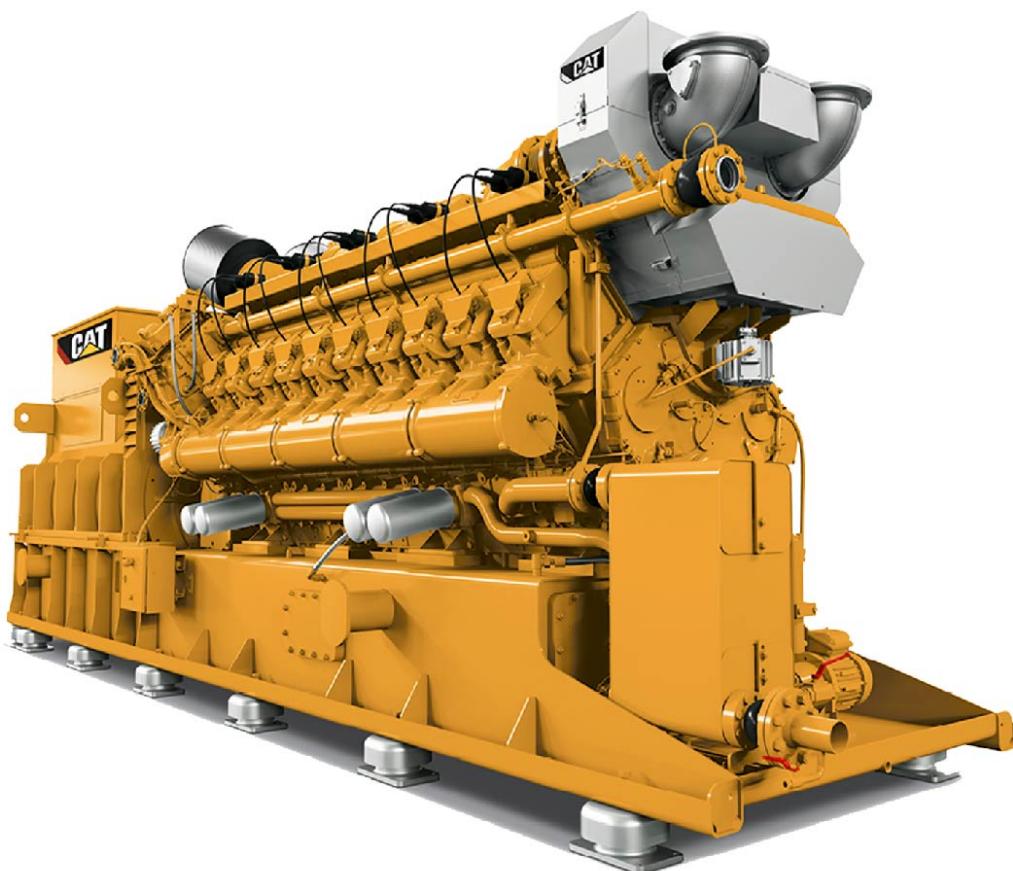




Genset

**CG170B
valid from TPEM 1.7
Operating manual
2024-07, 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.

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Contents

1	Release Notes	7
2	Safety information	9
2.1	General safety notes.....	9
2.2	Information on operating media.....	9
3	Technical data	11
3.1	Genset product data	12
3.2	Technical data	12
4	Structure and function	49
4.1	Genset	49
4.2	Engine.....	51
4.3	Generator.....	95
4.4	Transmission	96
4.5	Base frame	98
4.6	Coupling.....	99
4.7	Crankcase ventilation	100
4.8	Anti-vibration mounting	101
5	Transport and storage.....	103
5.1	Genset	103
6	Assembly	105
6.1	Genset	105
6.2	Fuel gas system.....	107
6.3	Intake air system.....	109
6.4	Exhaust system	110
6.5	Lube oil system.....	111
6.6	Cooling system	113



Contents

6.7	TPEM Connection Box	114
7	Commissioning	115
7.1	Genset	115
7.2	TPEM Connection Box	127
8	Operation	129
8.1	Genset	129
8.2	Generator	137
8.3	Transmission	139
8.4	TPEM	147
8.5	TPEM Connection Box	149
9	Decommissioning	151
9.1	Genset	151
10	Troubleshooting	161
10.1	Exhaust system	161
10.2	Genset	161
10.3	Intake air system	162
10.4	Mixture system	162
10.5	Generator	163
10.6	Transmission	164
10.7	Cooling system	166
10.8	Coupling	167
10.9	Engine	167
11	Maintenance	173
11.1	Genset	174
11.2	Coupling	178
11.3	Transmission	180



11.4	Tools	183
12	Work instructions	191
13	Dismantling and disposal	535
13.1	Genset	535
14	Feedback on documentation	537
	Glossary	538

1 Release Notes

OL-MRA10 / 43-12-12	Dismantling and mounting the exhaust turbocharger cover [▶ 451]	New work instructions
Special tool	As link in the work instructions	New
OL-MRA10 / 52-10-03	Visually inspecting the coupling [▶ 520]	Changed work instructions
OL-MRA10 / 26-03-37	Setting the global ignition angle [▶ 414]	New work instructions
Chapter/Operation	Notes on operation with hydrogen [▶ 135]	New description
Chapter Operation (transmission GU360)	Operation [▶ 139]	Description
Functional description (transmission GU360)	Functional description [▶ 96]	Description
Fault table (transmission GU360)	Fault table [▶ 164]	Description
OL-MRA10 / 03-01-01	Checking the lube oil (transmission) [▶ 361]	New work instructions
OL-MRA10 / 03-03-01	Checking the lube oil level (transmission) [▶ 370]	New work instructions
OL-MRA10 / 03-01-27	Replenishing the lube oil (transmission) [▶ 362]	New work instructions
OL-MRA10 / 03-01-22	Performing lube oil change (transmission) [▶ 365]	New work instructions
OL-MRA10 / 03-05-10	Removing and installing the lube oil filter (transmission) [▶ 371]	New work instructions
OL-MRA10 / 03-05-80	Cleaning the lube oil filter (transmission) [▶ 374]	New work instructions
OL-MRA10 / 03-10-28	Purging the transmission [▶ 376]	New work instructions

OL-MRA10 / 03-19-12	Dismantling and mounting the protective cover (generator) [▶ 383]	New work instructions
Functional description (transmission GU360)	Functional description [▶ 96]	Description
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

3.1	Genset product data	12
3.2	Technical data.....	12
3.2.1	Genset	12
3.2.2	Pressure sensor.....	14
3.2.3	Generator.....	19
3.2.4	Transmission	21
3.2.5	Base frame	26
3.2.6	Rubber expansion joint.....	27
3.2.7	Cooling system	28
3.2.8	Crankcase.....	29
3.2.9	Crankcase ventilation	29
3.2.10	Engine.....	31
3.2.11	Lube oil filter	35
3.2.12	Lube oil system.....	36
3.2.13	Flywheel.....	36
3.2.14	Temperature sensor	37
3.2.15	Anti-vibration mounting (elastic support)	43
3.2.16	Spark plug.....	45
3.2.17	Cylinder head.....	46

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



18014399084778507

- 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 union nuts

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

3.2.1.3 Tightening specifications for metric coarse pitch thread

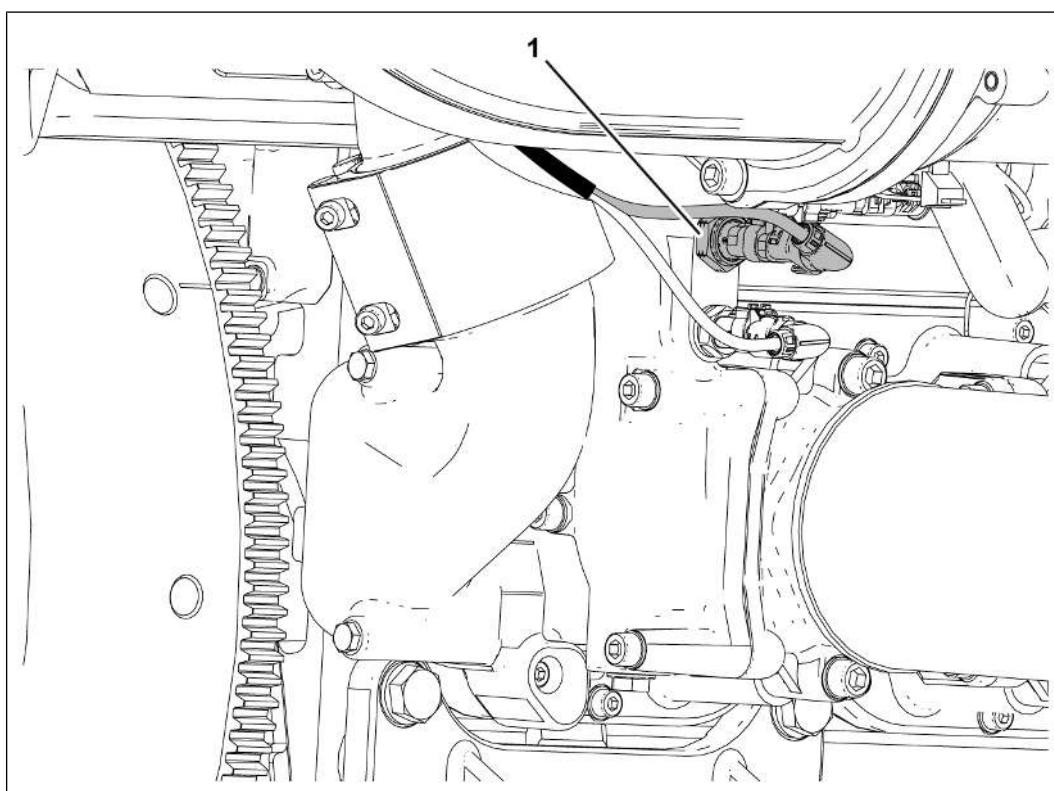
The following table is valid for all screw connections for which component-specific torque data have not been specified.

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

Standard metric thread*	Torque for each strength class		
	8.8	10.9	12.9
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.			

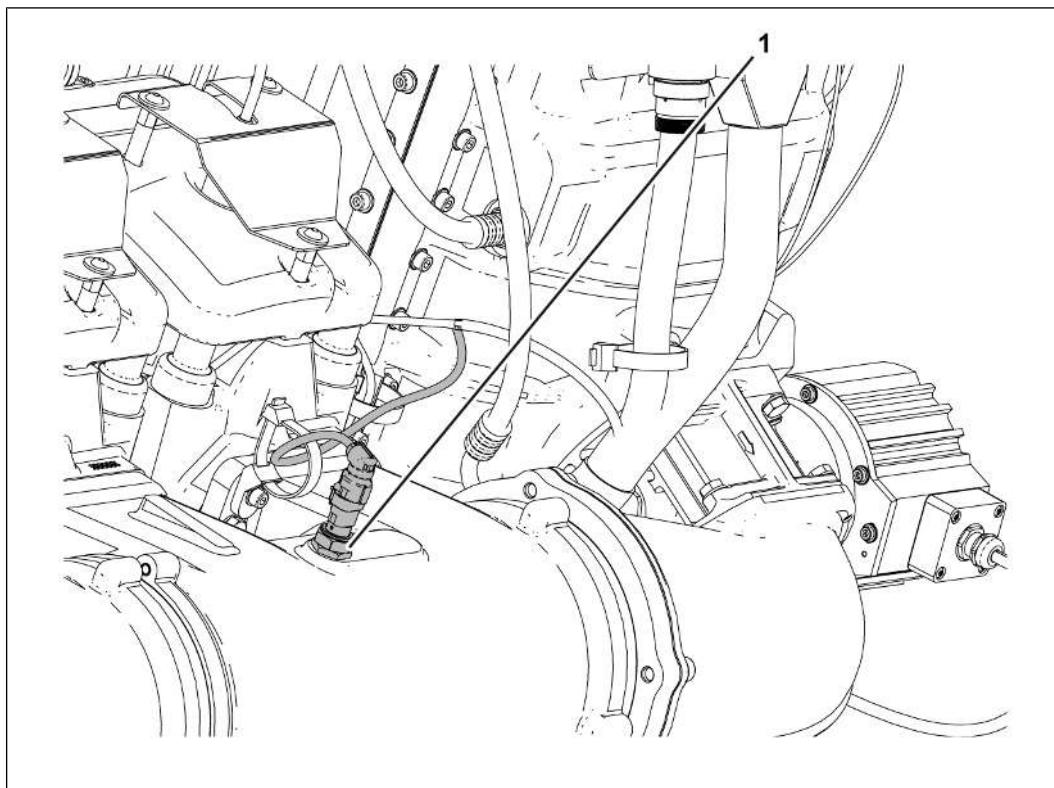
3.2.2 Pressure sensor

3.2.2.1 Technical data



537412619

Lube oil pressure sensor on lube oil pipe			
1	Pressure sensor ¹⁾	M12 x 1.5	10 Nm
¹⁾ Replace sealing ring.			

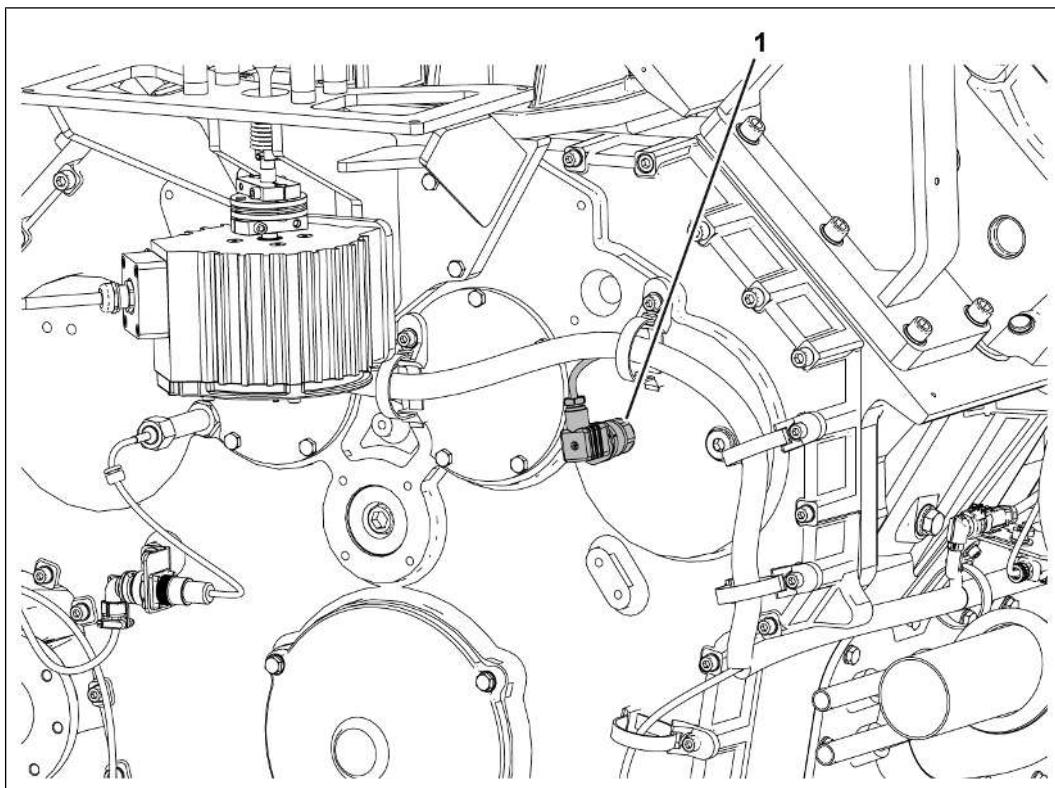


538012683

Mixture pressure sensor on mixture pipe

1	Pressure sensor ¹⁾	M14 x 1.5	10 Nm
---	-------------------------------	-----------	-------

¹⁾ Replace sealing ring.

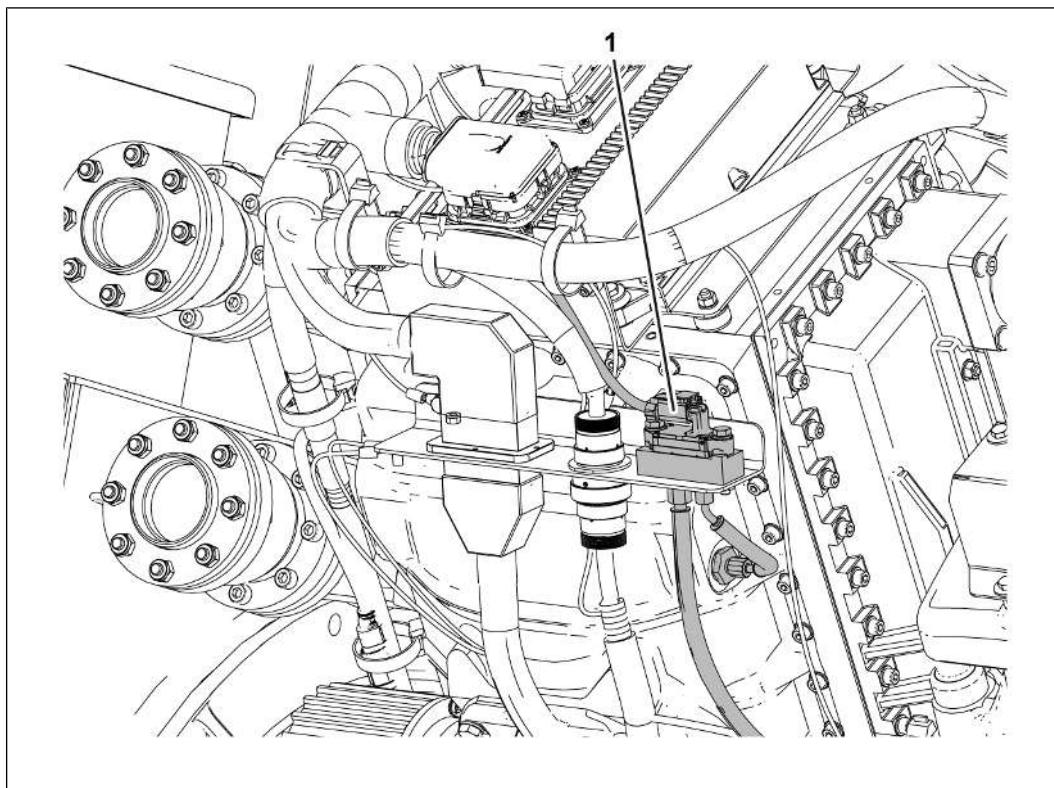


538139915

Crankcase pressure sensor on timing gear cover

1	Pressure sensor ¹⁾	M14 x 1.5	20 Nm
---	-------------------------------	-----------	-------

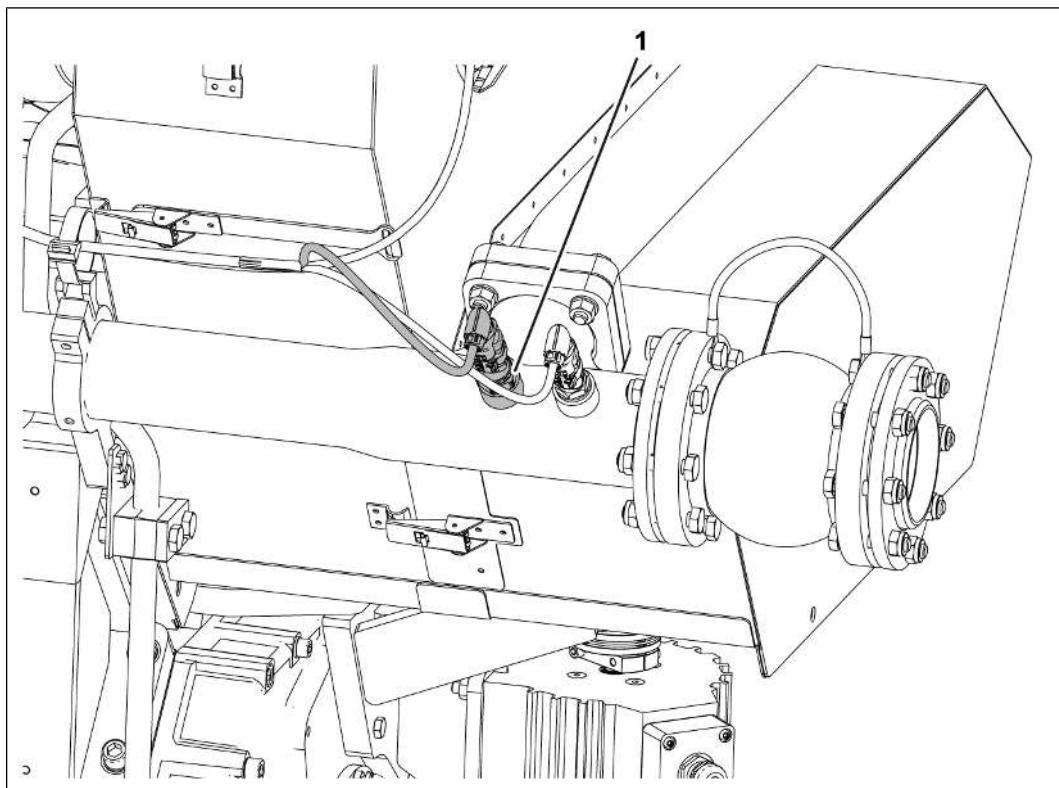
¹⁾ Replace sealing ring.



538192523

Differential pressure sensor on holder

1	Screw dimensions	M8 x 1.25	20 Nm



591200011

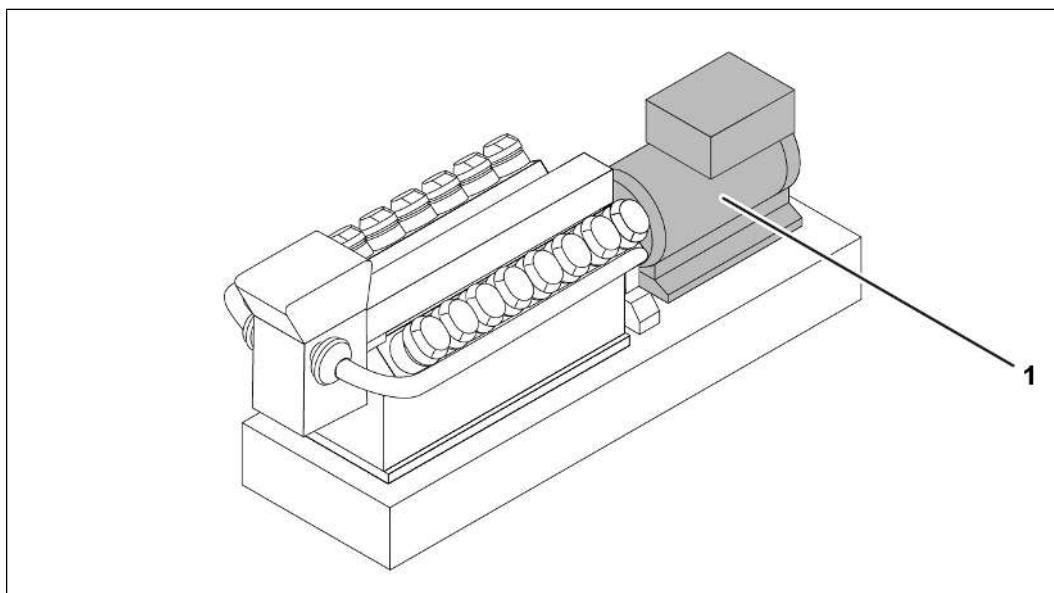
Coolant pressure sensor on coolant pipe

1	Pressure sensor ¹⁾	M14 x 1.5	10 Nm
---	-------------------------------	-----------	-------

¹⁾ Replace sealing ring.

3.2.3 Generator

3.2.3.1 Generator rating plate



397672203

1 Generator side with rating plate

The description of the rating plate is included in the corresponding component documentation, refer to *Operating Manual, chapter Operation, section Genset add-on parts*.

3.2.3.2 Technical data

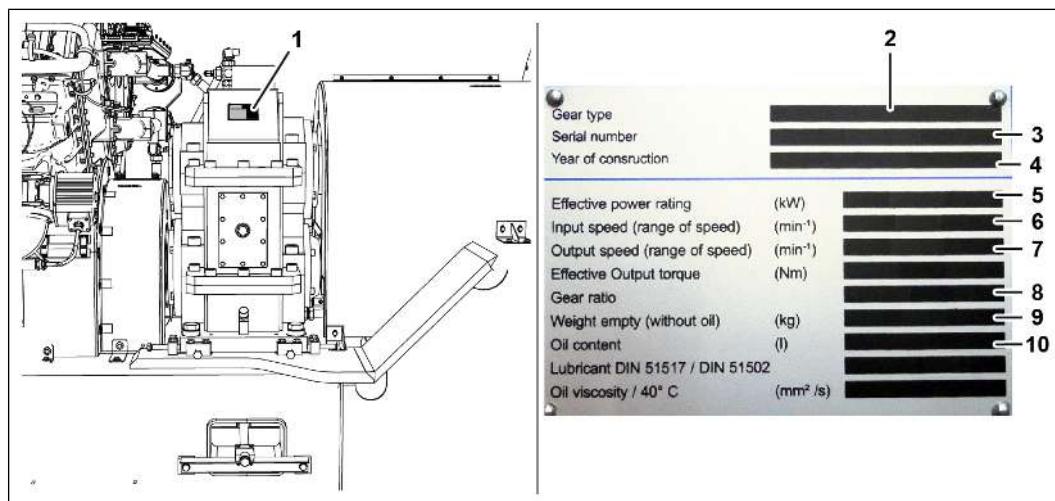
Tightening specifications for generator types MJB and MJH

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 Rating plate Transmission



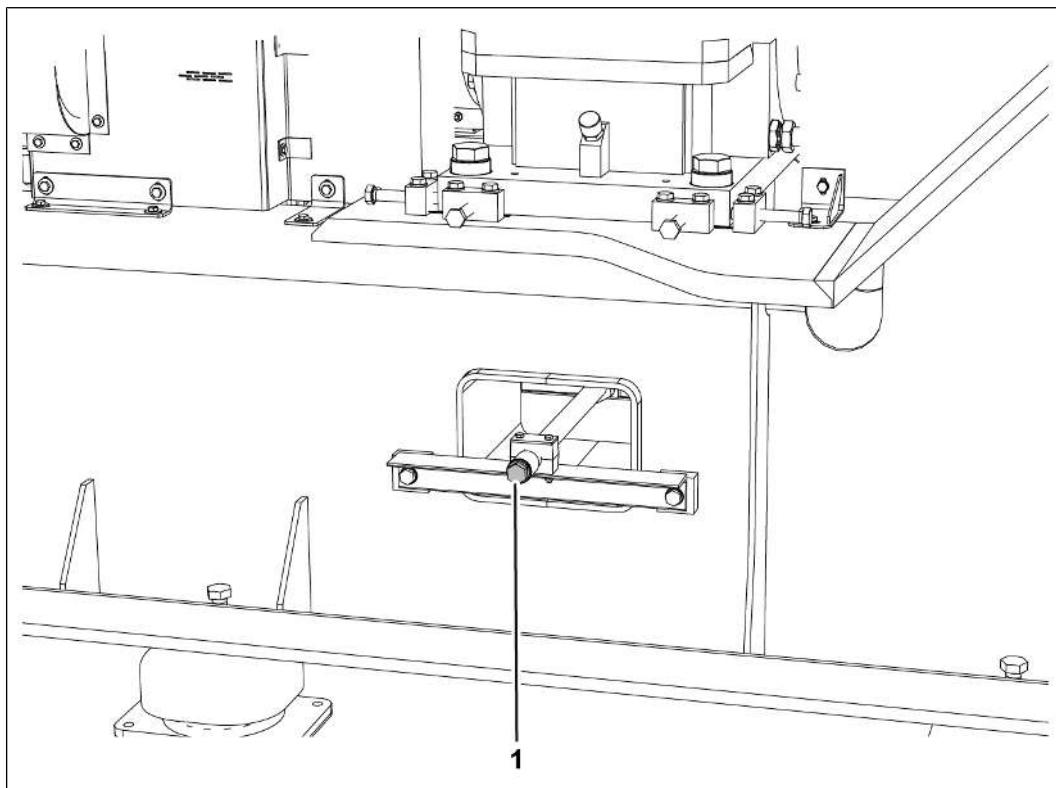
3283013003

- 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 Empty weight
- 10 Lube oil amount

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

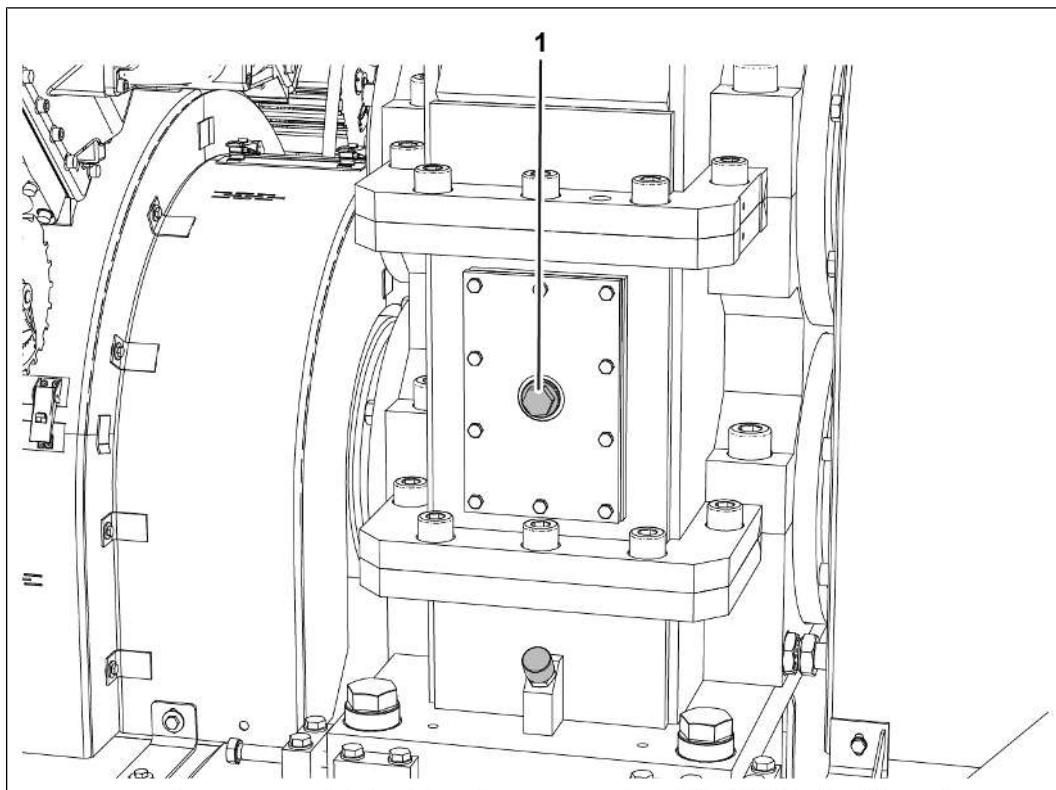
- Specific technical data is shown on the rating plate.

3.2.4.2 Technical data



3286343691

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

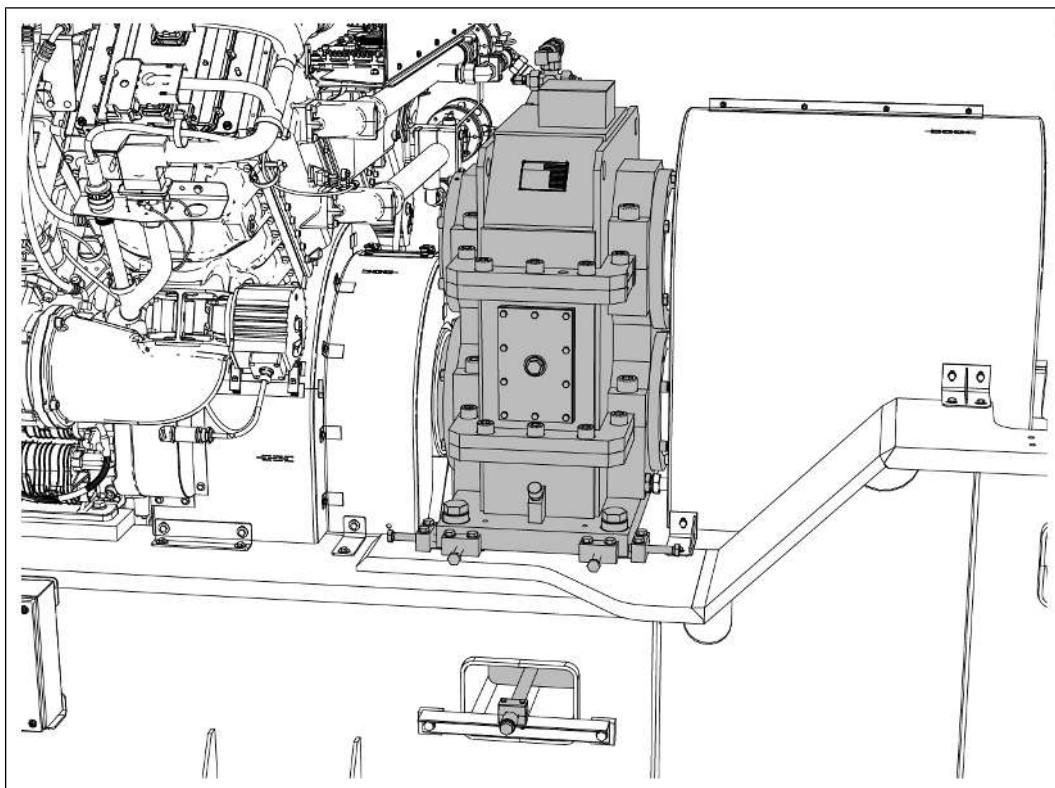


3286346123

Filler screw on inspection hole cover (2.0 MW genset)

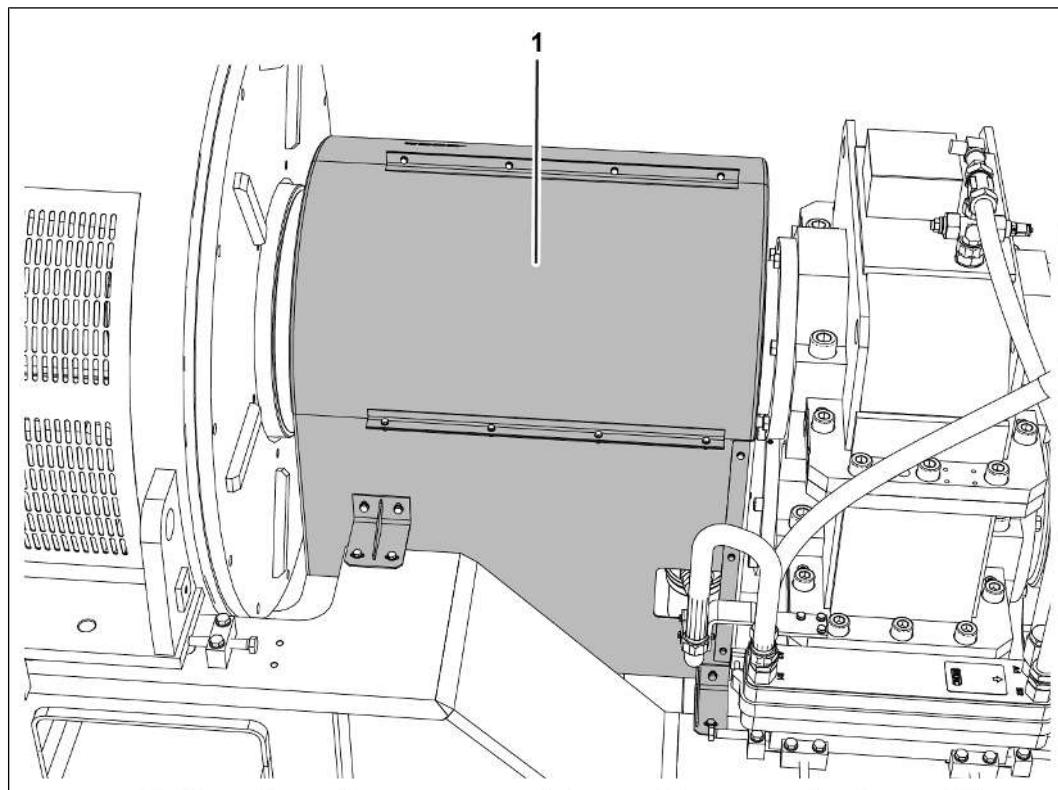
- | | | |
|----|---------------------|------------|
| 1. | Screw ¹⁾ | Hand tight |
|----|---------------------|------------|

¹⁾Replace sealing ring.



3285842059

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



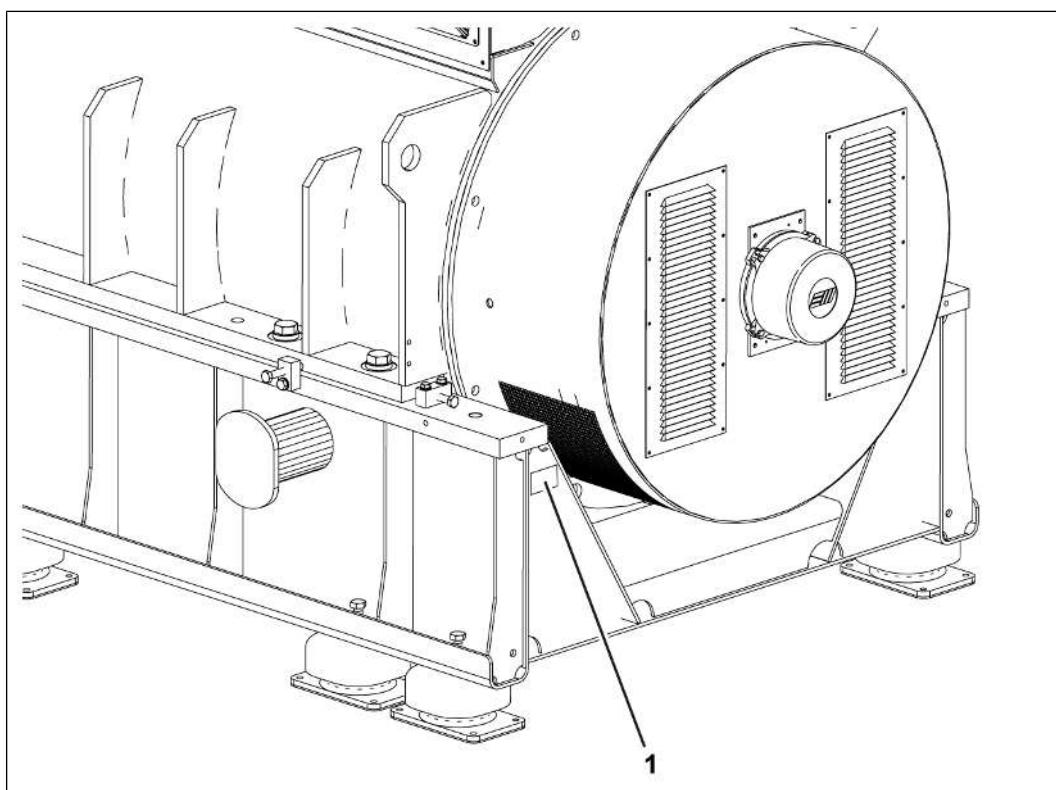
3286686603

Protective cover (1) on genset

All	Screws	Hand tight
-----	--------	------------

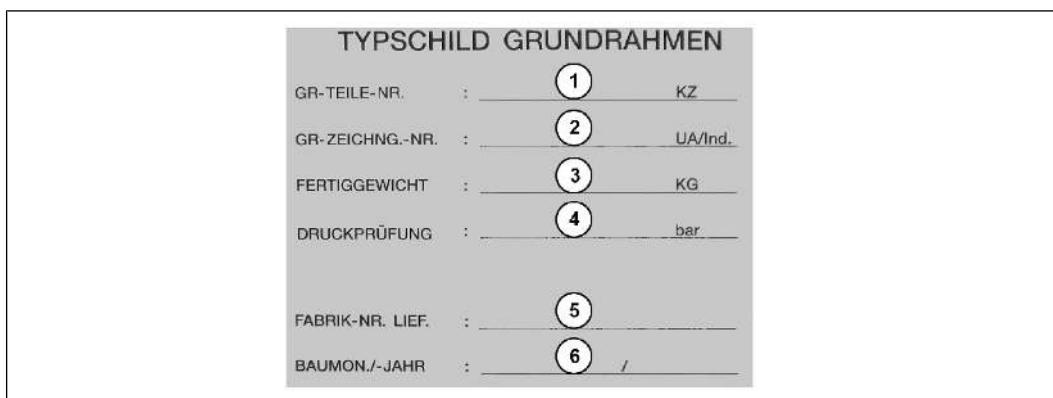
3.2.5 Base frame

3.2.5.1 Base frame rating plate



1071742731: Position on the base frame

1 Rating plate

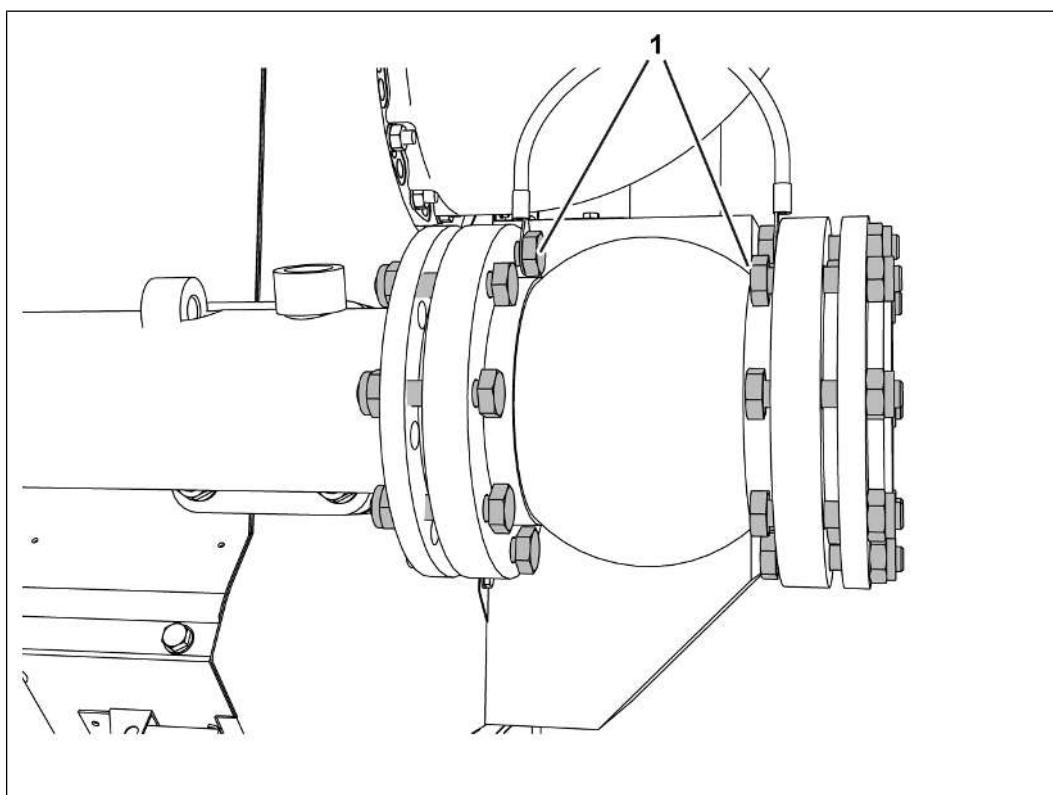


605088267: Rating plate

- 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

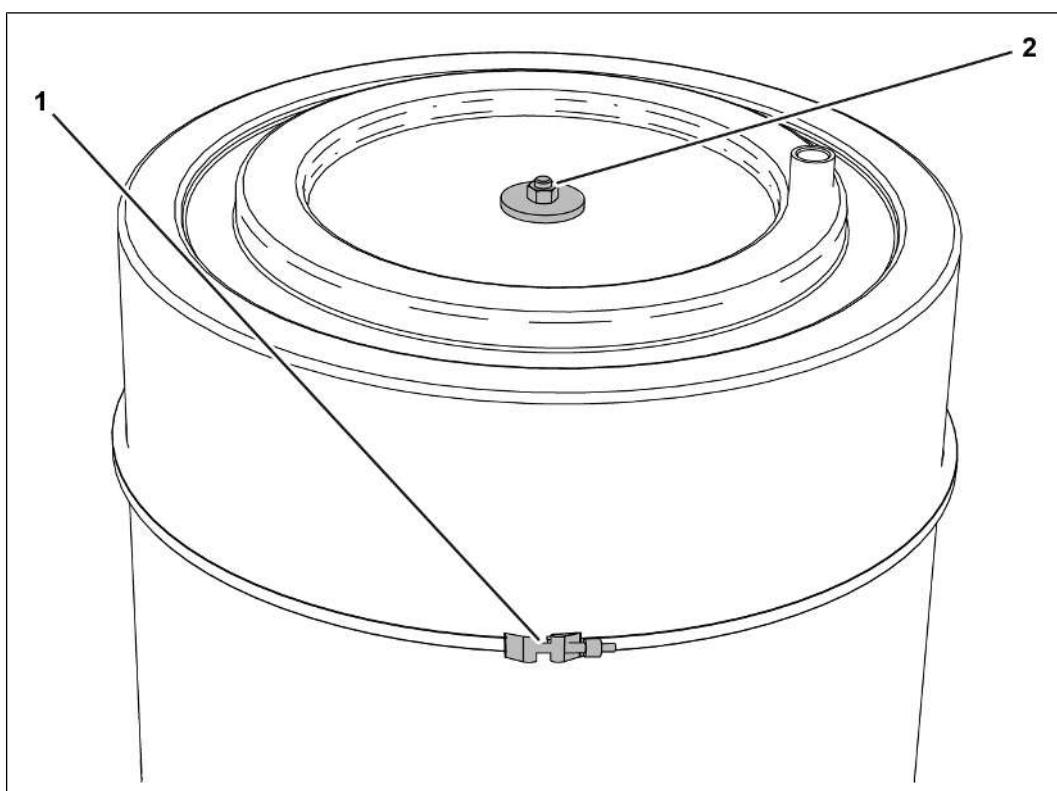
3.2.8.1 Technical data

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



969775371

Crankcase ventilation

Clamping clip on filter housing

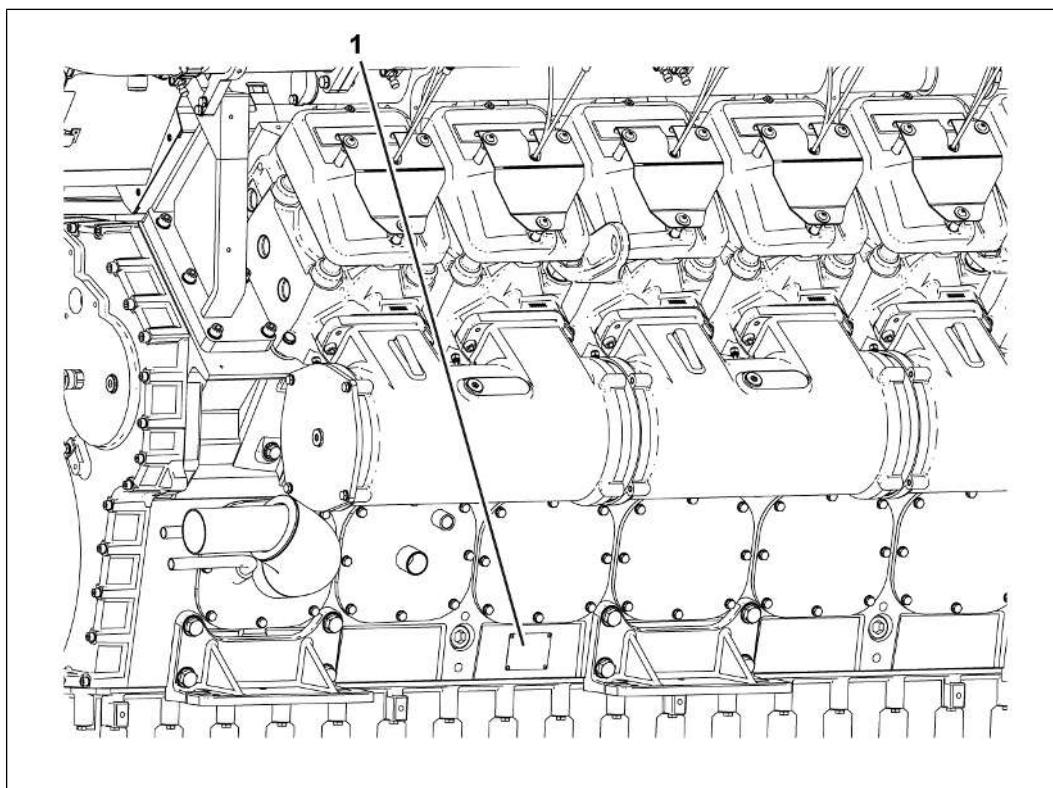
1. Screw M8 x 60 Hand tight

Filter cover on housing

2. Nut M10 10 Nm

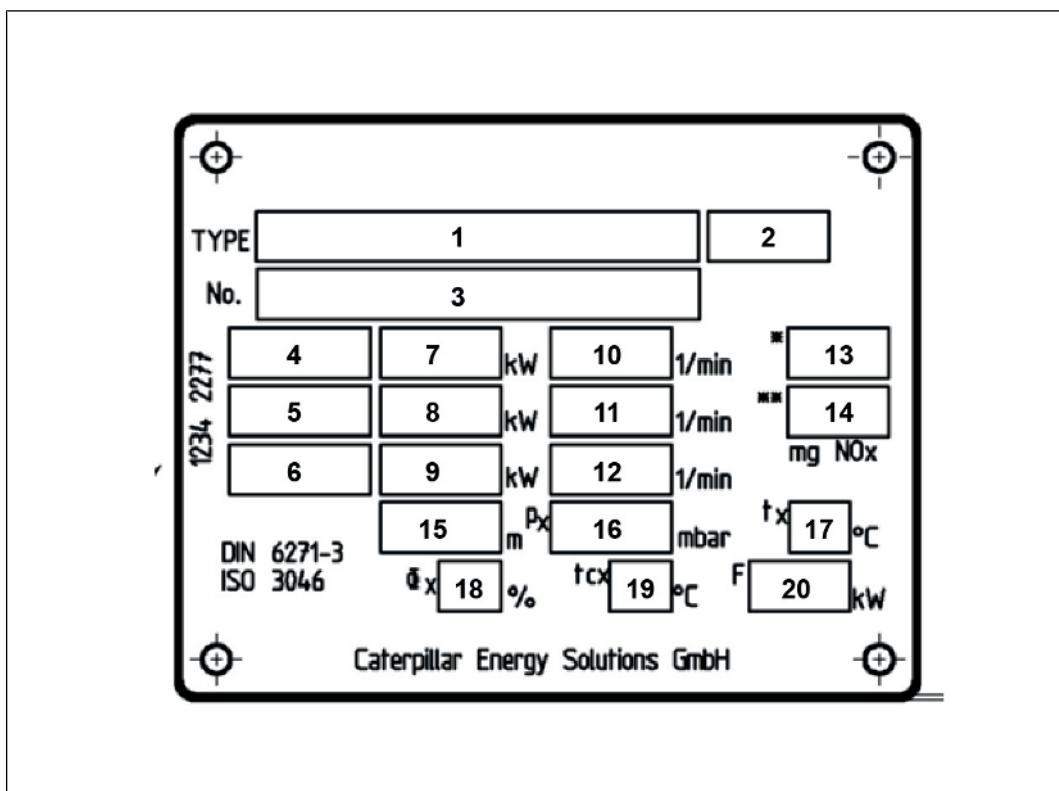
3.2.10 Engine

3.2.10.1 Engine rating plate



116337931: Position on the engine

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 Nitrous 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; see positions 13 and 14.

3.2.10.2 Type designation

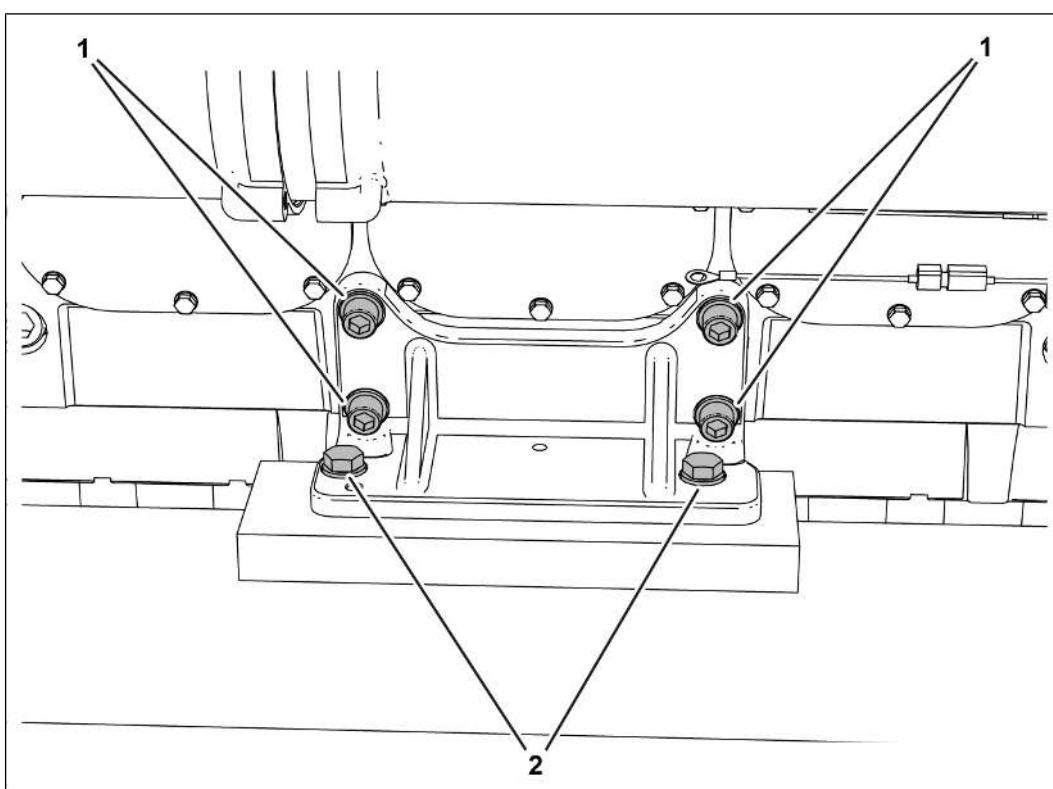
The type designation for an engine consists of a combination of the following letters, numbers and symbols:

- The letter **C** indicates the engine is equipped with a mixture cooler.
- The letter **G** indicates the engine type, e.g. Gas or Diesel.
- The three-digit sequence **xxx** indicates the model series.
- 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

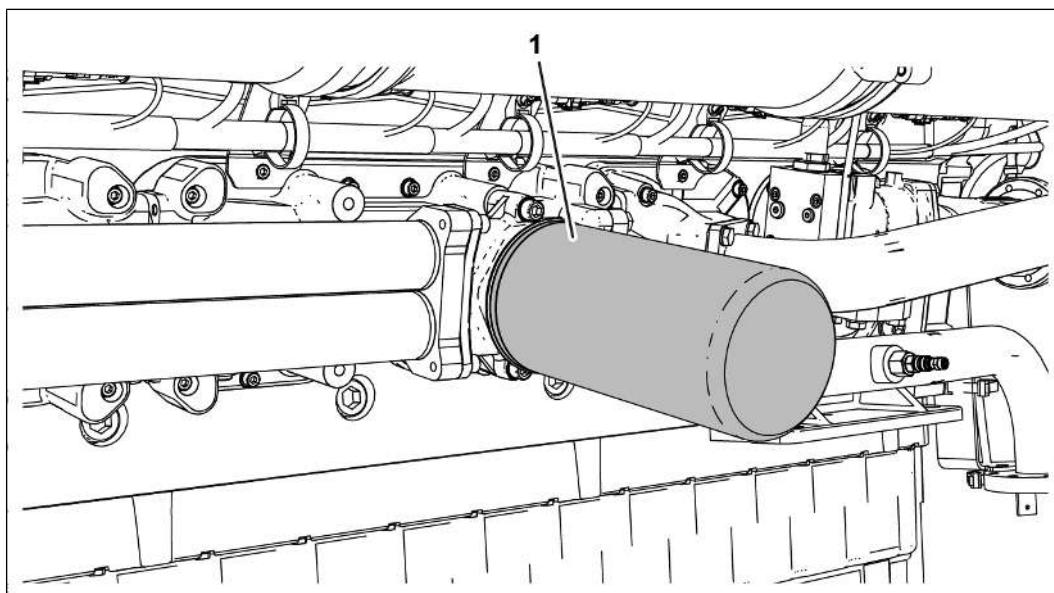
All product data for the engine can be found on the engine data sheet, see *Operating Manual, chapter General Specifications*.

3.2.10.4 Technical data



532487947

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

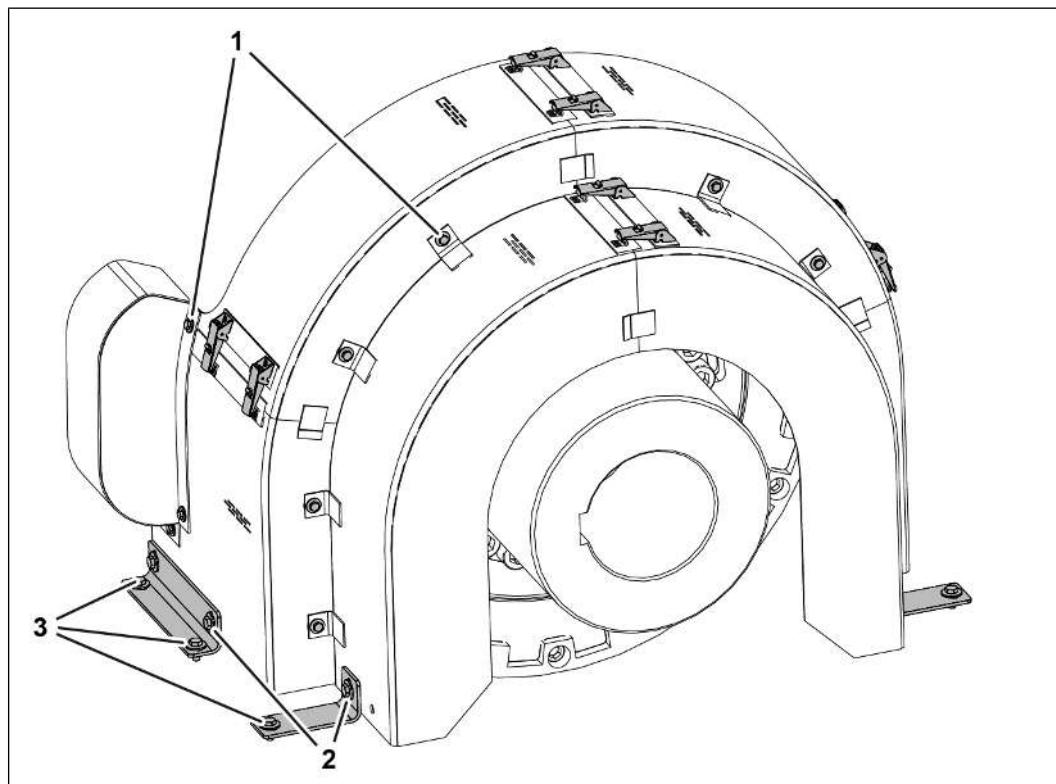
3.2.11 Lube oil filter**3.2.11.1 Technical data**

515255435

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 Lube oil system**3.2.12.1 Technical data**

Pumping out time for base frame	
V12 genset	Approx. 14 minutes (840 s)
V16 genset	Approx. 19.5 minutes (1170 s)
V20 genset	Approx. 19.5 minutes (1170 s)
Pumping out time when the lube oil sump is full	
V12 genset	Approx. 6 minutes (350 s)
V16 genset	Approx. 7.5 minutes (450 s)
V20 genset	Approx. 8.5 minutes (520 s)

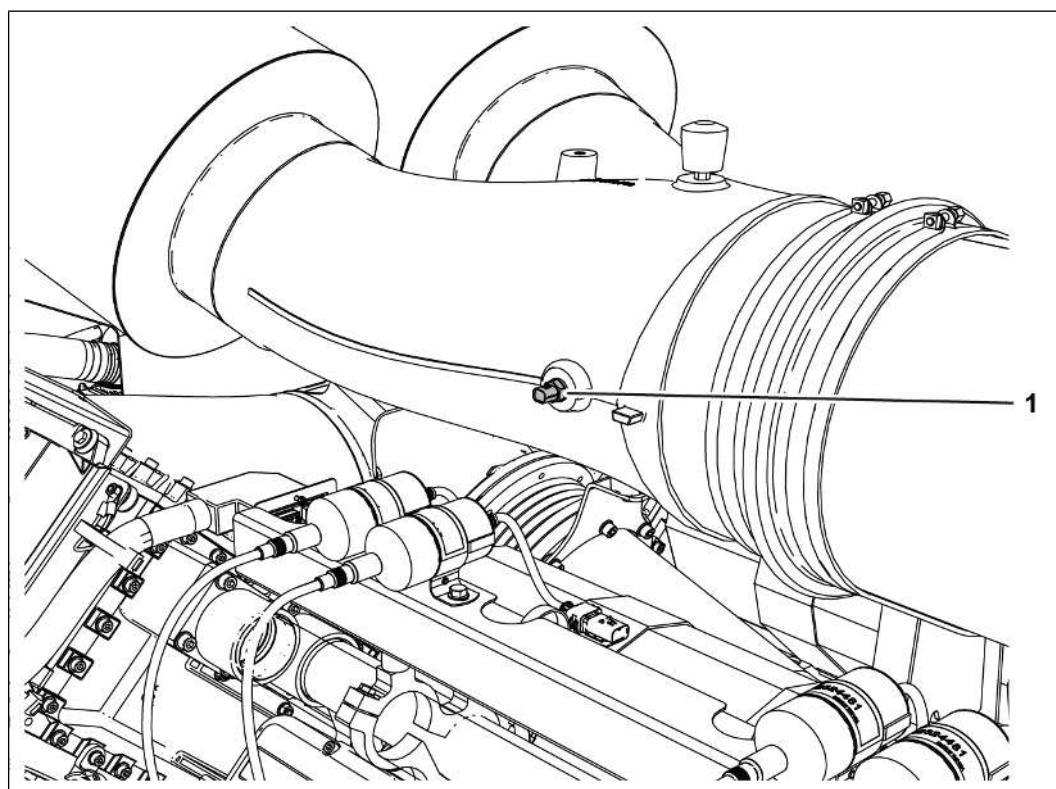
3.2.13 Flywheel**3.2.13.1 Technical data**

535579531

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

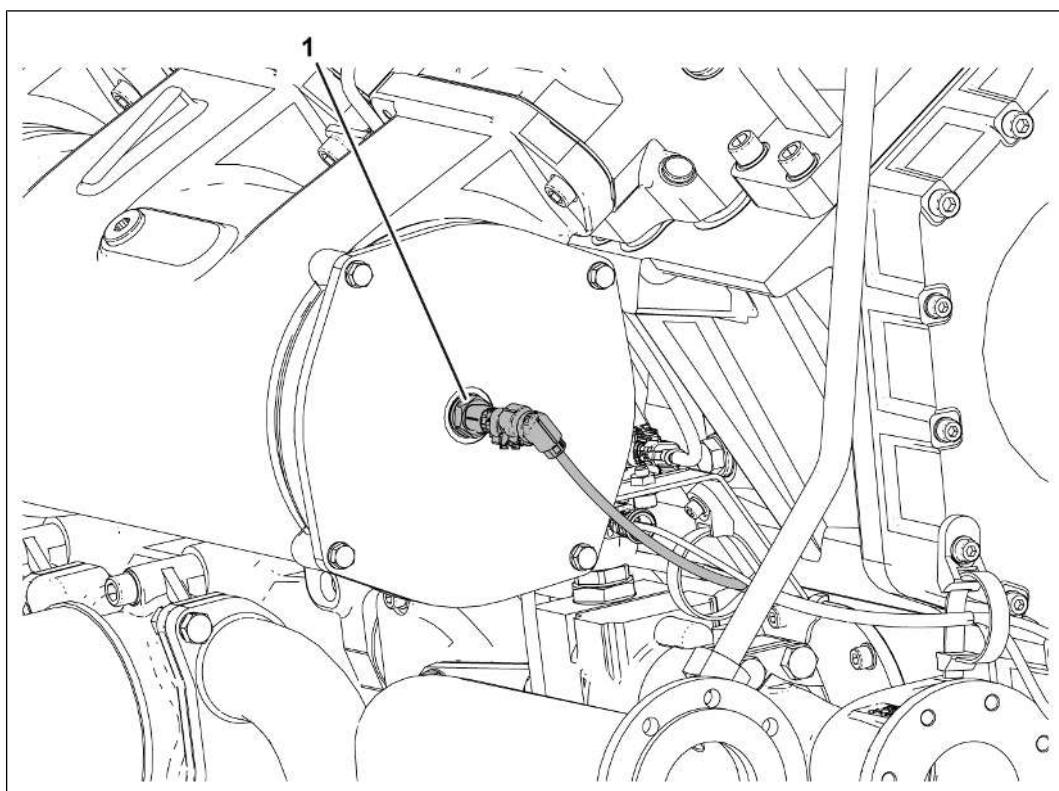
3.2.14 Temperature sensor

3.2.14.1 Technical data



536440715

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

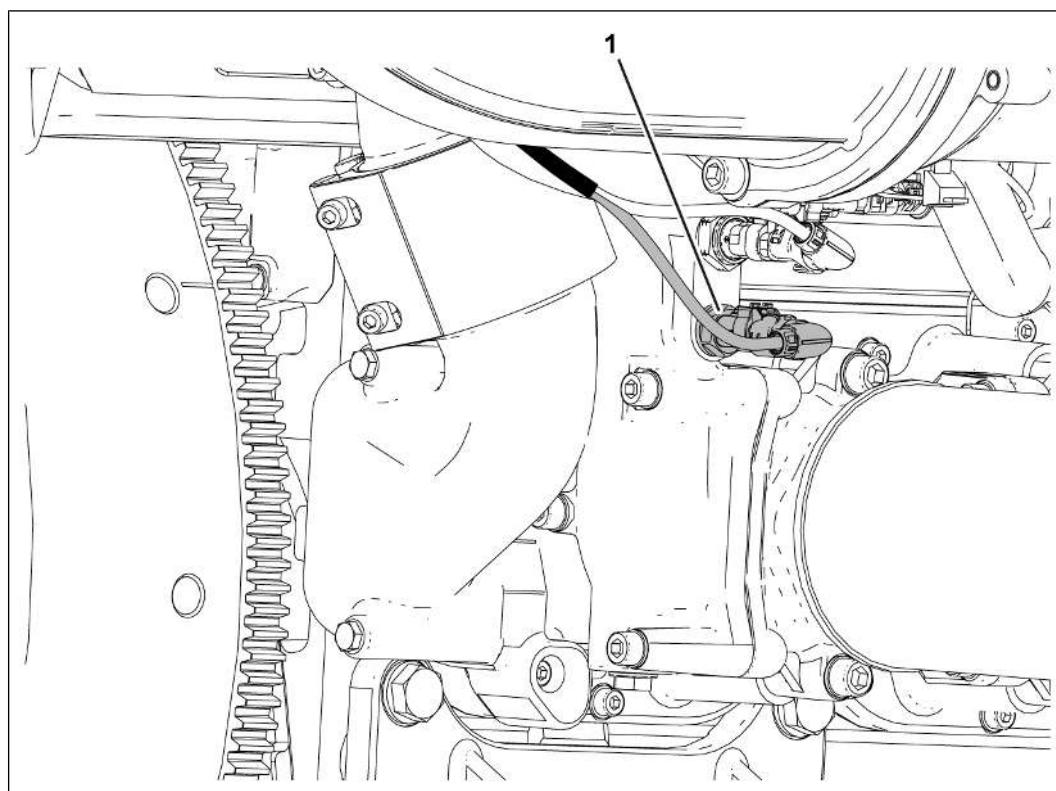


536612619

Mixture temperature sensor on the mixture pipe

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.

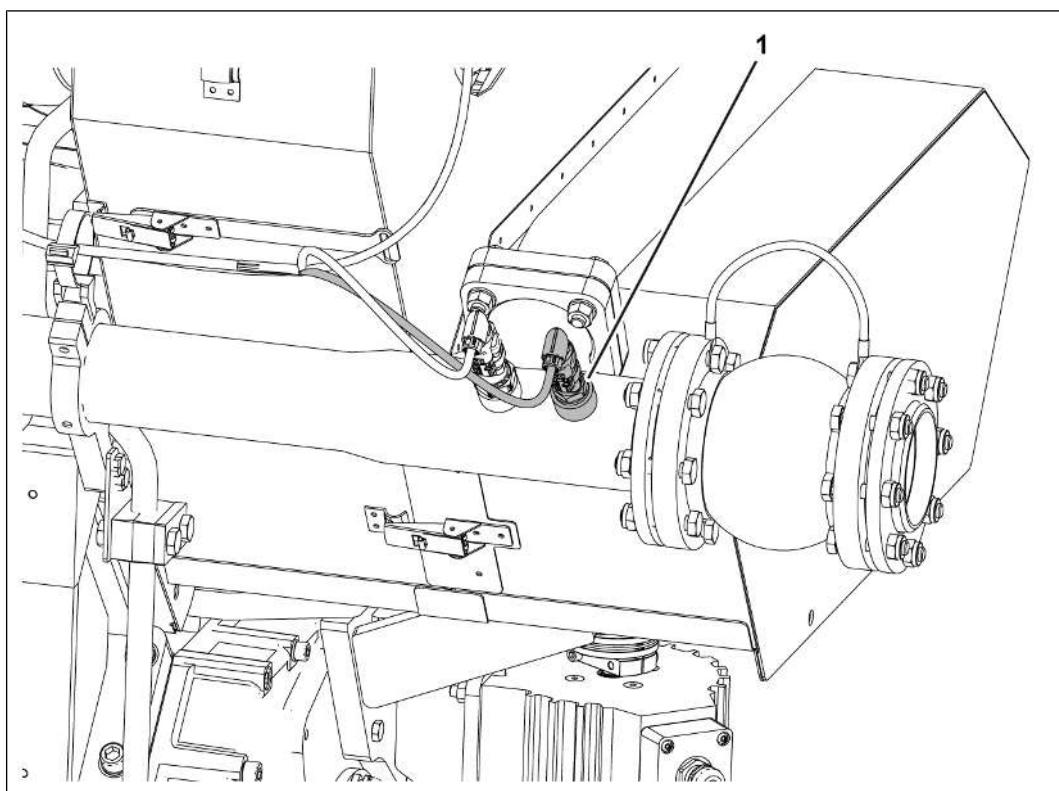


536737803

Lube oil temperature sensor on lube oil pipe

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.

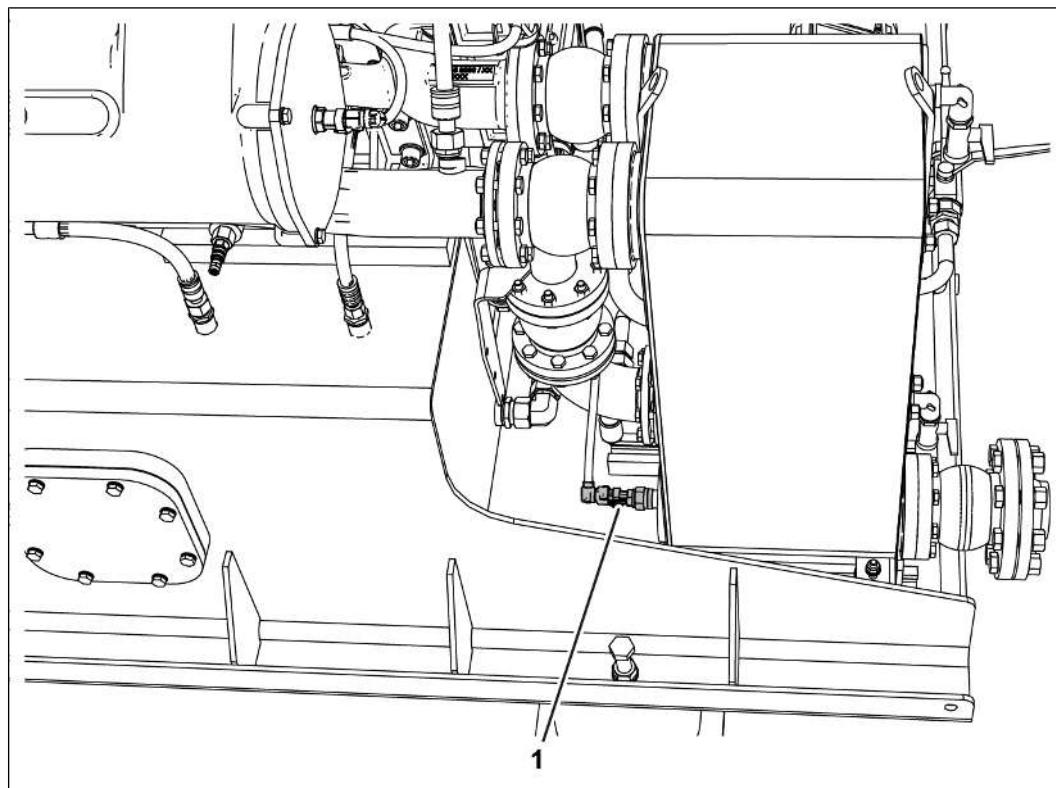


536885131

Coolant temperature sensor on coolant pipe

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.

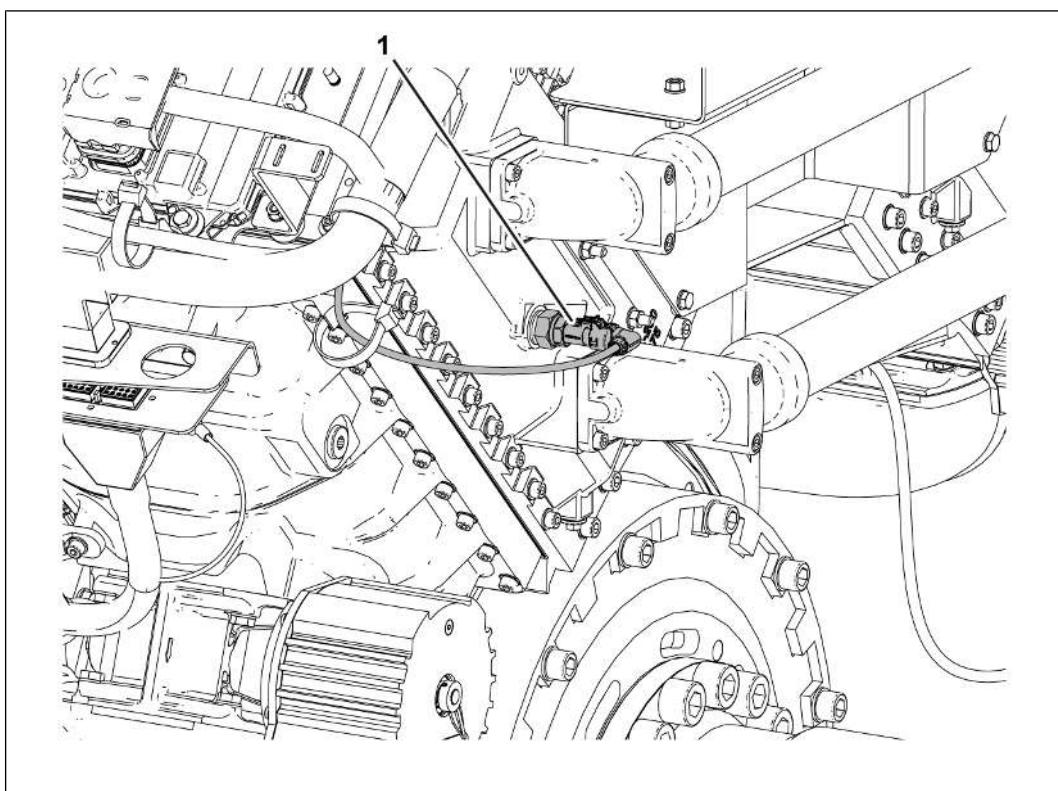


536957067

Coolant temperature sensor on lube oil cooler

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.



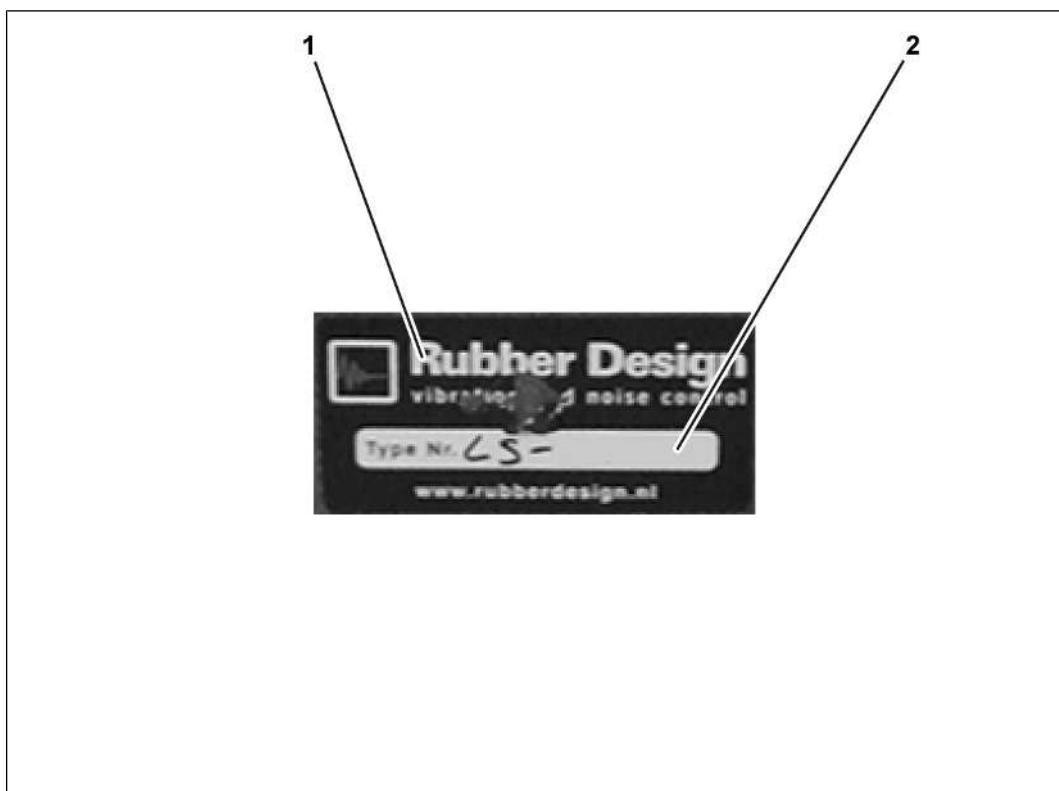
537192587

Coolant temperature sensor on mixture cooler		
1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A 20 Nm
¹⁾ Replace sealing ring.		

3.2.15 Anti-vibration mounting (elastic support)**3.2.15.1 Anti-vibration mounting rating plate**

605032843: Position

1 Rating plate



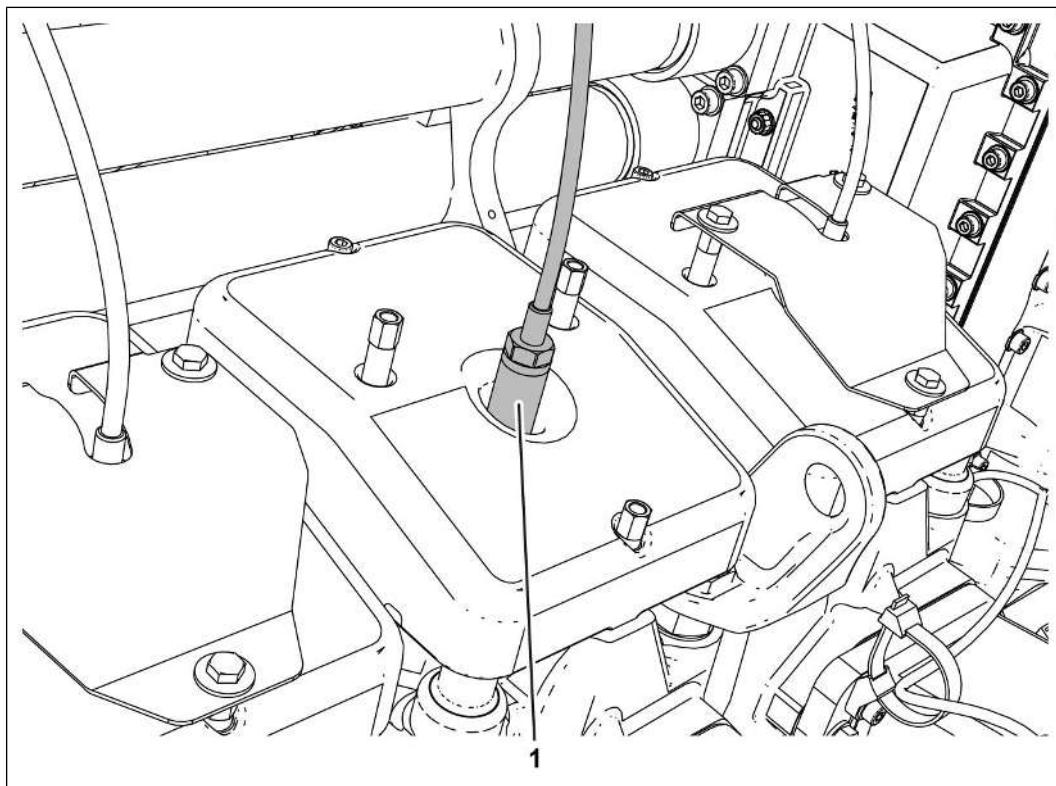
605030923: Rating plate

1 Manufacturer name

2 Type number

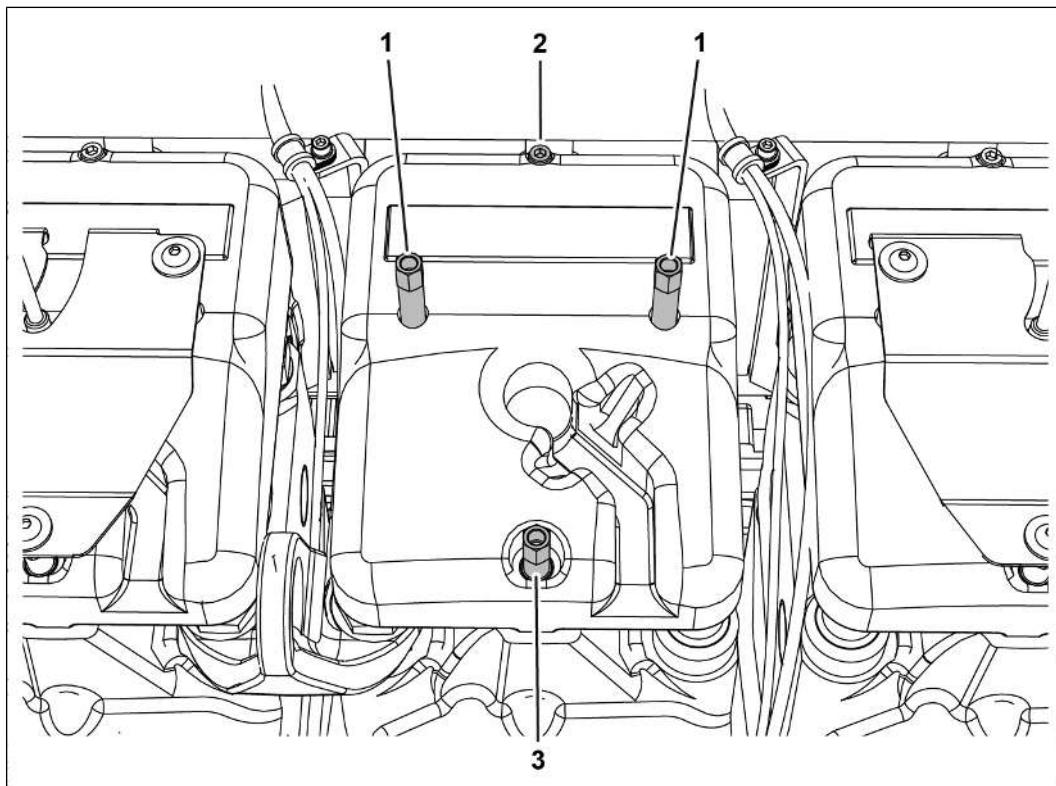
3.2.16 Spark plug

3.2.16.1 Technical data



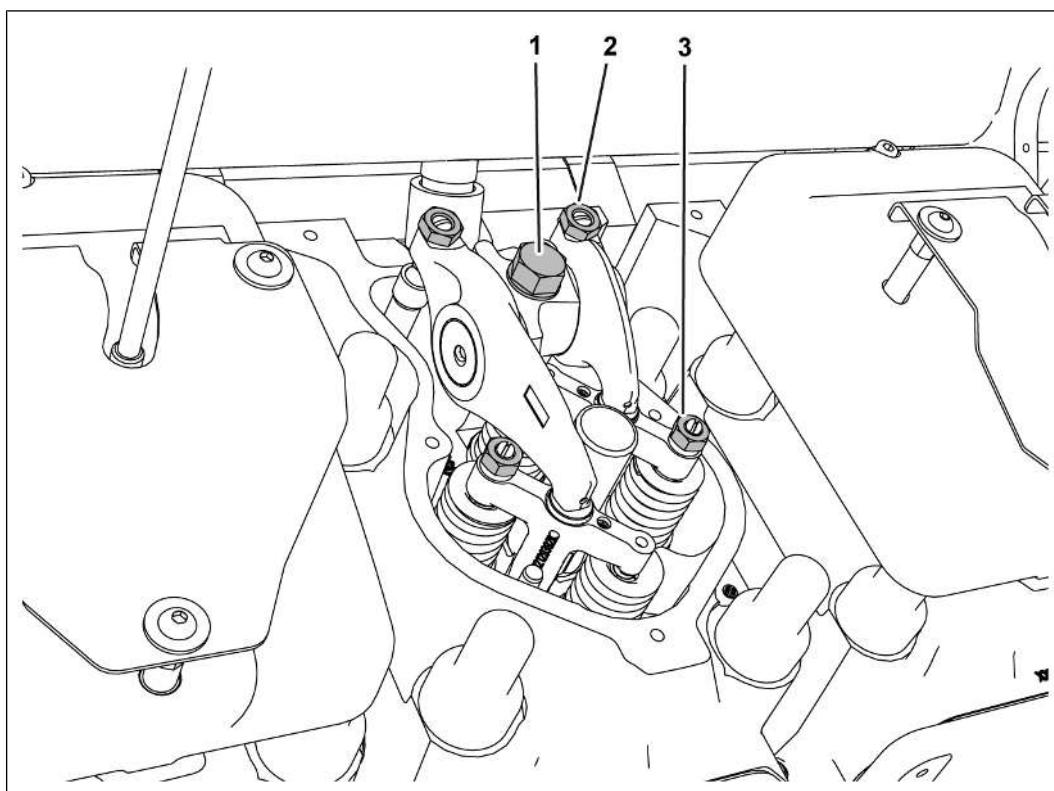
9007199756441867

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

3.2.17 Cylinder head**3.2.17.1 Technical data**

489451531

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

V12 engine valve setting		
	Ignition TDC	A1 B5 A2 B3 A4 B1 A6 B2 A5 B4 A3 B6
	Overlap	A6 B2 A5 B4 A3 B6 A1 B5 A2 B3 A4 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

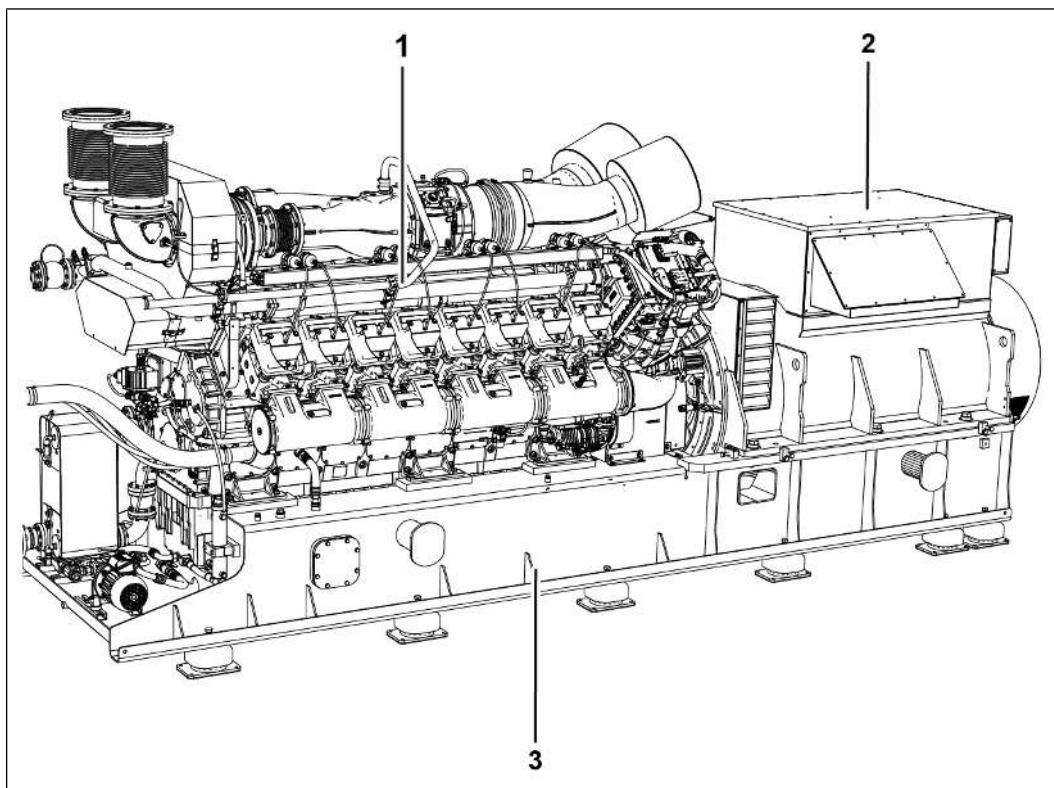
¹⁾ Measured from middle of the valve plate to the cylinder head sealing surface.

4 Structure and function

4.1 Genset

4.1.1 Genset

4.1.1.1 Functional description



1945793547

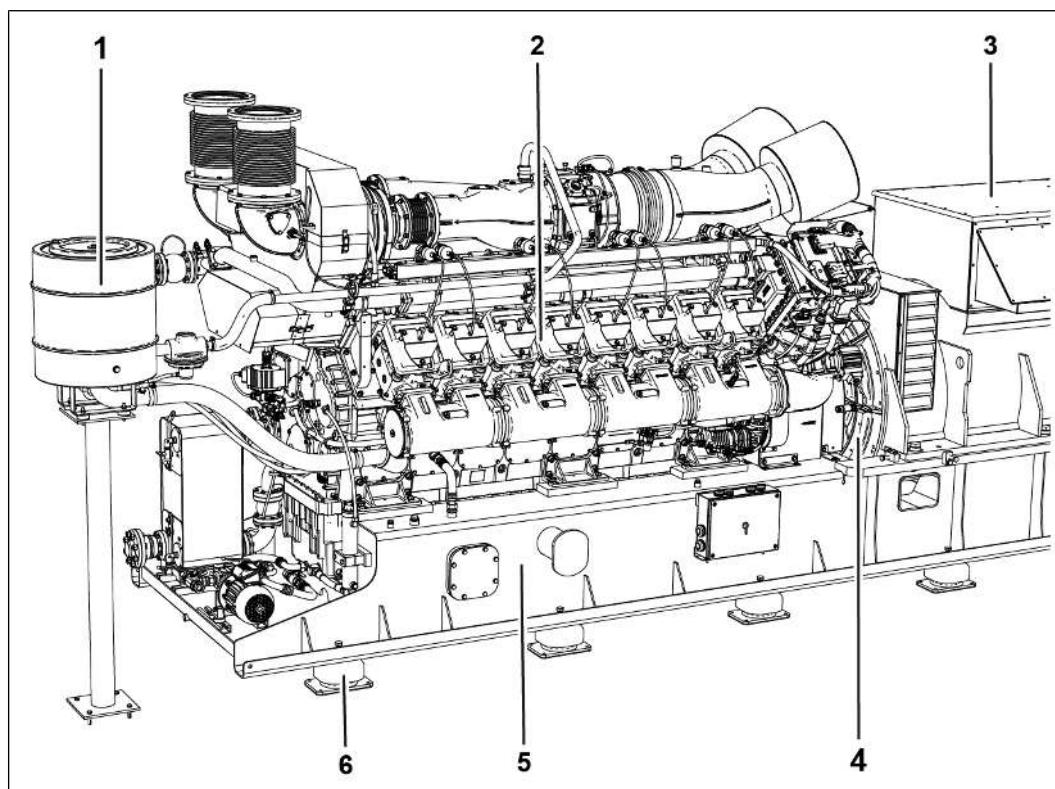
- 1 Engine
- 2 Generator
- 3 Base frame

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

9007201061300107

- 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

4.1.2 TPEM Connection Box

4.1.2.1 Functional description

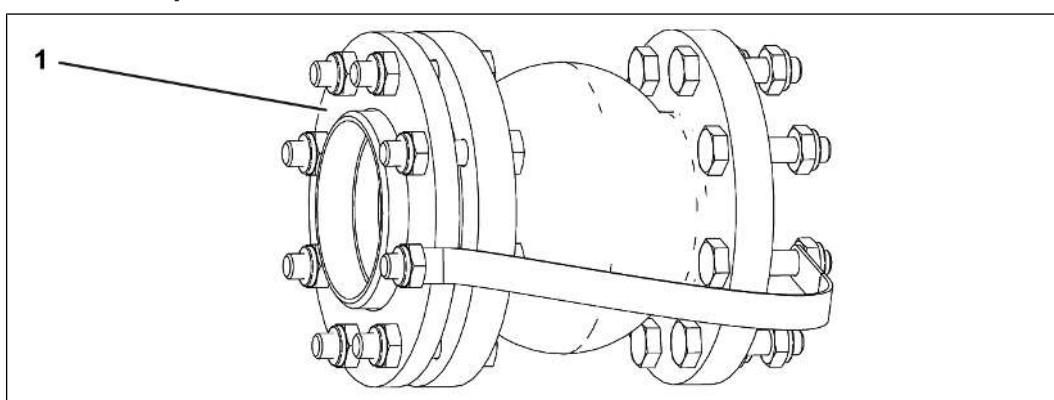
The TPEM CB forms the interface between the electronic control and the plant control.
The TPEM CB is mounted either on the crankcase ventilation holder or on the base frame.

For detailed information on the control, see *Operating Manual, chapter Operation, section Control*.

4.2 Engine

4.2.1 Rubber expansion joint

4.2.1.1 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.
- Rubber expansion joints with a "yellow-blue-yellow" color scheme can be installed on the lube oil cooler.

NOTE

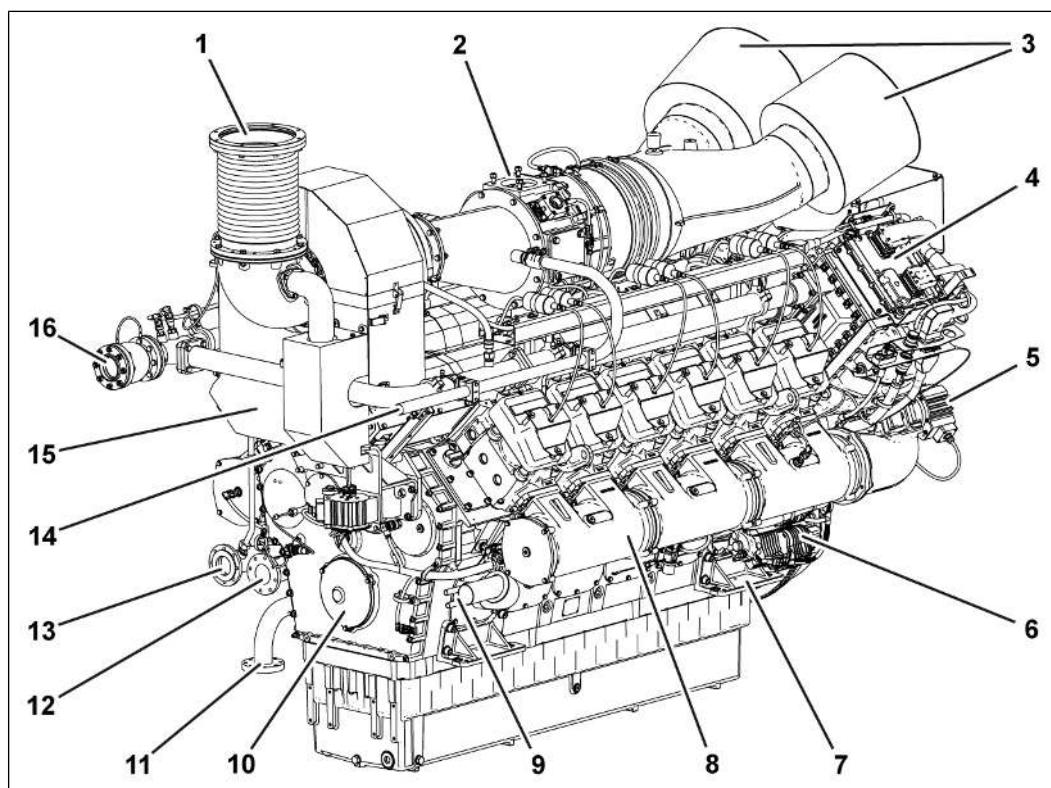
The rubber expansion joint is not intended to compensate for assembly inaccuracies.

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.

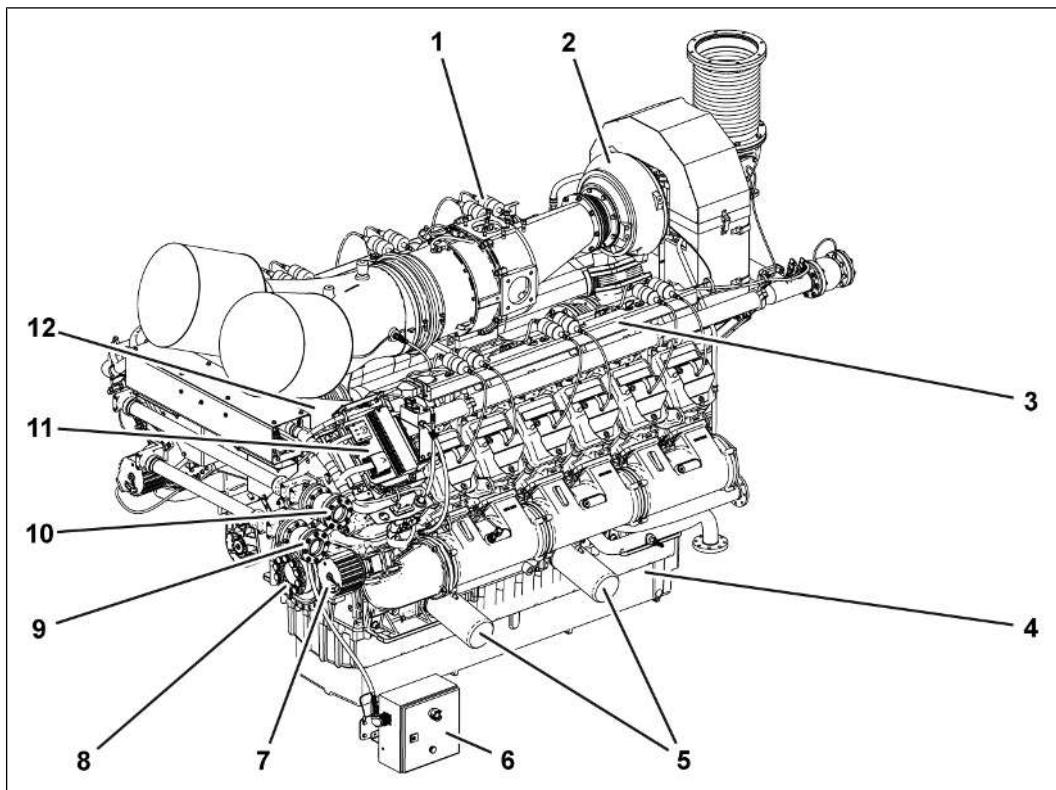
4.2.2 Engine

4.2.2.1 Assembly overview



150718859: Cylinder side A

- 1 Exhaust expansion joint
- 2 Gas-air mixer
- 3 Intake air filter
- 4 Auxiliary control device
- 5 Throttle valve actuator
- 6 Starter
- 7 Lug
- 8 Mixture pipe
- 9 Crankcase ventilation connection
- 10 Crankshaft sealing cover
- 11 Lube oil cooler inlet connection
- 12 Lube oil cooler outlet connection
- 13 Coolant inlet
- 14 Crankcase ventilation connection
- 15 Exhaust turbocharger cover
- 16 Coolant outlet



150713611: Cylinder side B

- 1 Ignition coil
- 2 Exhaust turbocharger
- 3 Ignition coil holder
- 4 Lube oil sump
- 5 Lube oil filter
- 6 TPEM Connection Box
- 7 Throttle valve actuator
- 8 Flywheel flange
- 9 Coolant inlet
- 10 Coolant outlet
- 11 Main control device
- 12 Mixture cooler

4.2.2.2 Functional description

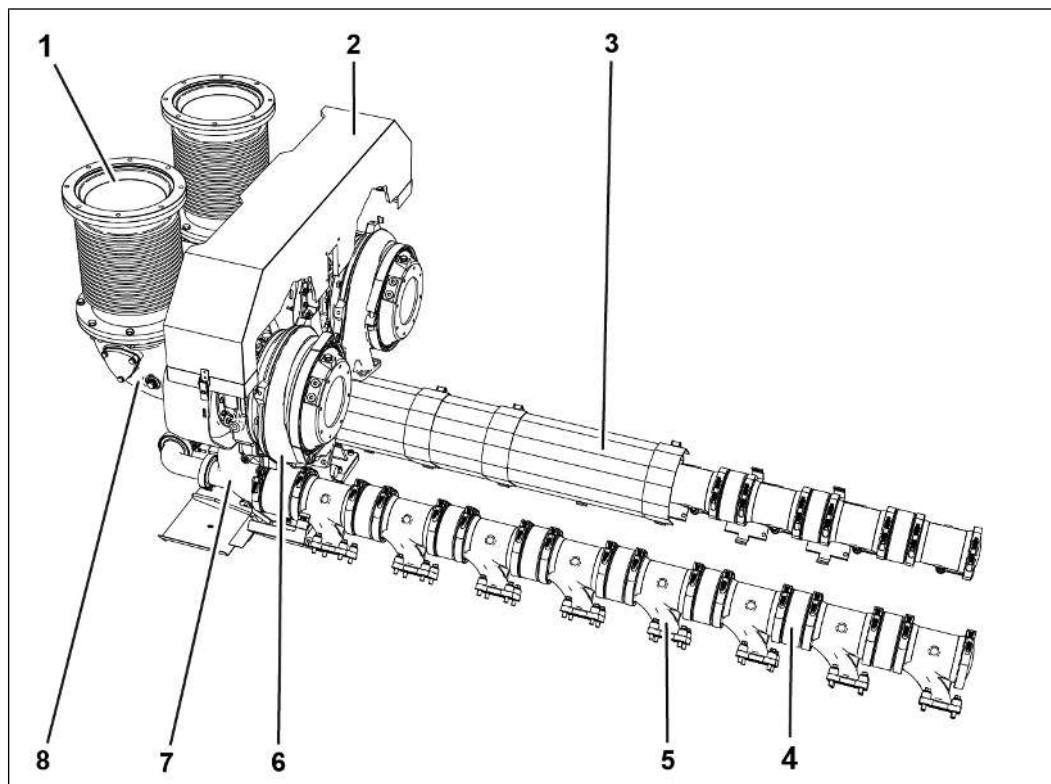
The engine is a liquid-cooled four-stroke gas engine. The gas type depends on the location and operational area of the engine. The permissible gas type is indicated on the rating plate of the engine.

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

4.2.3 Exhaust system

4.2.3.1 Exhaust system

Functional description



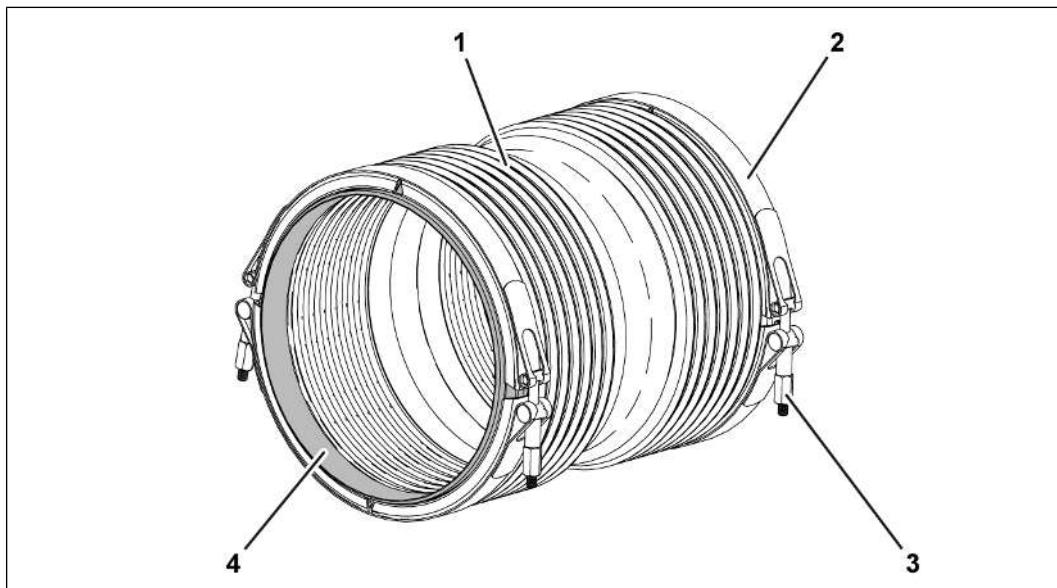
1818815115

- 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**

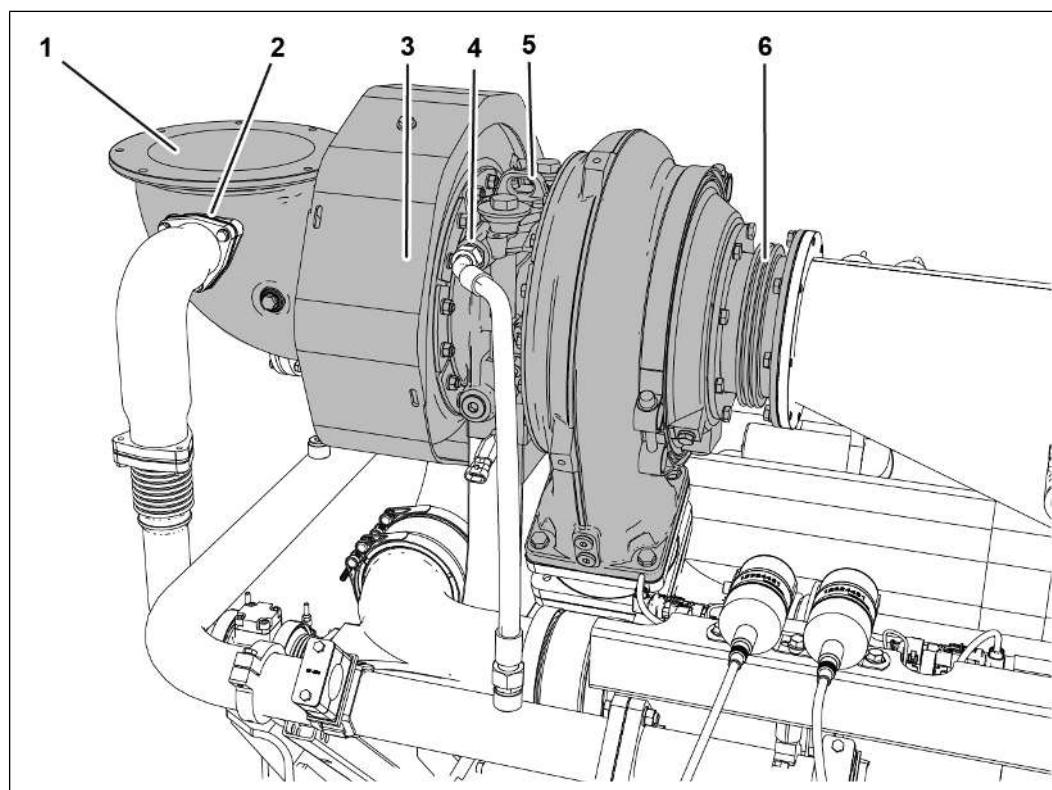
605240459

- 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.

