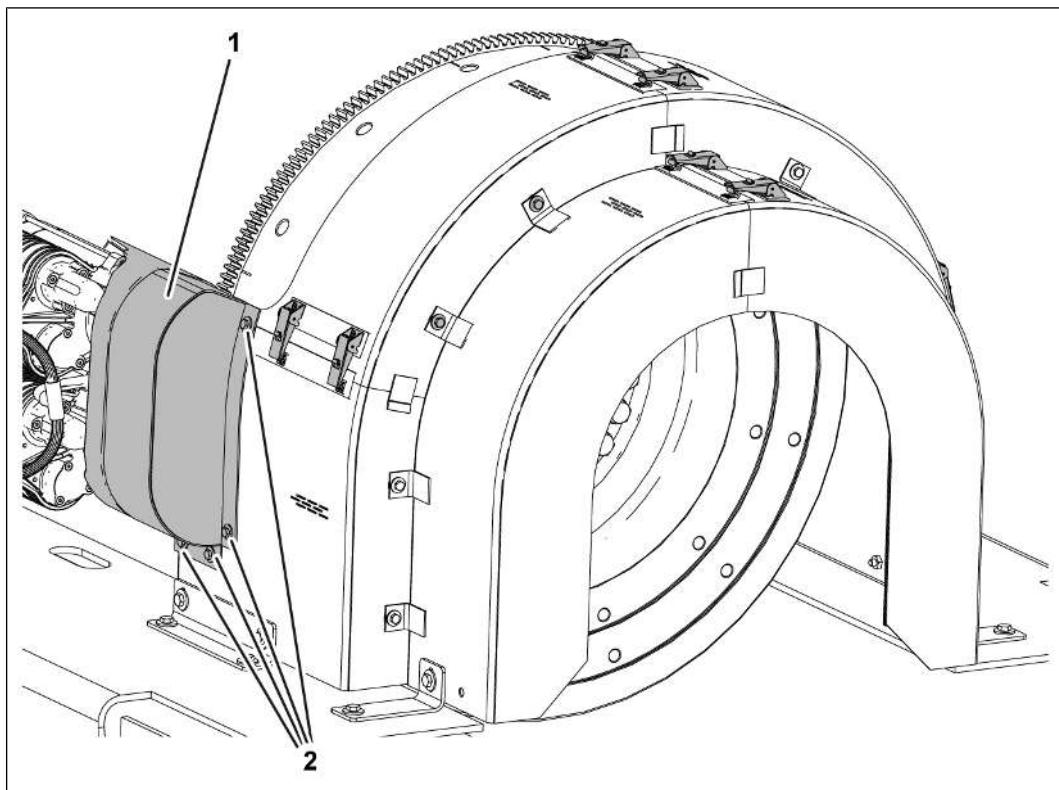
2672629259

4. Mount the upper flywheel guard cover (2).
 - Position the flywheel guard cover in the guides (3).
 - Tighten the screw connections (4).
 - Close clamping clips (1).
 - Proceed in the same way on the opposite side.



2672626827

5. Mount the engine turning rod cover (2).
 - Attach the engine turning rod cover.
 - Tighten the screw connections (1).



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6. Mount the starter pinion guard cover (1).
 - Attach the starter pinion guard cover.
 - Tighten the screw connections (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 136](#)

13 Dismantling and disposal

13.1 Genset

13.1.1 Dismantling the genset



Tools:

- Crane
- Load securing devices
- Standard tools

Description

If the genset has reached the end of life, disassemble the genset and dispose of it in an environmentally sound manner.



Danger to the environment

Improper dismantling of the genset may cause environmental damage.

- When dismantling the genset, adhere to all the national and regional environmental protection regulations.
- Ensure that the auxiliary media and operating media do not leak.
- Drain off, collect, and dispose of the auxiliary media and operating media properly.
- Sort the reusable materials (e.g. plastics, metals) and recycle them.
- If necessary, commission a designated and certified specialist company to do this.

Procedure to follow:

- ✓ The genset has reached its end of life.
1. Shut down the genset and secure it against restarting
 2. Physically separate the complete energy supply from the genset and discharge the saved residual energies
 3. Remove the operating and auxiliary media as well as the residual processing material and dispose of it in an environmentally sound manner
 4. Dismantle the genset

13.1.2 Disposing of the genset



Tools:

- Standard tools
- Welding device for cutting and welding work

Description

Unless a return agreement or disposal agreement was concluded, recycle the disassembled genset components.