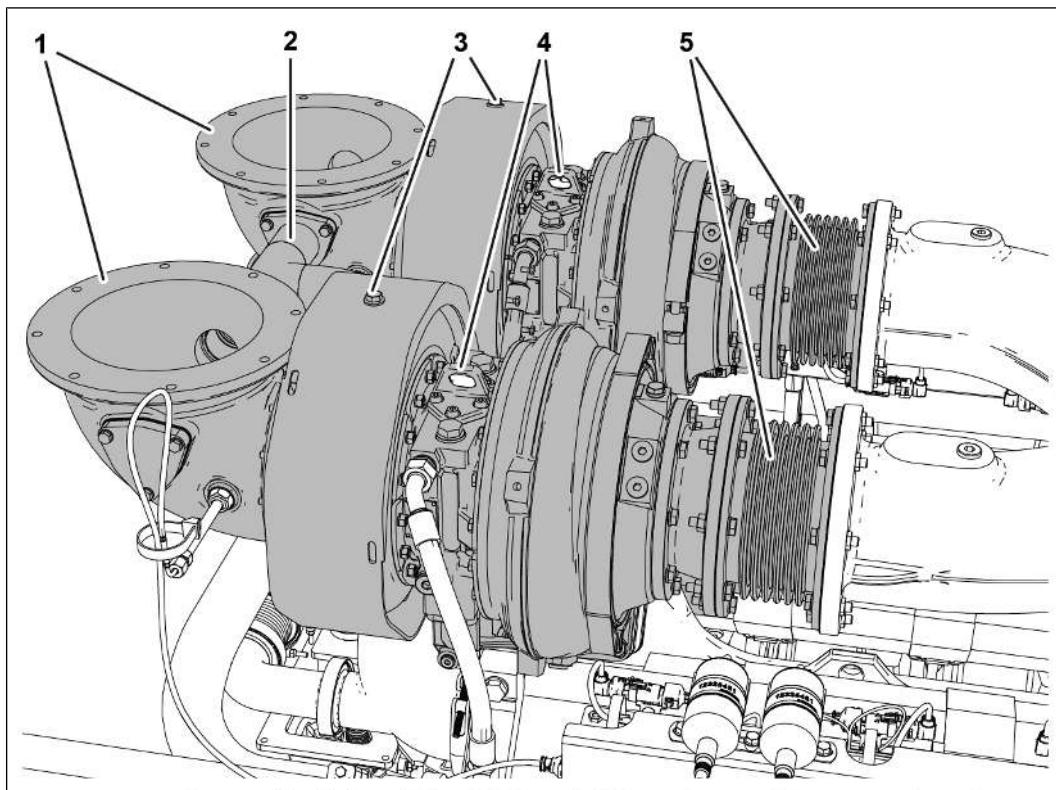
4.2.3.3 Exhaust turbocharger

Functional description



9007200980143371: V12 genset

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



2769849227: V16 and V20 genset

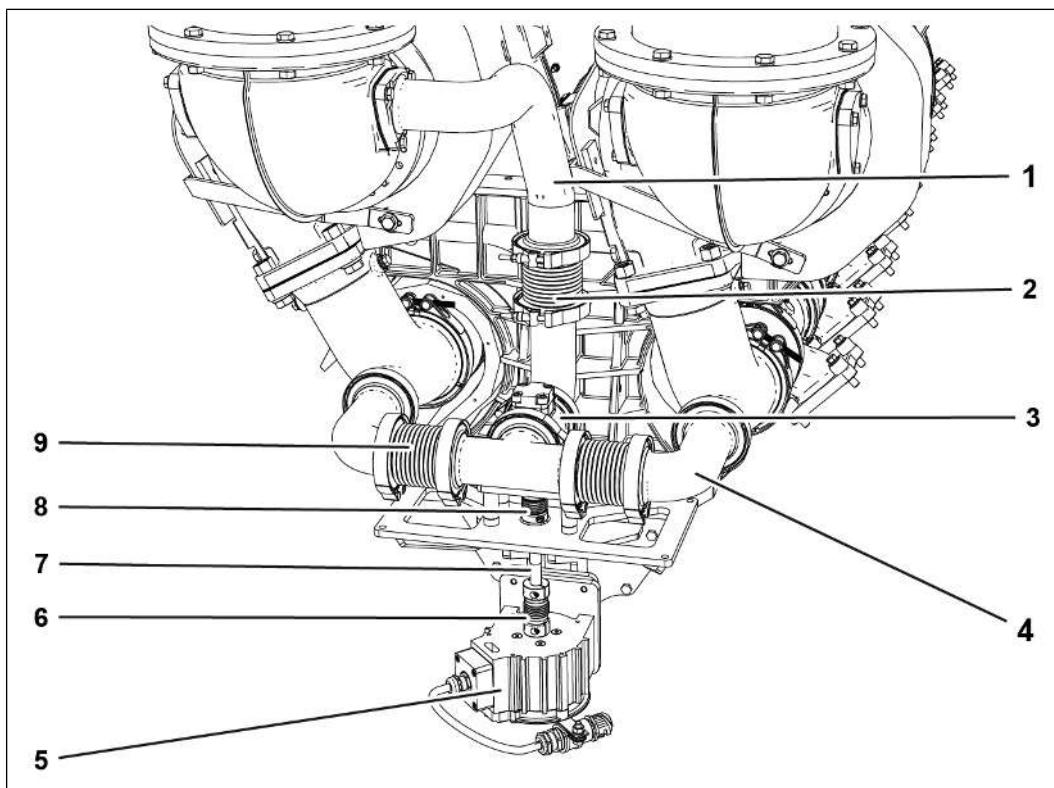
- 1 Exhaust manifold
- 2 Wastegate connection
- 3 Exhaust turbocharger
- 4 Lifting point
- 5 Expansion joint

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.

4.2.3.4 Wastegate

Functional description



1821534347

- 1 Exhaust manifold
- 2 Expansion joint
- 3 Exhaust flap
- 4 Exhaust pipe
- 5 Actuator
- 6 Coupling
- 7 Drive shaft
- 8 Coupling
- 9 Expansion joint

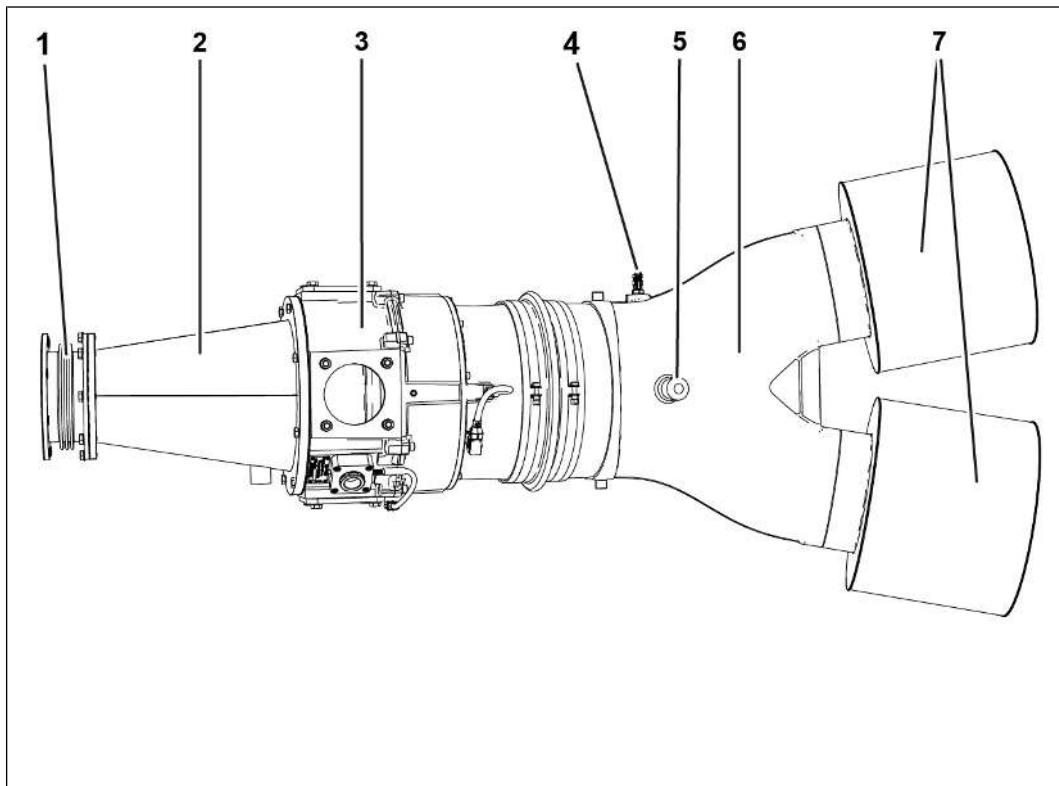
The wastegate regulates the power of the exhaust turbocharger. The unneeded exhaust gas quantity reaches the exhaust pipe directly and does not pass through the turbine wheel. The wider the wastegate is open, the more exhaust gas flows past the exhaust turbocharger and the lower the power from the exhaust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

4.2.4 Intake air system

4.2.4.1 Intake air system

Functional description



1825002763

- 1 Expansion joint
- 2 Mixture pipe
- 3 Gas-air mixer
- 4 Intake air temperature sensor
- 5 Service indicator
- 6 Intake air manifold
- 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](#).

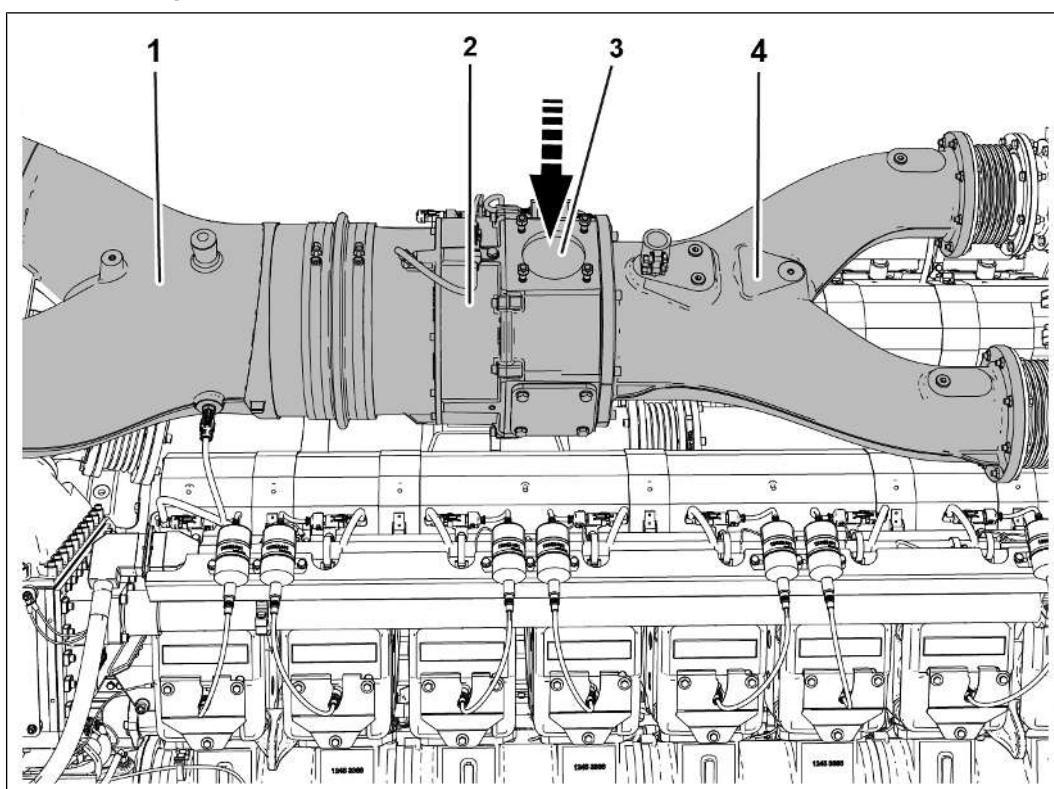
A temperature sensor that measures the temperature of the air and transmits it to the electronic control is installed in the intake air manifold.

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**

1826303243

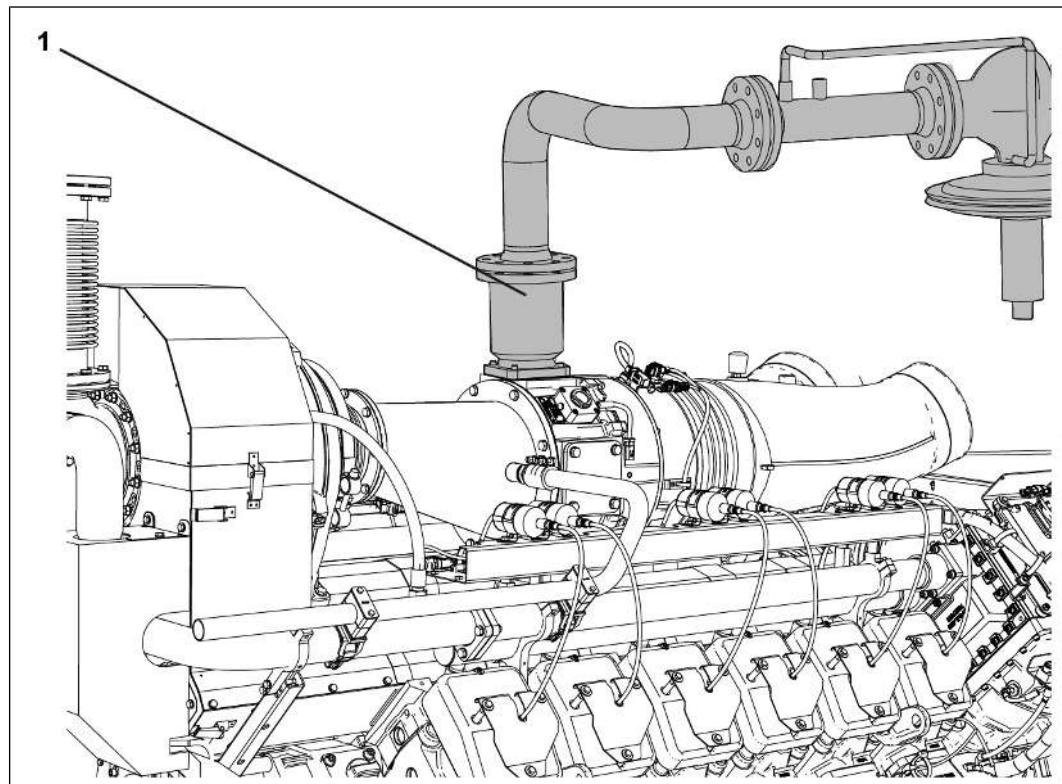
- 1 Intake air manifold
- 2 Gas-air mixer
- 3 Fuel gas inlet (arrow)
- 4 Mixture manifold

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



1917554699

- 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.

Automatic purge during decommissioning

For safety reasons, the fuel gas is completely purged from the gas train, the mixture system, and the cylinders whenever completing the *Decommissioning the genset* procedure.

To purge, the electronic control closes the gas valves in the gas train; the vacuum effect of the engine continuing to operate acts to empty the following components:

- Fuel gas line to the engine
- Gas-air mixer
- Exhaust turbocharger
- Mixture cooler
- Mixture pipe

The ignition remains turned on until the remaining fuel gas has fully combusted in the cylinders.

- Once the crankshaft is stationary, the electronic control turns the ignition off.

4.2.6 Electrical system

4.2.6.1 Electrical system

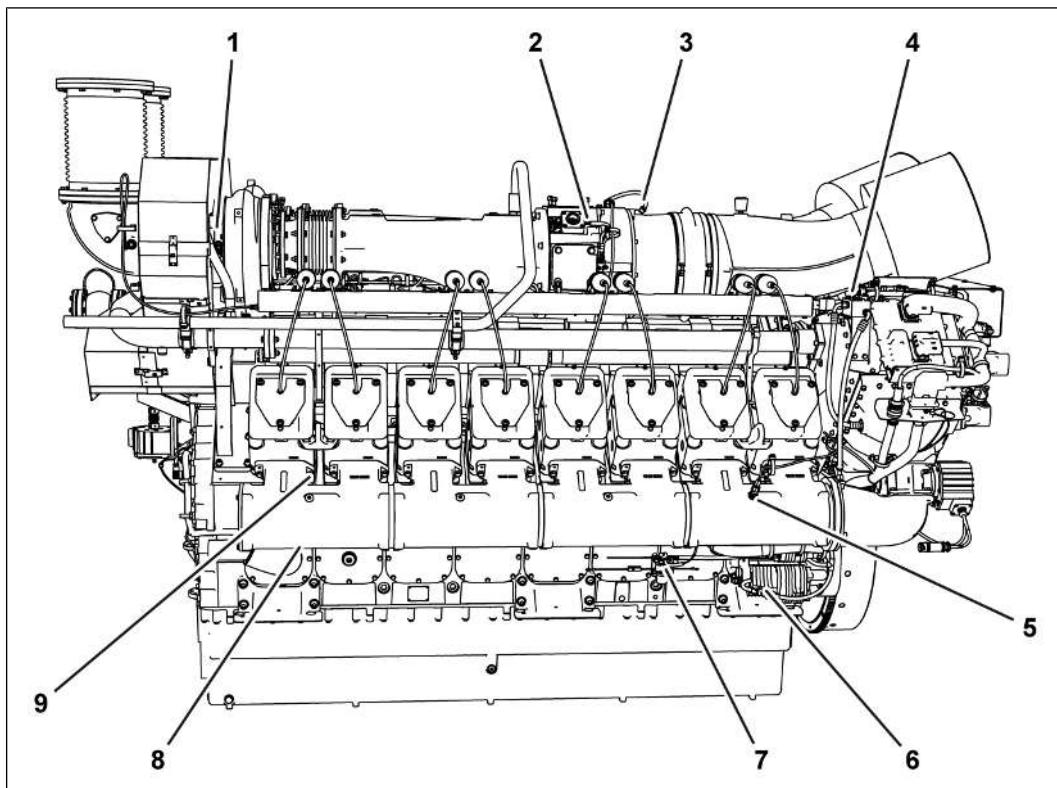
Functional description

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

The engine electrical system consists of the following components:

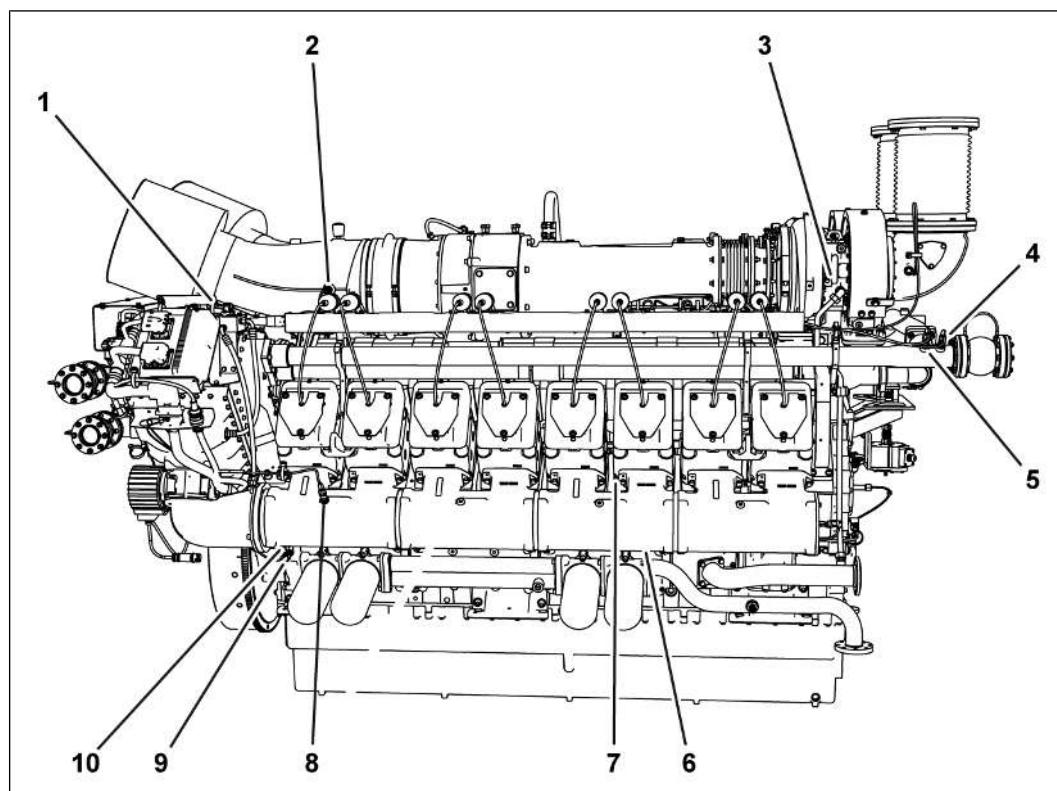
- Starter
- Ignition system
- Anti-knock control
- Control devices, wiring harness, and sensors
- Electronic control

For more information on the electronic control system, see the [TPEM Operating Manual](#).



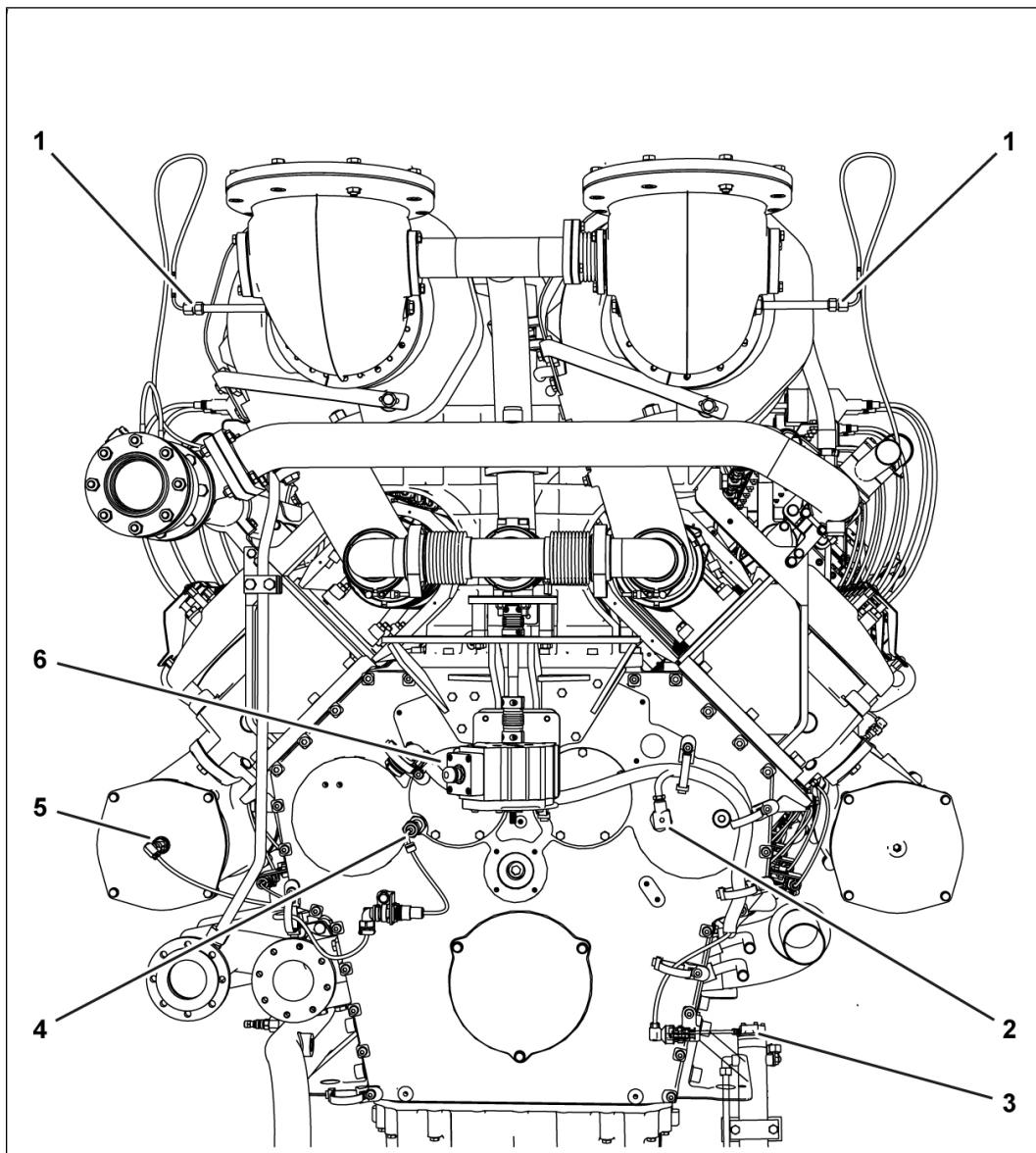
588542731: Electrical components on cylinder side A

- 1 Exhaust turbocharger speed sensor
- 2 Limit stop sensor
- 3 Gas-air mixer stepper motor
- 4 Throttle valve differential pressure sensor
- 5 Mixture pressure sensor
- 6 Starter
- 7 Starter relay
- 8 Knock sensor
- 9 Combustion chamber temperature sensor



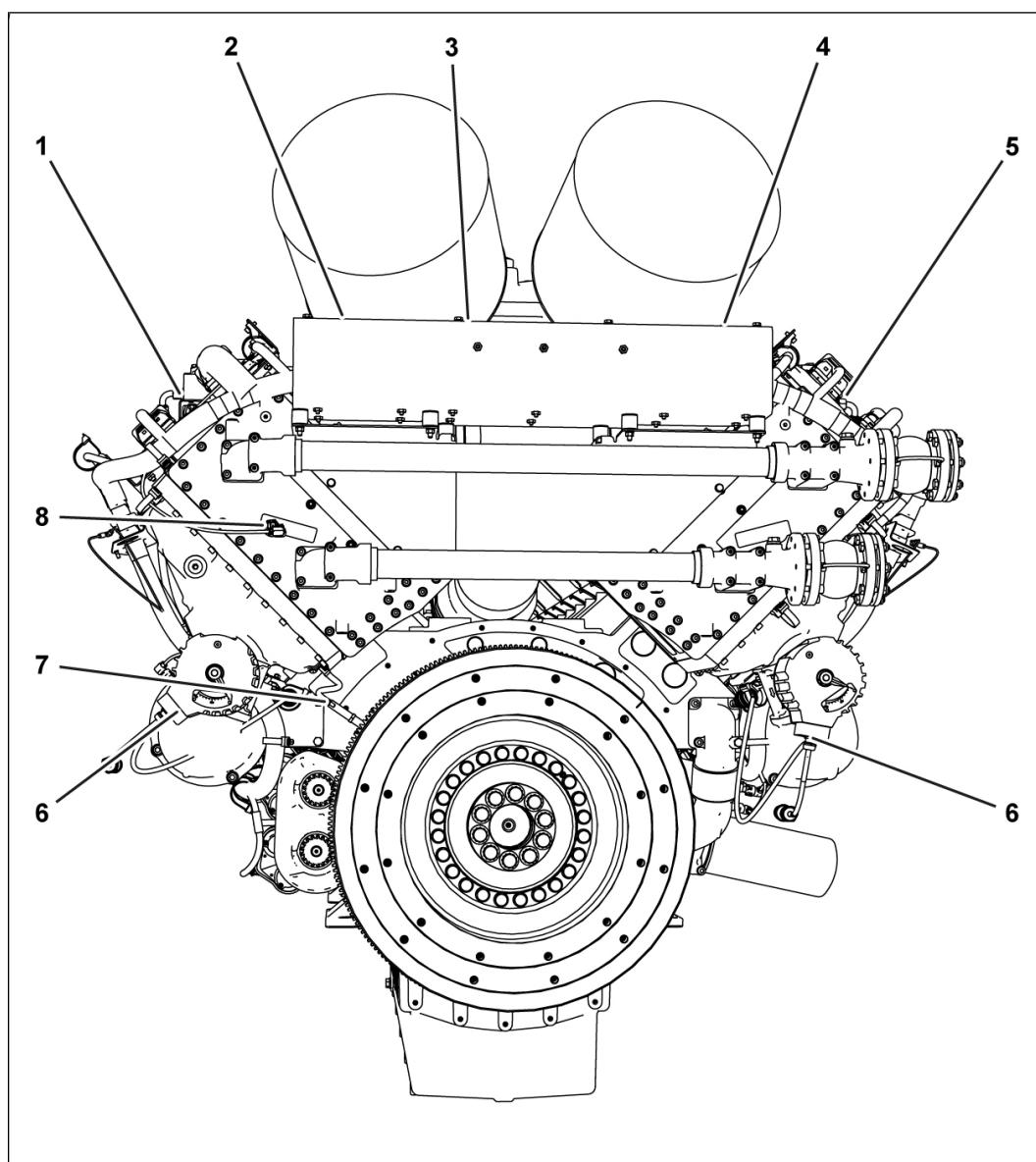
588545163: Electrical components on cylinder side B

- 1 Throttle valve differential pressure sensor
- 2 Intake air temperature sensor
- 3 Exhaust turbocharger speed sensor
- 4 Coolant temperature sensor
- 5 Coolant pressure sensor
- 6 Knock sensor
- 7 Combustion chamber temperature sensor
- 8 Mixture pressure sensor
- 9 Lube oil temperature sensor
- 10 Lube oil pressure sensor



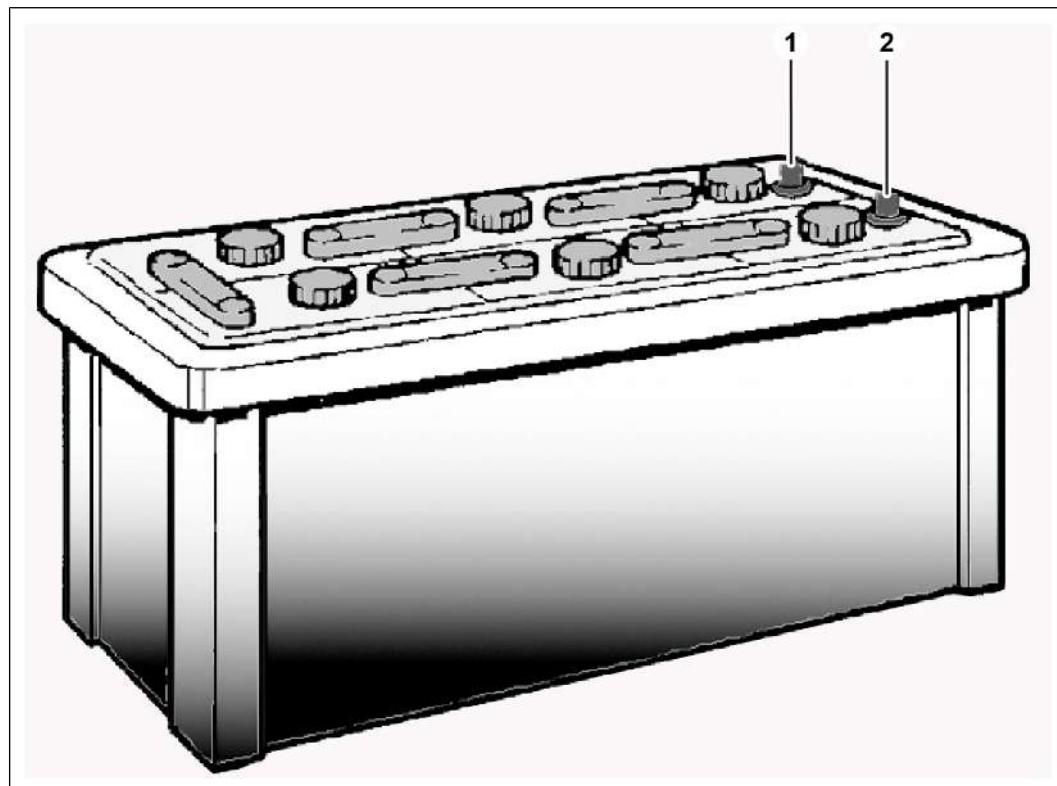
588547595: Free end electrical components

- 1 Exhaust turbocharger temperature sensor
- 2 Crankcase pressure sensor
- 3 Lube oil level sensor
- 4 Camshaft sensor
- 5 Mixture temperature sensor
- 6 Wastegate actuator



588550027: Drive end electrical components

- 1 Sensor control device
- 2 Output stage control device, throttle valve, and wastegate
- 3 Output stage control device, gas-air mixer
- 4 Output stage control device, throttle valve B
- 5 Main control device
- 6 Actuator (throttle valve)
- 7 Crankshaft sensor
- 8 Coolant temperature sensor

Functional description

1897293579

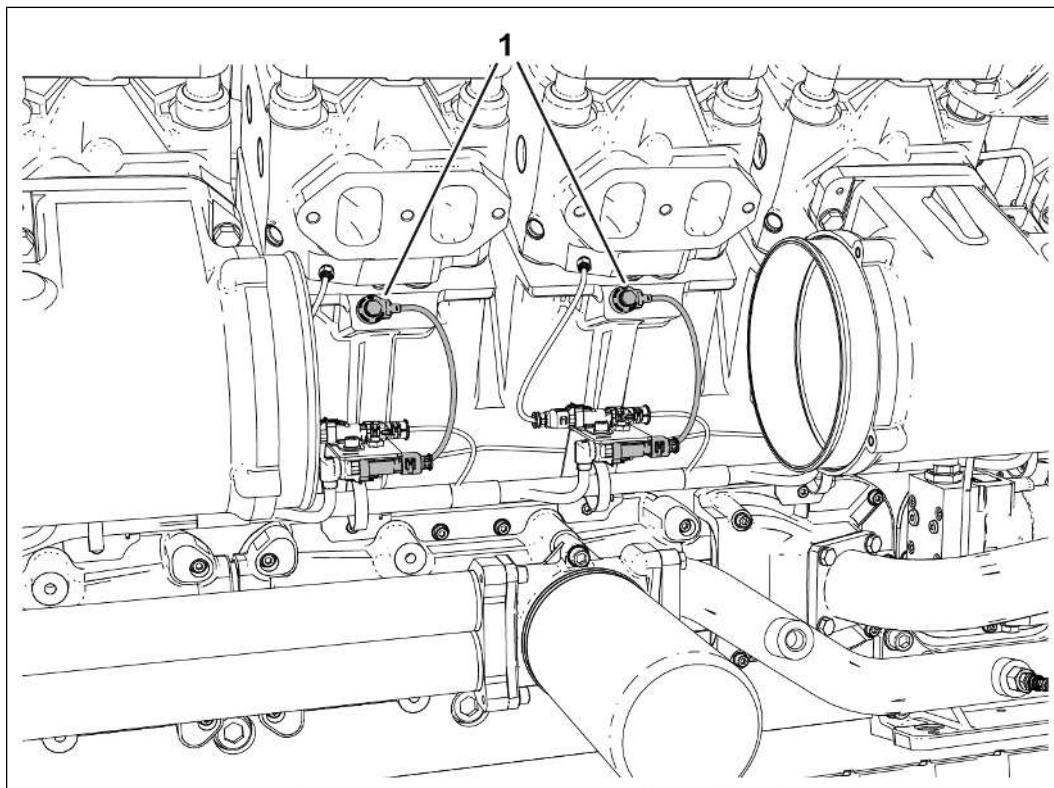
- 1 Negative pole
- 2 Positive pole

The battery is an electrochemical energy storage and conversion method. When discharging, the stored chemical energy is converted to electrical energy.

- The battery consists of one or more Galvanic cells that store chemical energy and discharge electrical energy.
- The converted energy is provided to the electric starter for the start sequence.

4.2.6.2 Knock sensor

Functional description



1853929227

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:

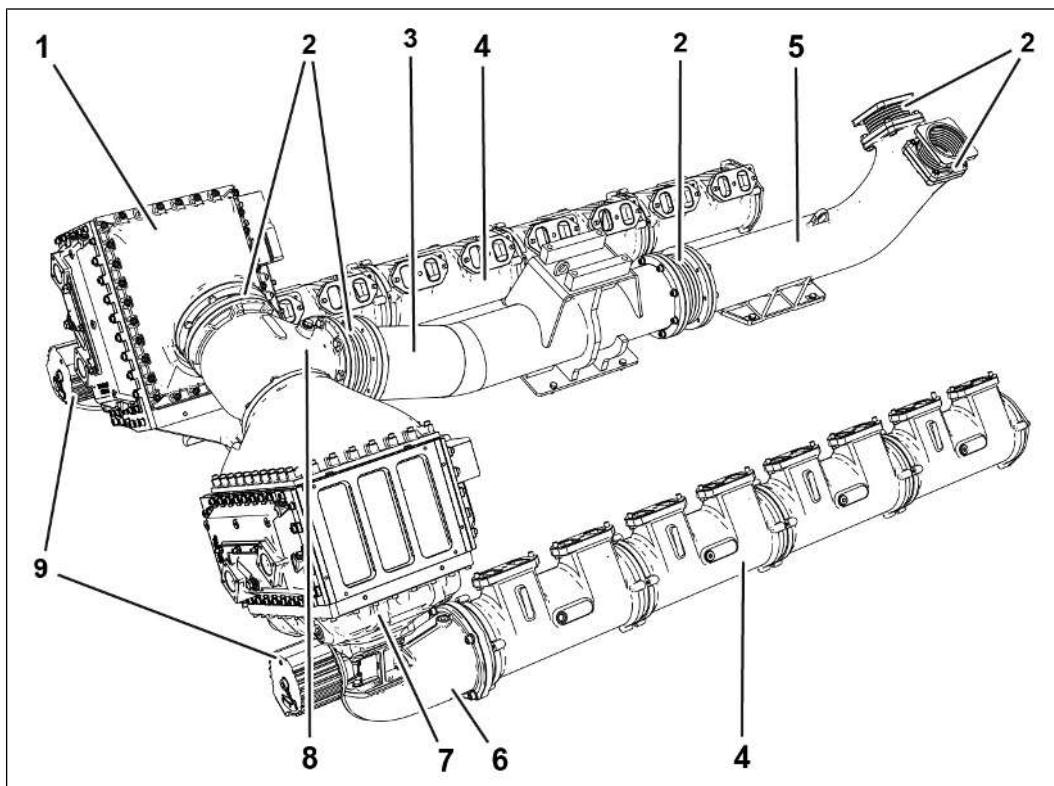
- Ignition timing is below 9° before top dead center (9° before TDC).
- Knocking combustion

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 Mixture system

4.2.7.1 Mixture system

Functional description



1826472715

- 1 Mixture cooler
- 2 Expansion joint
- 3 Mixture pipe
- 4 Mixture pipe
- 5 Mixture manifold
- 6 Mixture manifold
- 7 Mixture cooler cover
- 8 Mixture manifold
- 9 Actuator with throttle valve

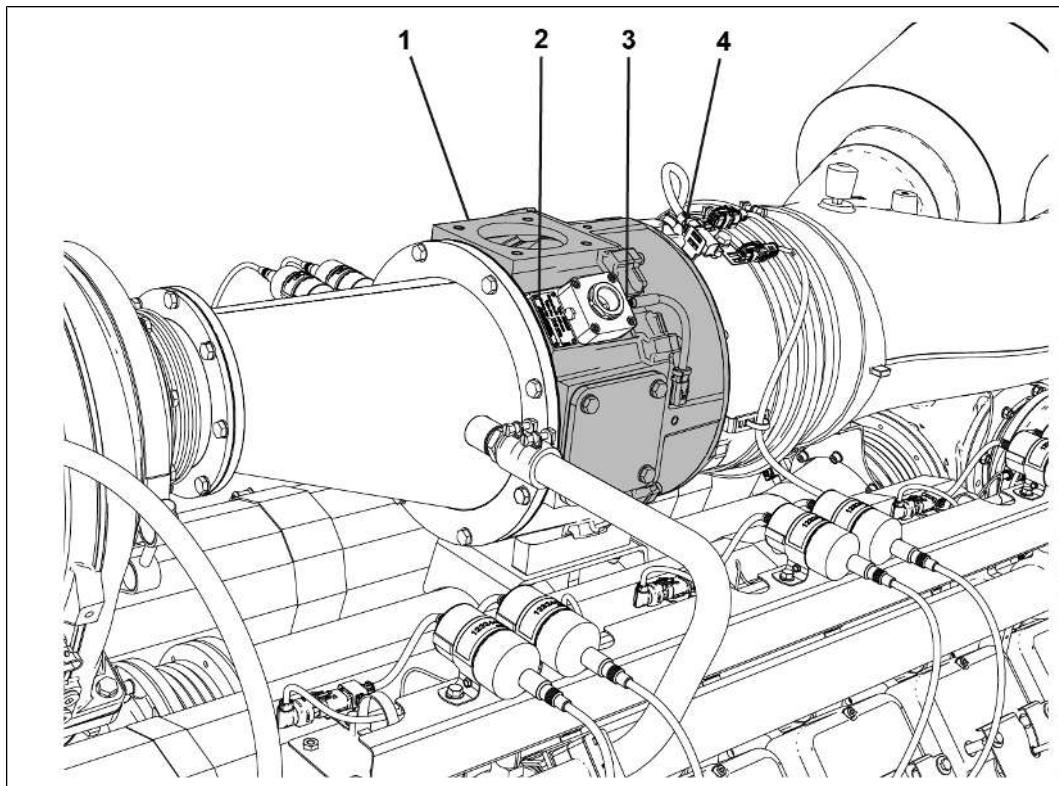
The mixture system feeds the turbocharged mixture through the mixture cooler to the cylinder heads.

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 \[▶ 86\]](#).

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.

4.2.7.2 Gas-air mixer

Functional description



1918573323

- 1 Gas-air mixer
- 2 Rating plate
- 3 Proximity switch
- 4 Stepper motor connector

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.

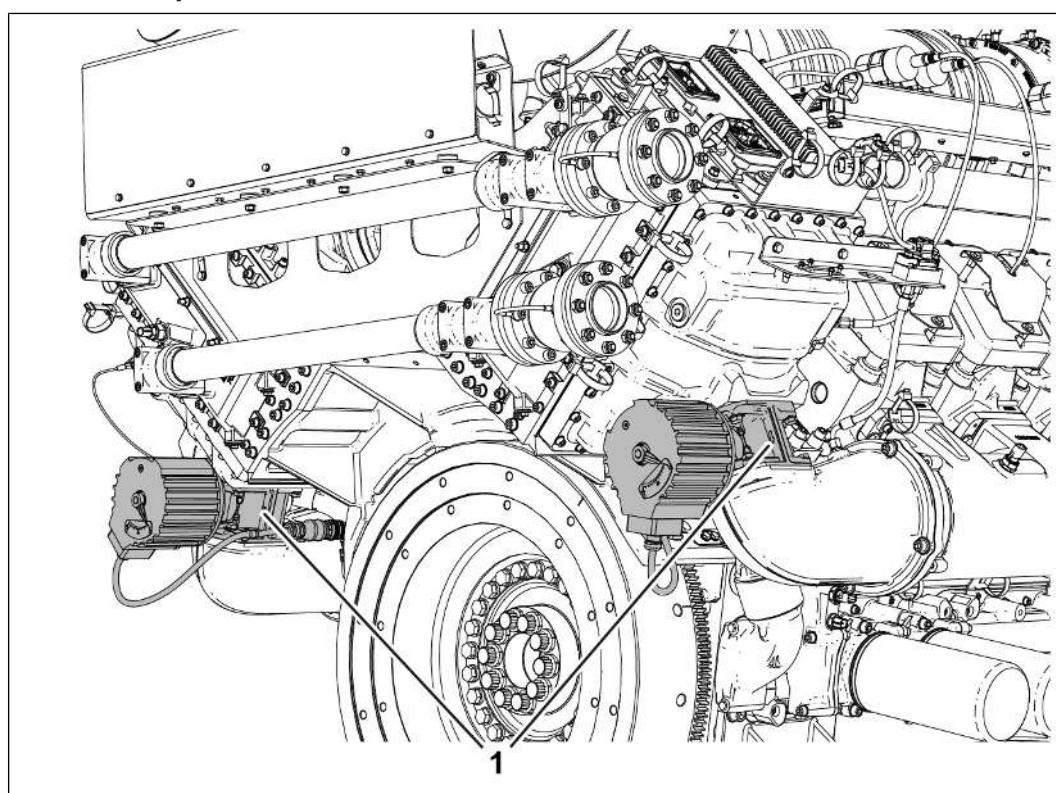
- For more information on the gas train, see *Operating Manual, chapter Operation, section Gas supply*.

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](#).

4.2.7.3 Throttle valve

Functional description



1806651915

1 Throttle valve with actuator

The engine is equipped with two throttle valves which are controlled by actuators.

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.

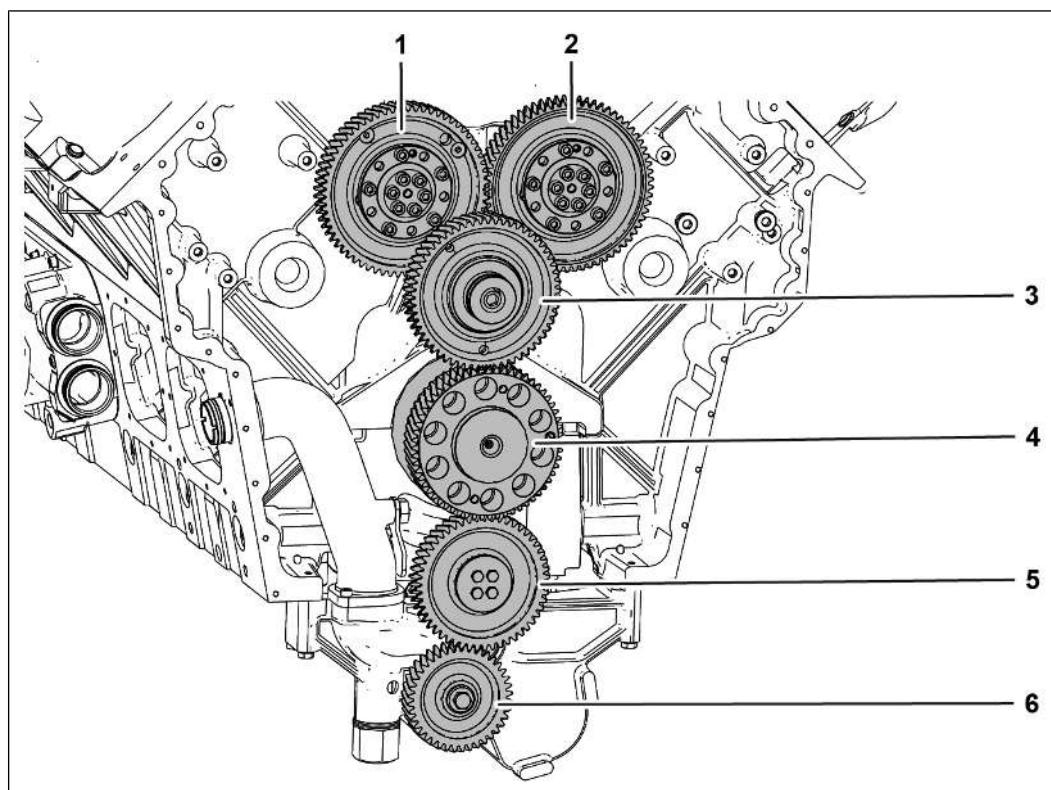
A sensor takes contactless readings of the position of the feedback cam on the actuator's output shaft and transmits the values to the electronic control.

4.2.8 Mechanical system

4.2.8.1 Mechanical control

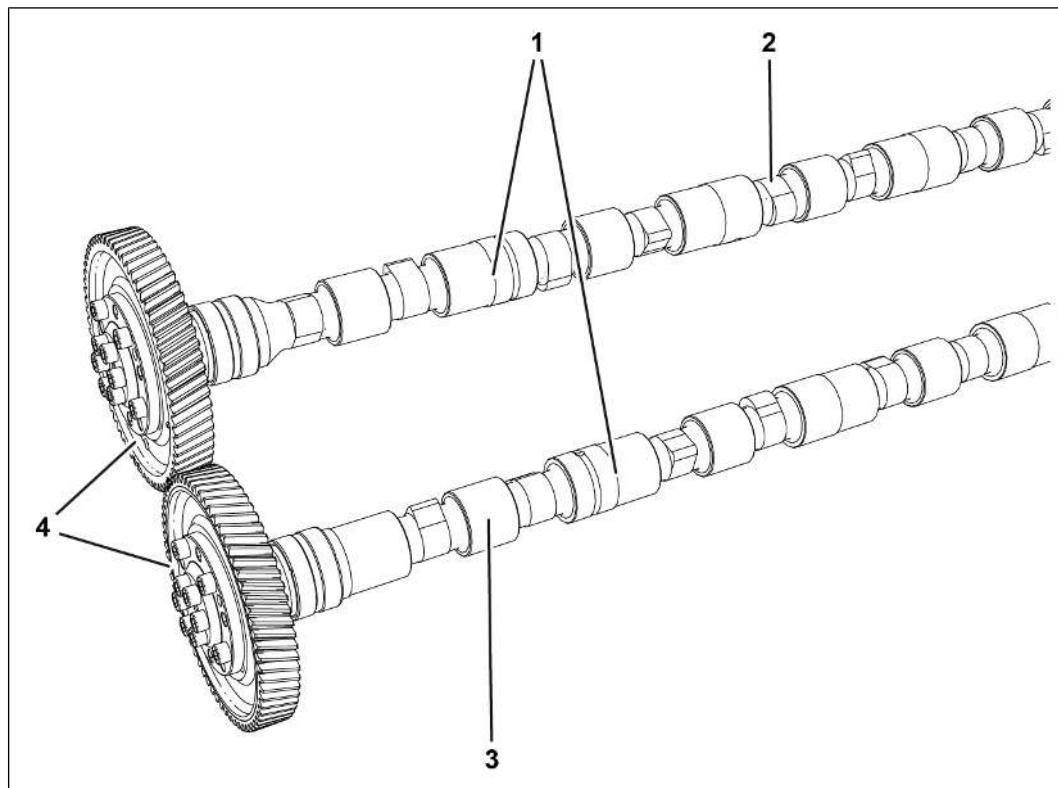
Functional description

The mechanical control consists of:



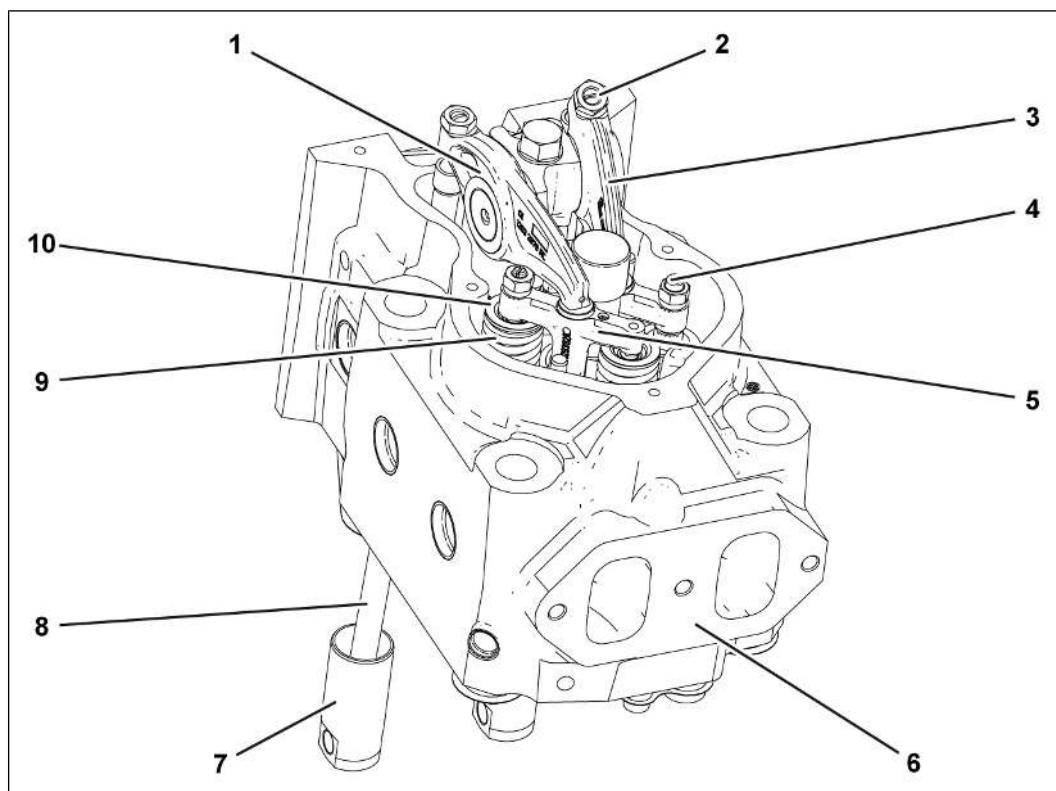
1981542411

- 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 \[▶ 84\]](#).



1983290123

- 1 Camshaft
 - 2 Cams
 - 3 Camshaft gear
 - 4 Bearing pins
- Camshaft, see [Functional description \[▶ 85\]](#).



150823307: TCG 3020

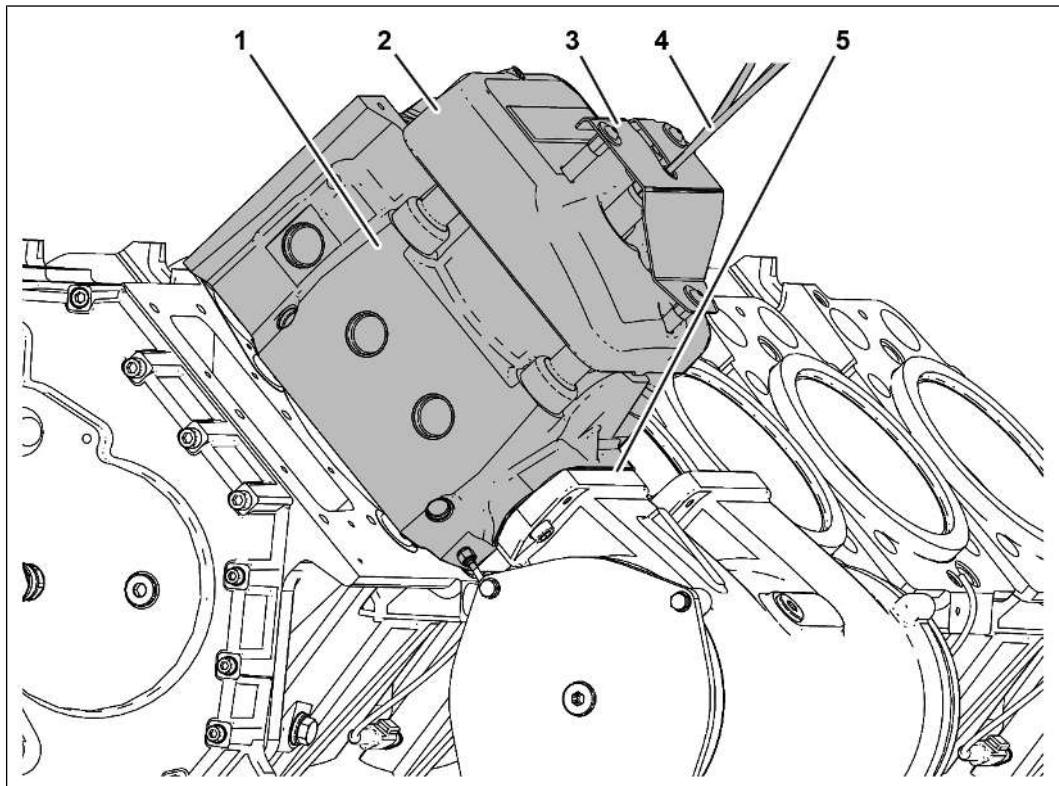
- 1 Inlet rocker arm
 - 2 Setting screw for valve clearance
 - 3 Outlet rocker arm
 - 4 Setting screw for valve crosshead
 - 5 Valve crosshead
 - 6 Cylinder head
 - 7 Roller tappet
 - 8 Push rod
 - 9 Valve spring
 - 10 Spring plate
- Valve train, see [Functional description \[▶ 79\]](#).

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.

4.2.8.2 Cylinder head**Functional description**

9007201200566283

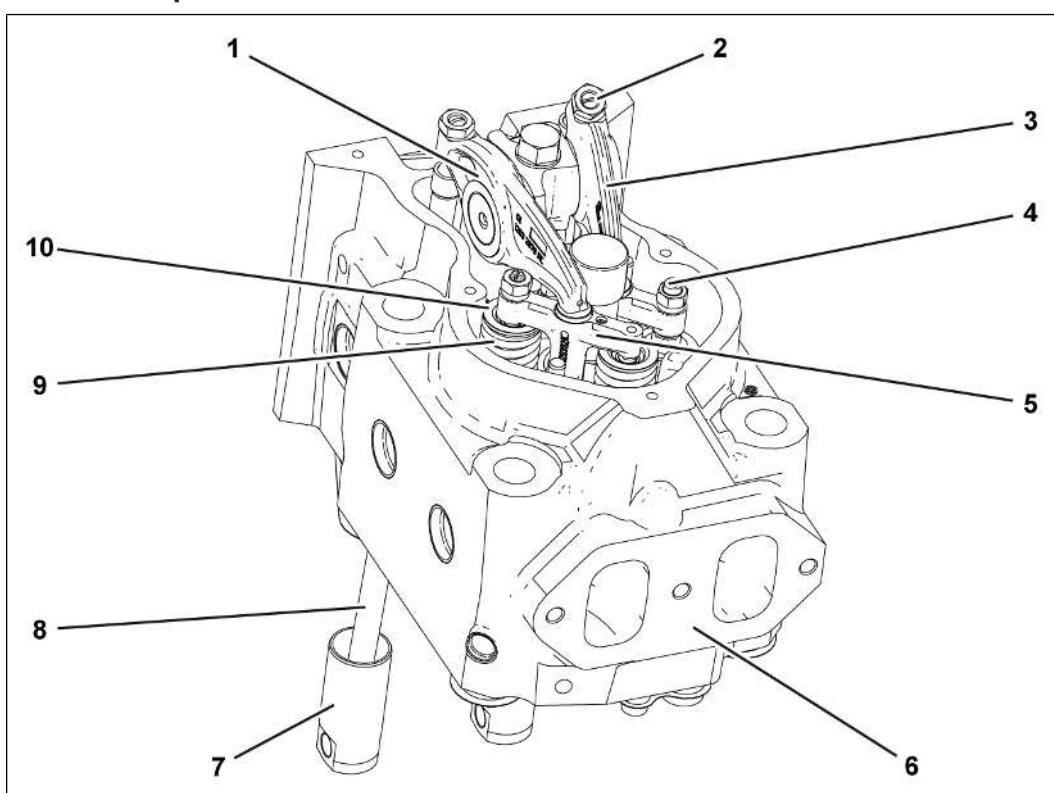
- 1 Cylinder head
- 2 Cylinder head cover
- 3 Spark plug cover
- 4 Ignition cable
- 5 Inlet connection piece

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

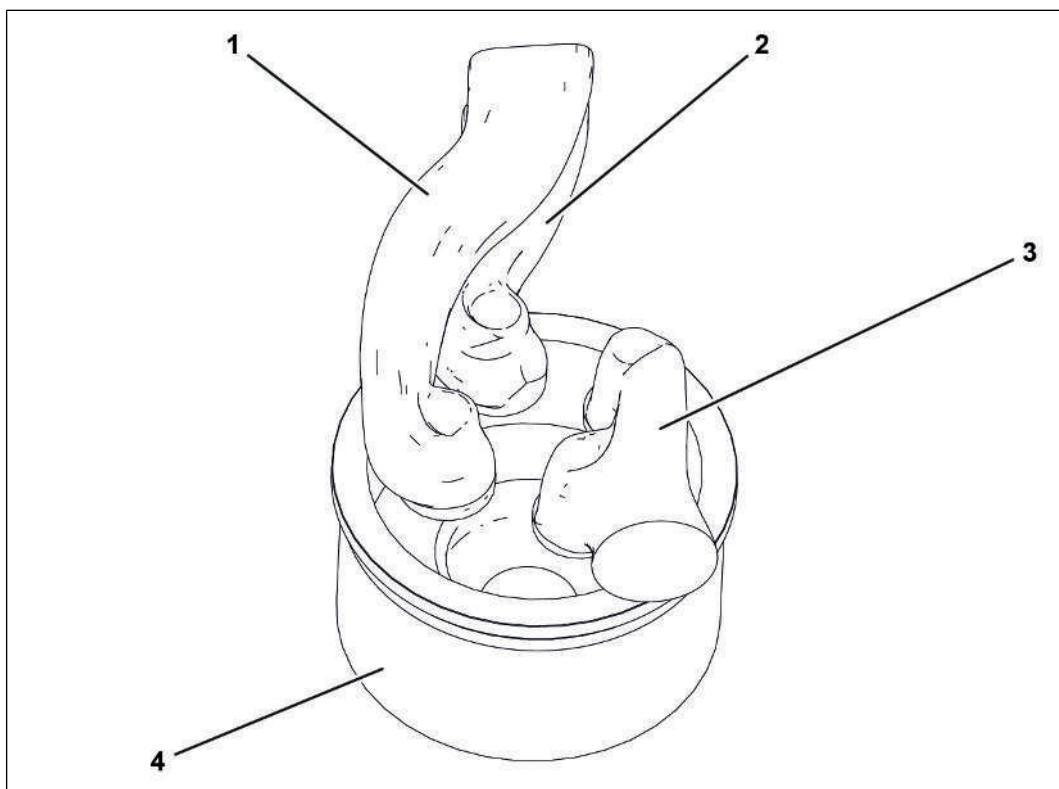
Each cylinder head has four valves.

- 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

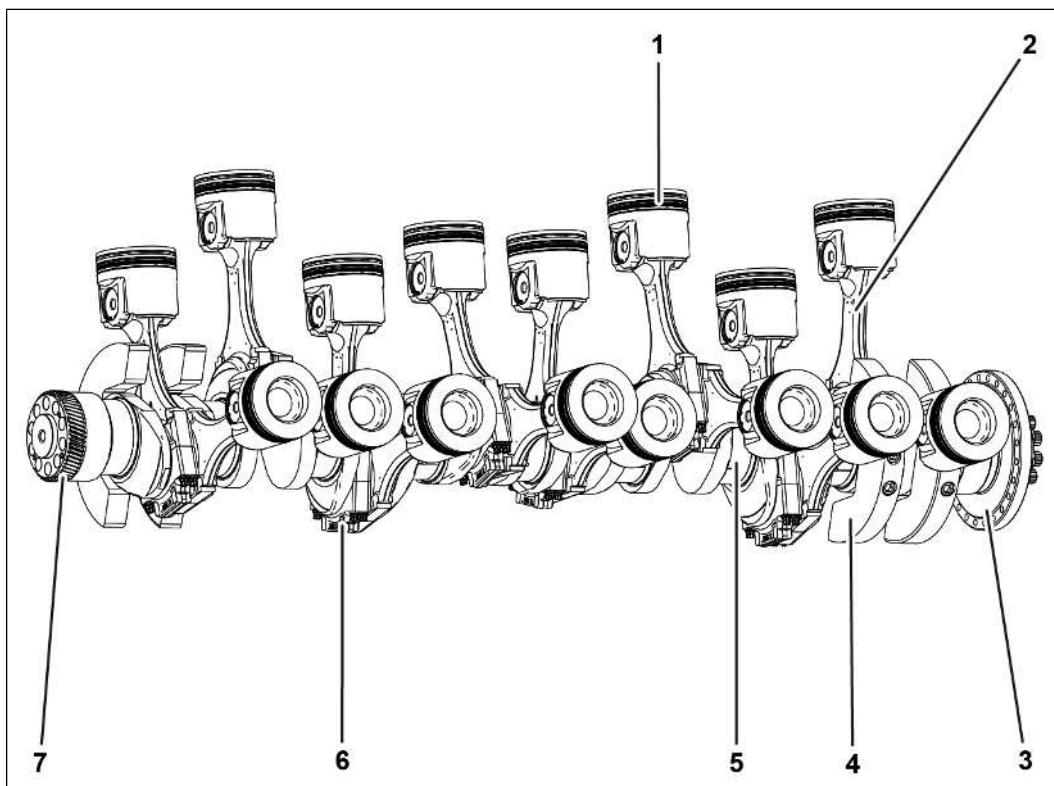
- 1 Swirl duct
- 2 Filling duct
- 3 Outlet duct
- 4 Cylinder liner

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.

4.2.8.3 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.

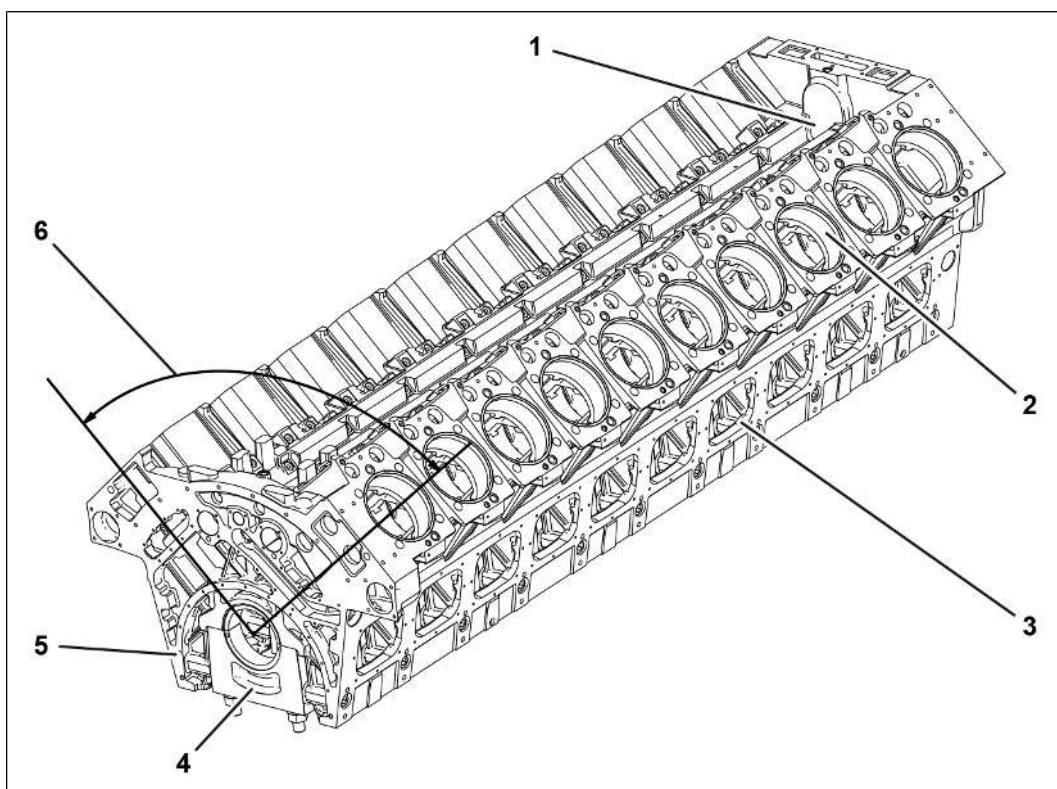
- The inertia of the flywheel ensures a uniform transmission of the force.

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.

4.2.8.4 Crankcase

Functional description



1857674123

- 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.

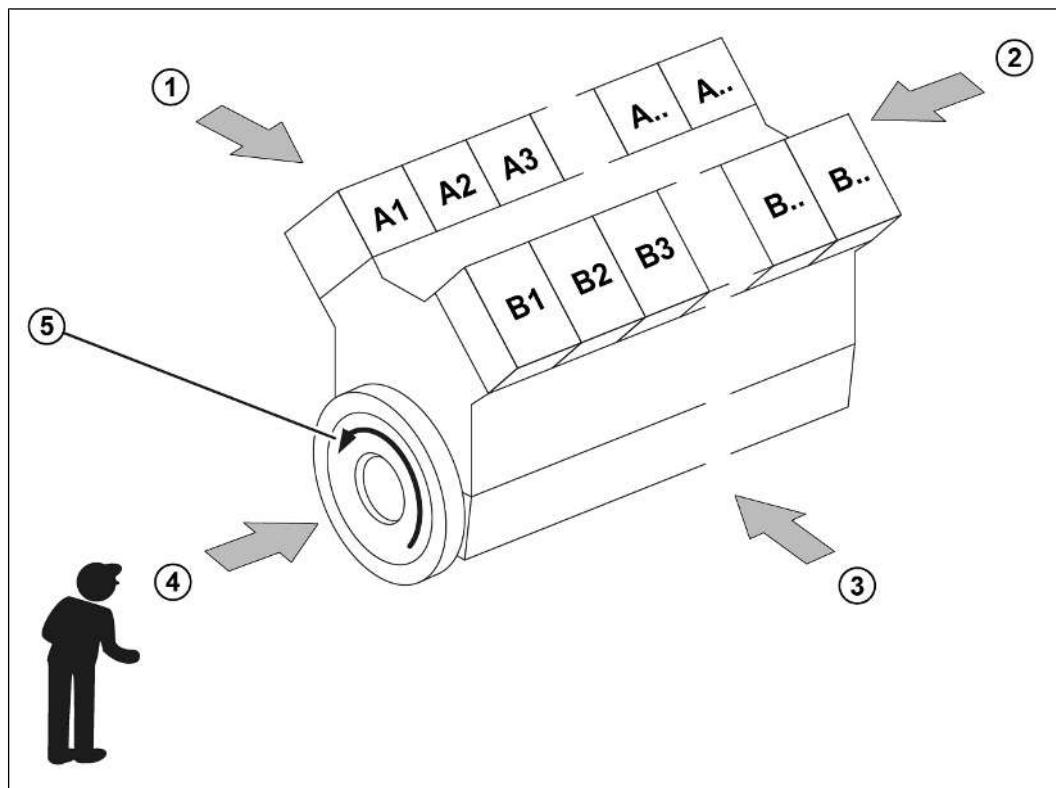
The crankcase is used to accommodate:

- Cylinder heads
- Cylinder liners

- Crankshaft
- Camshaft
- Mechanical engine control

4.2.8.5 Cylinders

Cylinder designation



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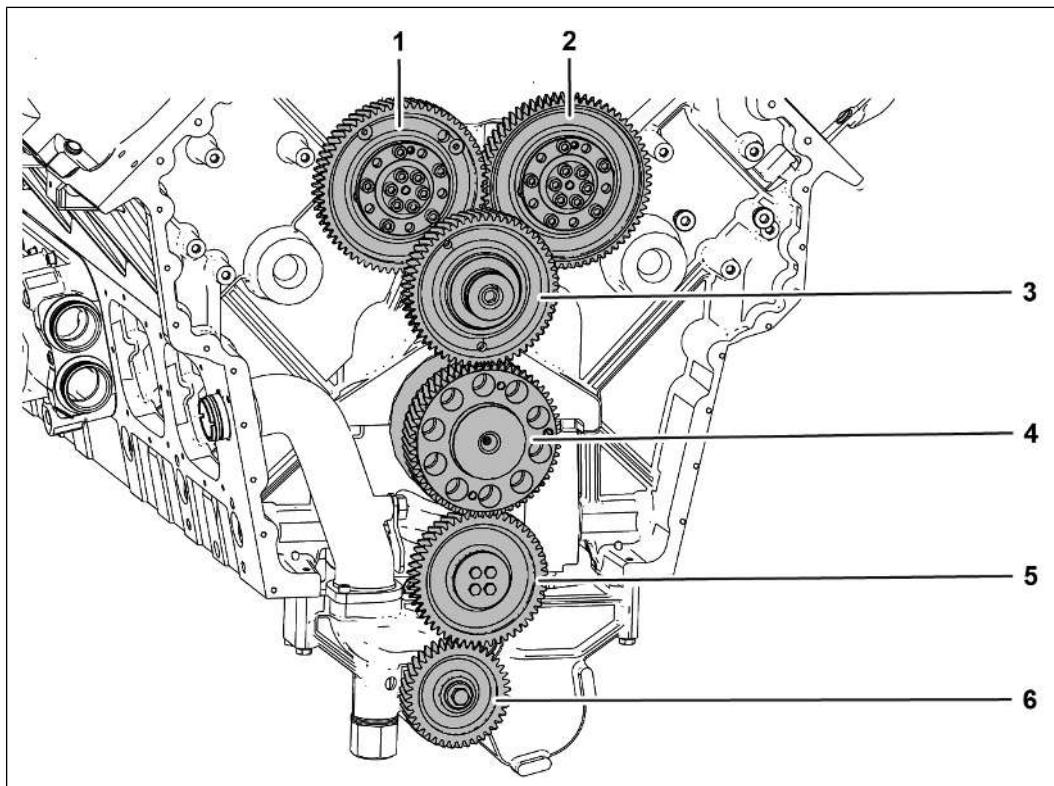
- 1 Cylinder side A (left engine side)
- 2 Free end (face side, i.e. side opposite the coupling)
- 3 Cylinder side B (right engine side)
- 4 Drive end (flywheel side or coupling side)
- 5 Flywheel direction of rotation (arrow)

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).

4.2.8.6 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

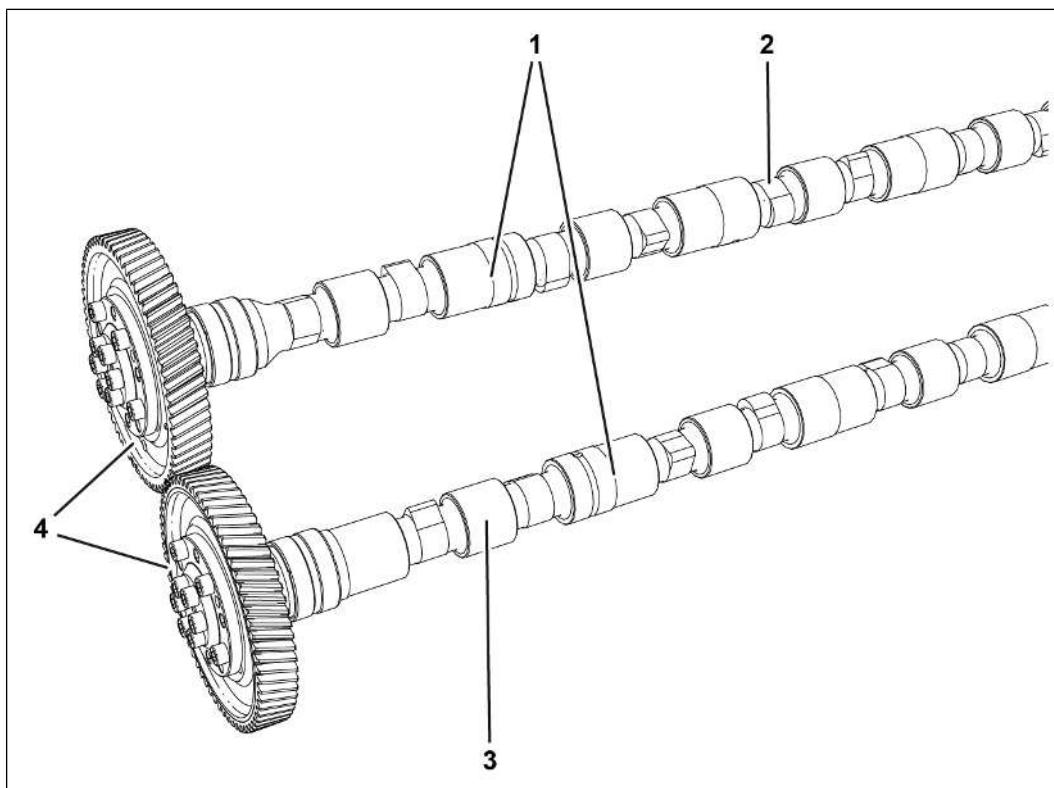
The gear drive is installed on the free end (opposite side of the coupling).

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.

4.2.8.7 Camshaft

Functional description



1983290123

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

The camshaft rests on replaceable bearing liners in the crankcase.

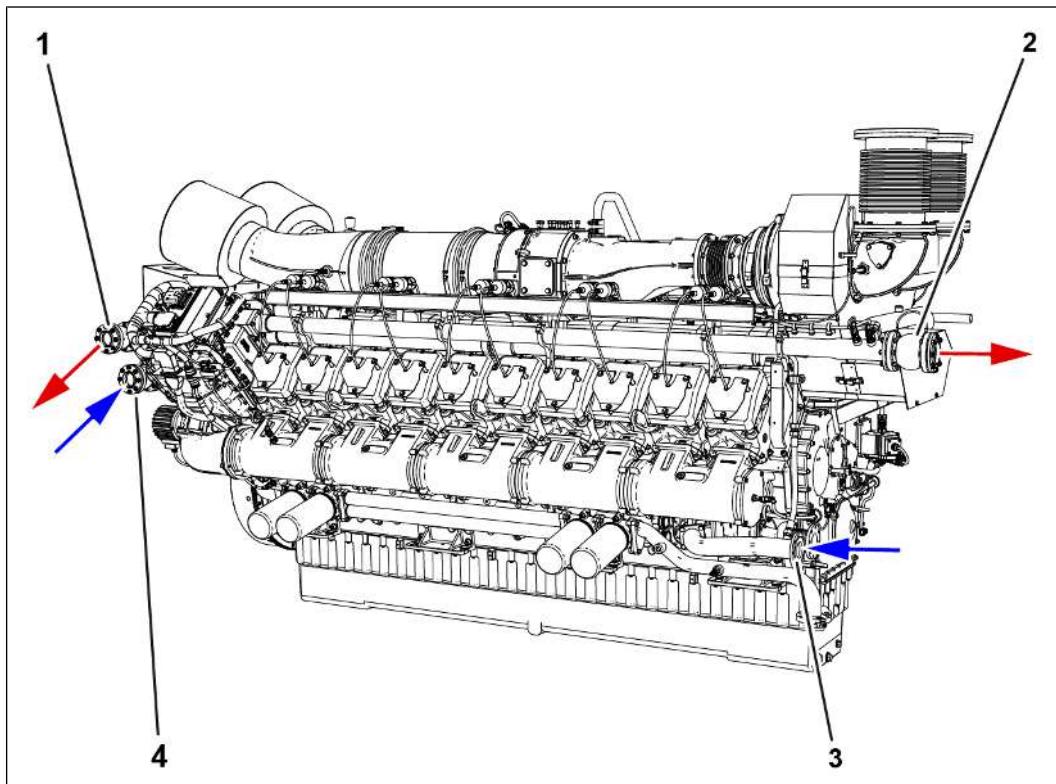
The camshaft is responsible for opening and closing the inlet valves and outlet valves at the right times.

- 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.

4.2.9 Cooling system

4.2.9.1 Cooling system

Functional description



18014400337135755

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

4.2.10 Lube oil system

4.2.10.1 Lube oil system

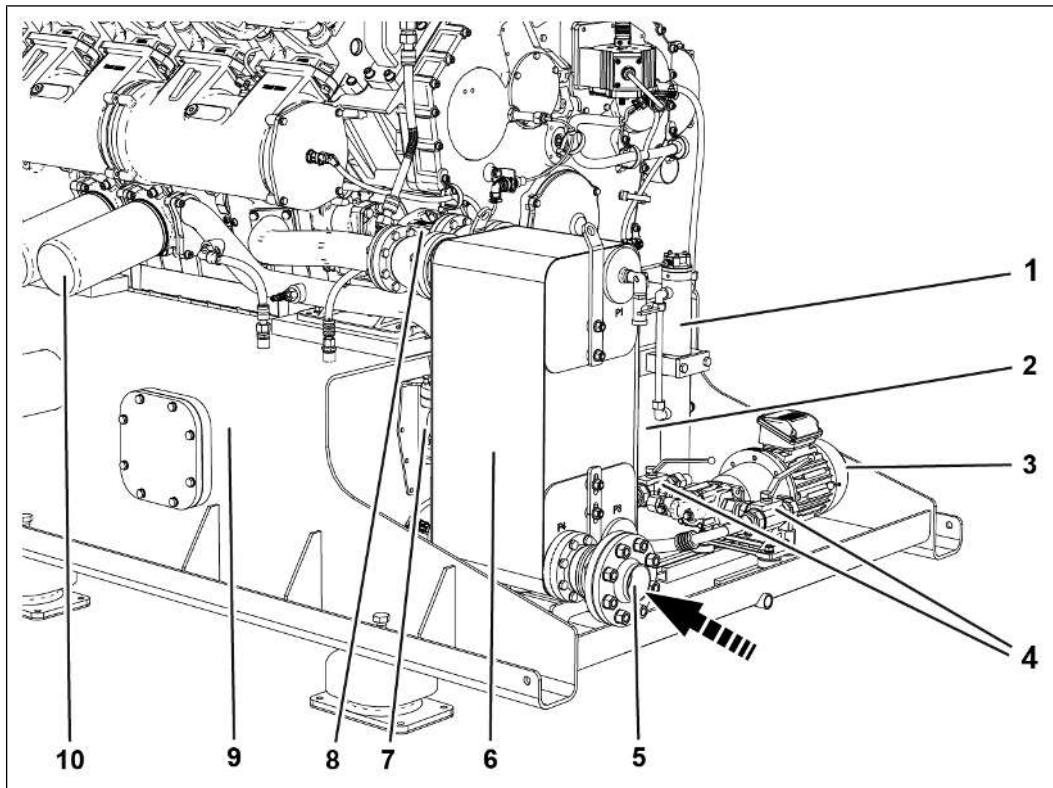
Functional description

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.



9007201098901771: Components of the lube oil system

- 1 Level sensor
- 2 Lube oil sump
- 3 Prelubrication pump
- 4 Ball valve
- 5 Lube oil inlet
- 6 Lube oil cooler
- 7 Engine lube oil return
- 8 Engine lube oil inlet
- 9 Base frame with lube oil tank
- 10 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.

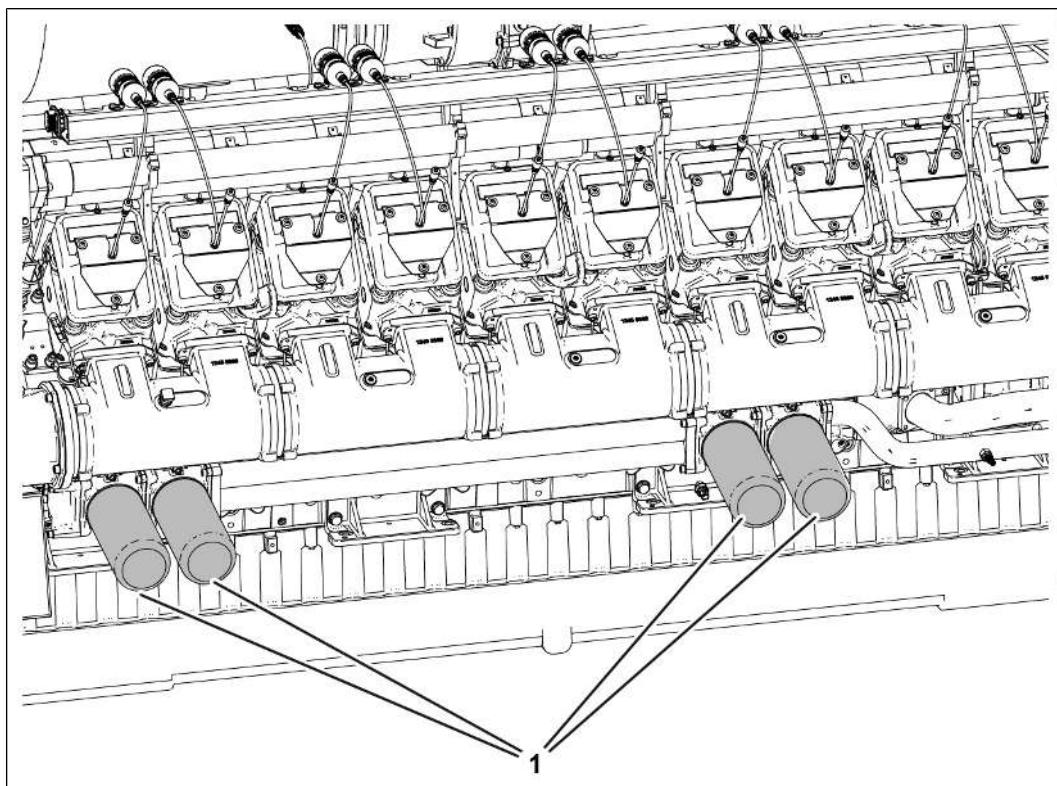
Pressure valves integrated in the lube oil circuit adjust the lube oil pressure.

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.

4.2.10.2 Lube oil filter

Functional description



1945975691

1 Lube oil filter

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

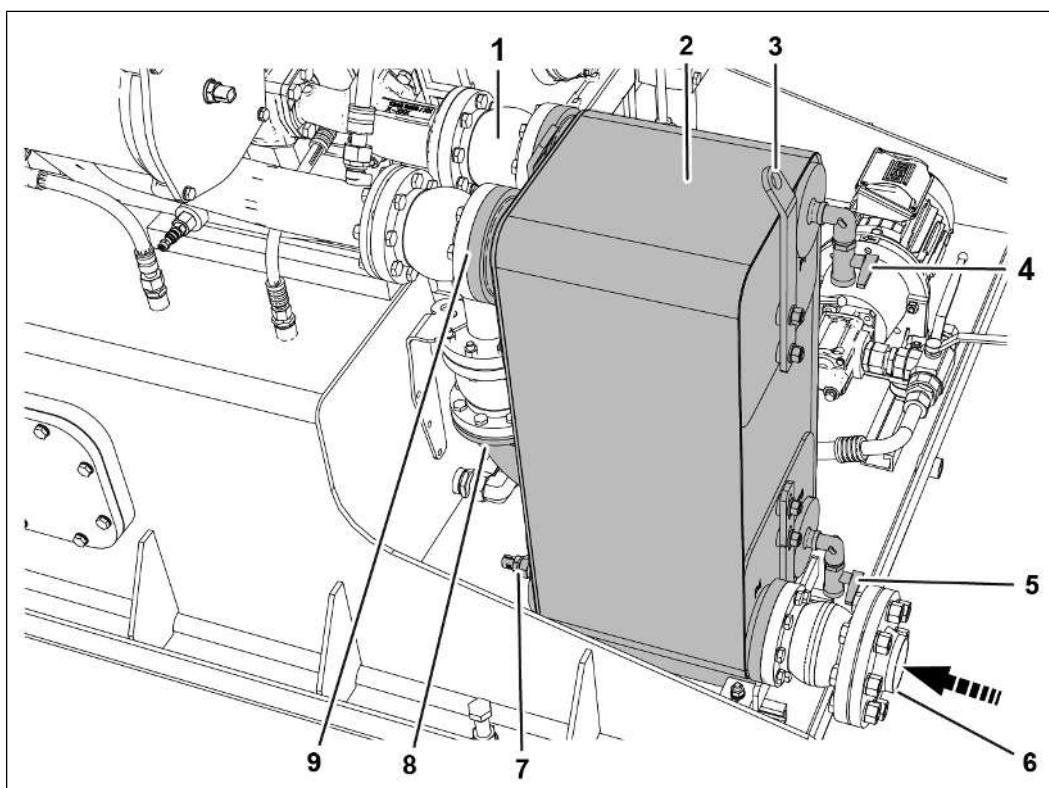
- Two or four lube oil filters can be installed.

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.

4.2.10.3 Lube oil cooler

Functional description



1844487691

- 1 Engine lube oil inlet
- 2 Lube oil cooler
- 3 Transport lug
- 4 Ball valve vent
- 5 Ball valve drain
- 6 Coolant inlet (external)
- 7 Bypass valve
- 8 Engine lube oil outlet
- 9 Coolant connection

The lube oil cooler is mounted on the free end of the genset.

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

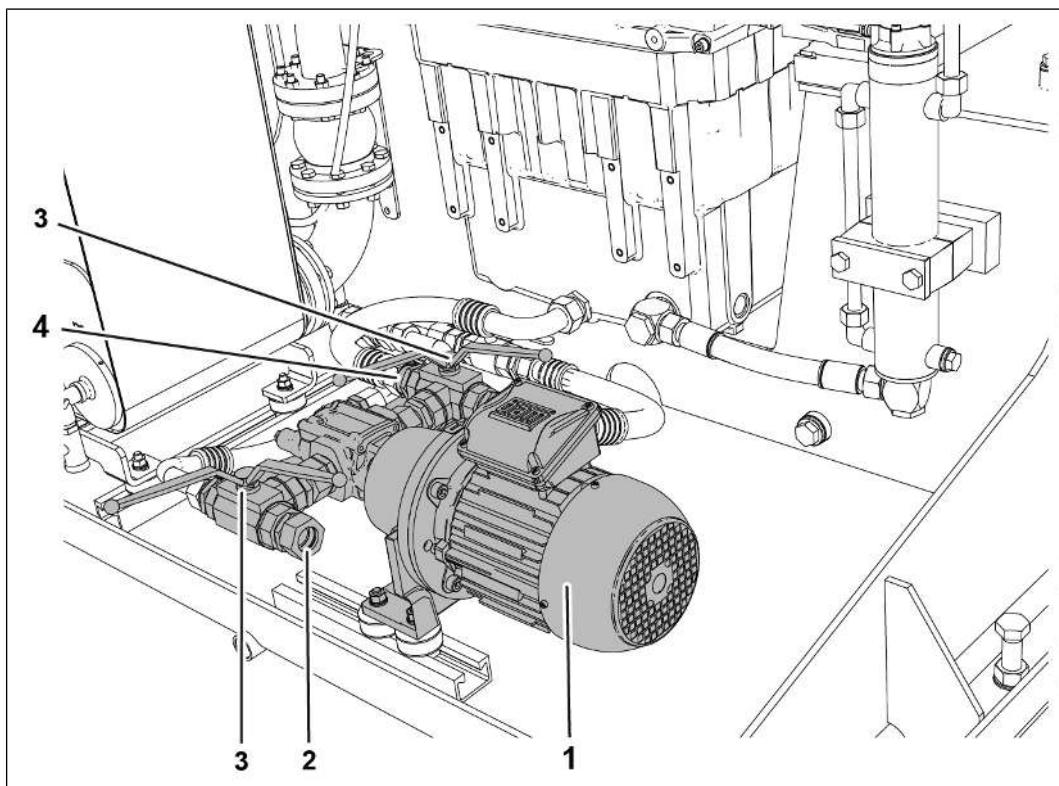
The two media approach the same temperature within the heat exchanger of the lube oil cooler.

- 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.

4.2.10.4 Prelubrication pump

Functional description



1844478731

- 1 Prelubrication pump
- 2 Lube oil connection
- 3 3-way valve
- 4 Lube oil sump connection

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:

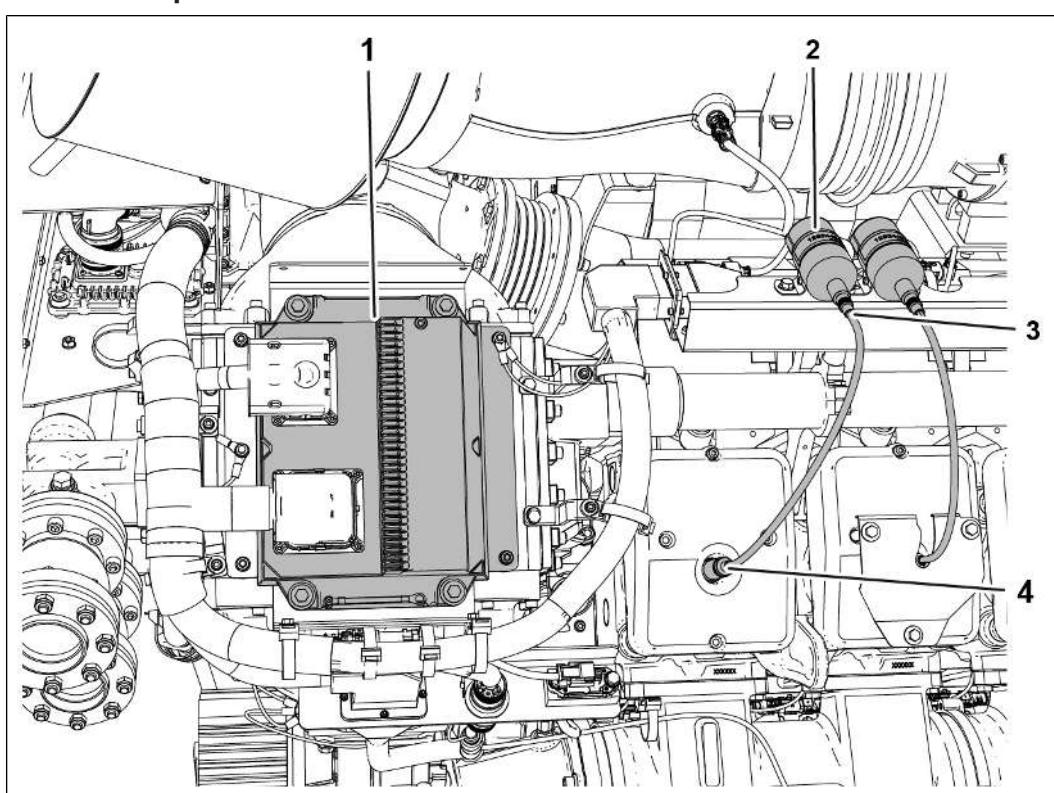
- Interval lubrication
- Prelubrication before every engine start
- Relubrication after shutting down engine

- 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 Ignition system

4.2.11.1 Ignition system

Functional description



1848690955: Top-down view of the engine

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

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.

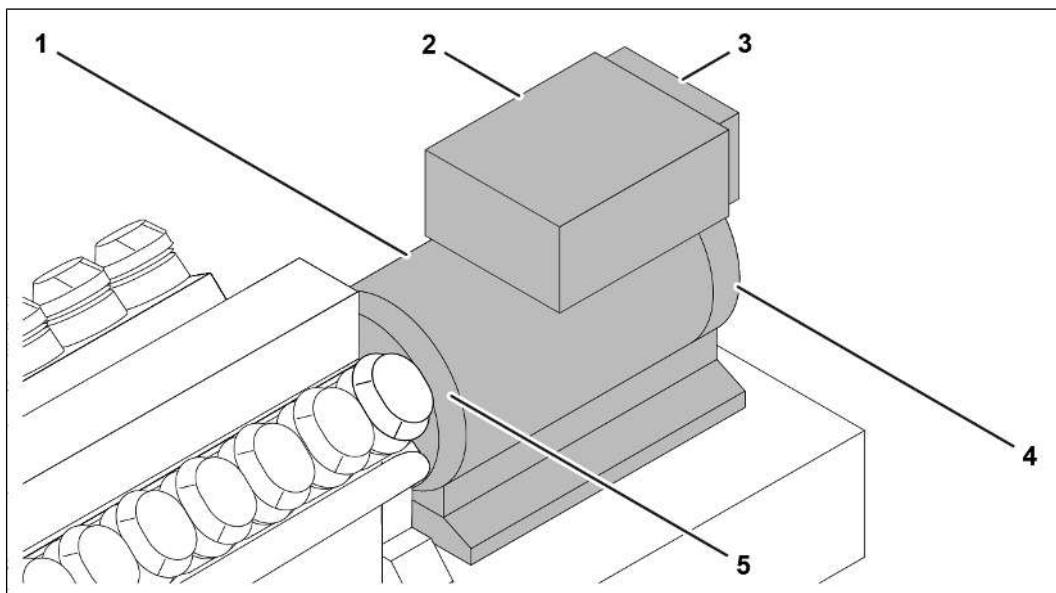
Advantages of a prechamber spark plug:

- 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

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.

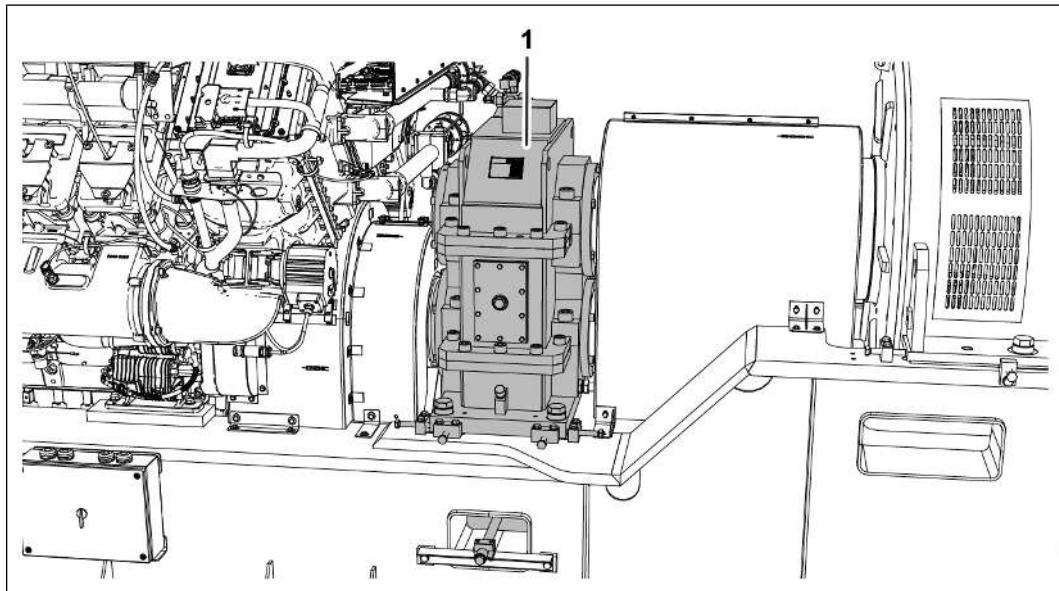
The generator is mounted on the base frame in the power flow direction downstream of the engine and coupling.

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

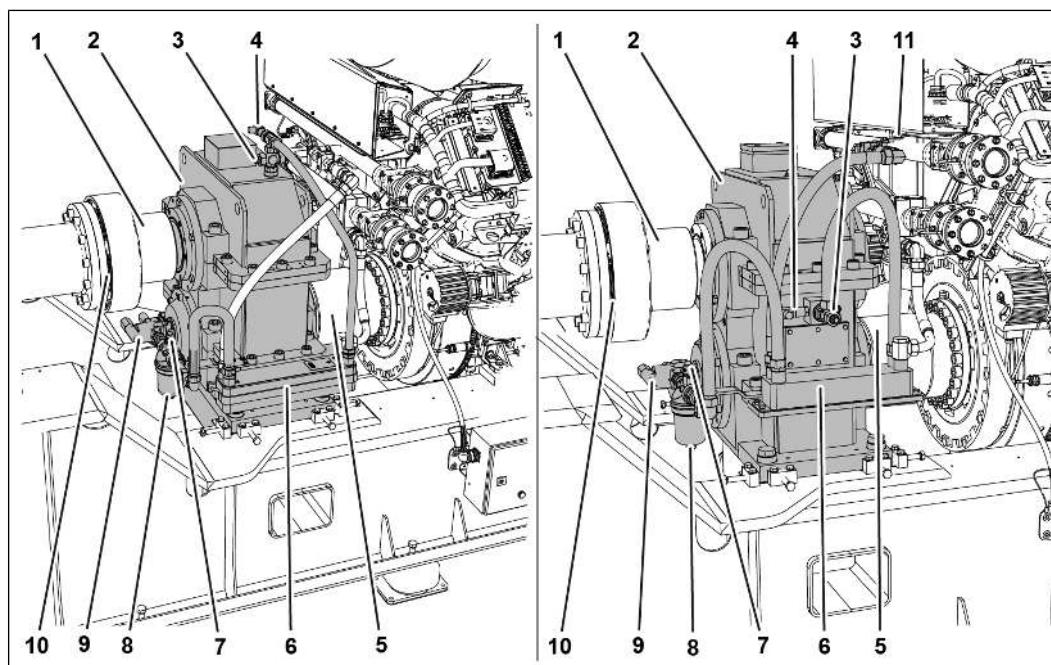


3283008139

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.



3283010571

Left	2.0 MW genset	Right	2.3 MW genset
------	---------------	-------	---------------

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

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

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.

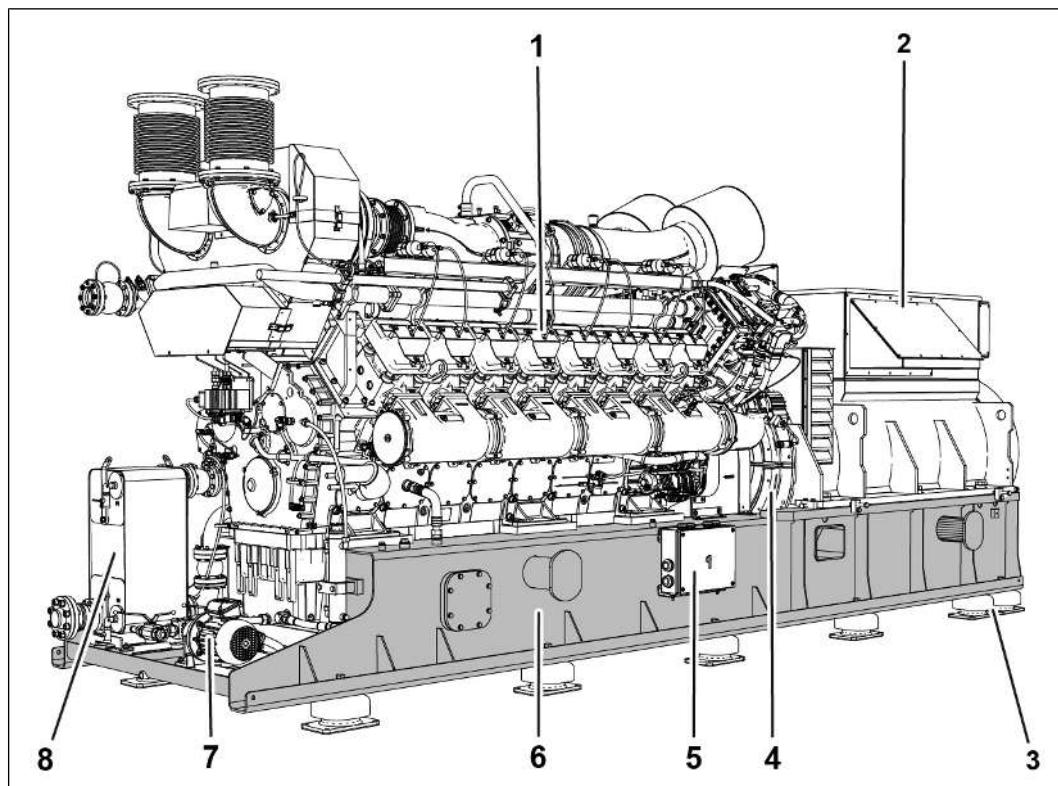
A heat exchanger is mounted on the transmission to cool the lube oil.

- 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



1855501195

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

The base frame rests on anti-vibration mountings.

The genset components are mounted on the base frame.

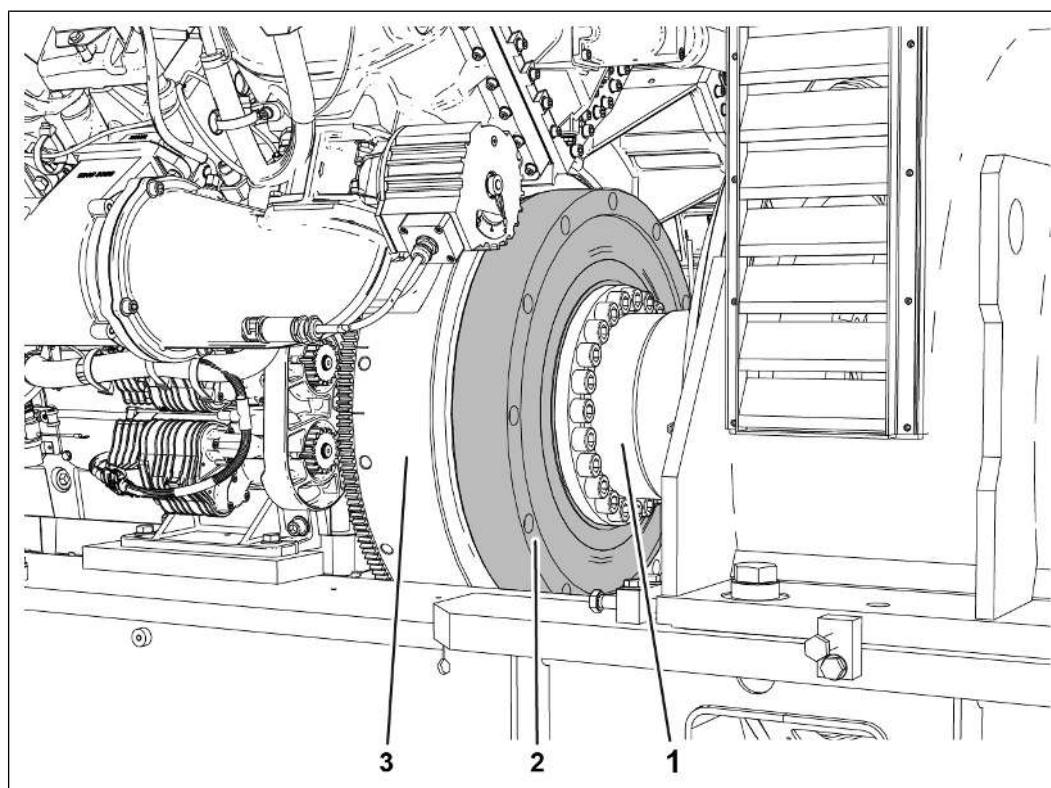
The base frame is available with or without an integrated lube oil tank.

- 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



1856864779

- 1 Generator flange
- 2 Coupling
- 3 Flywheel

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

- The elastic coupling cannot be switched.

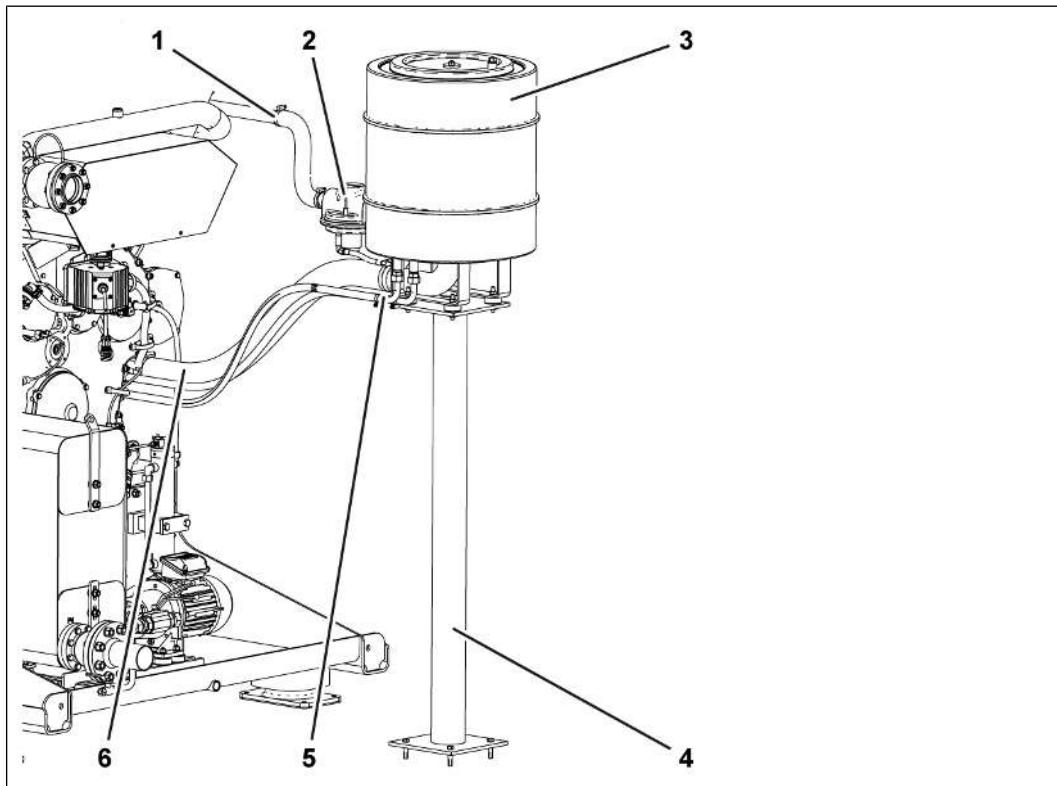
The coupling has the following functions:

- 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



150772491

- 1 Blow-by gas return line to the intake 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.

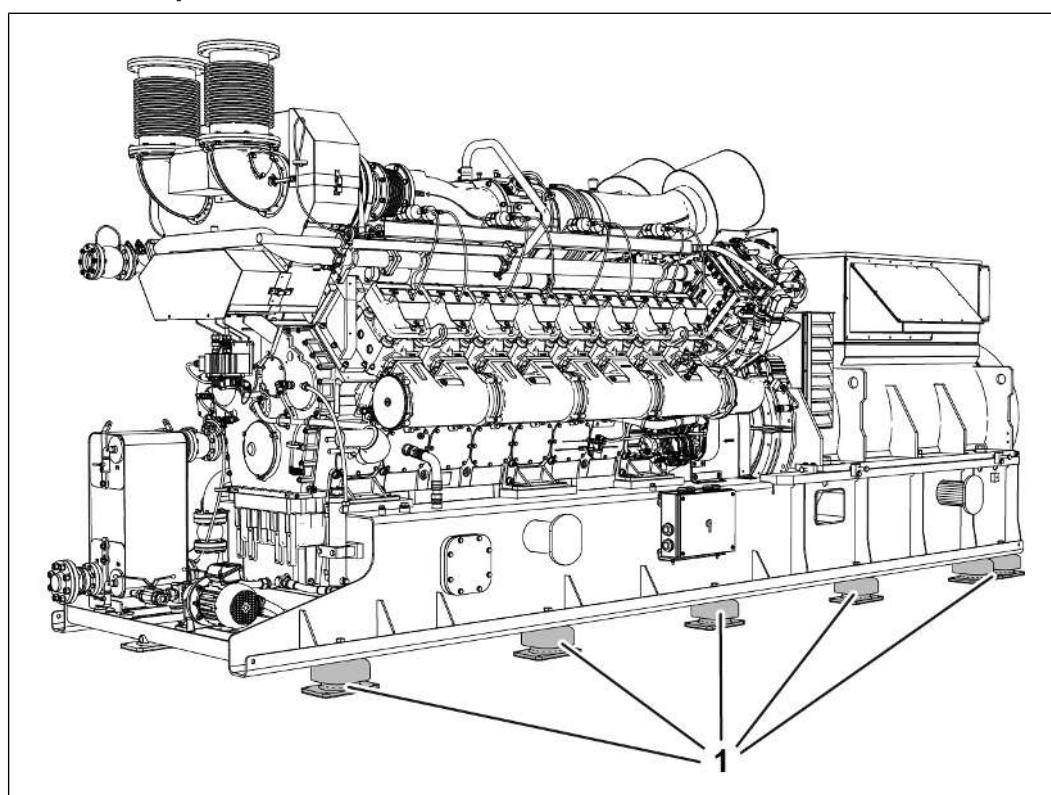
A return line directs the filtered lube oil back to the lube oil sump.

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



1856288267

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 when the genset comes from the factory.

The wiring harness is connected with a plug connector at the TPEM Connection Box.

- The TPEM Connection Box is the interface to the TPEM Control Cabinet.

DANGER



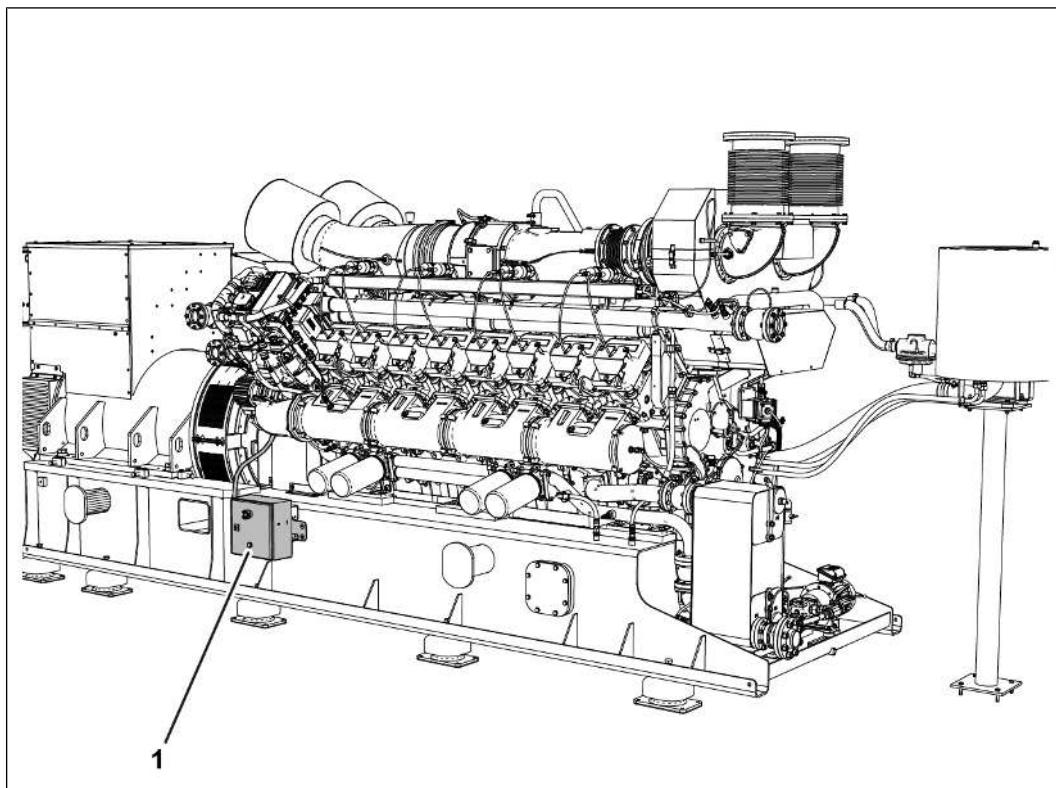
Electric shock if live components are touched.

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.

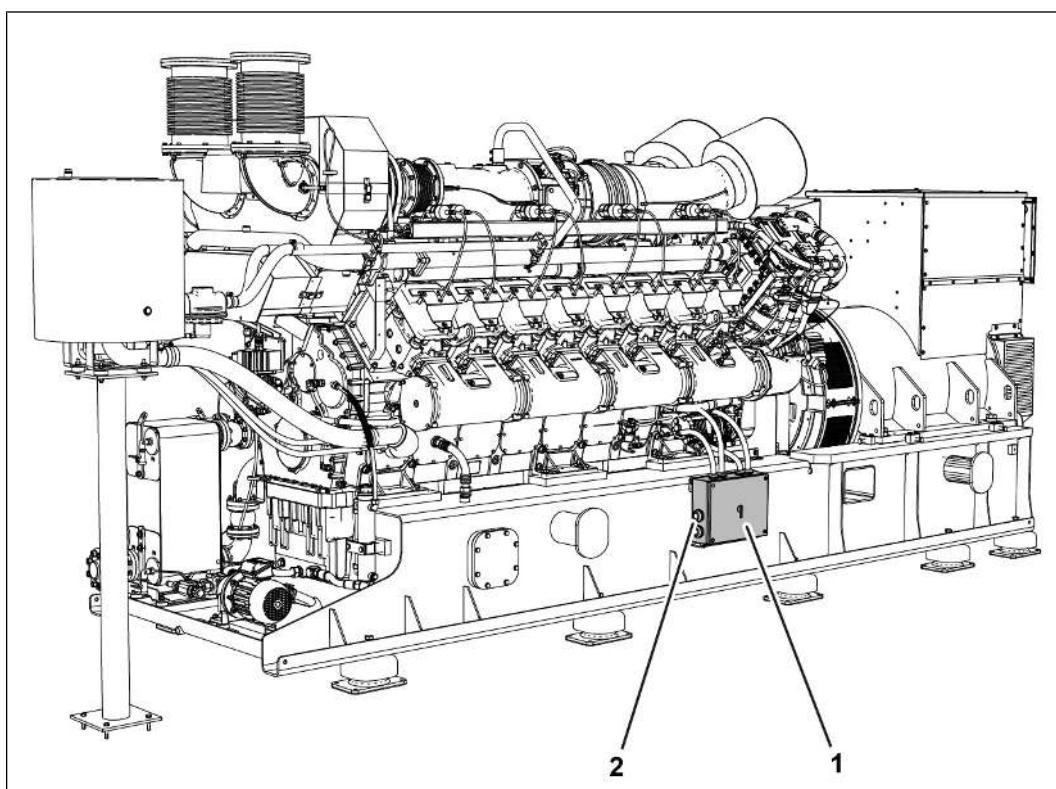
Connecting the genset to the electrical supply:

- ✓ The necessary switch cabinets have been set up.



1878125579

1. Connect the TPEM Connection Box (1) to the TPEM Control Cabinet.



1878128011

2. Electrically connect the battery disconnection switch.

-
- Connect the cables from the starter battery to the connections (2) on the terminal box (1).

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 Fuel gas system

6.2.1 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.

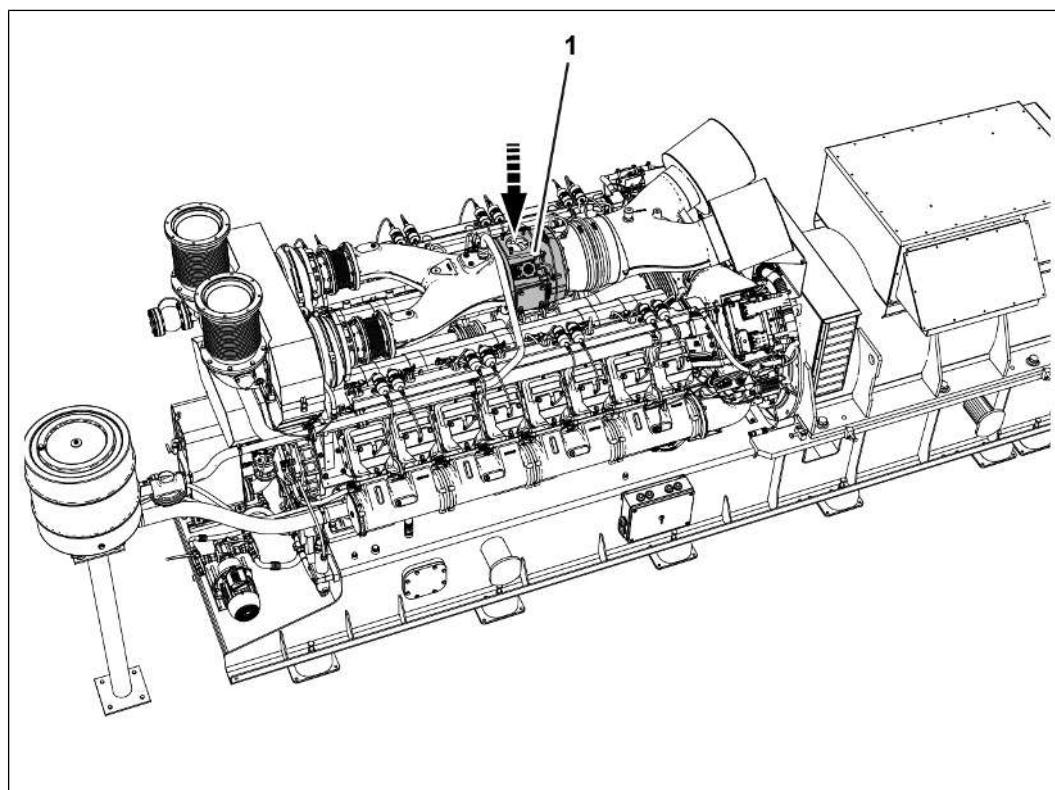
- Use a suitable expansion joint to decouple the genset and thereby minimize vibrations.

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.



1874327051

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 [▶ 105]

6.3 Intake air system

6.3.1 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 \[▶ 105\]](#)
- [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 [Dismantling and mounting the intake air filters \(mounted version\) \[▶ 412\]](#)
 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.

6.4 Exhaust system

6.4.1 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

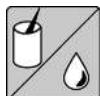
Alignment

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.

6.5 Lube oil system

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



Auxiliary media:

- Lube oil

General information

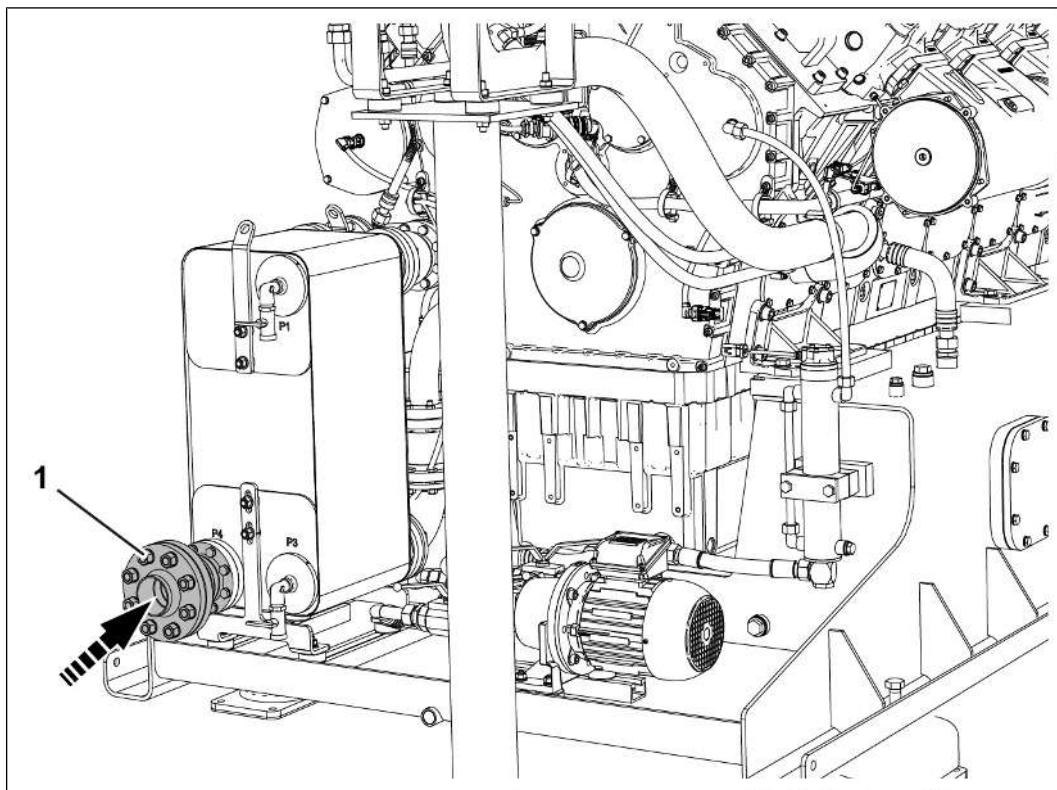
For detailed notes on installing the on-site lube oil system, see:

- 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.



1844197771

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 on-site lube oil connection to the lube oil cooler connection (1).

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

1. Close all lube oil valves on the genset.
2. Close all lube oil valves on the external lube oil equipment.
3. Fill external lube oil supply with lube oil.
4. Open all lube oil valves on the genset.
5. Open all lube oil valves on the external lube oil equipment.
6. Start TPEM.
7. Start the prelubrication pump.
 - The prelubrication fills, if necessary, the lube oil tank in the base frame of the genset.
 - The TPEM automatically stops the prelubrication when the lube oil level is too low.
8. Check lube oil level in the TPEM.

6.6 Cooling system

6.6.1 Connecting the on-site cooling system with the genset

Auxiliary media:

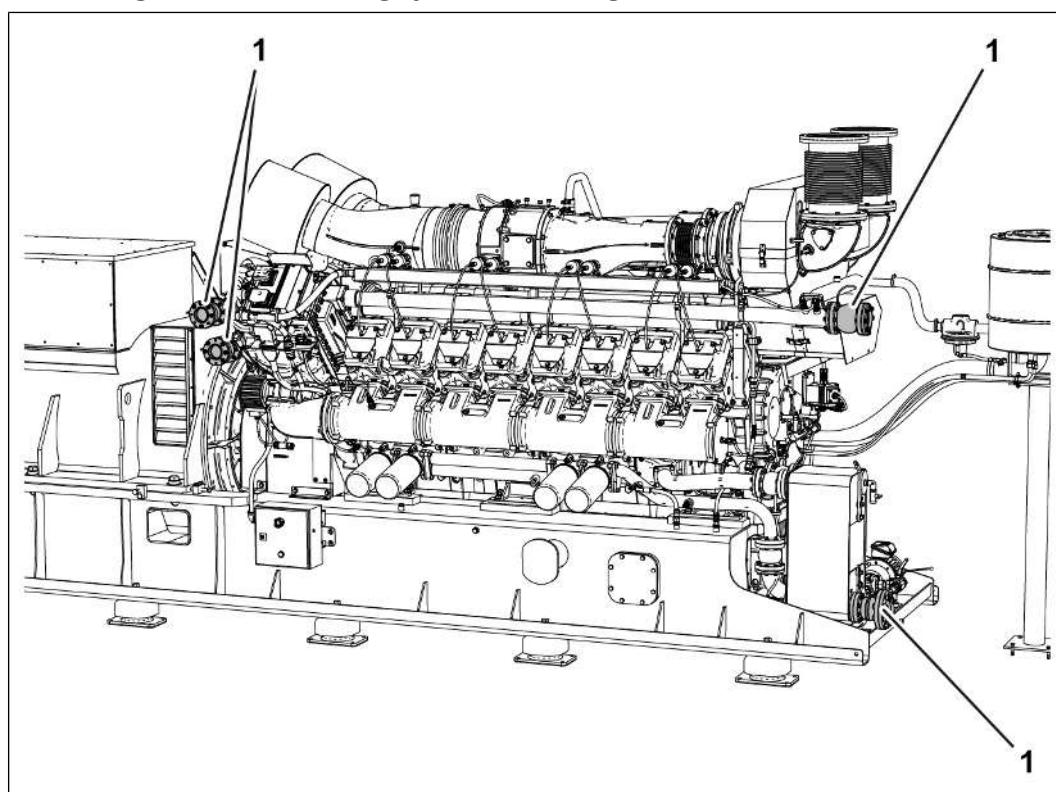
- Cooling system protection agent

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:



1874148235

- 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 \[▶ 311\]](#).
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 \[▶ 435\]](#)
 - 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.

6.7 TPEM Connection Box

6.7.1 Commissioning the TPEM Connection Box (TPEM CB)

The plant or genset and the TPEM Connection Box (TPEM CB) are commissioned at the same time. All functions are only available upon simultaneous commissioning.

1. Establish power supply
2. Switch on plant
3. Carry out electrical safety tests
4. Slowly start up plant
5. Run acceptance procedure
6. Switch off plant and secure
7. Create acceptance protocol

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 \[▶ 194\]](#).
 - 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 \[▶ 202\]](#).
 - 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 \[▶ 202\]](#).
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 \[▶ 202\]](#).
5. Check actuator for ease of movement, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \[▶ 433\]](#).
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 [Filling the cooling system \[▶ 441\]](#).
2. Check the coolant fill level, see OL-MRA10 / 38-01-23 [Filling the cooling system \[▶ 441\]](#).
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 level

1. Check the lube oil level on 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 (genset)** [▶ 337].

7.1.3 Start the genset

General information

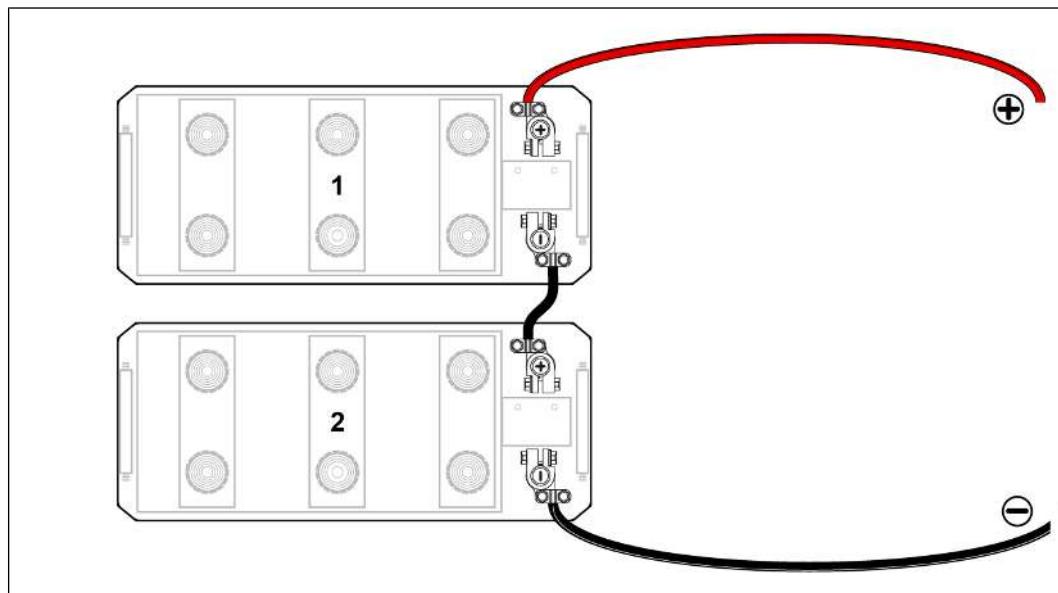
There are two ways to start the genset.

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.

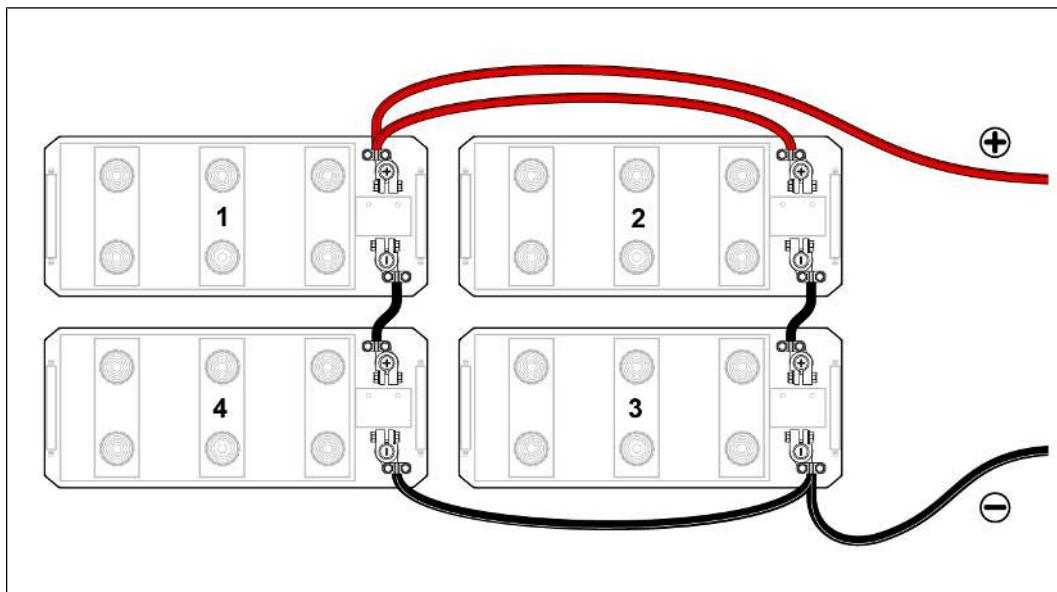
- Refer to Chapter "**Preparing the genset for start-up**".

Preparing the genset for start-up:



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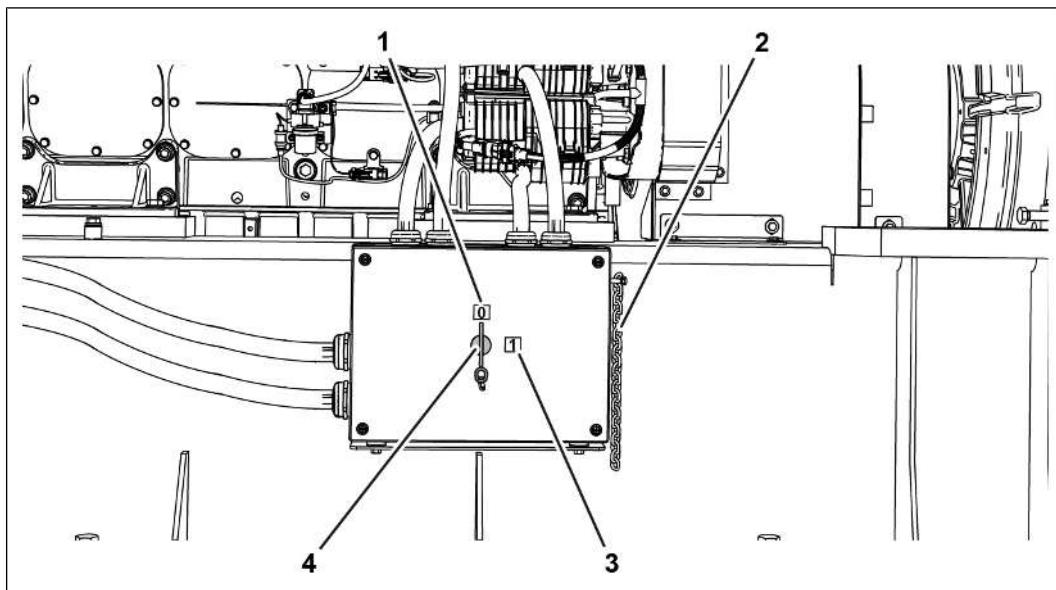
1. Connect the starter battery (two starter batteries).
 - Dismantle the covering cap of starter battery 1 at the positive terminal.
 - Mount the connection bridge of starter battery 1 at the positive terminal.
 - Mount the connection bridge of starter battery 2 at the negative terminal.
 - Mount the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

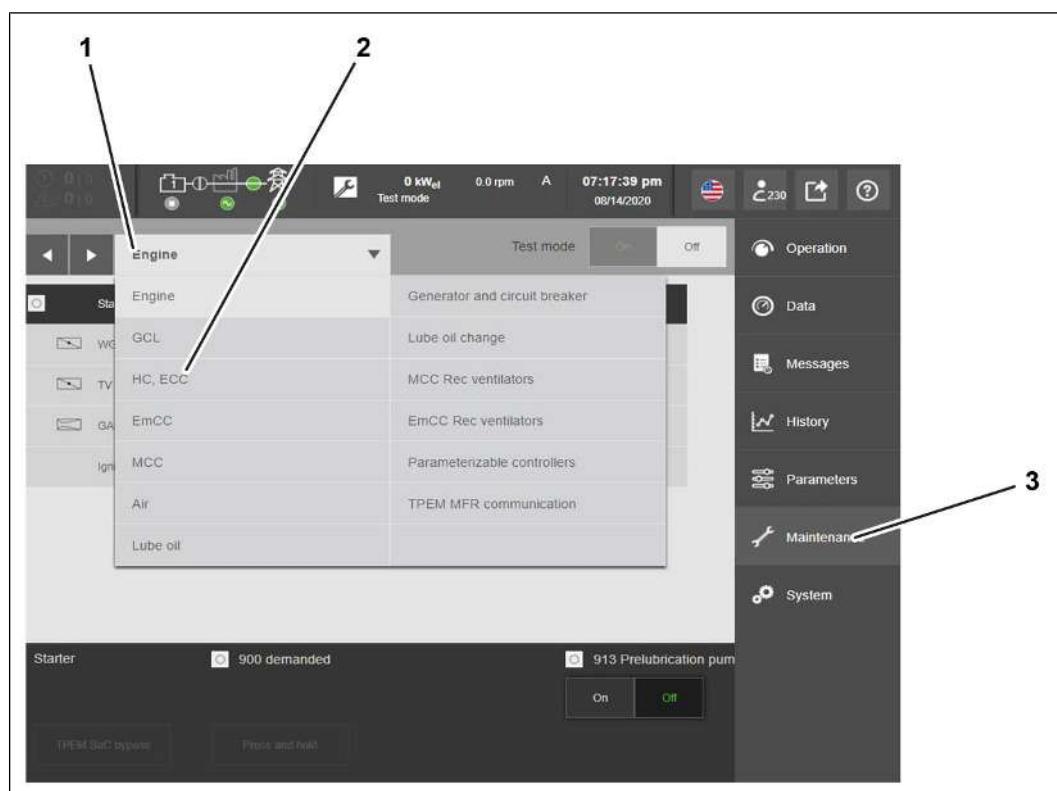
Have the work for the initial commissioning carried out according to the commissioning specification. Only have the work performed by employees from the manufacturer or people authorized by the manufacturer.

7.1.5 Establishing operational readiness

Preheating the genset

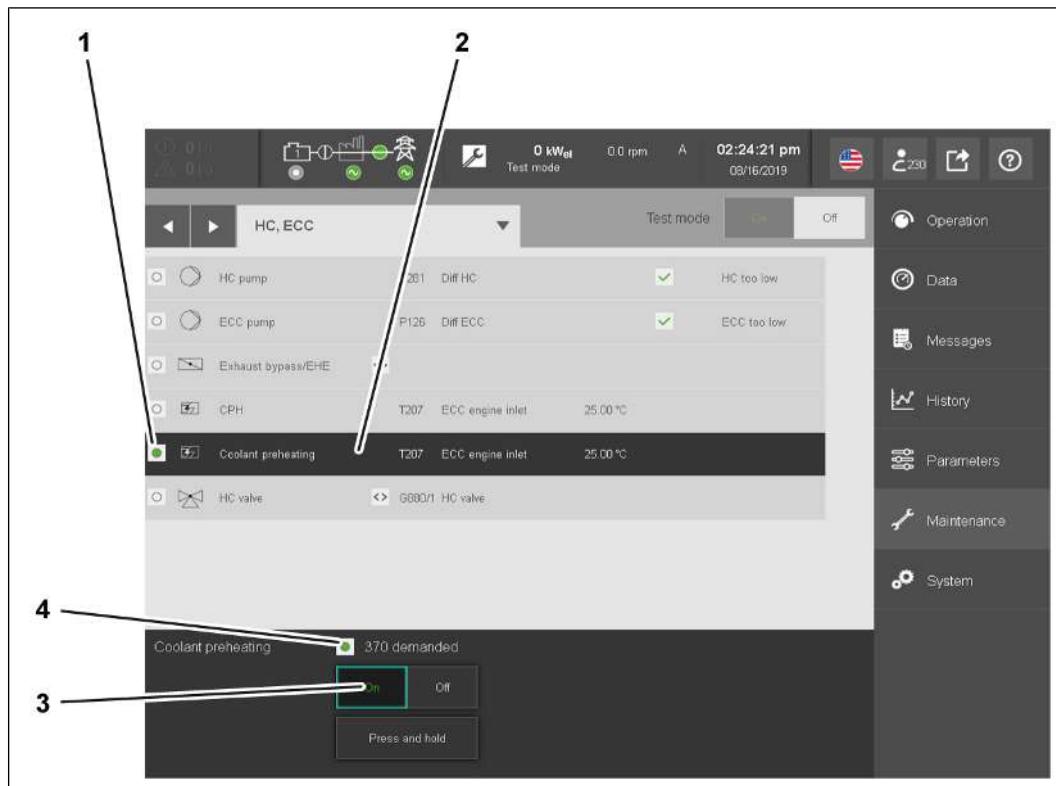
If the genset is not in operation, the preheater keeps the coolant at the preset temperature.

The coolant temperature in the engine cooling circuit reaches the necessary operating temperature not long after the engine is commissioned. The coolant is preheated independently of the temperature in the heating circuit.



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1. Tap the "Service" function group (3) button.
2. Press the HC, ECC (2) line in the pull-down menu (1)



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3. In the pull-down menu, tap on the line Coolant preheating (2).
 4. Tap the On (3) button.
 - The font color in the On (3) button changes from white to green.
 - A green dot (4) appears in the Coolant preheating 370 demanded dialog area.
 - A green dot (1) appears in the Coolant preheating dialog area.
- ⇒ Coolant preheating is switched on.

Checking the genset room ventilation

- ✓ Genset room ventilation is installed
- ✓ The electronic control is ready for operation, see chapter Control, [TPEM Operating manual](#).

1. Check the room temperature value on the electronic control.
 - If necessary, cool down the room temperature using an air conditioner.
 - If in doubt, do not start the genset.

Checking the intake air temperature

- ✓ Intake air preheating is installed (optional)

- ✓ The electronic control is ready for operation, see chapter Control, [TPEM Operating manual](#).
- 1. On the electronic control, check the value for the intake air temperature, see chapter Control, [TPEM Operating manual](#).
 - If necessary, warm up the intake air temperature using the intake air preheating (optional).
 - Alternatively, 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 turbocharger

The genset can be damaged.

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

1. **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.** Check lube oil supply

- If oily liquid continues to escape a few hours after commissioning, identify the root cause and remedy it immediately.
- If oily liquid escapes even though the lube oil supply of the exhaust turbocharger is working properly, contact Cat dealer.

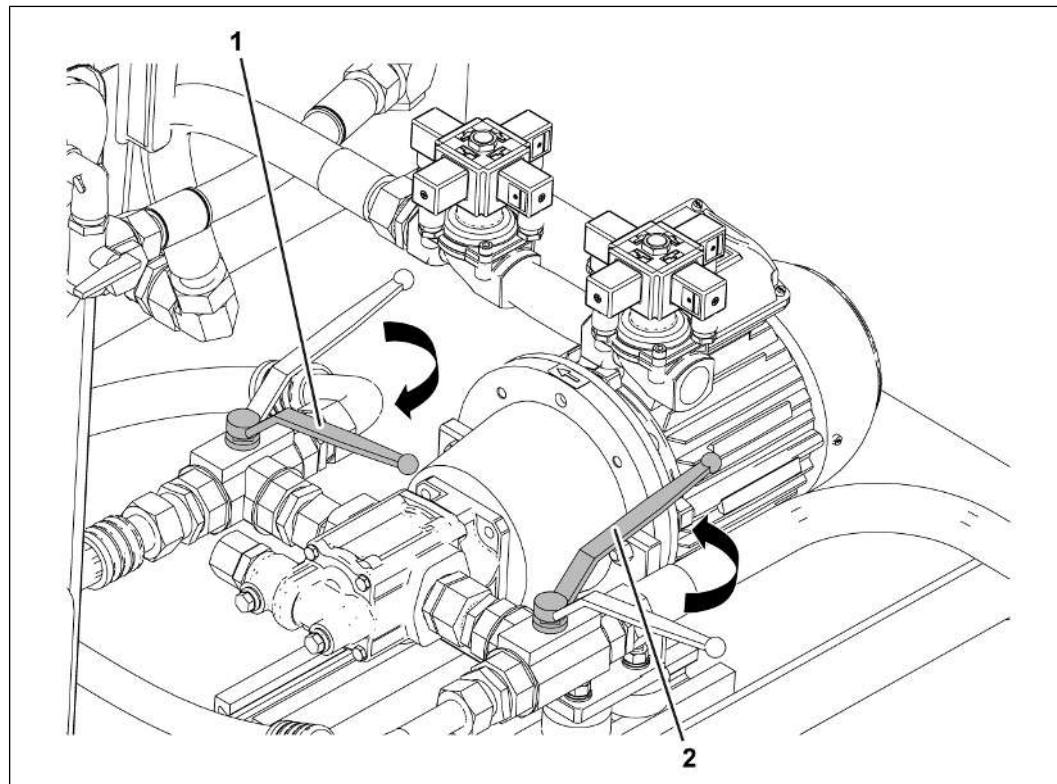
Checking the lube oil pressure using the control

1. **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 shuts down the genset.** Check the lube oil pressure on the electronic control, see chapter Control, [TPEM Operating manual](#).
 - If necessary, top up the lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(genset\)](#) [▶ 337].

Prelubricating the genset

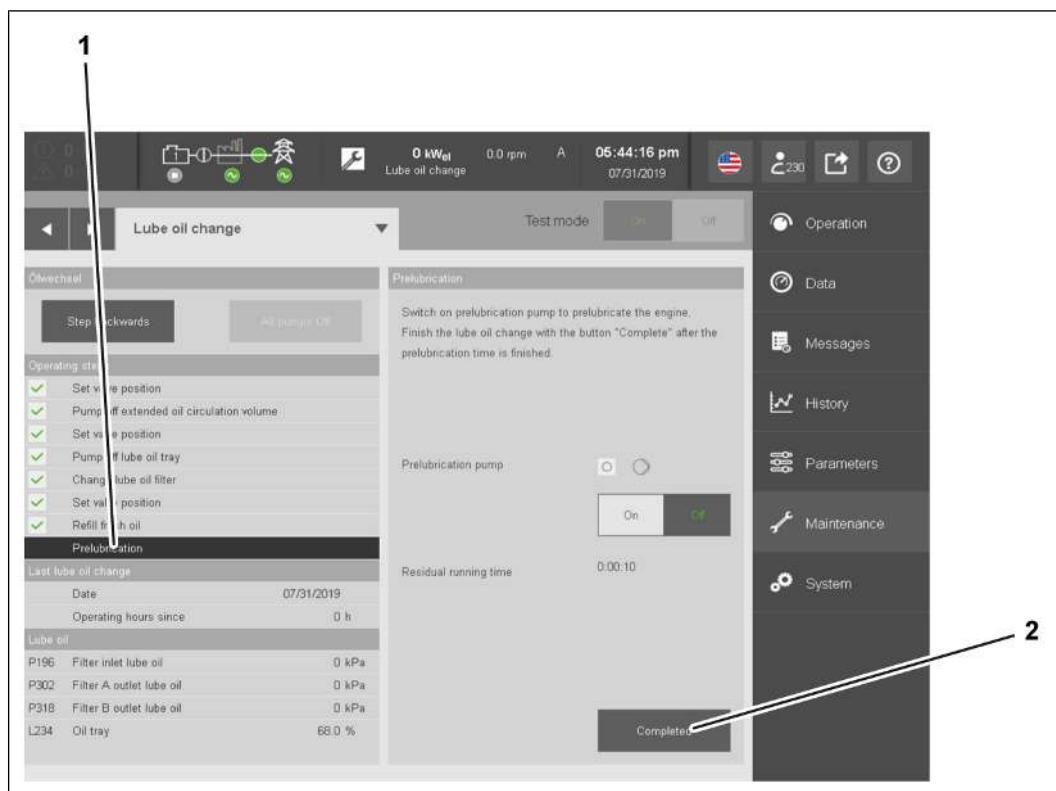
If the genset receives a start demand, the electronic control automatically starts the prelubrication.

A prelubrication process always lasts at least 20 minutes. The electronic control starts the engine only if the prelubrication is fully completed.



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1. Set the valves to position (1) and position (2).
2. Tap the ON (3) button.
 - A green dot (2) appears in the dialog area.
 - The residual running time is shown in the dialog area (5).
 - The genset is prelubricated.
3. Leave the prelubrication pump switched on for 20 minutes
4. To stop prelubrication manually, tap the All pumps Off (1) or Off (4) button.
 - The green dot (2) disappears from the dialog area.
 - The residual running time is stopped in the dialog area (5).
5. To continue prelubrication, tap the On (3) button.
 - A green dot (2) appears in the dialog area.
 - The residual running time resumes in the dialog area (5).



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6. Confirm prelubrication

- Tap the Completed (2) button.
- The operating step Prelubrication (1) is completed.
- The system returns to the start screen.

Establishing operational readiness using the control system

1. Check whether there are pending messages on the electronic control.
 - If there are pending warnings and alarms, remedy their causes, see chapter Control, [TPEM Operating manual](#).
 - Acknowledge pending warnings and alarms, see chapter Control, [TPEM Operating manual](#).
2. Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#).
3. [Performing test run and function run \[▶ 202\]](#).

7.1.6 Commissioning the TPEM Connection Box (TPEM CB)

The plant or genset and the TPEM Connection Box (TPEM CB) are commissioned at the same time. All functions are only available upon simultaneous commissioning.

1. Establish power supply
2. Switch on plant
3. Carry out electrical safety tests

4. Slowly start up plant
5. Run acceptance procedure
6. Switch off plant and secure
7. Create acceptance protocol

7.1.7 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.

7.1.8 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

7.1.9 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 chamber 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 the commissioning as per the commissioning report

7.2 TPEM Connection Box

7.2.1 Commissioning the TPEM Connection Box (TPEM CB)

The plant or genset and the TPEM Connection Box (TPEM CB) are commissioned at the same time. All functions are only available upon simultaneous commissioning.

1. Establish power supply
2. Switch on plant
3. Carry out electrical safety tests
4. Slowly start up plant
5. Run acceptance procedure
6. Switch off plant and secure
7. Create acceptance protocol

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 more details, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#).

8.1.2 Decommissioning the genset in an emergency situation

Decommissioning the genset in an emergency situation:

- Operate the emergency stop button immediately.
- Inform the on-site supervisor.
- Alert a doctor and the fire department.
- Keep people out of the danger zone.
- Initiate first aid measures.
- Switch off the main switch and secure it against restarting.
- Keep access routes for emergency services vehicles clear.

After emergency service/evacuation measures:

- Inform the relevant authorities if the emergency situation is serious.
- Get specialized personnel to correct the fault.
- Visually inspect the genset before starting it, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 194\]](#).
- Perform a test run and function run before starting the genset, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 202\]](#).
- Check that all safety devices are installed and working correctly.

8.1.3 Commissioning the genset

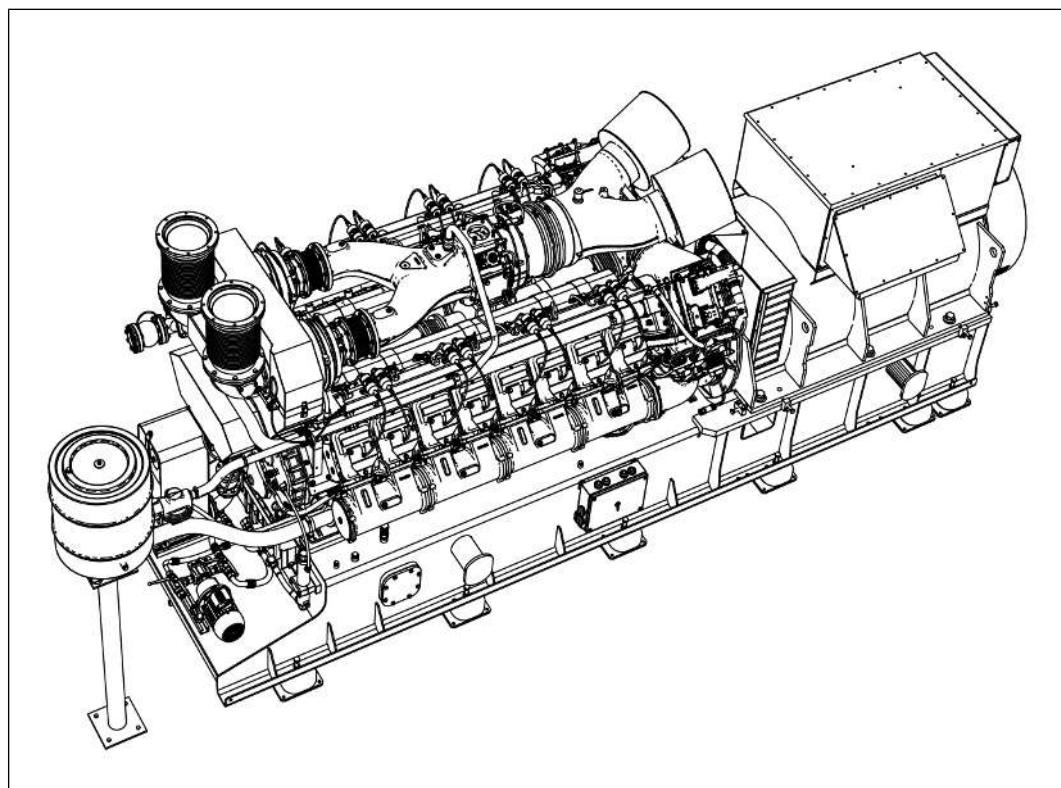
The following control modes can be activated on the electronic control:

- 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 TPEM Operating manual](#).

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

8.1.4 Industrial safety around the genset



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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 electronic control system

The control system consists of the following main components:

- Central control cabinet TPEM Control Cabinet (TPEM CC) with TPEM Touch Panel (TP)
- TPEM Rendezvous Server (TPEM RS) access server
- TPEM Remote Client (TPEM RC) visualization software
- Central control unit TPEM Control Unit (TPEM CU)
- TPEM Connection Box (TPEM CB) terminal box
- TPEM IO Controller (TPEM IO) auxiliary drive interface

For detailed information on plant control, see

Chapter Operation, Electrical system [Functional description \[▶ 63\]](#)

8.1.6 Monitoring the operation (TPEM)

1. Check that the genset is running smoothly, and check for noises, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 202\]](#).
2. Visually inspect the genset and plant parts for leaks, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 194\]](#).
3. Check genset and plant parts for leaks, see OL-MRA10 / 00-15-30 [Performing the auxiliary drive test \(TPEM\) \[▶ 205\]](#)



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 *Operating Manual, chapter Control, section TPEM 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 [Checking coolant level and coolant system pressure \[▶ 446\]](#).
2. Check the coolant quality, see OL-MRA10 / 38-03-01 [Checking the cooling system protection agent \[▶ 449\]](#).

Checking the electric starter

1. Perform a weekly check of the electric starter, see OL-MRA10 / 00-16-01 [Checking the starting system \[▶ 284\]](#).
 - Check the functioning of the electric starter, see OL-MRA10 / 00-15-30 [Performing the auxiliary drive test \(TPEM\) \[▶ 205\]](#).
2. Replace the electric starter if necessary. Contact Cat dealer.

8.1.7

Notes on operation with hydrogen

The transition from fossil fuels to renewable energy production is subject to natural fluctuations. Depending on the available energy from wind and solar power, regeneratively produced hydrogen can be fed into the natural gas grid. This compensates for fluctuations in the energy grid.

The CG132B and CG170B series gensets of the configurations P+, PV+, R+ and RV+ with the corresponding H2 kit (see below) are approved for operation with natural gas containing up to 25 vol.% hydrogen.

- Operation with up to 10 vol.% necessitates no structural modifications.
- Structural modifications are required for operation with a hydrogen content of up to 25 vol.%.

The manufacturer offers gensets with the following adapted or newly developed genset components:

- The gas train is equipped for hydrogen operation.
- A flame arrester is installed in the mixture pipe for each cylinder, which prevents the hydrogen from backfiring.
- In the CG170B series, the V12 genset has one explosion protection valve installed in the hatch cover, while the V16/V20 genset has two explosion protection valves.
- The software contains all necessary parameters for hydrogen operation.

All genset components are installed during assembly and setup and then commissioned.

- All necessary parameter assignments are configured and set during commissioning.



Risk of destruction of components

Incorrect parameter setting for hydrogen operation

The genset and/or components can be damaged or destroyed.

- Always operate the genset with the parameters specified for the given hydrogen content:
 - For technical data for hydrogen content in natural gas, see OL-MRA10 / 26-03-37 [Setting the global ignition angle \[▶ 414\]](#)
 - Adjust the set combustion chamber temperature, see OL-MRA10 / 00-25-01 [Checking pollutant emissions in the exhaust gas \(TPEM\) \[▶ 293\]](#).

Compared to natural gas, hydrogen combusts more rapidly.

- The faster combustion is regulated by adjusting the global ignition angle and a modified set combustion chamber temperature.
- The global ignition angle and the temperature curve for the set combustion chamber temperature must be stored in the engine control for each hydrogen concentration.

8.1.8 Software access authorizations

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

The operator can acquire the required access authorization only by participating in a training program. After the training program is complete, the operator receives a personalized TPEM USB token.

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 software with their TPEM USB token. The 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:

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

For additional information on access authorizations, see *Operating Manual, chapter Operation, section Control*

8.2 Generator

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 drawn 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 plants operating in island mode). For this reason, the "Cos-phi 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 current into the integrated power grid or consumer grid. The voltage and frequency are set by the mains. 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 mains. The synchronization device adjusts the engine speed and generator voltage during the synchronization process. The synchronization function is part of the supplied TPEM Multi Function Relay (TPEM MFR). Generator protection is also integrated in the TPEM MFR.

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

The phase position of the generator is adjusted to the mains 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 plants with 60 Hz application, a transmission is used.

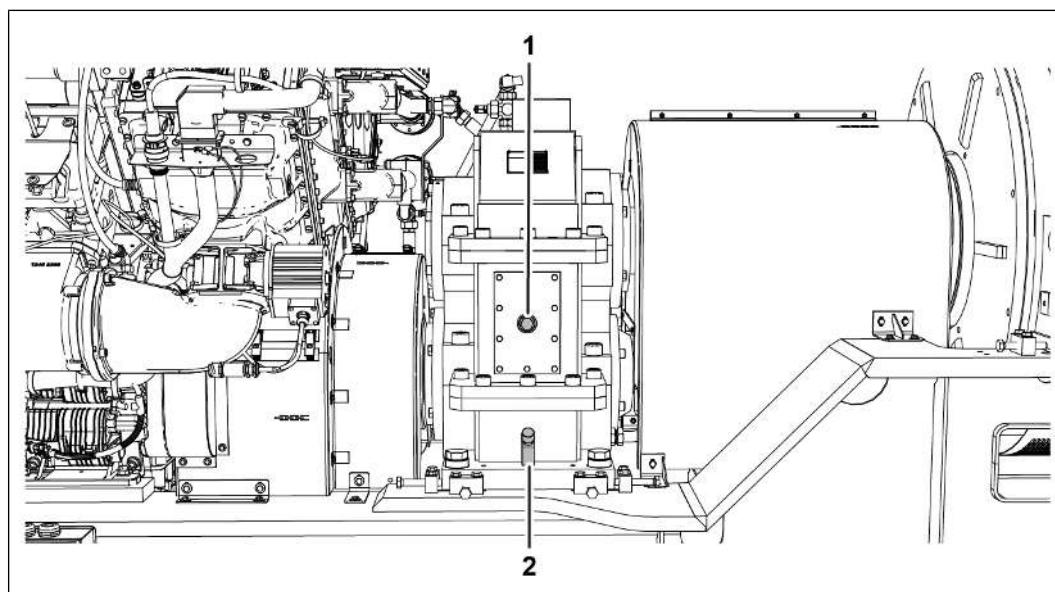
The transmission has the task of transforming the engine speed to the corresponding generator speed.

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 not reached, the genset will be stopped automatically by the TPEM without prior warning.

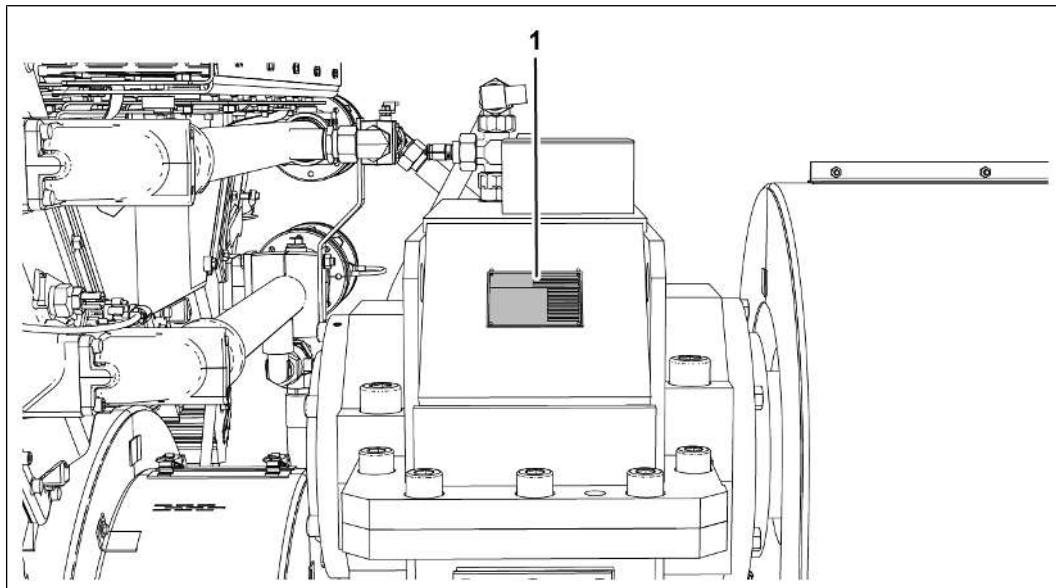
The lube oil temperature will be monitored by a Pt100 resistor. If the permissible limit values are exceeded, the genset will be stopped automatically by the TPEM (version 1.10 or higher) after issuing a prior warning.



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- 1 Inspection hole cover with filler screw
- 2 Dipstick

Rating plate:

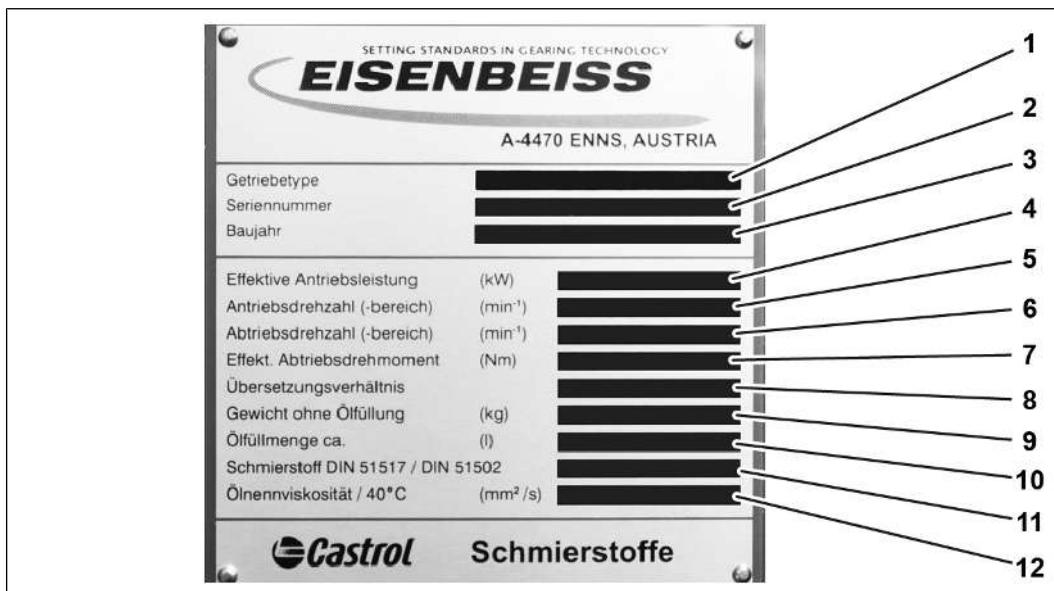


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1	Rating plate
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The rating plate is fastened to the transmission.

Designation of the data fields.



3282965515

- 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 GU360.

- For a list of products that are approved as transmission lube oil, see Technical Bulletin (TR) 2147, [Specification for auxiliary media](#).
- The transmission should be filled for the first time before being commissioned by the operator.

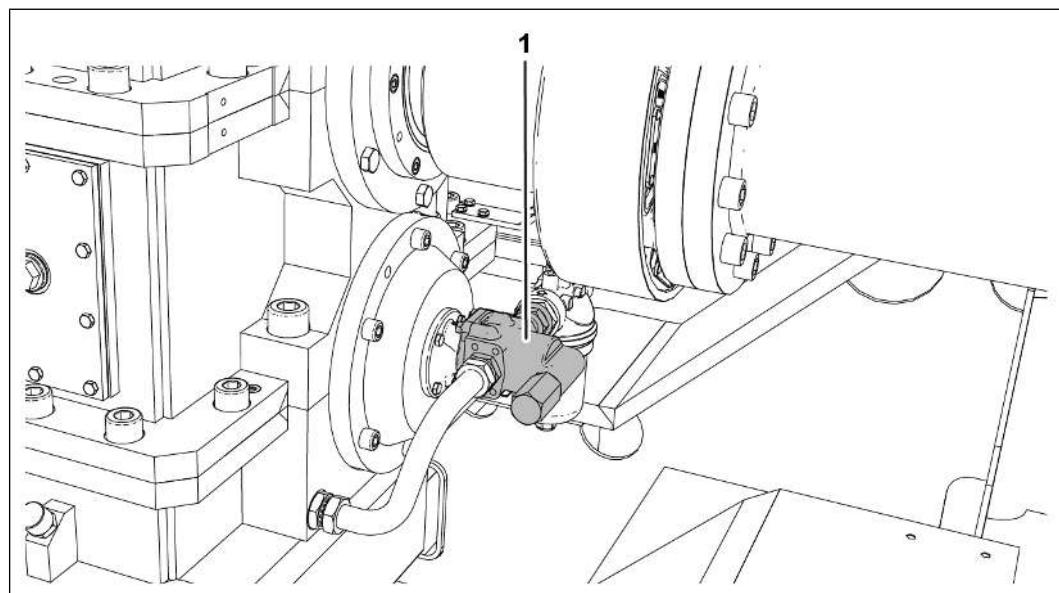
Transmission lube oils have the following properties as per API classifications (API: American Petroleum Institute) and SAE classes (SAE: Society of Automotive Engineers):

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

Checking 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:

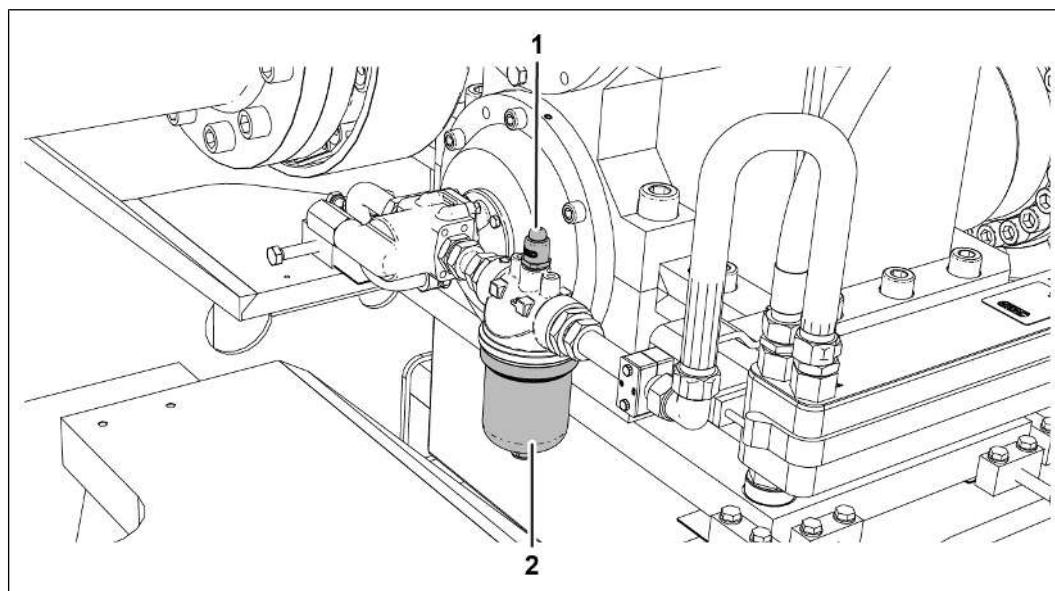


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1	Lube oil pump
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The lube oil pump is designed as a gearwheel pump and works according to the rotating displacement principle.

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:

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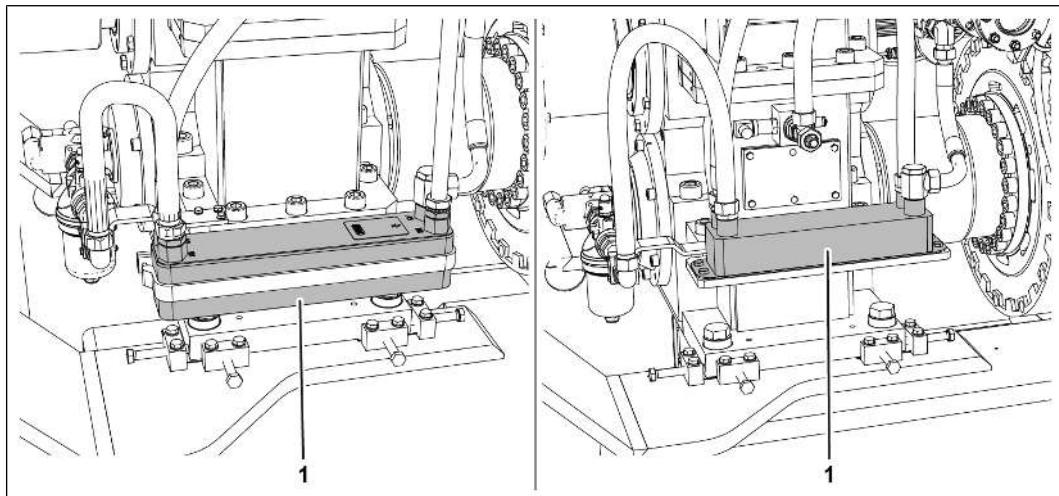
1	Service indicator	2	Lube oil filter
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The lube oil is pumped through the lube oil filter.

- 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.

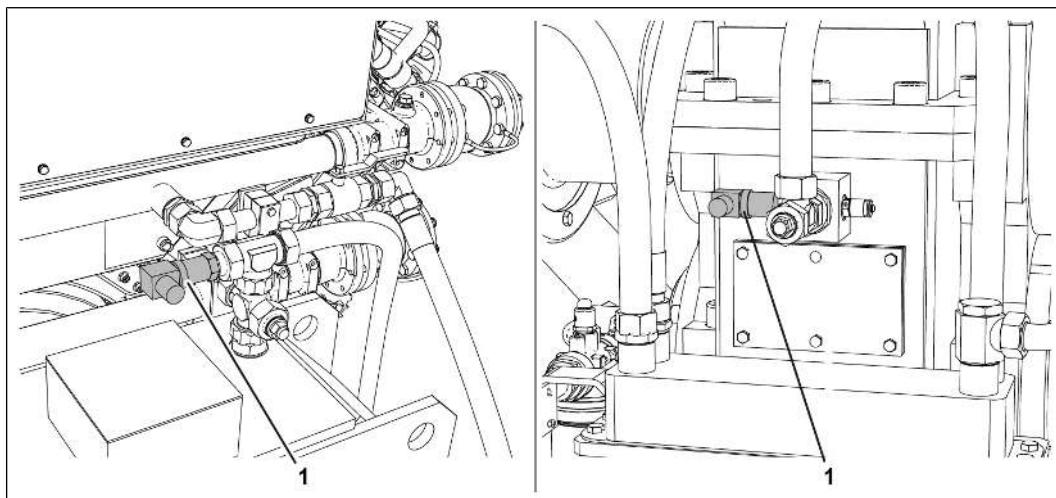
Lube oil heat exchanger:

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Left	2.0 MW genset	Right	2.3 MW genset
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:

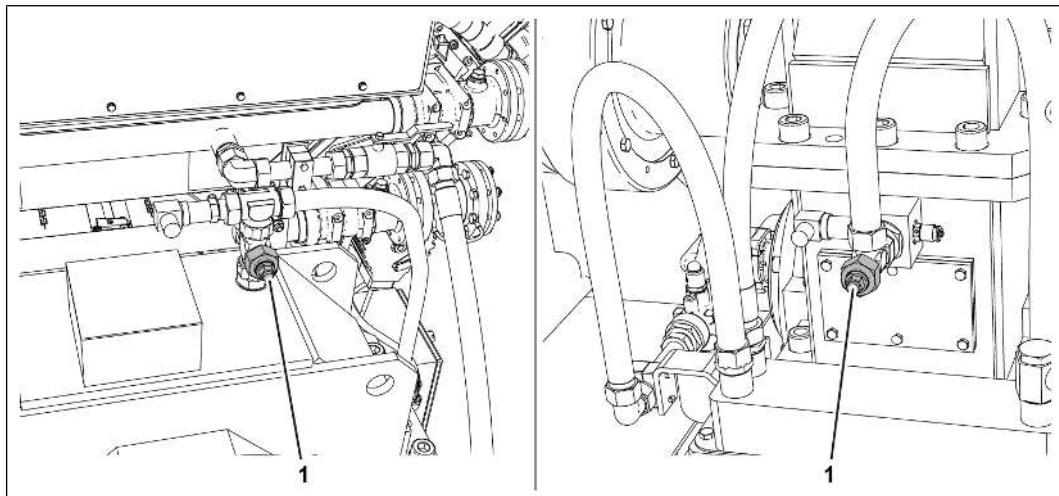
3282975243

Left	2.0 MW genset	Right	2.3 MW genset
1	Oil pressure switch		

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

The transmission oil pressure is monitored by the TPEM.

- If the measured pressure is less than the permissible limit value, the genset will be automatically switched off by the TPEM without prior warning.

Temperature sensor:

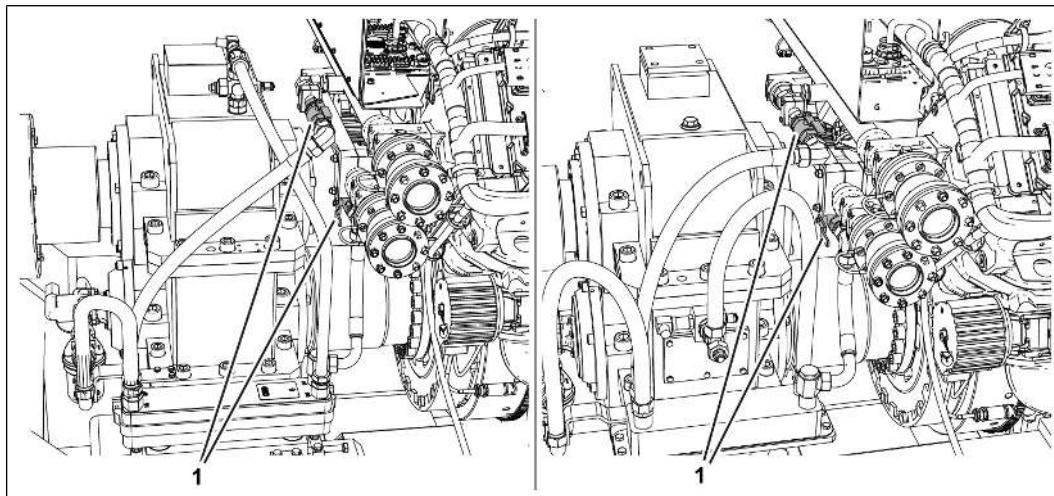
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Left	2.0 MW genset	Right	2.3 MW genset
1	Temperature sensor		

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

The transmission lube oil temperature is monitored by the TPEM.

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

Ball valve

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Left	2.0 MW genset	Right	2.3 MW genset
1	Ball valve		

Two ball valves are integrated in order to close off the cooling system from the transmission to the engine.

- There is no need to drain the complete cooling system of the genset for maintenance work on the transmission.

Transport, storage and preservation:

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

8.4 TPEM

8.4.1 Overview of the operation modes

The electronic control system has the following operation modes:

- Mains parallel mode: power-controlled
- Island mode: speed-controlled

For relevant information on the operation modes, see *Operating Manual, chapter Operation, section Control*

The following operation modes are defined for the genset's operation:

- Steady-state operation:

In this operation mode, the following parameters do not change:

- Temperature
- Power
- Engine speed
- Emissions

Steady-state operation can take place both in mains parallel mode as well as in island mode.

- Transient operation:

In this operation mode, one or more of the following parameters will change:

- Load ramp (in mains parallel mode)
- Load spikes (in island mode)
- Engine speed
- Gas composition
- The genset actively responds to faults in the grid (Grid Code case).

Transient operation can take place both in mains parallel mode as well as in island mode.

8.4.2 Software access authorizations

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

The operator can acquire the required access authorization only by participating in a training program. After the training program is complete, the operator receives a personalized TPEM USB token.

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 software with their TPEM USB token. The software activates the access options in accordance with the level of the logged-in operator.

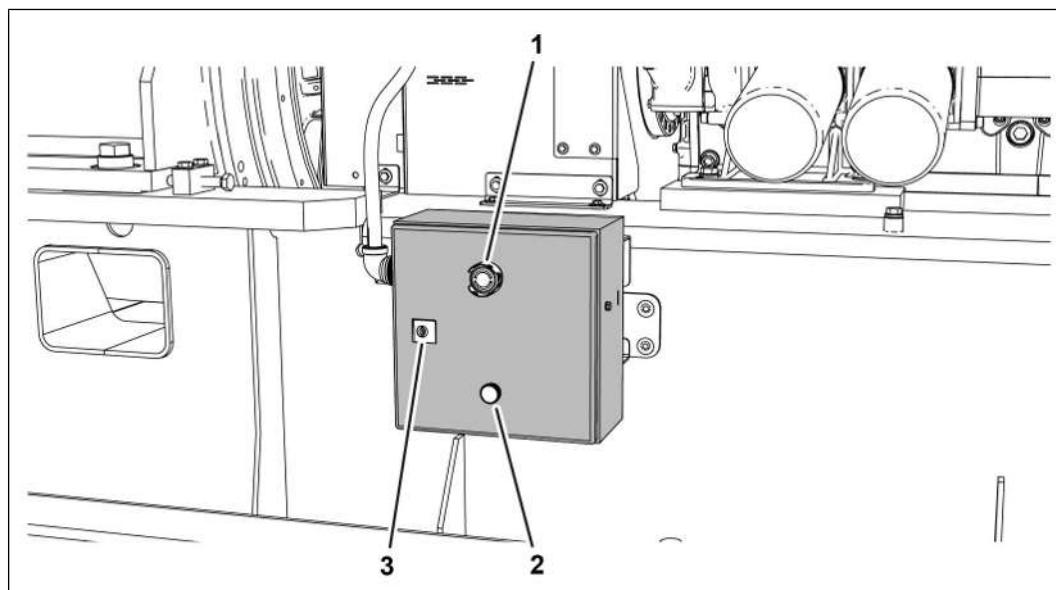
Further information on the training options can be found on the homepage:

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

For additional information on access authorizations, see *Operating Manual, chapter Operation, section Control*

8.5 TPEM Connection Box

8.5.1 Operating elements on the TPEM Connection Box (TPEM CB)



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- 1 EMERGENCY stop button
- 2 Service interface
- 3 Locking mechanism

9 Decommissioning

9.1 Genset

9.1.1 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, switch 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 antifreeze to the coolant or empty the cooling system
 - For further information on coolant, storage and preservation, see *Operating Manual, chapter General, section Operating media regulations*
- Ensure that no foreign bodies, dust or humidity penetrate

Different work must be performed depending on the period of the decommissioning. The following periods are distinguished between for the decommissioning:

- Decommissioning for maximum two months
- Decommissioning for two to eight months
- Decommissioning for more than eight months

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

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

9.1.2 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

9.1.3 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 \[▶ 152\]](#)
- 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.
 - For additional information on the exhaust line and shut-off flap, see *Operating Manual, chapter General, section Installation directive*
- 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.
 - For further information on the lube oil limit values, see *Operating Manual, chapter General, section Operating media 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 systems are excluded from the cleaning.** Cleaning 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.

9.1.4 Stopping the genset in an emergency situation**General information**

Stopping the genset in an emergency situation:

- Operate the emergency stop button immediately.
- Inform the on-site supervisor.
- Alert a doctor and the fire department.
- Keep people out of the danger zone.
- Initiate first aid measures.
- Switch off the main switch and secure it against restarting.
- Keep access routes for emergency services vehicles clear.

After emergency service/evacuation measures:

- Inform the relevant authorities if the emergency situation is serious.
- Get specialized personnel to correct the fault.
- Visually inspect the genset before starting it, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 194\]](#).
- Perform a test run and function run before starting the genset, see OL-MRA10 / 00-11-30 [Performing test run and function run \[▶ 202\]](#).
- Check that all safety devices are installed and working correctly.

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 \[▶ 152\]](#)
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.

9.1.6 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 "**Stopping the genset**".

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 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.
 - Operate the emergency stop button.
 5. **NOTE! Ensure that power is supplied to the BIOS battery of the TPEM.** 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 TPEM.
 - 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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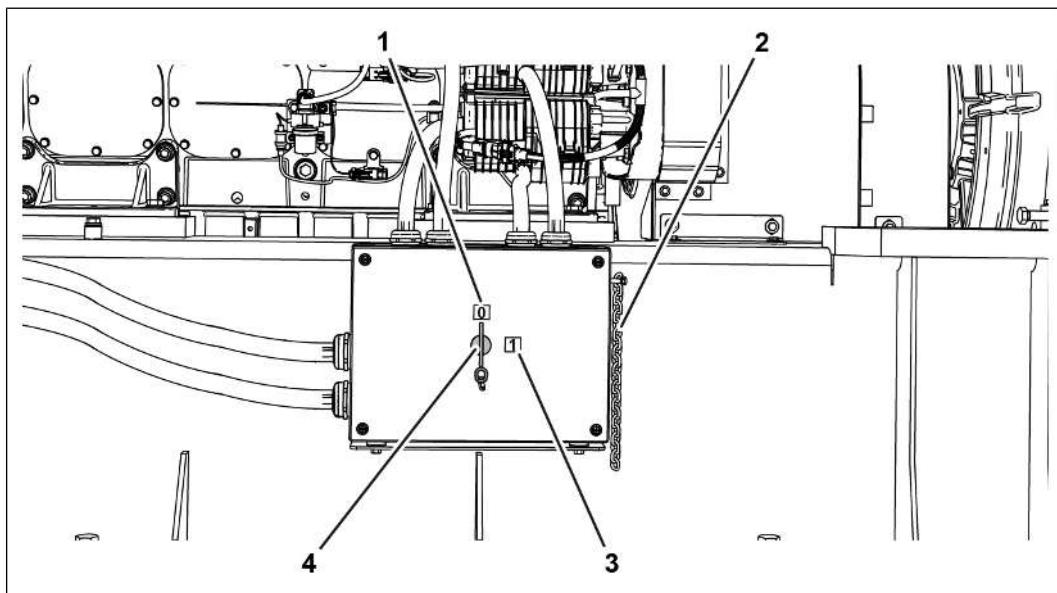
1. Press the OPEN GCB (5) button.
 - The symbol (2) flashes.
 - The display in the status bar (4) shows Relieving.
 - After successful relieving: the symbol (2) lights up continuously gray (opened).
 - The display in the status bar (4) shows Idle and the idle speed.
2. Press the MODULE STOP (3) button.
 - 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-to-start.
3. Allow the ventilation to keep running until the temperature preset in the control is reached.

4. Switch off the control.
 - Operate the emergency stop button.
5. 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 TPEM.
 - 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:

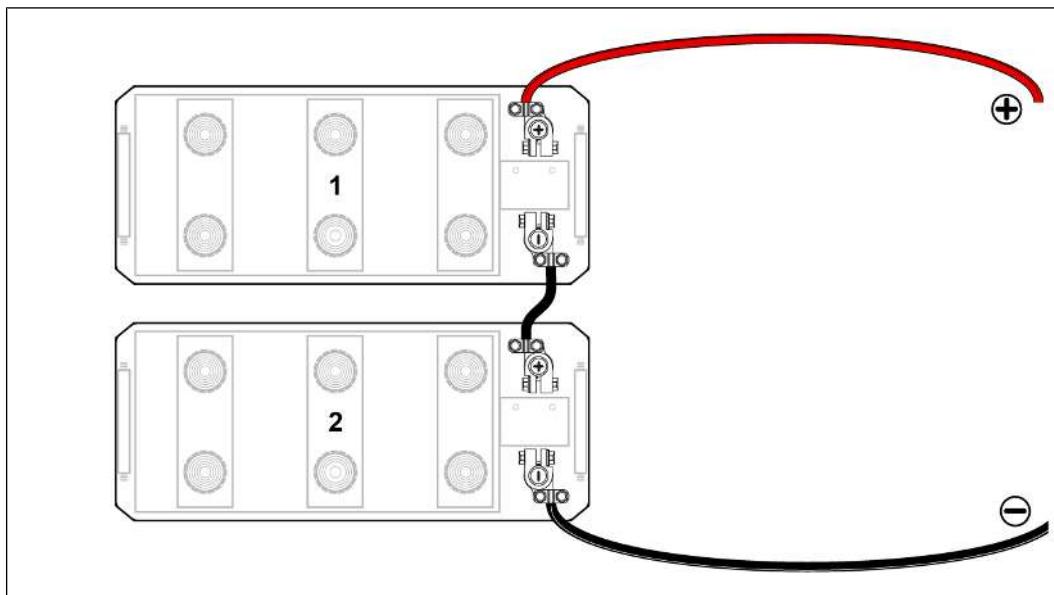
1. Shut off the fuel gas supply.
 - Close ball valve of the fuel gas line upstream of the gas train.
 - Secure the hand lever of the ball valve with a chain and U-lock.
 - Decommission the gas analysis device, see "**System documentation, chapter Gas supply**".
 - Open ball valve in the drain and release 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.
 - Vent the compressed air line between the starter valve and ball valve.



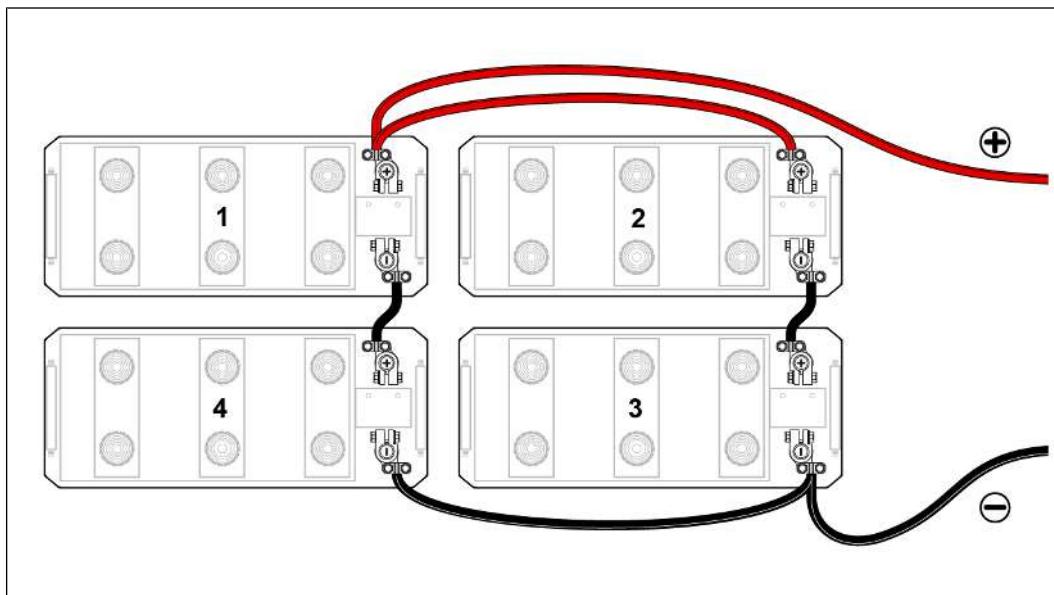
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4. Lock battery disconnection switch.
 - Remove the key (4) on the terminal box from the chain (2).
 - With the key (4), set the battery disconnection switch on the terminal box from position 1 (3) to position 0 (1).
 - Remove the key (4) from the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

10 Troubleshooting

10.1 Exhaust system

10.1.1 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: Cat dealer
	Loose screw connection	1. Contact person: Cat dealer
Insufficient performance of the exhaust heat exchanger (pressure loss)	Upstream side of the exhaust heat exchanger is dirty	1. Contact person: Cat dealer
	Exhaust gas side of the exhaust heat exchanger is dirty	1. Contact person: Cat dealer
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: Cat dealer
	Loose screw connection	1. Contact person: Cat dealer

Table 1: Exhaust system is leaking or faulty

10.2 Genset

10.2.1 Fault displays

The majority of fault displays appear on the TPEM Touch Panel (TPEM TP) as text messages.

Acoustic or visual fault displays may be installed in the immediate vicinity of the genset, if applicable. The operator is responsible for integrating the genset into the signal chain of the overall plant.

For relevant information on the fault displays, see *Operating Manual, chapter Control, section TPEM Operating manual*.

10.2.2 Checking after troubleshooting

1. Ensure that all the protective covers are mounted completely and 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 faults on the TPEM Touch Panel (TPEM TP), see TPEM .
 - You can find the document in the order-specific operating manual or in the Service Library.

10.3 Intake air system

10.3.1 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: Cat dealer

Table 2: Intake air system is leaking or faulty

10.4 Mixture system

10.4.1 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: Cat dealer
	Loose screw connection.	1. Contact person: Cat dealer

Table 3: Mixture pipe leaks

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

Component and fault	Possible cause	Troubleshooting
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 4: Mixture values are not correct

10.5 Generator

Part number: (null)

10.5.1 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
	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: Cat dealer
	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: Cat dealer

Component and fault	Possible cause	Troubleshooting
Generator builds no voltage	Exciter safety switch has been triggered	1. Contact person: Cat dealer
	Excitation diodes faulty	
Generator voltage drops greatly under load	Input speed drops under load	1. Contact person: Cat dealer
	Protective fuse faulty	
	Excitation diodes faulty	

Table 5: Generator generates no voltage or an incorrect voltage, or is 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 Cat dealer.
Transmission noises	Too much bearing clearance	Contact Cat dealer.
Transmission noises	Bearing faulty	Contact Cat dealer.
Transmission noises	Coupling defective	Contact Cat dealer.

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 Cat dealer.

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

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 Cat dealer.

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 Cat dealer.
Lube oil pressure too low	Lube oil too hot	Contact Cat dealer.
Lube oil pressure too low	Suction line of the lube oil pump blocked	Contact Cat dealer.

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 Cat dealer.

10.7 Cooling system

10.7.1 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: Cat dealer
	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
	Bearing faulty	1. Contact person: Cat dealer

Component and fault	Possible cause	Troubleshooting
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: Cat dealer
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 6: Cooling system is depressurized or faulty

10.8 Coupling

10.8.1 Fault table for coupling

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

Table 7: Coupling damaged or faulty

10.9 Engine

10.9.1 Fault tables for engine

Component and fault	Possible cause	Troubleshooting
Gas supply interrupted	Gas shut-off elements closed	1. Open gas shut-off elements

Component and fault	Possible cause	Troubleshooting
	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: Cat dealer
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: Cat dealer
	Cable broken	
Camshaft sensor does not give any signal	Spacing too large	1. Contact person: Cat dealer
	Sensor or sensor cable faulty	1. Contact person: Cat dealer
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: Cat dealer
	Coolant pump faulty	1. Contact person: Cat dealer
	Coolant pump leaking	1. Contact person: Cat dealer
	Cooling system dirty	1. Contact person: Cat dealer

Table 8: 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: Cat dealer
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: Cat dealer
Camshaft sensor does not give any signal	Spacing too large	1. Contact person: Cat dealer
Crankshaft sensor does not give any signal	Spacing too large	1. Check setting

Table 9: Engine does not start

Component and fault	Possible cause	Troubleshooting
Inlet valves do not close	Valve clearance too small	1. Checking the valve clearance
	Inlet valve leaking	1. Contact person: Cat dealer
Outlet valves do not close	Valve clearance too small	1. Checking the valve clearance

Component and fault	Possible cause	Troubleshooting
	Outlet valve leaking	1. Contact person: Cat dealer
	Oil residues at the outlet valve	1. Contact person: Cat dealer
Compression pressure too low	Piston rings faulty	1. Contact person: Cat dealer
	Cylinder liner worn	1. Contact person: Cat dealer
Gas supply is impaired	Gas line not ventilated	1. Contact person: Qualified gas technician
	Stepper motor of gas-air mixer faulty	1. Contact person: Cat dealer
Ignition takes place irregularly or does not take place at all	Spark plug faulty	1. Check spark plug

Table 10: 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: Cat dealer
Signal from camshaft sensor is too weak	Spacing too large	1. Contact person: Cat dealer
	Camshaft sensor faulty	1. Contact person: Cat dealer
Signal from crankshaft sensor is too weak	Spacing too large	1. Check setting
	Crankshaft sensor faulty	1. Renew crankshaft sensor

Table 11: 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: Cat dealer
Poor heat transmission (secondary heating circuit)	3-way valve faulty	1. Contact person: Cat dealer
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: Cat dealer
	Coolant pump faulty	1. Contact person: Cat dealer
	Coolant pump leaking	1. Contact person: Cat dealer

Table 12: Engine is overheating

11 Maintenance

Contents

11.1	Genset	174
11.1.1	Fluoropolymer elastomers on the genset	174
11.1.2	Conducting checks after maintenance is complete	175
11.1.3	Performing cleaning.....	175
11.1.4	Performing cutting work, grinding work, soldering work, and welding work on the genset.....	176
11.1.5	Maintenance and inspection schedule.....	178
11.1.6	Performing maintenance work	178
11.2	Coupling	178
11.2.1	Maintenance information for coupling.....	178
11.3	Transmission.....	180
11.3.1	Notes for maintenance on the transmission	180
11.3.2	Maintenance information for transmission	181
11.4	Tools	183
11.4.1	Tool competence level OL	183

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 [Commissioning/Genset Start the genset \[▶ 117\]](#).

11.1.3 Performing cleaning

For cleaning instructions, see OL-MRA10 / 00-02-80 [Cleaning the genset \[▶ 197\]](#).

- For information on cleaning agents, see Service Library, Technical Bulletin ([TR 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 \[▶ 154\]](#).

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 \[▶ 117\]](#)

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 \[▶ 173\]](#).

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 Coupling

11.2.1 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.

As specified	If required	Maintenance work
		<ul style="list-style-type: none"> 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

11.3 Transmission

11.3.1 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.

11.3.2 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 Cat dealer.

For more information on competencies, see [Notes for maintenance on the transmission](#) [▶ 180].

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. • 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.

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
			<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

11.4 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 case1203 0375 Open-end wrench 460115 1236 Open-end wrench 36 × 411203 0358 Feeler gauge set 0.05 to 0.50115 1247 Socket wrench insert 22 × 12.50155 1248 Socket wrench insert 24 × 200155 1249 Socket wrench insert 27 × 200155 1250 Socket wrench insert 30 × 200155 1251 Socket wrench insert 32 × 201203 0376 Socket wrench insert width across flats 36, extra deepSocket wrench insert, inside width across flats 171203 0354 Slide CH 1772/391203 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">• 1218 9924 Socket wrench 3/8 inch No.33• 0703 7936 Socket wrench insert 16 x 12.5• 0703 7935 Wrench B 16• 1215 8153 Strap wrench• 1214 1829 Pliers, valve stem gasket• 1221 7605 Socket wrench insert for spark plug
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11.4.1.3 Tool kit (standard kit, small) 1215 0000

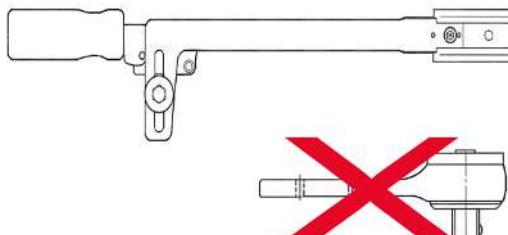
	<p>Tool kit consisting of:</p> <ul style="list-style-type: none">• 1215 8074 Tool case• 0115 4248 Open-end wrench 8 x 10• 0115 4250 Open-end wrench 12 x 14• 0115 4251 Open-end wrench 13 x 17• 0115 4252 Open-end wrench 14 x 15• 0115 4254 Open-end wrench 19 x 22• 0112 9228 Open-end wrench 24 x 27• 0703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

- | | |
|--|---|
| | <ul style="list-style-type: none">• 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

	Tool kit consisting of: <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

	Torque wrench, measuring range 1 to 210 Nm (0 to 21 kpm). The ratchet is not included! <ul style="list-style-type: none">• Ratchet 3/4 inch 1203 0352• Ratchet 1/2 inch 1203 0362
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11.4.1.6 Extension for torque wrench 1203 035

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

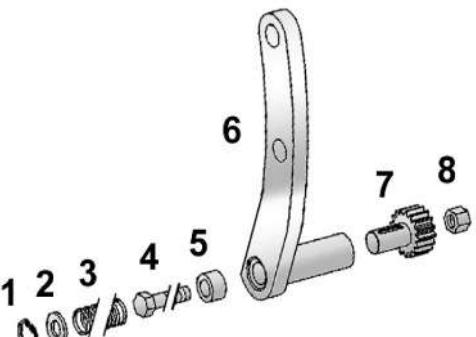
11.4.1.8 Measuring device for valve wear 1221 7445

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

	For removing and installing the prechamber spark plug.
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11.4.1.15 Spark plug thread cleaner 1251 5557

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

11.4.1.16 Timing light 1221 7826

For checking the ignition timing.

- Replaces the part number 1215 3977.

11.4.1.17 Acidimeter 1215 7944

For checking the battery fluid.

- Measuring the acid density

11.4.1.18 Lubricating grease mass flowmeter 1221 8953

For measuring the lubricating grease quantities for the generator rolling bearing.

In conjunction with:

- Hand-operated grease pumps
- Electrically operated grease pumps
- Compressed air operated grease pumps

12 Work instructions

Contents

OL-MRA10 / 00-02-03 Visually inspecting the genset	194
OL-MRA10 / 00-02-80 Cleaning the genset.....	197
OL-MRA10 / 00-10-30 Performing a test run.....	200
OL-MRA10 / 00-11-30 Performing test run and function run	202
OL-MRA10 / 00-13-30 Performing black start.....	204
OL-MRA10 / 00-15-30 Performing the auxiliary drive test (TPEM).....	205
OL-MRA10 / 00-16-01 Checking the starting system	284
OI-MRA10 / 00-20-25 Taking lube oil samples	286
OL-MRA10 / 00-21-25 Sampling the fuel gas	289
OL-MRA10 / 00-25-01 Checking pollutant emissions in the exhaust gas (TPEM)	293
OL-MRA10 / 00-47-01 Checking the mounting buffers.....	301
OL-MRA10 / 00-47-10 Removing and installing the mounting buffers.....	302
OL-MRA10 / 00-50-01 Checking the rubber expansion joint	307
OL-MRA10 / 00-50-10 Removing and installing the rubber expansion joint	311
OL-MRA10 / 00-59-98 Working with hexavalent chromium (Cr6).....	318
OL-MRA10 / 01-01-01 Checking the crankcase chamber pressure	322
OL-MRA10 / 01-50-20 Servicing the crankcase ventilation (UPF model).....	324
OL-MRA10 / 02-02-30 Performing lube oil change (genset).....	337
OL-MRA10 / 03-01-01 Checking the lube oil (transmission).....	361
OL-MRA10 / 03-01-27 Replenishing the lube oil (transmission).....	362
OL-MRA10 / 03-02-30 Performing lube oil change (transmission)	365
OL-MRA10 / 03-03-01 Checking the lube oil level (transmission)	370
OL-MRA10 / 03-05-10 Removing and installing the lube oil filter (transmission).....	371
OL-MRA10 / 03-05-80 Cleaning the lube oil filter (transmission).....	374
OL-MRA10 / 03-10-28 Purging the transmission	376
OL-MRA10 / 03-19-12 Dismantling and mounting the protective cover (generator).....	383

OL-MRA10 / 08-02-01 Checking the valve clearance.....	388
OL-MRA10 / 08-03-01 Checking the valve recession (cylinder head mounted)	395
OL-MRA10 / 08-50-12 Dismantling and mounting the cylinder head cover.....	398
OL-MRA10 / 15-10-10 Removing and installing the lube oil filter	403
OL-MRA10 / 15-27-80 Cleaning the lube oil cooler	407
OI-MRA10 / 16-15-01 Checking the flexible lube oil line.....	408
OI-MRA10 / 16-22-01 Checking the lube oil line	410
OL-MRA10 / 22-10-10 Dismantling and mounting the intake air filters (mounted ver- sion)	412
OL-MRA10 / 26-03-37 Setting the global ignition angle.....	414
OL-MRA10 / 26-10-10 Removing and installing the spark plug.....	419
OL-MRA10 / 26-13-01 Checking the spark plug and ignition cable	428
OL-MRA10 / 27-10-01 Checking the throttle valve	431
OL-MRA10 / 27-17-01 Checking the speed control actuator	433
OL-MRA10 / 38-01-23 Emptying and filling the cooling system.....	435
OI-MRA10 / 38-03-01 Checking the cooling system protection agent	449
OL-MRA10 / 43-12-12 Dismantling and mounting the exhaust turbocharger cover	451
OL-MRA10 / 43-17-01 Checking the wastegate	461
OL-MRA10 / 43-17-03 Visually inspecting the wastegate.....	466
OL-MRA10 / 45-60-12 Dismantling and mounting the starter relay	470
OL-MRA10 / 46-10-01 Checking the lugs	472
OL-MRA10 / 48-19-10 Removing and installing the intake air temperature sensor.....	474
OL-MRA10 / 48-22-10 Removing and installing the differential pressure sensor (throt- tle valve).....	477
OL-MRA10 / 48-26-10 Removing and installing the crankcase pressure sensor	481
OL-MRA10 / 48-29-10 Removing and installing the mixture temperature sensor	484
OL-MRA10 / 48-30-10 Removing and installing the mixture pressure sensor.....	487
OL-MRA10 / 48-33-10 Removing and installing the lube oil temperature sensor.....	490
OL-MRA10 / 48-34-10 Removing and installing the lube oil pressure sensor	494
OL-MRA10 / 48-38-10 Removing and installing the coolant temperature sensor.....	498

OL-MRA10 / 48-38-10 Removing and installing the coolant temperature sensor (mix- ture cooler).....	502
OL-MRA10 / 48-38-10 Removing and installing the coolant temperature sensor (en- gine inlet)	506
OL-MRA10 / 48-39-10 Removing and installing the coolant pressure sensor.....	510
OL-MRA10 / 49-01-13 Mounting and dismantling the engine turning gear.....	514
OL-MRA10 / 52-10-03 Visually inspecting the coupling.....	520
OL-MRA10 / 52-90-12 Dismantling and mounting the protective cover (flywheel)	522

Visually inspecting the genset

Valid for:

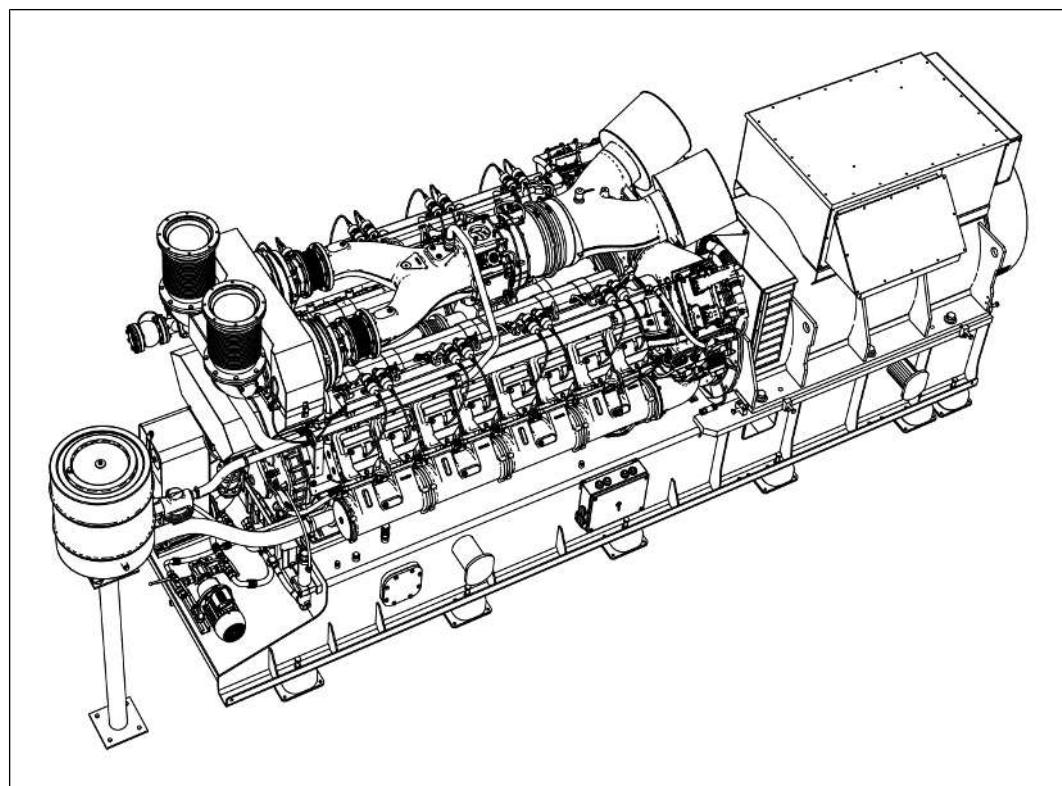
CG170B



Tools:

- Standard tools

General information



558271499

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](#) [▶ 197].

- Check safety devices for functionality and completeness.
 - Check the engine for noise emission.
 - In case of increased or abnormal noise emission, contact Cat dealer.
- 2. Check the electronic control.**
- Check the display data and pilot lights on the switchgear and the electronic control, see the TPEM Operating manual.
 - Compare the current operation values with the values in the commissioning log from the operations log, see Operating Manual, chapter the TPEM Operating manual.
 - If the operation values are outside the tolerances, contact Cat dealer.
- 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 [Dismantling and mounting the intake air filters \(mounted version\)](#) [▶ 412].
- 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 Cat dealer.
- 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 Cat dealer.
- 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 Cat dealer.
 - Check the lube oil level, see OL-MRA10 / 02-01-22 [Performing lube oil change \(genset\)](#) [▶ 337].
- 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](#) [▶ 307].

- Renew damaged components and eliminate leaks, also contact Cat dealer.

8. Check the generator.

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

9. Check the coupling.

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

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 Cat dealer.

Cleaning the genset

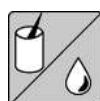
Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

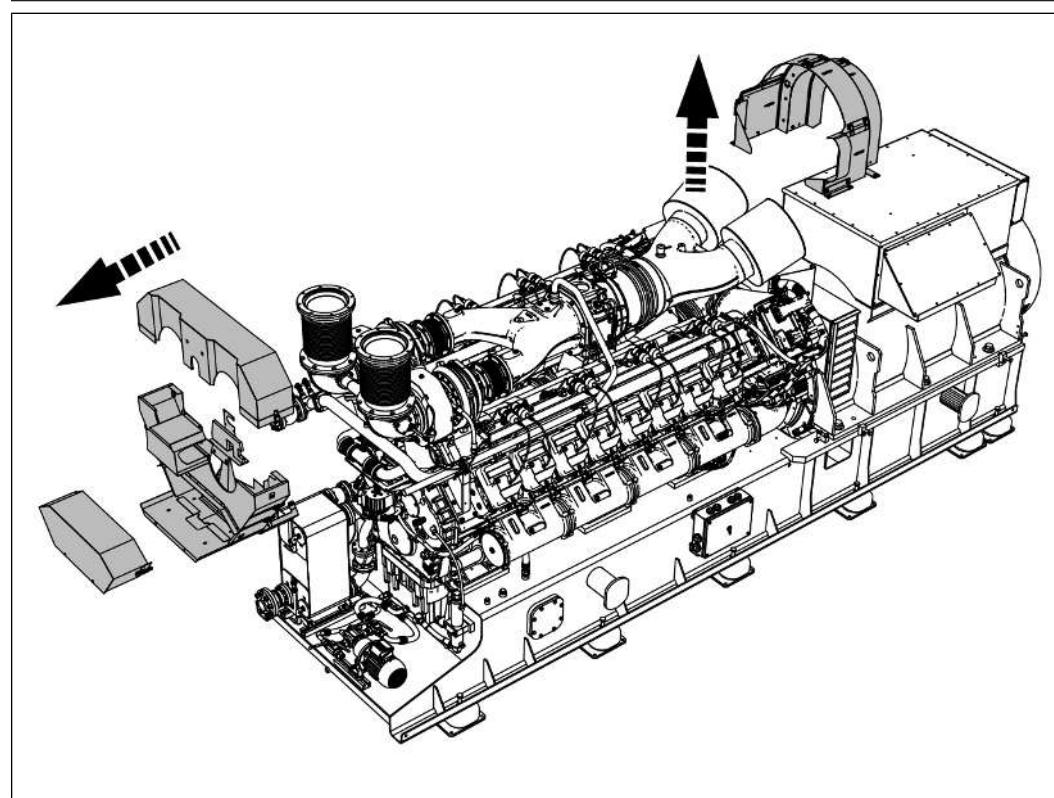
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Sealing plug
- Covers

General information

NOTE

Information about the cleaning agents

Technical Bulletin (TR) 2147 Specification for auxiliary media.



558273931

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 watertight.

NOTE

With partially dismantled gensets

Seal housing openings or cover so that they are watertight.

5. **NOTE! See Technical Bulletin (TR) 2147 Specification for auxiliary media** and choose a suitable cleaning agent.

Cleaning the genset:

1. **NOTE! Observe action time as per manufacturer instructions.** Spray genset with cleaning agent
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 covers with cleaning agents
4. Spray dismantled housing covers and housing panels with strong water jet or wash off.
 - If the desired level of cleanliness is not achieved, repeat the cleaning process.

End the cleaning process:

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 safeguards properly and check that they are working correctly.

Performing a test run

Valid for:

CG170B

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 Cat dealer.

NOTE

Control for pump lag.

The control for the pump lag functions only if **TPEM** stops 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 **TPEM** 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 OL-MRA10 / 00-02-03 **Visually inspecting the genset** [▶ 194].
 - If irregularities occur during the test run, decommission the genset, see Decommissioning/Genset Stopping the genset.

-
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.
2. Visually inspect the genset during the function test run, see OL-MRA10 / 00-02-03 [Visually inspecting the genset \[▶ 194\]](#).
 - If irregularities occur during the test run, decommission the genset, see Decommissioning/Genset Stopping the genset.
3. Find and eliminate the cause of the irregularities.
4. Repeat the load test run.

See also

- [\[▶\] Stopping the genset \[▶ 154\]](#)

Performing test run and function run

Valid for:
CG132B, CG170B

General information

Perform a test run and function run after all maintenance and repair work. If any irregularities occur during the test run and function run, decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#).

The operation values are specified in the commissioning report. If a commissioning report is not available, use the report from the test bench inspection.

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

Starting the genset:

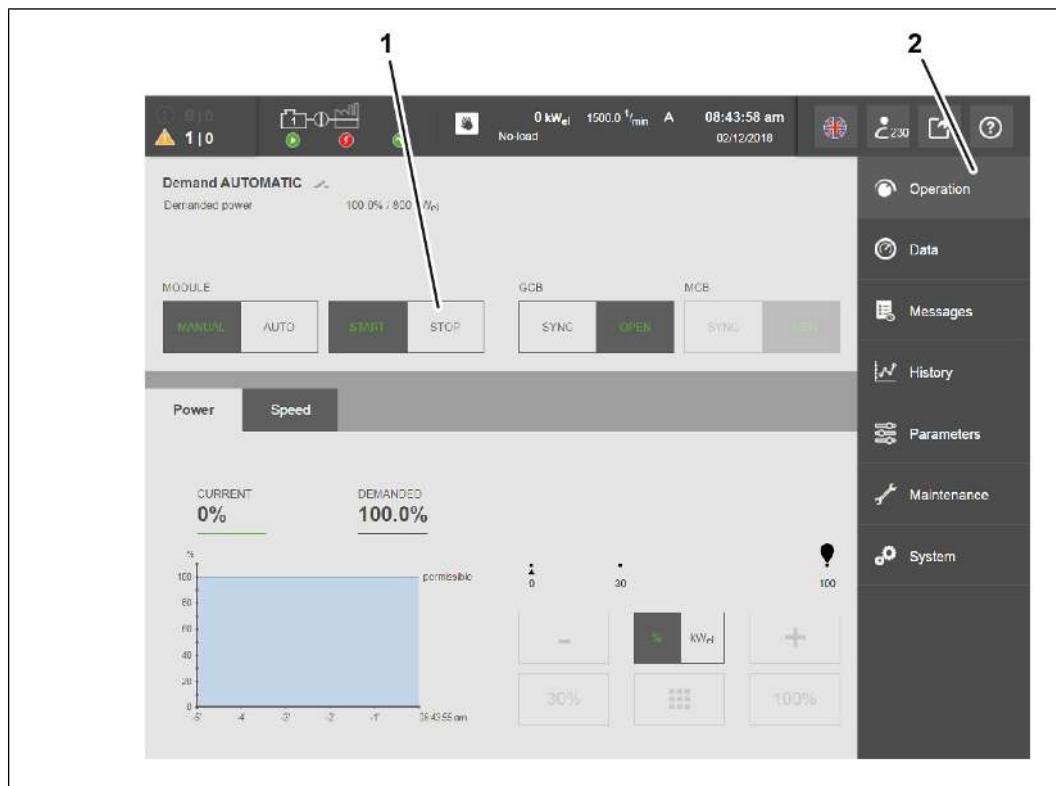


306249739

1. Press functional group Operation (4).
2. Tap the MANUAL (1) button.
 - The manual operation is set.
3. Tap the START (3) button.
 - The genset starts.

4. Tap the GCB SYNC (4) button
 - The synchronization starts.
5. Wait until the power demand 50.0 % is reached in the Power (2) dialog area.
6. Tap the + (6) button until the power demand 100.0 % is reached in the Power dialog area.
 - The genset progresses over the power ramp to 100.0 % power or to the power permissible for the operation.
7. If the maximum power 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. If in doubt, contact Cat dealer.