The local authority or specialist companies for disposal shall provide information on environmentally sound removal.



Danger to the environment

Incorrect disposal of components and operating media may cause environmental damage.

- Electronic scrap, electronic components, lubricants and other auxiliary media are subject to the treatment of special refuse
- Electronic scrap, electronic components, lubricants and other auxiliary media may be disposed of only by designated and certified specialist companies

Procedure:

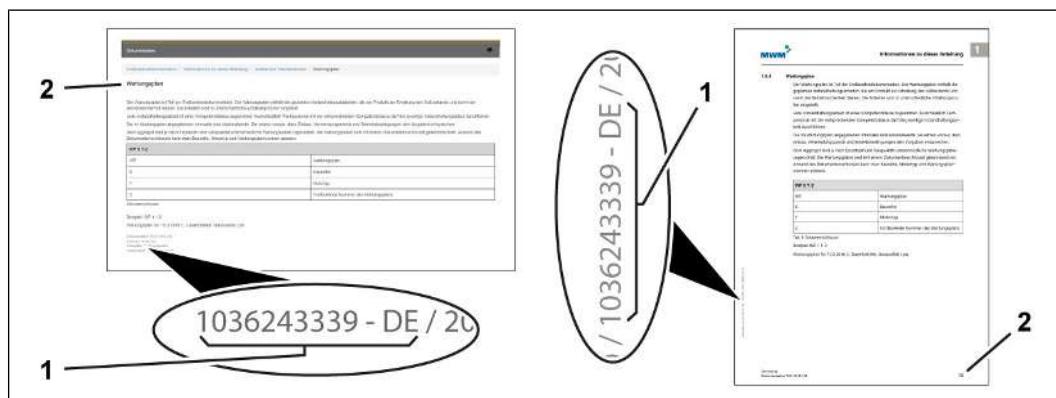
1. Scrap metals
2. Recycle plastic elements
3. Sort the remaining components as per the material properties and dispose of them properly

14 Feedback on documentation

Do you have any praise, criticism or suggestions for improvement for this document?

Send an e-mail to techred@mwm.net.

Describe your request as precisely as possible. So that we can categorize your feedback, please also provide the following information:



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- Page title or page number (2)
- Contact data (name, email) for potential further enquiries

Thank you for your support. We read all feedback carefully.

We look forward to hearing from you!

Glossary

AKC

Antiklopfregelung

BL

BOP Specialist Level: Kompetenzlevel, das eine Person dazu befähigt, solche Bauteile und Baugruppen von Caterpillar-Energy-Solutions-Produkten zu montieren, zu inspizieren, zu warten und instand zu setzen, die wegen ihrer Komplexität oder wegen ihres Gefahrenpotentials Spezialkenntnisse des Herstellers erfordern oder die eine spezielle Erfahrung und Qualifikation erfordern.

CL

Kompetenzklasse: Wissen und Können, das eine Person besitzt und das diese Person dazu befähigt, bestimmte Tätigkeiten im Zusammenhang mit der bestimmungsgemäßen Verwendung von CES-Produkten auszuführen.

HT

Hochtemperatur

LT

Niedertemperatur

ML

Maintenance Level: Kompetenzlevel, das eine Person dazu befähigt, bestimmte Bauteile und Baugruppen von Caterpillar-Energy-Solutions-Produkten zu montieren, zu inspizieren, zu warten, instand zu setzen und anschließend wieder in Betrieb zu nehmen.

OL

Operator Level: Kompetenzlevel, das eine Person dazu befähigt, eine Energieversorgungsanlage von Caterpillar Energy Solutions zu steuern und zu überwachen.

SL

Service Level: Kompetenzlevel, das eine Person dazu befähigt, alle Bauteile und Baugruppen von Caterpillar-Energy-Solutions-Produkten zu montieren, zu inspizieren, zu warten, instand zu setzen und anschließend wieder in Betrieb zu nehmen, für die Caterpillar Energy Solutions eine Instandhaltung vorsieht.

TDC

oberer Totpunkt

TR

Technisches Rundschreiben