Stopping the genset after the test run and function run:



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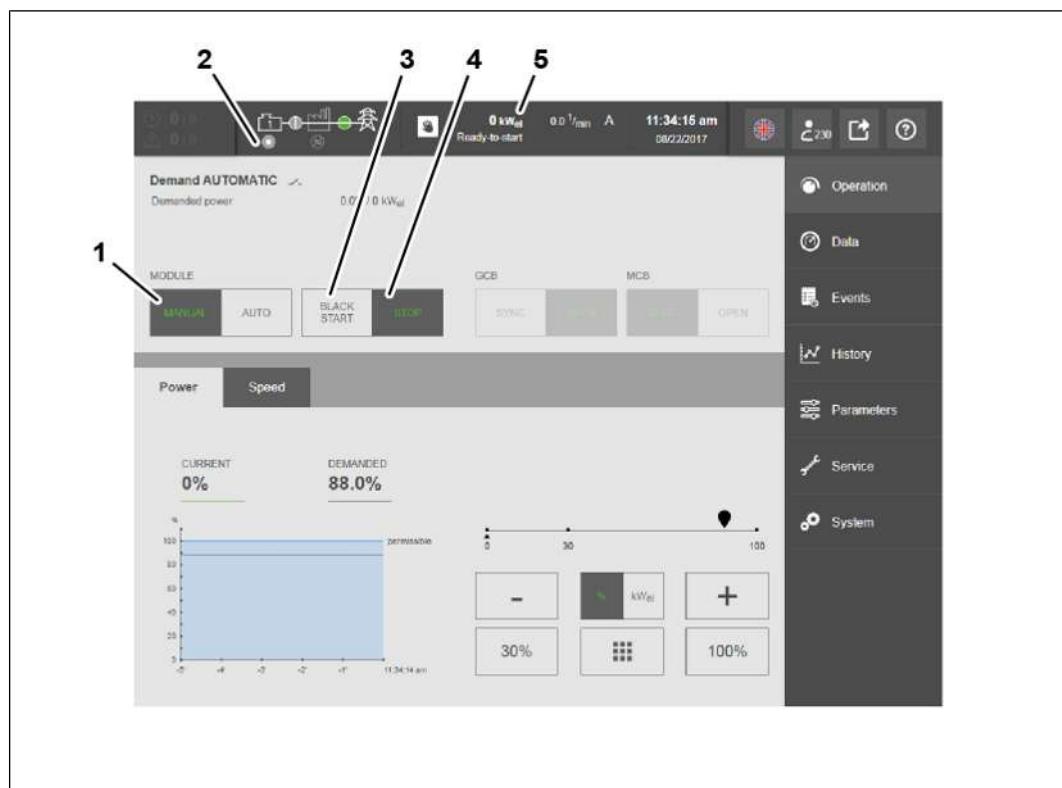
1. Press functional group Operation (2).
2. Tap the STOP (1) button.
 - The engine is stopped.
3. Check whether all the auxiliary drives are functioning and running properly, see [Performing the auxiliary drive test \(TPEM\)](#) [▶ 205]
4. Then perform a visual inspection, see [OL-MRA10 / 00-02-03 Visually inspecting the genset](#) [▶ 194]

Performing black start

Valid for:
CG132B, CG170B

Procedure to follow:

- ✓ 24 V voltage supply
- ✓ Demand contact 179 on the [TPEM I/O Controller](#) closed (customer side)
- ✓ Parameter 20105303 Black start possible activated, see *Operating Manual chapter Operation, TPEM Operating manual*



306600459

1. In the functional group **Operation**, tap the button **MANUAL** (1)
2. Manual operation is activated.
3. Tap the **BLACK START** (3) button
 - The engine performs the black start automatically.
 - Black start is displayed in the status bar (2).
 - The electric power (5) is displayed in the status bar (2).
4. To end the Black start function, tap the **STOP** (4) button

Performing the auxiliary drive test (TPEM)

General Information



Risk of destruction of components

Insufficient prelubrication can damage the engine.

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

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

The plant control only allows auxiliary drives to be tested if they are available and activated in the parameters. In some cases you can enter only odd values in the parameters for the maximum values:

- e.g. 6999 instead of 7000
- Or 1 % instead of 0 %

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:

- Genset is stopped
- Manual operation is selected
- Quick stop function is not activated

No engine start is possible in test mode. You can only activate individual auxiliary drives (e.g. starter) via the Touch button for safety reasons. The auxiliary drive then only stays switched on for as long as the Press and hold button is pressed.

Some auxiliary drive tests contain visual and audio samples. To do this, the operator must be in the immediate vicinity of the genset.

If the touch panel is not installed in the immediate vicinity of the genset, these auxiliary drive tests must then be performed in pairs.

Description of the buttons

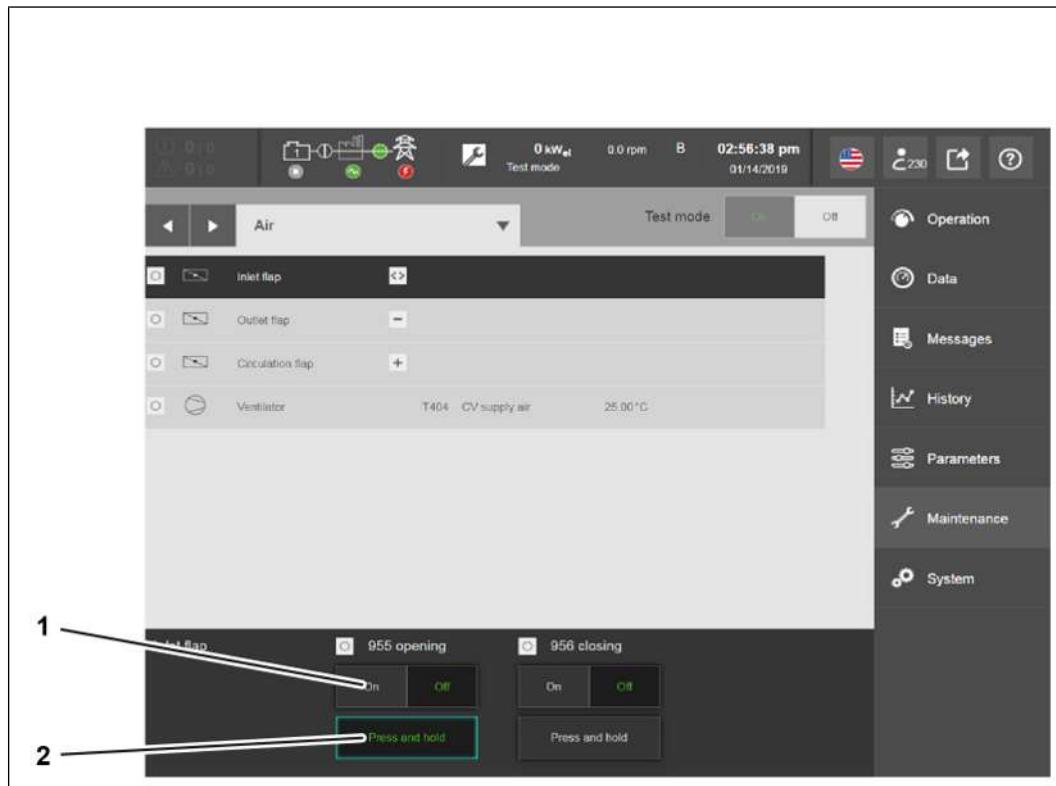
Activated or activatable buttons have the following features:

- Cyan colored border
- Black button
- Green writing

Not activated or non-activatable buttons have the following features:

- Light gray or dark gray button
- Light gray or dark gray writing

Information about the Press and hold button



3122733451

The Press and hold (2) button is active during some auxiliary drive tests. You can then also perform the required auxiliary drive test using the Press and hold (2) button. The Press and hold(2) button activates the relevant auxiliary drive only for as long as you keep pressing the Press and hold(2) button. To perform auxiliary drive tests for valves, radiators or pumps, you must move them to their end positions. In these cases, it is easier to perform the required auxiliary drive test using the On(1) button. The control system then automatically moves to the end positions.

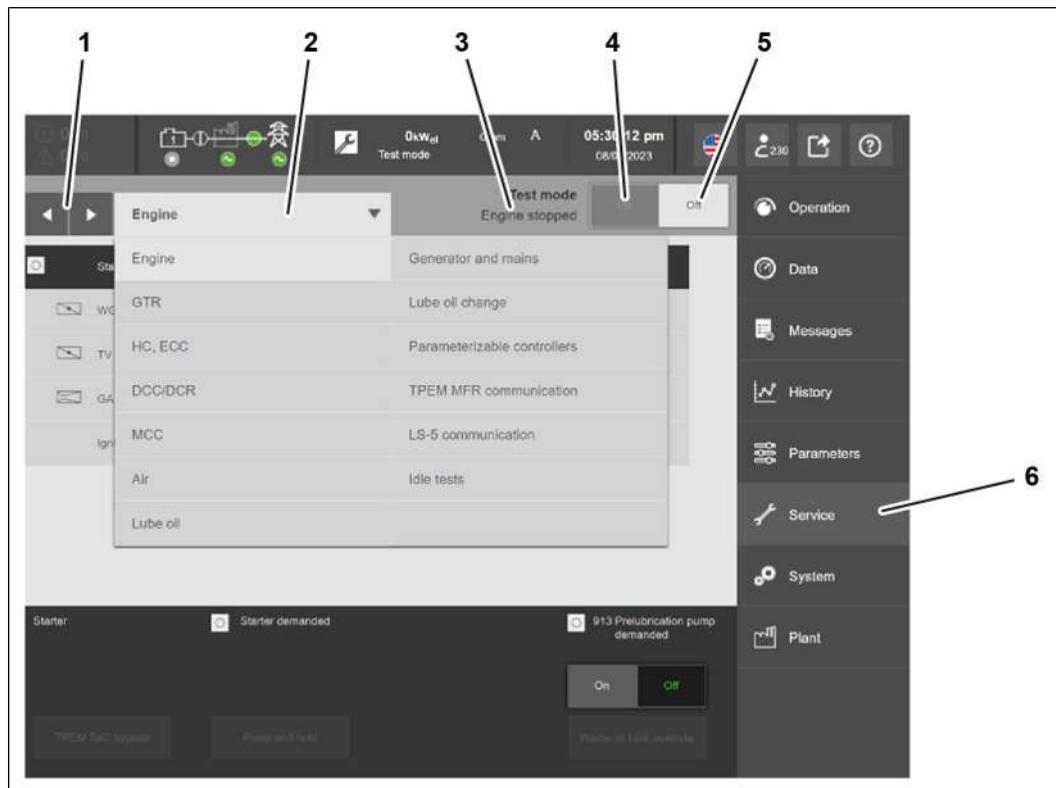
The information provided for the individual auxiliary drive tests describes which button you can use to perform the relevant auxiliary drive test.

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
	Gray rotation arrow	Check is performed (e.g. calibration)
	Plus sign	Actuator has reached the plus limit stop (e.g. rich, hot)
	Minus sign	Actuator has reached the minus limit stop (e.g. lean, cold)
	Double arrow	Actuator moves or stops between the limit stops

Table 13: Test result description symbols

Selecting the auxiliary drive test, activating and deactivating the test mode:



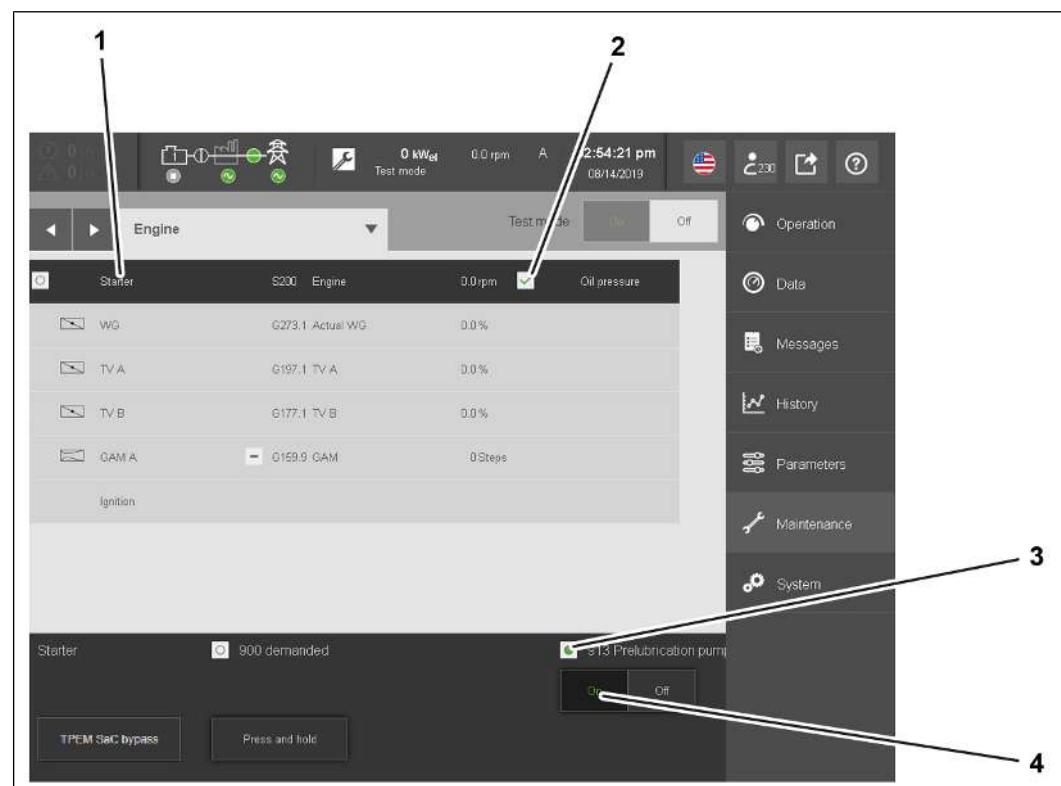
18014398812766091

1. Tap the Service (6) button.
 - The Engine auxiliary drive subgroup is open and the Starter line has a black background.
 - The Test mode dialog area shows the operating state (3) of the engine.
2. Select and open an auxiliary drive subgroup.
 - Tap the Engine (2) button, the pull-down menu opens.
 - Tap the desired auxiliary drive subgroup in the pull-down menu line.
 - The selected auxiliary drive subgroup opens.
 - Tap the buttons (1) to toggle between the individual auxiliary drive subgroups.
3. Tap the Test mode ON (4) button.
 - Test mode is activated.
4. Tap the Test mode OFF (5) button.
 - Test mode is deactivated.

Engine auxiliary drive test

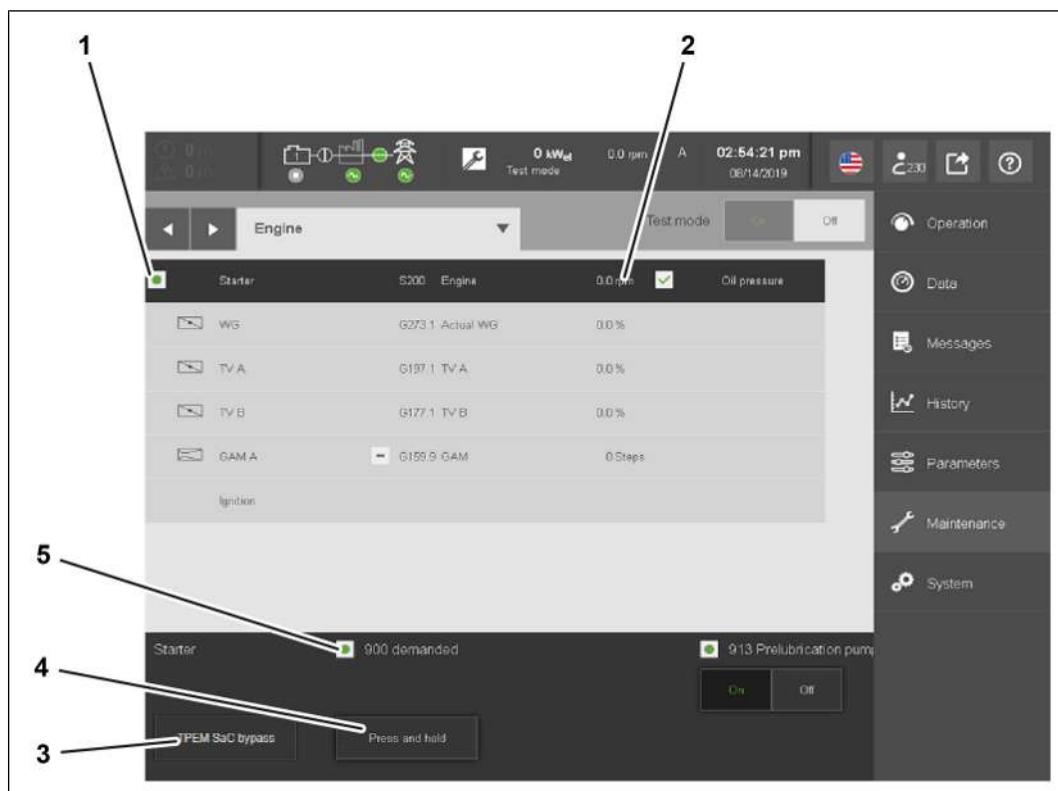
Valid for:
CG132B, CG170B

Checking the starter



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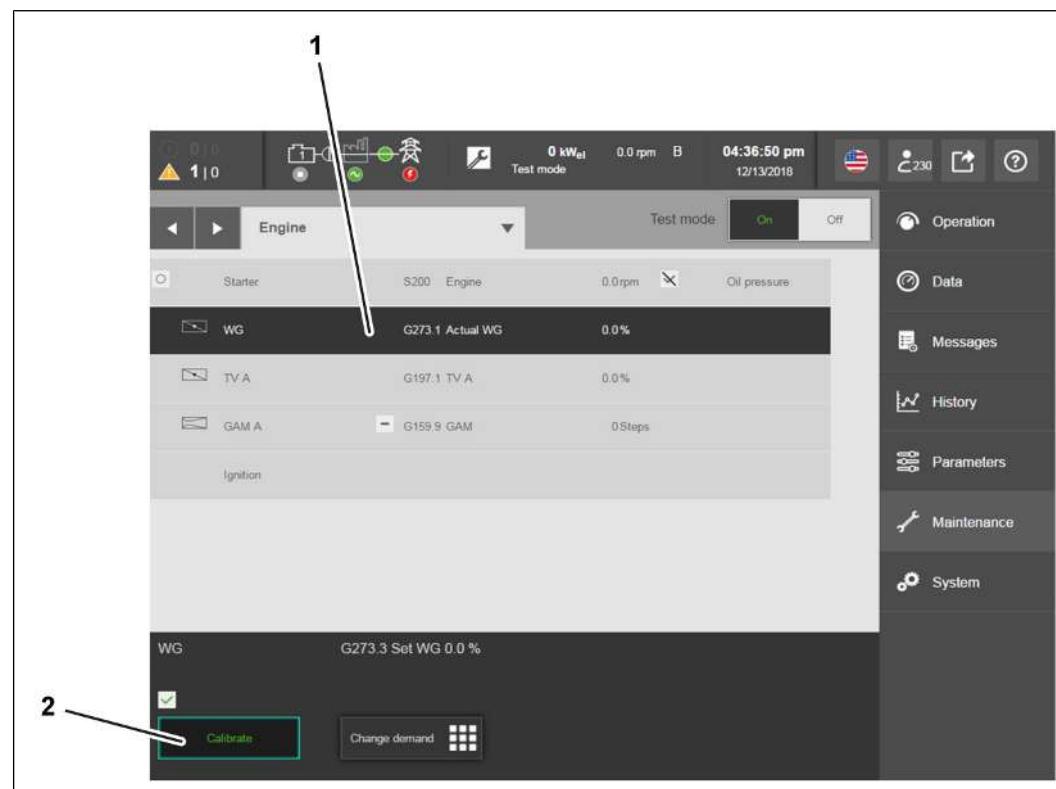
1. Tap Starter (1) line in the pull-down menu
2. Tap the On (4) button.
 - A green dot (3) appears in the 913 Prelubrication pump dialog area. The output 114K1DO6 is demanded.
 - When the required oil pressure is reached, a green checkmark (2) appears in the Starter (1) dialog area.



9007199558136203

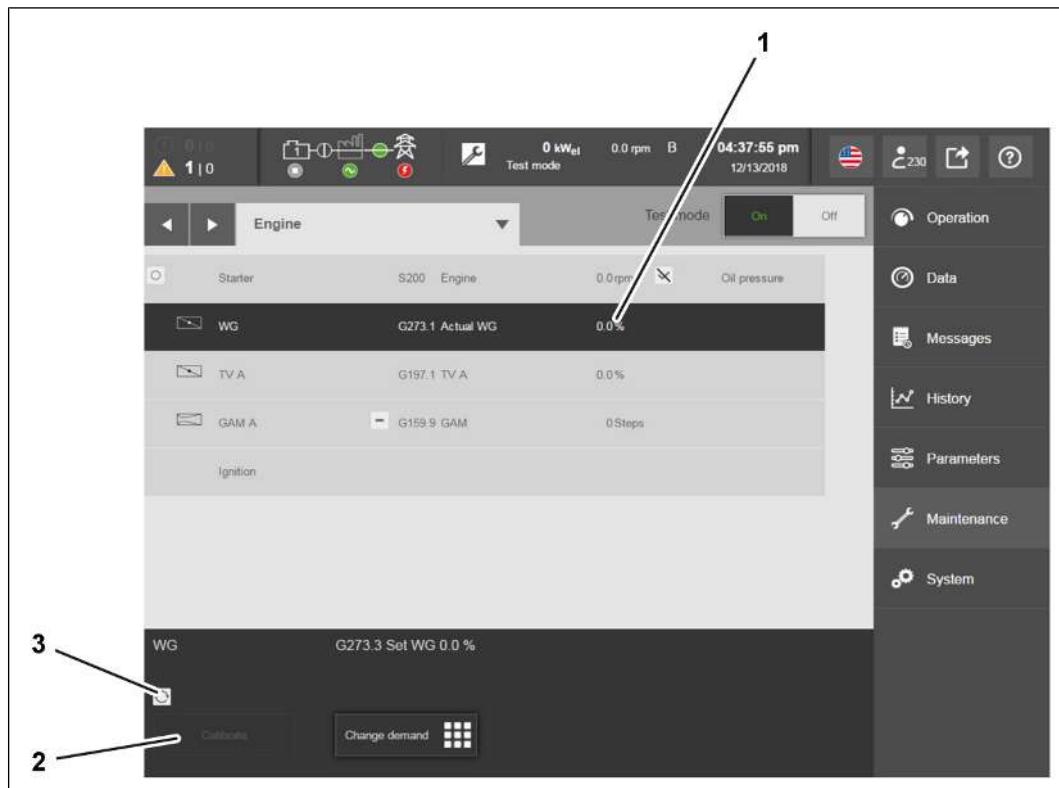
3. The button TPEM SaC bypass (5) is activated. The auxiliary drive test Starter is activated.
4. Press the Press and hold (3) button and hold for a short time
 - A green dot (4) appears in the Starter demanded dialog area. The output DO9 Module 60K4 is demanded.
 - A green dot (1) appears in the Starter dialog area.
 - When the speed display (2) changes in the Starter dialog area, the starter is functional. Otherwise, you must check the starter and replace it if necessary. For assistance, contact the Cat dealer.

Performing wastegate calibration



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1. Tap the WG (1) line in the pull-down menu
2. Tap the Calibrate (2) button



303573771

3. Wait for wastegate calibration

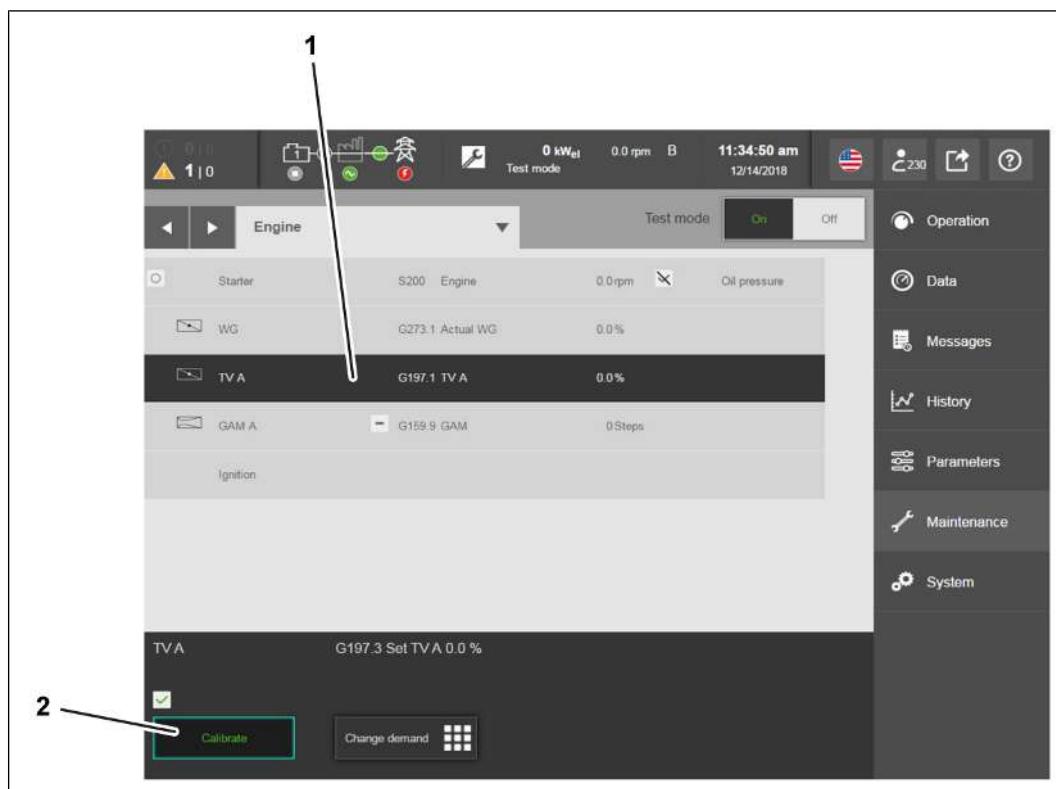
- The actuator conducts a calibration cycle. To do this, the actuator moves up from 0 % to 100 % (open) and back down to 0 % (closed).
- The Calibrate (2) button is grayed out during calibration.
- A percentage shows the wastegate presetting in the dialog area (1).
- A rotation arrow shows the duration of the calibration in the dialog area (3).
- The result of the check is displayed by a symbol in the dialog area (3)

4. If the result is not OK, contact Cat dealer

Calibrating throttle valve A

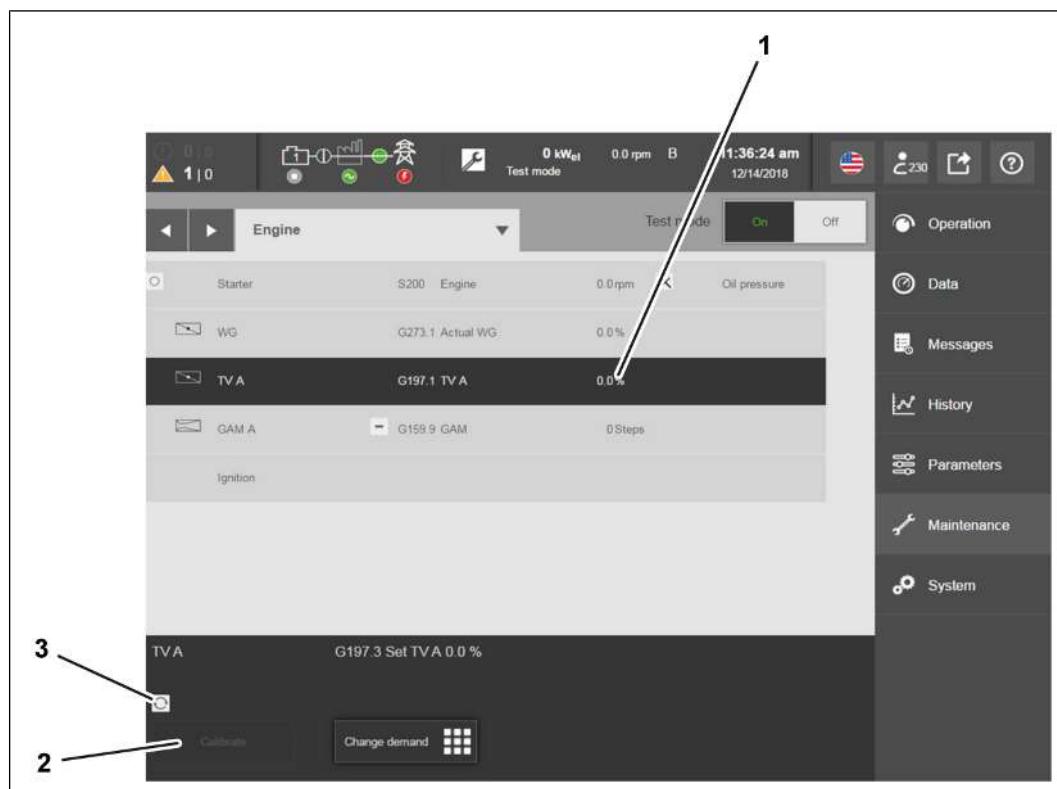
NOTE

If available, perform the throttle valve B check according to the throttle valve A calibration.



303590411

1. Tap the TV A (1) line in the pull-down menu
2. Tap the Calibrate (2) button



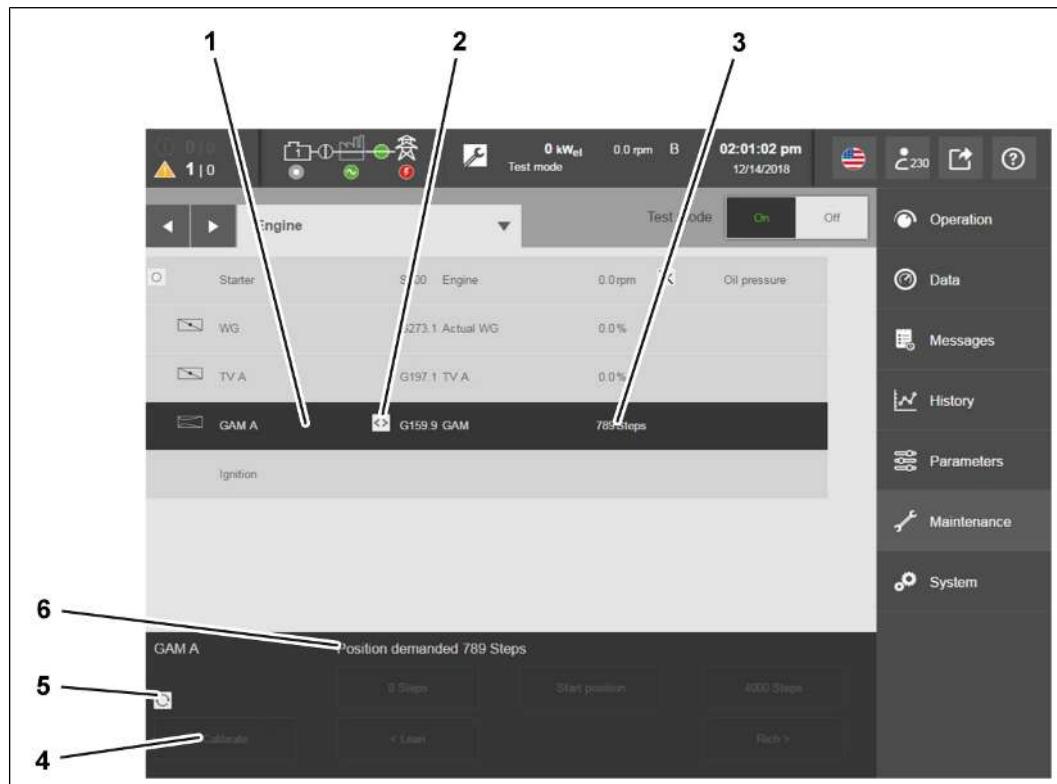
303637771

3. Wait for calibration of the throttle valve A

- The actuator conducts a calibration cycle. To do this, the actuator moves up from 0 % to 100 % (open) and back down to 0 % (closed).
- The Calibrate (2) button is grayed out during calibration.
- A percentage shows the throttle valve A presetting in the dialog area (1).
- A rotation arrow shows the duration of the calibration in the dialog area (3).
- The result of the check is displayed by a symbol in the dialog area (3)

4. If the result is not OK, contact Cat dealer

Calibrating gas-air mixer A



303652491

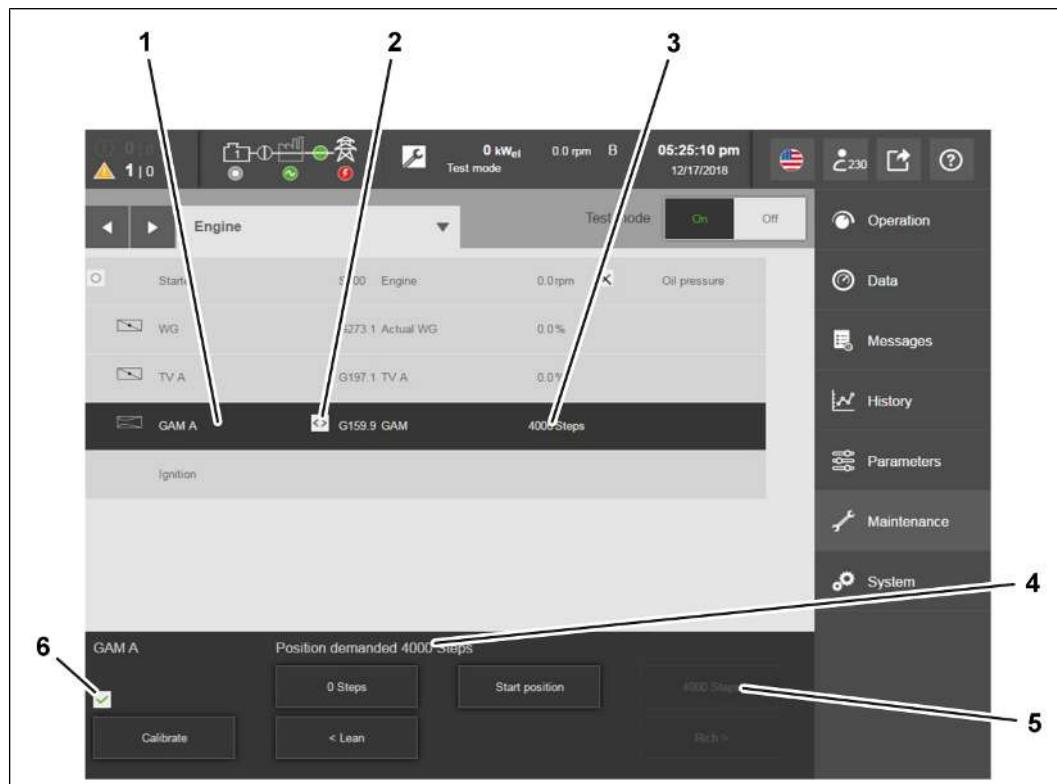
1. Tap the GAM A (1) line in the pull-down menu
2. **NOTE! You must calibrate the gas-air mixer before starting the test. The gas-air mixer moves up to a maximum of 4000 steps. A non-calibrated gas-air mixer can move the 4000 steps in addition to its actual start position. At an actual start position of 500 Steps, for example, the gas-air mixer tries to move an additional 4000 steps. The gas-air mixer gets stuck. In this case, you must remove the gas-air mixer and make it move again.** Calibrating gas-air mixer A
 - Tap the Calibrate (4) button. The Calibrate (4) button is grayed out during calibration.
 - The display of the start position, e.g. 789 Steps, set in the parameters appears in the Position demanded (6) dialog area.
 - The gas-air mixer moves from its current position to the 0 Steps position.
 - The gas-air mixer moves from position 0 Steps to the start position, e.g. 789 Steps, set in the parameters.
 - A rotation arrow (5) appears in the GAM A dialog area during calibration.
 - The dialog area GAM A shows the start position of the gas-air mixer in steps (3).
 - The position of the gas-air mixer is indicated by a symbol (2) in the GAM A dialog area.

Checking the gas-air mixer A stop position

NOTE

If available, perform the gas-air mixer B check according to the gas-air mixer A check.

Before you check the stop position, you must calibrate the gas-air mixer, see section *Calibrating the gas-air mixer*.



303681675

1. Tap the 4000 Steps (5) button
 - Observe gas-air mixer A via the inspection window to see whether it adjusts itself in the rich direction.
 - The 4000 Steps display appears in the Position demanded (4) dialog area.
 - Gas-air mixer A moves to the Rich position.
 - The position of the gas-air mixer is indicated by a symbol (2) in the GAM A dialog area.
 - The dialog area GAM A shows the position of the gas-air mixer in steps (3).
 - A symbol (6) shows the result of the check in the GAM A dialog area

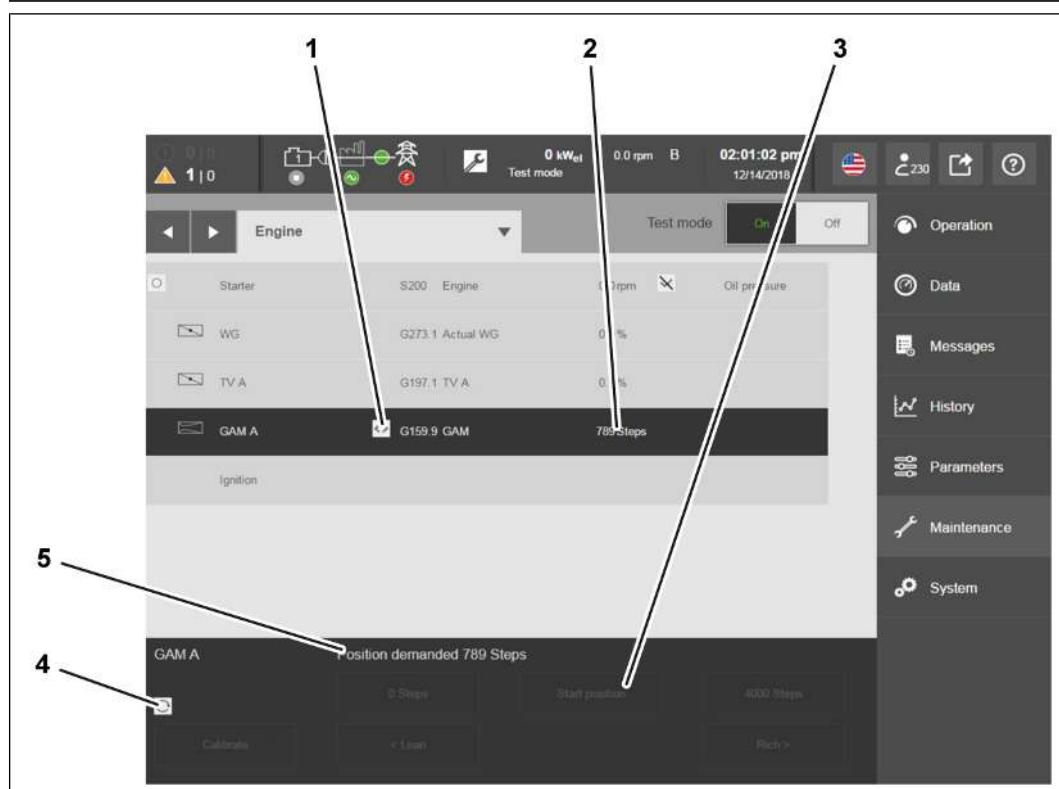
NOTE

- If a red lightning bolt appears in the dialog area GAM A, repeat the auxiliary drive test for the gas-air mixer A start position.
- If a red lightning bolt is also shown in the GAM A dialog area when the auxiliary drive test is repeated, contact Cat dealer

Checking the gas-air mixer A start position**NOTE**

If available, perform the gas-air mixer B check according to the gas-air mixer A check.

Before you check the start position, you must calibrate the gas-air mixer, see section *Calibrating the gas-air mixer*.



303712267

1. Tap the Start position (3) button

- Observe gas-air mixer A via the inspection window to see whether it adjusts in the lean direction.
- Gas-air mixer A moves to the Lean position.
- The 0 Steps display appears in the Position demanded (5) dialog area.
- The position of the gas-air mixer is indicated by a symbol (1) in the GAM A dialog area.

- The dialog area GAM A shows the position of the gas-air mixer in steps (2).
- A symbol (4) shows the result of the check in the GAM A dialog area

NOTE

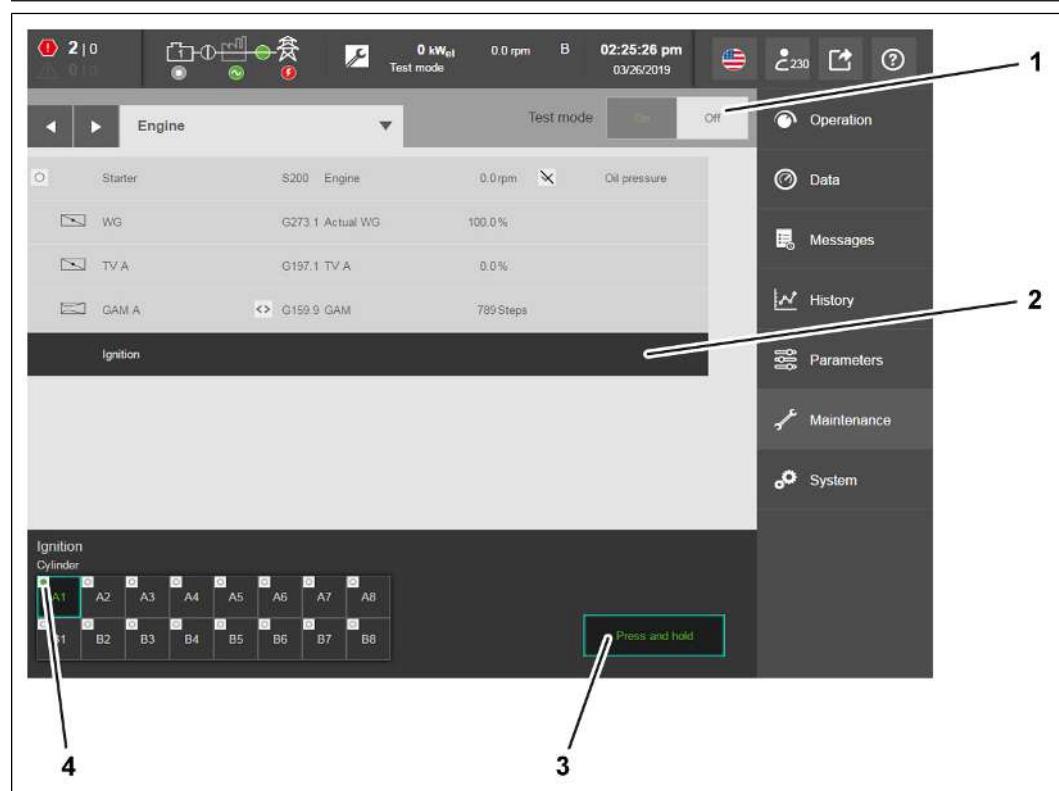
If a red lightning bolt appears in the dialog area GAM A, repeat the auxiliary drive test for the gas-air mixer A start position. If a red lightning bolt is also shown in the GAM A dialog area when the auxiliary drive test is repeated, contact Cat dealer.

Checking the ignition

NOTE

The engine variant determines the number of cylinders. Perform the ignition check for each displayed cylinder.

- Perform the test for the other cylinders according to the ignition check for cylinder A1.



304259723

1. Tap the Ignition (2) line in the pull-down menu.
2. Tap the A1 (4) button.
 - The ignition check is activated for cylinder A1.

3. Press the Press and hold (3) button and hold for a short time
 - A green dot (3) appears in the A1 button. The main control device controls the ignition coil.
 - The font color in the A1 button changes from white to green.
 - **DANGER! Risk of fatal injuries from high-voltage ignition coils. All work on ignition bars and ignition coils must only be performed by qualified electricians.** If the result is not OK, there is no voltage on the ignition coil. Contact the Cat dealer.
 4. Repeat the ignition check for all the other cylinders.
 5. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (1) button.
 6. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
 7. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (1) button.
- ⇒ The auxiliary drive test is ended.

Gas train (GTR) auxiliary drive test

Valid for:

CG132B, CG170B

Checking the GTR A gas shut-off valves:

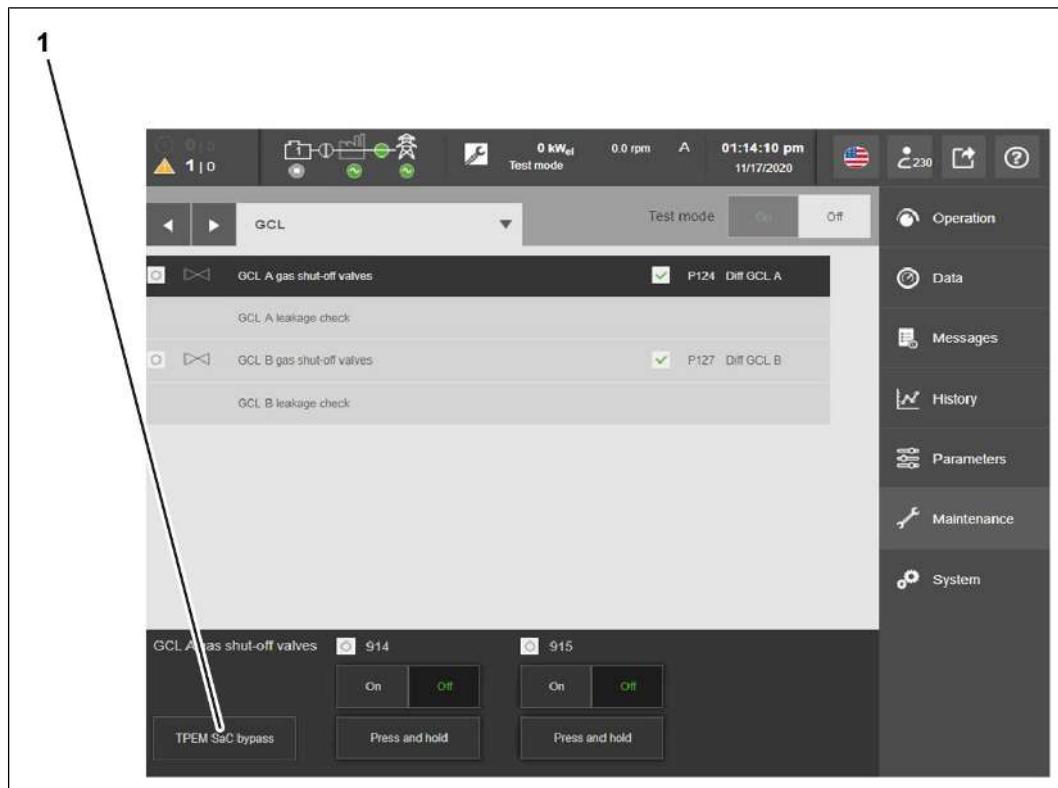
NOTE

The control displays the auxiliary drive test for additional gas shut-off valves for dual gas operation only.

Perform the check for all additional gas shut-off valves according to the check of the GTR A gas shut-off valve.

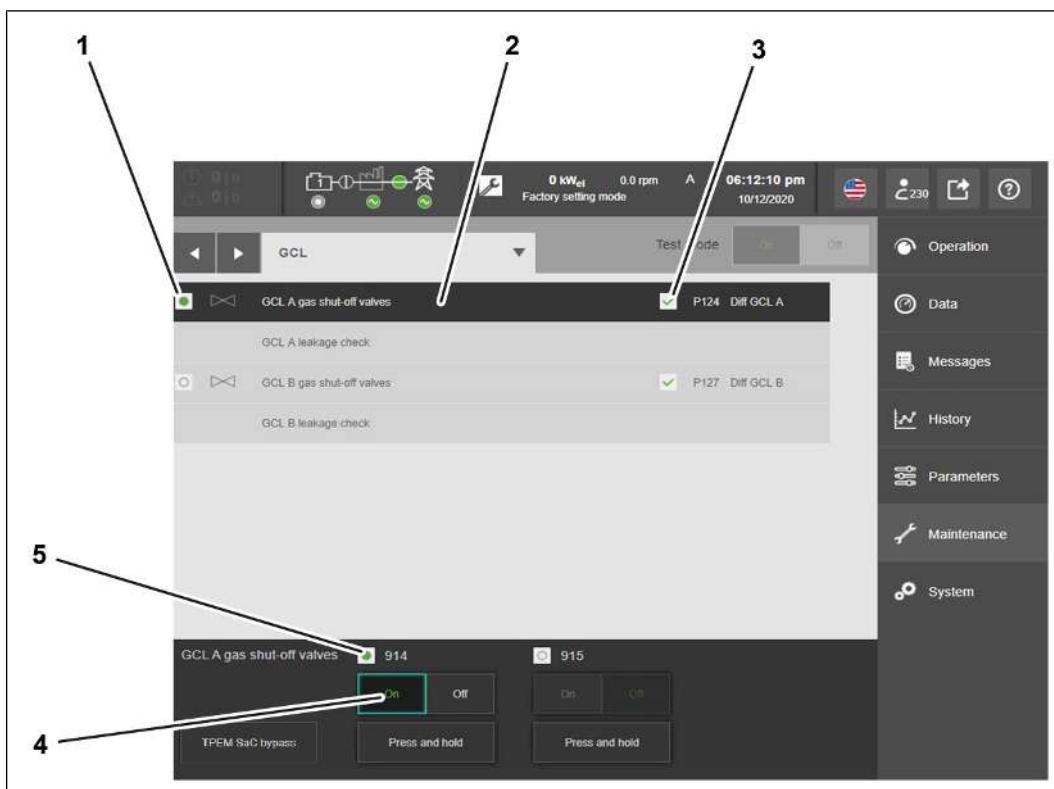
The following outputs are used on the central unit for the GTR B gas shut-off valve:

- Tapping the On button will select the outputs 50K6 and 50K7.
- If the TPEM SaC bypass function is active, the outputs 47Q7 and 47Q8 will be selected.



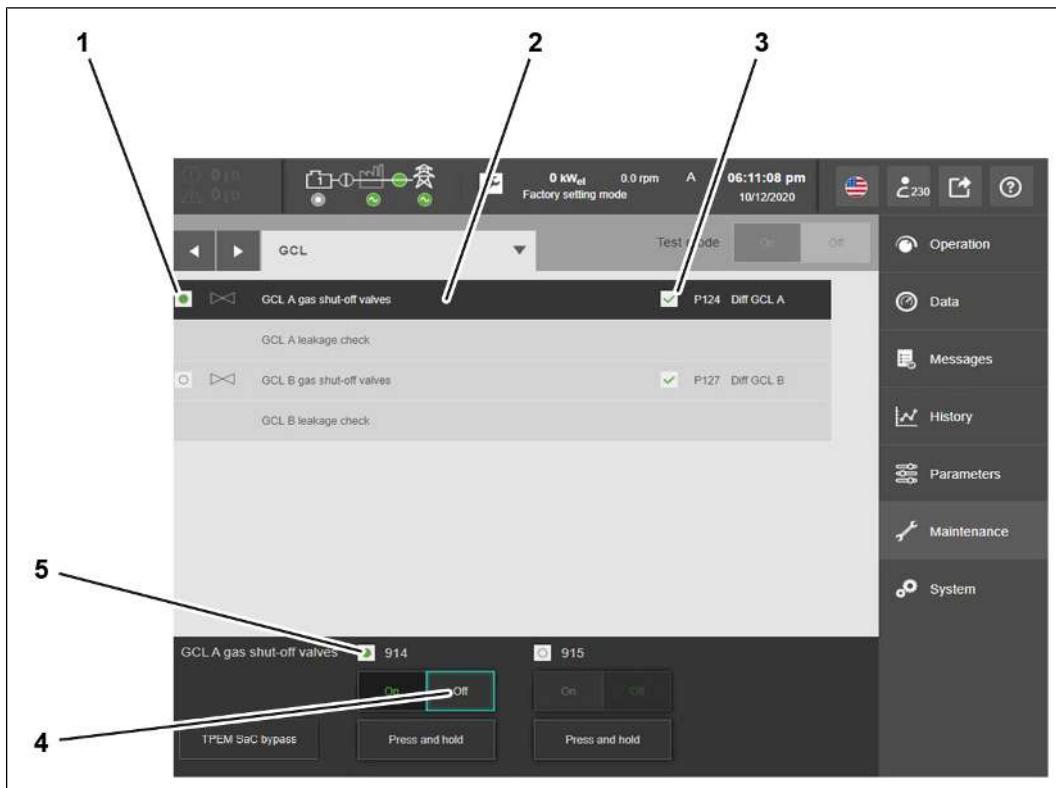
304290187

1. Check whether the TPEM SaC bypass (1) button is activated
 - If the TPEM SaC bypass (1) button is not activated, check oil pressure.
 - Activate prelubrication pump if necessary, see [Engine auxiliary drive test \[▶ 209\]](#).



304303627

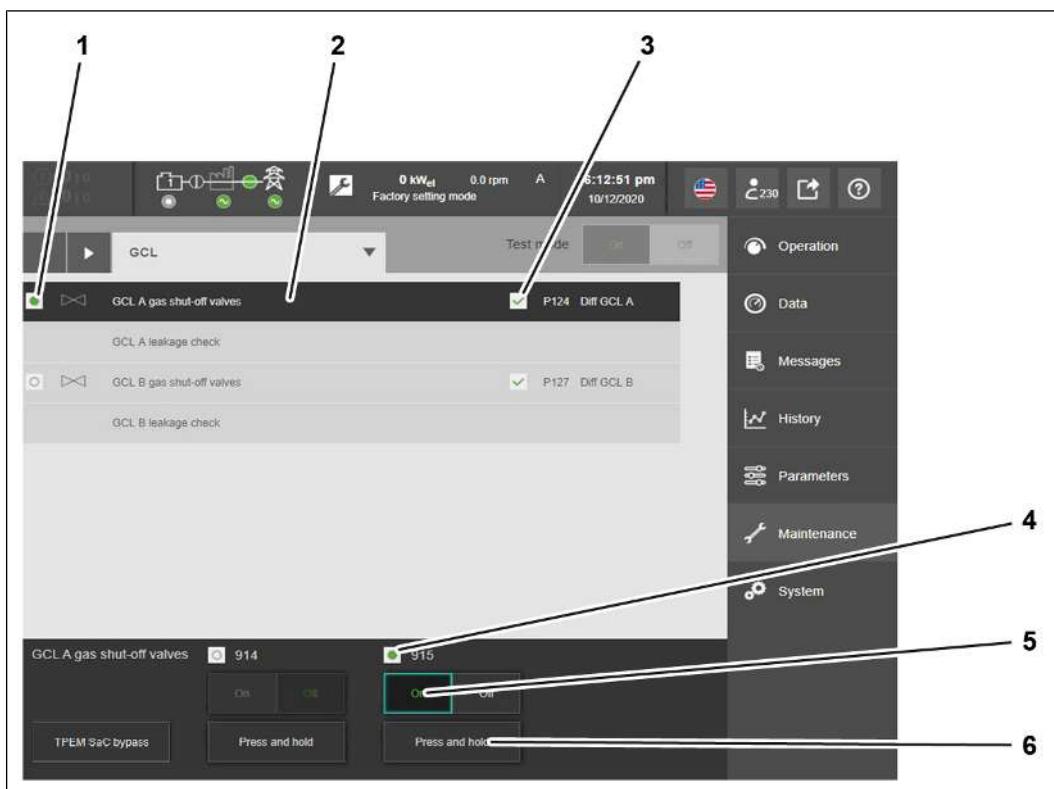
2. Tap the GTR A gas shut-off valves (2) line in the pull-down menu.
 - A green checkmark (3) appears in the P124 Diff GTR A dialog area.
3. **NOTE! You can only activate one solenoid valve at a time. While the solenoid valve is activated, the other solenoid valve is deactivated. You can touch the deactivated solenoid valve. When you touch the deactivated solenoid valve, the solenoid valve opens audibly and noticeably in terms of tactile perception.** Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the GTR A gas shut-off valves (2) dialog area.
 - A green dot (5) appears in the GTR A gas shut-off valves 914 dialog area. The output 50K4 is demanded in the central unit.
 - If the TPEM SaC bypass function is active, the output 46Q7 is demanded.
 - The solenoid valve opens audibly and noticeably in terms of tactile perception.



304329867

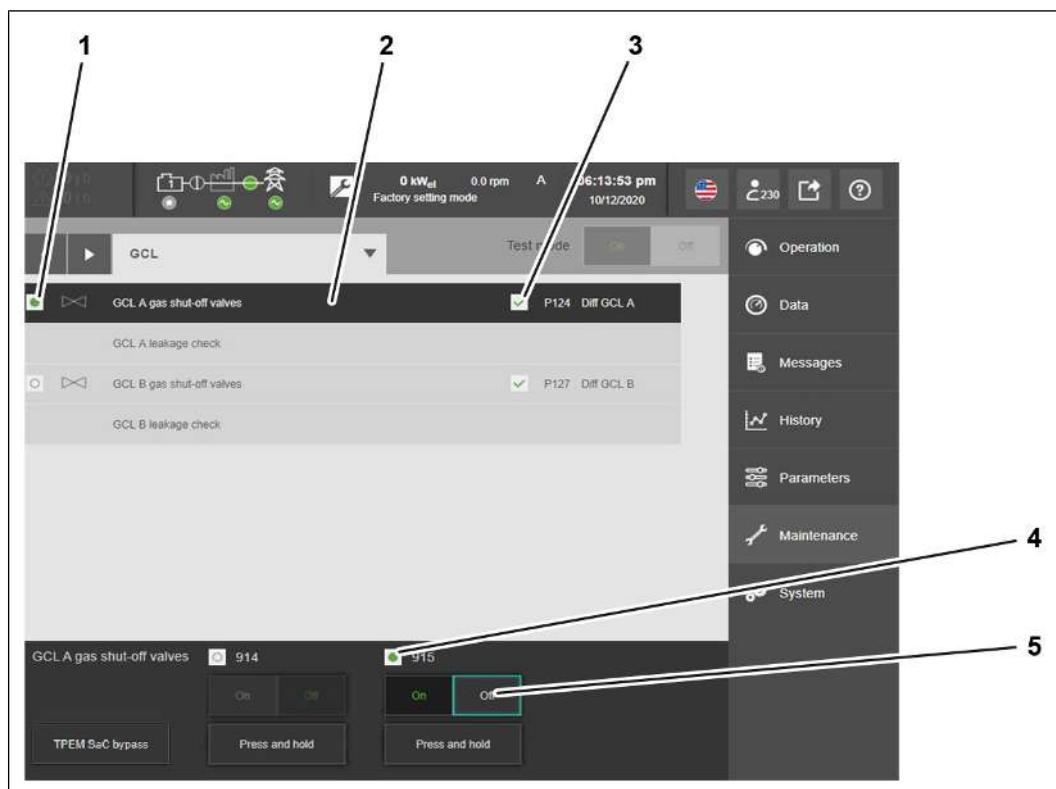
4. Tap the **Off** (4) button.

- The font color in the **Off** (4) button changes from white to green.
- The green dot (1) disappears from the GTR A gas shut-off valves (2) dialog area.
- A green checkmark (3) appears in the P124 Diff GTR A dialog area.
- The green dot (5) disappears from the GTR A gas shut-off valves 914 dialog area. The output 50K4 is no longer demanded in the central unit.
- If the TPEM SaC bypass function was active, the output 46Q7 is no longer demanded.



304356107

5. Tap the GTR A gas shut-off valves (2) line in the pull-down menu.
 - A green checkmark (3) appears in the P124 Diff GTR A dialog area.
6. Tap the On (5) button.
 - The font color in the On (5) button changes from white to green.
 - A green dot (1) appears in the GTR A gas shut-off valves (2) dialog area.
 - A green dot (5) appears in the GTR A gas shut-off valves 914 dialog area. The output 50K5 is demanded in the central unit.
 - If the TPEM SaC bypass function is active, the output 46Q8 is demanded.
7. Press the Press and hold (6) button and hold for a short time.
 - The solenoid valve switches audibly and noticeably in terms of tactile perception.



304382347

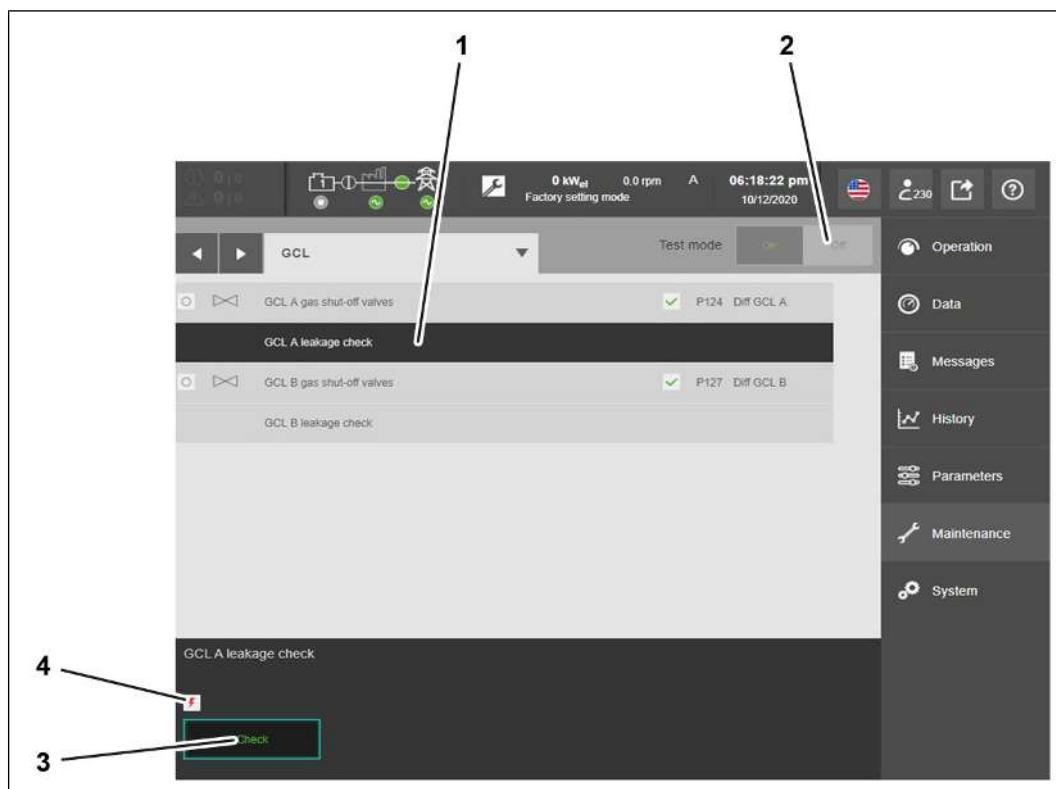
8. Tap the Off (6) button.
 - The font color in the Off (6) button changes from white to green.
 - The green dot (1) disappears from the GTR A gas shut-off valves (2) dialog area.
 - A green checkmark (3) appears in the P124 Diff GTR A dialog area.
 - The green dot (5) disappears from the GTR A gas shut-off valves 914 dialog area. The output 50K5 is no longer demanded in the central unit.
 - If the TPEM SaC bypass function was active, the output 46Q8 is no longer demanded.

Leakage check for the GTR A gas shut-off valves:

NOTE

The control displays the auxiliary drive test for additional gas shut-off valves for dual gas operation only.

Perform the check for all additional gas shut-off valves according to the check of the GTR A gas shut-off valve.



304395787

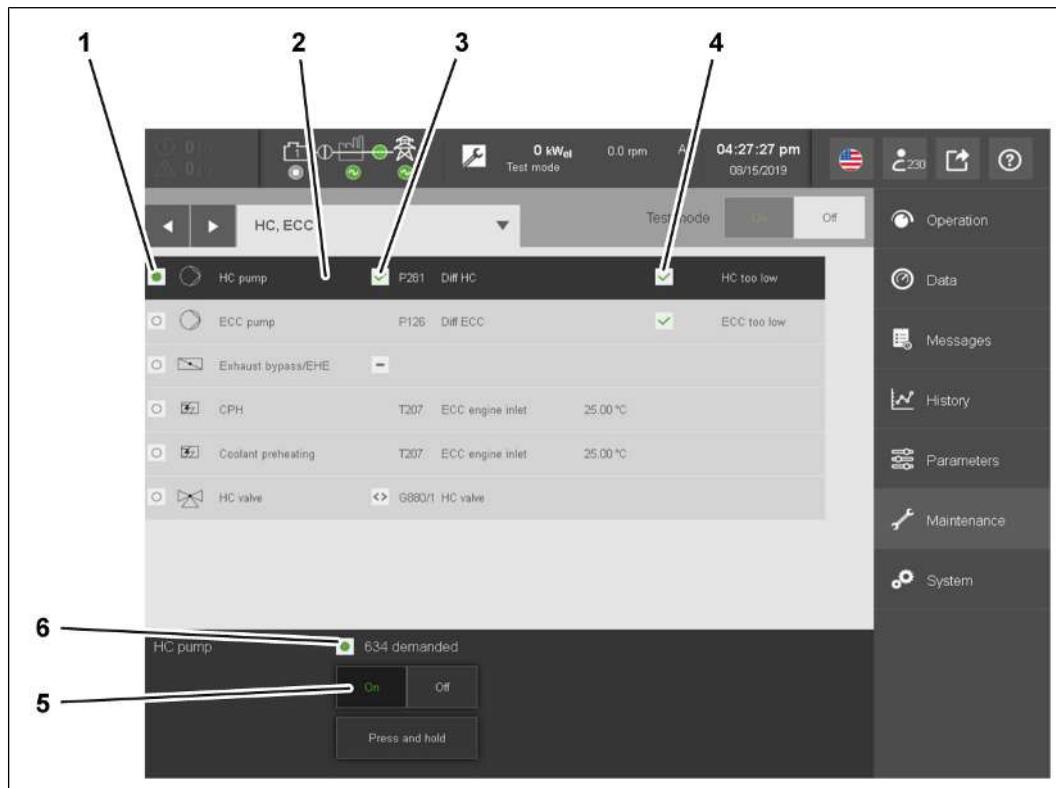
1. Tap the GTR A leakage check (1) line in the pull-down menu.
2. Tap the Check (3) button.
 - Wait for the check result. The check can take up to 90 seconds.
 - The result of the check is indicated by a symbol (4) in the dialog area GTR A leakage check.
3. If the result is not OK, contact the Cat dealer.
4. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
5. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
 - ⇒ The auxiliary drive test is ended.

Heating circuit (HC) and engine cooling circuit (ECC) auxiliary drive test

Valid for:

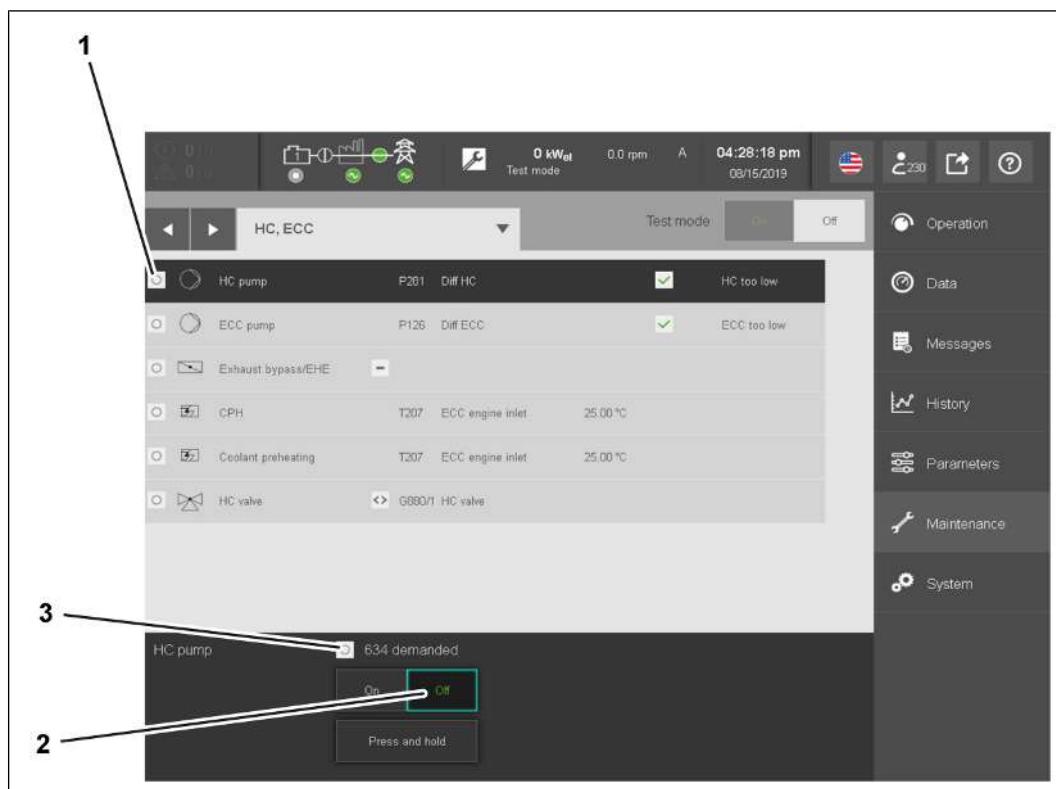
CG132B, CG170B

Checking the heating circuit pump



304428427

1. Tap the HC pump (2) line in the pull-down menu.
 - A green checkmark appears in the L280 HC too low (4) dialog area. The liquid level is OK. You can start the auxiliary drive test.
 - A red lightning bolt appears in the L280 HC too low dialog area (4). The liquid level is not OK. Find and correct the root cause of the low liquid level before starting the auxiliary drive test. If necessary, contact the Cat dealer.
2. Tap the On (5) button.
 - The font color in the On (5) button changes from white to green.
 - A green dot (1) appears in the HC pump (2) dialog area.
 - A green dot (6) appears in the HC pump 634 demanded dialog area. The output 114K1D08 is demanded.
3. Check the function and direction of rotation of the pump.
 - A green checkmark (3) appears in the P281 Diff HC dialog area. The flow monitor measures the differential pressure. The pump is running.
 - Visually inspect the direction of rotation. If the direction of rotation of the pump is incorrect, contact your Cat dealer.
 - A red checkmark (3) appears in the P281 Diff HC dialog area. The differential pressure sensor does not measure any differential pressure. Removing and installing the differential pressure sensor.



304477707

4. Tap the Off (2) button.
 - The font color in the Off (2) button changes from white to green.
 - The green dot (3) disappears from the HC pump 634 demanded dialog area. The output 114K1D08 is no longer demanded.
 - The green dot (1) disappears from the HC pump dialog area.

Checking the engine cooling circuit pump:

NOTE

Perform the engine cooling circuit pump check according to the heating circuit pump check.

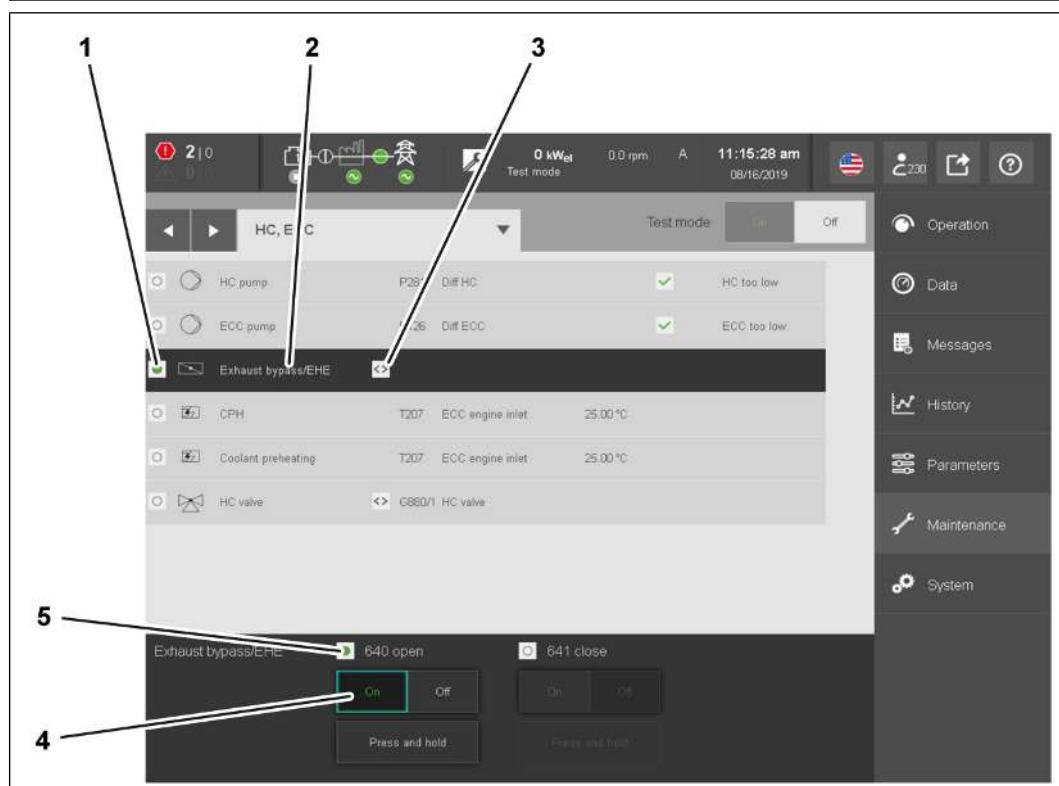
- The output 114K1D011 is demanded during the check.

Checking exhaust bypass/EHE

NOTE

Perform the check for the limit stop, minus (close) according to the check for the limit stop, plus (open).

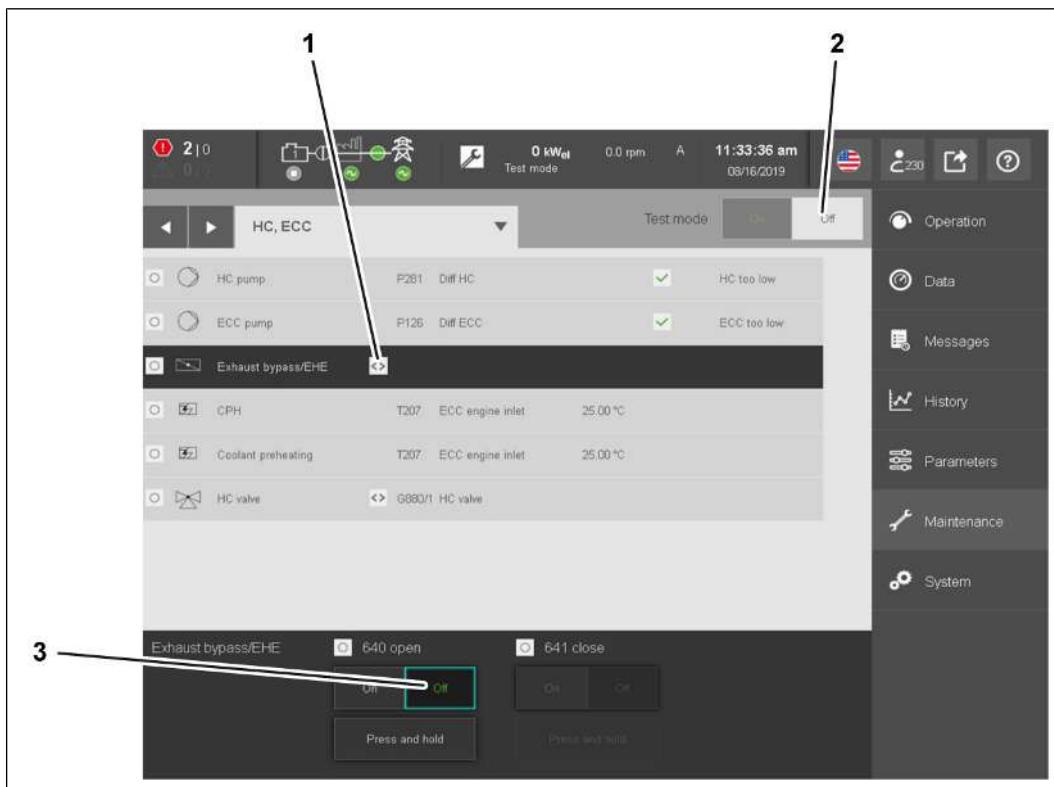
- The output 114K2D06 is demanded during the check.
- Check the activation of the engine cooling circuit pump during the exhaust bypass/EHE auxiliary drive test. Activation is indicated by a green dot in the ECC pump line.



9007199559291147

1. Tap the Exhaust bypass/EHE (2) line in the pull-down menu.
 - A green dot (2) appears in the Exhaust bypass/EHE dialog area.
2. Tap the On (4) button.
 - A double arrow (3) appears in the Exhaust bypass/EHE dialog area.
 - The font color in the On (4) button changes from white to green.
 - A green dot (5) appears in the Exhaust bypass/EHE 640 open (2) dialog area. The output 114K2D05 is demanded.
3. Check that the exhaust flap is working correctly.
 - Visually inspecting the wastegate
 - A symbol (3) in the Exhaust bypass/EHE dialog area indicates the position of the exhaust flap.

- If the exhaust flap is not working correctly, contact your Cat dealer.



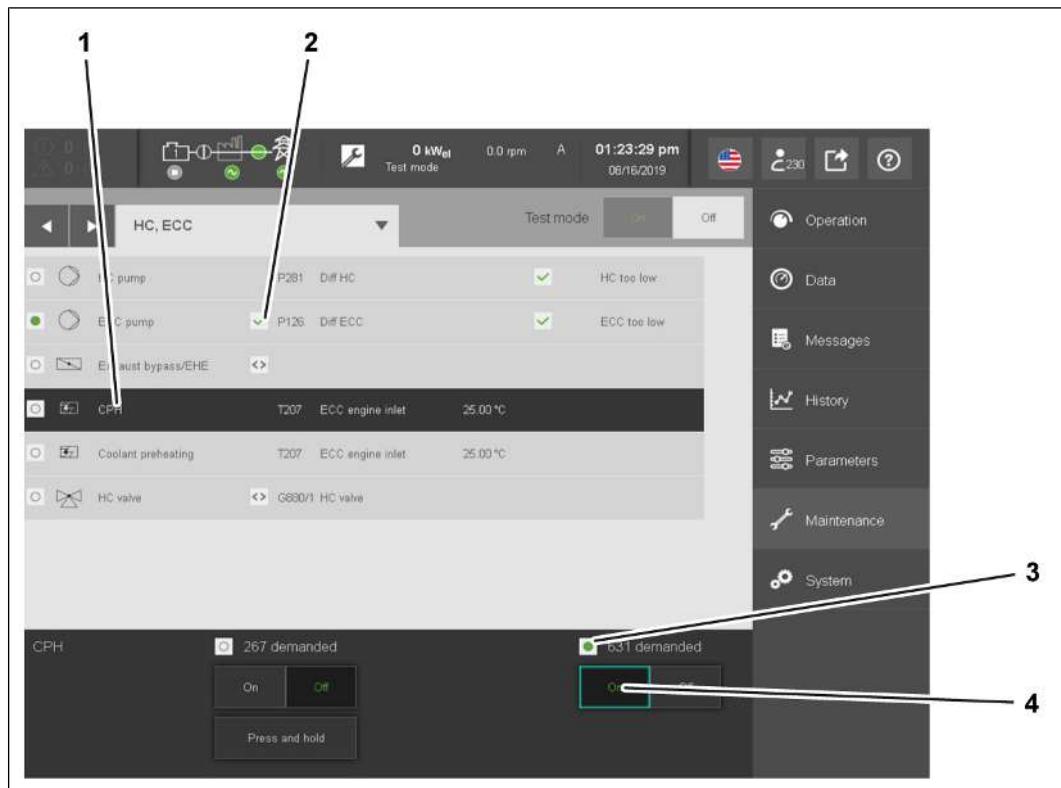
9007199559300875

4. Tap the **Off** (3) button.
 - The font color in the **Off** (3) button changes from white to green.
 - The position of the heating circuit valve is indicated by a symbol (1) in the **Exhaust bypass/EHE** dialog area.
 - The green dot (5) disappears from the **Exhaust bypass/EHE 640 open** dialog area (2). The output **114K2D05** is no longer demanded.
5. If you do not want to carry out any more auxiliary drive tests, press the **Test mode OFF** (2) button.
6. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.

Checking the CPH

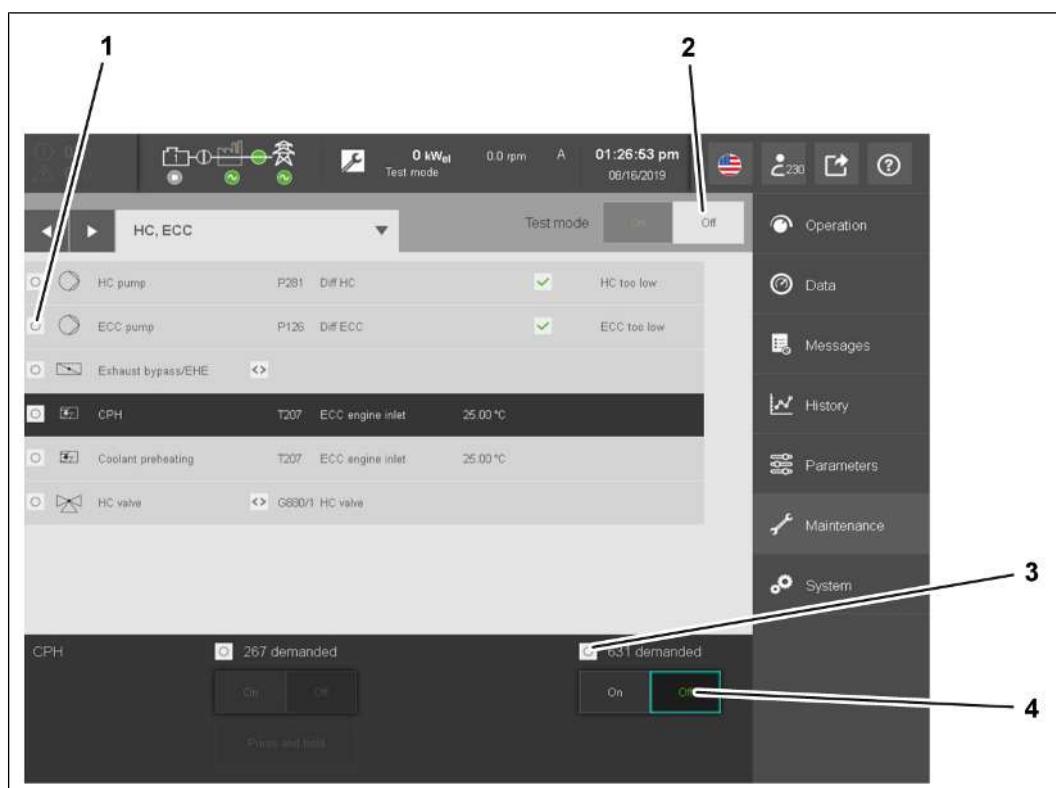
NOTE

- Check the activation of the engine cooling circuit pump during the exhaust bypass/EHE auxiliary drive test.
 - Activation will be indicated by a green dot in the **ECC pump** (2) line.
- The output **114K2D014** is demanded during the check.



304601611

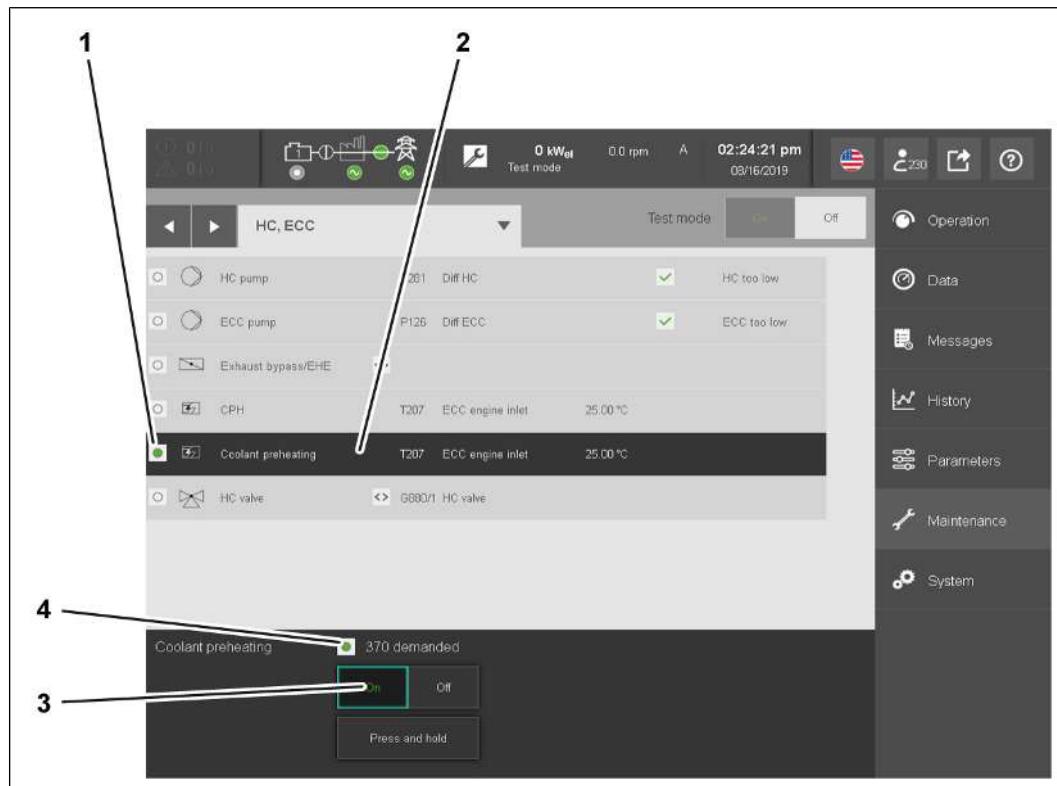
1. Tap the CPH (1) line in the pull-down menu
2. Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the CPH (1) dialog area.
 - A green dot (3) appears in the 631 demanded dialog area. The output 114K1D011 is demanded.
3. Check whether the coolant lines are warming up.
4. If the coolant lines are not warming up, contact Cat dealer.



304636171

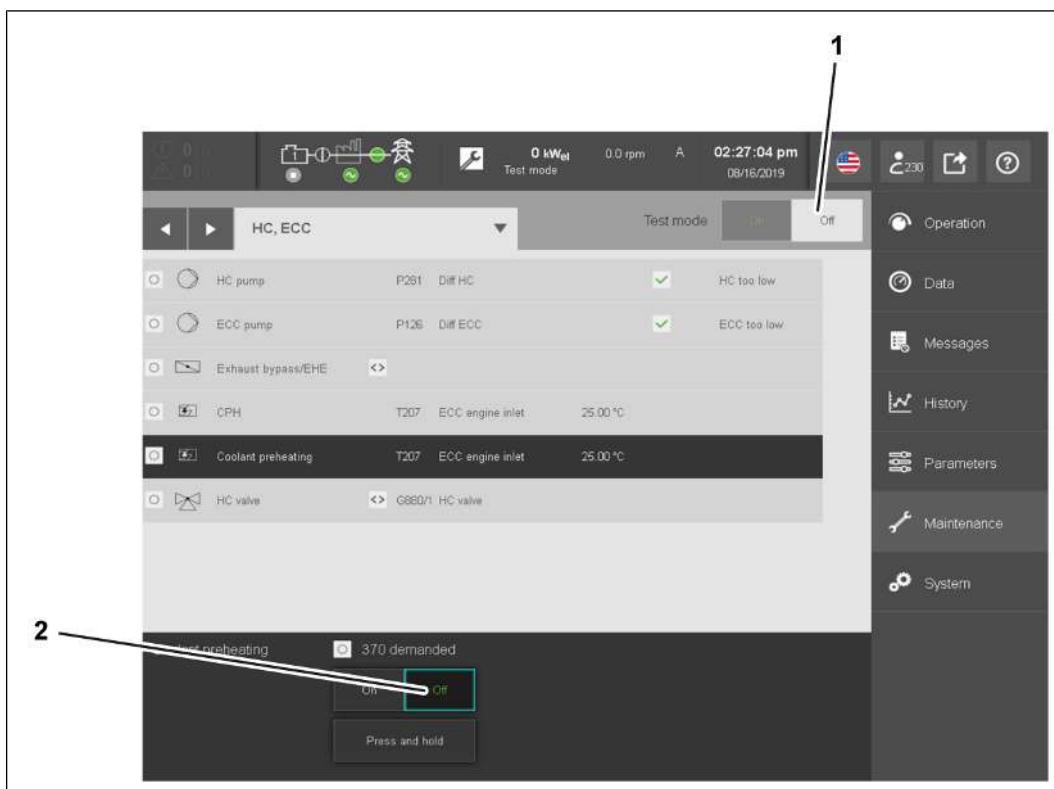
5. Tap the Off (1) button.
 - The font color in the Off (1) button changes from white to green.
 - The green dot (1) disappears from the ECC pump dialog area.
 - The green dot (3) disappears from the CPH 631 demanded dialog area. The output 114K1D011 is no longer demanded.
6. Repeat the procedure for 267 demanded.
7. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
8. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.

Checking coolant preheating



9007199559453323

1. In the pull-down menu, tap on the line Coolant preheating (2).
2. Tap the On (3) button.
 - The font color in the On (3) button changes from white to green.
 - A green dot (1) appears in the Coolant preheating dialog area.
 - A green dot (4) appears in the Coolant preheating 370 demanded dialog area. The output 114K1D05 is demanded.
3. Check whether the coolant lines are warming up
4. If the coolant lines are not warming up, contact Cat dealer.



9007199559463051

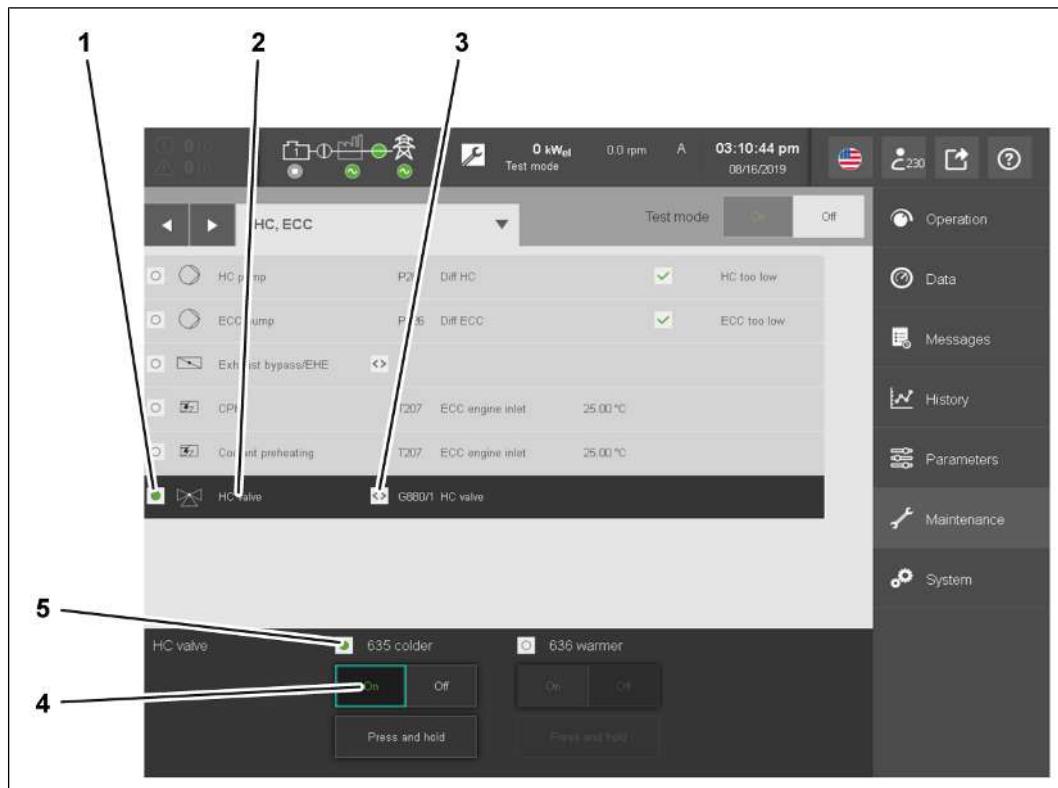
5. Tap the Off (2) button.
 - The font color in the Off (2) button changes from white to green.
 - The green dot (4) disappears from the Coolant preheating 370 demanded dialog area. The output 114K1D05 is no longer demanded.
6. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (1) button.
7. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.

Checking the heating circuit valve:

NOTE

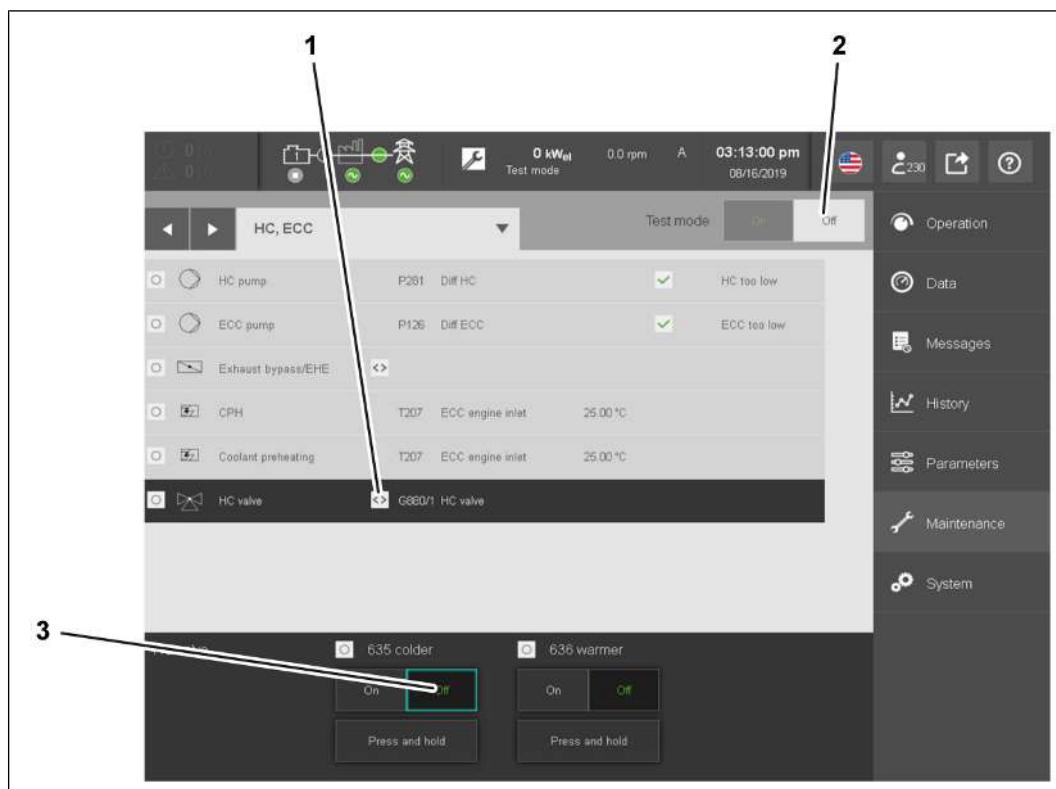
Perform the check for the limit stop, plus (warmer) according to the check for the limit stop, minus (colder).

- Activation will be indicated by a green dot in the HC valve 636 warmer dialog area. The output 114K1D015 is demanded.



304810251

1. Tap the HC valve (2) line in the pull-down menu.
 - A double arrow (3) appears in the G880/1 HC valve dialog area.
2. Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the HC valve (2) dialog area.
 - A green dot (5) appears in the HC valve 635 colder dialog area. The output 114K1D016 is demanded.
3. Check that the heating circuit valve is working.
 - You must be able to hear the heating circuit valve switching.
 - The position of the heating circuit valve is indicated by a symbol (2) in the G880/1 HC valve dialog area.
 - If the heating circuit valve is not working correctly, contact your Cat dealer.



304819979

4. Tap the Off (3) button.
 - The font color in the Off (3) button changes from white to green.
 - The position of the heating circuit valve is indicated by a symbol (1) in the G880/1 HC valve dialog area:
 - The green dot (5) disappears from the HC valve 635 colder dialog area. The output 114K1DO16110K1DI14 is no longer demanded.
5. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive test.
6. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
 - ⇒ The auxiliary drive test is ended.

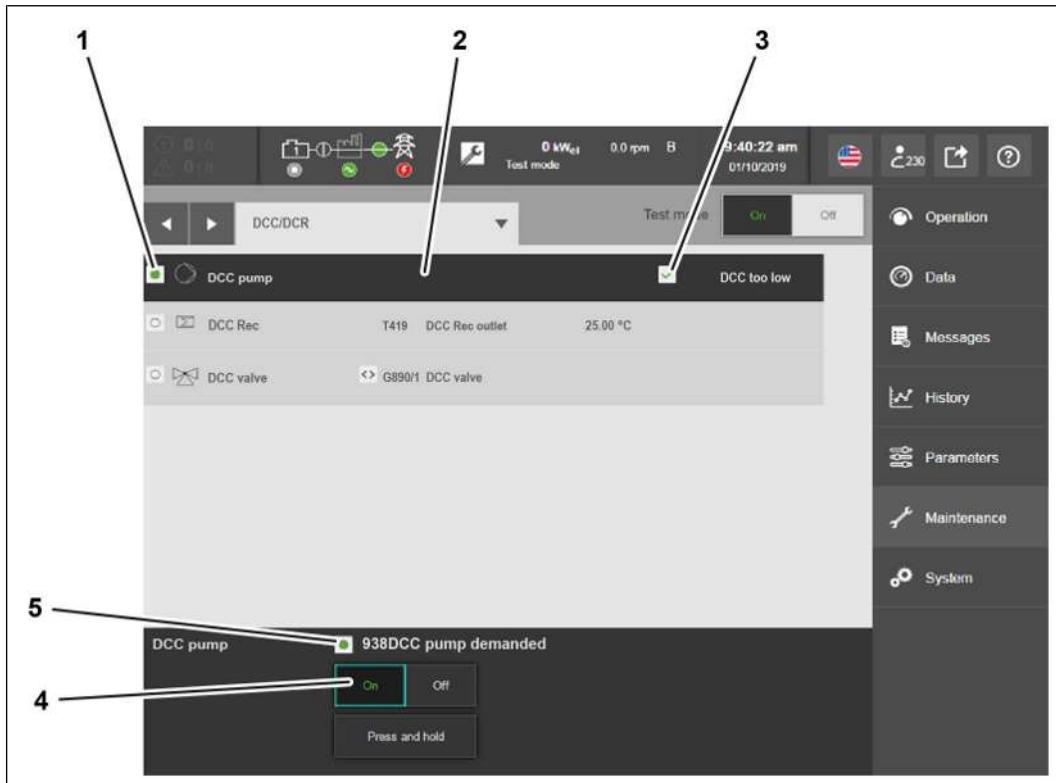
Dump cooling circuit and dual core radiator (DCC/DCR) auxiliary drive test for frequency control

Valid for:

CG132B, CG170B

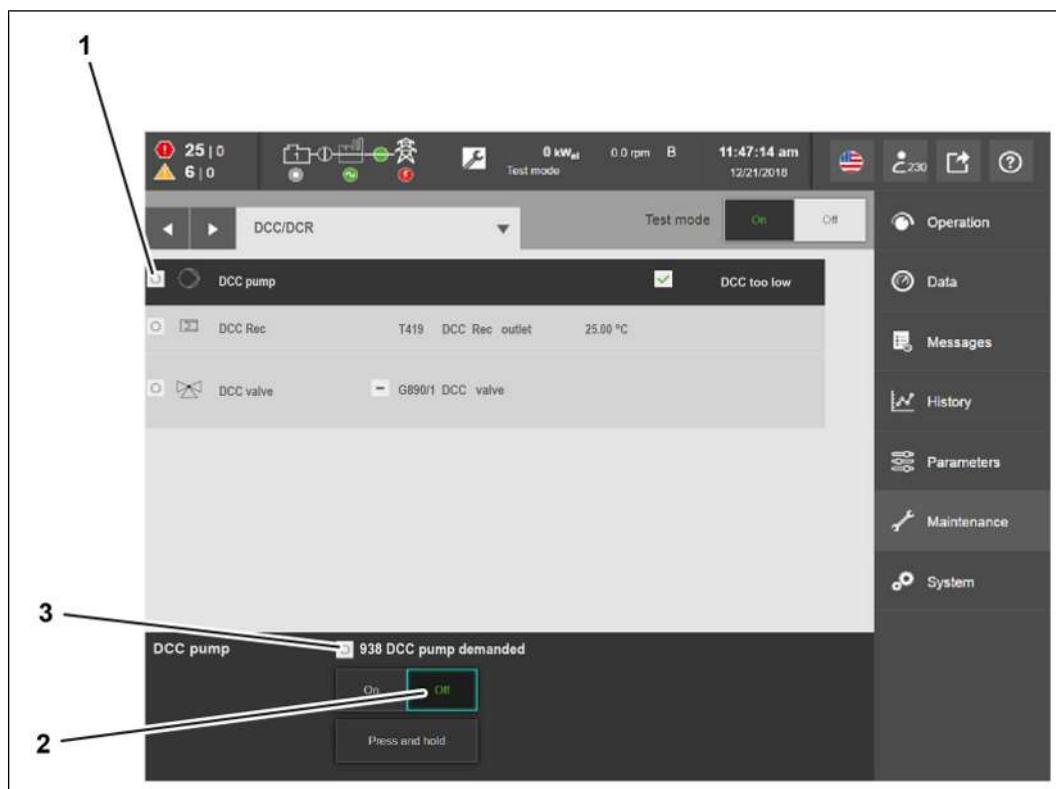
NOTE

You must activate Frequency control for the dump cooling circuit as the Initial setup in the Parameters so that the checks are visible.

Checking the dump cooling circuit pump


9007199559602315

1. Tap the DCC pump (2) line in the pull-down menu
 - A green checkmark (3) appears in the L458 DCC too low dialog area. The liquid level is OK. You can start the auxiliary drive test.
 - A red lightning bolt appears in the L458 DCC too low (4) dialog area. The liquid level is not OK. Find and correct the root cause of the low liquid level before starting the auxiliary drive test. If necessary, contact the Cat dealer.
2. Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the DCC pump (2) dialog area.
 - A green dot (5) appears in the DCC pump 938 demanded dialog area. The output 114K2DO2 is demanded.
3. Check the function and direction of rotation of the pump.
 - Visually inspect the direction of rotation. If the direction of rotation of the pump is incorrect, contact Cat dealer.



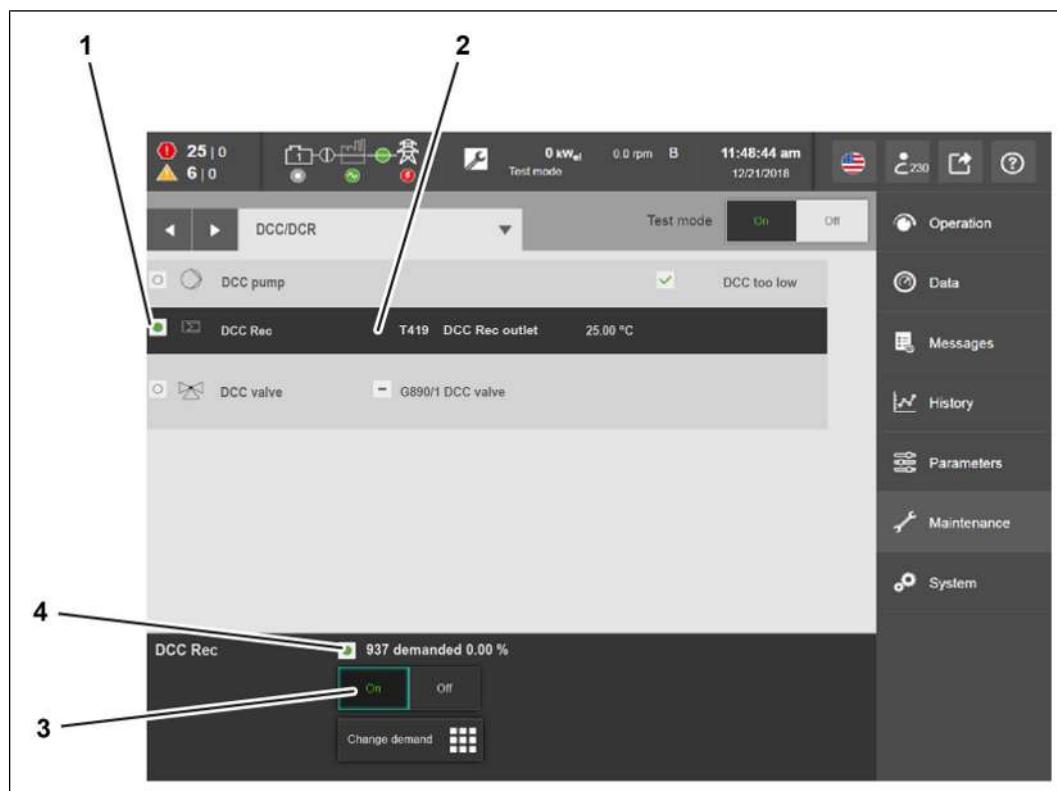
9007199559612043

4. Tap the Off (2) button
 - The font color in the Off (2) button changes from white to green.
 - The green dot (3) disappears from the DCC pump 938 demanded dialog area. The output 114K2DO2 is no longer demanded.
 - The green dot (1) disappears from the DCC pump dialog area.

Checking the dump cooling circuit radiator

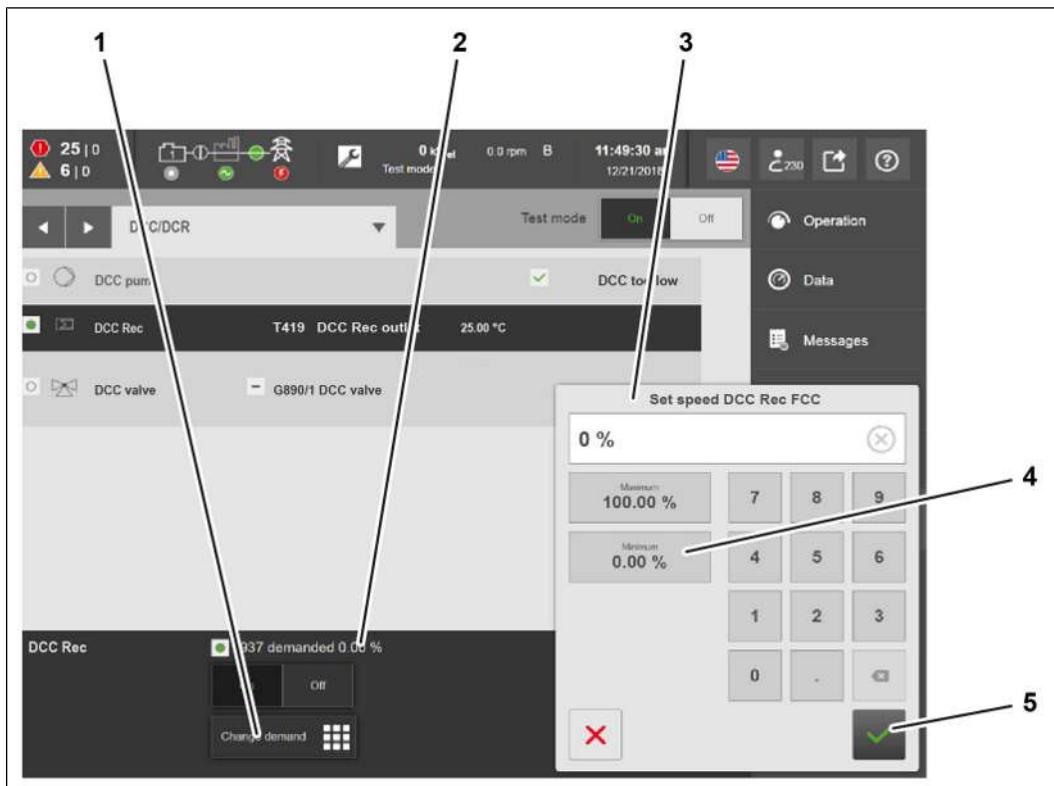
NOTE

Perform the check for the dump cooling circuit radiator with stage switching according to the check for the [Mixture cooling circuit \(MCC\) auxiliary drive test for stage control \[▶ 245\]](#).



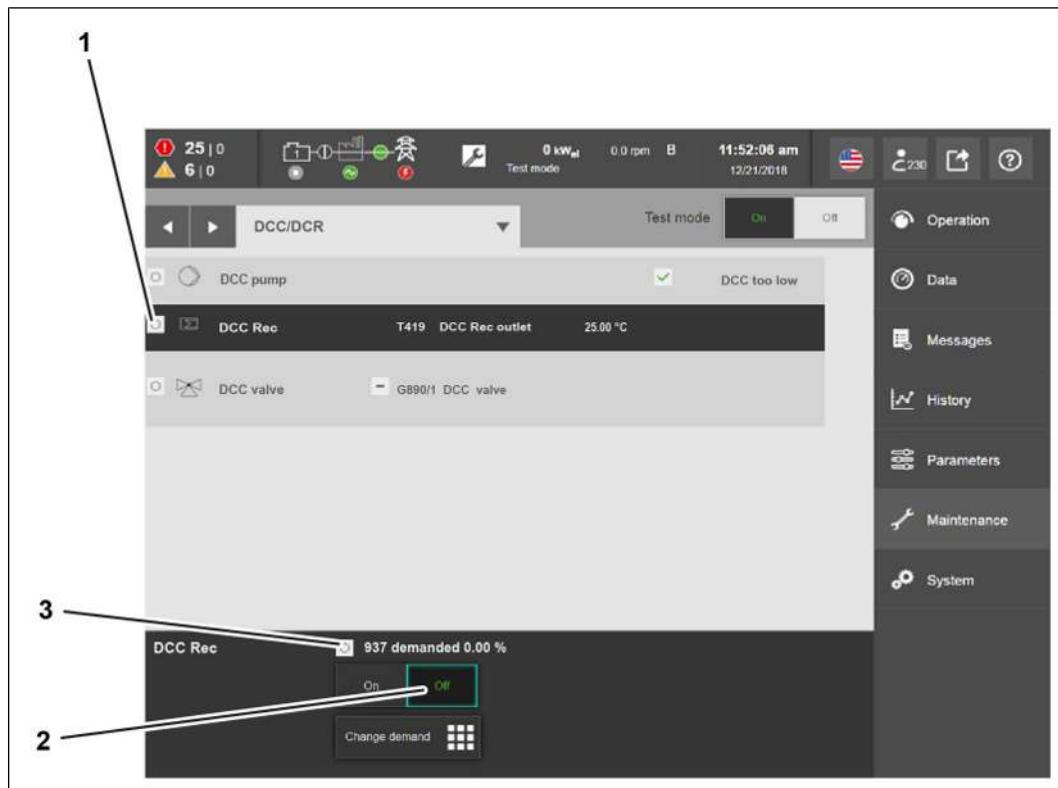
9007199559675531

1. Tap the DCC RDTR (2) line in the pull-down menu
2. Tap the On (3) button.
 - The font color in the On (3) button changes from white to green.
 - A green dot (1) appears in the DCC RDTR (2) dialog area.
 - A green dot (4) appears in the DCC RDTR 937 demanded – % dialog area. The output 114K2DO1 is demanded.



9007199559680395

3. Tap the Change demand (1) button
 - The Set speed DCC RDTR/DCR FC (3) input mask opens.
4. Enter setpoint 0 %
 - Tap the Minimum 0.00 % (4) button in the Set speed DCC RDTR/DCR FC (3) input mask.
 - Press the Accept input (5) button.
 - The Set speed DCC RDTR/DCR FC (3) input mask closes.
 - The dialog area DCC RDTR 937 demanded shows the setpoint 0.00 % (2).
 - The fan continuously decreases the speed until the setpoint of 0.00 % is reached.
5. Repeat the procedure for the setpoint of 100.00 %.
 - The fan continuously increases the speed until the setpoint of 100.00 % is reached.
6. If the result is not OK, contact your Cat dealer.



9007199559685259

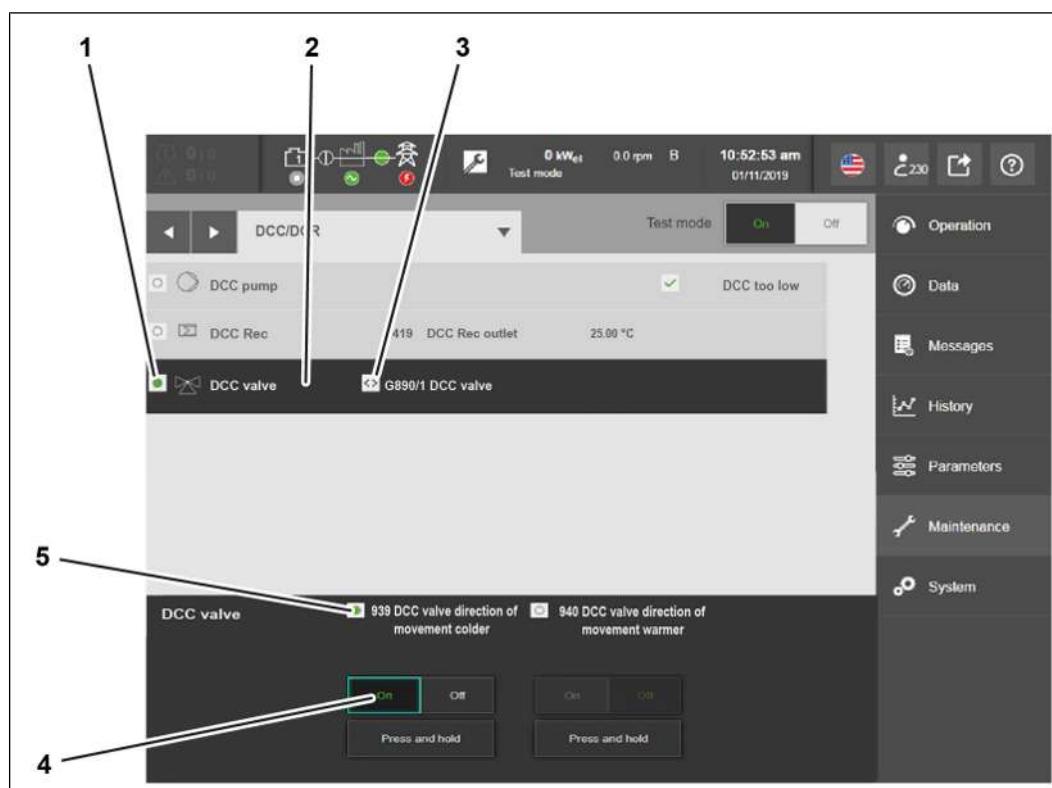
7. Tap the Off (2) button
 - The font color in the Off (2) button changes from white to green.
 - The green dot (1) disappears from the DCC RDTR dialog area.
 - The green dot (3) disappears from the DCC RDTR 937 demanded dialog area.
 - The output 114K2D01 is no longer demanded.

Checking the dump cooling circuit valve

NOTE

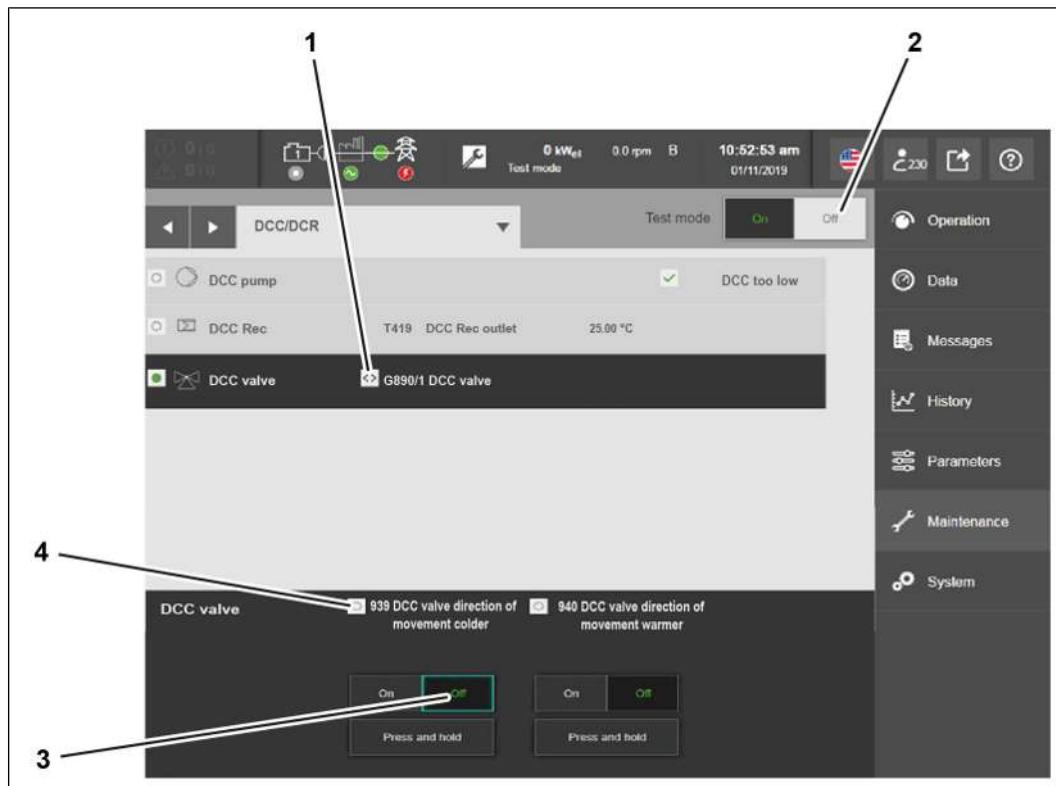
Perform the check for the limit stop, plus (warmer) according to the check for the limit stop, minus (colder).

- Activation is indicated by a green dot in the 940 DCC valve direction of movement colder line. The output 114K2D03 is demanded.



18014398814484875

1. Tap the DCC valve (2) line in the pull-down menu
 - A double arrow (3) appears in the G890/1 DCC valve dialog area.
2. Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the DCC valve (2) dialog area.
 - A green dot (5) appears in the 939 DCC valve direction of movement colder dialog area. The output 114K2DO4 is demanded.
3. Check that the dump cooling circuit valve is working correctly.
 - You must be able to hear the heating circuit valve switching.
 - The position of the dump cooling circuit valve is indicated by a symbol (1) in the G890/1 DCC valve dialog area.
 - If the dump cooling circuit valve is not working correctly, contact your Cat dealer.



9007199559726219

4. Tap the Off (3) button.
 - The font color in the Off (3) button changes from white to green.
 - The position of the dump cooling circuit valve is indicated by a symbol (1) in the G890/1 DCC valve dialog area.
 - The green dot (5) disappears from the 939 DCC valve direction of movement colder dialog area. The output 114K2D04 is no longer demanded.
5. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
6. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
 - ⇒ The auxiliary drive test is ended.

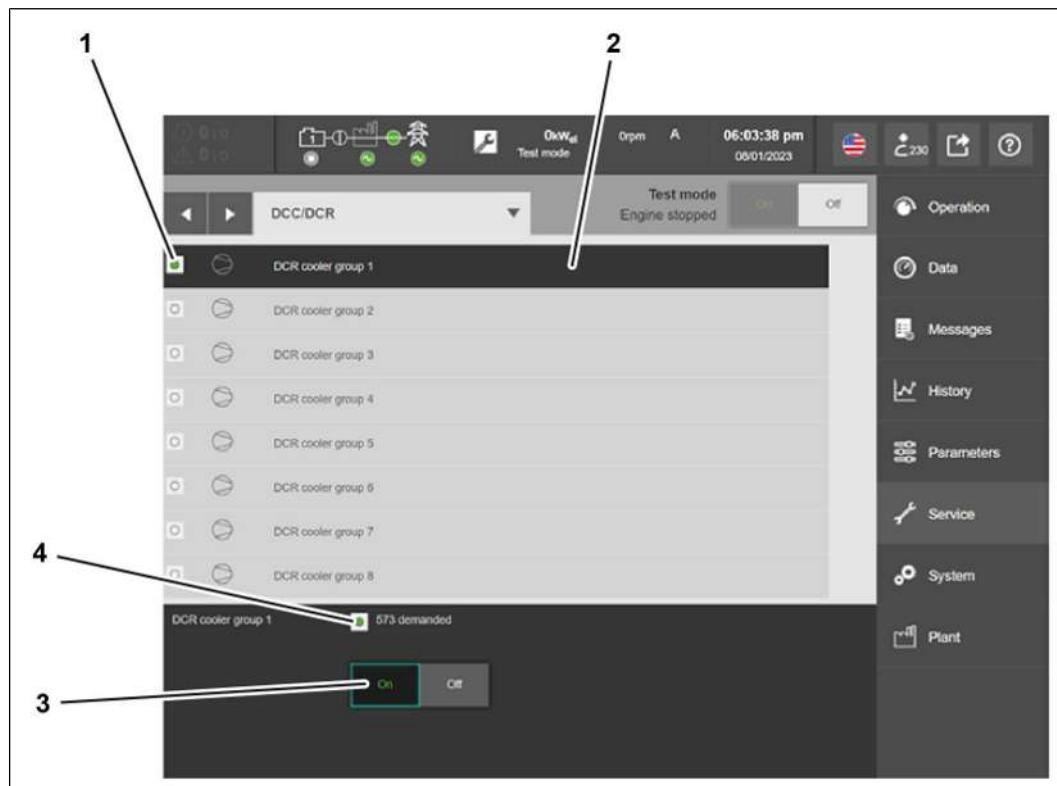
Dump cooling circuit and dual core radiator (DCC/DCR) auxiliary drive test for stage control

Valid for:

CG132B, CG170B

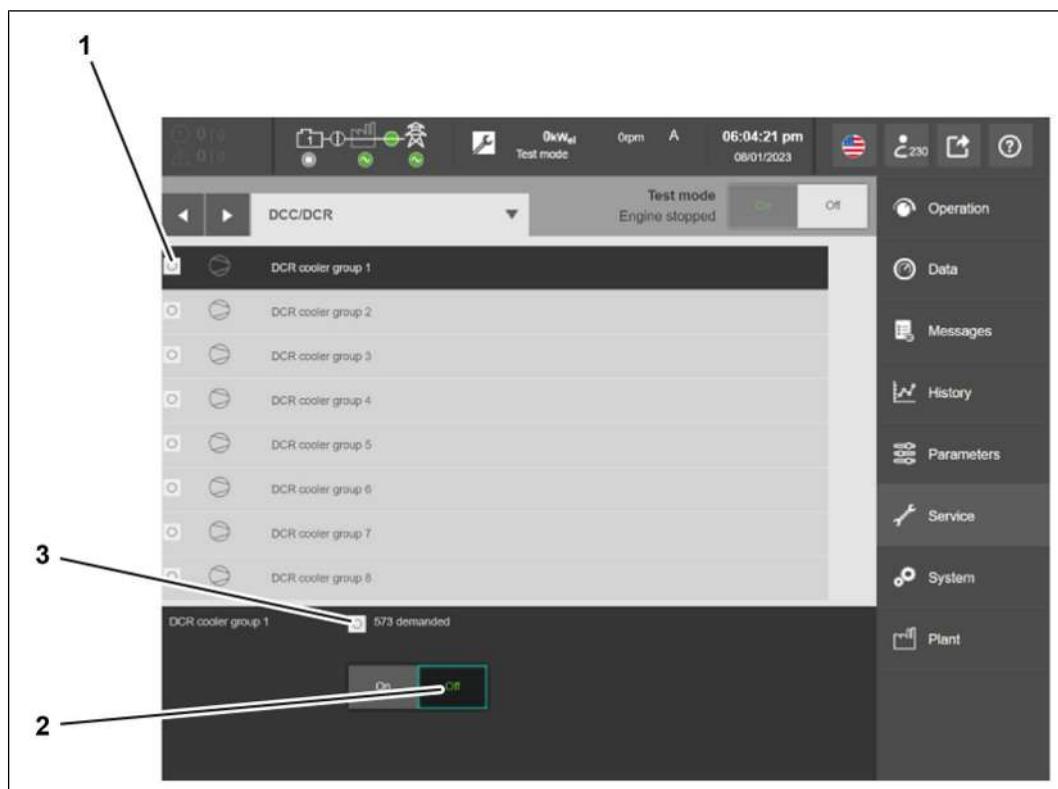
NOTE

You must activate Stage control for the dual core radiator as the Initial setup in the Parameters so that the checks are visible.

Checking DCR cooler group 1

2801986827

1. Tap the DCR cooler group 1 (2) line in the pull-down menu.
2. Tap the On (3) button.
 - The font color in the On (3) button changes from white to green.
 - A green dot (1) appears in the DCR cooler group 1 (2) dialog area.
 - A green dot (4) appears in the 573 demanded dialog area. The output 114K5D01 is demanded.



9007202056673675

3. Tap the Off (2) button
 - The font color in the Off (2) button changes from white to green.
 - The green dot (1) disappears from the DCR cooler group 1 dialog area.
 - The green dot (3) disappears from the 573 demanded dialog area. The output 114K5D01 is no longer demanded.
4. Perform all other checks for the DCR cooler groups as described above.
5. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
6. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
 - ⇒ The auxiliary drive test is ended.

Mixture cooling circuit (MCC) auxiliary drive test for frequency control

Valid for:

CG132B, CG170B

Checking the mixture cooling circuit pump:

NOTE

- Perform the mixture cooling circuit pump check according to the dump cooling circuit pump check: [Dump cooling circuit and dual core radiator \(DCC/DCR\) auxiliary drive test for frequency control \[▶ 235\]](#)
-

Checking the mixture cooling circuit radiator:

NOTE

- Perform the mixture cooling circuit radiator warmer check according to the dump cooling circuit radiator colder check: [Dump cooling circuit and dual core radiator \(DCC/DCR\) auxiliary drive test for frequency control \[▶ 235\]](#)
 - The setpoint for the mixture cooling circuit radiator warmer check is 100.00 %.
-

Checking the mixture cooling circuit valve:

NOTE

- Perform the mixture cooling circuit valve check according to the dump cooling circuit valve check: [Dump cooling circuit and dual core radiator \(DCC/DCR\) auxiliary drive test for frequency control \[▶ 235\]](#)
-

Mixture cooling circuit (MCC) auxiliary drive test for stage control

Valid for:

CG132B, CG170B

Checking MCC cooler group 1:

NOTE

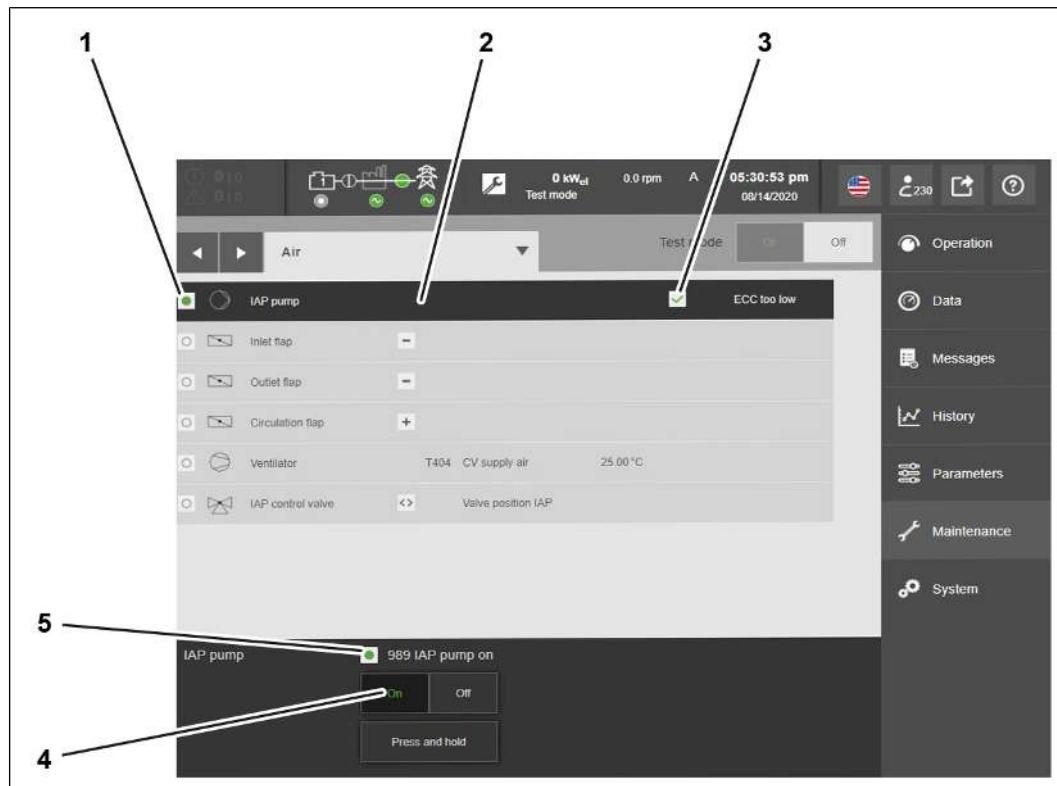
- Perform the checks for the MCC cooler groups according to the checks for the DCC cooler groups: [Dump cooling circuit and dual core radiator \(DCC/DCR\) auxiliary drive test for stage control \[▶ 242\]](#)
-

Air auxiliary drive test

Valid for:

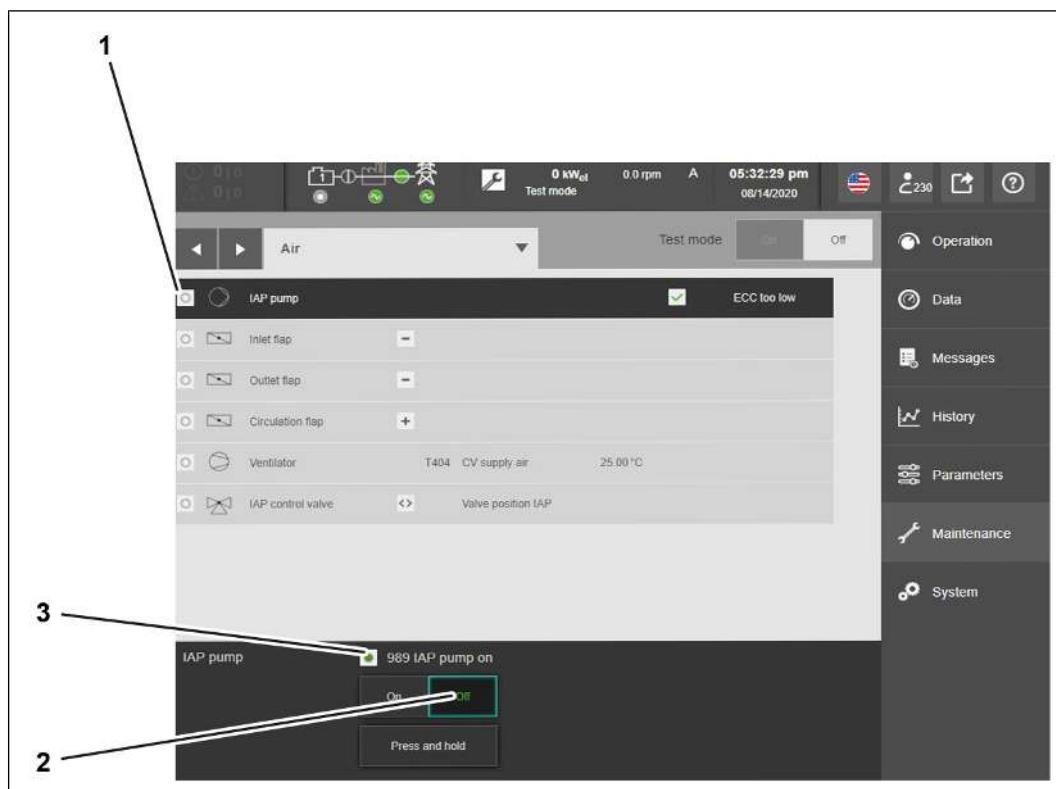
CG132B, CG170B

Checking the IAP pump:



305076491

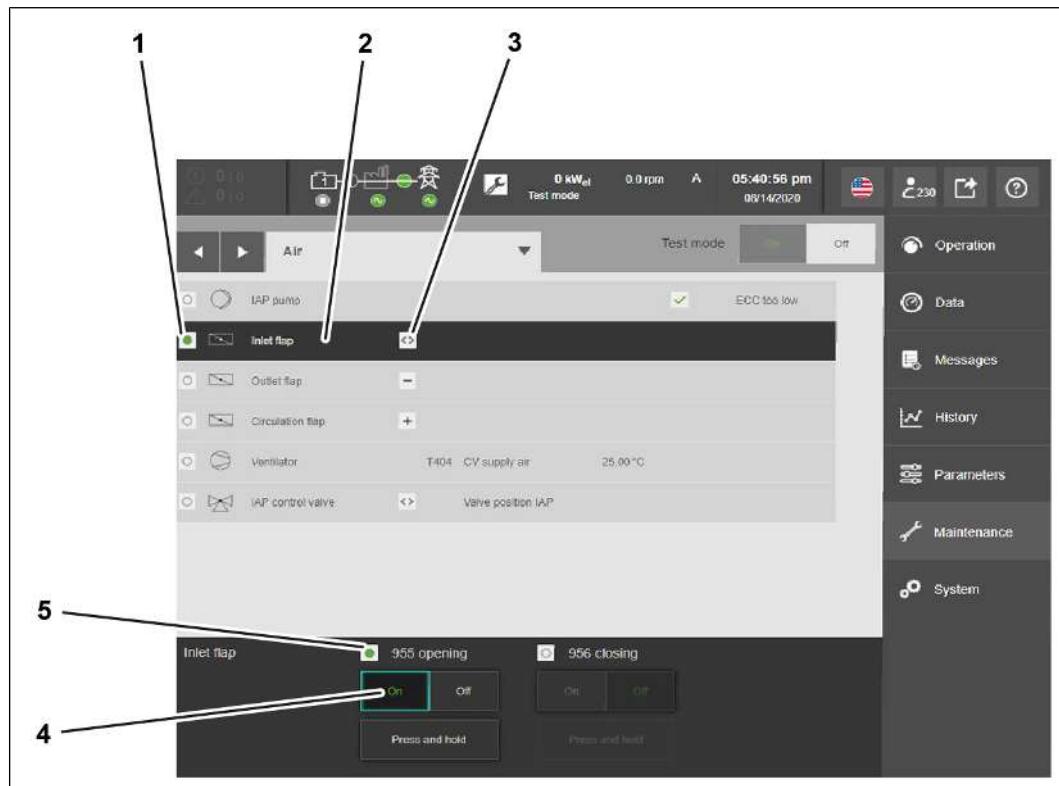
1. Tap the IAP pump (2) line in the pull-down menu
 - A green checkmark appears in the ECC too low (3) dialog area. The liquid level is OK. You can start the auxiliary drive test.
 - A red lightning bolt appears in the ECC too low (3) dialog area. The liquid level is not OK. Find and correct the root cause of the low liquid level before starting the auxiliary drive test. If necessary, contact Cat dealer.
2. Tap the On (4) button.
 - The font color in the On (4) button changes from white to green.
 - A green dot (1) appears in the IAP pump (2) dialog area.
 - A green dot (5) appears in the IAP pump 989 IAP pump on dialog area. The output 114K3D013 is demanded.
3. Check the function and direction of rotation of the pump.
 - Visually inspect the direction of rotation. If the direction of rotation of the pump is incorrect, contact the Cat dealer.



305086219

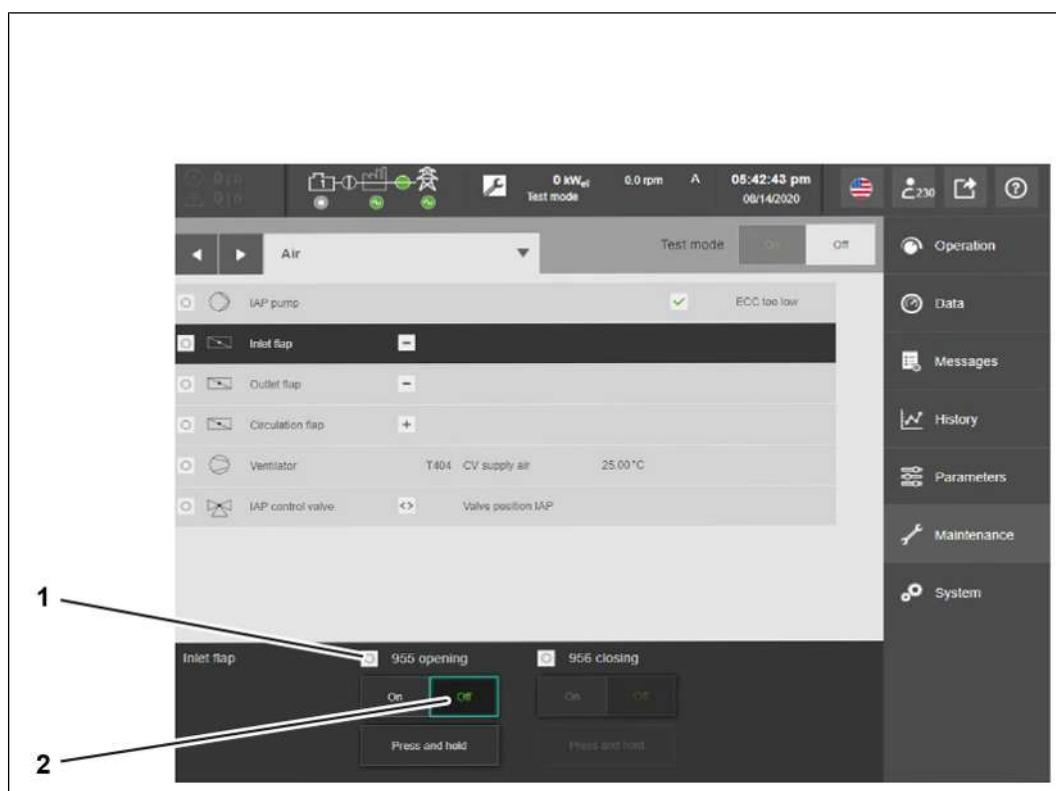
4. Tap the **Off** (2) button
 - The font color in the **Off** (2) button changes from white to green.
 - The green dot (1) disappears from the **IAP pump** dialog area.
 - The green dot (3) disappears from the **989 IAP pump on** dialog area. The output 114K3DO13 is no longer demanded.

Checking the supply air louver damper



305140747

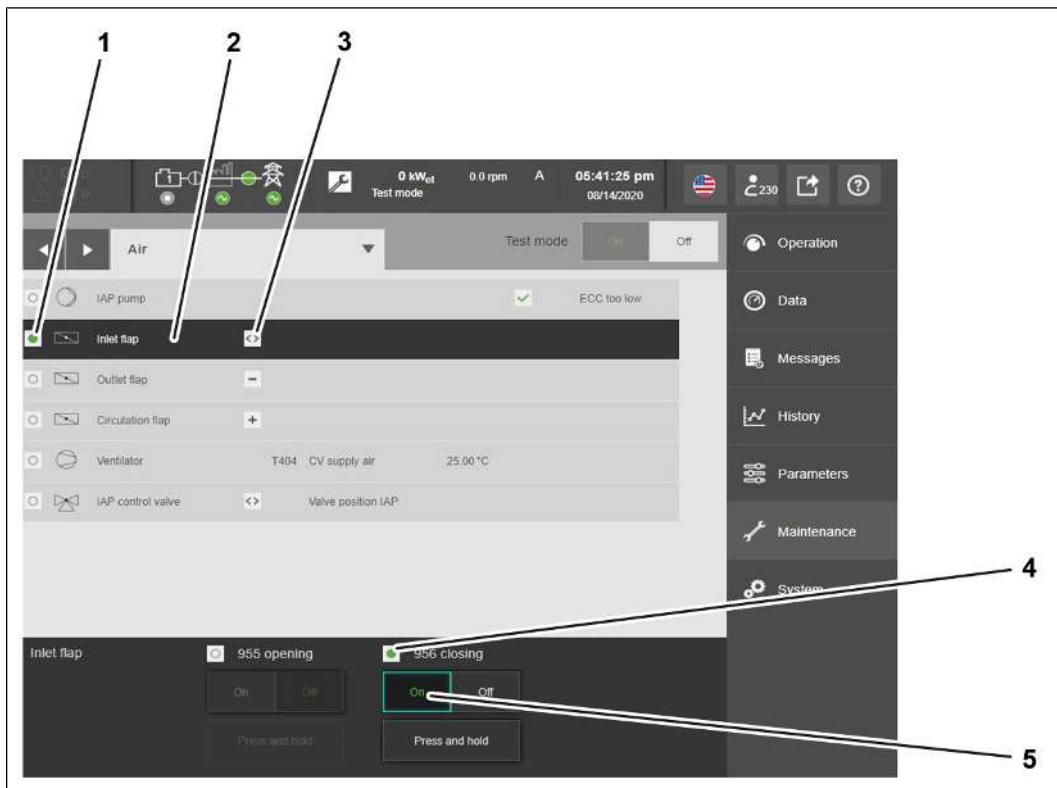
1. Tap the Supply air louver damper (2) line in the pull-down menu
 - A green dot (1) appears in the Inlet flap dialog area.
2. Tap the On (4) button.
 - A double arrow (3) appears in the Inlet flap dialog area.
 - The font color in the On (4) button changes from white to green.
 - A green dot (5) appears in the Inlet flap 955 open dialog area. The output 114K2D09 is demanded.
3. Check that the supply air louver damper is working correctly.
 - The position of the supply air louver damper is indicated by a symbol (3) in the Supply air louver damper dialog area.
 - The slats of the supply air louver damper must be fully open.
 - If the supply air louver damper is not working correctly, contact the Cat dealer.



9007199559891467

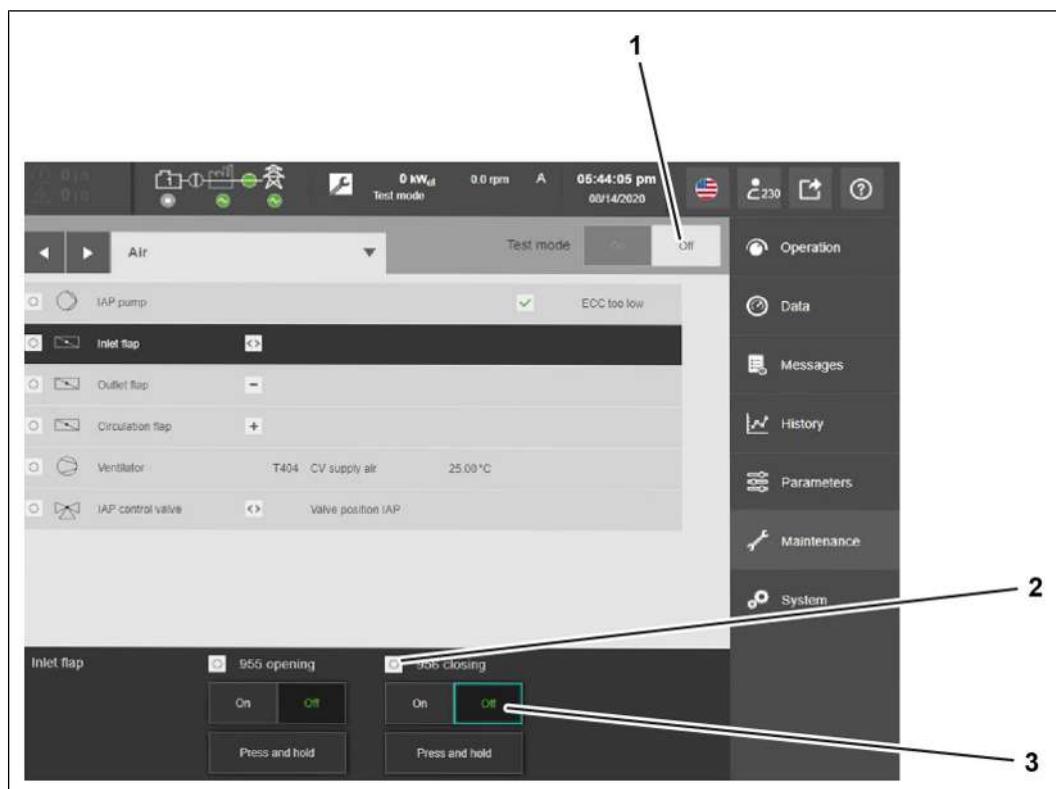
4. Tap the Off (1) button

- The font color in the Off (1) button changes from white to green. The output 114K2D09 is no longer demanded.



305155339

5. Tap the Inlet flap (2) line in the pull-down menu
 - A green dot (1) appears in the Inlet flap dialog area.
6. Tap the On (4) button.
 - A double arrow (3) appears in the Inlet flap dialog area.
 - The font color in the On (4) button changes from white to green.
 - A green dot (5) appears in the Inlet flap 956 close dialog area. The output 114K2D08 is demanded.
7. Check that the supply air louver damper is working correctly.
 - The position of the supply air louver damper is indicated by a symbol (3) in the Supply air louver damper dialog area.
 - The slats of the supply air louver damper must be fully closed.
 - If the supply air louver damper is not working correctly, contact the Cat dealer.



9007199559906059

8. Tap the **Off** (2) button
 - The font color in the **Off** (2) button changes from white to green. The output **114K2D08** is demanded.
9. If you do not want to carry out any more auxiliary drive tests, press the **Test mode OFF** (1) button.
10. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.

Checking the exhaust air louver damper

NOTE

Perform the exhaust air louver damper check according to the supply air louver damper check.

- The following outputs will be demanded during this check:
 - **114K2D010** Close exhaust air louver damper
 - **114K2D011** Open exhaust air louver damper

Checking the circulating air louver damper

NOTE

Perform the circulating air louver damper check according to the supply air louver damper check.

- The following outputs will be demanded during this check:
 - 114K2D012 Close circulating air louver damper
 - 114K2D013 Open circulating air louver damper

Checking the ventilator

NOTE

Perform the ventilator warmer check according to the ventilation colder check.

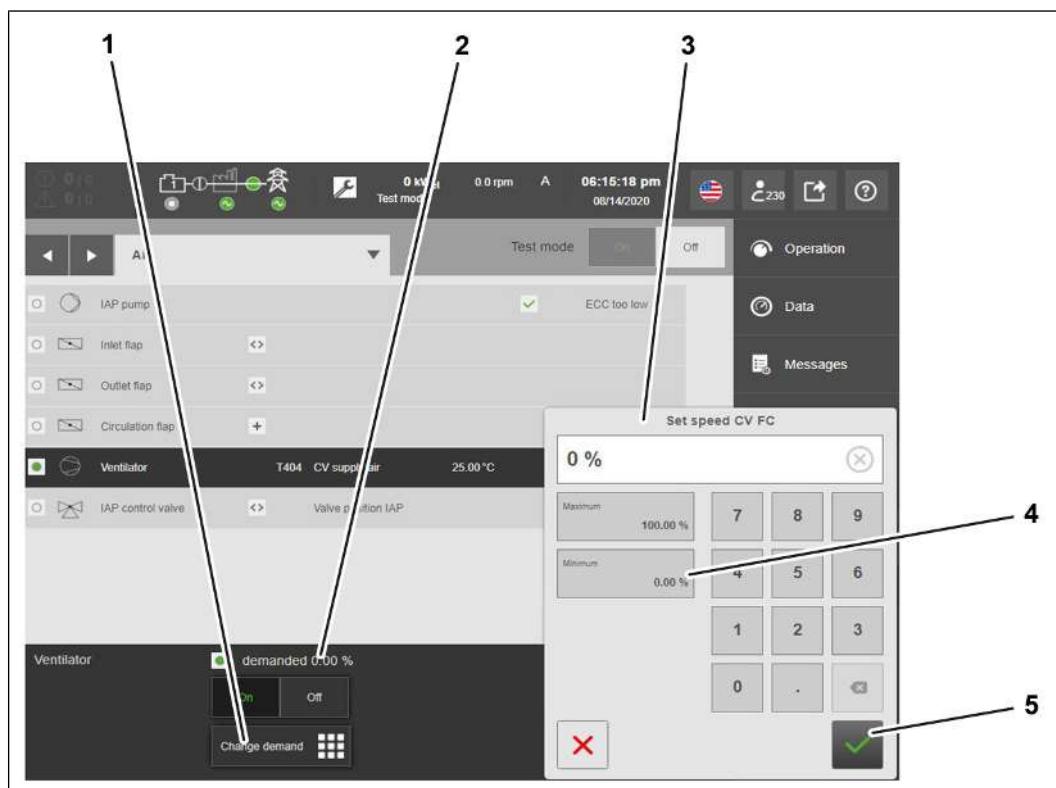
- The setpoint of the ventilator warmer check is 100.00 %.
- The output 114K2D07 will be demanded during this check.



305255691

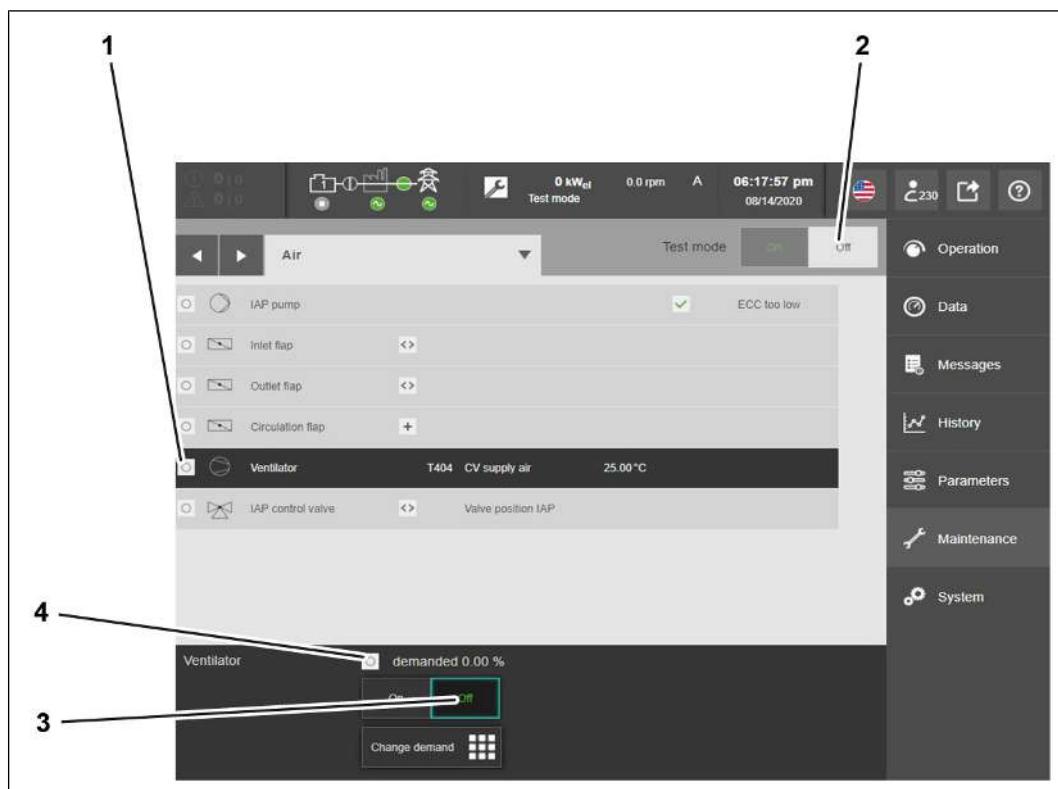
1. Tap the Ventilator (2) line in the pull-down menu
2. Tap the On (3) button.
 - A green dot (1) appears in the Ventilator (2) dialog area.
 - The font color in the On (3) button changes from white to green.

- A green dot (4) appears in the Ventilator demanded 0.00 % dialog area. The output 114K2DO7 is demanded.



305260555

3. Tap the Change demand (1) button
 - The Set speed CV FC (3) input mask opens.
4. Enter setpoint 0 %
 - Tap the Minimum 0.00 % (4) button in the Set speed CV FC (3) input mask.
 - Press the Accept input (5) button.
 - The Set speed CV FC (3) input mask closes.
 - The setpoint value 0.00 % (2) appears in the Ventilator demanded dialog area.
 - The fan continuously decreases the speed until the setpoint is reached.
5. If the result is not OK, contact Cat dealer



305265419

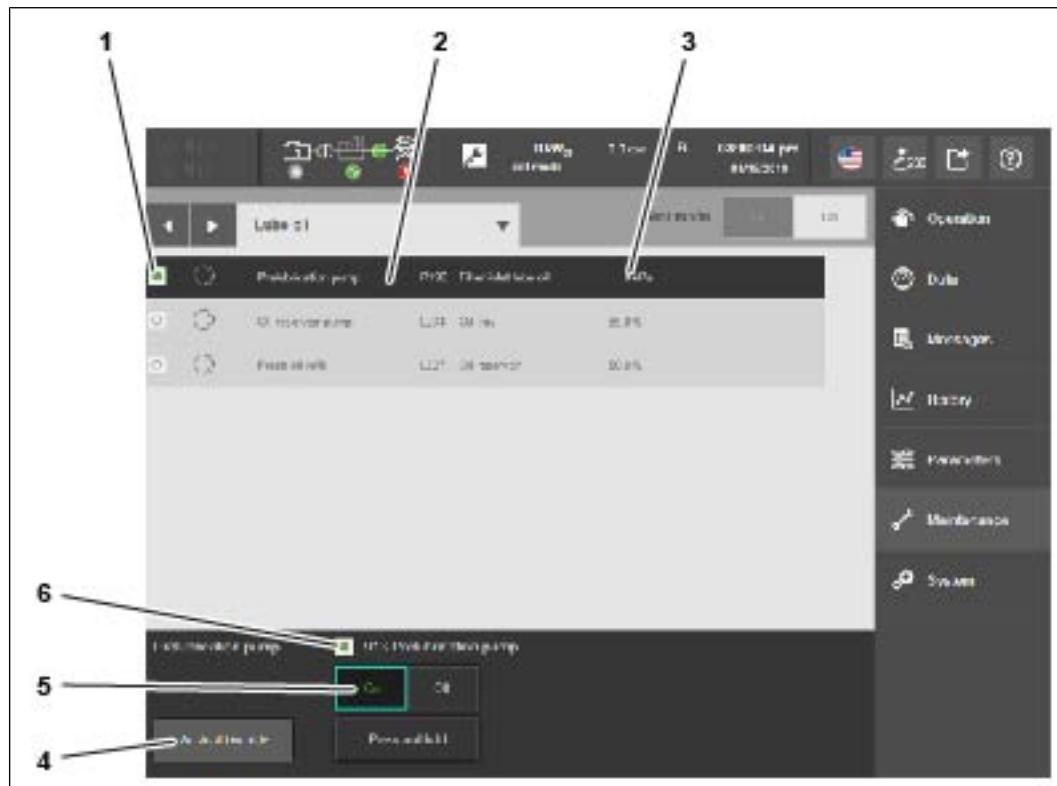
6. Tap the Off (3) button
 - The font color in the Off (3) button changes from white to green.
 - The green dot (1) disappears from the Ventilator dialog area.
 - The green dot (4) disappears from the Ventilator demanded dialog area. The output 114K2D07 is no longer demanded.
7. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
8. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (2) button.
 - ⇒ The auxiliary drive test is ended.

Lube oil auxiliary drive test

Valid for:

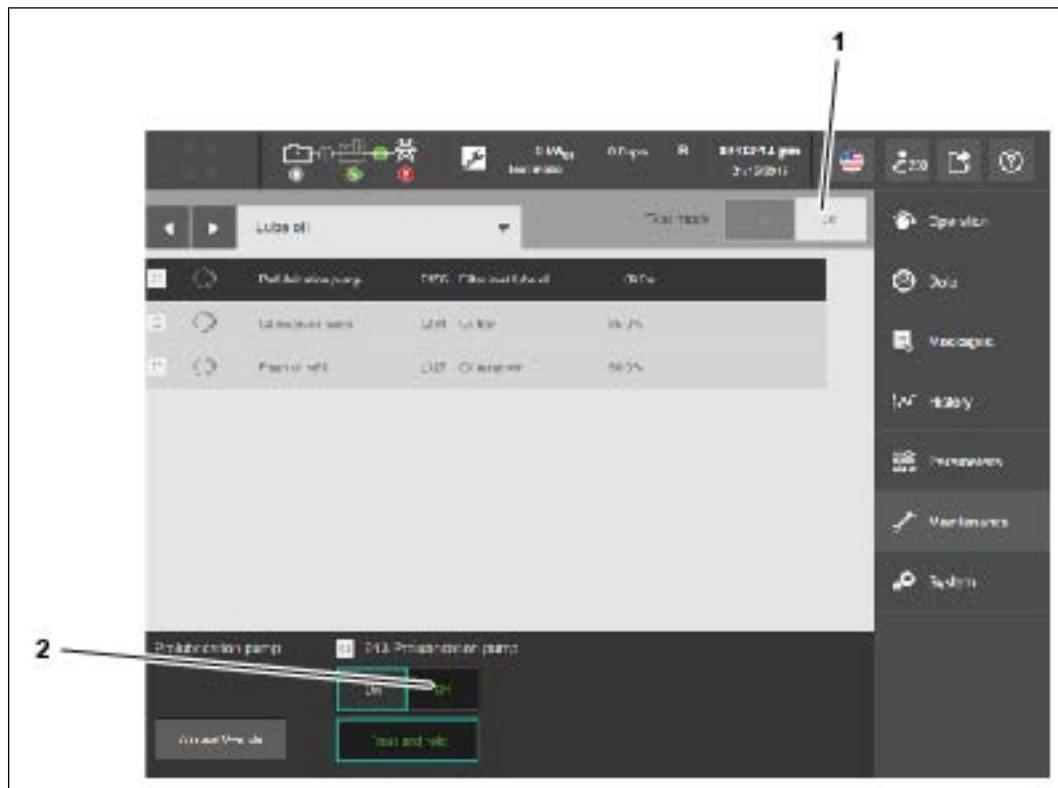
CG132B, CG170B

Checking the prelubrication pump



18014398814802315

1. **NOTE! If a warning about waste oil tank overfilling or leakage is present on the electrical control system, you cannot activate the prelubrication pump.** Press the Waste oil tank override (4) button
2. Tap the Prelubrication pump (2) line in the pull-down menu.
 - The control displays the current oil pressure (3) in the P196 Filter inlet lube oil dialog area.
 - Tap the ON (5) button.
 - The font color in the ON (5) button changes from white to green.
 - A green dot (6) appears in the Prelubrication pump (2) dialog area. The output 114K1D06 is demanded.
 - The dialog area continuously displays the oil pressure (2) in the P196 Filter inlet lube oil.
3. If the lube oil pressure display does not change, check the lube oil level
 - Top up the lube oil if necessary.
 - If the lube oil level is OK, contact Cat dealer.



18014398814812043

4. Tap the Off (2) button
 - The font color in the Off (2) button changes from white to green. The output 114K1D06 is no longer demanded.
5. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (1) button.

Checking the oil reservoir pump:

NOTE

Perform the oil reservoir pump check according to the fresh oil refill check.

- The output 114K2D015 is demanded during the check.
-

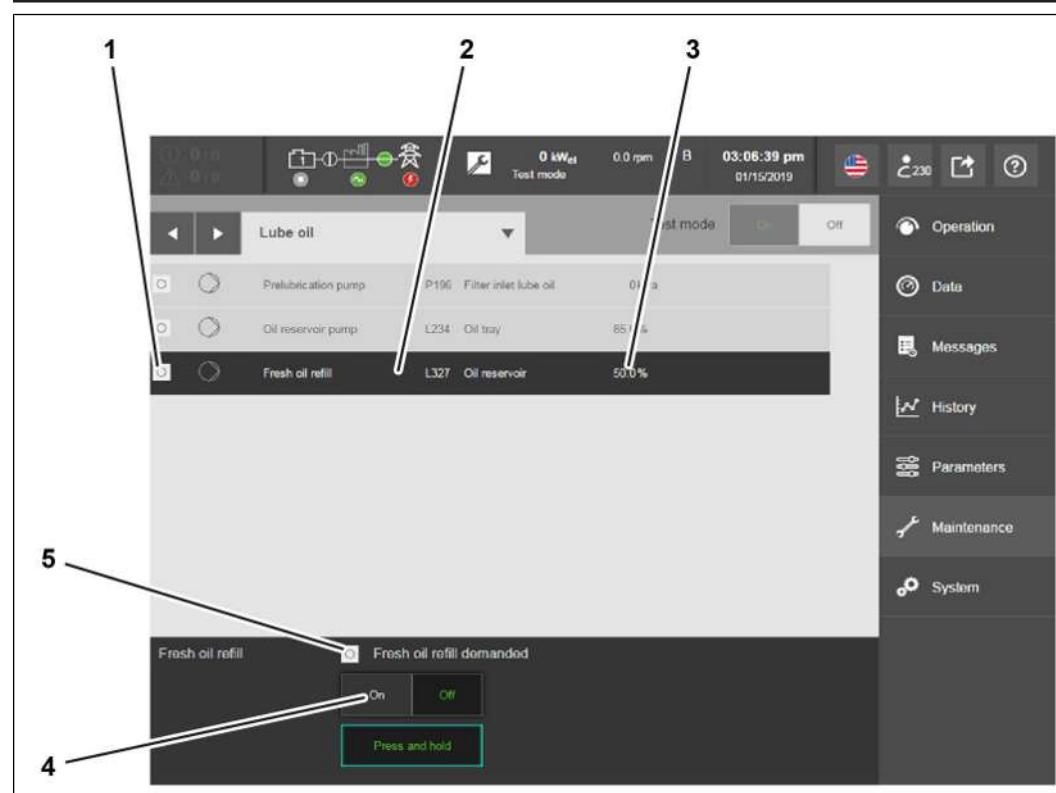
Checking the fresh oil refill:

NOTE

The auxiliary drive test for fresh oil refill checks the solenoid valves for the lube oil supply. Depending on the structure of the plant, various solenoid valves are installed in differing numbers.

During the auxiliary drive test for the fresh oil refill, open the solenoid valves and top up the lube oil sump with lube oil from the extended oil circulation volume. There is no feedback regarding the current lube oil level of the expanded circulating oil volume in the fresh oil refill dialog area.

- Depending on the fill level of the lube oil sump, the check of the solenoid valves for the lube oil supply may be deactivated. Contact Cat dealer.



27021598069640971

- Tap the Fresh oil refill (2) line in the pull-down menu



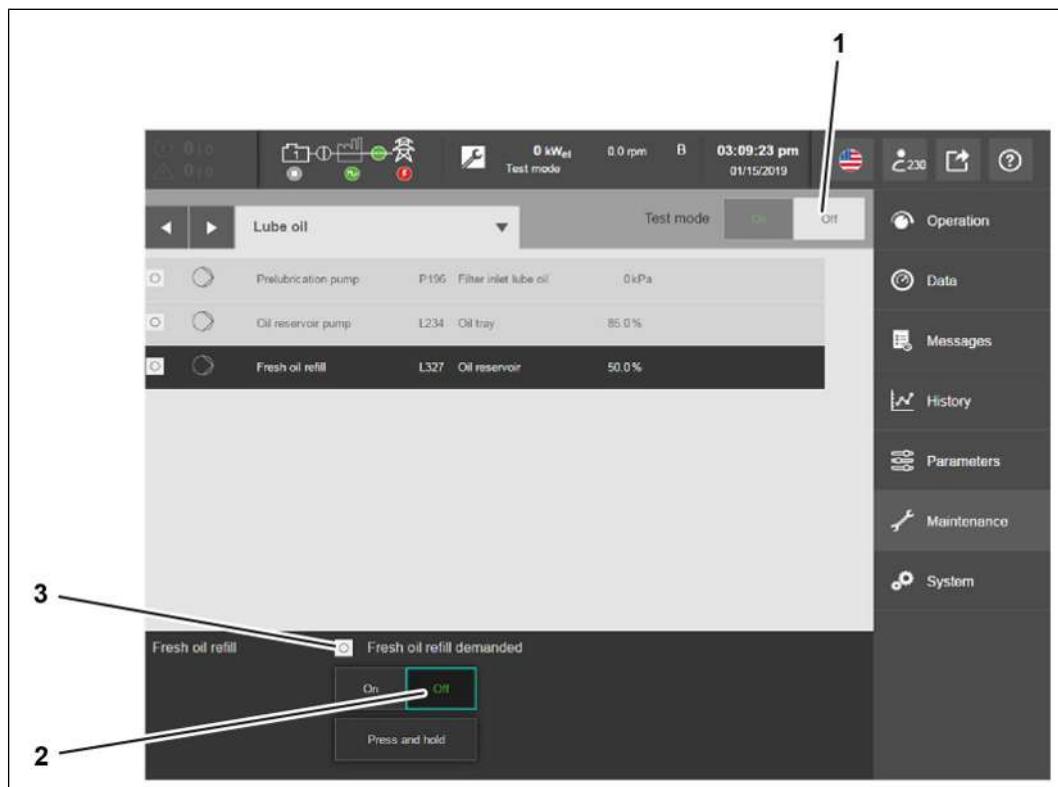
Risk of destruction of components

Risk of destruction of components

Components can be damaged or destroyed due to an excessively high lube oil level

- Do not top up the lube oil reservoir over 100.00 %
- Observe the oil level during the fresh oil refill and stop the fresh oil refill in time.

2. Tap the On (4) button.
 - A green dot (1) appears in the Fresh oil refill (2) dialog area.
 - The font color in the On (4) button changes from white to green.
 - The control system displays the current fill level in percent (3) in the L327 Oil reservoir dialog area.
 - A green dot (5) appears in the Fresh oil refill Fresh oil refill demanded dialog area. The output 114K4D05 is demanded.
 - The control continuously displays the oil level in percent (2) in the L327 Oil reservoir dialog area.
3. Check the lube oil level.
 - If the displayed lube oil level in the oil reservoir does not change, check the lube oil level in the fresh oil tank.
 - Top up the lube oil if necessary.
 - If the lube oil level is OK, contact your Cat dealer.



27021598069658635

4. Tap the Off (2) button.
 - The font color in the Off (2) button changes from white to green.
 - The green dot (3) disappears from the Fresh oil refill Fresh oil refill demanded dialog area. The output 114K4D05 is no longer demanded.

-
5. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
 6. If you do not want to carry out any more auxiliary drive tests, press the Test mode OFF (1) button.
 - ⇒ The auxiliary drive test is ended.

Lube oil change auxiliary drive test

Valid for:

CG132B, CG170B

NOTE

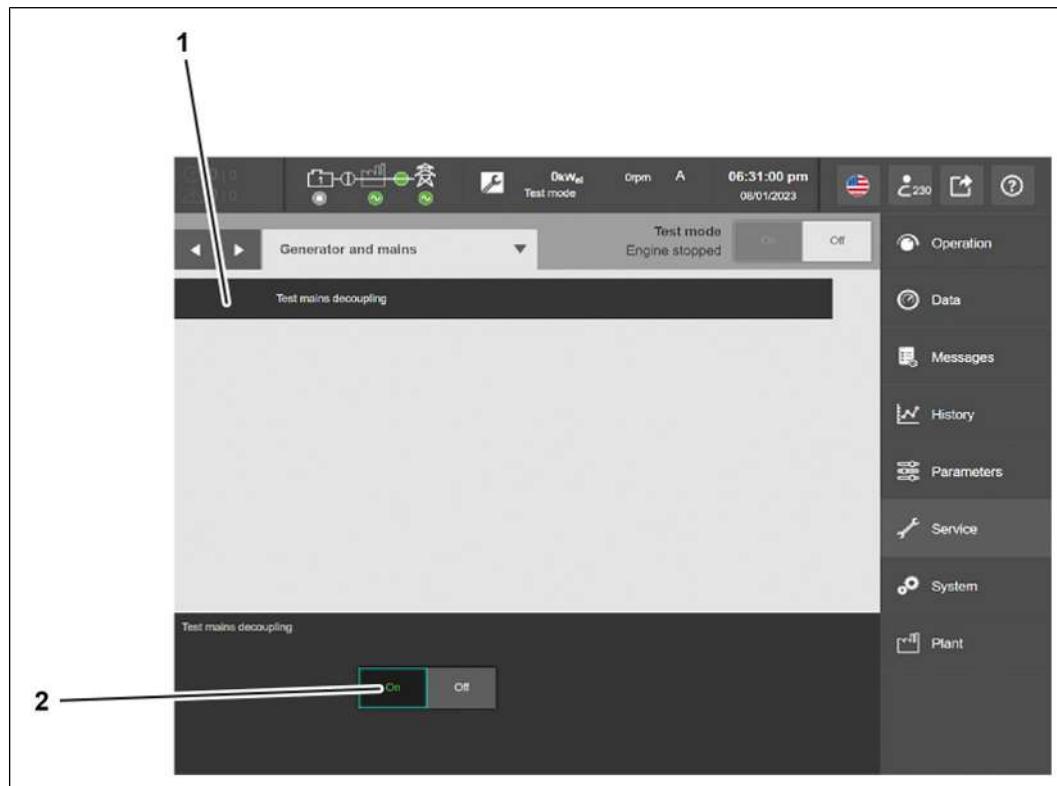
The lube oil change auxiliary drive test is described in the job card [Performing lube oil change \(genset\)](#) [▶ 337].

Generator and mains auxiliary drive test

Valid for:

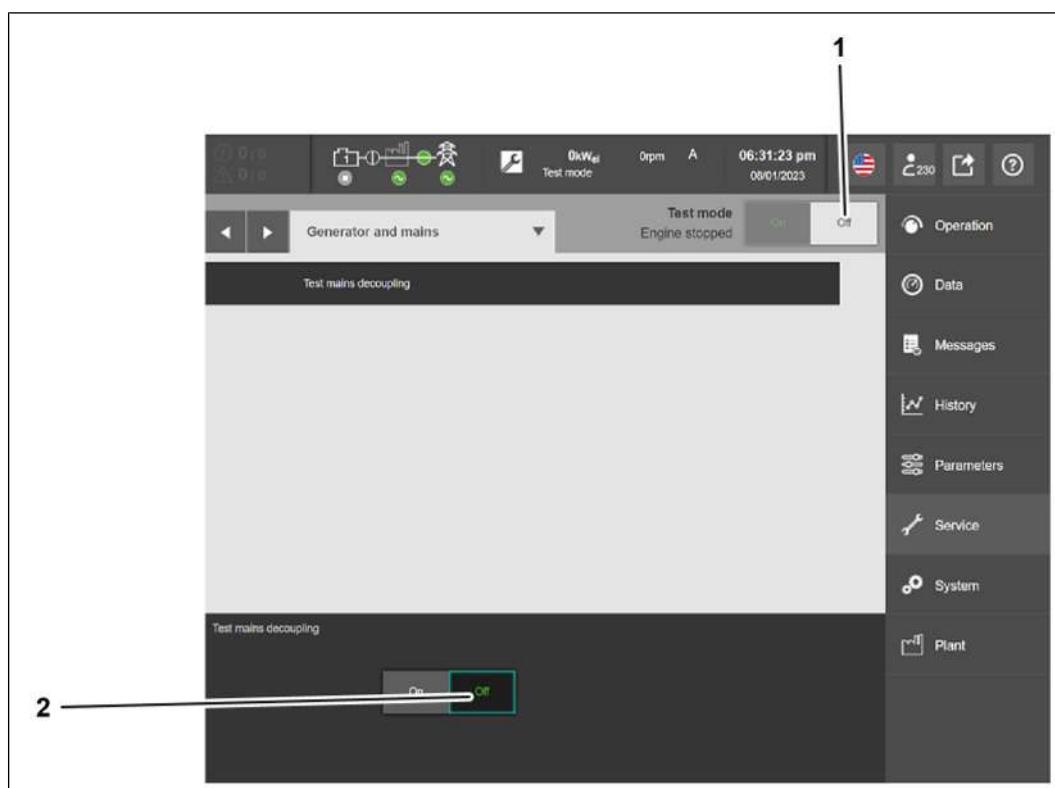
CG132B, CG170B

Checking the mains coupling test mode



27021598069706123

1. Tap the Test mains decoupling (1) line in the pull-down menu
2. Tap the On (2) button.
 - The font color in the On (2) button changes from white to green.



27021598069710987

3. Tap the **Off** (2) button
 - The font color in the **Off** (2) button changes from white to green.
4. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
5. If you do not want to carry out any more auxiliary drive tests, press the **Test mode OFF** (1) button.
 - ⇒ The auxiliary drive test is ended.

Parameterizable controllers auxiliary drive test

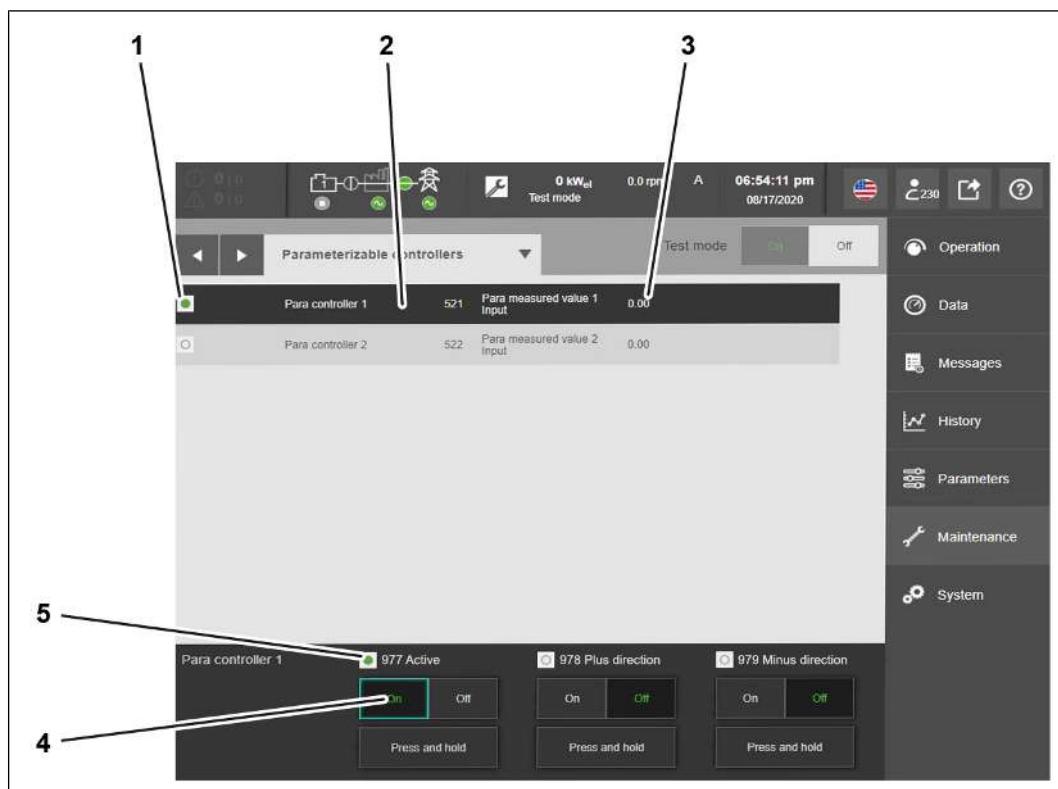
Valid for:

CG132B, CG170B

Checking the parameterizable controllers:

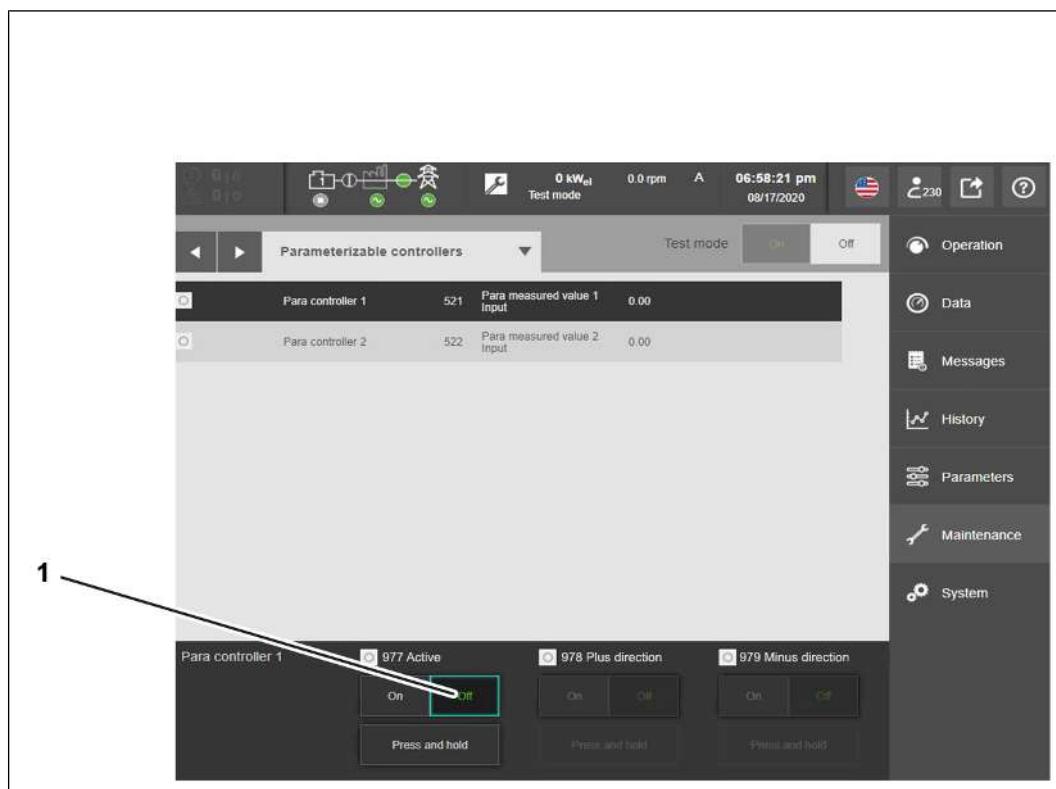
NOTE

- Perform the check for all additional parameterizable controllers according to the parameterizable controller 1 check



9007199560300683

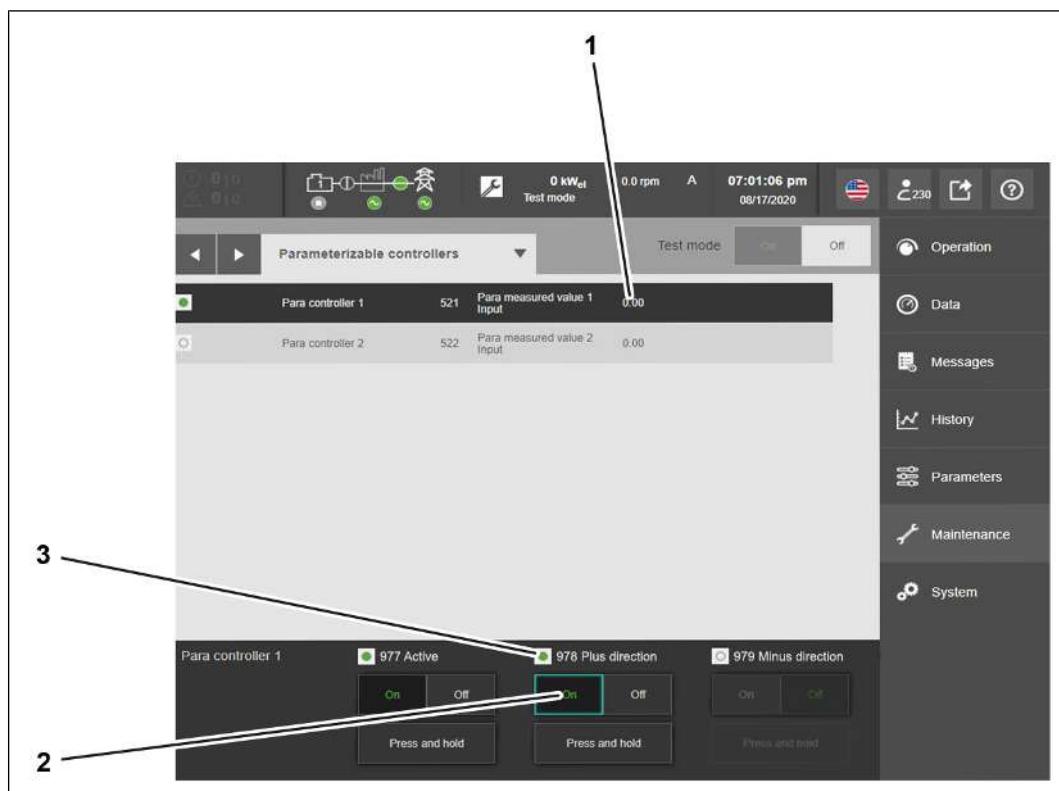
1. Tap the Para controller 1 (2) line in the pull-down menu
 - A measured value (3) is shown in the 521 Para measured value 1 Input dialog area.
2. Tap the On (4) button.
 - A green dot (1) appears in the Para controller 1 dialog area.
 - The font color in the On (4) button changes from white to green.
 - A green dot (5) appears in the Para controller 1 977 Para controller 1 Active dialog area. The output 114K3DO3 is demanded.
 - The current measured value (3) is shown in the 521 Para measured value 1 Input dialog area.



9007199560310411

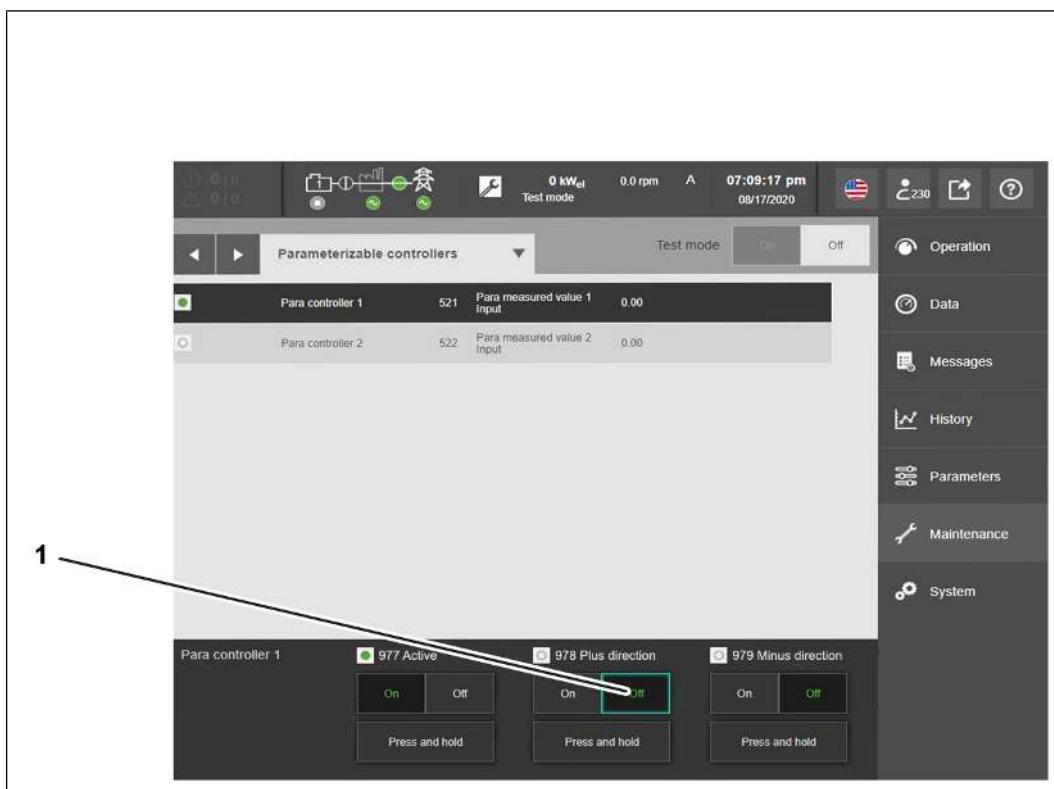
3. Tap the **Off** (1) button

- The font color in the **Off** (1) button changes from white to green. The output 114K3DO3 is no longer demanded.



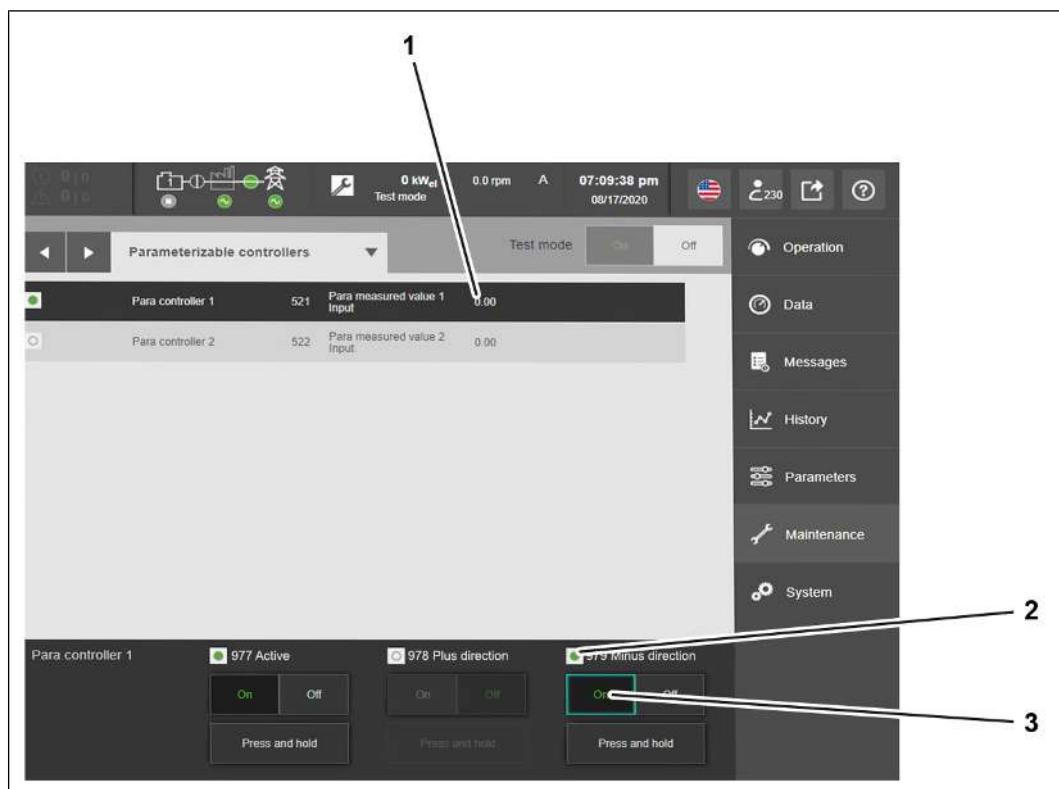
9007199560315275

4. Tap the On (2) button.
 - The font color in the On (2) button changes from white to green.
 - A green dot (3) appears in the Para controller 1 978 Para controller 1 Plus direction dialog area. The output 114K3D04 is demanded.
 - An increasing measured value (2) is shown in the 521 Para measured value 1 Input dialog area.



9007199560325003

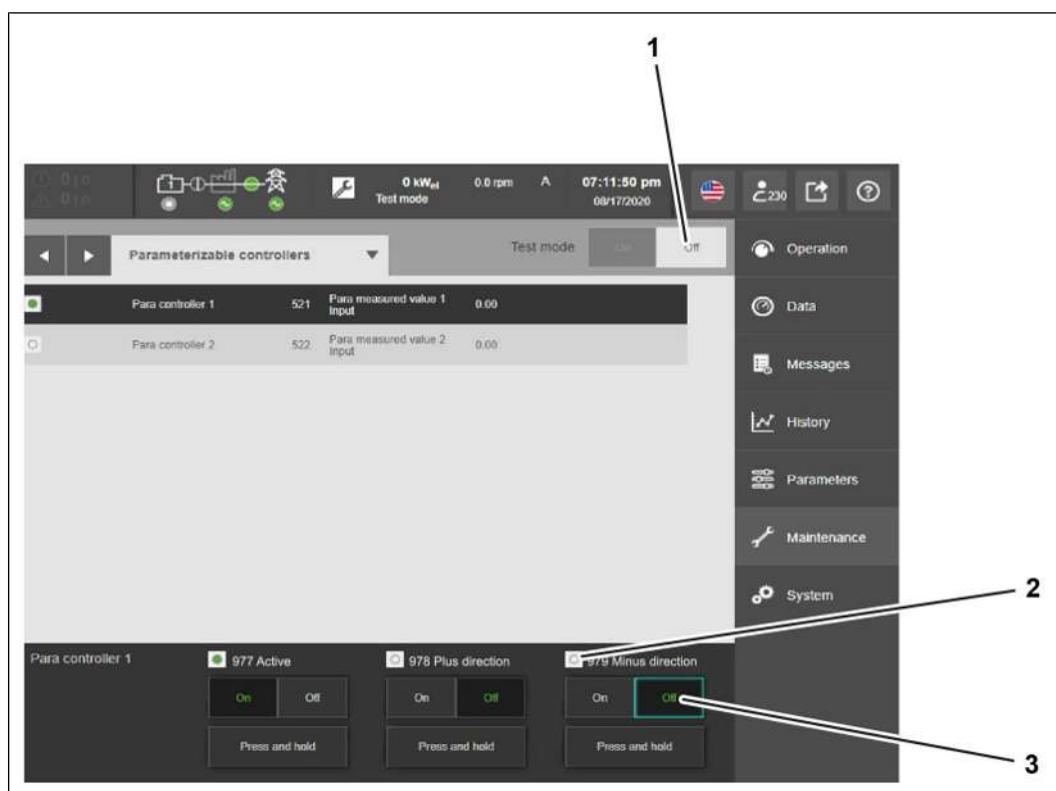
5. Tap the Off (1) button
 - The font color in the Off (1) button changes from white to green. The output 114K3DO4 is no longer demanded.



9007199560329867

6. Tap the On (3) button.

- The font color in the On (3) button changes from white to green.
- A measured value (1) appears in the 521 Para measured value 1 Input dialog area.
- A green dot (2) appears in the Para controller 1 979 Para controller 1 Minus direction dialog area. The output 114K3D05 is demanded.
- The 521 Para measured value 1 Input dialog area shows a decreasing measured value (1).

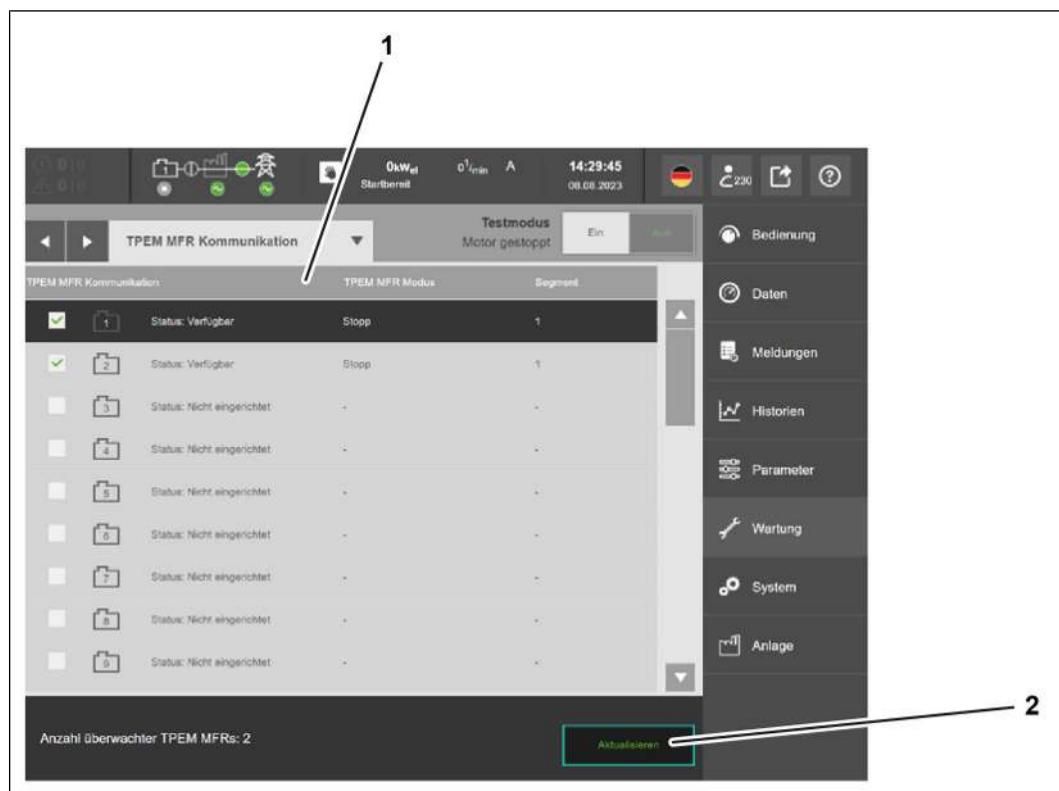


18014398815080587

7. Tap the **OFF** (2) button
 - The font color in the **OFF** (2) button changes from white to green. The output **114K3D05** is no longer demanded.
8. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
9. If you do not want to carry out any more auxiliary drive tests, press the **Test mode OFF** (1) button.
 - ⇒ The auxiliary drive test is ended.

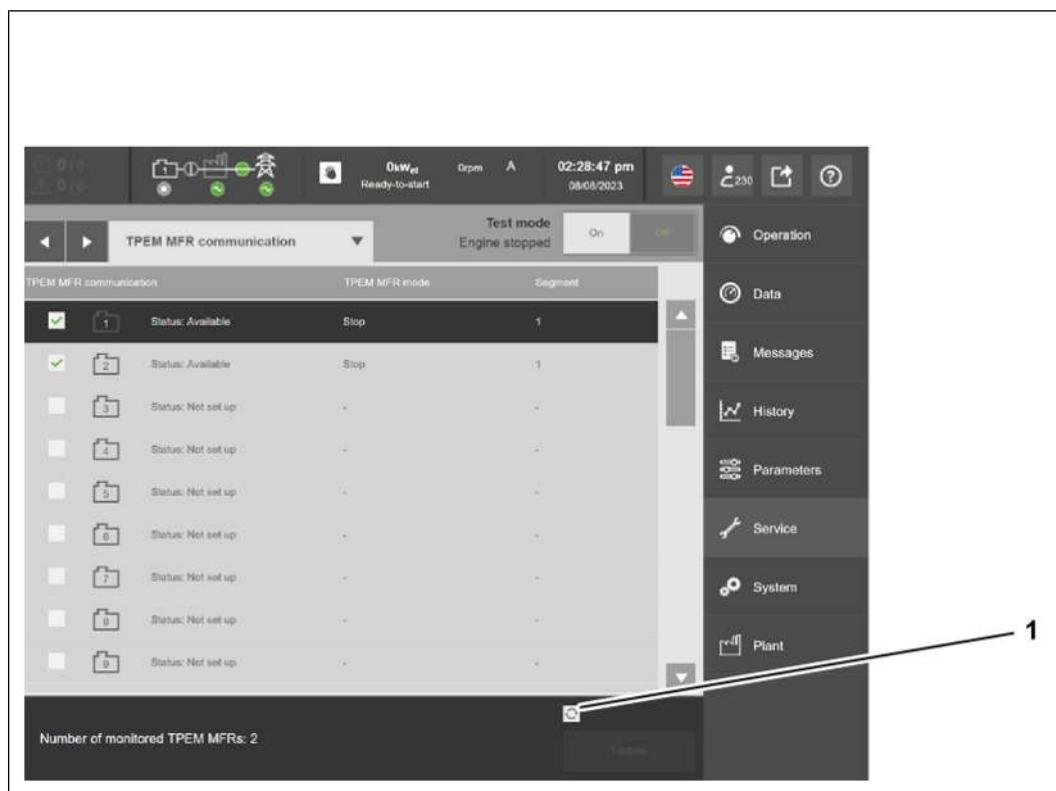
TPEM MFR communication auxiliary drive test

Valid for:
CG132B, CG170B



2806349195

1. The TPEM MFR communication dialog box displays all TPEM MFR device locations.
2. Tap the Update (4) button.
 - The font color in the Update (4) button changes from white to green.



2806544139

- A symbol (1) in the Number of monitored TPEM MFRs: dialog area indicates the duration of the check.



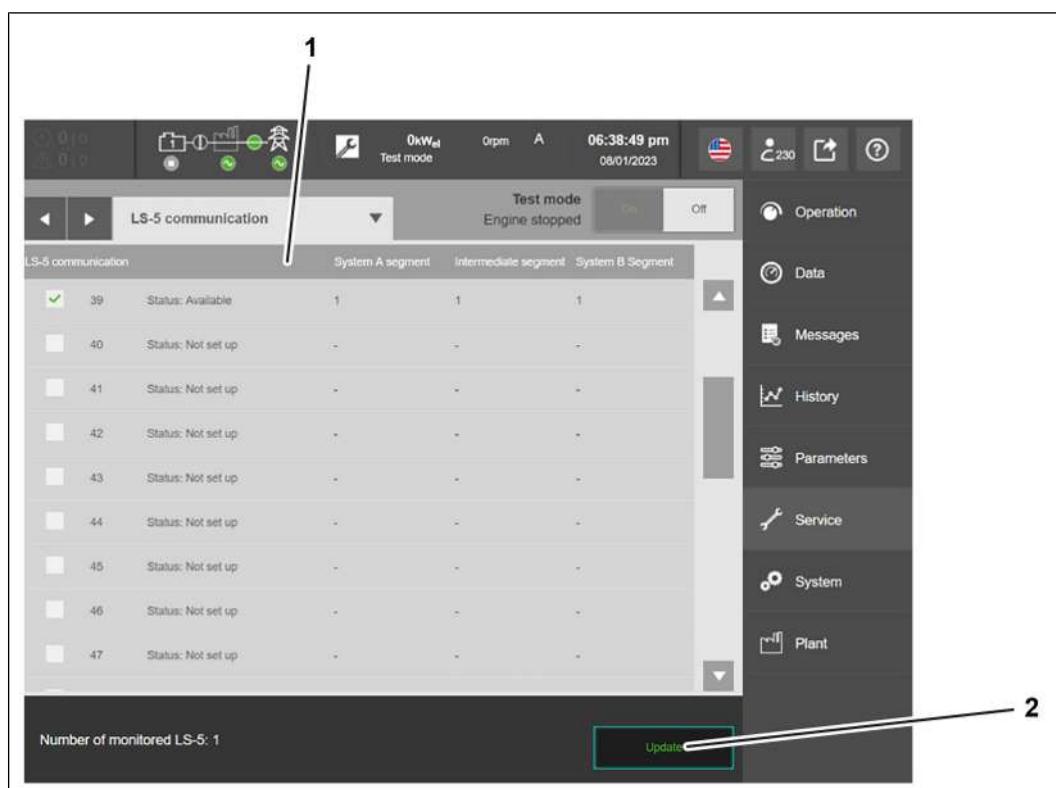
2806547083

3. Use the scrollbar to display all available TPEM MFR devices.
 - A green checkmark (1) in the TPEM MFR communication (2) dialog area marks every available LS-5 device.
 - The Number of monitored TPEM MFRs: (4) dialog area shows the total number of available TPEM MFR devices.
4. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
5. If you do not want to perform any more auxiliary drive tests, press the Test mode Off (3) button.
 - ⇒ The auxiliary drive test is ended.

LS-5 communication auxiliary drive test

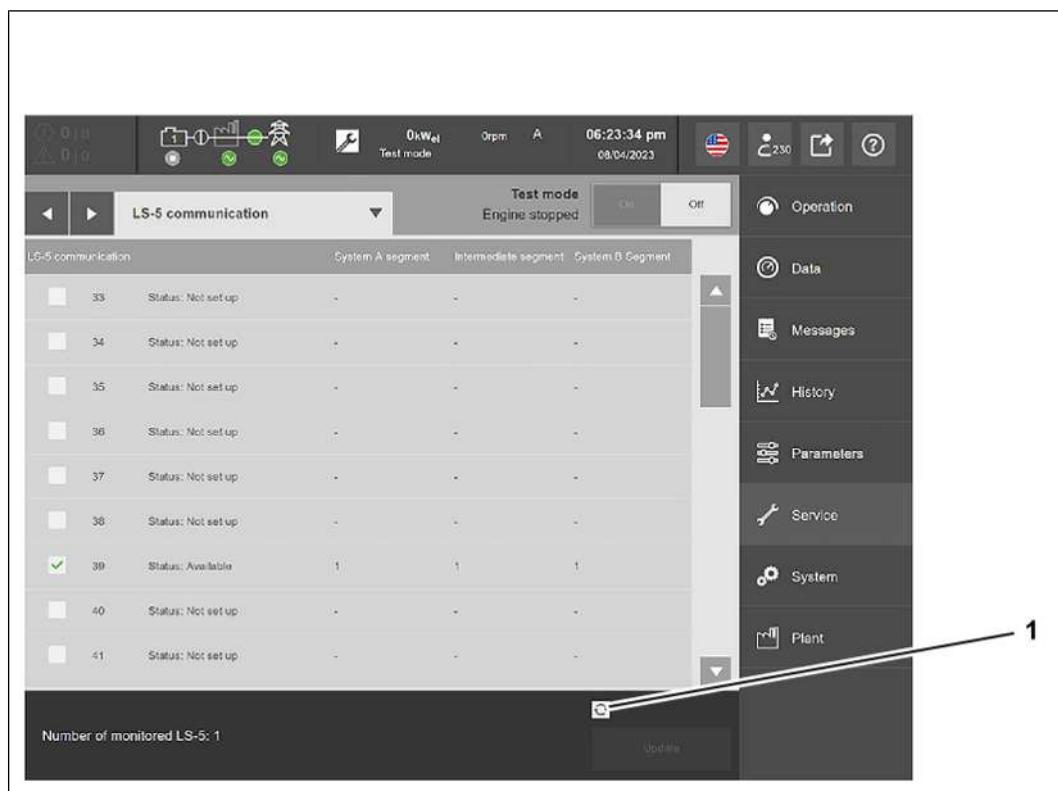
Valid for:

CG132B, CG170B



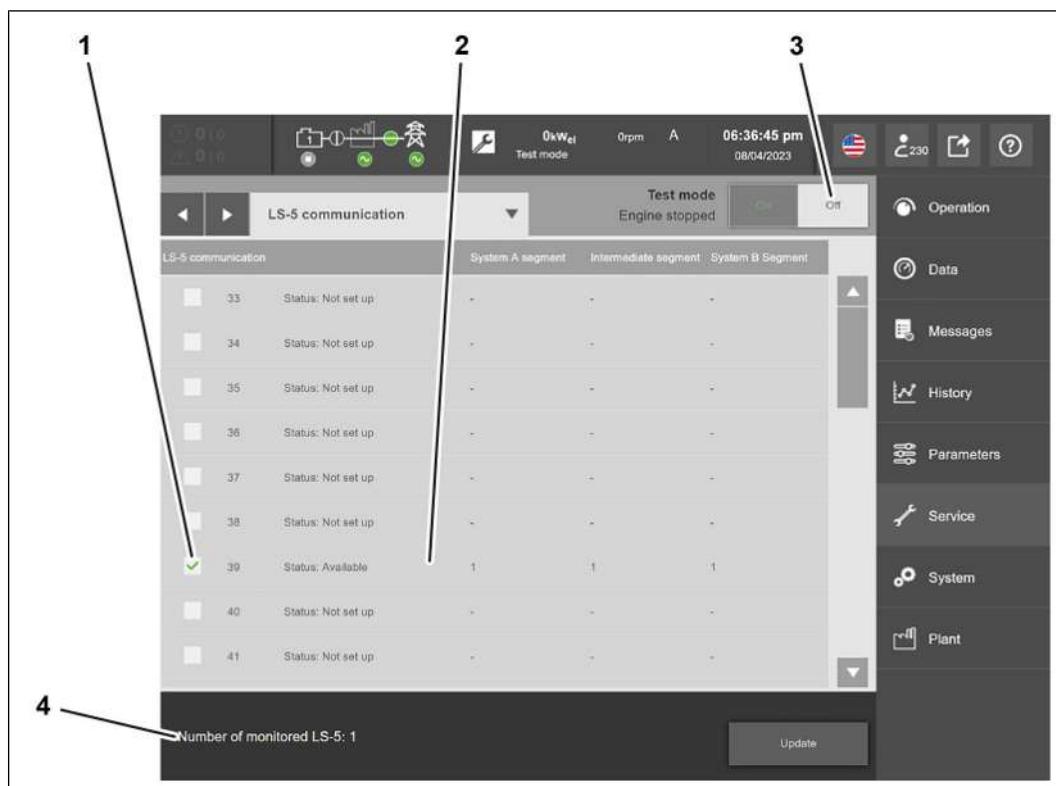
2804753675

1. The LS-5 communication dialog box displays all LS-5 device locations.
2. Tap the Update (4) button.
 - The font color in the Update (4) button changes from white to green.



9007202058765707

- A symbol (1) in the Number of monitored LS-5: dialog area indicates the duration of the check.



2804552843

3. Use the scrollbar to display all available LS-5 devices.
 - A green checkmark (1) in the LS-5 communication (2) dialog area marks every available LS-5 device.
 - The Number of monitored LS-5: (4) dialog area shows the total number of available LS-5 devices.
4. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
5. If you do not want to perform any more auxiliary drive tests, press the Test mode Off (3) button.
 - ⇒ The auxiliary drive test is ended.

Idle tests auxiliary drive test

Valid for:

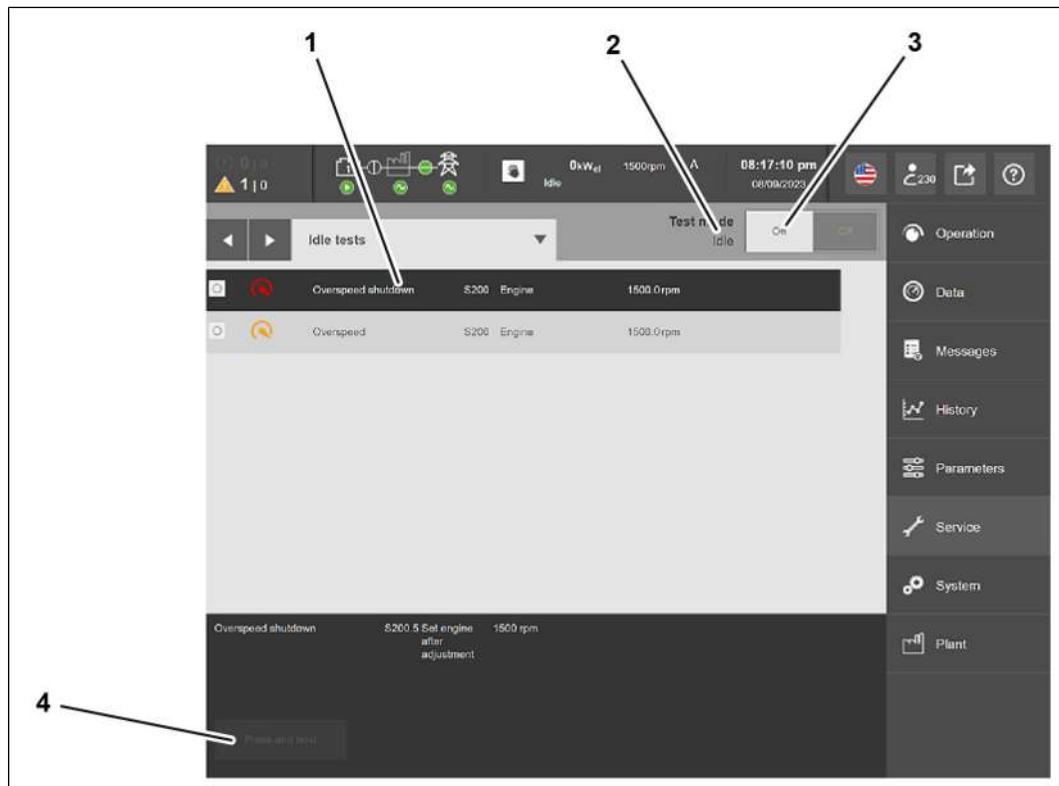
CG132B, CG170B

NOTE

The engine must be idle in order to be able to perform the Idle tests auxiliary drive test. The control system stops the idle state after 10 minutes. You can start the engine in idle mode again if necessary.

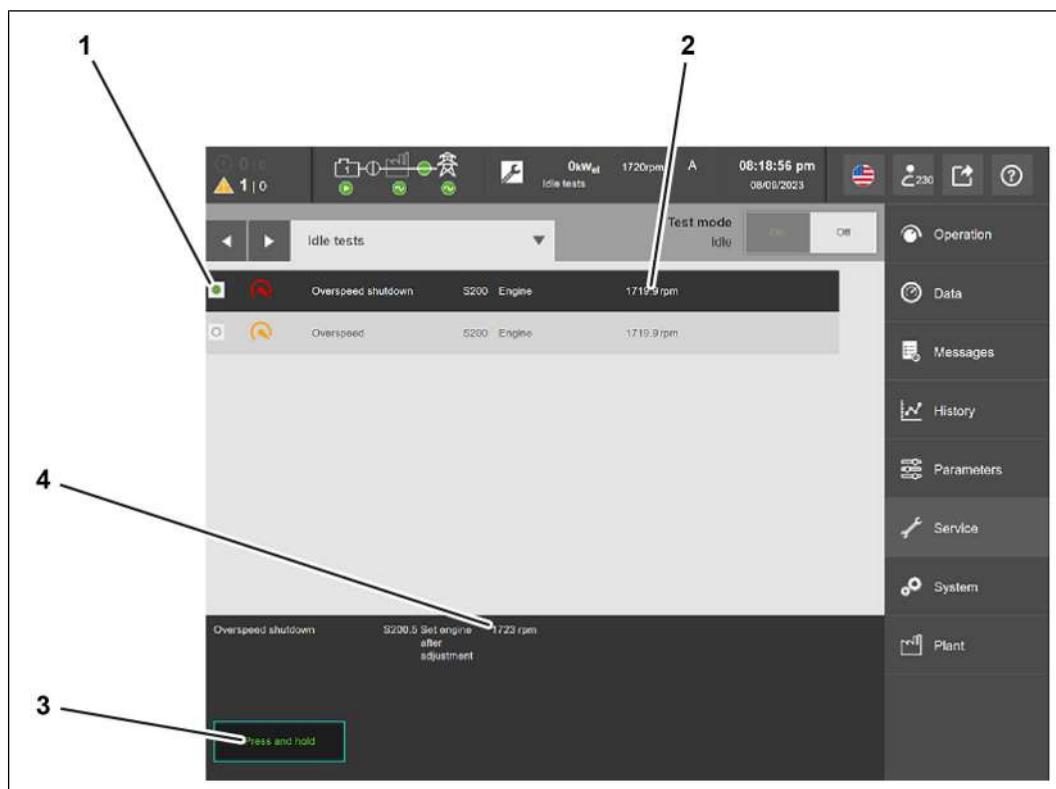
Checking overspeed shutdown:

- ✓ MANUAL operation mode is activated
- ✓ The generator circuit breaker (GCB) is open
- ✓ The engine is idling



2810213899

1. Tap the Overspeed shutdown (1) line in the pull-down menu.
2. **NOTE! If you cannot tap the On button, check whether Idle is displayed in the Test mode dialog area (2). If Idle is not displayed, you must start the engine in idle mode. Tap the On (3) button.**
 - The Press and hold (4) button is activated.



2809402635

3. Press the Press and hold (3) button and keep it pressed.
 - A green dot (1) appears in the Overspeed shutdown dialog area.
 - The speed (3) changes in the S200.5 Set engine after adjustment dialog area.
 - The speed (2) changes in the Overspeed shutdown dialog area.
- ⇒ The speed increases up to a threshold of max. 25 % above the rated speed. Before reaching this threshold, the control system must stop the genset and display a fault message.
- ⇒ If the control system does not stop the genset or does not display a fault message, contact your Cat dealer.

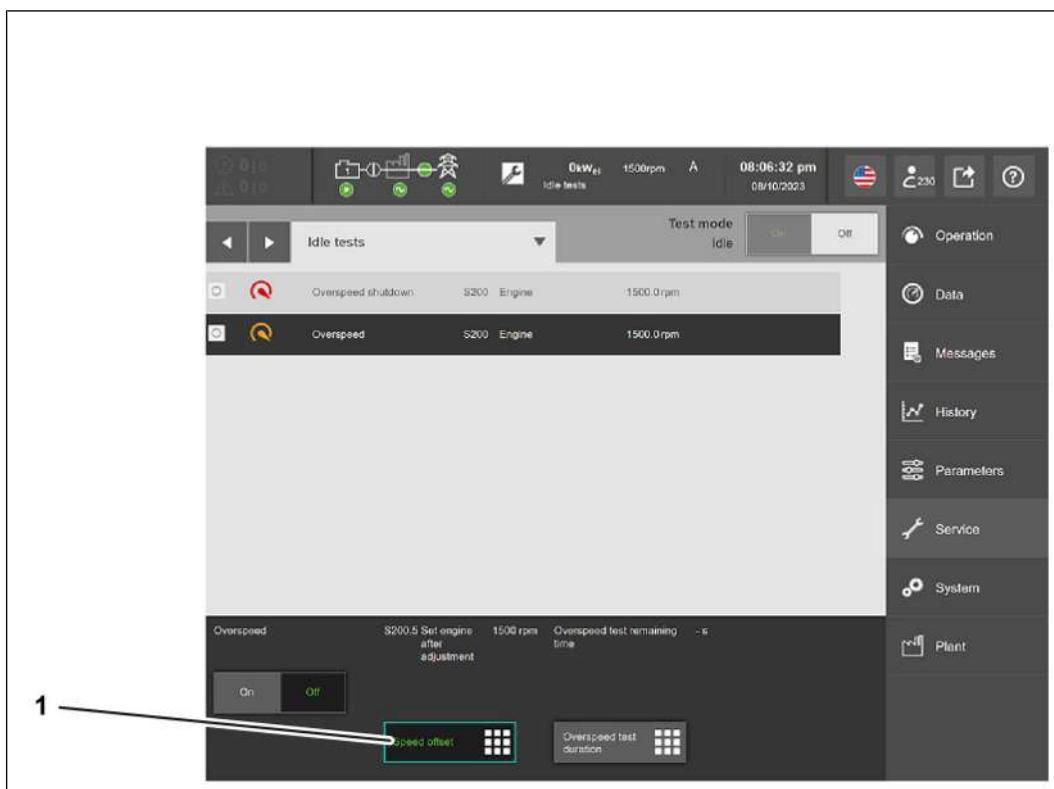
Checking overspeed:

- ✓ MANUAL operation mode is activated
- ✓ The generator circuit breaker (GCB) is open
- ✓ The engine is idling



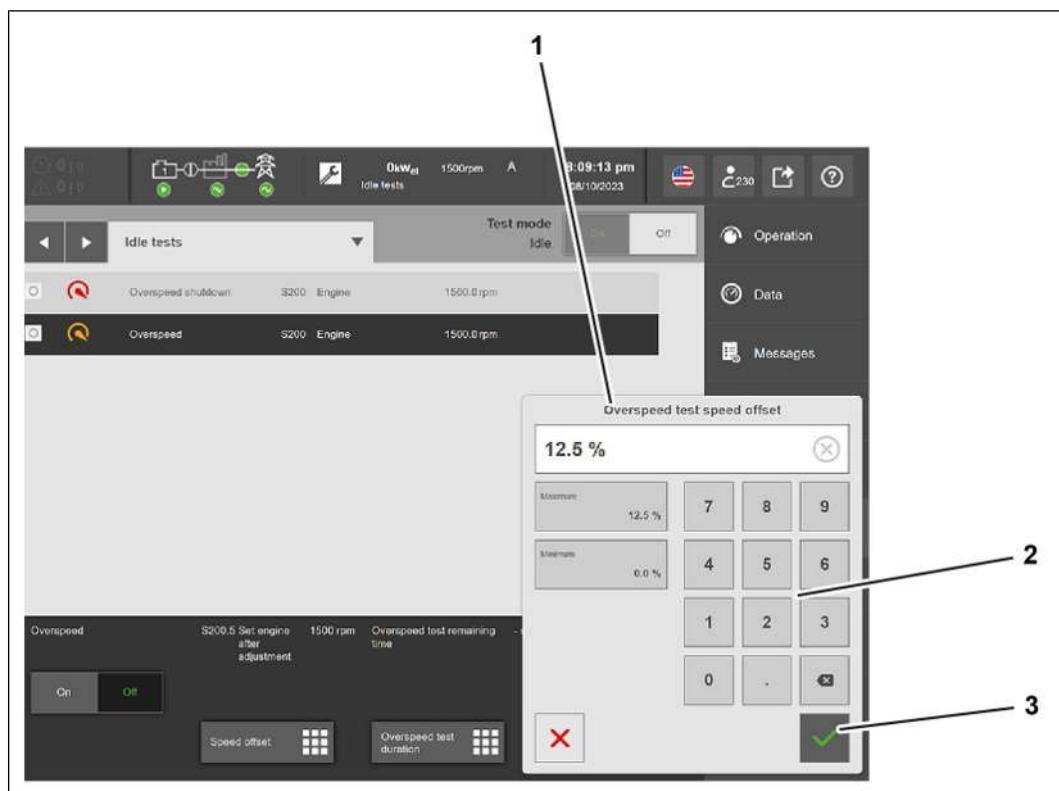
2814827787

1. Tap the Overspeed (1) line in the pull-down menu.
2. **NOTE! If the On (3) button is not activated, check whether Idle (2) is displayed in the Test mode dialog area. If Idle is not displayed, you must start the engine in idle mode.** Tap the On (3) button.



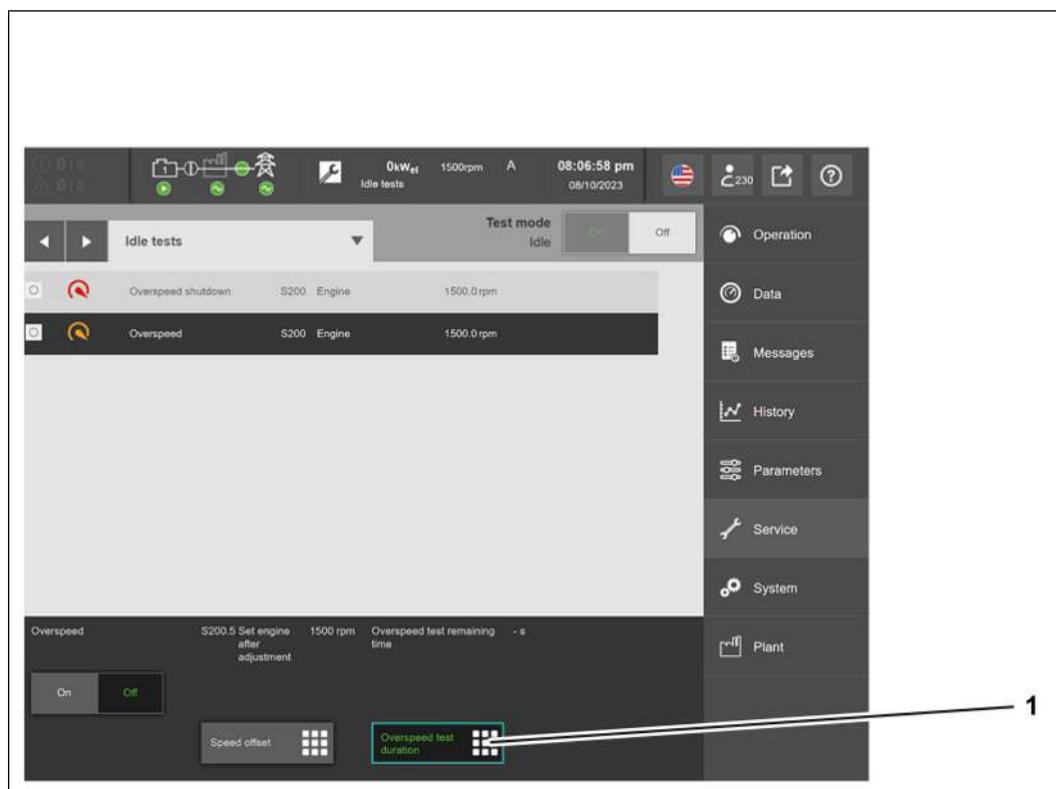
2812057099

3. Tap the Speed offset (1) button to set the speed offset.
 - The Overspeed test speed offset input mask opens.



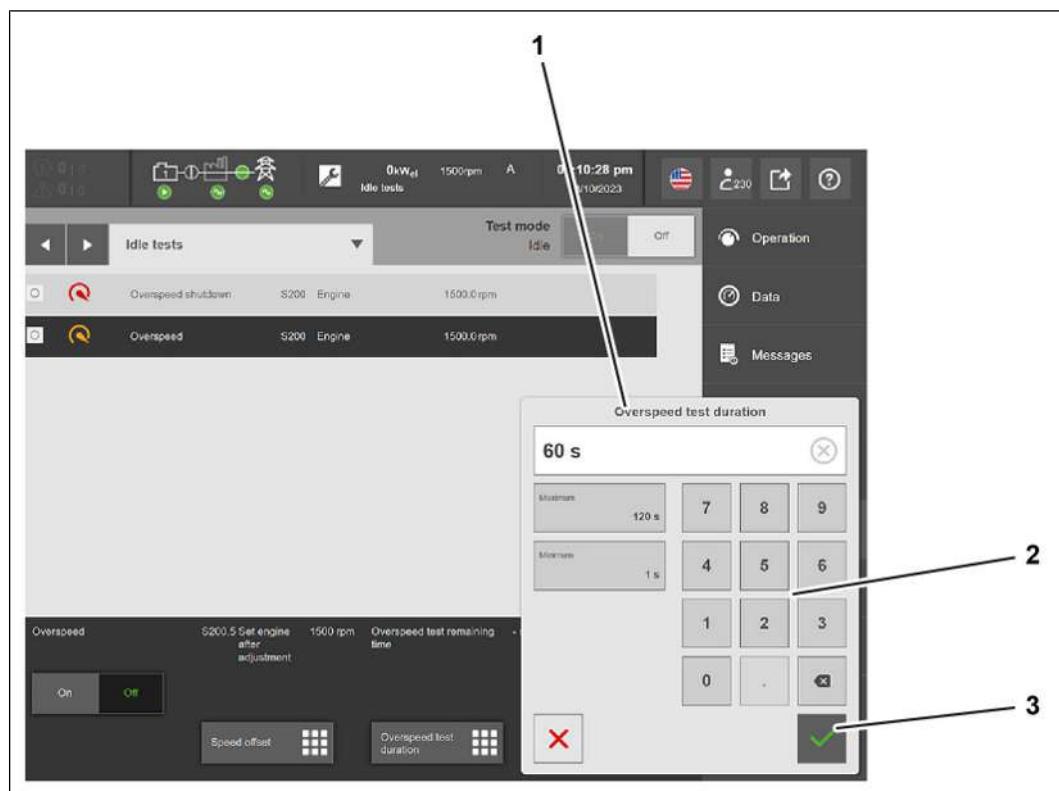
2814824843

4. Use the numeric keypad (2) to enter the desired speed offset as a percentage.
 - The input value must be between 0.0 and 12.5.
 - Press the Accept input (3) button.
 - The Overspeed test speed offset (1) input mask closes.



2812051211

5. Tap the Overspeed test duration (1) button to set the duration for the overspeed test.
 - The Overspeed test duration input mask opens.



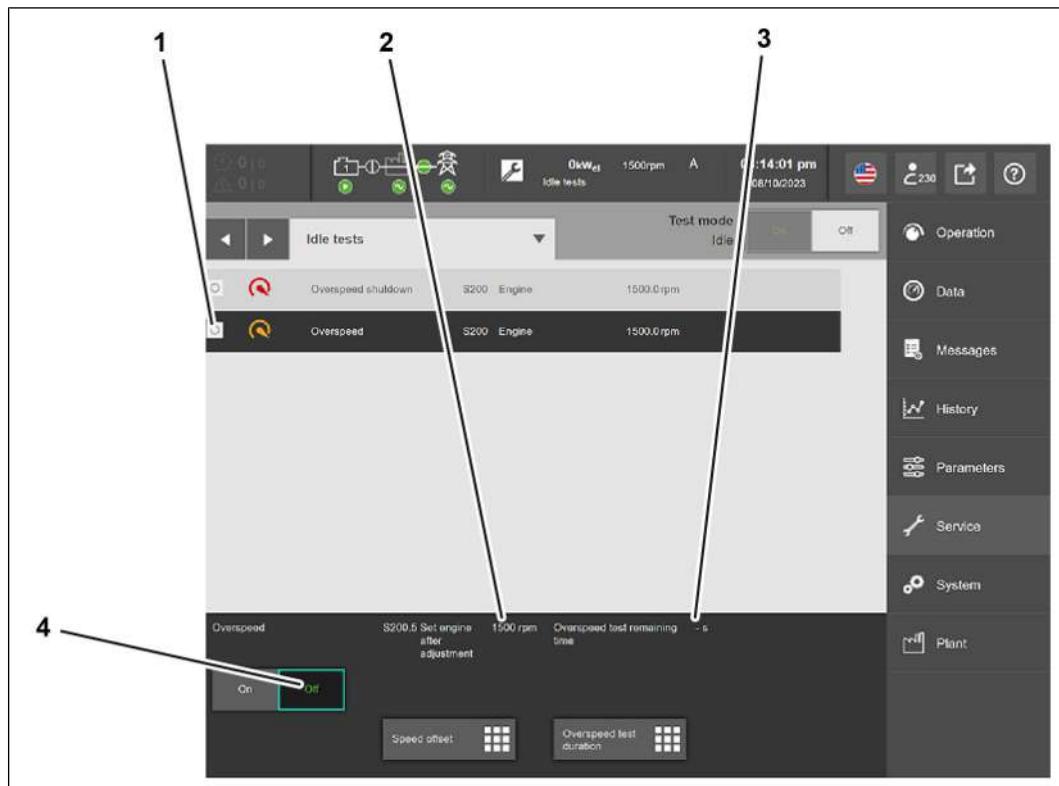
2812054155

6. Use the numeric keypad to enter the desired test duration in seconds.
 - The input value must be between 1 and 120.
 - Press the Accept input (3) button.
 - The Overspeed test duration (1) input mask closes.



2814830731

7. Tap the On (1) button to start the overspeed test.
 - A green dot (1) appears in the Overspeed dialog area.
 - The speed continuously increases in the S200.5 Set engine after adjustment (1) dialog area until the overspeed that was set is reached.
 - Once the overspeed that was set is reached, the running time that was set for the overspeed test starts. The Overspeed test remaining time dialog area shows the residual running time.

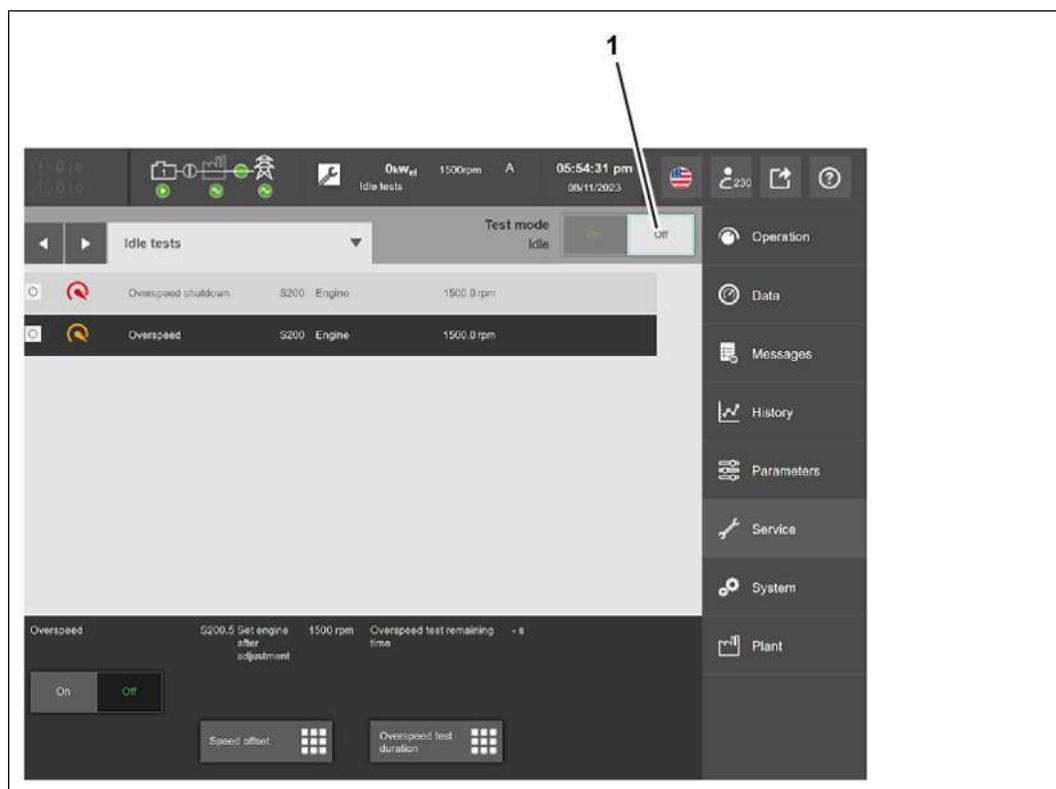


2814835851

8. You can stop the overspeed test by tapping the **Off** (4) button.
 - The green dot (1) disappears from the Overspeed shutdown dialog area.
 - The speed continuously decreases in the S200.5 Set engine after adjustment (2) dialog area until the rated speed is reached.
 - The Overspeed test remaining time (3) dialog area shows a dash.

⇒ The control system must not stop the genset or display a fault message during the overspeed test.

⇒ If the control system stops the genset or displays a fault message, contact your Cat dealer.



2812048267

1. If you want to perform additional auxiliary drive tests, select and open the next auxiliary drive subgroup.
2. If you do not want to carry out any more auxiliary drive tests, press the test mode **Off** (1) button.
 - The auxiliary drive test is ended.

Checking the starting system

Valid for:

CG170B



Tools:

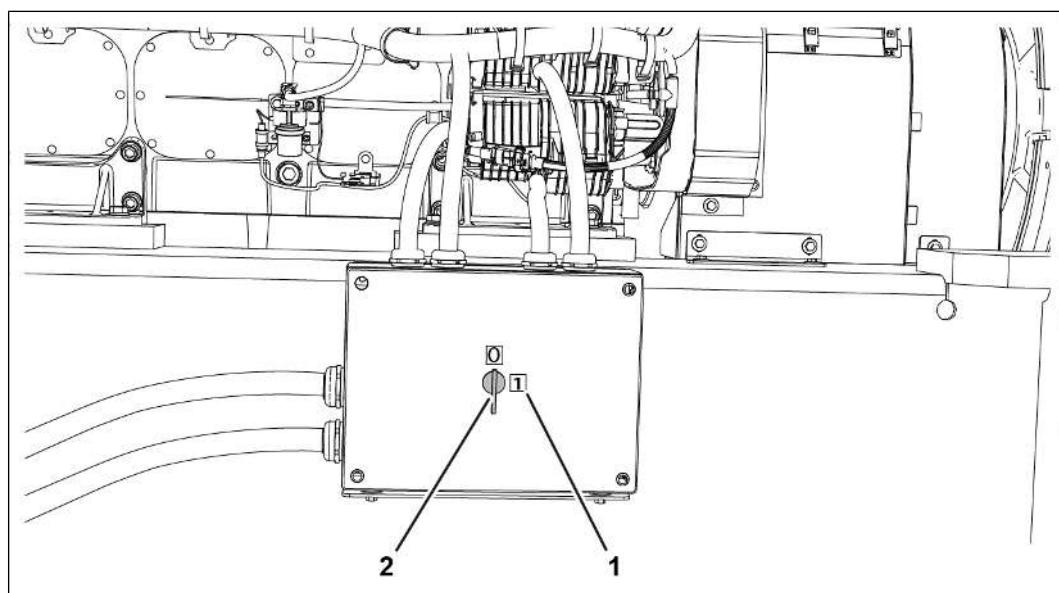
- Standard tools

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.

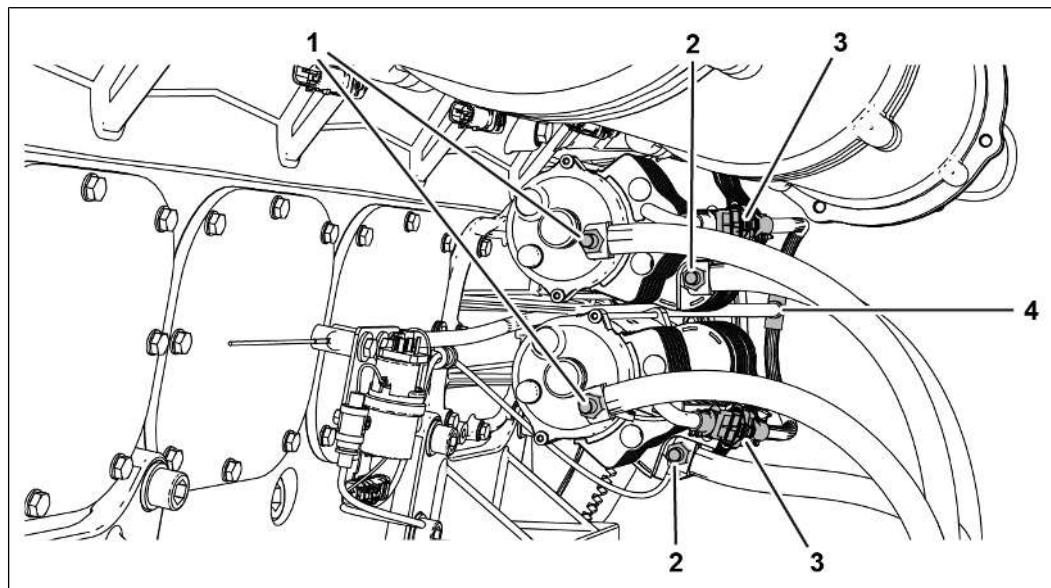
Check the battery disconnection switch:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



541249419

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:

541277451

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 \[▶ 117\]](#)

Taking lube oil samples

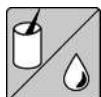
Valid for:

CG170B



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

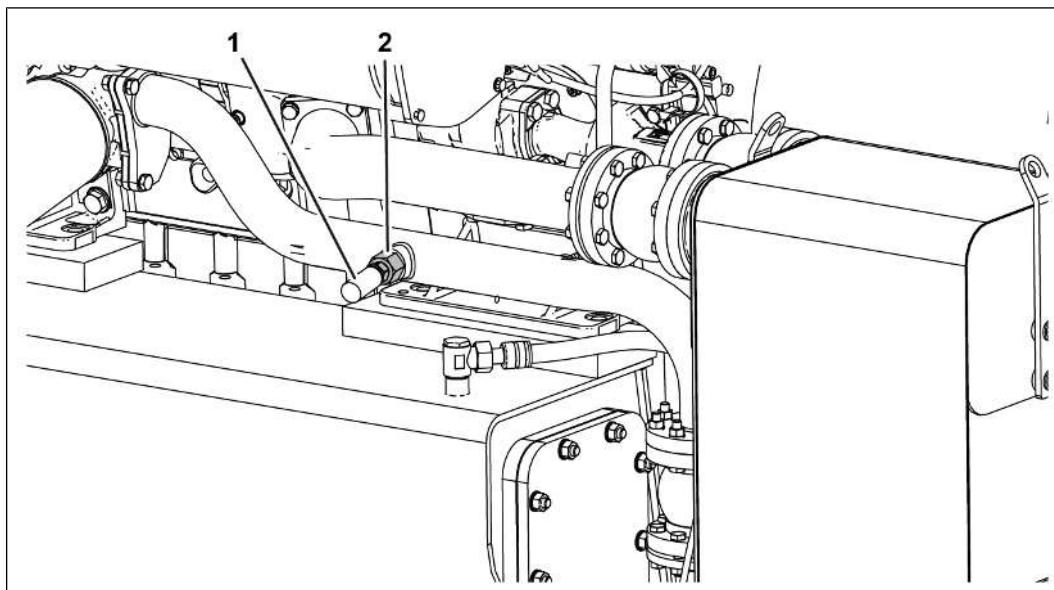
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

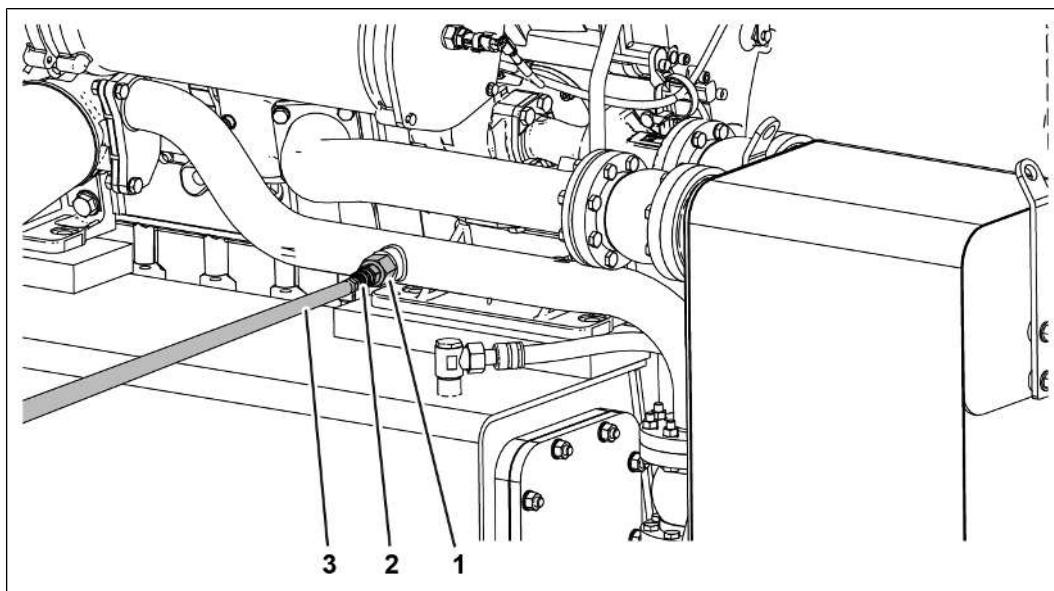
Taking lube oil samples:

- ✓ The genset is in operation
- ✓ The lube oil temperature is at least 60 °C



540674827

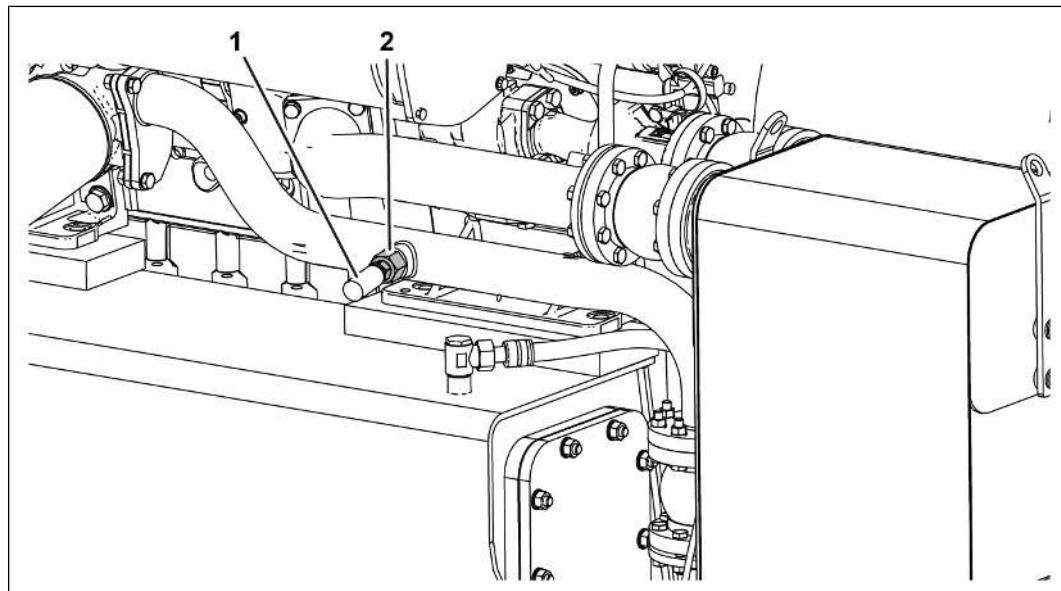
1. Place the collecting tray underneath.
2. Remove the cover from the (1) lube oil extraction valve (2).



540702859

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).



540674827

7. Place the cover (1) on the lube oil extraction valve (2).
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:

CG132B, CG260, CG170, CG170B



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 Cat dealer

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 Cat dealer.



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

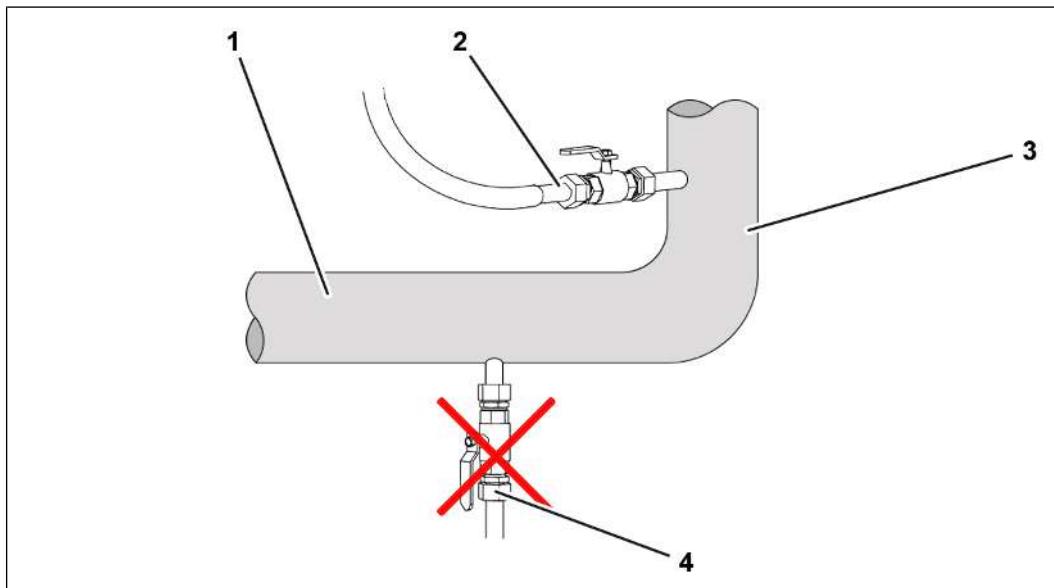
Condensate ruins the fuel gas sample taken

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:

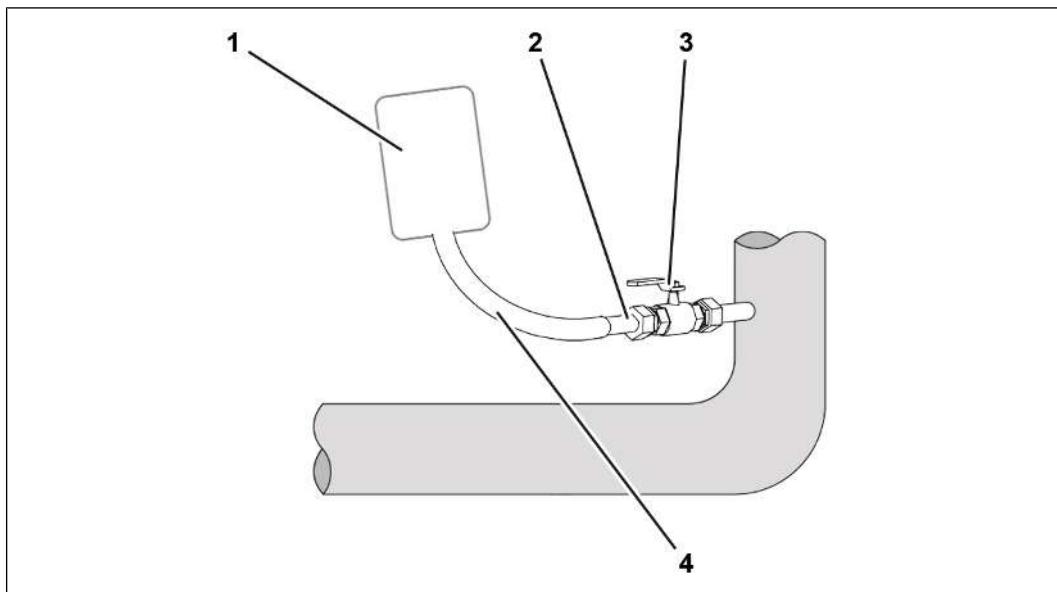
- ✓ The genset is in operation.
- ✓ The fuel gas production has been running for at least three hours.
- ✓ The engine load is 100 % (full load).
- ✓ The gas volume flow must be at least 75 % of the operating volume flow which occurs at full load operation of the gas engine system.

- ✓ 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 (TPEM)

Valid for:
CG170B, CG132B

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 Cat dealer.

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 nitrogen oxide level (NO_x) in the exhaust gas is a reference value for emission protection.

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 the nitrogen oxide level, 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 (NO_2) in parts per million (ppm)

Caterpillar Energy Solutions GmbH recommends the use of one 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 TPEM USB token.

After the exhaust gas measurement, have the engine settings adjusted only by persons qualified and trained by the manufacturer.

The required information on training options can be found on the webpage <https://www.mwm.net/en/trainings/learning-center-service/seminar-program/>

Notes on the exhaust gas measurement process

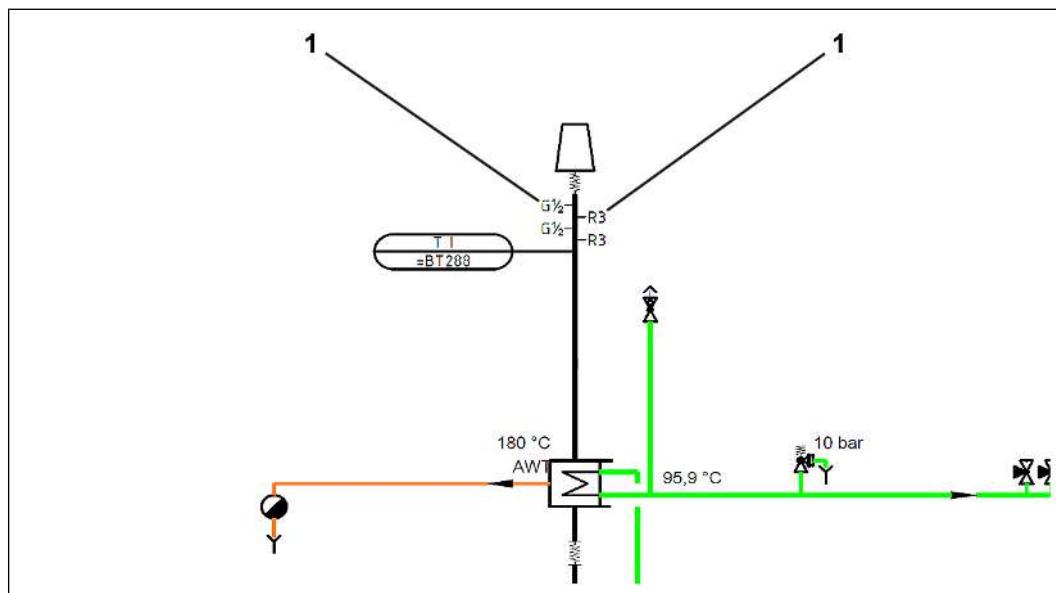
For a relevant exhaust gas measurement, the exhaust system must have heated up to operational temperature. Before starting the exhaust gas measurement, the genset must run at 100 % load until all operation values have reached steady state.

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 in the genset data sheet. You can find the document in the order-specific operating manual in chapter [Technical data \[▶ 11\]](#).

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 Commissioning/Genset [Start the genset \[▶ 117\]](#)
 - ✓ Parameter 20260431 T combustion chamber Set 2 control type is Grid-parallel / Island changeover see . You can find the document in the Service Library and in the order-specific operating manual.
 - ✓ Exhaust system has warmed up to operational 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 percent by volume. When using natural gas or mixtures of natural gas and hydrogen, the oxygen concentration is approx. 11 vol %.** Assess the oxygen concentration
 - An excessive oxygen concentration indicates external fresh air intake or an incorrect engine setting. Remedy the cause of the problem and repeat the measurement.

- Too low oxygen concentration indicates an incorrect engine setting or a defective measuring device. Remedy the cause of the problem and repeat the measurement.
2. Convert the nitrogen oxide values' unit of measurement:
 - $\text{NO (ppm)} + \text{NO}_2 \text{ (ppm)} = \text{NO}_x \text{ (ppm)}$
 - $\text{NO}_x \text{ (ppm)} \times 2.05 \text{ (21 \% - 5 \%)} / (21 \% - \text{O}_2 \text{ meas}) = \text{NO}_x \text{ mg/m}^3$
 3. If the measurement result is incorrect, you must correct the set combustion chamber temperature.

Correcting nitrogen oxide concentration in the exhaust gas

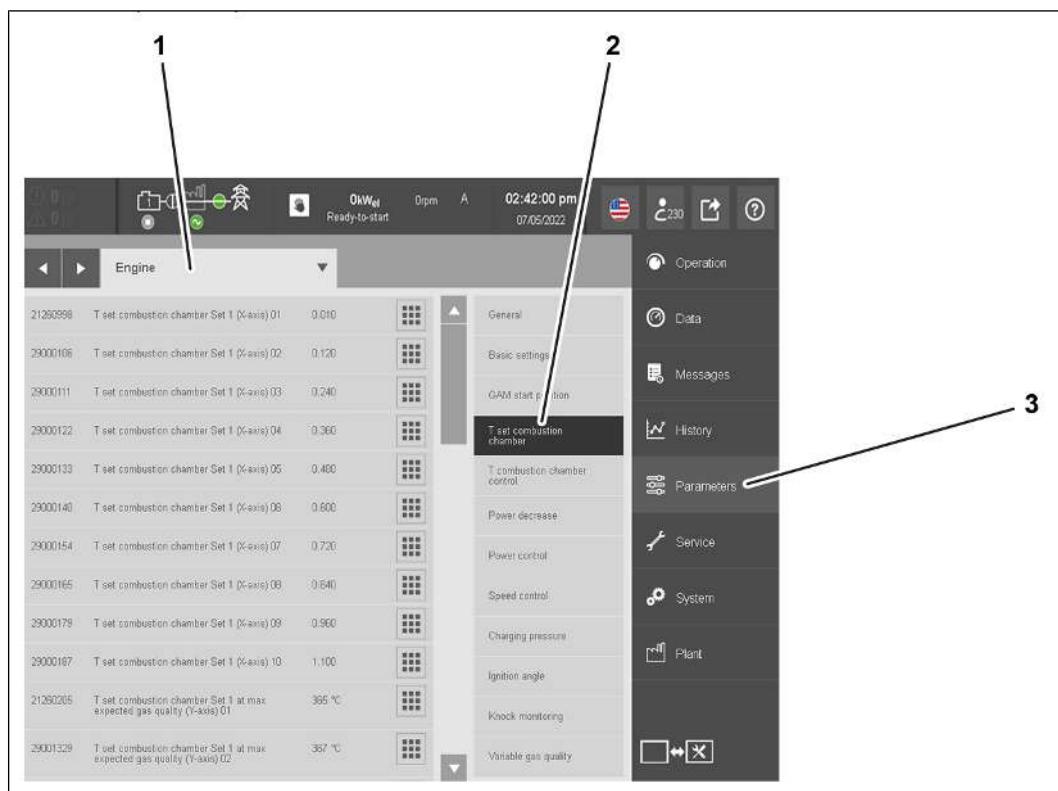
NOTE! If you have measured a nitrogen oxide value higher than the value specified in the genset data sheet, you must lower the combustion chamber set temperature. If you have measured a nitrogen oxide value lower than the value specified in the genset data sheet, you must raise the combustion chamber set temperature.

Additional information on adjusting the combustion chamber set temperature for special gas types or operating modes can be found in the following Service Bulletins:

- For information about the CG170B series, see Service Library, Service Bulletin (SM 6643) [Reduction of the combustion chamber temperature](#).
- For information about all other series, see Service Library, Service Bulletin (SM 6643) [Setting Values and Mode of Operation for Biogas](#).

Contact your Cat dealer 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 in the genset data sheet. You can find the document in the order-specific operating manual in chapter [Technical data \[▶ 11\]](#).



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2. Adjust the combustion chamber set temperature.
 - Open the functional group **Parameters** (3).
 - Select the subgroup **Engine** (1).
 - Select the function **T set combustion chamber** (2).



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3. Select the corresponding parameter depending on the gas quality.

NOTE

10 load points are defined for each combustion chamber set temperature characteristic curve. The load points are defined as a function of the respective gas quality. The intervals between the load points correspond to a load change of 10 %. For example, given a maximum expected gas quality, if you want to change the combustion chamber set temperature for the 20 % load range, select the parameter 29004787 T set combustion chamber Set 2 at max expected gas quality (Y-axis).

- Use the scroll bar (5) to navigate to the desired parameter, e.g. T set combustion chamber Set 2 at average expected gas quality (Y-axis).
- Tap the symbol (2) in the dialog area T set combustion chamber Set 2 at max expected gas quality (Y-axis) (1). The input mask opens.

NOTE

The load points for the existing combustion chamber set temperature characteristic curve must be adjusted upward if the hydrogen concentration is 10 vol % or higher.

At a nitrogen oxide value of 250 mg, the load points must be increased once by at least 30 Kelvin. At a nitrogen oxide value of 500 mg, the load points must be increased once by at least 15 to 30 Kelvin. Perform subsequent fine-tuning in increments of 2 to 3 K as described below.

If the hydrogen content of the natural gas changes, you must re-adjust the load points to maintain the desired emission values.

-
- Use the keypad (3) to adjust the combustion chamber set temperature in increments of 2 to 3 K.
 - Confirm entry by pressing the green checkmark (4).
4. After each change, allow the genset to continue running unaltered for at least 5 minutes.
 5. Measure the nitrogen oxide concentration in the exhaust gas.
 - Perform the exhaust gas measurement as described above.
 6. Continue to adjust the combustion chamber set temperature according to the measurement result, if necessary.
 7. **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
 8. 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:

CG170B

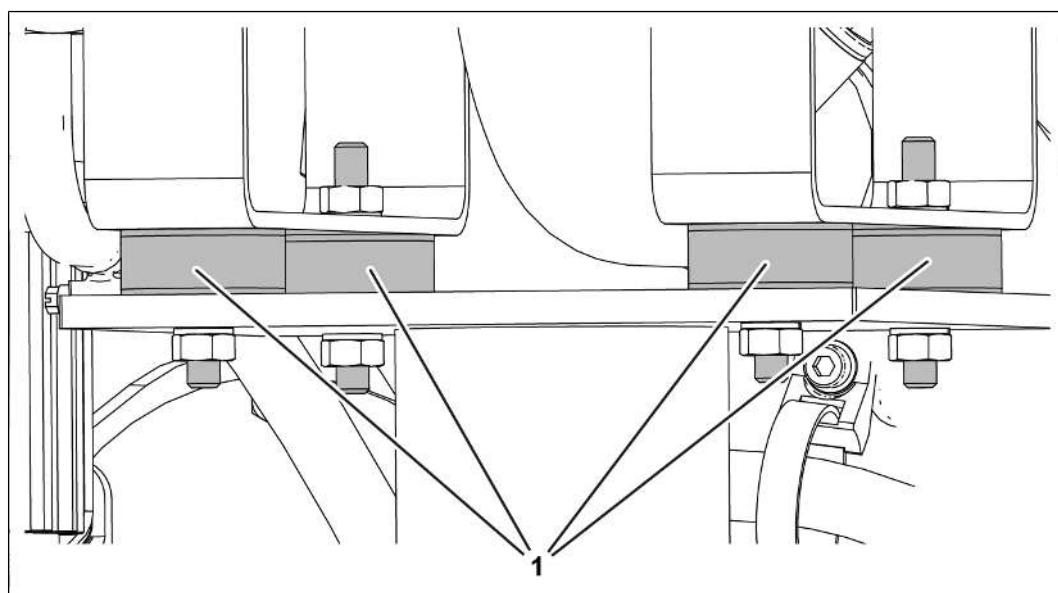


Tools:

- Standard tools

Checking the mounting buffer:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



514551563

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 \[▶ 302\]](#).
 - 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 \[▶ 117\]](#)

Removing and installing the mounting buffers

Removing the mounting buffers

Valid for:

CG170B

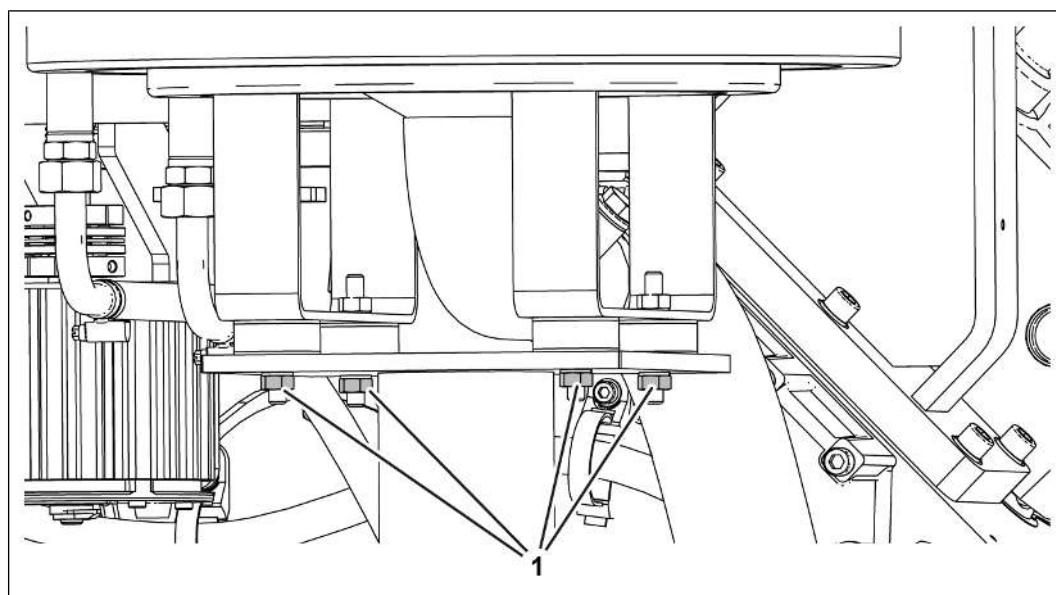


Tools:

- Standard tools

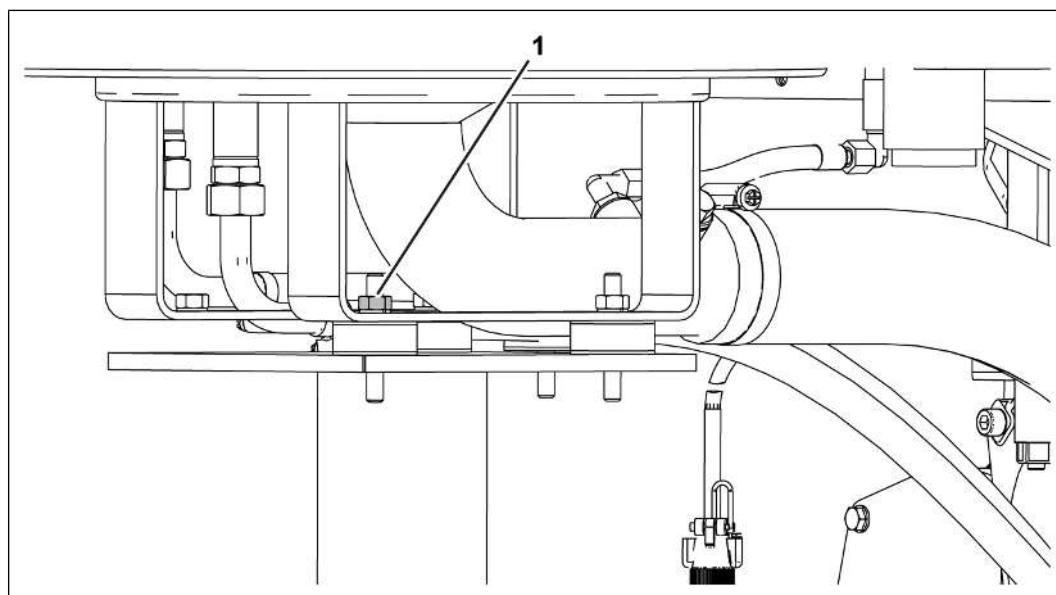
Removing the mounting buffer:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



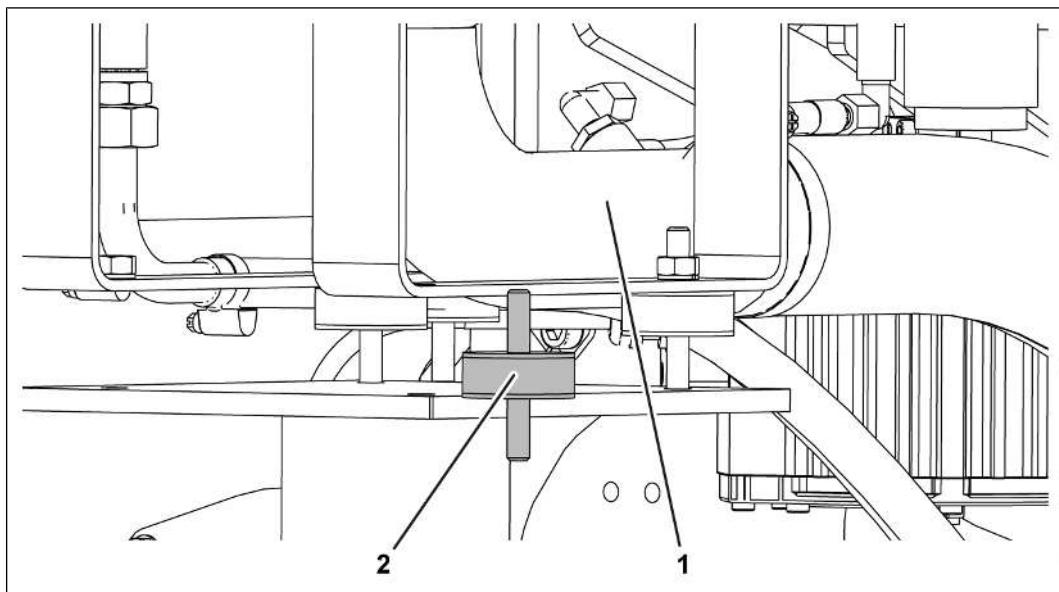
514553483

1. Unscrew nuts (1).



514555403

2. Unscrew nut (1).



514557323

3. Lift support of crankcase ventilation (1) lightly.
4. Remove mounting buffer (2).

Installing the mounting buffers

Valid for:

CG170B



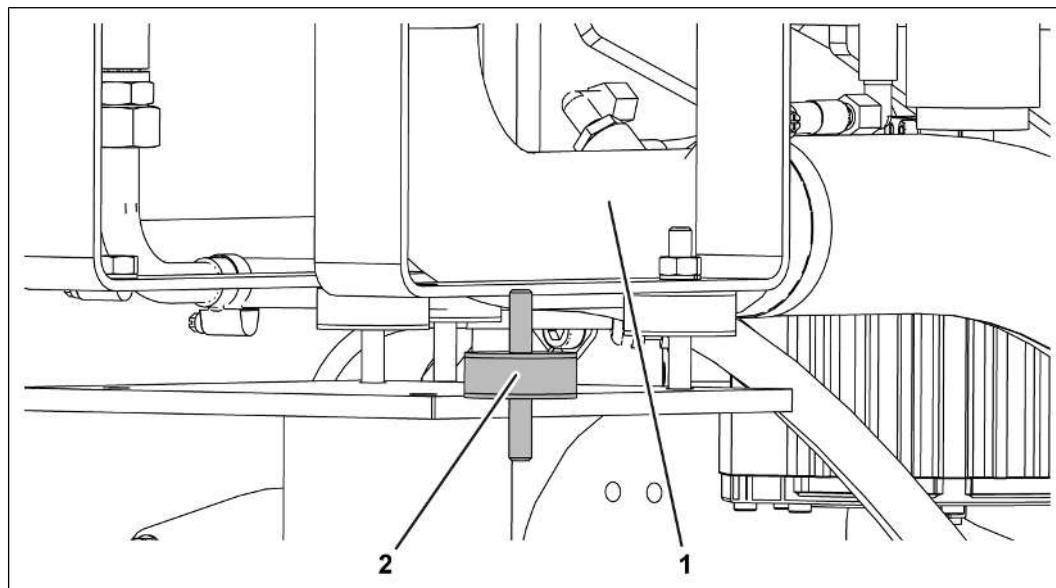
Tools:

- Standard tools



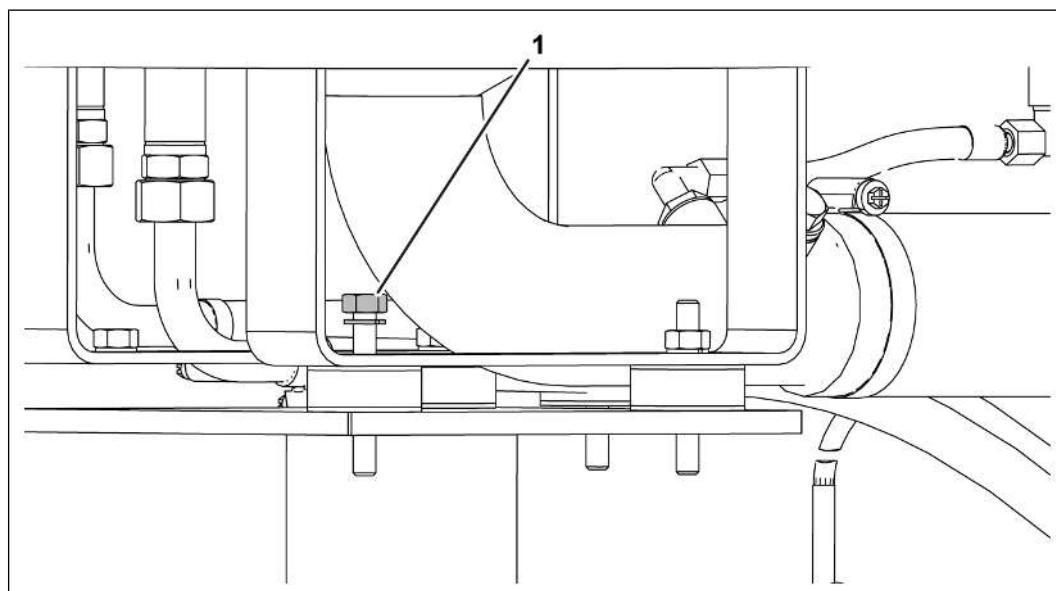
Spare parts:

- Mounting buffers, if necessary

Installing the mounting buffer:

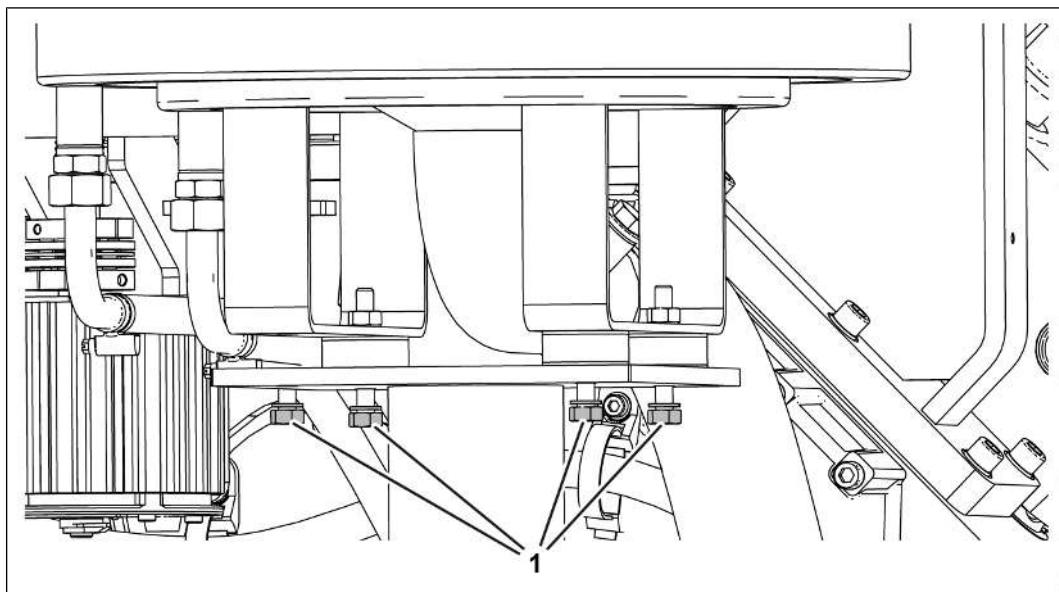
514557323

1. Lift support of crankcase ventilation (1) lightly.
2. Insert mounting buffer (2).



514559243

3. Tighten nut (1).



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4. Tighten nuts (1).

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the rubber expansion joint

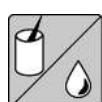
Valid for:

CG170 (K), CG170, CG170B



Tools:

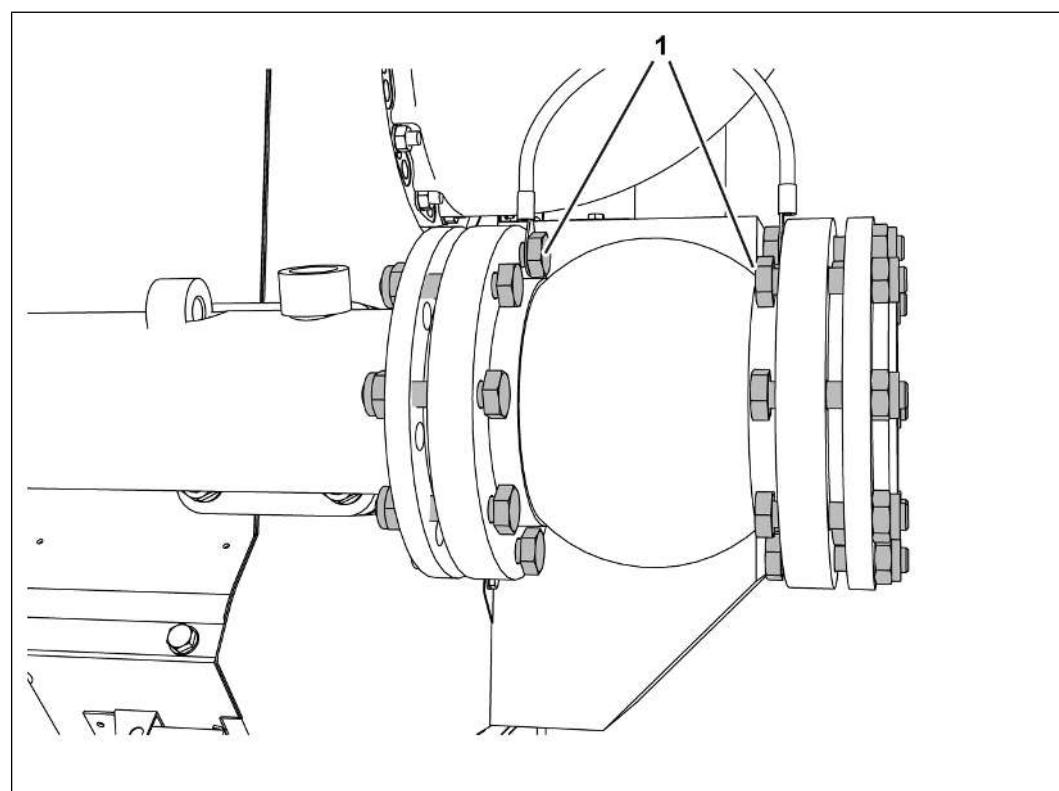
- Standard tools
- Special tool
 - Torque wrench 1203 0350



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

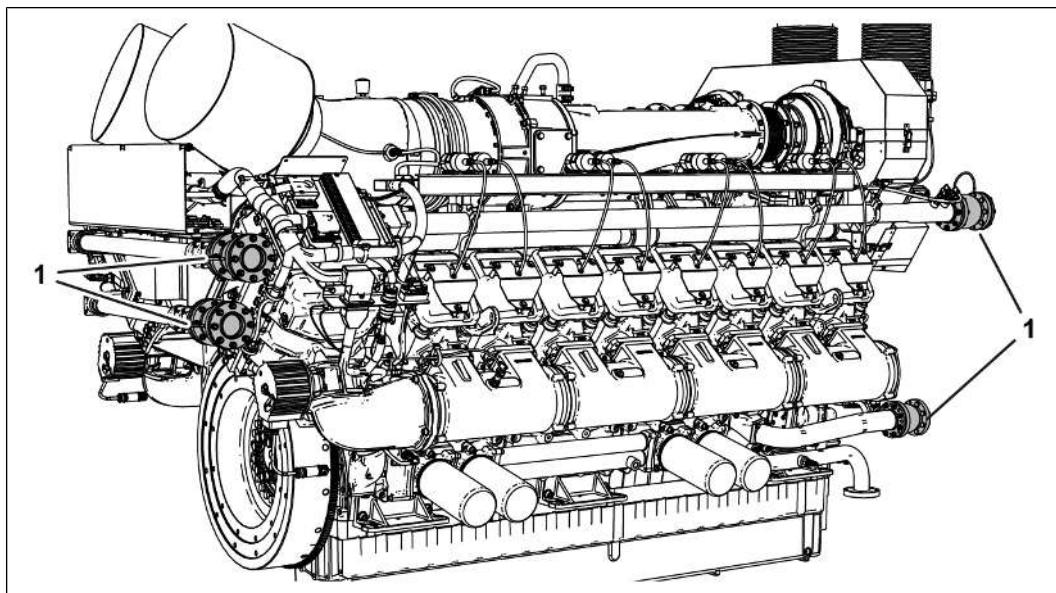
Risk of destruction of components

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.

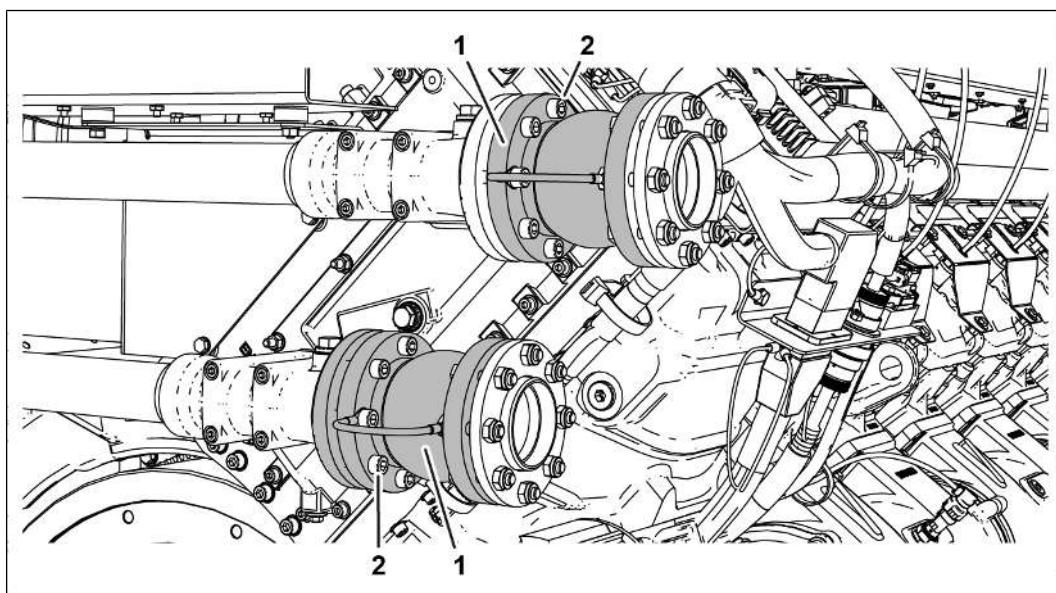
Checking the rubber expansion joint:

- ✓ Decommission the genset, see [Decommissioning/Genset Stopping the genset \[▶ 154\]](#)



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 \[▶ 311\]](#).
 - Visible defects are, for example, formation of bubbles, surface cracks or uneven deformation.



492137483

2. Clean the rubber bellows (1).
3. Check all screw connections (2) for tight fit.
 - Tighten screws while counteracting at the nuts if necessary.

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the rubber expansion joint

Removing rubber expansion joint

Valid for:

CG170, CG170B



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

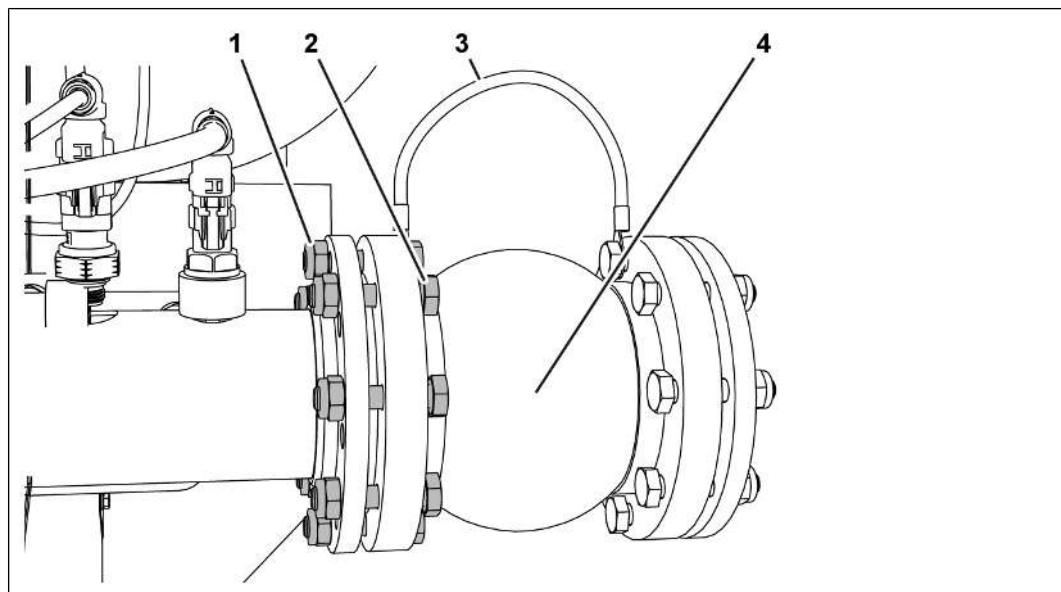
Incorrectly installed rubber expansion joints

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.

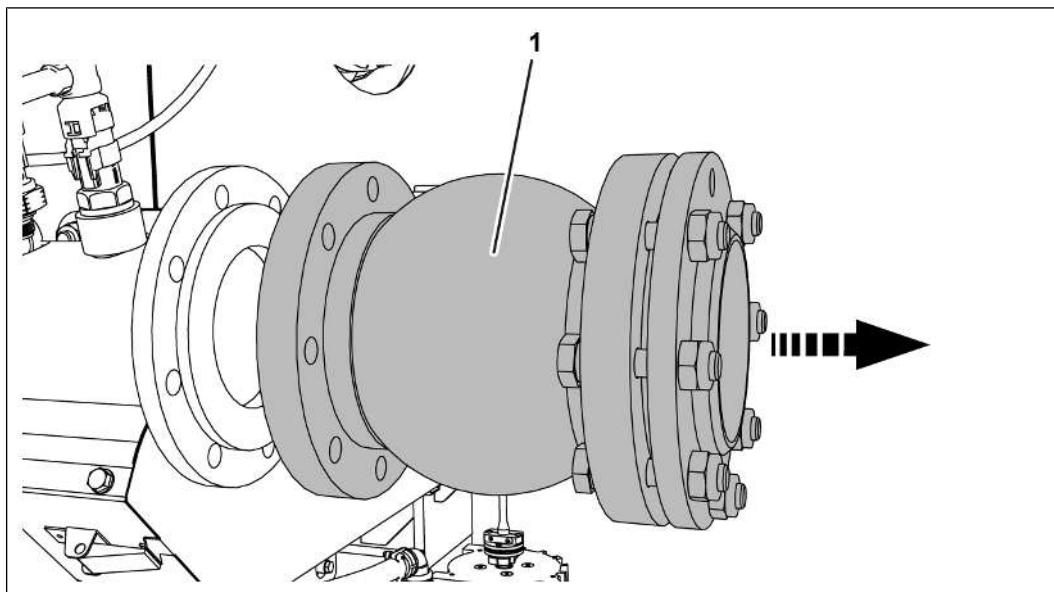
Removing rubber expansion joint:

- ✓ Empty the cooling system if necessary, see OL-MRA10 / 38-01-23 [Emptying the cooling system \[▶ 435\]](#).
- ✓ If necessary, pump out lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(genset\) \[▶ 337\]](#).



504257035

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:

CG170 (K), CG170, CG170B



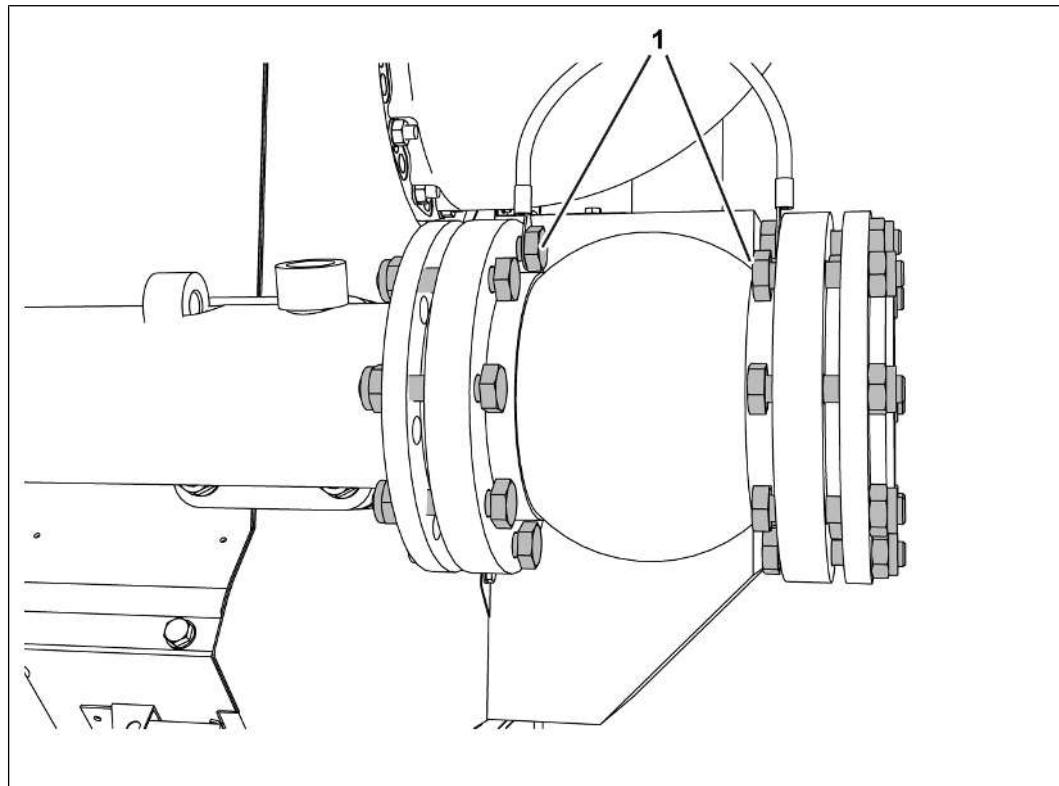
Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



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

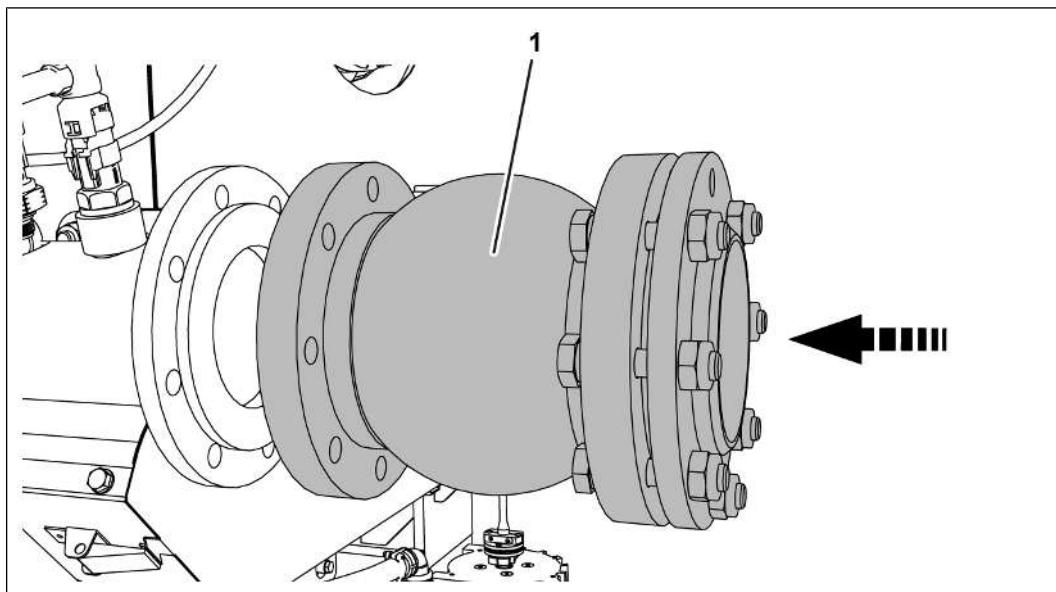
Risk of destruction of components

Due to incorrect tool handling.

- Hold the wrench on the bellows side and turn the wrench on the side of the counter flange.
-

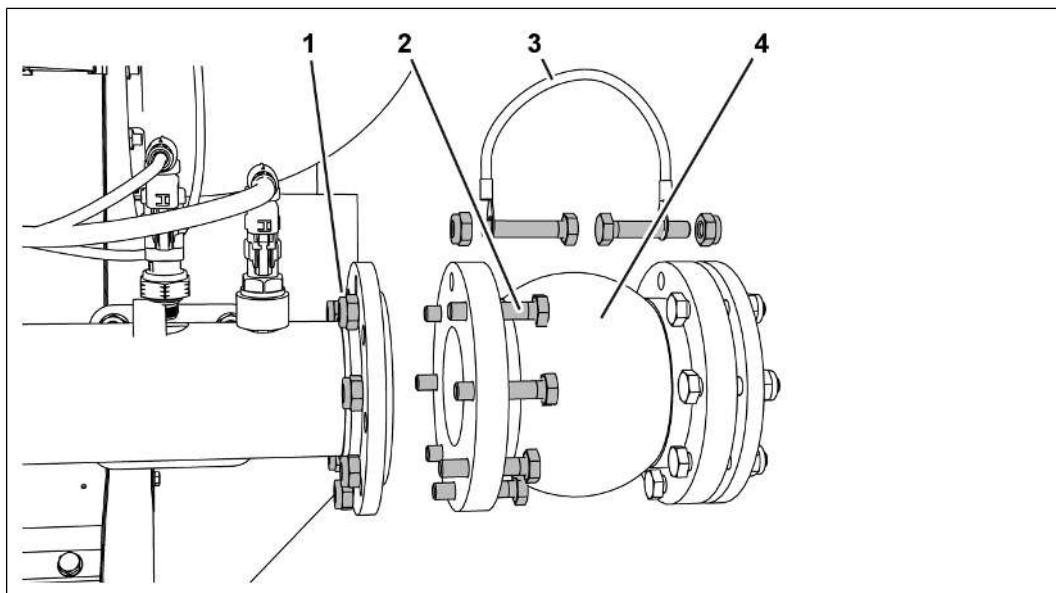
Installing rubber expansion joint:

1. Clean the sealing surface.
2. Check the component for damage and wear, see OL-MRA10 / 00-50-01 [Checking the rubber expansion joint \[▶ 307\]](#)



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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 \[▶ 441\]](#)

 - ⇒ If necessary, top up the lube oil, see OL-MRA10 / 02-01-22 [Performing lube oil change \(genset\) \[▶ 337\]](#)

Working with hexavalent chromium (Cr6)

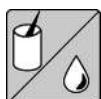
Valid for:

CG170, CG170 (K), CG170B



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**

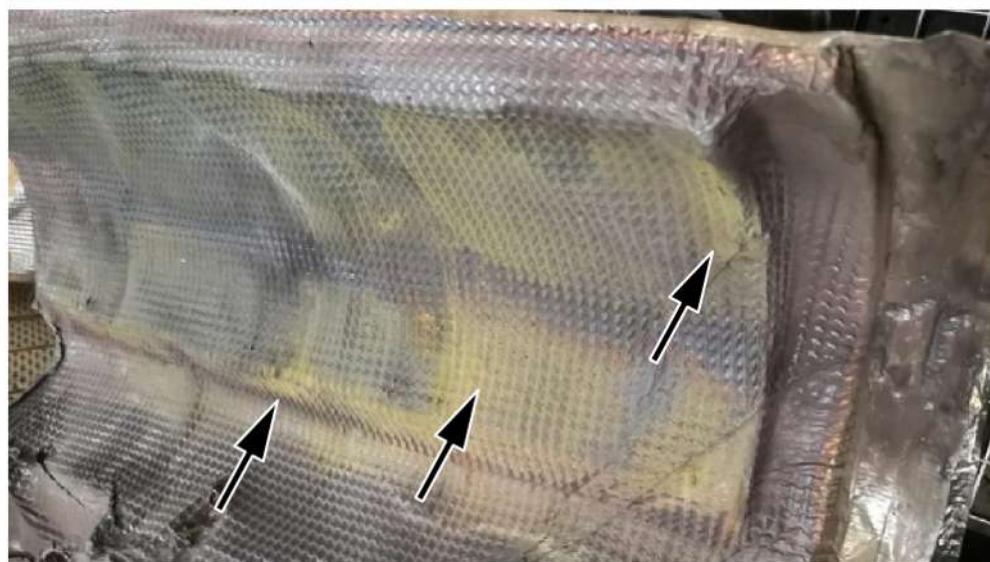
Injuries due to improper handling when working with components contaminated with hexavalent chromium (Cr6)

This can lead to minor or severe injuries.

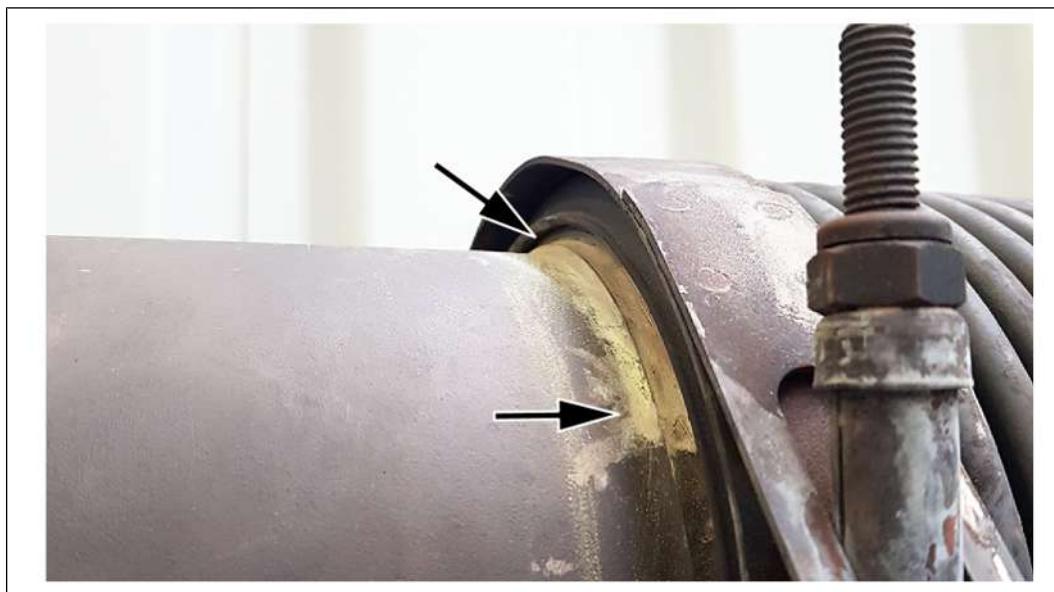
- Close off the working area for unauthorized persons.
- Wear personal protective equipment.
- Avoid contact with skin.
- Use a suitable tool for inserting and removing the components into and from the tank.
- Use a suitable tank.
- Treat residues and components according to national regulations.
- Take 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 \[▶ 154\]](#)



1057867531: Protective cover with yellow residue



1057869963: Exhaust system with yellow residue

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:

1057872395

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 Cat dealer.
 - 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 \[▶ 117\]](#)

Checking the crankcase chamber pressure

Valid for:

CG170B

Technical data

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

General information

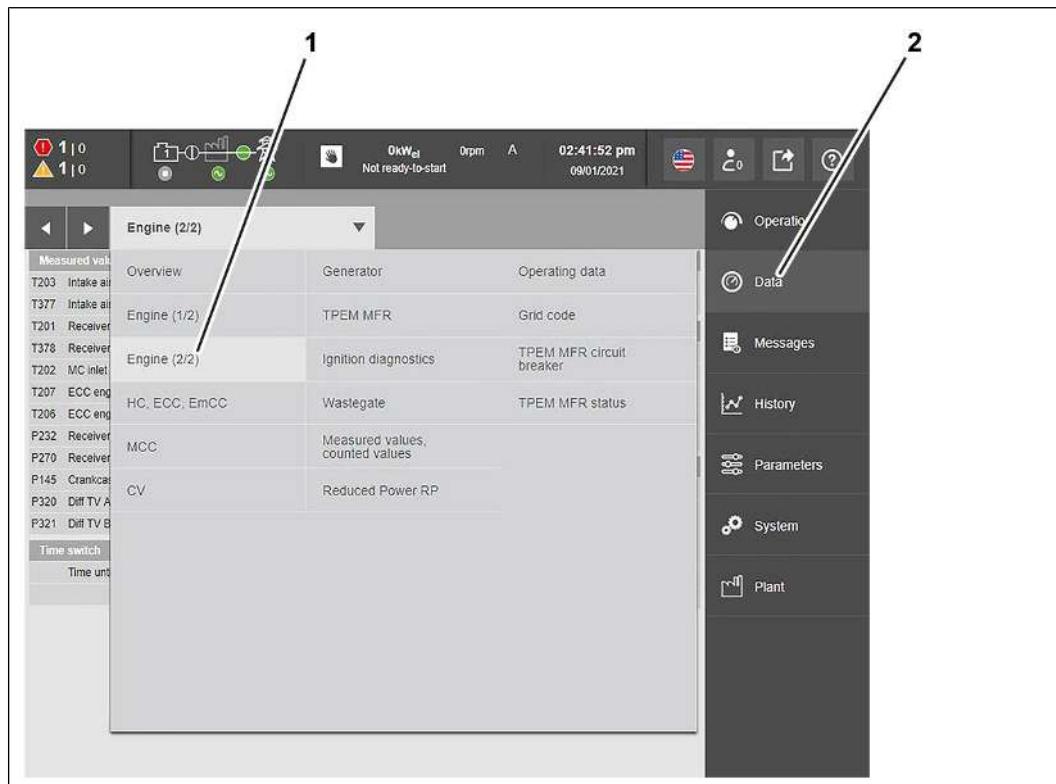


Risk of destruction of components

Risk of destruction of components

The engine can be destroyed due to incorrect crankcase chamber pressure.

- If the TPEM system shuts down the genset and displays the P145 Crankcase chamber fault message, do not restart the genset.
- Do not acknowledge the fault message.
- Contact Cat dealer.

Check the crankcase chamber pressure:

575355915

1. Tap the Data button (2) in the menu.
2. Tap the Engine 2/2 (1) group in the menu.
 - The Engine 2/2 (1) group opens.
3. In the menu, read the measured value (2) for the crankcase chamber pressure in parameter P145 crankcase chamber (1).
 - The displayed measured value is 0.00 mbar, service the crankcase ventilation; see
 - Above a measured value of -4 mbar, contact Cat dealer and service the gas pressure controller.

Servicing the crankcase ventilation (UPF model)

Valid for:

CG170B



Tools:

- Standard tools
- Measuring device for separating quality
- Bottle brush
- Hose for water column, if necessary
- Measuring device for blow-by quantity, if necessary
- Special tools
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



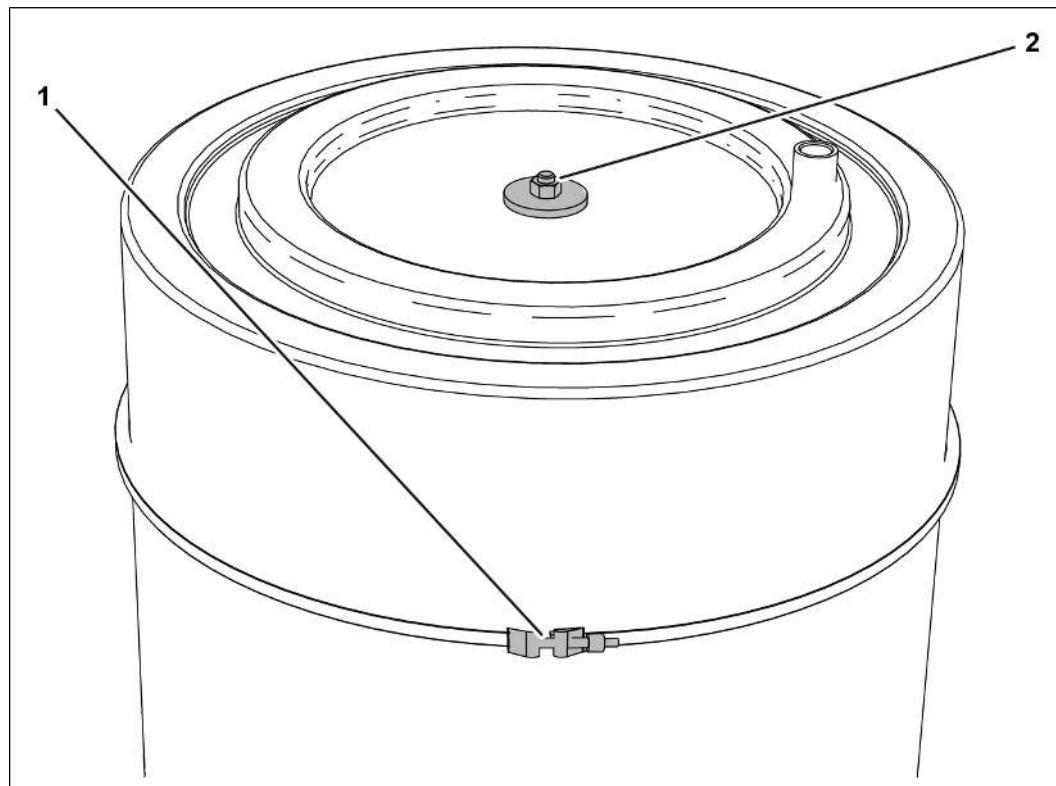
Auxiliary media:

- Acid-free grease
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Inner filter insert
- Outer filter insert
- Seals, if necessary

Technical data

969775371

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](#).

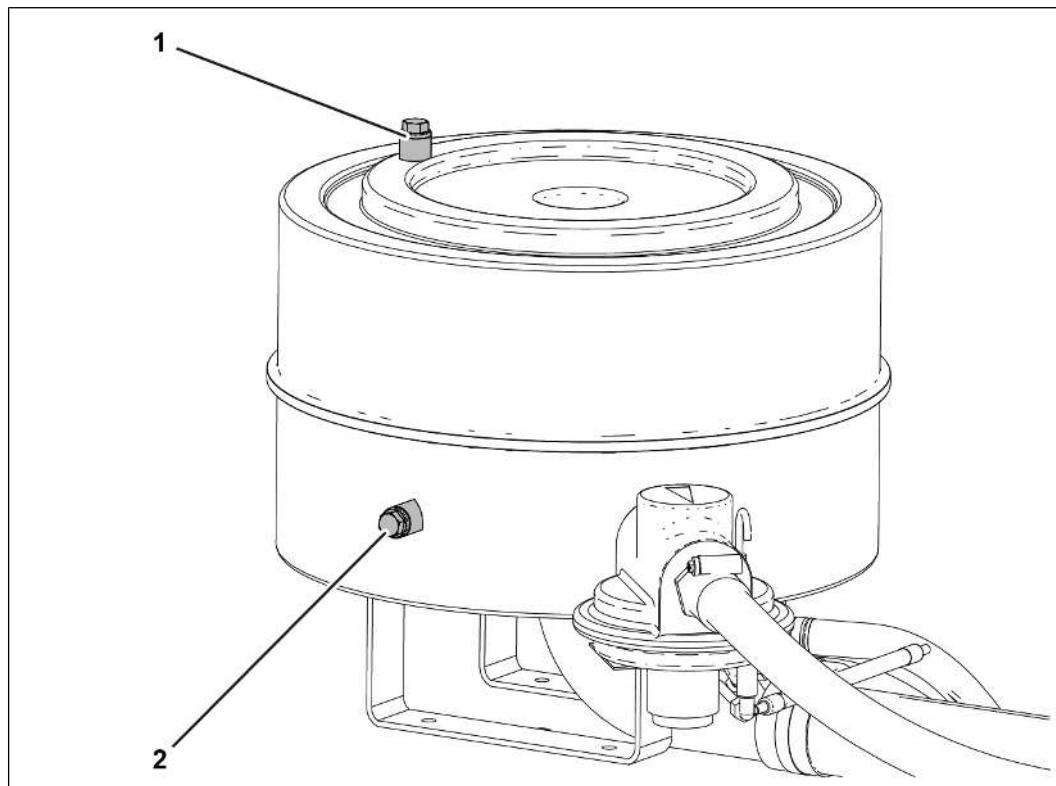


Danger to the environment

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:

3011842443

NOTE

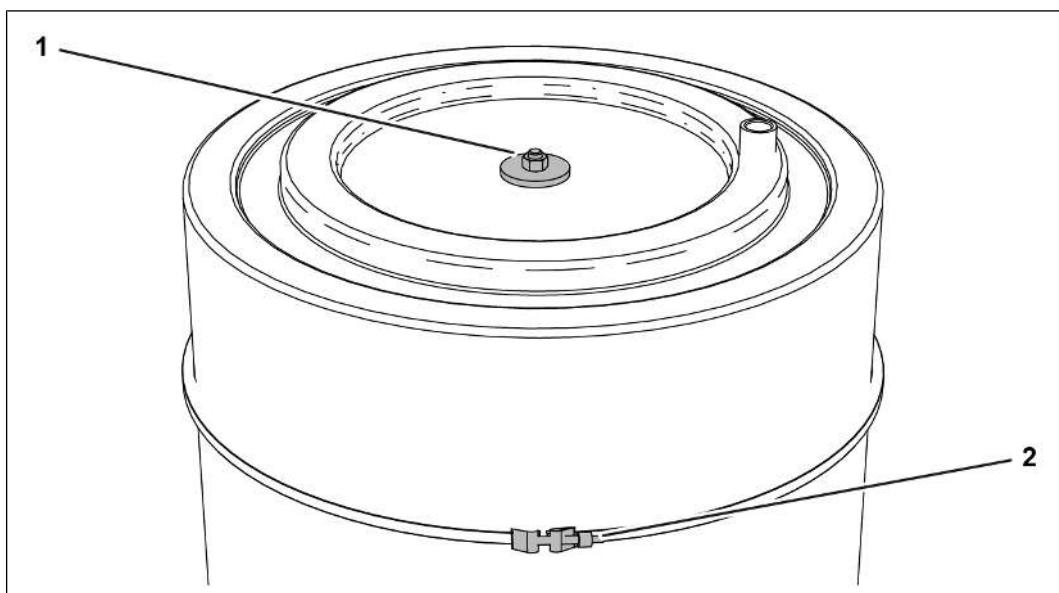
Incorrect measurement

Observe the manufacturer's instructions when handling the measuring device.

1. Measure the lube oil content using the measuring device 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 device 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, replace the filter insert.

Removing the filter inserts:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 154]



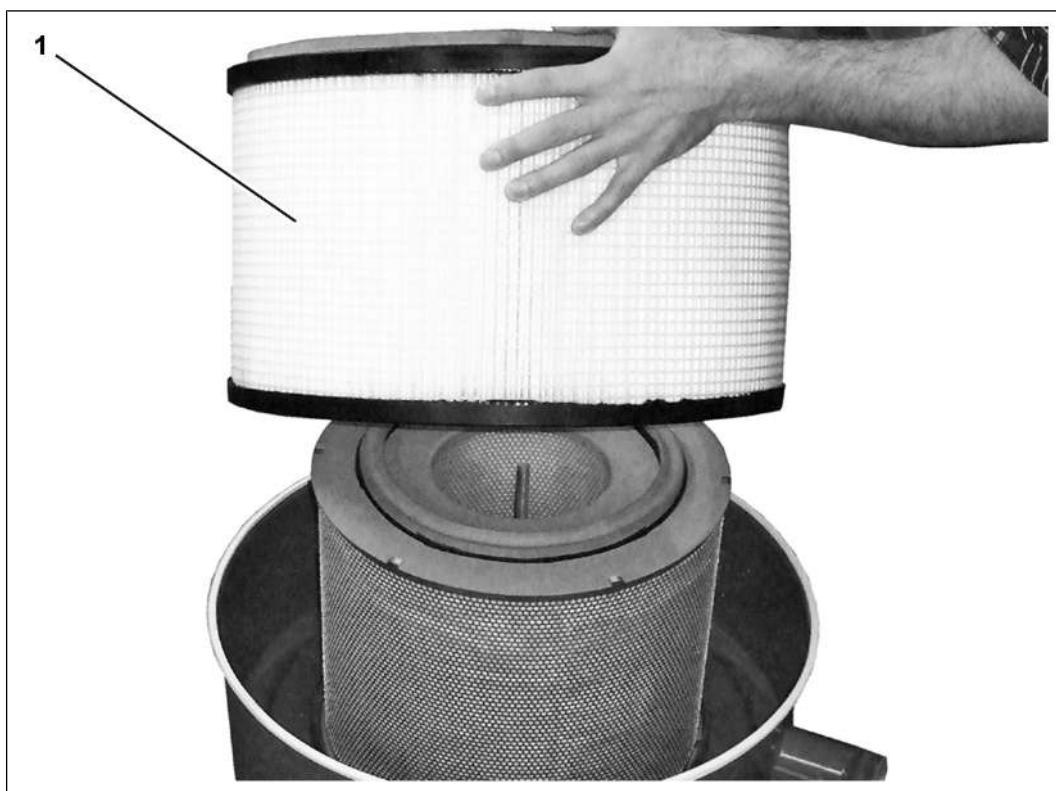
969743115

1. Unscrew nut (1).
2. Dismantle clamping clip.
 - Unscrew screw (2).
 - Unscrew the screw (2) on the opposite side.
 - Remove the clamping clip.



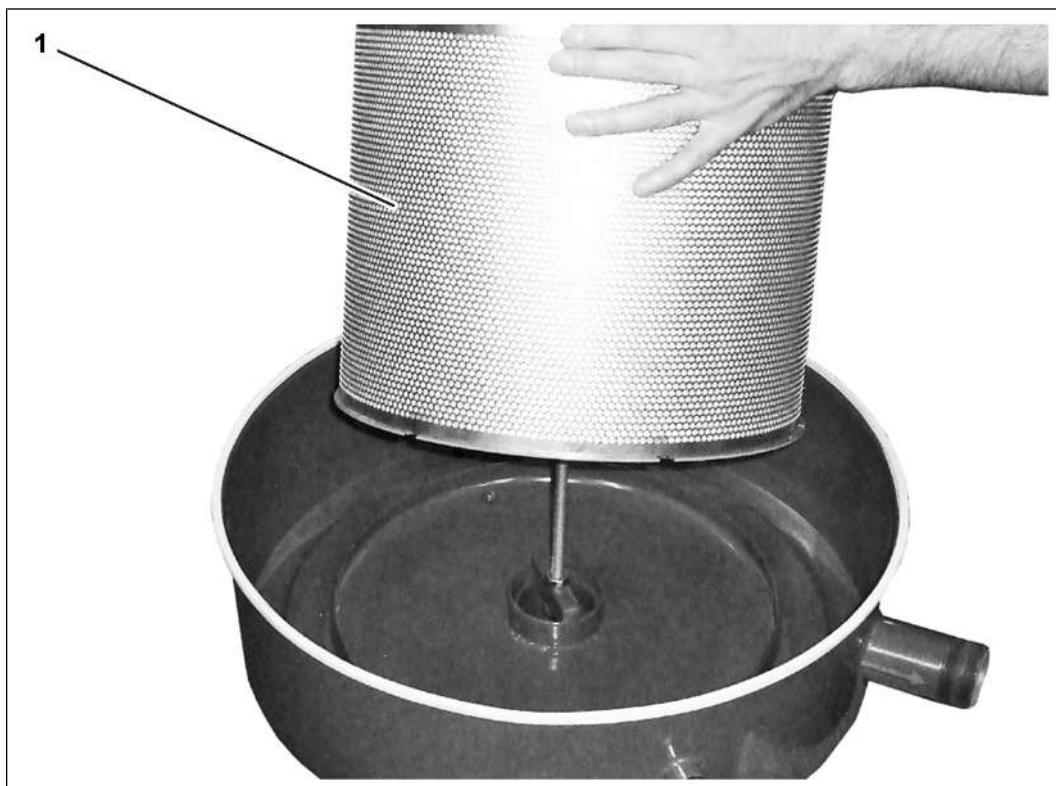
969745547

3. Remove cover (1).
 - Remove rubber seal (2).



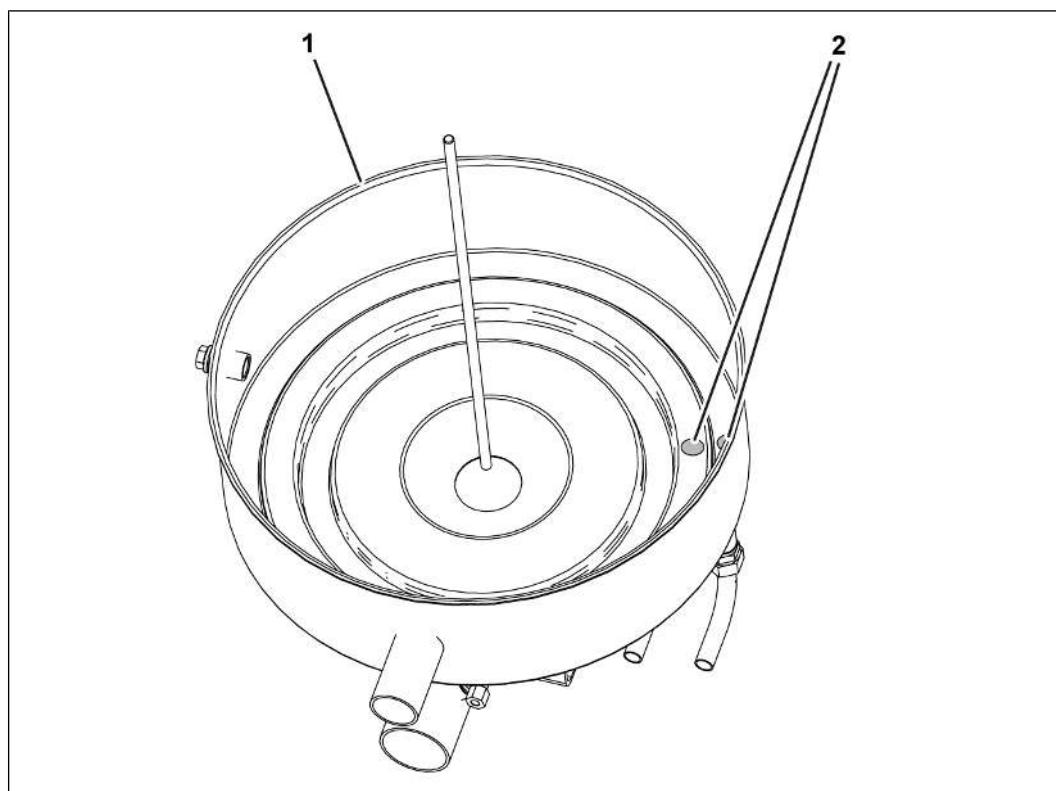
969747979

4. Remove outer filter insert (1).



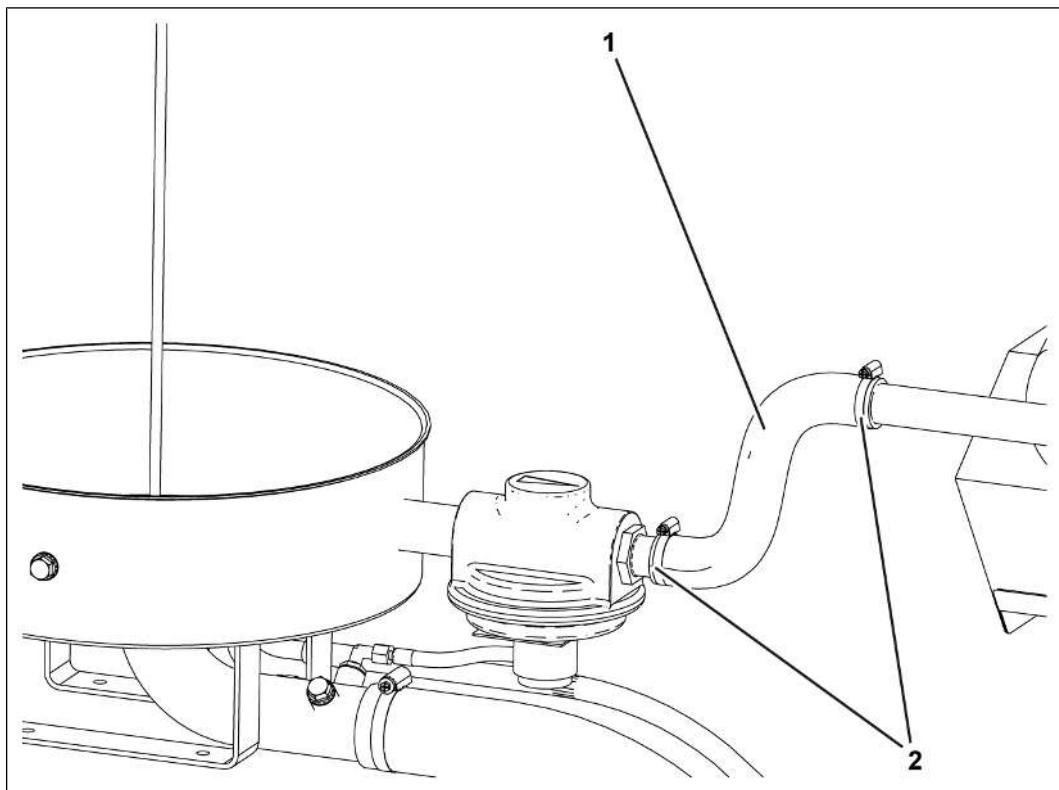
969750411

5. Remove inner filter insert (1).



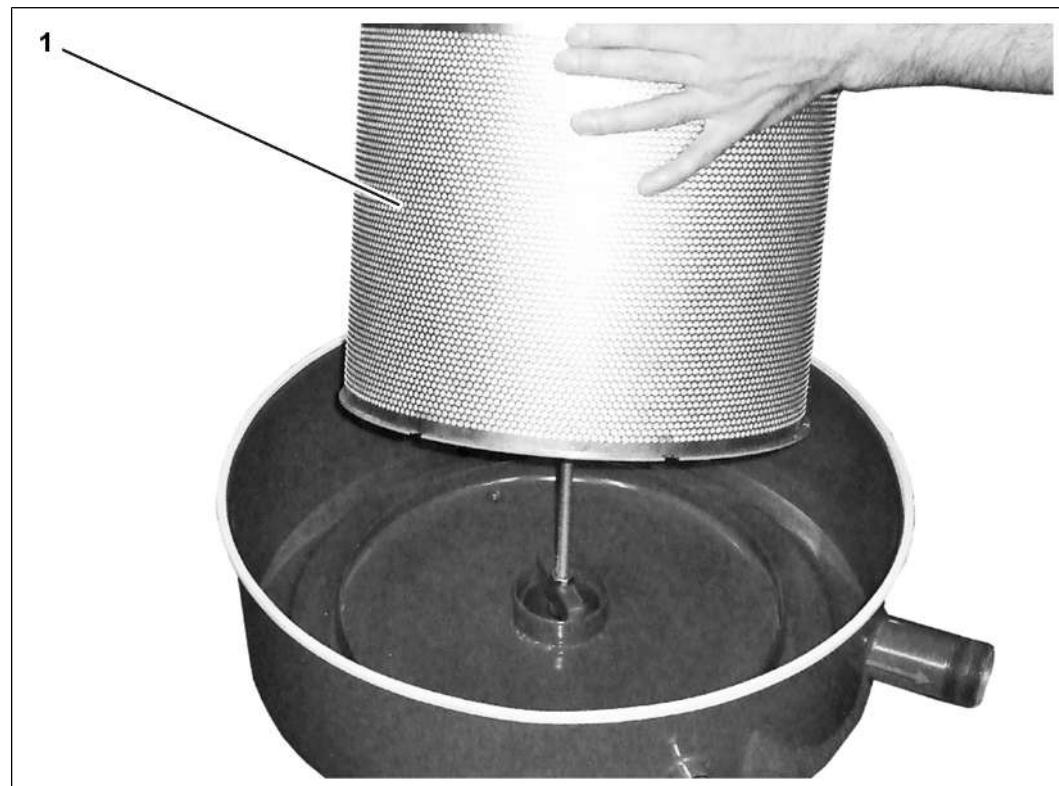
969765643

6. Check rubber seal (1) for damage.
 - Replace the rubber seal if necessary.
7. Clean the drain holes (2).
 - Ensure no dirt or cleaning liquid gets into the drain holes.



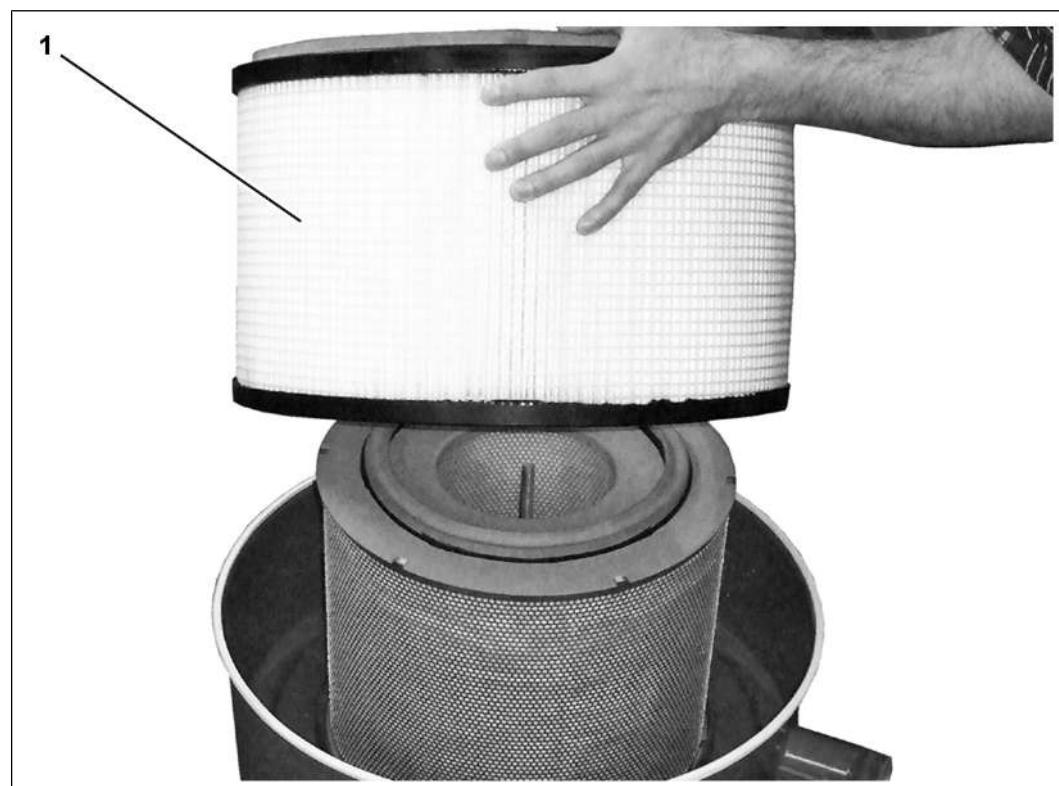
969768075

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 the hose (1) with a bottle brush.
 - Attach the hose (1) and fasten hose clamps (2).
 - Remove the collecting tray and properly dispose of collected operating medium.

Install filter inserts:

969750411

1. Insert inner filter insert (1).



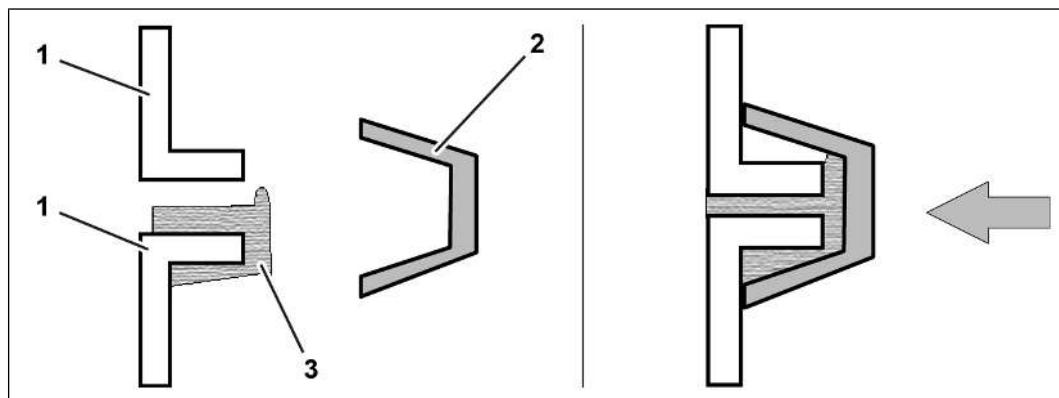
969747979

2. Insert outer filter insert (1).



969745547

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 (2).
6. Mount clamping clip.



969770507



Risk of destruction of components

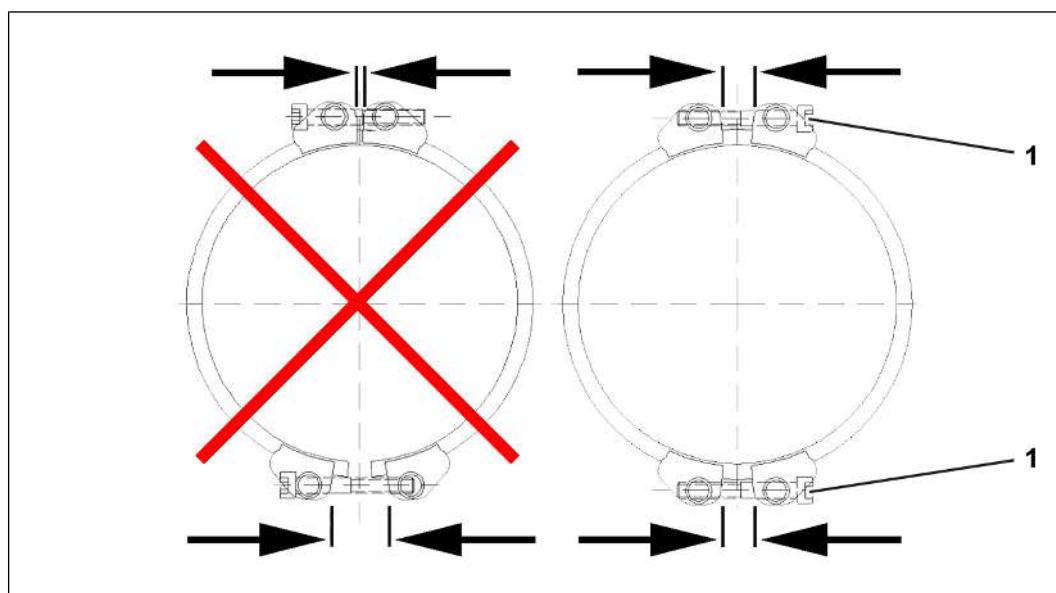
Improperly mounted clamping clip

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.

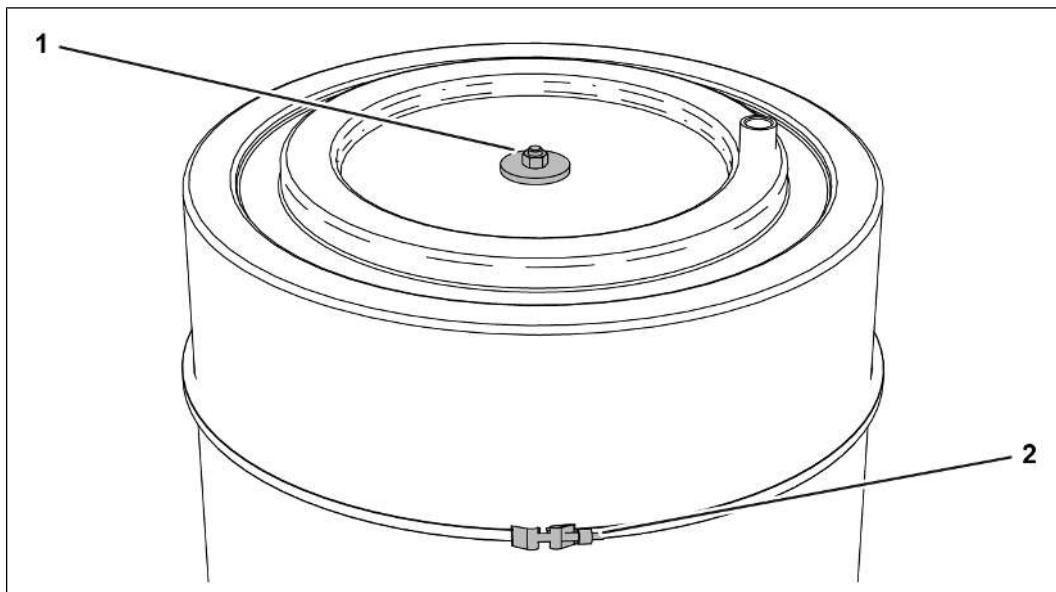
The underpressure filter does not work correctly and the UPF filter does not separate or only partially separates the lube oil.

- Ensure that the clamping clip encloses the rubber seal completely.



969772939

- 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.



969743115

- 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.
 - 9. Note the determined values (measured values) on the measurement sheet.
 - Document the maintenance and replacement of the filter elements.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset ▶ 117](#)

Performing lube oil change (genset)

Valid for:

CG170B

Tools:

- Standard tools

Auxiliary media:

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

Spare parts:

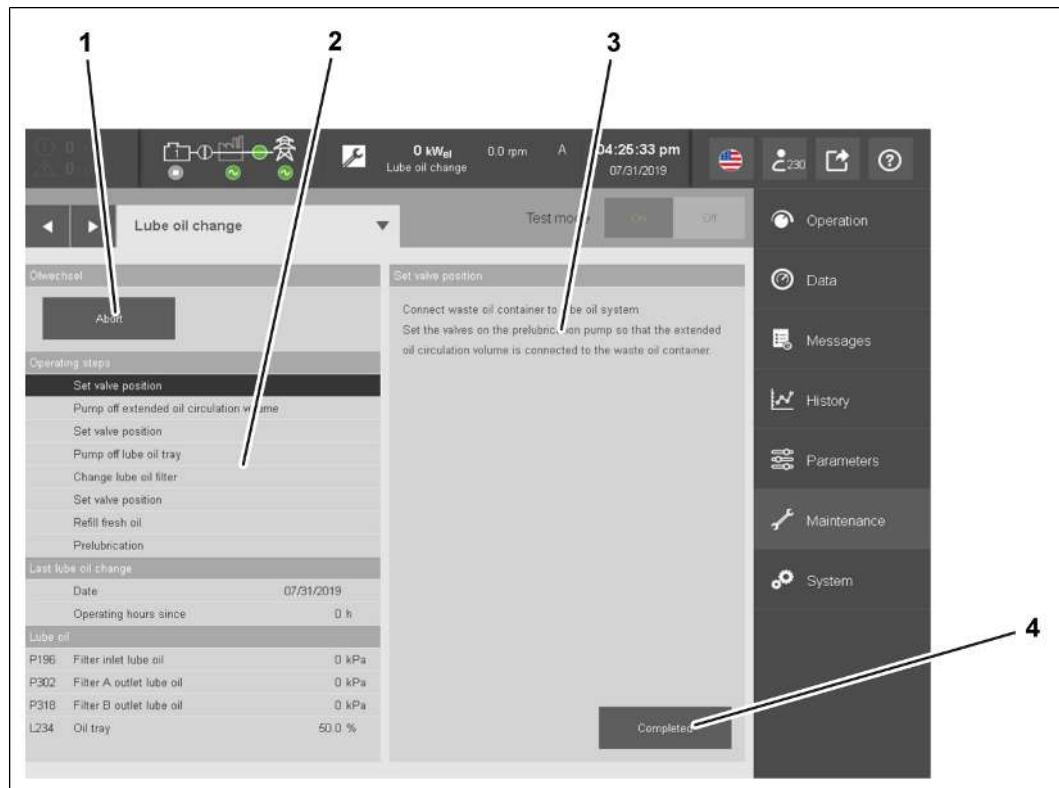
- Lube oil
 - See Service Library, Technical Bulletin ([TR 2105](#)), [Specification for lube oil](#).

Technical data

Pumping out time for base frame	
V12 genset	Approx. 14 minutes (840 s)
V16 genset	Approx. 19.5 minutes (1170 s)
V20 genset	Approx. 19.5 minutes (1170 s)
Pumping out time when the lube oil sump is full	
V12 genset	Approx. 6 minutes (350 s)
V16 genset	Approx. 7.5 minutes (450 s)
V20 genset	Approx. 8.5 minutes (520 s)

General information

Process for the lube oil change



9007200260421899

- The operating steps for the lube oil change are listed in the Lube oil change start mask (2). The current operating step is briefly described in the dialog area (3). When an operating step is completed, you must acknowledge this operating step in the dialog area with the Completed (4) button.
- The lube oil change can be interrupted at any time using the Abort (1) button.
- If the pumping out of lube oil is started, the lube oil change must be performed completely.

The requirements for the lube oil change are:

- The lube oil temperature for draining the lube oil is at least 60 °C.
- No fault messages and no warning messages on the control are signaled regarding the lube oil change.
- The auxiliary drive test function is deactivated on the control, see [Performing the auxiliary drive test \(TPEM\) \[▶ 205\]](#).
- The MANUAL operation mode is set on the genset.
- The parameter 20105776 Oil reservoir automatic refill is activated.
- The parameter 20130189 Automatic Fresh oil refill is activated.



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.



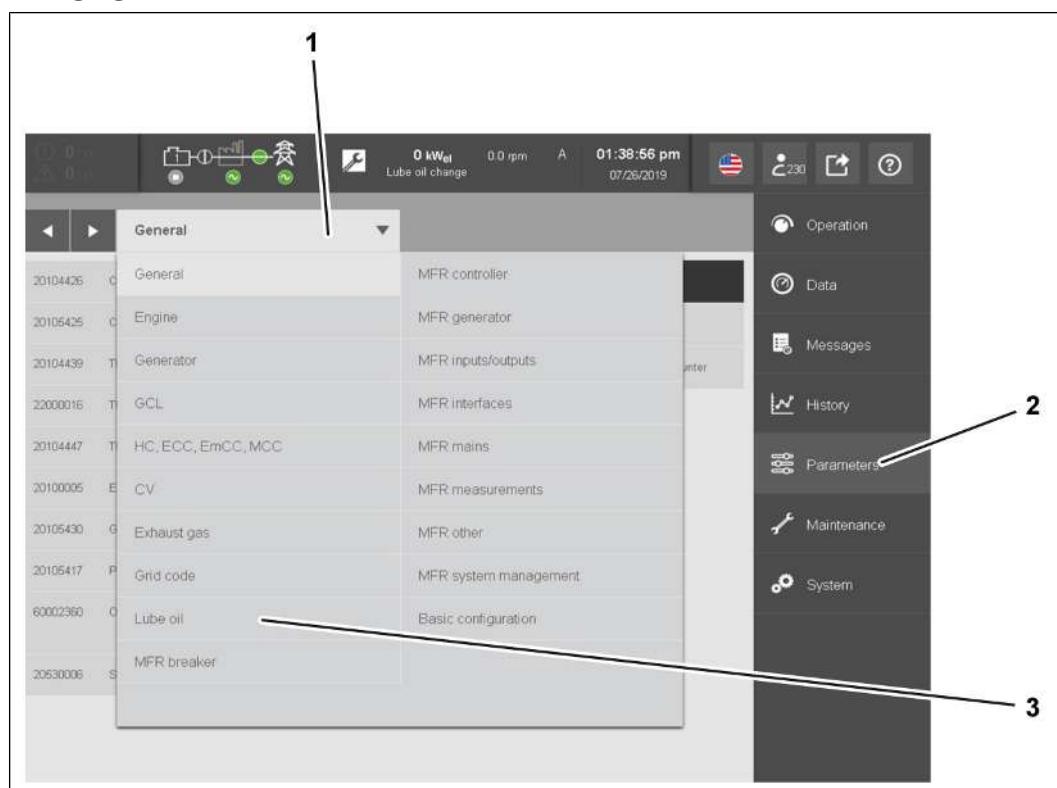
Risk of destruction of components

The prelubrication pump can run dry

Damage to or destruction of the prelubrication pump

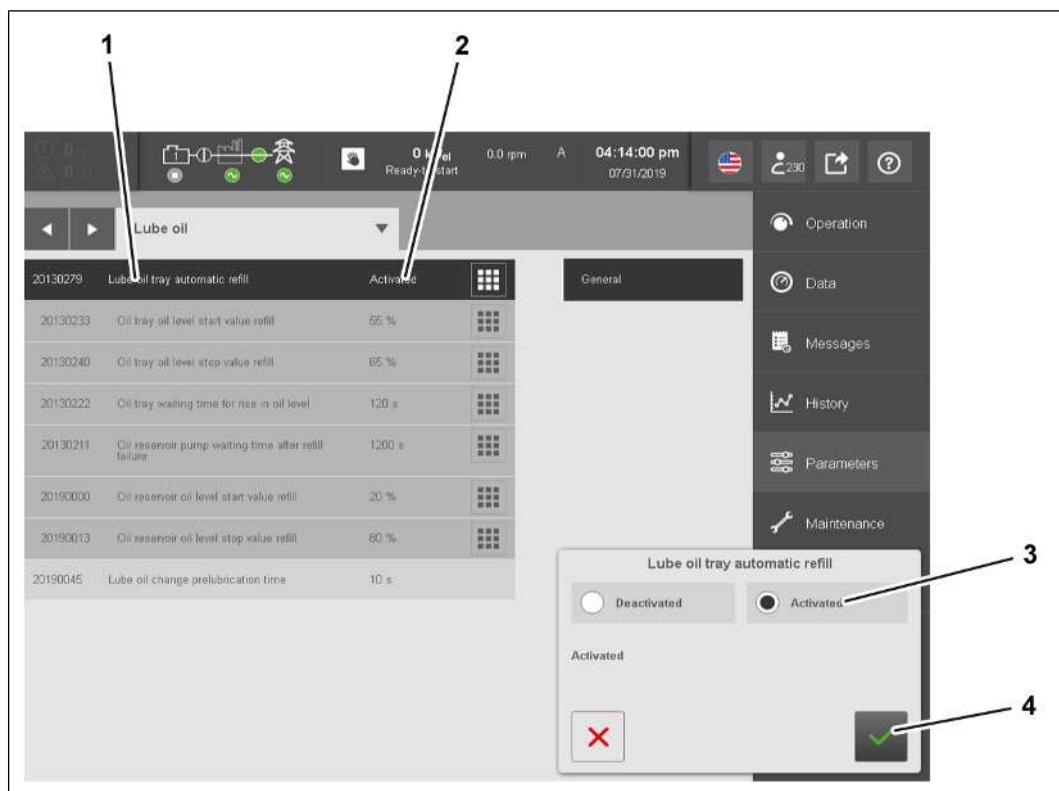
- Do not leave the genset unattended when performing a lube oil change.
- Stop the prelubrication pump immediately if it runs dry.

Changing the lube oil:



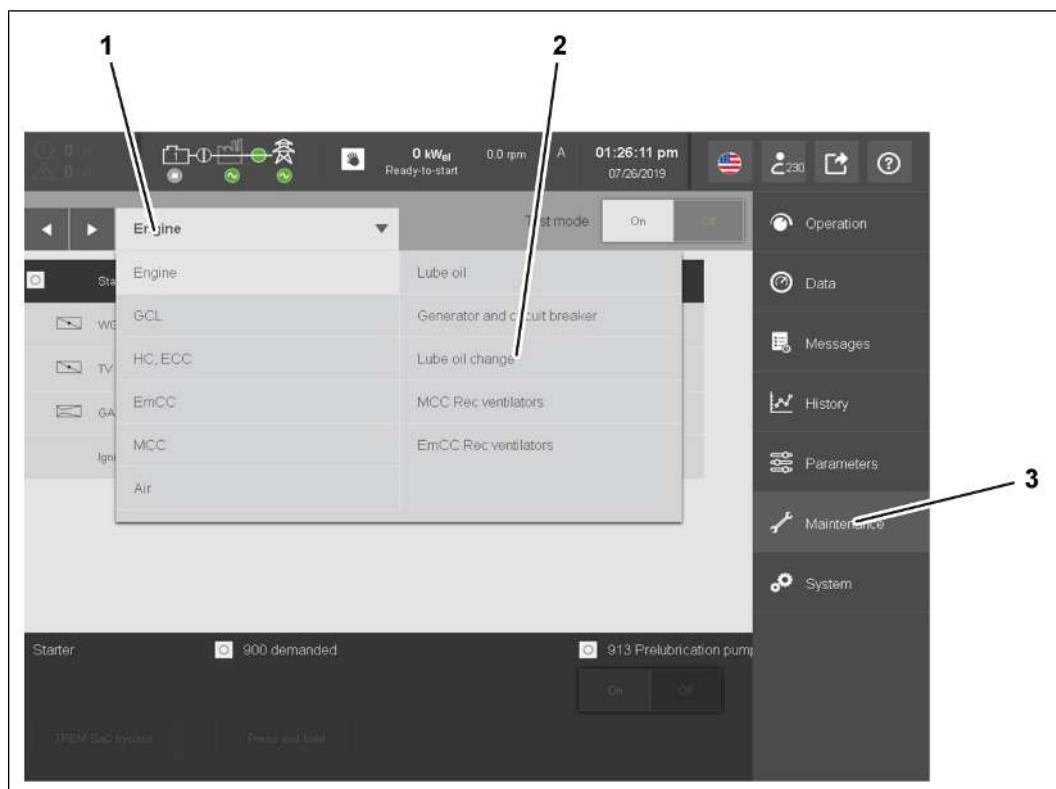
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1. Activate the parameter 20105776 Oil reservoir automatic refill.
 - Tap the Parameter (2) button.
 - Tap Parameter (1) line Lube oil (3) in the pull-down menu.



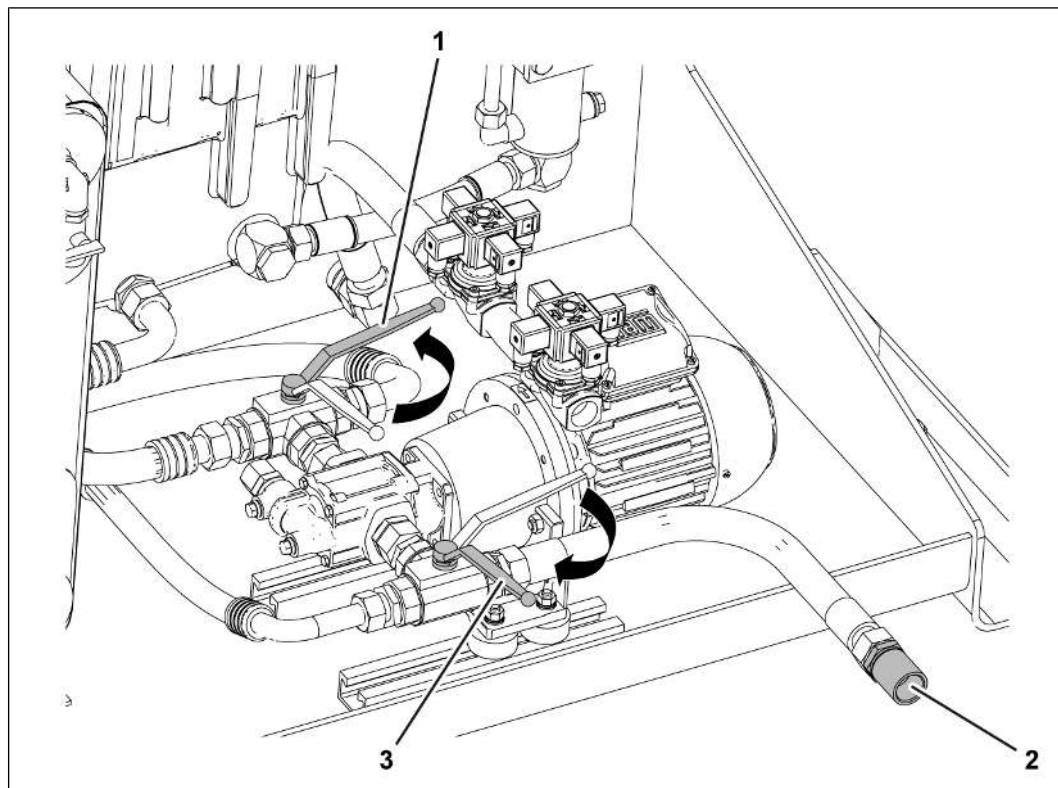
9007200260426763

- Tap the 20130279 Lube oil sump automatic refill (1) line.
- In the input mask Automatic refill, tap the Activated (3) button.
- Confirm entry with the Accept input (4) button.
- The specification Activated (2) appears in the 20130279 Lube oil sump automatic refill (1) line.



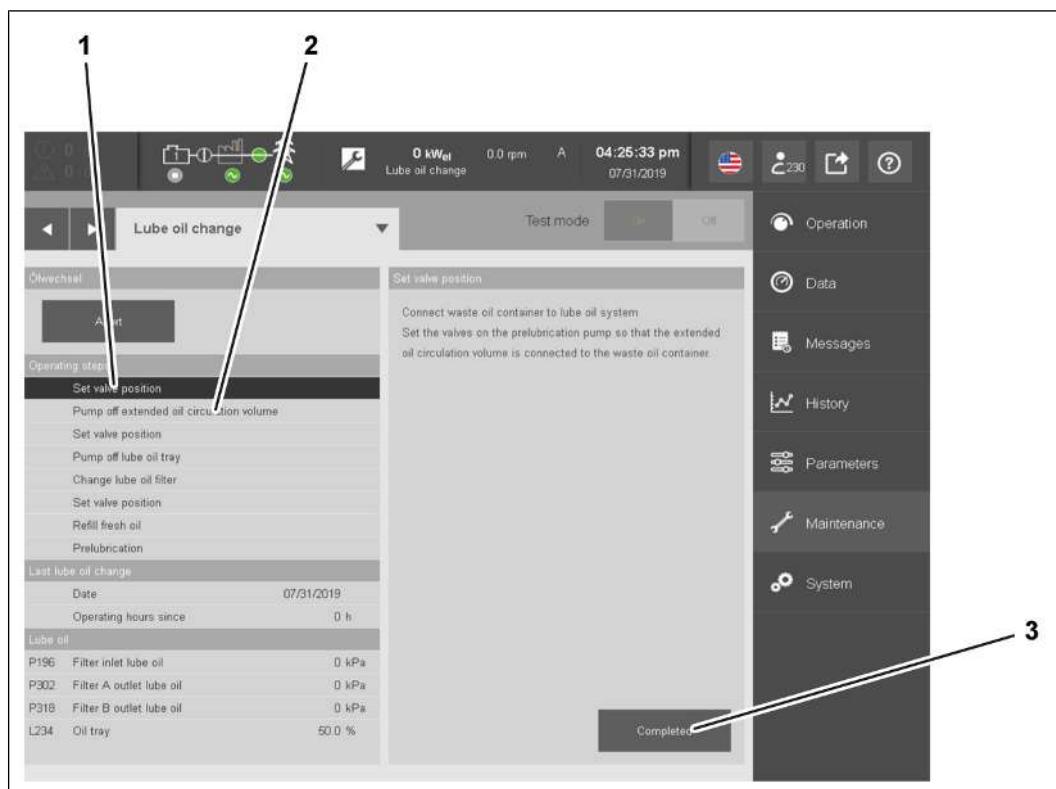
1005688203

2. Start the Lube oil change functional group.
 - Tap the Service (3) button,
 - Tap the Lube oil change (2) line in the Engine (1) pull-down menu.
3. Pump the lube oil out of the lube oil tank in the base frame.
 - Tap the Start (1) button and activate Lube oil change.



1005690635

- Connect the lube oil outlet hose (2) to the prelubrication pump and tighten the union nut.
- Turn the ball valve (3) forward.
- Turn the ball valve (1) backward.
- Open the ball valve in the supply to the lube oil tank in the base frame.



1005693067

NOTE

Start pumping the extended oil circulation volume out into the lube oil tank for old lube oil.

The system stops pumping automatically after the preset time has elapsed.

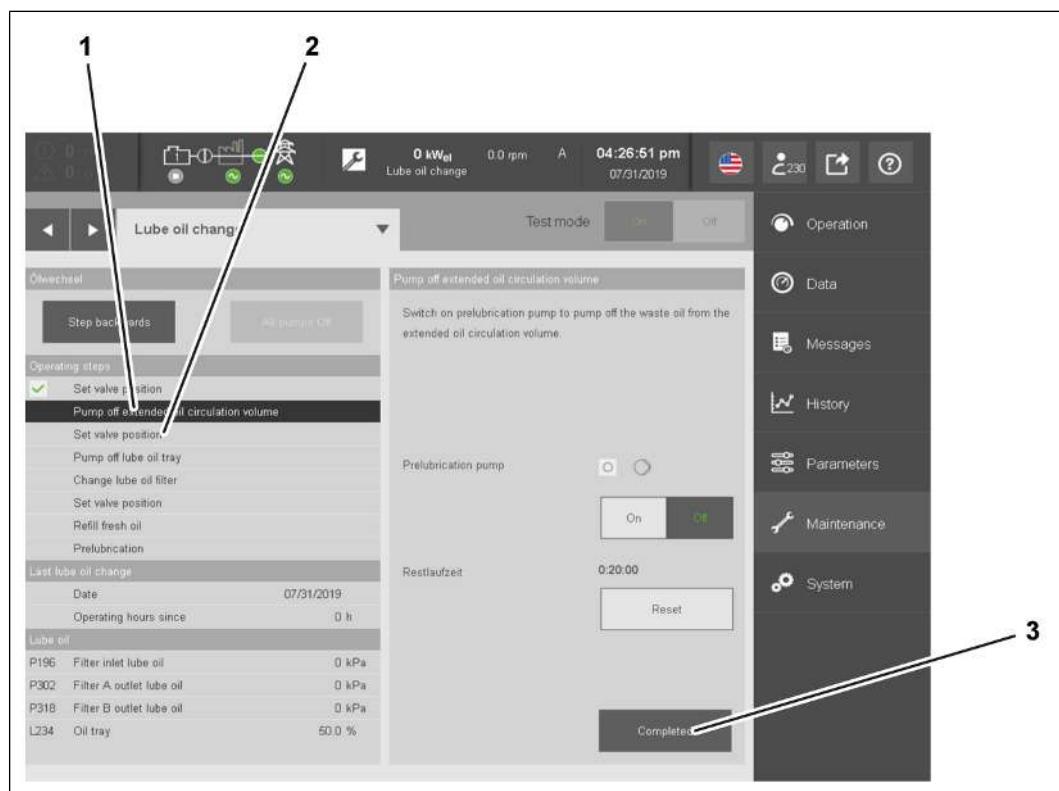
The pumping out time corresponds to the extended lube oil volume, see the technical data.

- The lube oil is pumped out of the extended lube oil volume into the lube oil tank for old lube oil.
 - Tap the ON (3) button.
 - A green dot (2) lights up in the dialog area.
 - To stop prelubrication pump manually, tap the All pumps Off (1) button or Off (4) button.
 - The green dot (2) disappears from the dialog area.
 - The residual running time (5) is shown in the dialog area.
 - To continue pumping out, tap the On (3) button.
 - A green dot (2) appears in the dialog area.
 - The residual running time (5) is continued.

NOTE

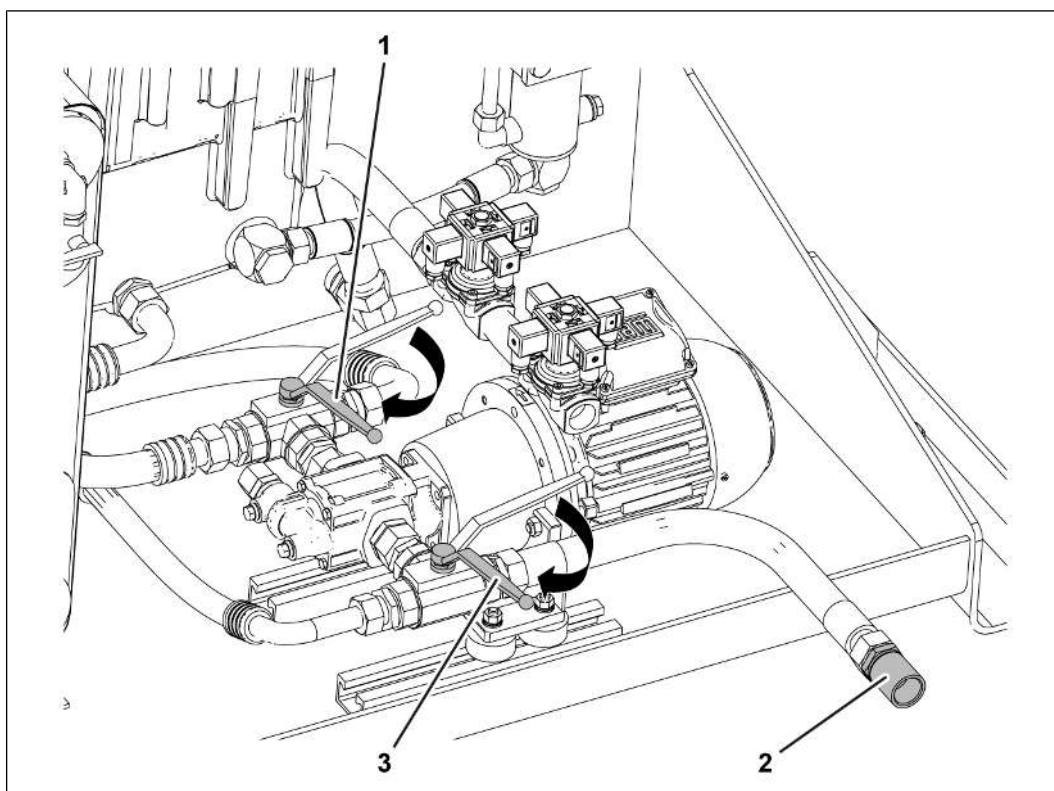
Reset the residual running time

To reset the residual running time, tap the Reset (6) button.



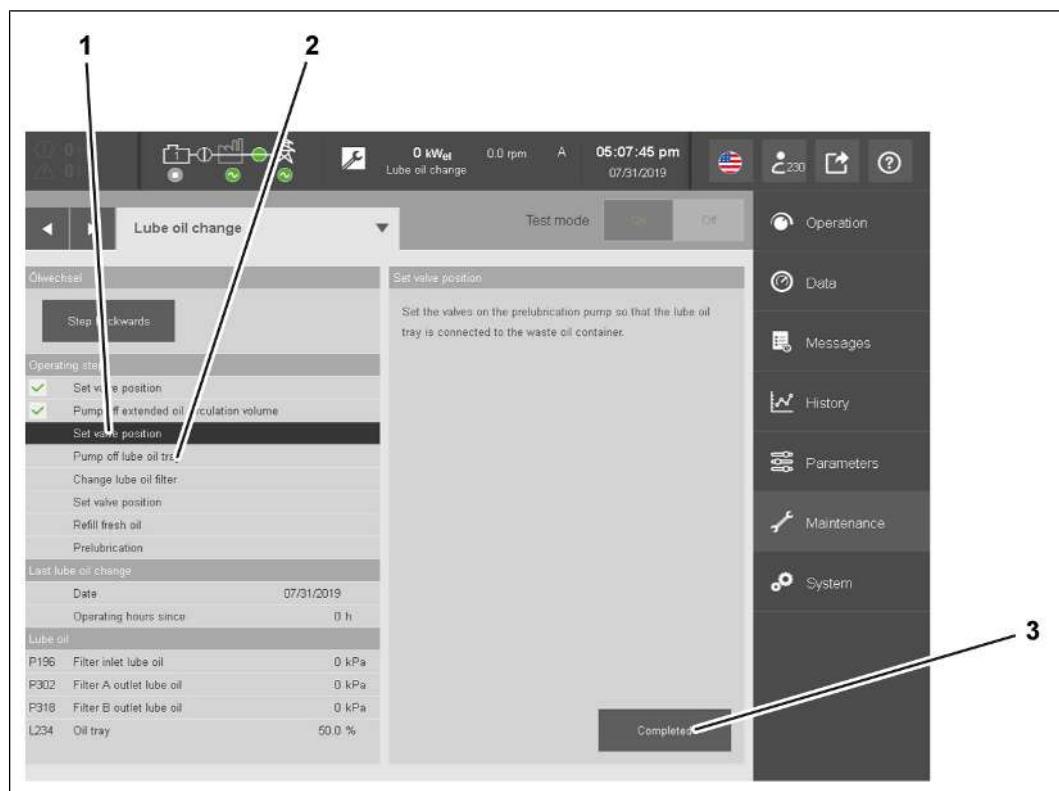
1005759499

- Tap the Completed (3) button to confirm pumping out the expanded circulating oil volume.
 - The operating step Pump off extended oil circulation volume (1) is completed.
 - The operating step Set valve position (2) is activated.
4. Pump off old lube oil out of the lube oil sump.



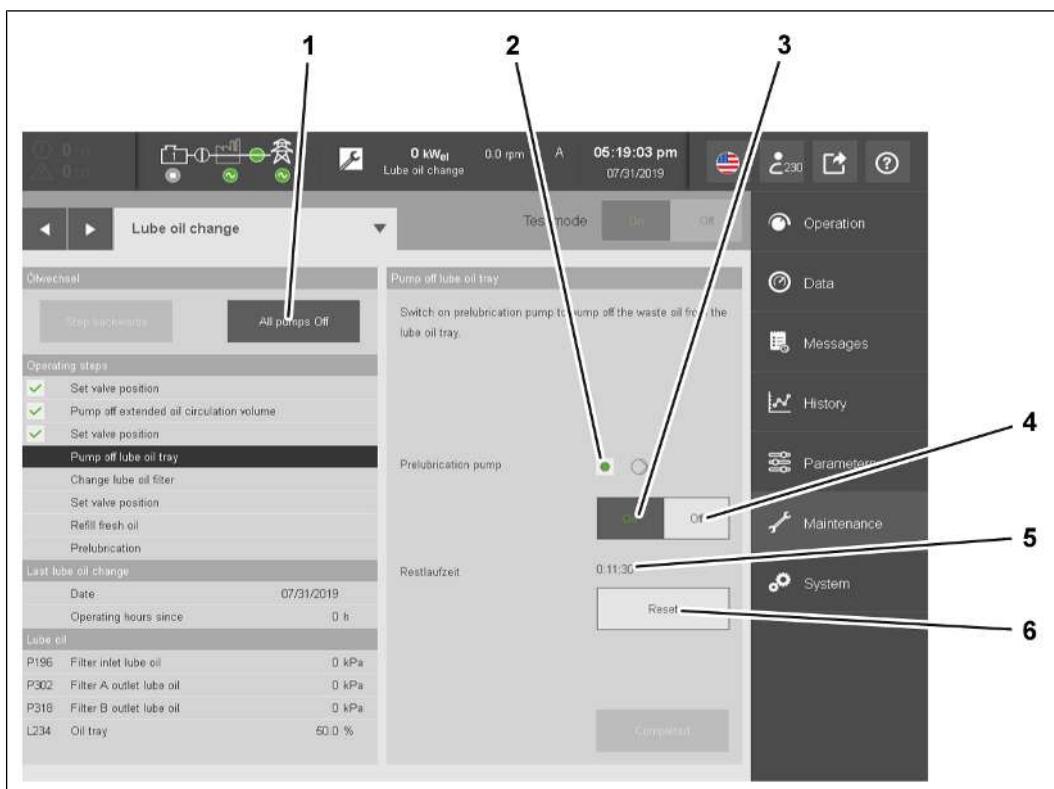
1005761931

- Connect the lube oil outlet hose (2) to the prelubrication pump and tighten the union nut.
- Turn the ball valve (3) forward.
- Turn the ball valve (1) forward.
- Close the ball valve in the supply to the lube oil tank in the base frame.



1005764363

- Tap the Completed (3) button to confirm setting of valve positions.
- The operating step Set valve position (1) is completed.
- The operating step Pump off lube oil sump (2) is activated.



1005766795

- Tap the ON (3) button.
- A green dot (2) lights up in the dialog area.
- The residual running time (5) is shown in the dialog area.

NOTE

Start pumping the extended oil circulation volume out into the lube oil tank for old lube oil.

The system stops pumping automatically after the preset time has elapsed.

The pumping out time corresponds to the extended lube oil volume of the lube oil sump, see the technical data.

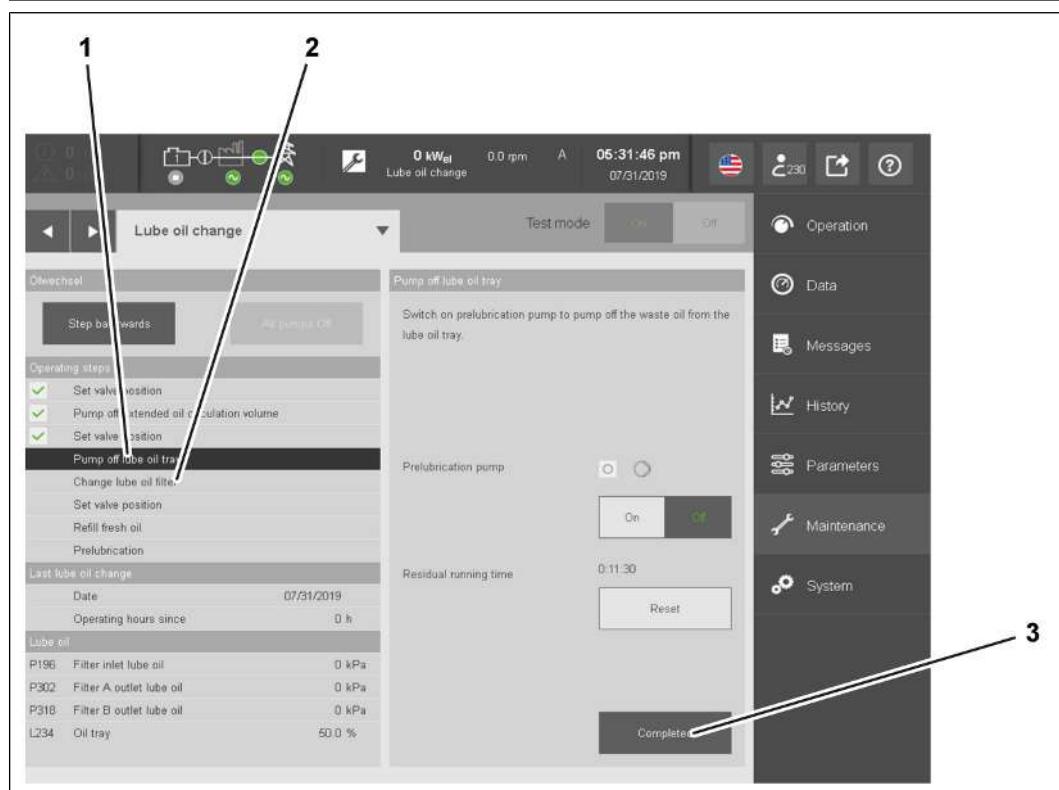
- If the lube oil volume is lower, stop pumping out manually.
 - The lube oil is pumped out of the extended lube oil volume into the lube oil tank for old lube oil.
-
- To stop prelubrication pump manually, tap the All pumps Off (1) button or Off (4) button.
 - The green dot (2) disappears from the dialog area.
 - The residual running time (5) is shown in the dialog area.
 - To continue pumping out, tap the On (3) button.
 - A green dot (2) appears in the dialog area.

- The residual running time (5) is continued.

NOTE

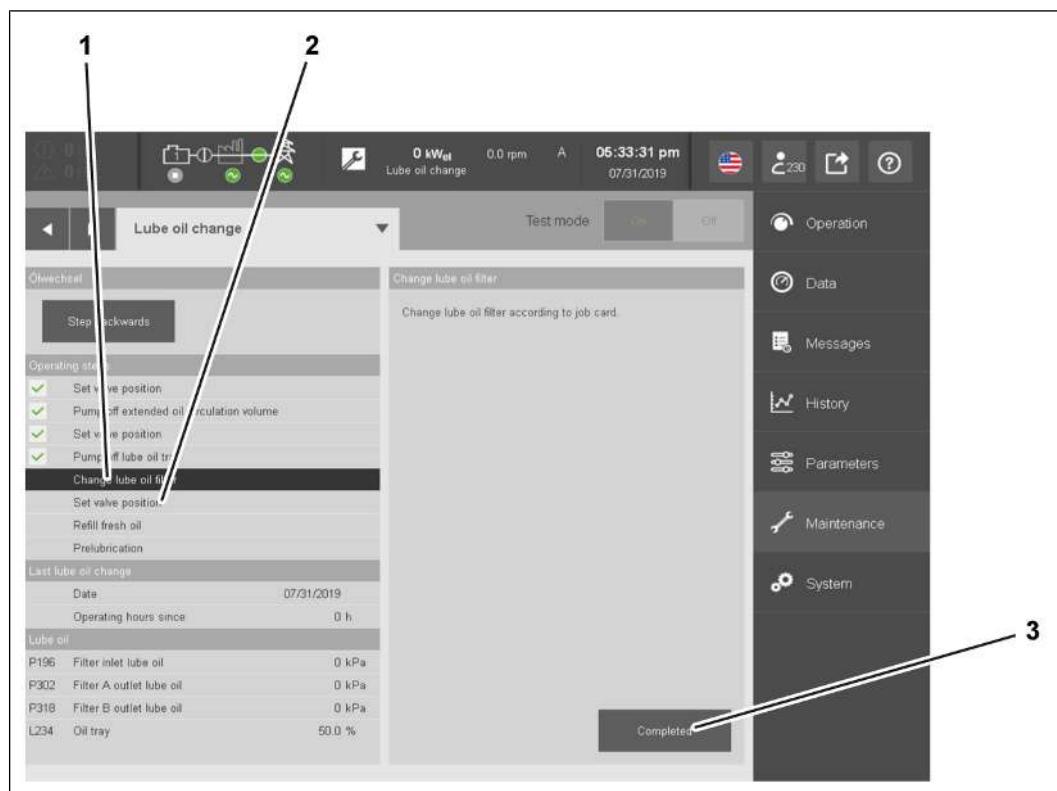
Reset the residual running time

To reset the residual running time, tap the Reset (6) button.



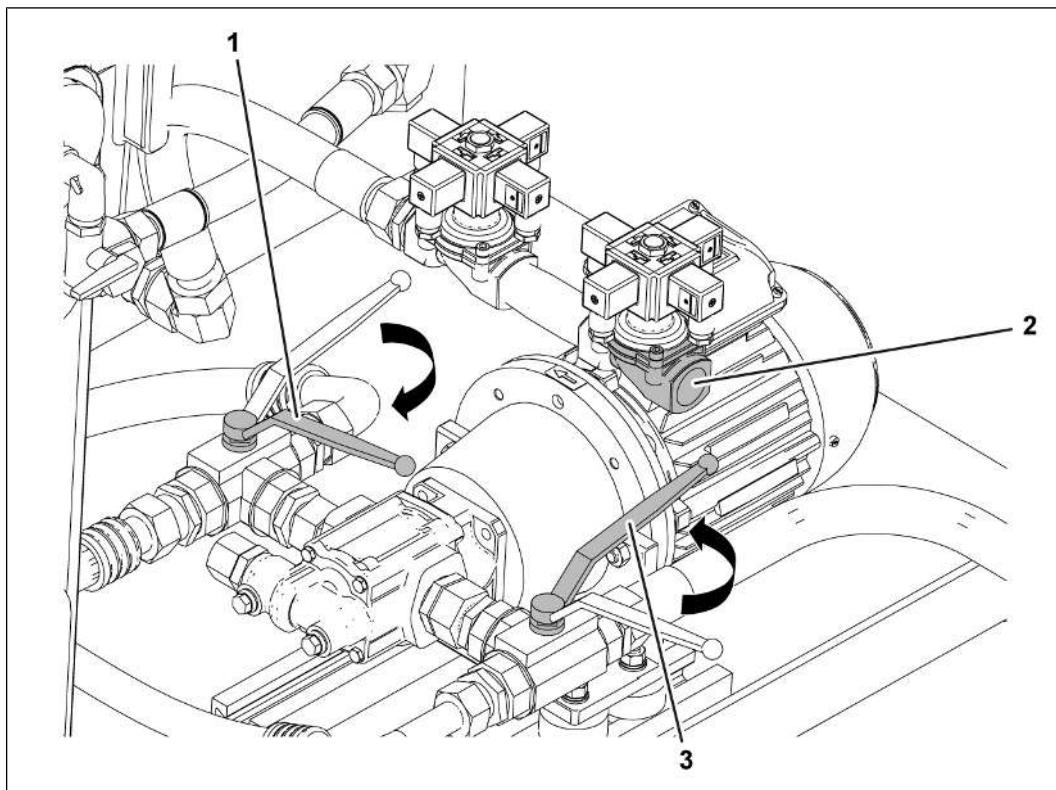
1005862539

- Tap the Completed (3) button to confirm pumping out of the lube oil sump.
 - The operating step Pump off lube oil sump (1) is completed.
 - The operating step Change lube oil filter (2) is activated.
5. Change the lube oil filter.
 - Change the lube oil filter, see OL-MRA10 / 15-10-10 [Removing and installing the lube oil filter \[▶ 403\]](#).



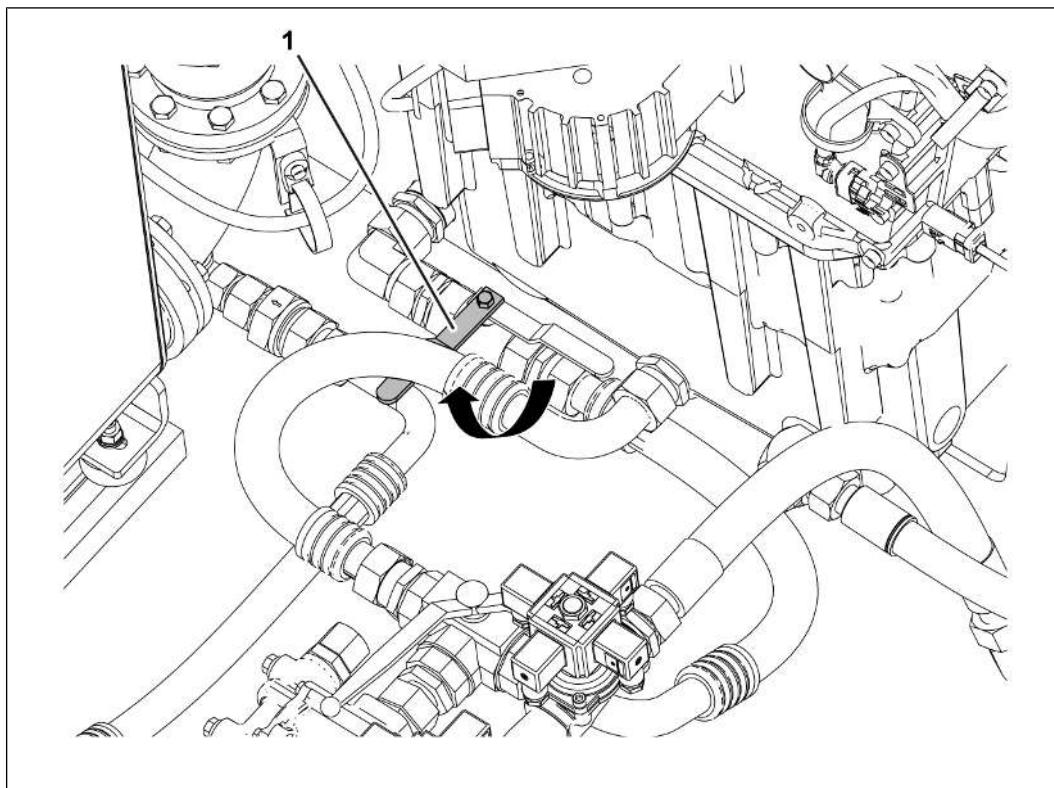
1005864971

- Tap the Completed (3) button to confirm the lube oil filter change.
 - The operating step Change lube oil filter (1) is completed.
 - The operating step Set valve position (2) is activated.
6. Fill the lube oil tank and lube oil sump.



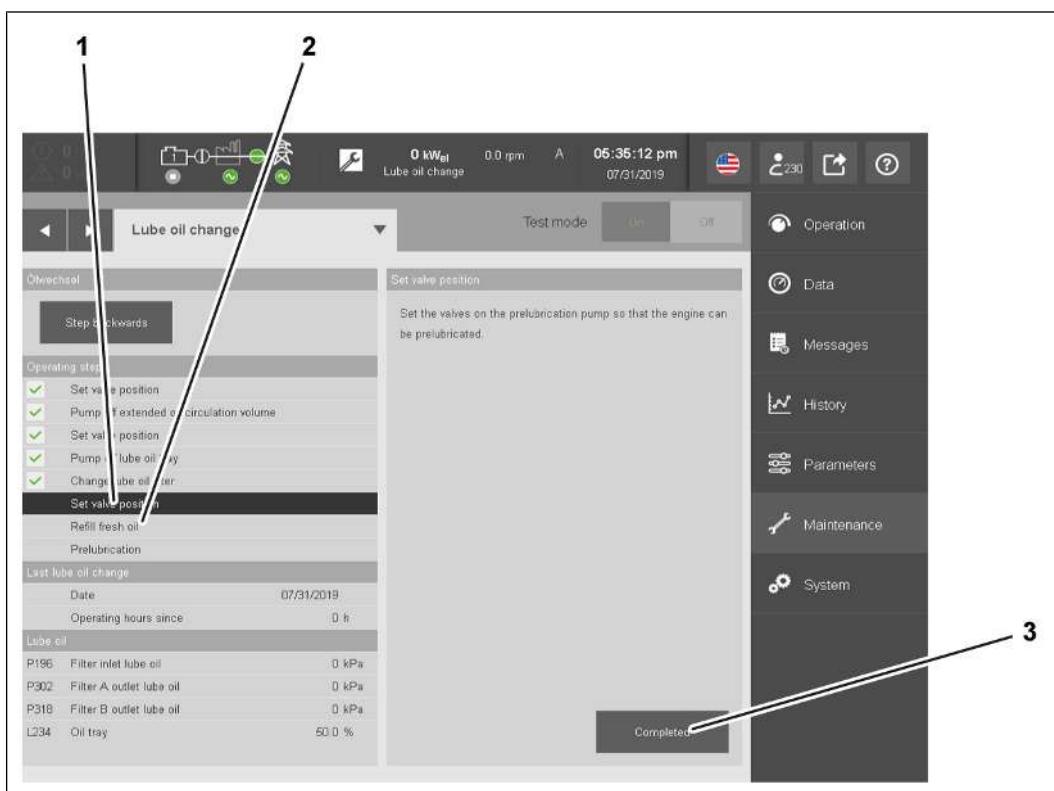
1005867403

- Connect the lube oil outlet hose (2) to the prelubrication pump and tighten the union nut.
- Turn the ball valve (3) backward.
- Turn the ball valve (1) forward.



1005869835

- Turn the ball valve for the supply to the lube oil tank in the base frame forward.



1005872267

- Tap the Completed (3) button to confirm setting of valve positions.

- The operating step Set valve position (1) is completed.
- The operating step Refill fresh oil (2) is activated.

NOTE

Check the active parameters

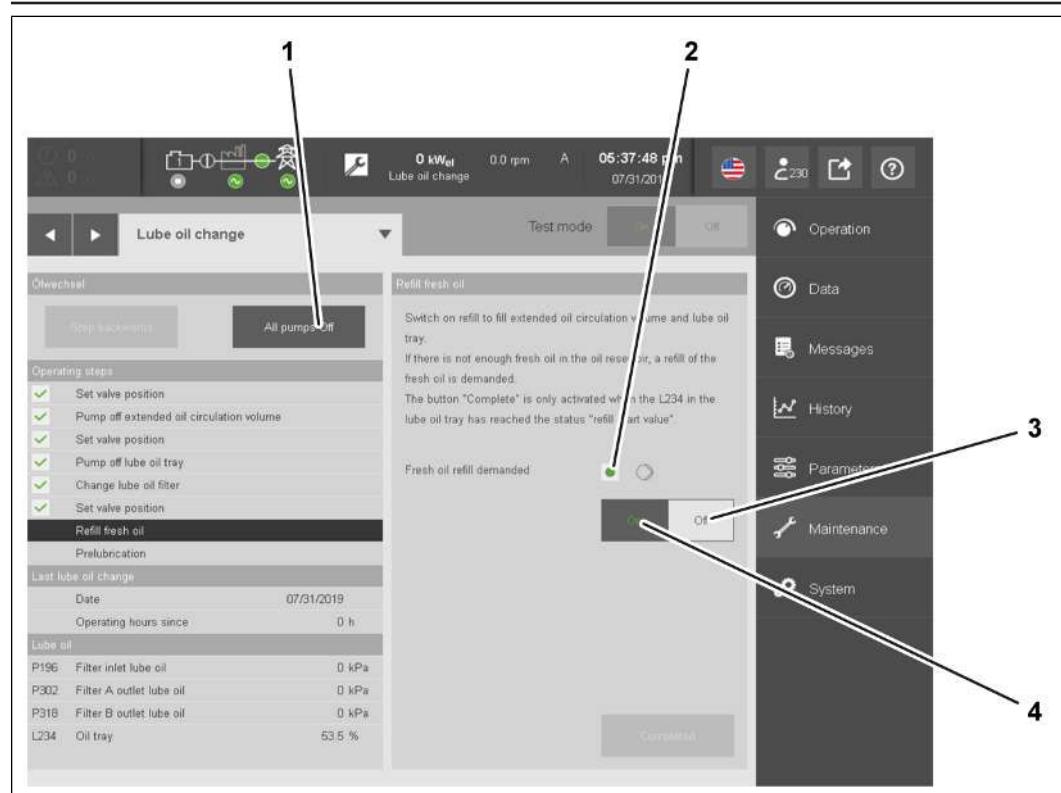
The 20130279 Lube oil sump automatic refill parameter must be activated.

- Activate the 20130279 Lube oil sump automatic refill parameter.

NOTE

The lube oil sump is filled through the lube oil tank overflow in the base frame

Therefore make sure that the value 20190013 Oil reservoir oil level start value refill is greater than 30 %.



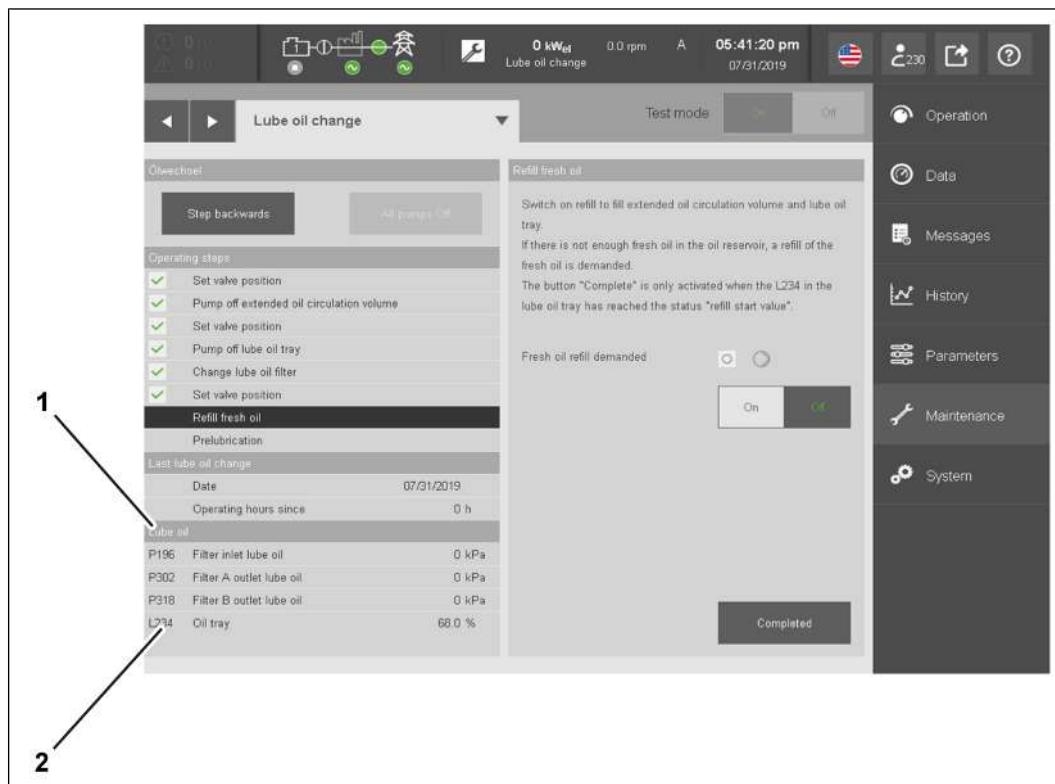
1005887499

- Tap the ON (4) button.
- A green dot (2) lights up in the dialog area.
- The extended oil circulation volume and lube oil sump are filled with fresh oil.

NOTE

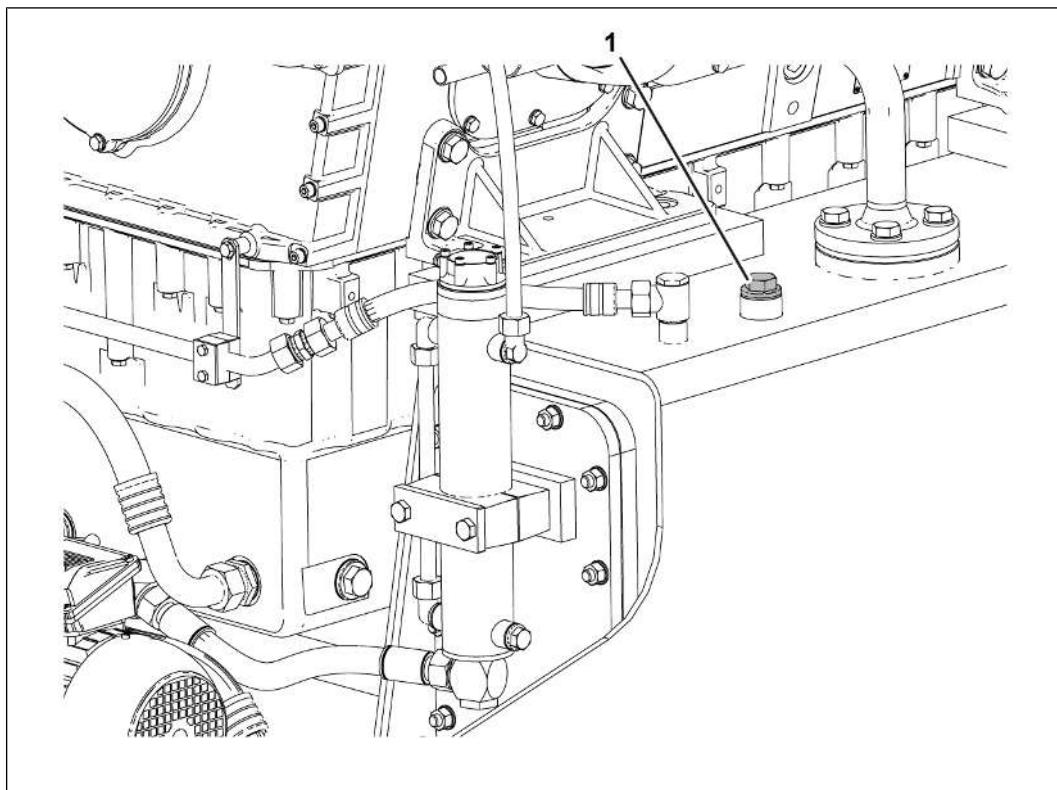
If the Start value refill parameter value for the lube oil sump is reached, the Completed button is activated.

- To stop the fresh oil filling manually, tap the All pumps Off (1) button or Off (4) button.
- The green dot (2) disappears from the dialog area.



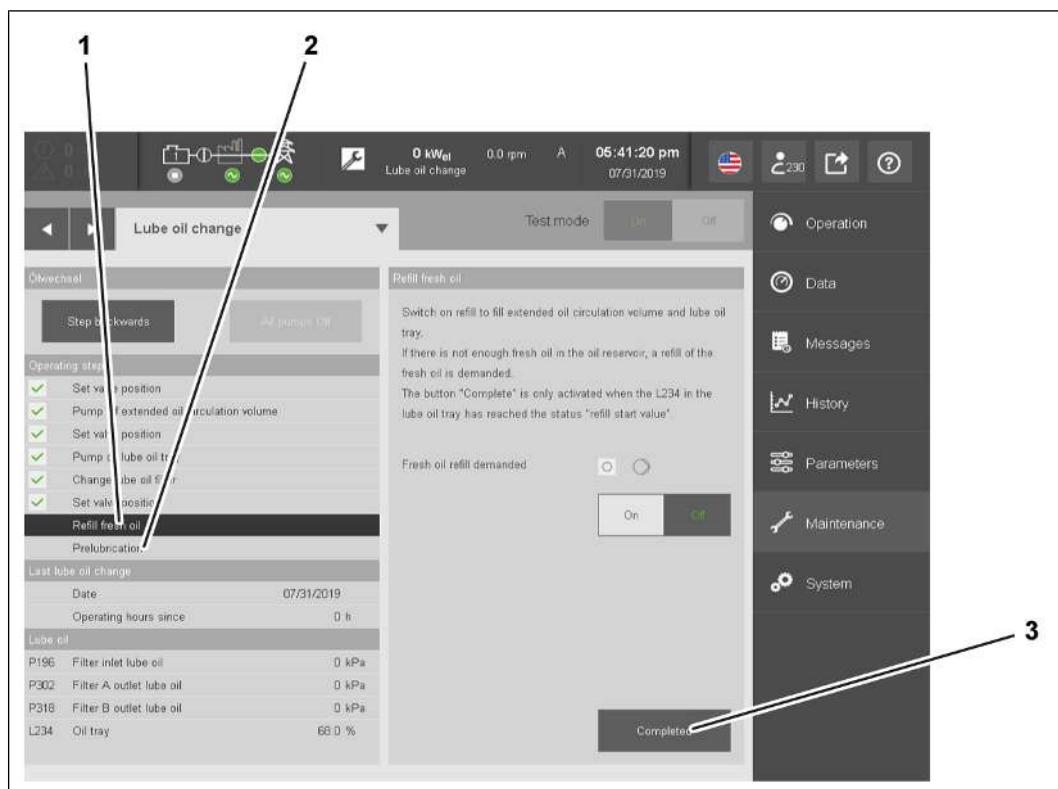
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- The lube oil level is shown as a percentage in the Lube oil (1) dialog area.
- Once the preset value L234 lube oil sump (2) is reached, the lube oil pump switches off automatically.



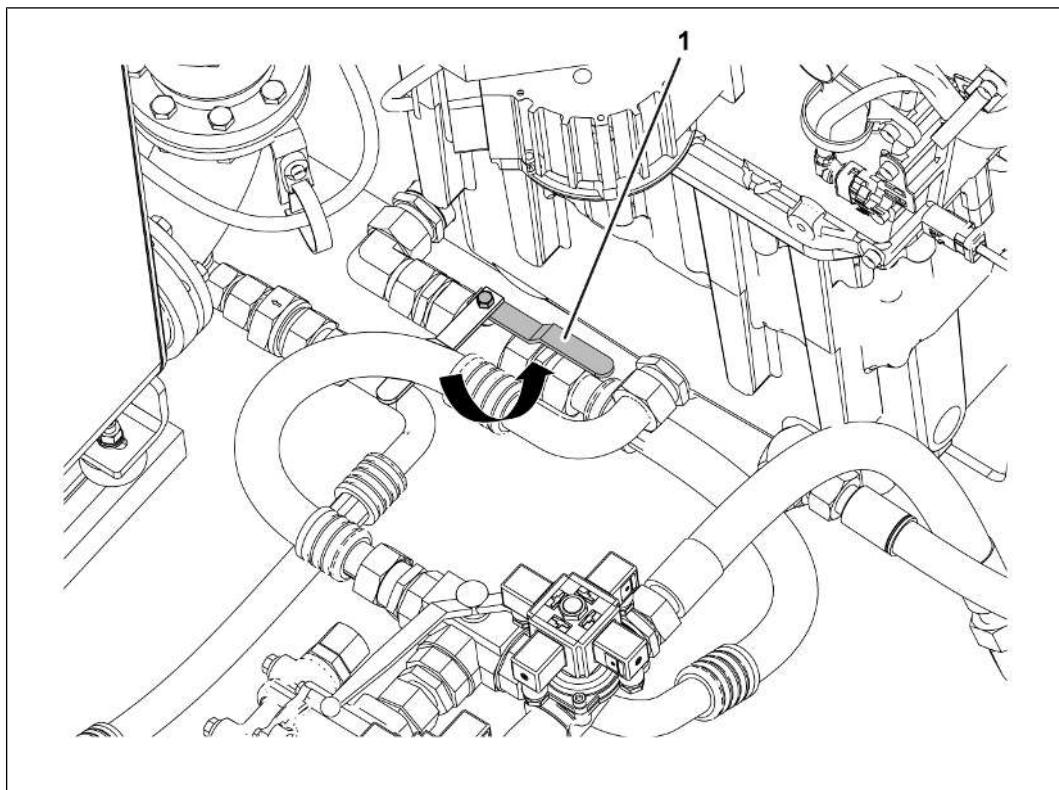
1005892363

7. Vent the lube oil system.
 - Open the screw plug (1).
 - Close the screw plug (1) as soon as lube oil comes out.



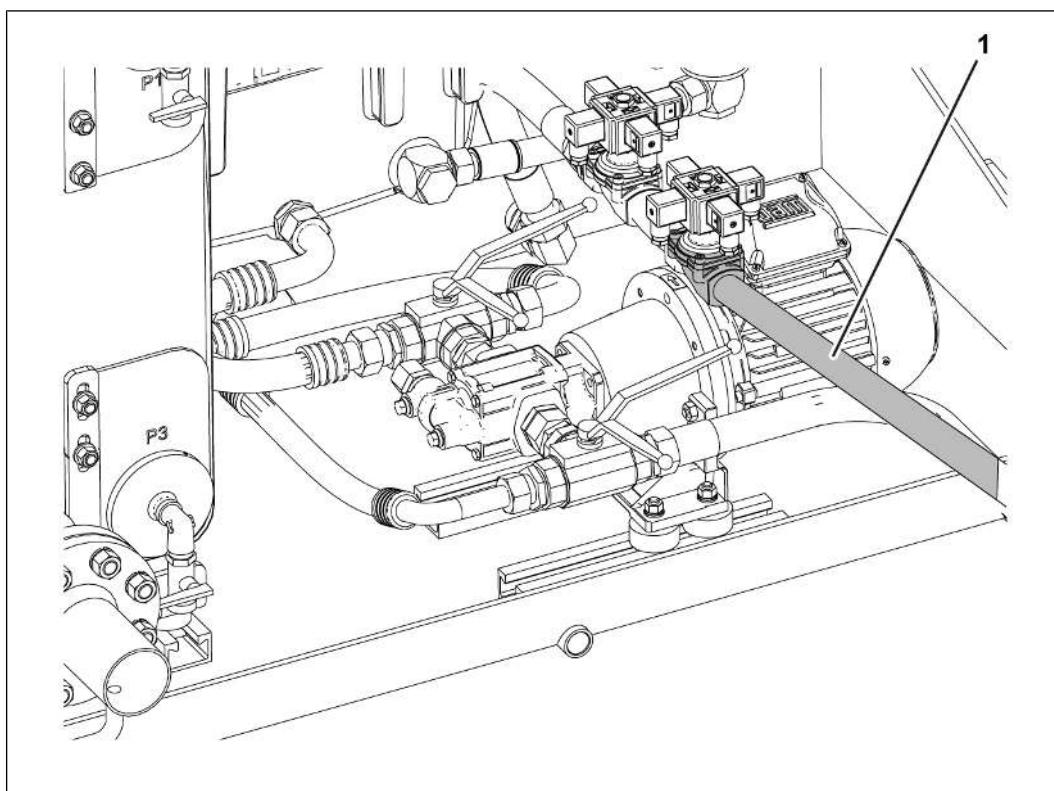
1005894795

8. Tap the Completed (3) button confirm fresh oil refill.
 - The operating step Refill fresh oil (1) is completed.
 - The operating step Prelubrication (2) is activated.



1005934987

- Turn the ball valve for the supply to the lube oil tank in the base frame backward.



1005963019

9. Dismantle the lube oil supply hose (1).
 - Place the collecting tray underneath.
 - Loosen the union nut and remove lube oil supply hose (1).
10. Prelubricate the engine.

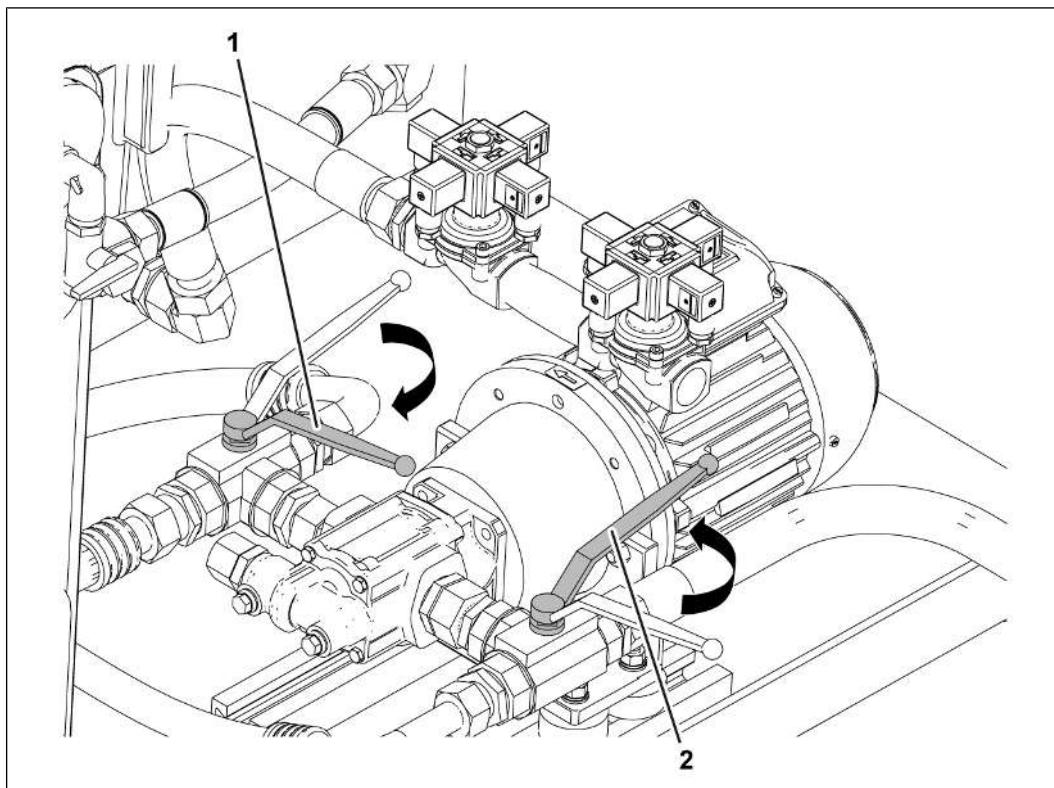


Risk of destruction of components

Insufficient pre-lubrication of the genset

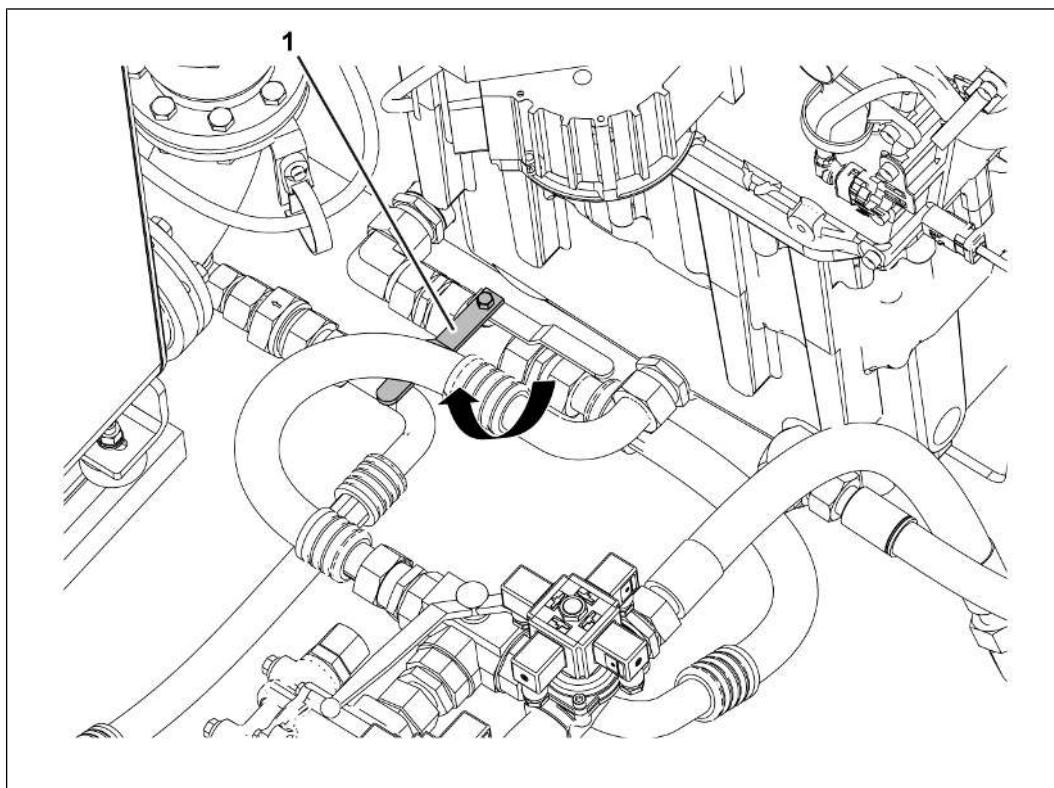
The genset can be damaged and its power affected.

- Prelubricate the genset completely before starting.
- Continue prelubrication immediately after an interruption until the preset prelubrication time is reached.



1005965451

- Set the ball valves of the prelubrication pump in position (1) and position (2).



1005967883

- Turn the ball valve for the supply to the lube oil tank in the base frame forward.



1005992459

- Tap the ON (3) button
- A green dot (2) lights up in the dialog area.
- The residual running time is shown in the dialog area (5).

11. Leave the prelubrication pump switched on for 20 minutes.

NOTE

Prelubrication time

After the preset prelubrication time has elapsed, the system stops prelubrication automatically.

- Prelubrication can also be interrupted manually at any time.
- After the prelubrication time has elapsed, the system activates the Completed button.

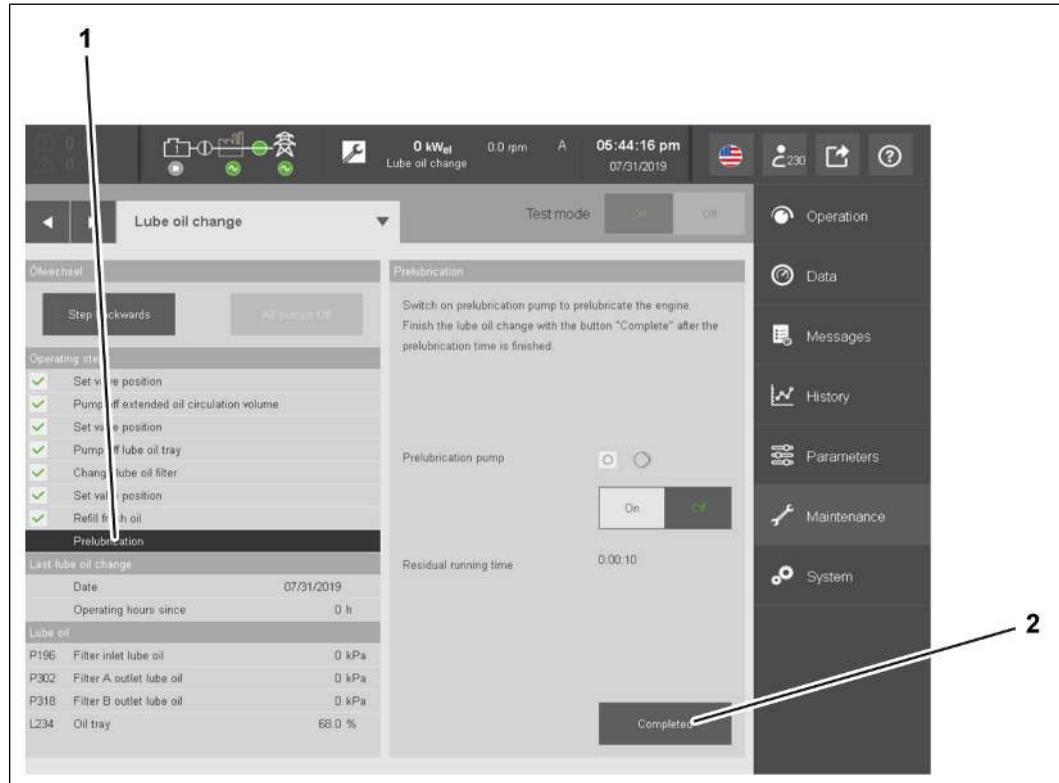
- To stop prelubrication manually, tap the All pumps Off (1) button or Off (4) button.
- The green dot (2) disappears from the dialog area.
- The residual running time (5) is displayed.

NOTE

Continue pre-lubrication

To continue pre-lubrication, tap the On (3) button.

- A green dot (2) lights up in the dialog area.
- The residual running time resumes in the dialog area (5).



1005994891

12. Tap the Completed (2) button to confirm pre-lubrication.
 - The operating step Prelubrication (1) is completed.
 - The lube oil change is completed.
 - The system returns to the start screen.
13. Check the lube oil level, top up if necessary.
14. Remove the collecting tray.
 - Properly dispose of the collected lube oil.
15. Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)
16. Visually inspect all the components and screw connections for leaks.

Checking the lube oil (transmission)

Valid for:

CG170B

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:

CG170B

60 Hz

Tools:

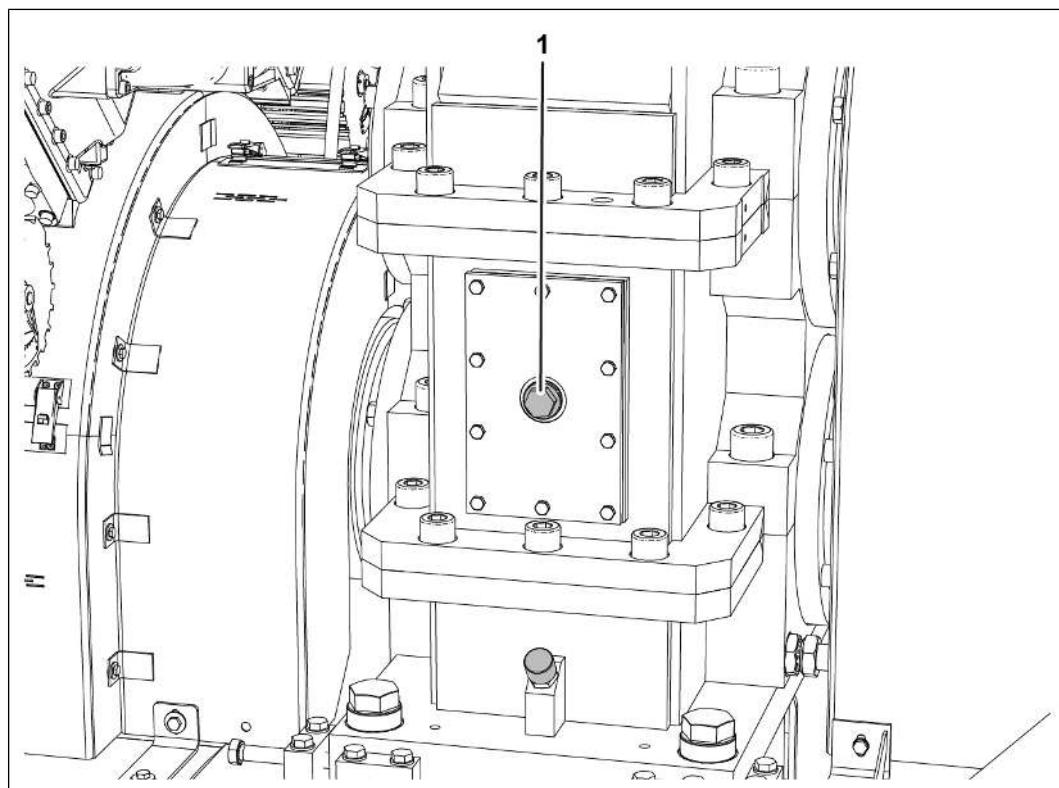
- Standard tools

Spare parts:

- Lube oil for transmission

– See Service Library, Technical Bulletin ([TR 2147](#)), **Specification for auxiliary media**.

Technical data



3286346123

Filler screw on inspection hole cover (2.0 MW genset)

1. Screw ¹⁾	Hand tight
------------------------	------------

¹⁾ Replace 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.

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

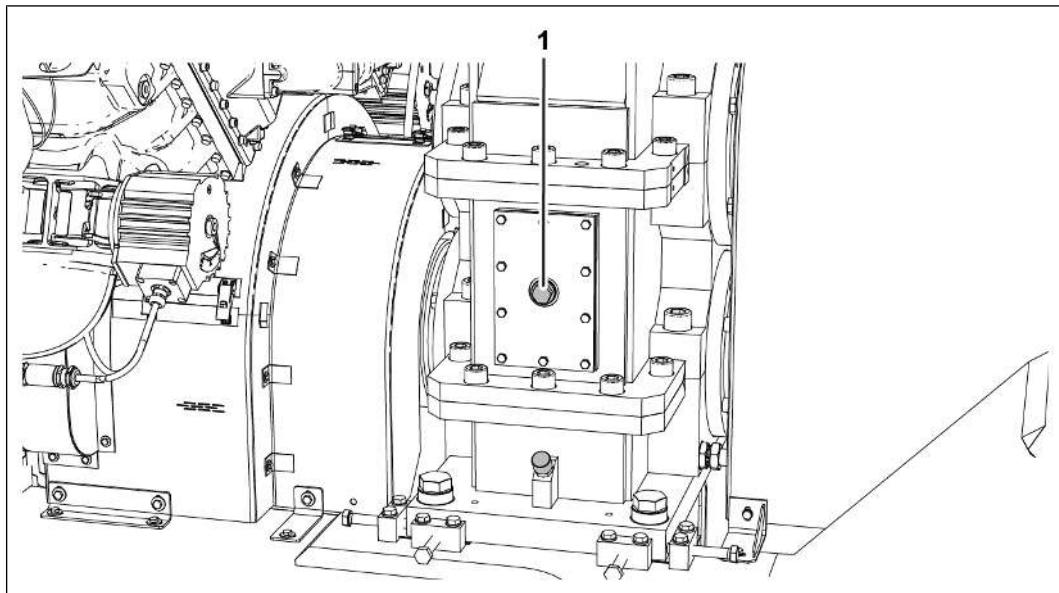
Due to escaping operating media that enter the environment.

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 \(transmission\)](#)
[▶ 361]



3283055499

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:

CG170B

60 Hz

Tools:

- Standard tools

Auxiliary media:

- Cleaning agent

– See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

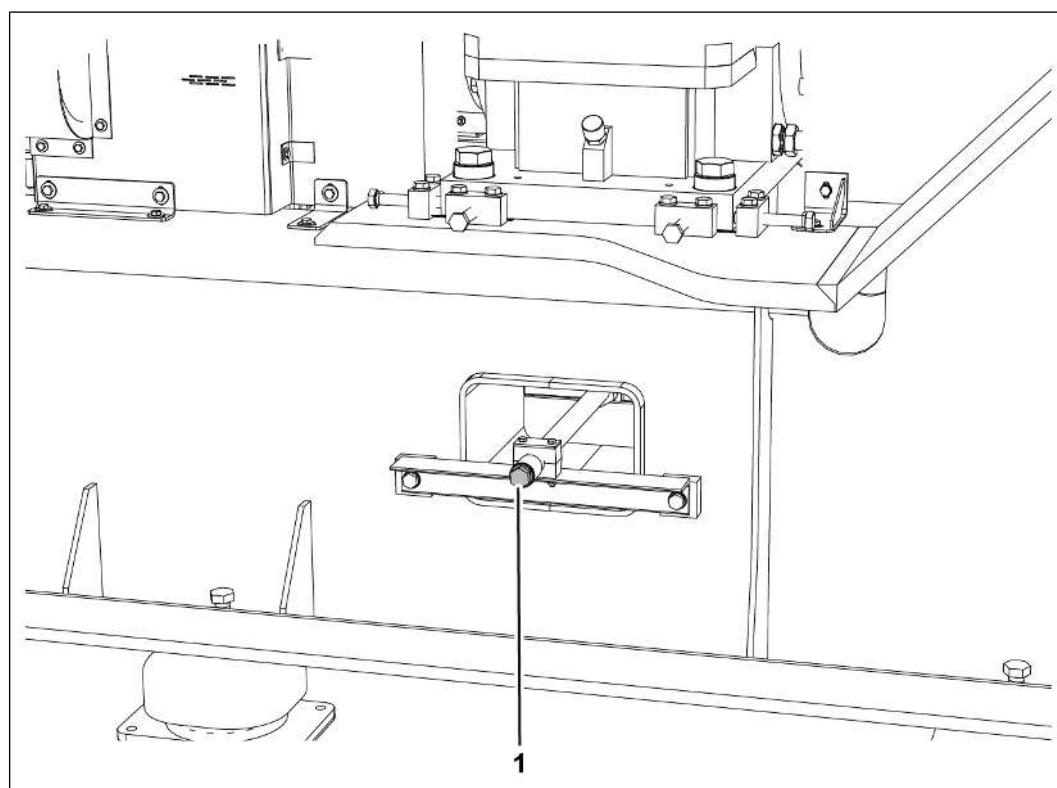
Spare parts:

- Lube oil for transmission

– See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

- Lube oil filter, if necessary

Technical data

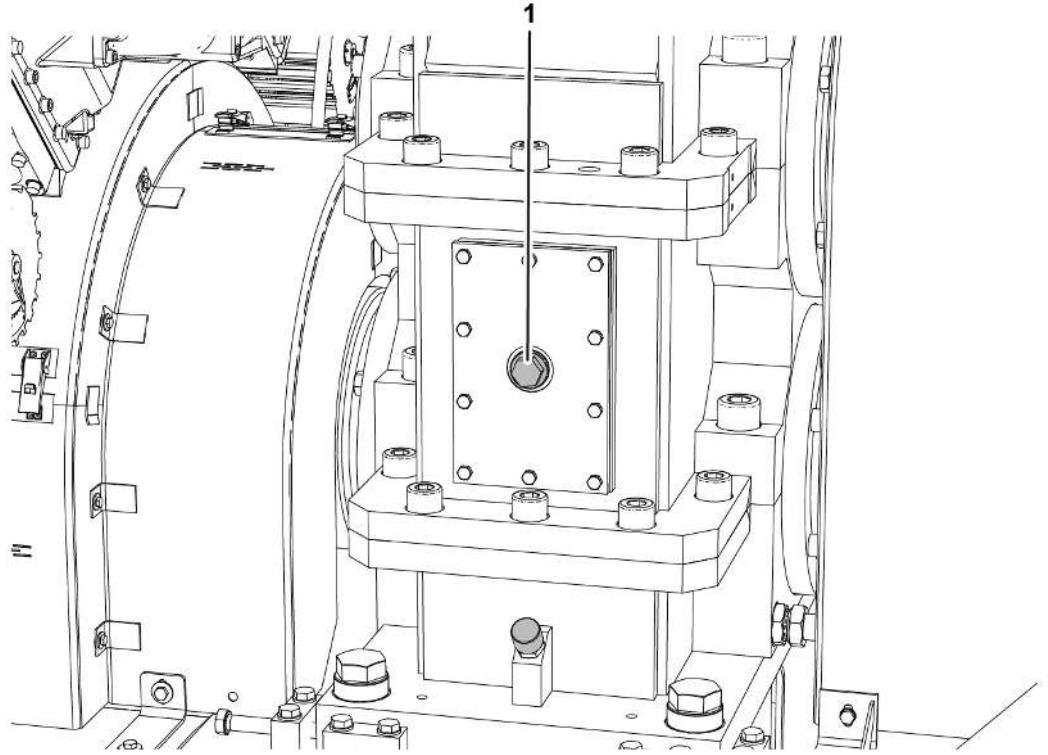


3286343691

Drain screw on lube oil pipe

- | | | |
|----|---------------------|------------|
| 1. | Screw ¹⁾ | Hand tight |
|----|---------------------|------------|

¹⁾Renew sealing ring.



3286346123

Filler screw on inspection hole cover (2.0 MW genset)

- | | | |
|----|---------------------|------------|
| 1. | Screw ¹⁾ | Hand tight |
|----|---------------------|------------|

¹⁾Replace 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](#) [▶ 376].

- 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.

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

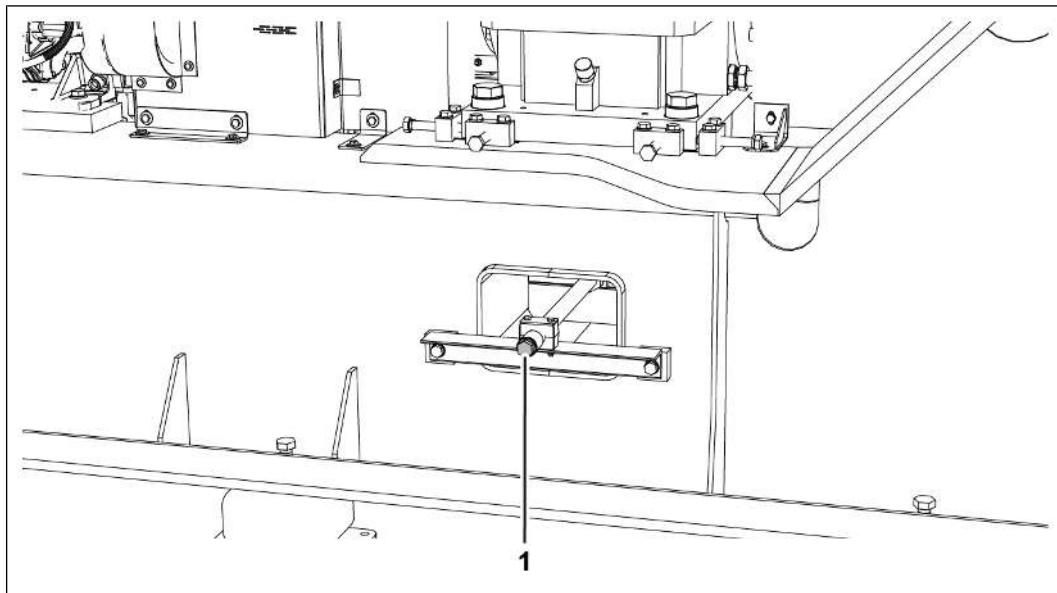
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

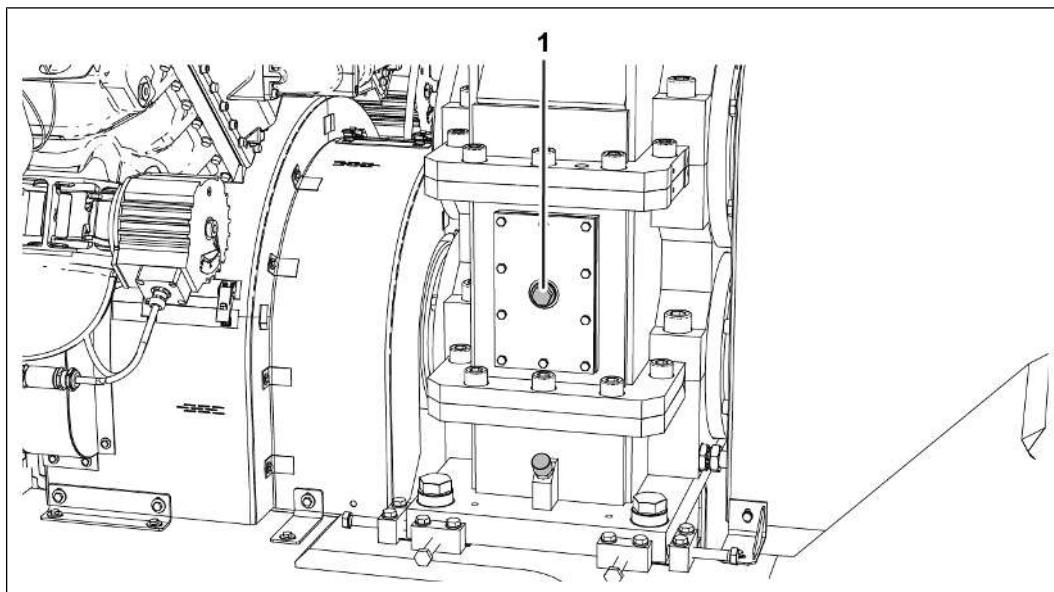
Changing the lube oil:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



3283053067

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 \(transmission\) \[▶ 361\]](#).
4. Tighten drain screw (1).
 - Replace sealing ring.



3283055499

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 \(transmission\)](#) [▶ 370].
 7. Tighten filler screw (1).
 - Replace sealing ring.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 117]

Checking the lube oil level (transmission)

Valid for:

CG170B

60 Hz

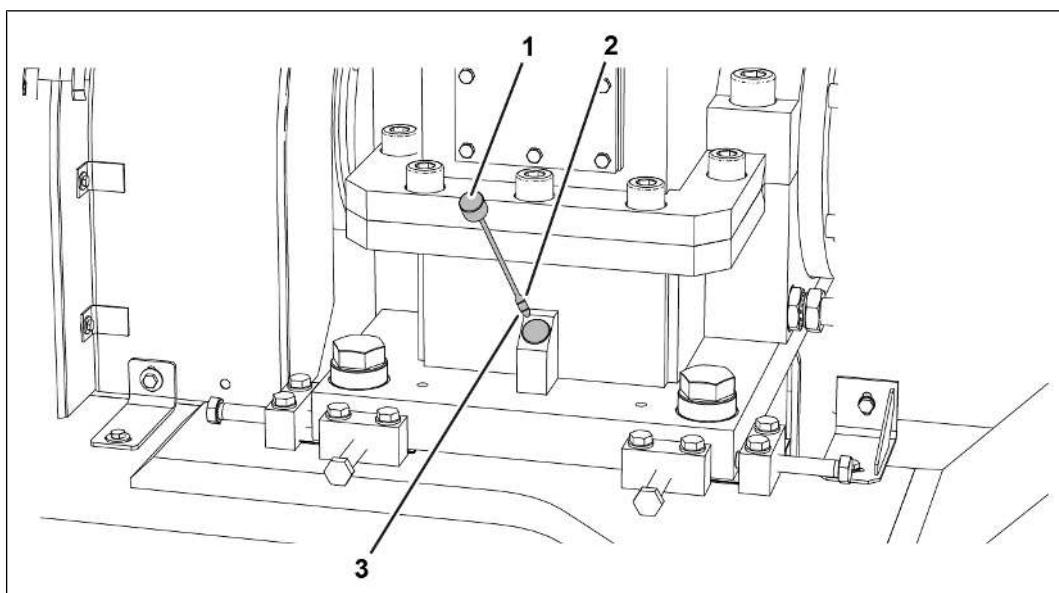
General information:

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:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



3283037835

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 (3) and the maximum marking (2).
 - 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 \[▶ 117\]](#)

Removing and installing the lube oil filter (transmission)

Removing the lube oil filter

Valid for:

CG170B

60 Hz



Tools:

- Standard tools
- Special tool
 - Lube oil filter key 1215 8153 [▶ 189]

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

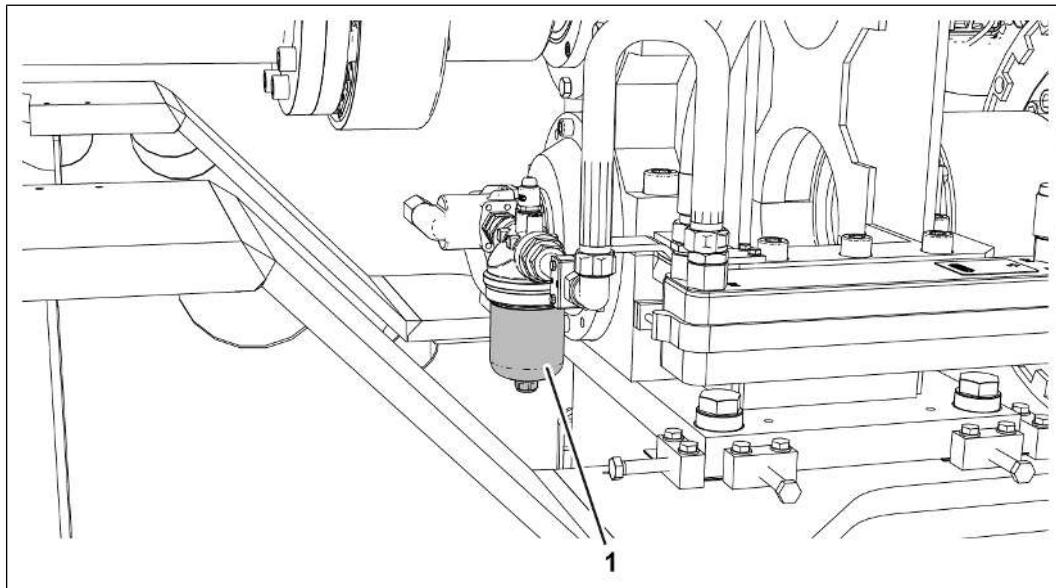
Due to escaping operating media that enter the environment.

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 \[▶ 383\]](#).



3283420939

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.

Installing the lube oil filter

Valid for:

CG170B

60 Hz



Tools:

- Standard tools
- Special tool
 - [Lube oil filter key 1215 8153 \[▶ 189\]](#)

Auxiliary media:

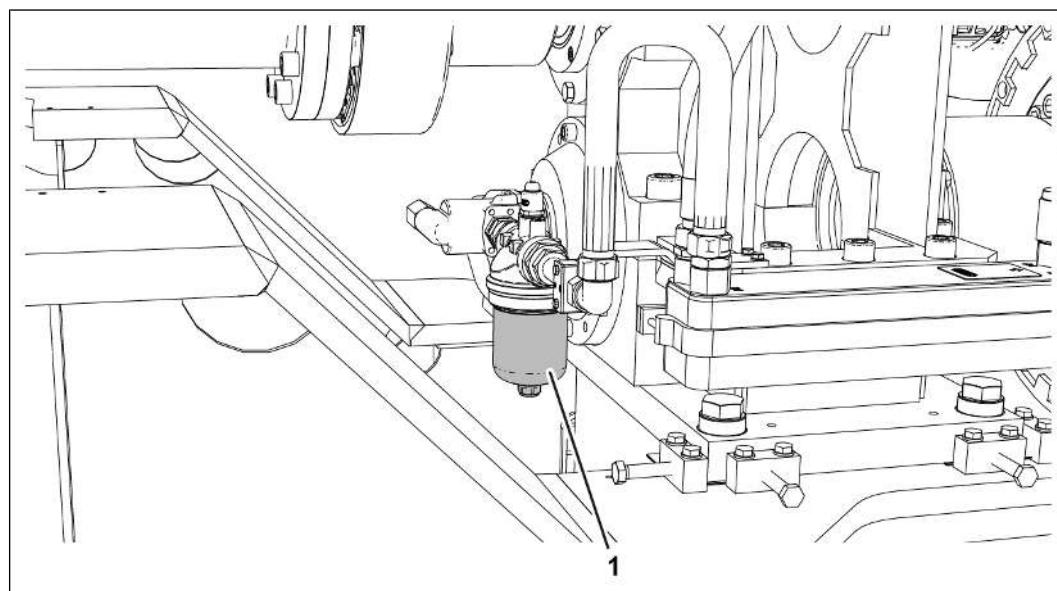
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Lube oil filter

Installing the lube oil filter:



3283420939

1. Clean lube oil filter housing.
2. Insert lube oil filter.
3. Tighten lube oil filter housing (1).
4. Mount protective cover, see OL-MRA10 / 03-19-12 [Mounting complete protective cover \[▶ 384\]](#).

Cleaning the lube oil filter (transmission)

Valid for:

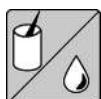
CG170B

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:

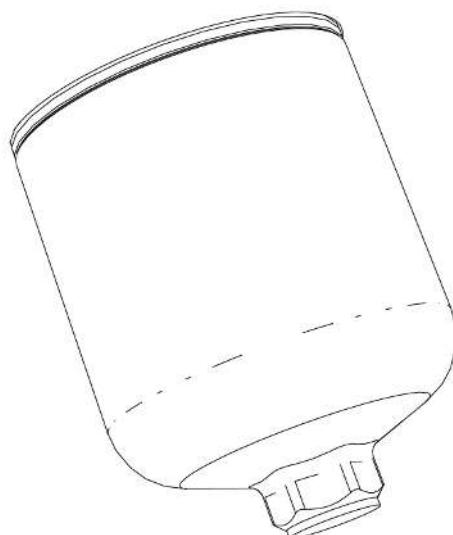
CAUTION



Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.
-

Cleaning the lube oil filter:

3283440139

1. Lube oil filter dismantled, see OL-MRA10 / 03-05-10 [Removing the lube oil filter \[▶ 371\]](#).
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 \[▶ 372\]](#).

Purging the transmission

Valid for:

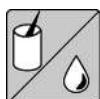
CG170B

60 Hz



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

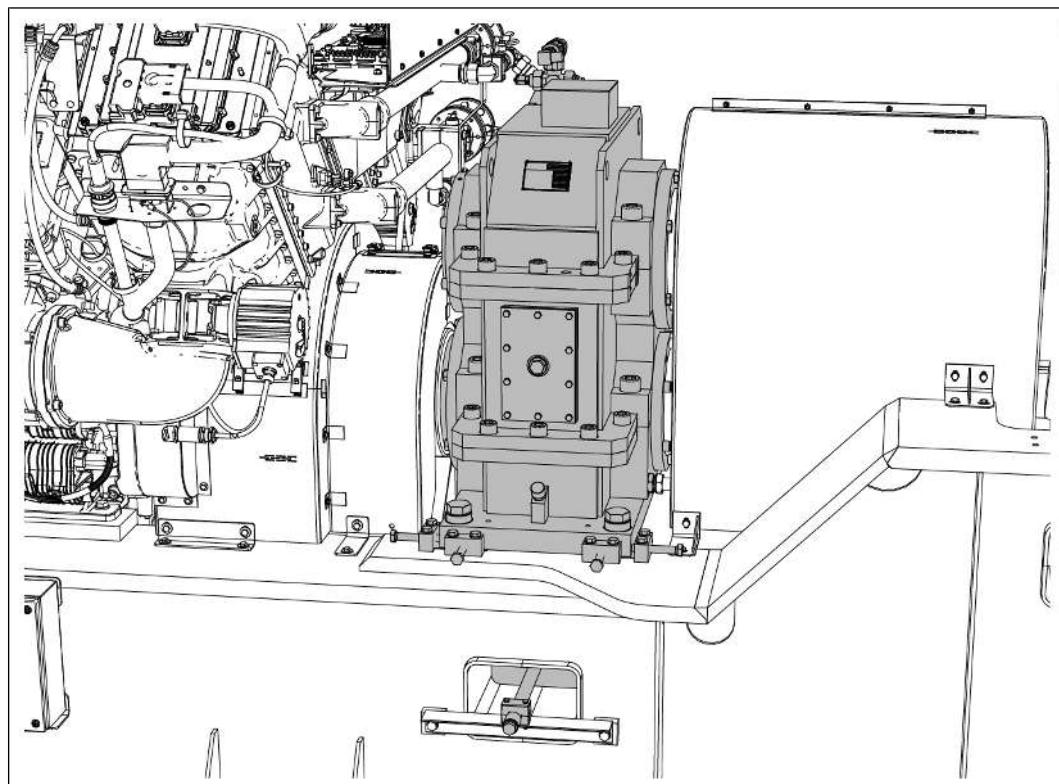
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Lube oil for transmission
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).
- Seal

Technical data



3285842059

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**

Purge the transmission.

It is not permissible 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**

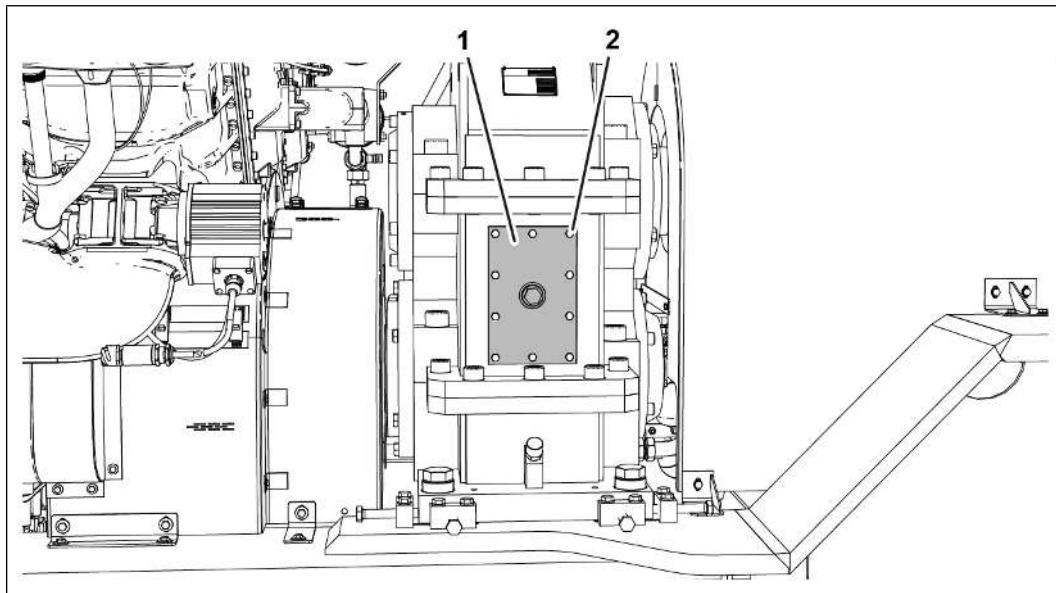
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
- Dispose of operating media properly.

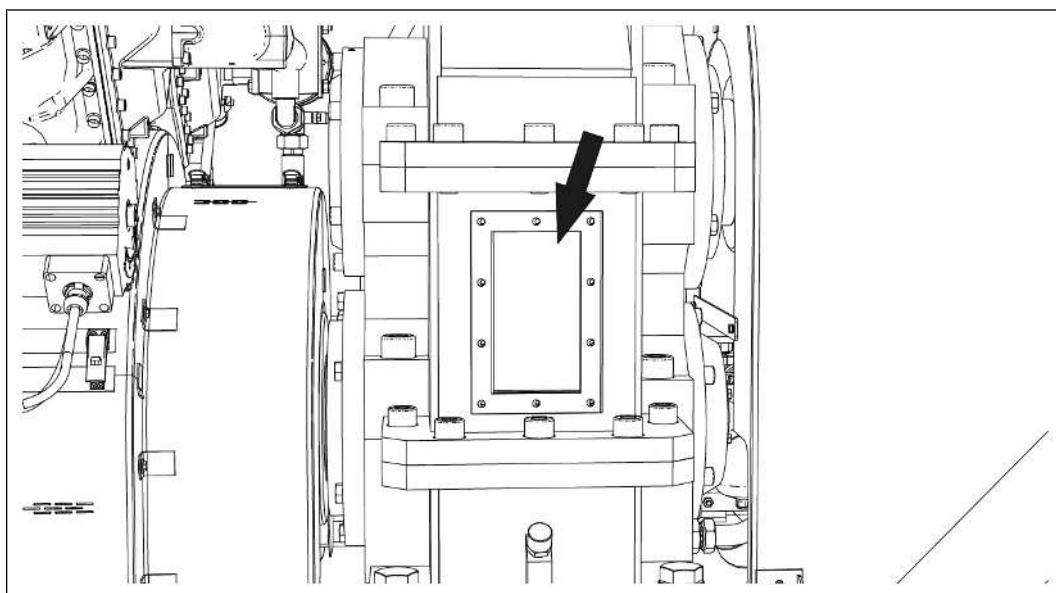
Purging the transmission:

1. The lube oil has drained away, see OL-MRA10 / 03-01-22 [Performing lube oil change \(transmission\) \[▶ 365\]](#).
2. The lube oil filter is cleaned or replaced, see OL-MRA10 / 03-05-10 [Cleaning the lube oil filter \(transmission\) \[▶ 374\]](#).



3283385739

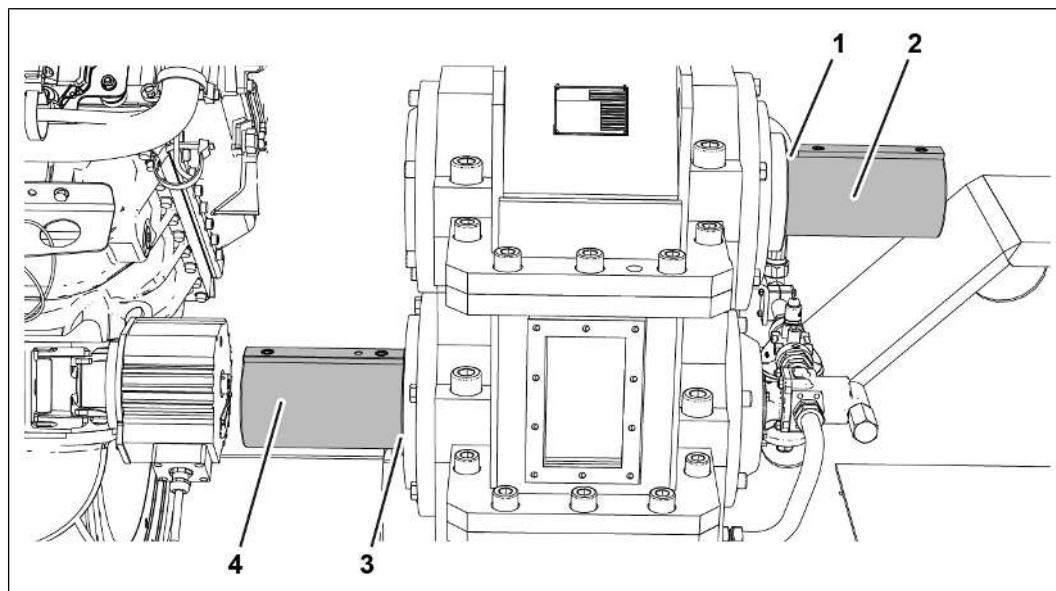
3. Dismantle inspection hole cover (1).
 - Unscrew screws (2).
 - Remove inspection hole cover.
 - Remove seal.



3283387659

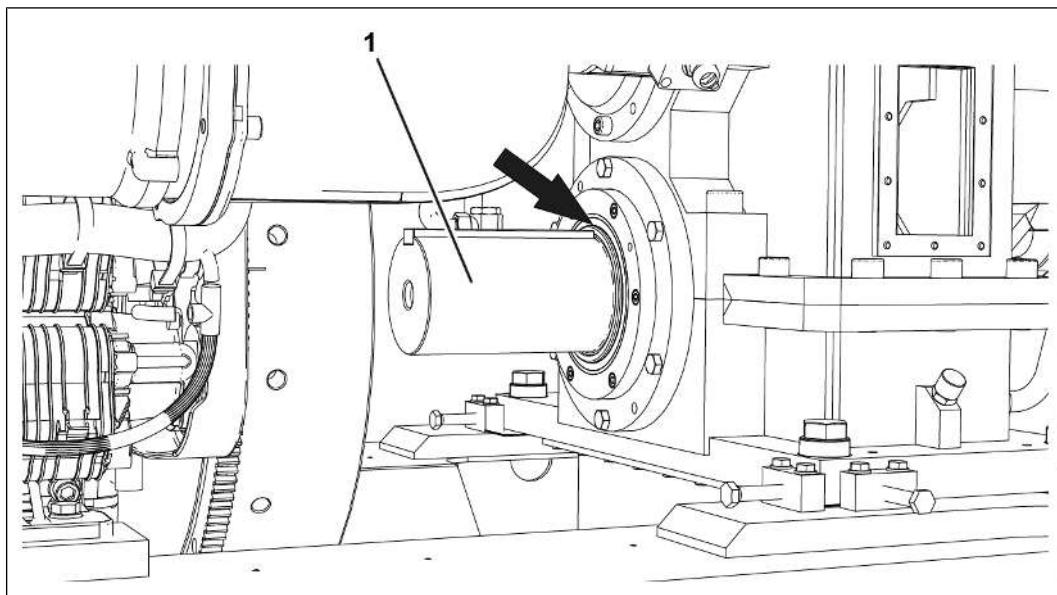
4. Completely remove remaining lube oil as far as possible.

5. Clean inside of transmission (arrow) with a non-fraying rag.
6. Check inside of transmission (arrow) for deposits and residues.



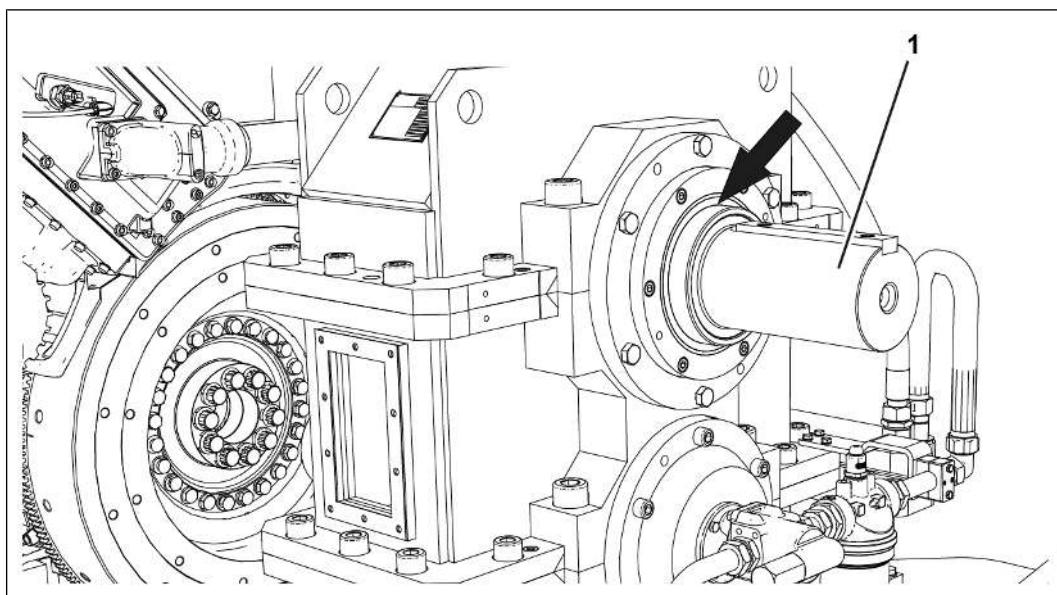
3283389579

- 1 Labyrinth sealing ring of the output shaft
 - 2 Output shaft
 - 3 Labyrinth sealing ring of the drive shaft
 - 4 Drive shaft
7. Dismantle the protective cover (flywheel), see OL-MRA10 / 52-90-12 [Dismantling the protective cover](#) [▶ 522]
 8. Dismantle the protective cover (transmission), see OL-MRA10 / 03-19-12 [Dismantling complete protective cover](#) [▶ 383].



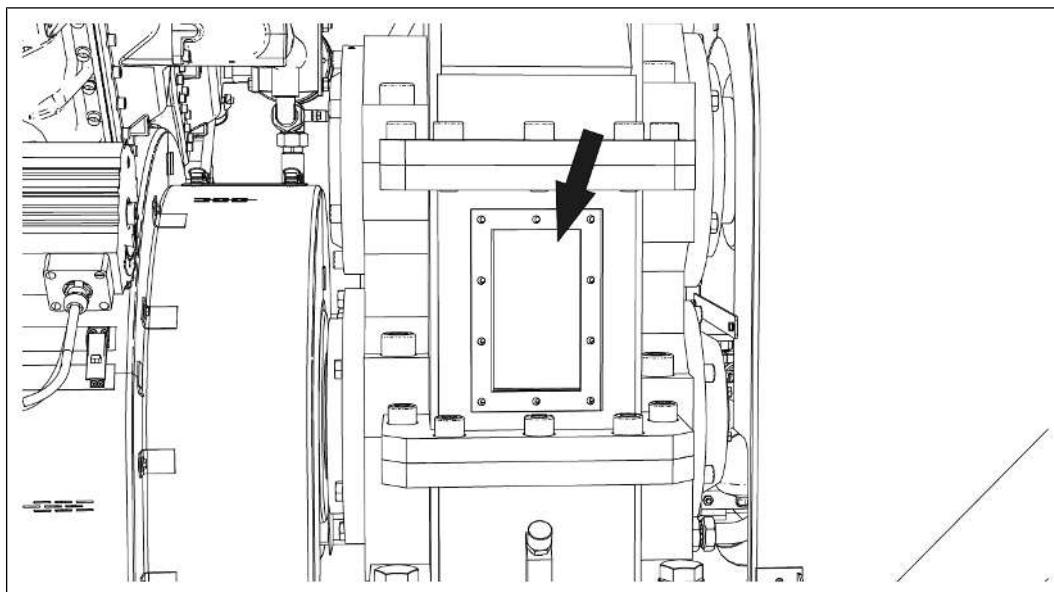
3283391499

9. Clean labyrinth sealing ring of the drive shaft (1).
 - Blow out labyrinth sealing ring all around with compressed air through the gap (arrow).



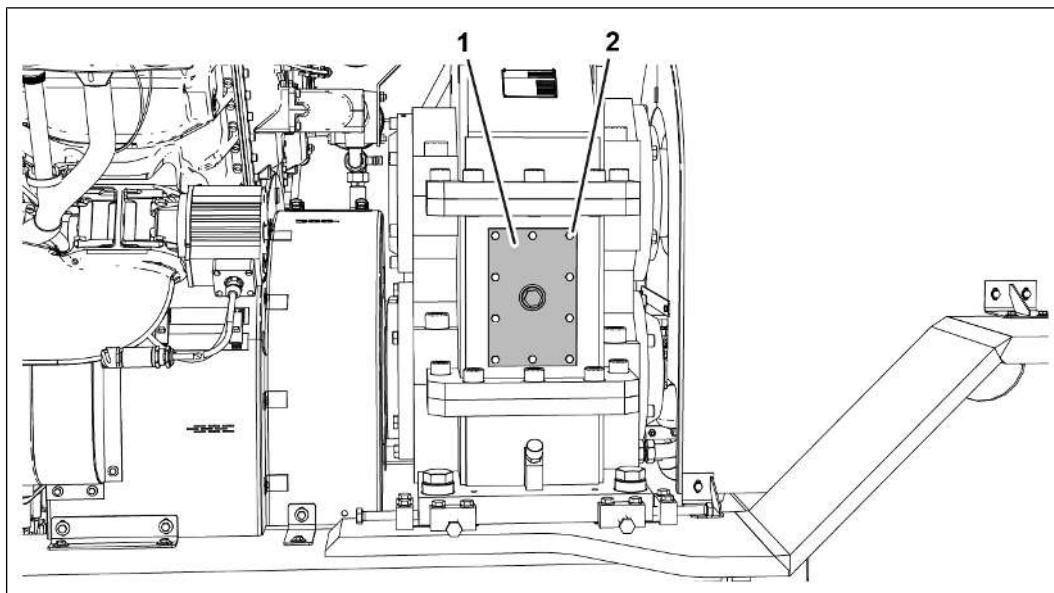
3283393419

10. Clean labyrinth sealing ring of the output shaft (1).
 - Blow out labyrinth sealing ring all around with compressed air through the gap (arrow).



3283387659

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 \(transmission\)](#) [▶ 362].



3283385739

13. Mount inspection hole cover (1).
 - Replace the seal.
 - Attach the inspection hole cover.
 - Tighten screws (2).
14. Dismantle the protective cover (transmission), see OL-MRA10 / 03-19-12 [Mounting complete protective cover](#) [▶ 384].

-
15. Dismantle the protective cover (flywheel), see OL-MRA10 / 52-90-12 [Mounting the protective cover](#) [▶ 527]
 16. Perform sampling without a load, see OL-MRA10 / 00-10-30 [Performing a test run](#) [▶ 200]
 17. Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 154].
 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 foaming 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 Cat dealer.

-
19. Check transmission and lube oil for formation of foam.
 20. Top up lube oil, see OL-MRA10 / 03-01-22 [Performing lube oil change \(transmission\)](#) [▶ 365].
 - **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](#) [▶ 117].

Dismantling and mounting the protective cover (generator)

Dismantling complete protective cover

Valid for:

CG170B

60 Hz

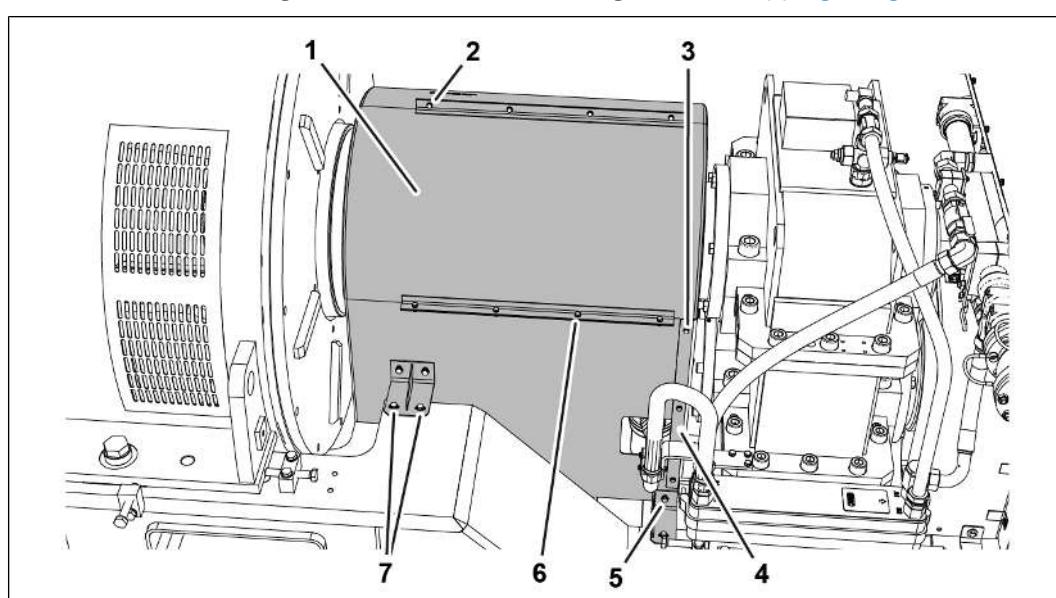


Tools:

- Standard tools

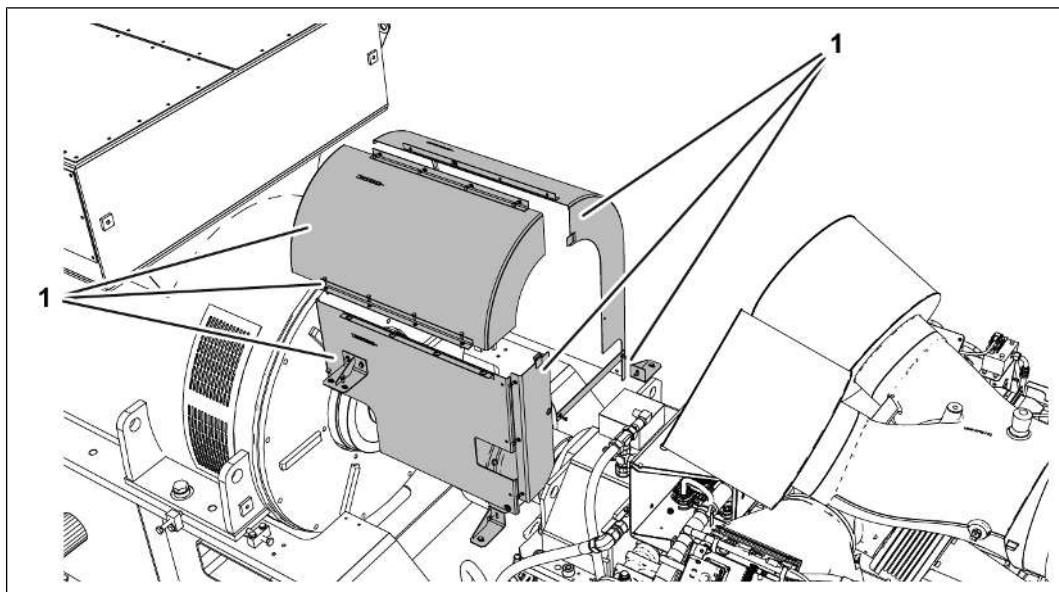
Dismantling complete protective cover:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



3283447819

1. Dismantle protective cover (1).
 - Unscrew screws (2).
 - Unscrew screws (3).
 - Remove cover (4).
 - Unscrew the screw (5).
 - Unscrew screws (6).
 - Unscrew screws (7).
 - Set aside the screws, nuts and washers.



3285830539

2. Remove protective cover assembly.
 - Remove protective covers (1) in an upward direction.

Mounting complete protective cover

Valid for:

CG170B

60 Hz



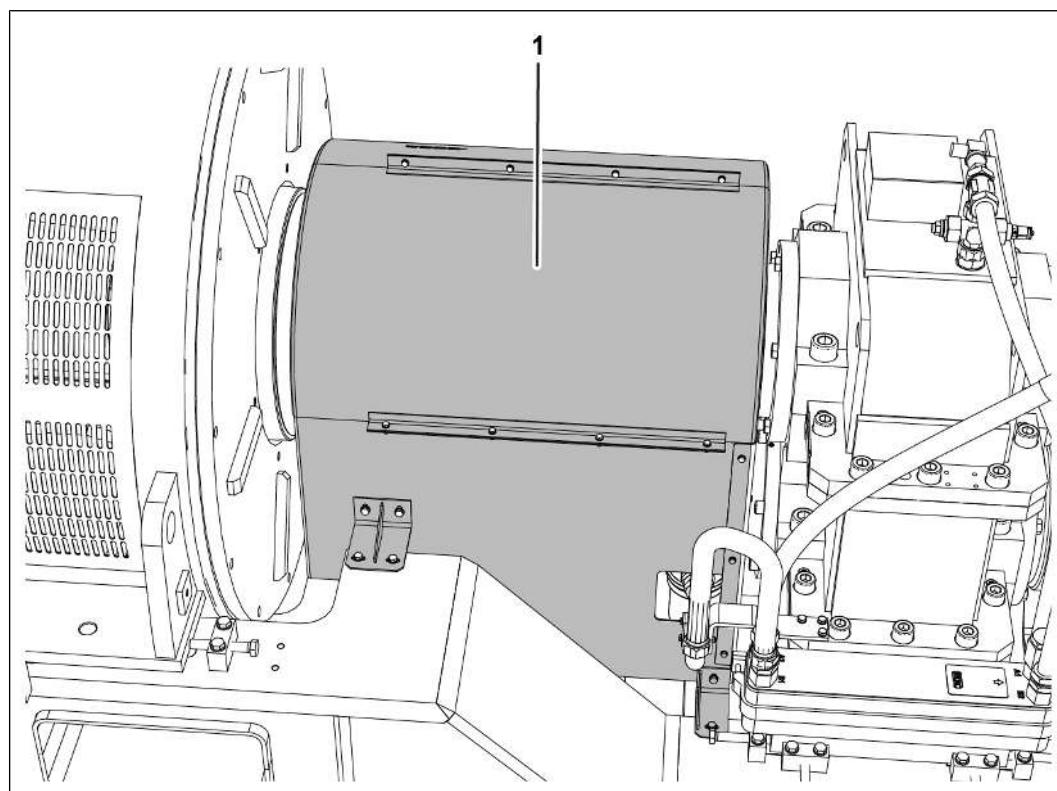
Tools:

- Standard tools

Auxiliary media:

- Cleaning agent

– See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

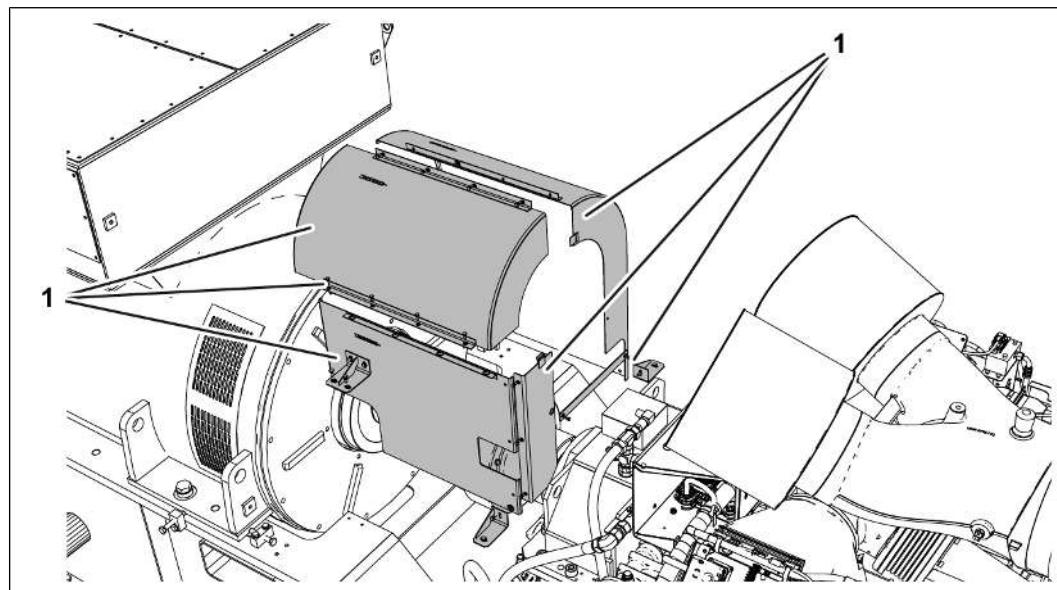
Technical data

3286686603

Protective cover (1) on genset

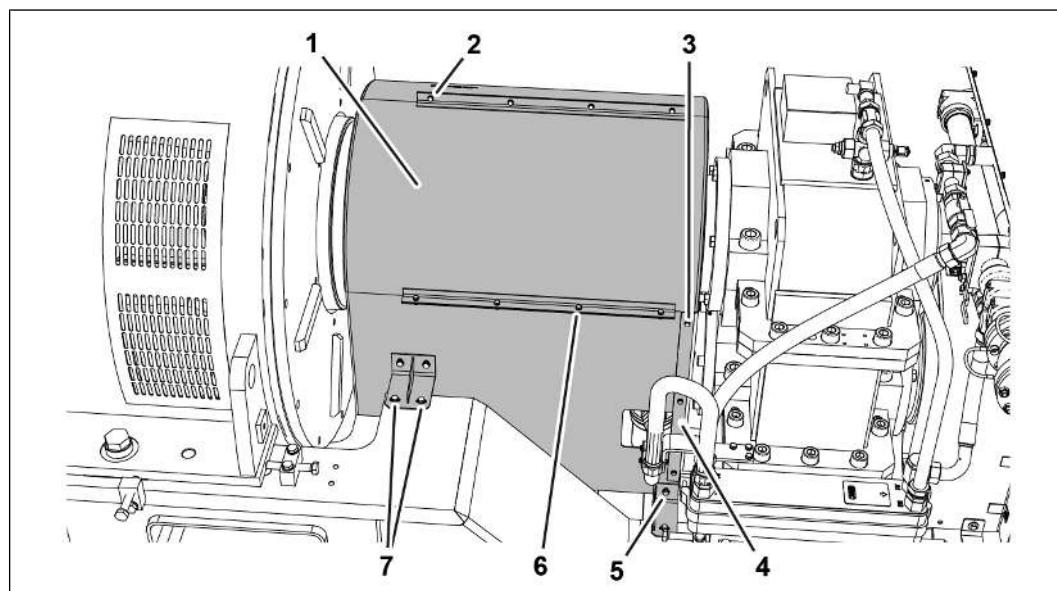
All Screws

Hand tight

Mounting complete protective cover:


3285830539

1. Clean all components (1).
2. Mount protective cover assembly.
 - Attach protective covers (1) from above.



3283447819

3.
 - Position protective cover (1).
 - Tighten screws (2).
 - Attach cover (4).
 - Tighten screws (3).
 - Tighten screw (5).

-
- Tighten screws (6).
 - Tighten screws (7).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the valve clearance

Valid for:

CG170B



Tools:

- Standard tools
- Feeler gauge

Special tools

- [Engine turning gear 1244 1150 \[▶ 188\]](#)
- Alternative: [Engine turning rod 1242 0844 \[▶ 188\]](#)
- [Torque wrench 1203 0350 \[▶ 186\]](#)
- [Key for the setting screw of the valve crosshead 1230 3225 \[▶ 187\]](#)



Spare parts:

- If necessary, seal for cylinder head cover

Technical data

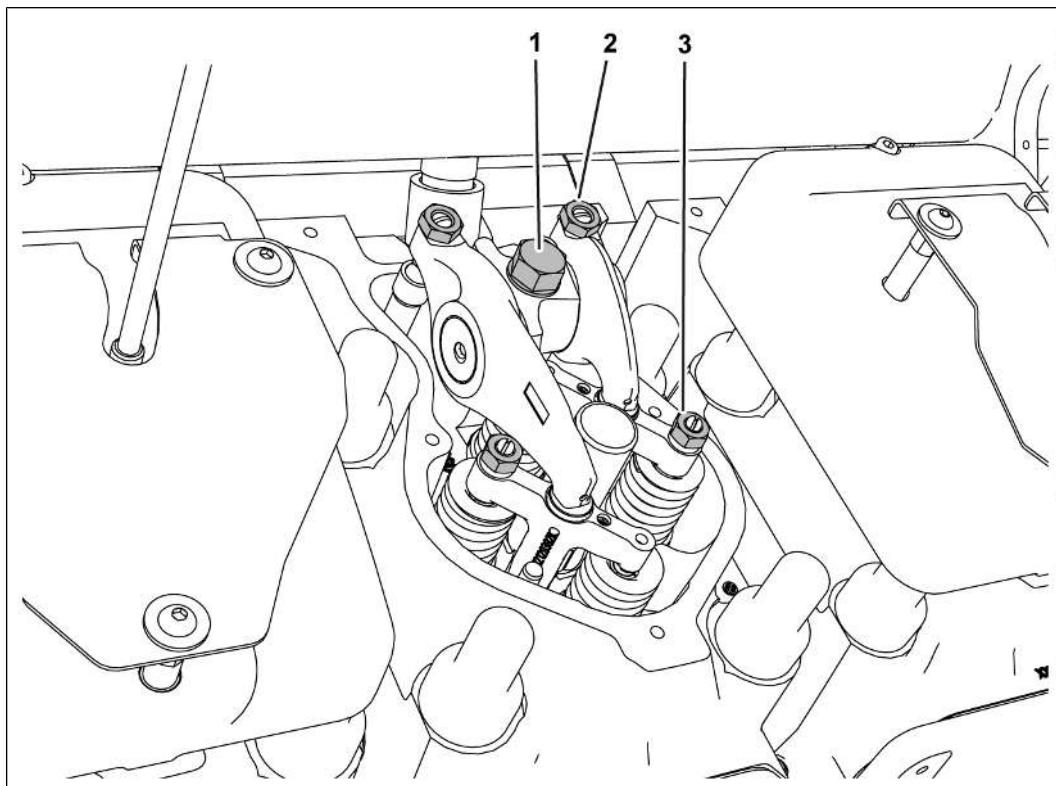
Valve clearance		
Inlet valve	Setting value	0.3 mm
Outlet valve	Setting value	0.7 mm

Rocker arm jack		
Valve crosshead	Setting value	0.05 mm

V12 engine valve setting		
Ignition TDC	A1 B5 A2 B3 A4 B1 A6 B2 A5 B4 A3 B6	
Overlap	A6 B2 A5 B4 A3 B6 A1 B5 A2 B3 A4 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 accurately 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 setpoint, check the valve clearance and eliminate the cause of the problem.

NOTE

The work described below is performed on one valve crosshead and one valve.

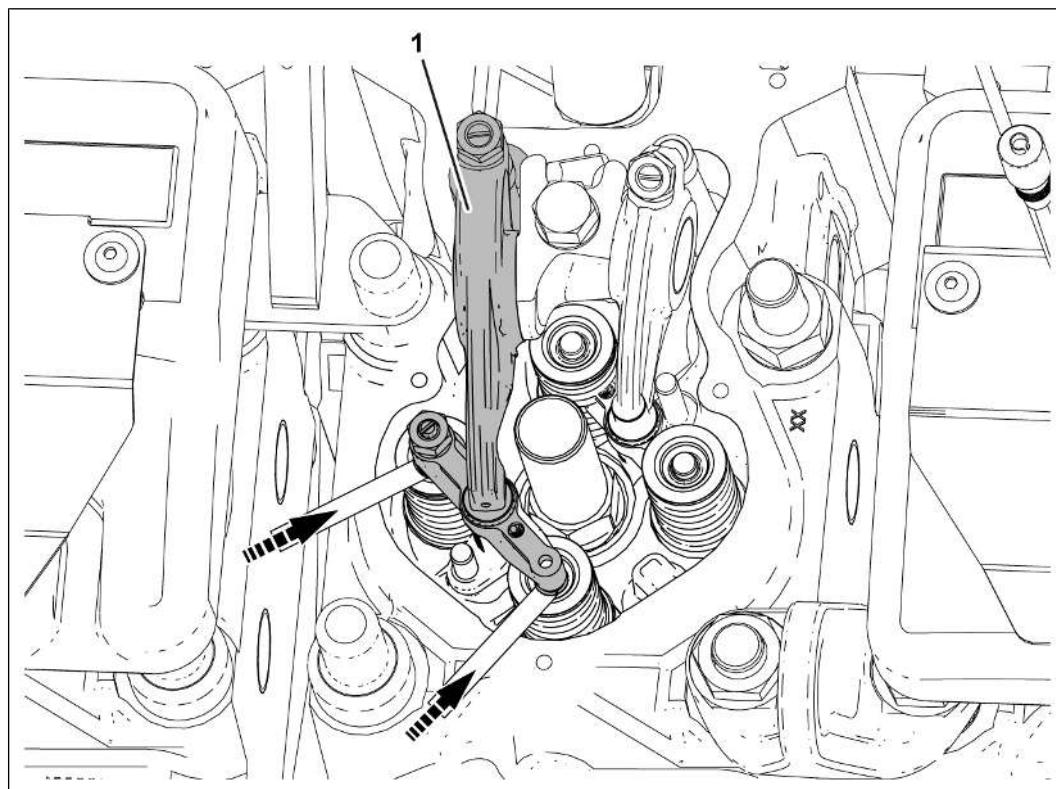
Proceed in the same way for all others.

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](#) [▶ 398]
- ✓ Engine turning gear mounted, see OI-MRA10 / 49-01-12 [Mounting the engine turning gear](#) [▶ 514]

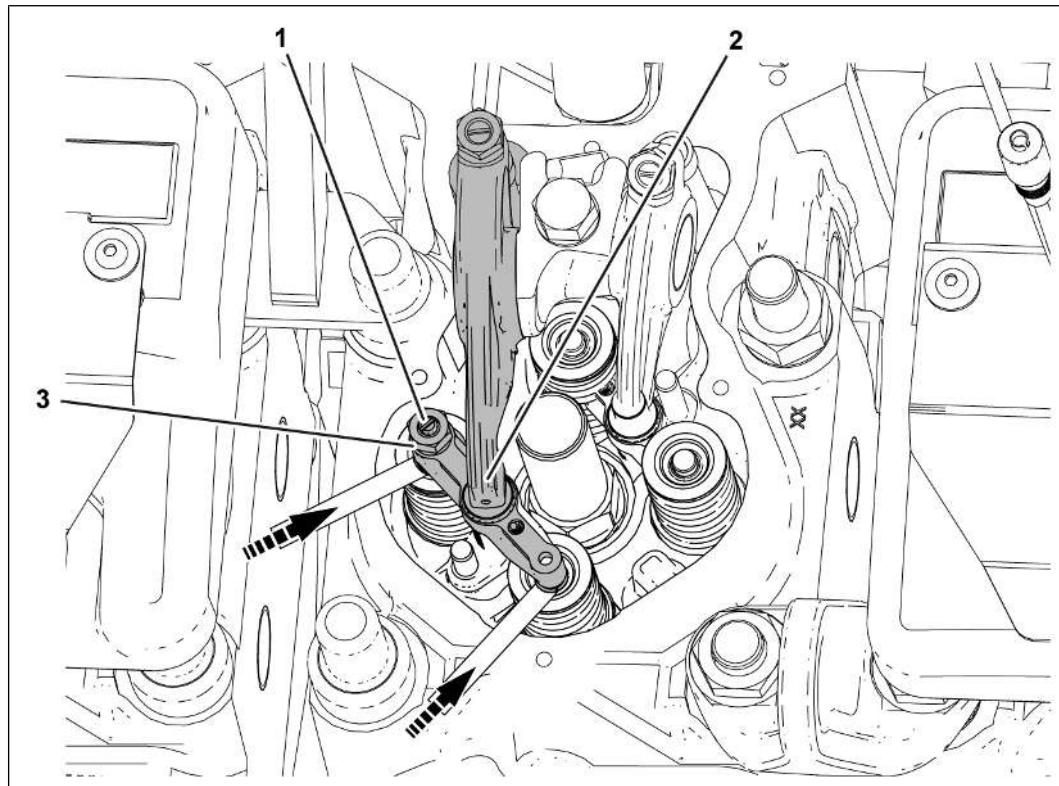
1. Turn crankshaft in direction of rotation until cylinder A1 is in the ignition **TDC**



486111755

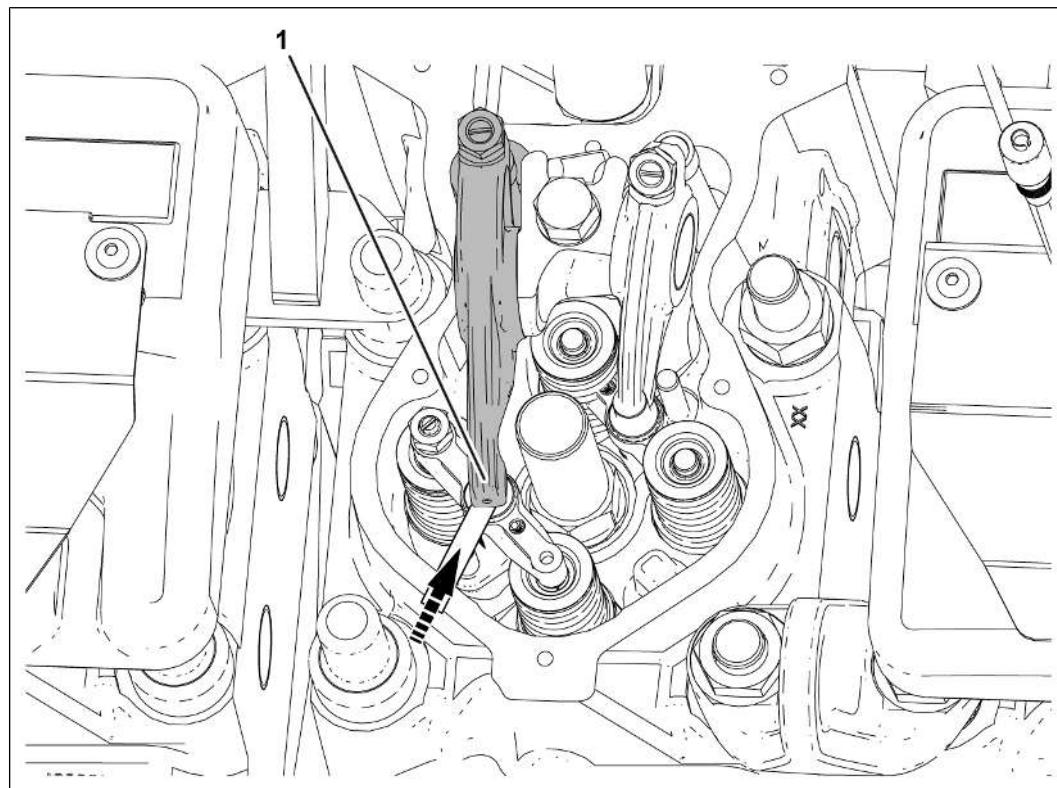
2. Check the clearance of the valve crosshead.

- 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

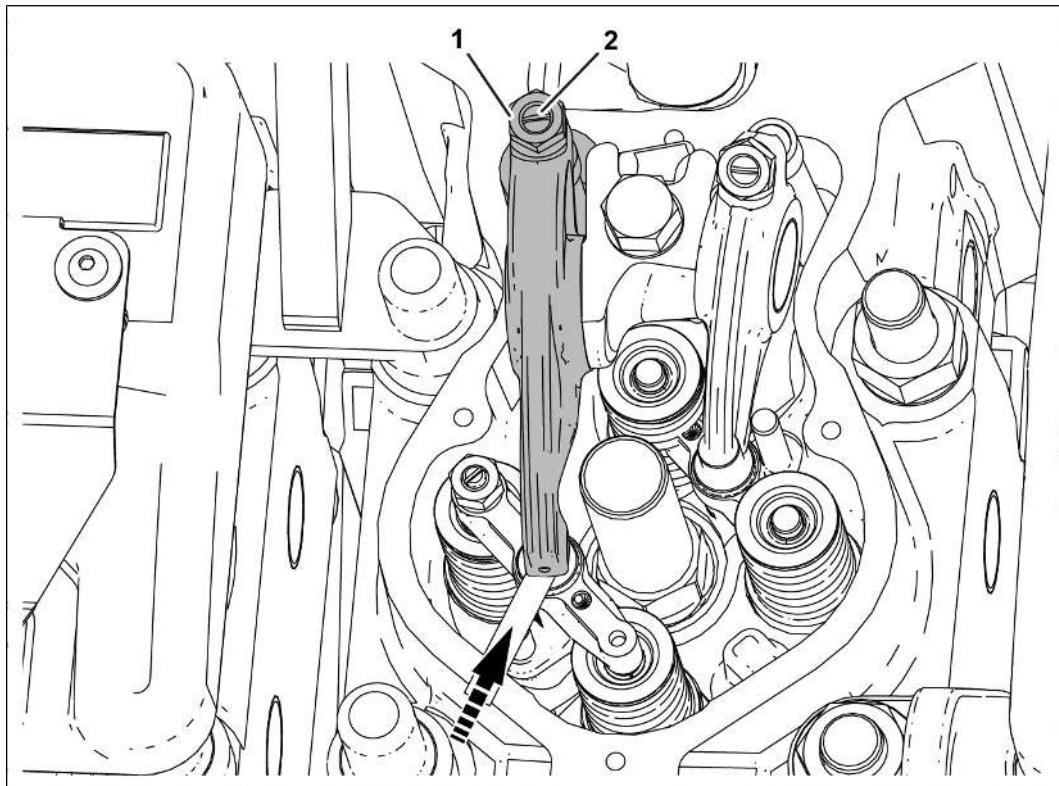
1. Unscrew nut (3).
2. Push in feeler gauges.
 - At the same time on both valves of a valve crosshead between valve shaft and valve crosshead (arrows).
3. Unscrew or screw in a setting screw (1) until the correct valve clearance is set.
4. Using a finger, press the rocker arm (2) on the valve crosshead.
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.

Adjust 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 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 gear, see OL-MRA10 / 49-01-12 [Dismantle the engine turning gear \[▶ 519\]](#)
- ⇒ Mount cylinder cover, see OL-MRA10 / 08-50-12 [Mounting the cylinder head cover \[▶ 399\]](#)

Checking the valve recession (cylinder head mounted)

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - Measuring device for valve wear 1221 7445 [▶ 187]
 - Depth caliper gauge for valve wear 1221 7475 [▶ 187]



Spare parts:

- Spare part
 - If necessary, sealing ring for spark plug

Technical data

V12 engine valve setting		
	Ignition TDC	A1 B5 A2 B3 A4 B1 A6 B2 A5 B4 A3 B6
	Overlap	A6 B2 A5 B4 A3 B6 A1 B5 A2 B3 A4 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.

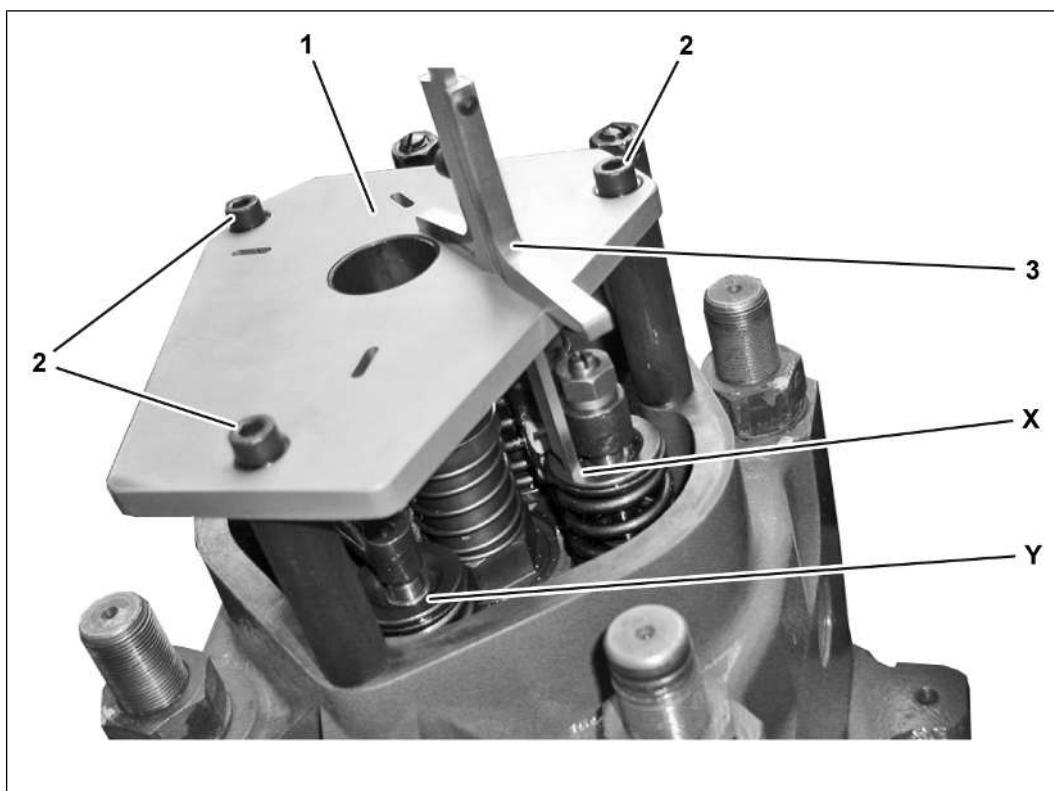
NOTE

The work described below is performed on one valve.

Proceed in the same way for all others.

Checking the valve recession (cylinder head mounted)

- ✓ Cylinder head cover dismantled, see OL-MRA10 / 08-50-12 [Dismantling the cylinder head cover \[▶ 398\]](#)
 - ✓ Spark plug dismantled, see OL-MRA10 / 26-10-10 [Removing the spark plug \[▶ 419\]](#)
 - ✓ Engine turning gear dismantled, see OL-MRA10 / 49-01-13 [Mounting the engine turning gear \[▶ 514\]](#)
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 screws (2).
5. Measure 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 Cat dealer.
8. Repeat the measurement for all cylinders.
 - ⇒ Dismantle engine turning gear, see [OL-MRA10 / 49-01-13 Dismantle the engine turning gear \[▶ 519\]](#)
 - ⇒ Install spark plug, see [OL-MRA10 / 26-10-10 Installing the spark plug \[▶ 422\]](#)
 - ⇒ Mount the cylinder head cover, see [OL-MRA10 / 08-50-12 Mounting the cylinder head cover \[▶ 399\]](#)

Dismantling and mounting the cylinder head cover

Dismantling the cylinder head cover

Valid for:

CG170B

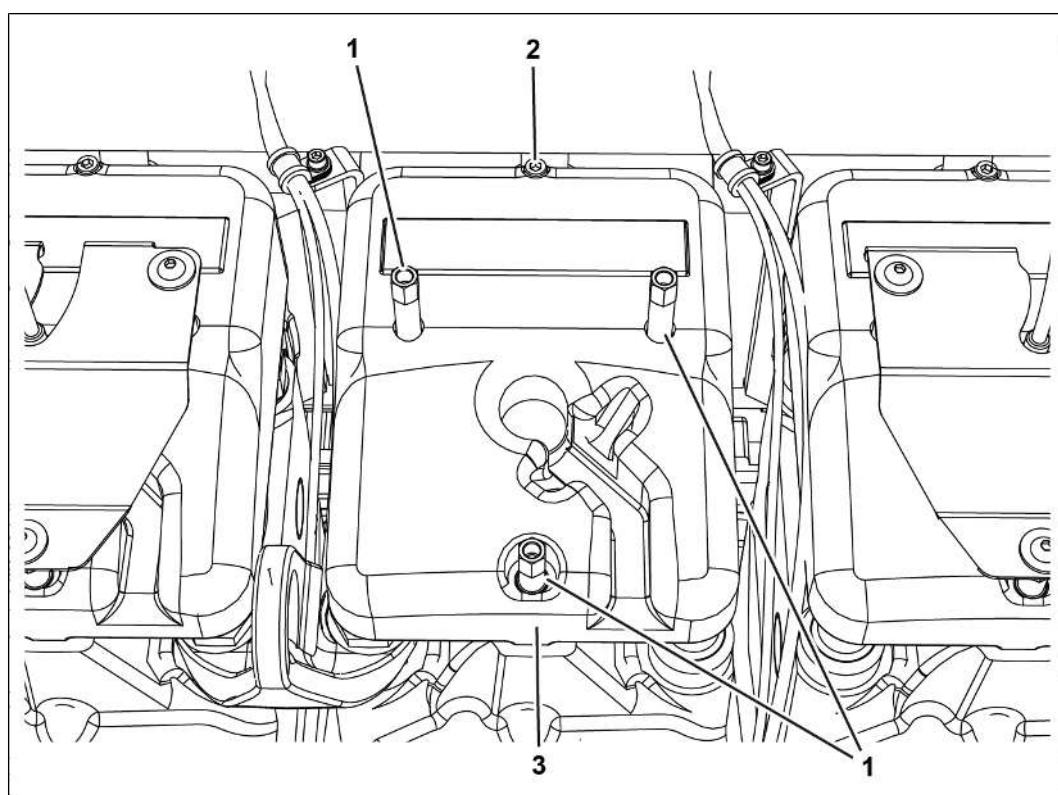


Tools:

- Standard tools

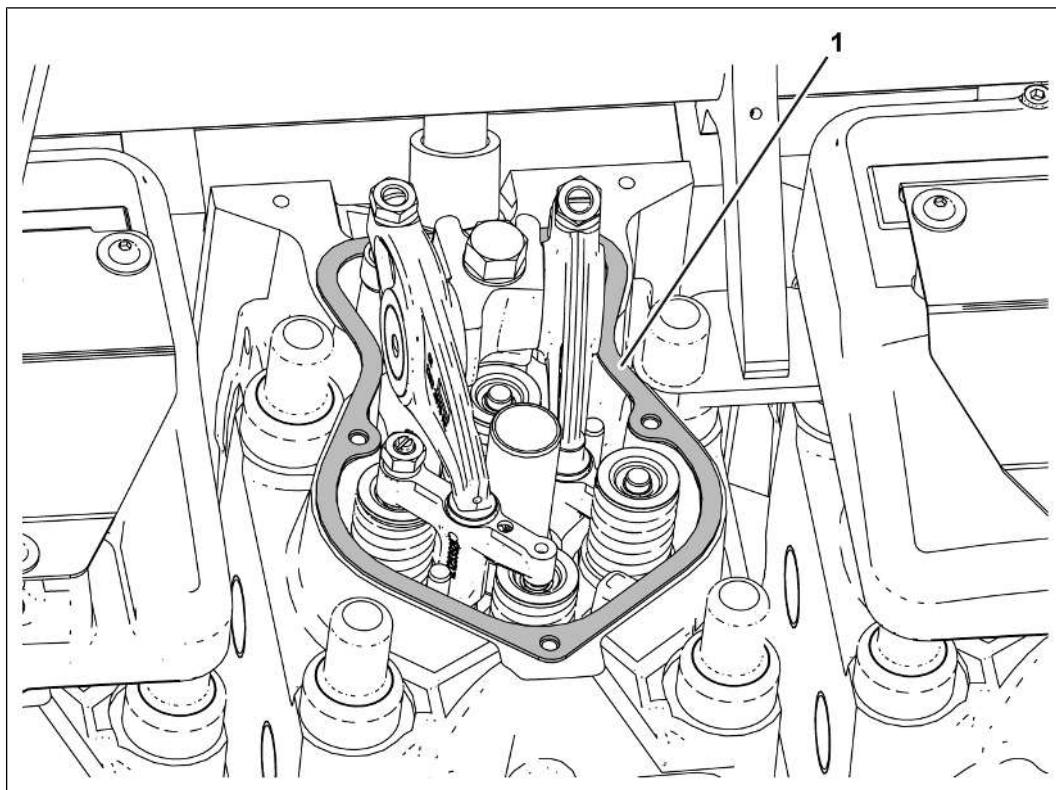
Dismantling the cylinder head cover:

- ✓ Remove spark plug, see OL-MRA10 / 26-10-10 [Removing the spark plug \[▶ 419\]](#)



489453963

1. Unscrew the screw (2).
2. Unscrew screws (1).
3. Remove cylinder head cover (3).



489456395

4. Check the seal (1) for cracks and wear.
 - Remove seal (1) if necessary.

Mounting the cylinder head cover

Valid for:

CG170B



Tools:

- Standard tools

Special tools

- [Torque wrench 1203 0350 \[▶ 186\]](#)

Auxiliary media:

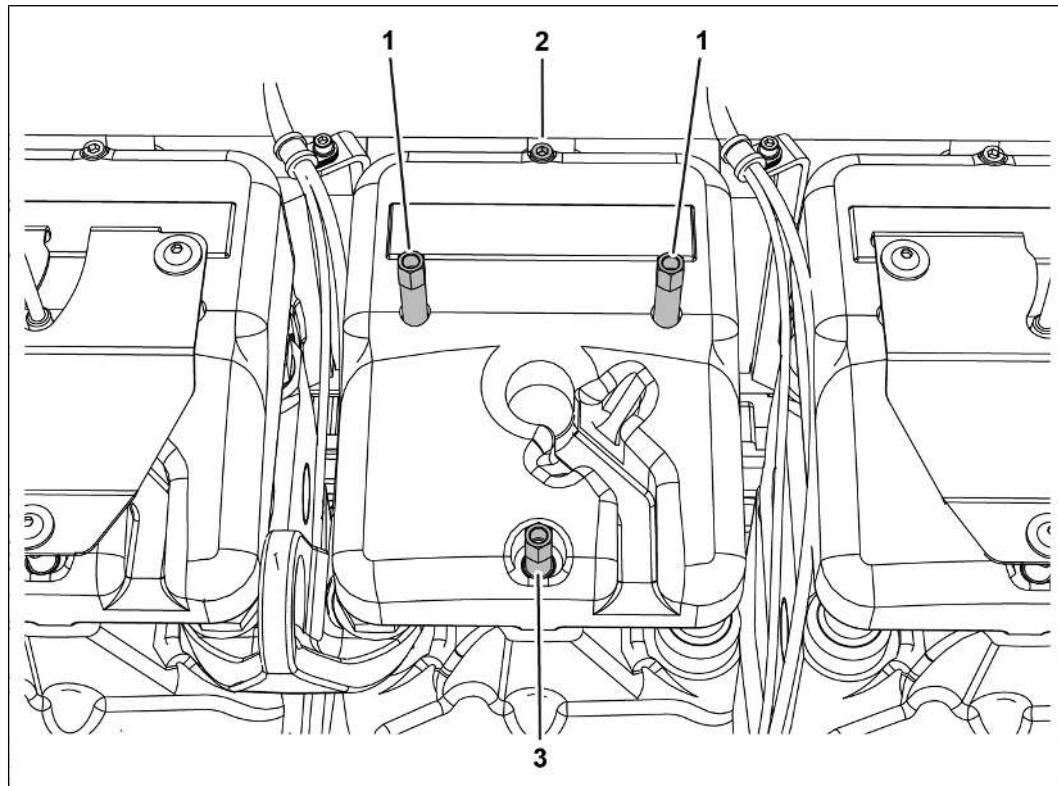
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

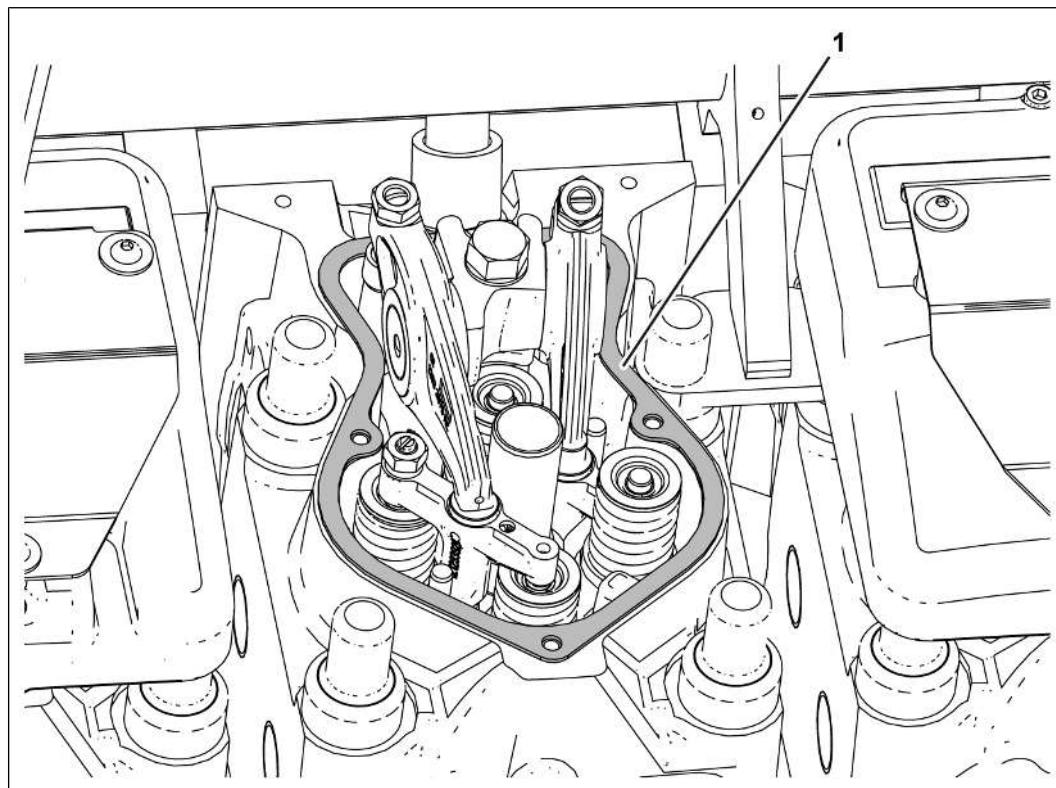
- If necessary, seal for cylinder head cover

Technical data



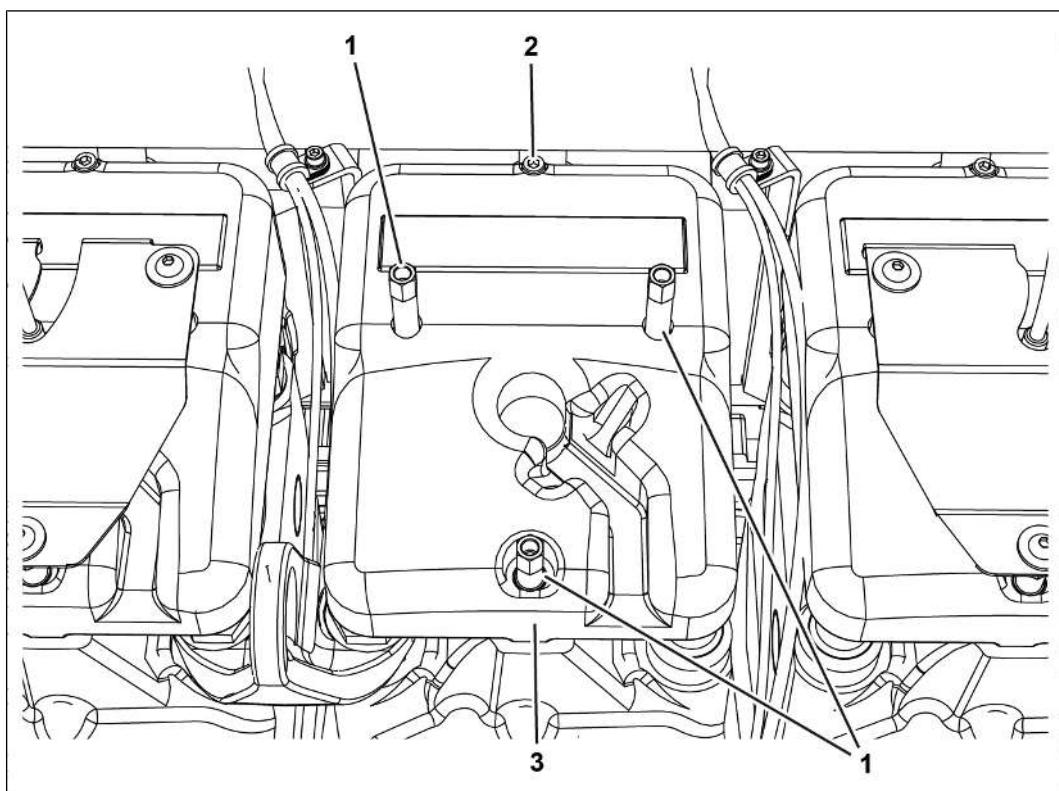
489451531

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:

489456395

1. Clean components.
2. Replace the seal (1).
 - Clean the sealing surface if necessary.
 - Fit seal (1).



489453963

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 \[▶ 422\]](#)

Removing and installing the lube oil filter

Removing the lube oil filter

Valid for:

CG170B



Tools:

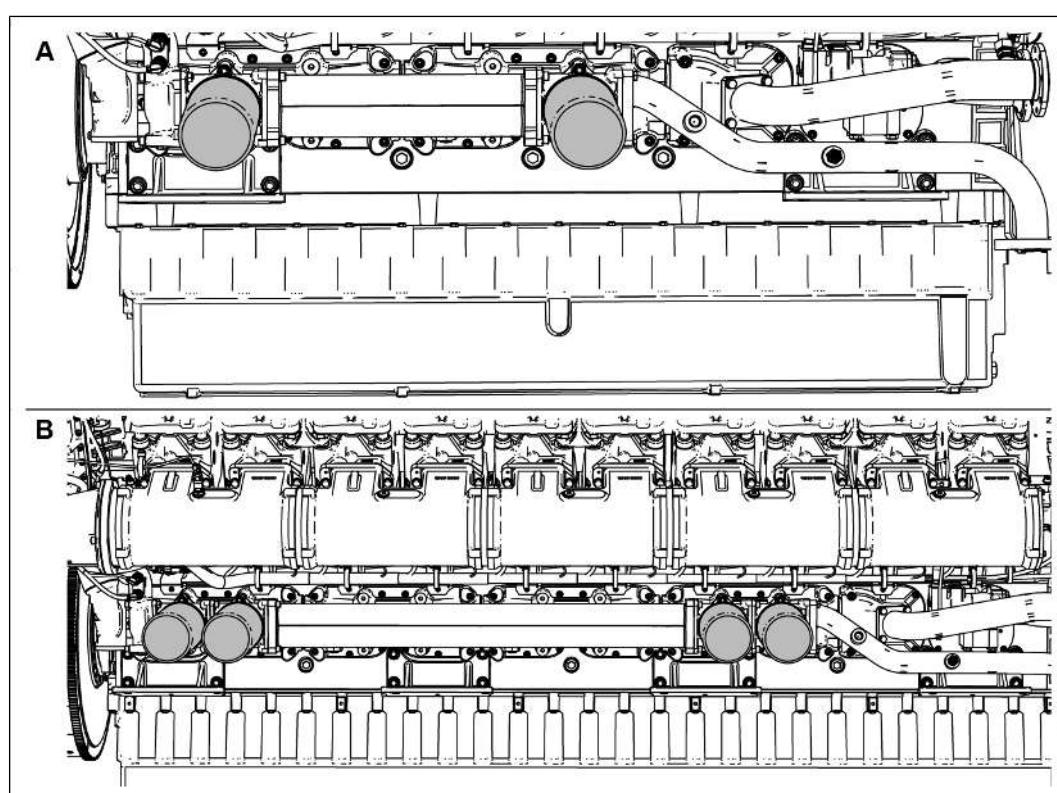
- Standard tools
- Special tool
 - Lube oil filter key 1215 8153 [▶ 189]



Auxiliary media:

- Binding agent

General information



515261195

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**

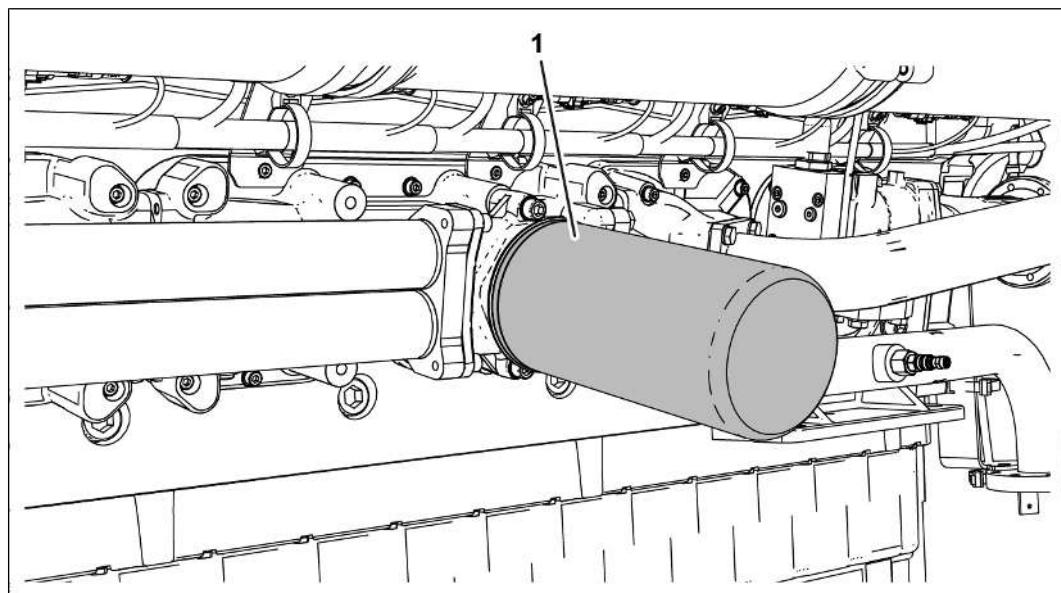
Due to escaping operating media that enter the environment.

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 \[▶ 154\]](#)
- 1. Wait for re-lubrication procedure.
- 2. Operate the emergency stop button.



515255435

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

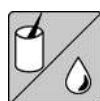
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Lube oil filter key 1215 8153 \[▶ 189\]](#)



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](#).

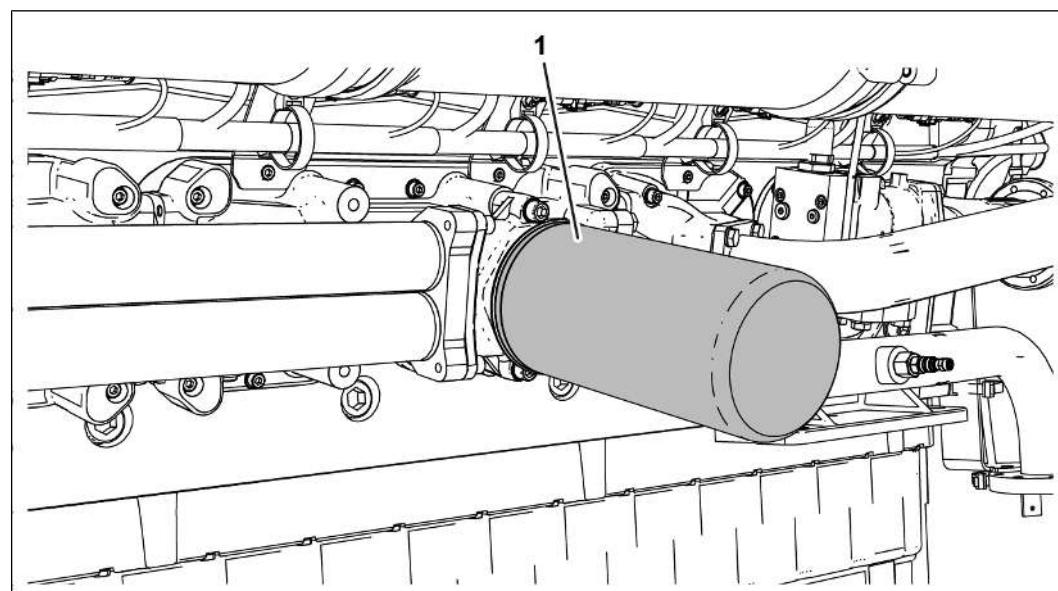


Spare parts:

- Lube oil filter

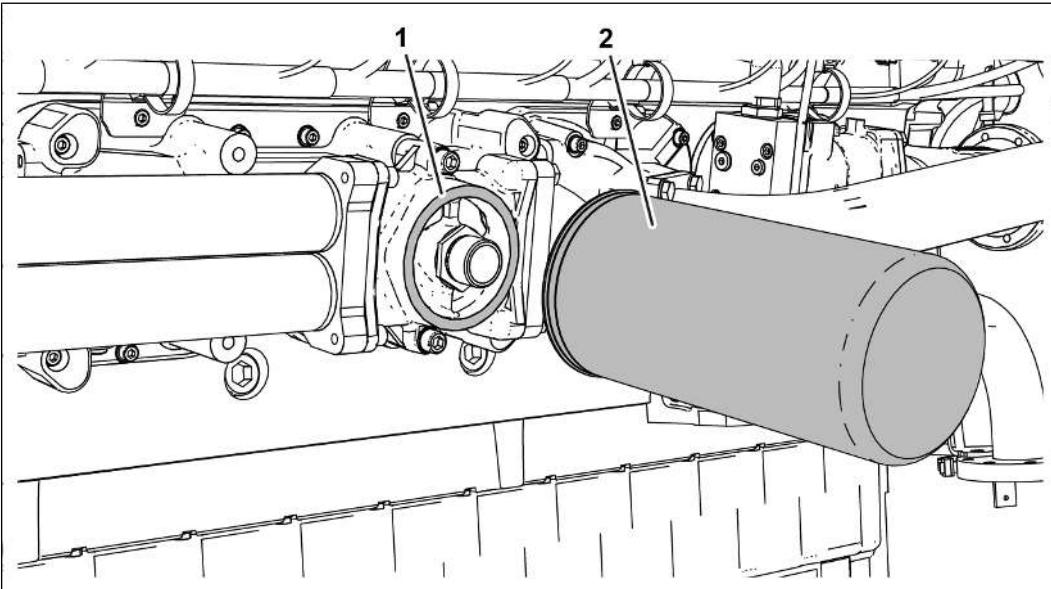
Technical data

Installing the lube oil filter:



515255435

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.			



515257355

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 system, see the Troubleshooting chapter, Fault displays section.
 4. Start the prelubrication, see OL-MRA10 / 02-01-22 [Performing lube oil change \(genset\)](#) [▶ 337].
 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](#) [▶ 117]

Cleaning the lube oil cooler

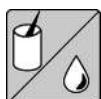
Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Cleaning agent

– See Service Library, Technical Bulletin (TR 2147), [Specification for auxiliary media](#).

General information



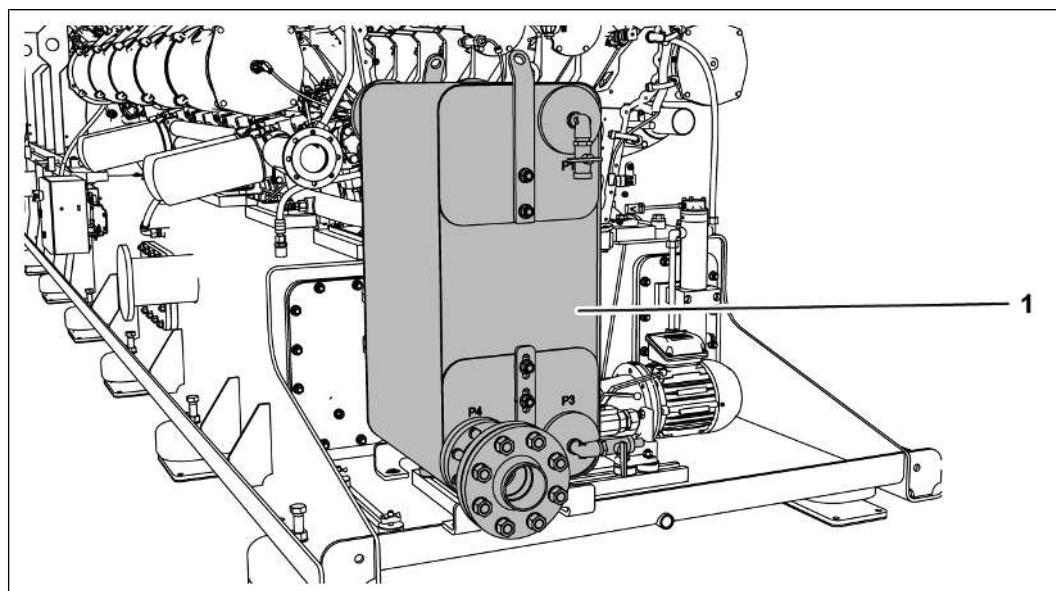
CAUTION

Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.

Cleaning the lube oil cooler:



556898187

1. Clean the outside of the lube oil cooler (1).
2. **WARNING! Dirt particles that come loose!** Clean the outside of the lube oil cooler (1)
 - Clean with compressed air if necessary.

Checking the flexible lube oil line

Valid for:

CG170B



Tools:

- Standard tools

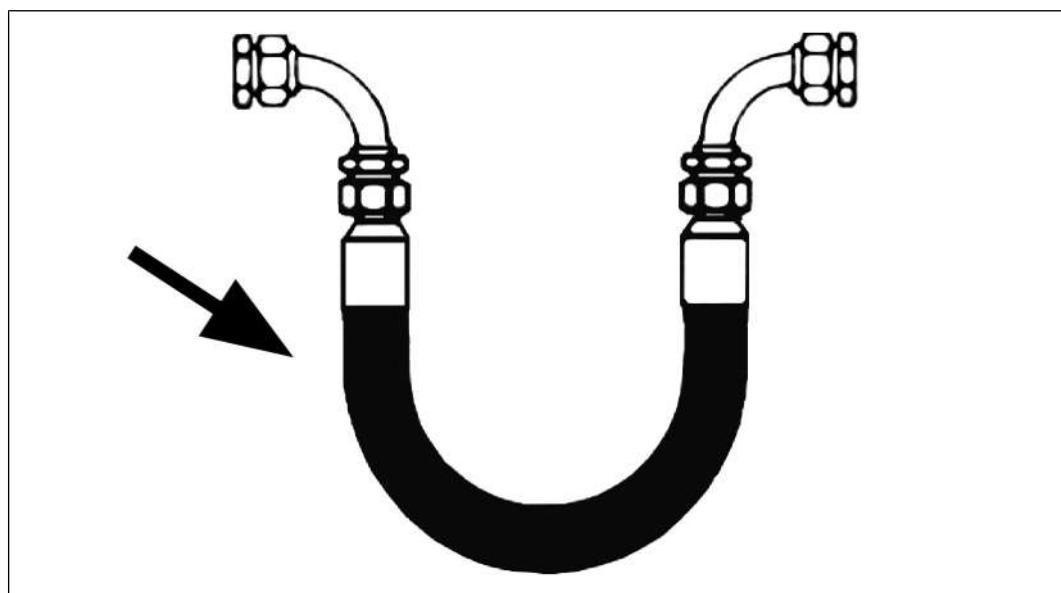
Technical data

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

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, replace 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

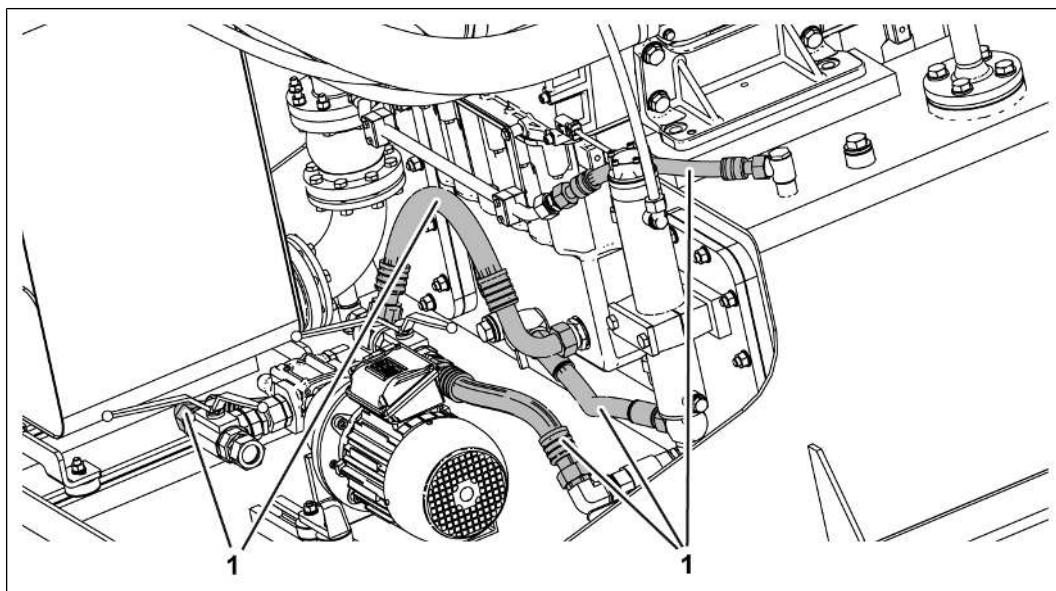
Risk of burns from touching hot operating media or hot components

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 ▶ 154](#)



515793291

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 ▶ 117](#)

Checking the lube oil line

Valid for:

CG170B



Tools:

- Standard tools

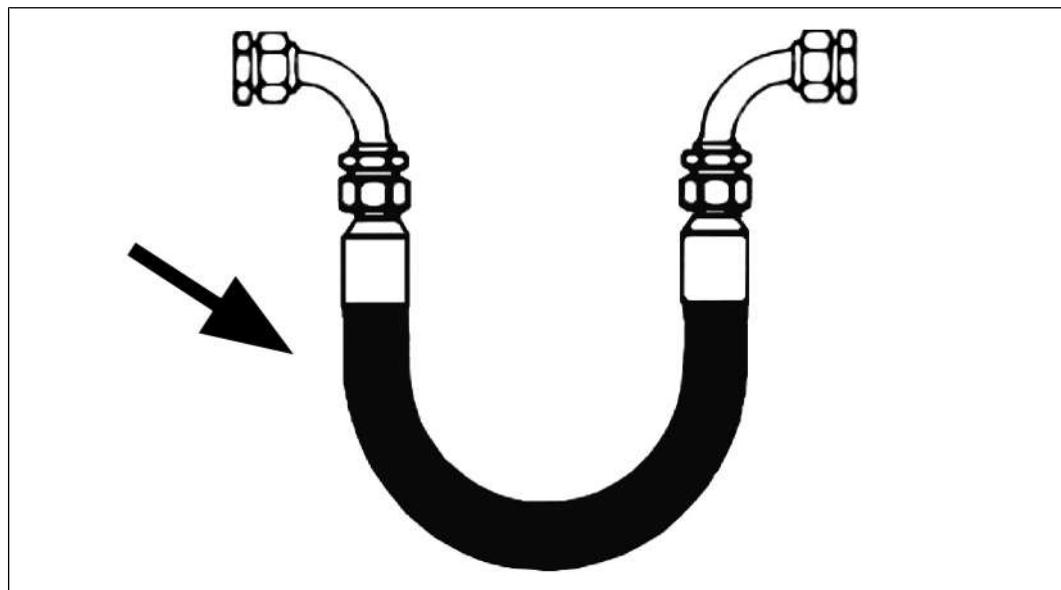
Technical data

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

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, replace 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

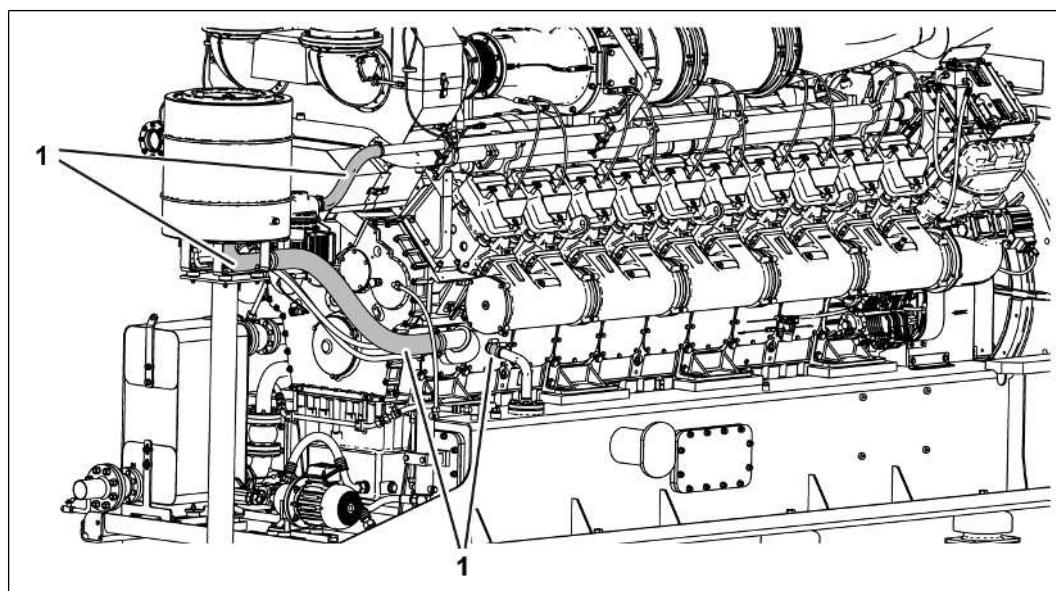
Risk of burns from touching hot operating media or hot components

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 \[▶ 154\]](#)



515790859

1. Visually inspect lube oil line (1).
 2. Check the lube oil line is tight.
- ⇒ Commission the genset, see [Commissioning/Genset Start the genset \[▶ 117\]](#)

Dismantling and mounting the intake air filters (mounted version)

Dismantling the intake air filter

Valid for:

CG170B

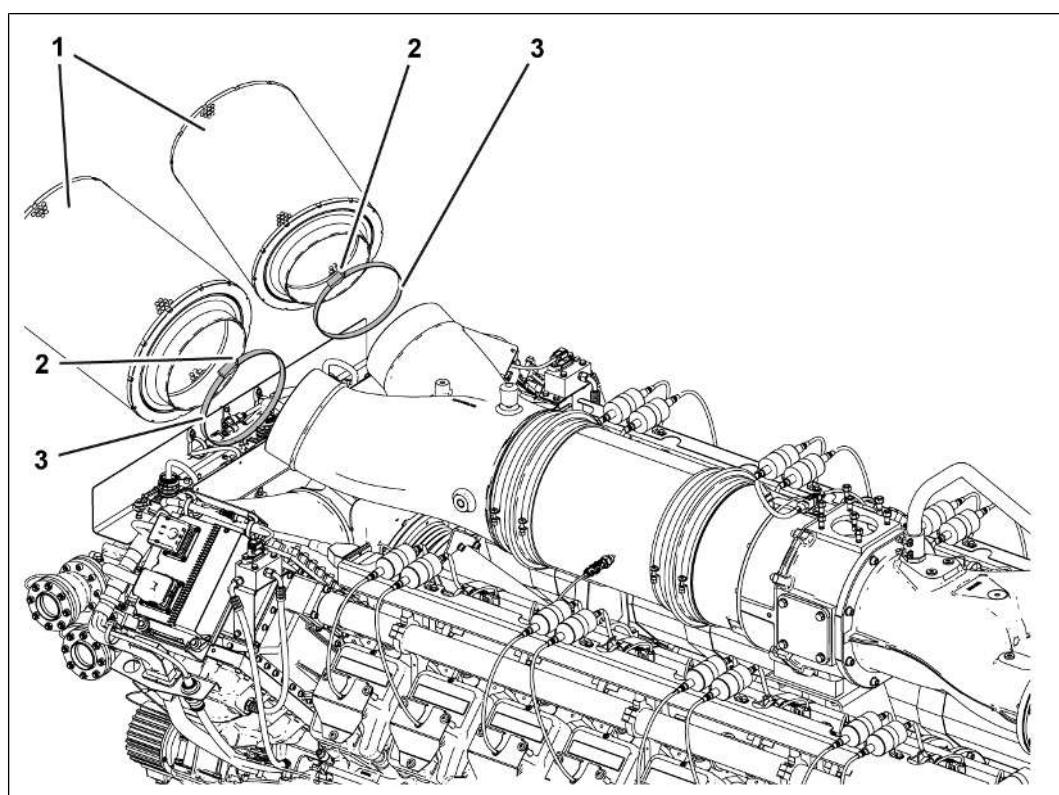


Tools:

- Standard tools

Dismantling the intake air filter:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



491996555

1. Open clamping clip (3).
 - Loosen screw (2).
2. Remove the intake air filter (1).
3. Remove the clamping clip (3).

Mounting the intake air filter

Valid for:

CG170B



Tools:

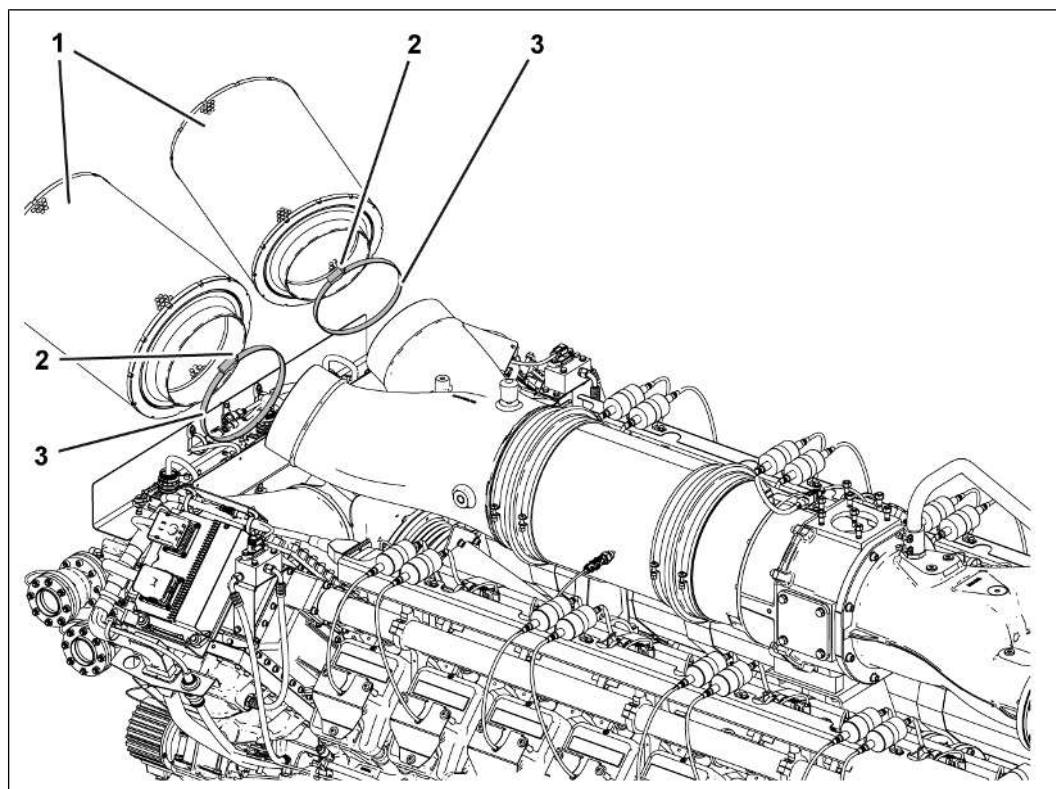
- Standard tools



Spare parts:

- Spare part
 - If necessary, intake air filter

Mounting the intake air filter:



491996555

1. Attach the intake air filter (1) with the clamping clip (3).
 2. Close the clamping clip (3).
 - Tighten screw (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Setting the global ignition angle

Valid for:

CG170B

Technical data

Global ignition angle for standard gases	
Configuration	Global ignition angle [° crankshaft before top dead center]
P, PV, R, RV (natural gases)	27
X, XV (biogas)	27
Z (propane gas)	19

Global ignition angle as a function of the methane number	
Methane number	Global ignition angle
Configurations: P, PV, R, RV	[° crankshaft before top dead center]
from 33	19
from 45	21
from 55	23
from 65	25
from 70	27

Methane number	Global ignition angle
Configuration: Z	[° crankshaft before top dead center]
from 33	19
from 45	20
from 55	21
from 65	22
from 70	23

Global ignition angle for natural gases with hydrogen content	
Hydrogen content [vol. % H₂]	Global ignition angle
Configurations: P+, PV+, R+, RV+	
0	27
to 5	25
to 10	23
to 15	22
to 20	20
to 25	19

Global ignition angle for sewage gas, landfill gases, and other biogases	
Methane content [vol. % CH₄]	Global ignition angle
Configurations: X, XV	
to 55	29
to 60	28
from 60	27

General information

Fuel gases with a higher proportion of hydrogen (H₂) or longer hydrocarbons (propane C₃H₈) burn faster.

- Faster combustion must be compensated by adjusting the global ignition angle.
- The global ignition angle for each hydrogen concentration must be stored in the engine control system.

When commissioning the genset, the commissioning engineer stores the global ignition angle in the engine control system.

When the gas composition changes (hydrogen content in natural gas, methane content in biogas, etc.), the global ignition angle must be adjusted.

- For operation, the global ignition angle must be set according to the actual hydrogen content in the natural gas.
- For information on the global ignition angle for each hydrogen or methane content level, see Technical data.

The control system adjusts the ignition angle to the actual combustion characteristic curves (balancing).

- Based on the global ignition angle, the control system continuously calculates the required ignition angle adjustment for this purpose.
- Based on the ignition angle adjustment made, the ignition occurs a few degrees crank angle earlier or later.

When **biogas** is used, the methane content of the biogas influences combustion.

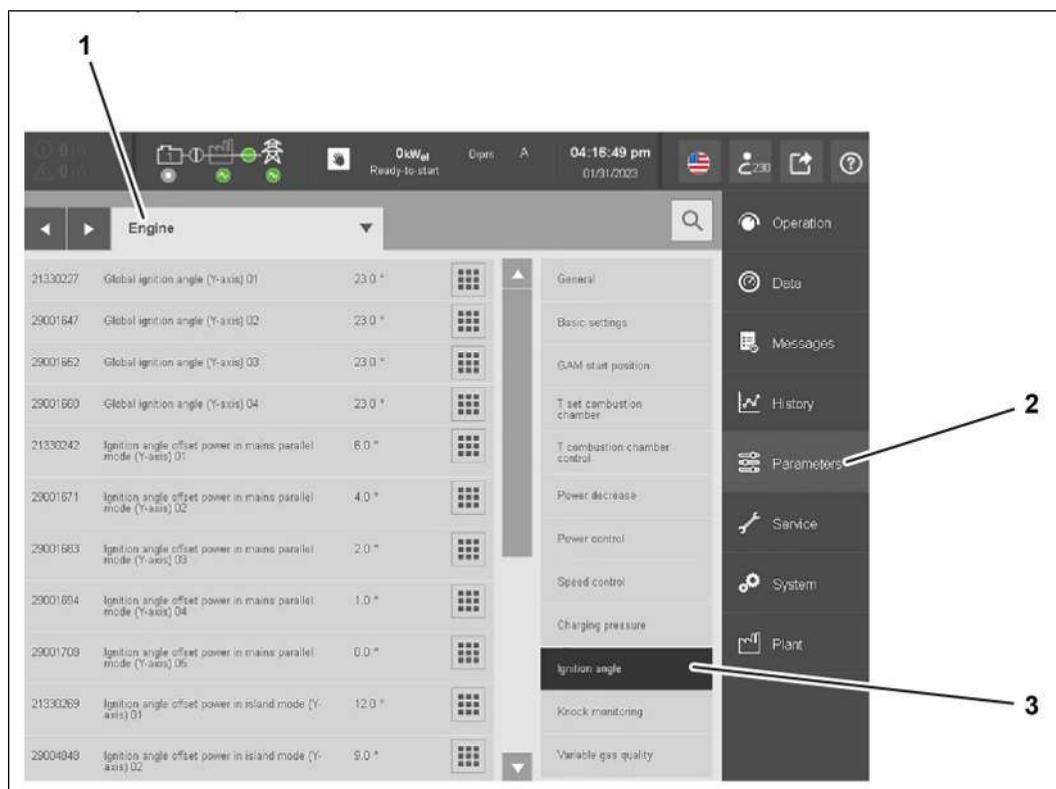
- A lower methane concentration in biogas must be compensated by adjusting the global ignition angle.
- The global ignition angle for each possible methane concentration is stored in the engine control.

NOTE! When the genset is retrofitted for hydrogen operation, the global ignition angle for hydrogen operation must be adjusted in the engine control. Store the global ignition angle in the Global ignition angle parameter.

- Set the global ignition angle for operation according to the actual hydrogen content in the natural gas.

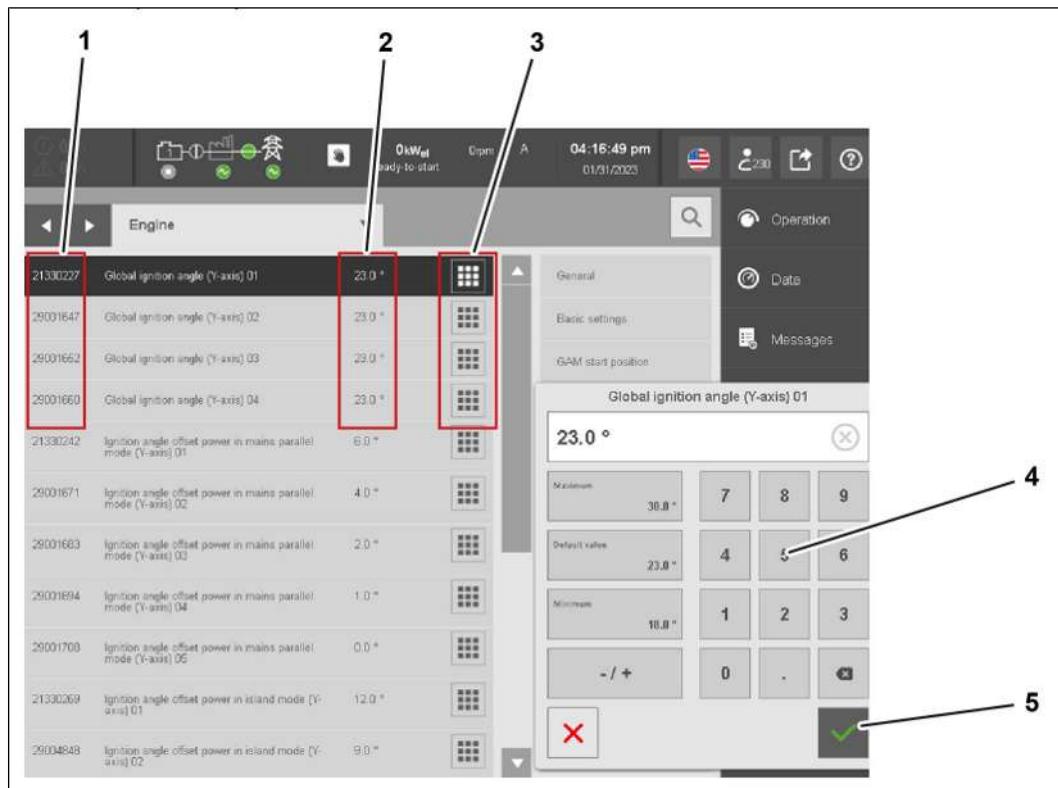
Setting the global ignition angle:

- ✓ The engine control system is equipped with **TPEM** version 1.8.2 or higher.
- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



1856877579

1. Open the functional group **Parameters** (2).
 - Open sub-group **Engine** (1).
 - Select the function **Ignition angle** (3).



1856876427

2. Adjust parameter 21330227 Global ignition angle (Y-axis) 01.
 - In the dialog area 21330227 Global ignition angle (Y-axis) 01 (1), select the symbol (3). The input mask opens.
 - Use the numeric keypad (4) to enter the value for the respective hydrogen content according to the technical data.
 - Confirm entry by pressing the green checkmark (5).
 - The new ignition angle (2) appears in the dialog area 21330227 Global ignition angle (Y-axis) 01 (2).
3. **NOTE! Enter the same value for every parameter based on the hydrogen or methane content.** Repeat the procedure described above for the following parameters:
 - 29001647 Global ignition angle (Y-axis) 02,
 - 29001652 Global ignition angle (Y-axis) 03 and
 - 29001660 Global ignition angle (Y-axis) 04

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the spark plug

Removing the spark plug

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Socket wrench insert for spark plug \(prechamber spark plug\) 1230 1538 \[▶ 189\]](#)

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

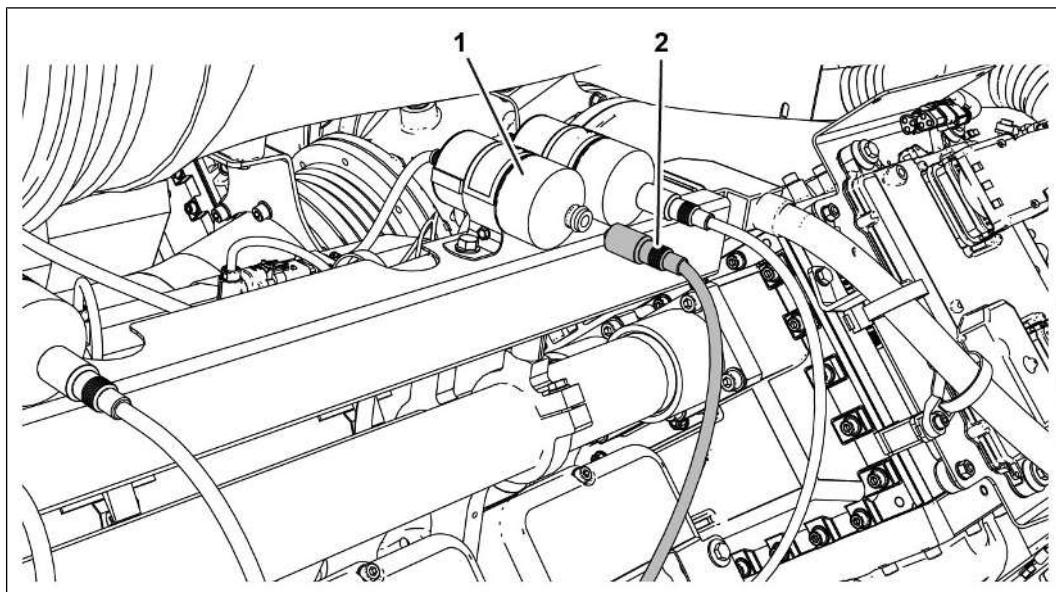
Injury due to particles of dirt

Minor or severe injuries may result.

- Wear personal protective equipment.
-

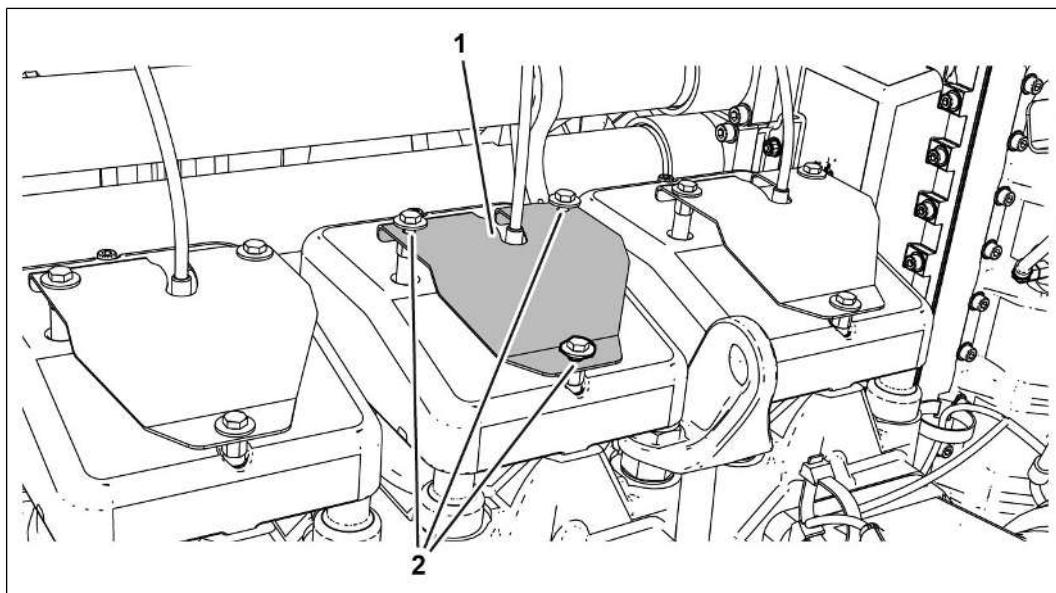
Removing the spark plug:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



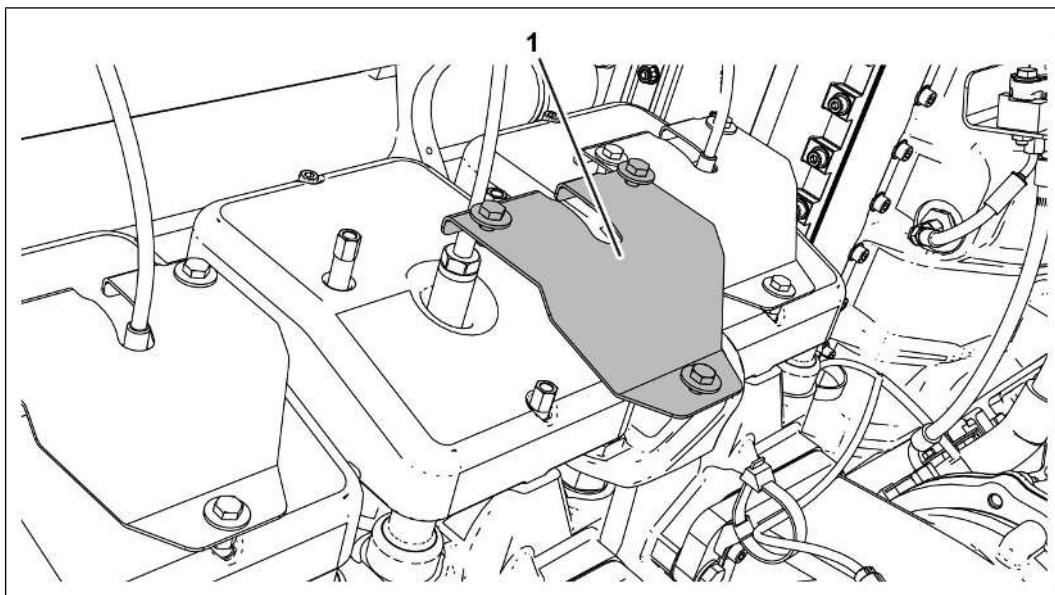
501702795

1. Disconnect ignition cable (2) from ignition coil (1).



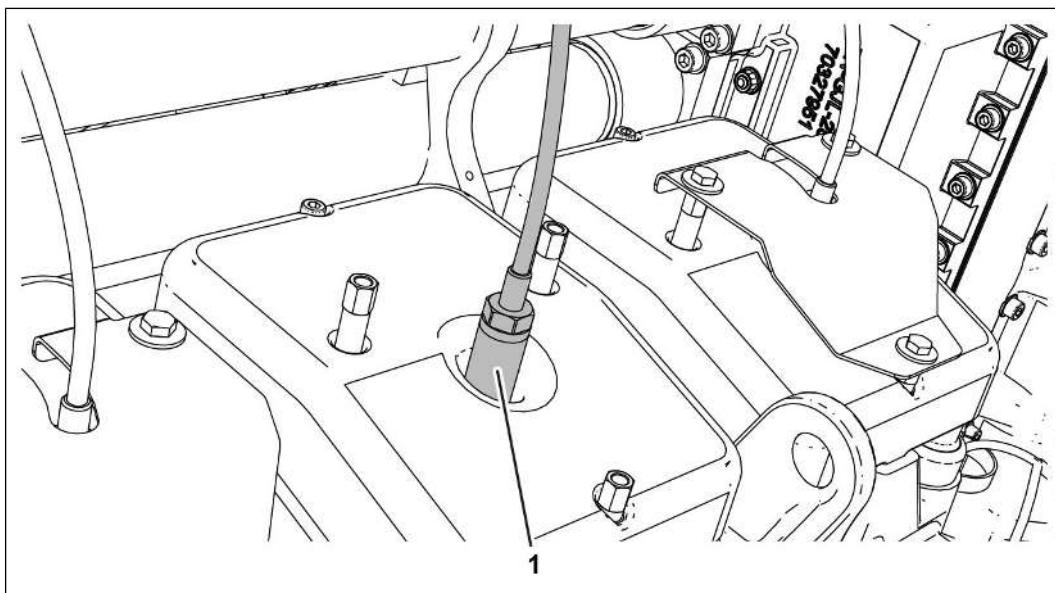
501704715

2. Dismantle the spark plug cover (1).
 - Unscrew screws (2).



501706635

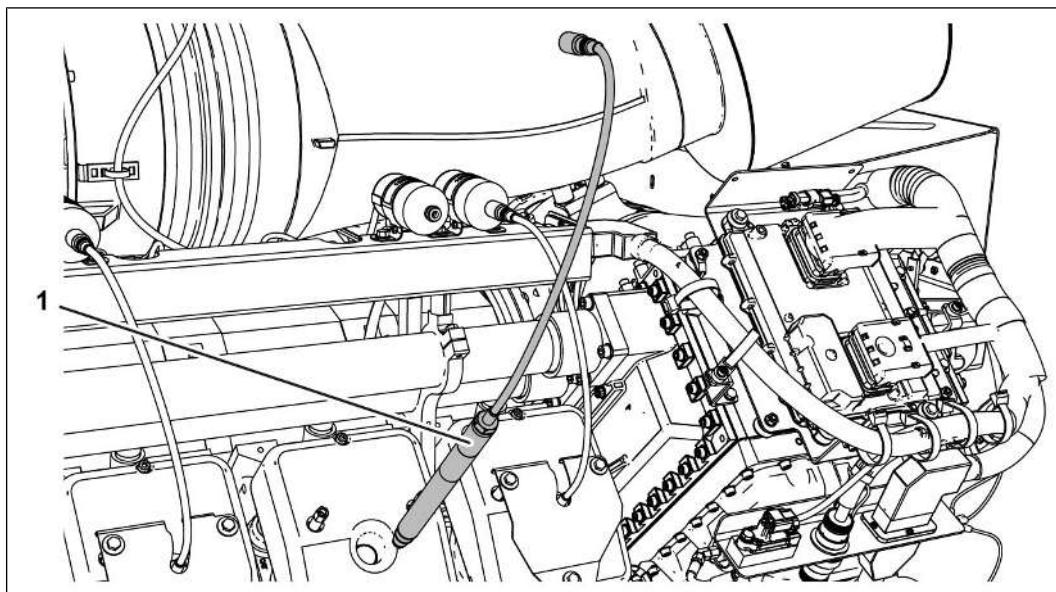
- Remove the spark plug cover (1).



501708555

3. Remove the 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.

See also

Checking the spark plug and ignition cable [[► 428](#)]

Installing the spark plug

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Socket wrench insert for spark plug \(prechamber spark plug\) 1230 1538 \[► 189\]](#)
 - [Spark plug thread cleaner 1251 5557 \[► 189\]](#)

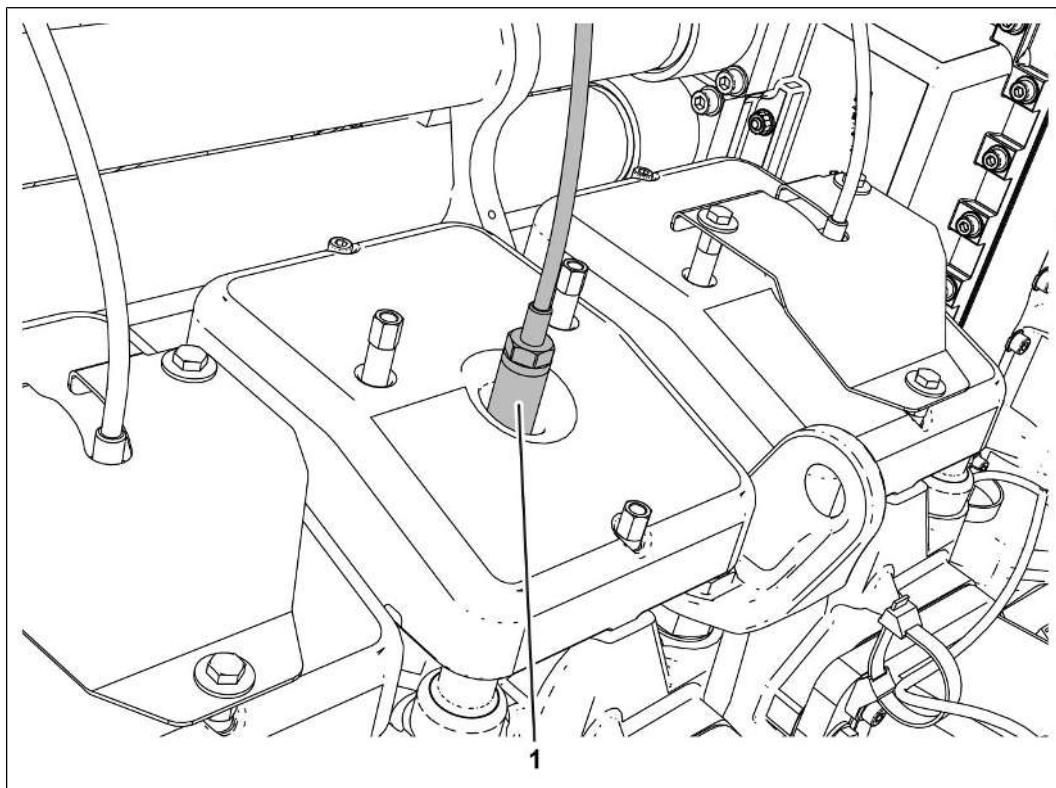
Auxiliary media:

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



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.

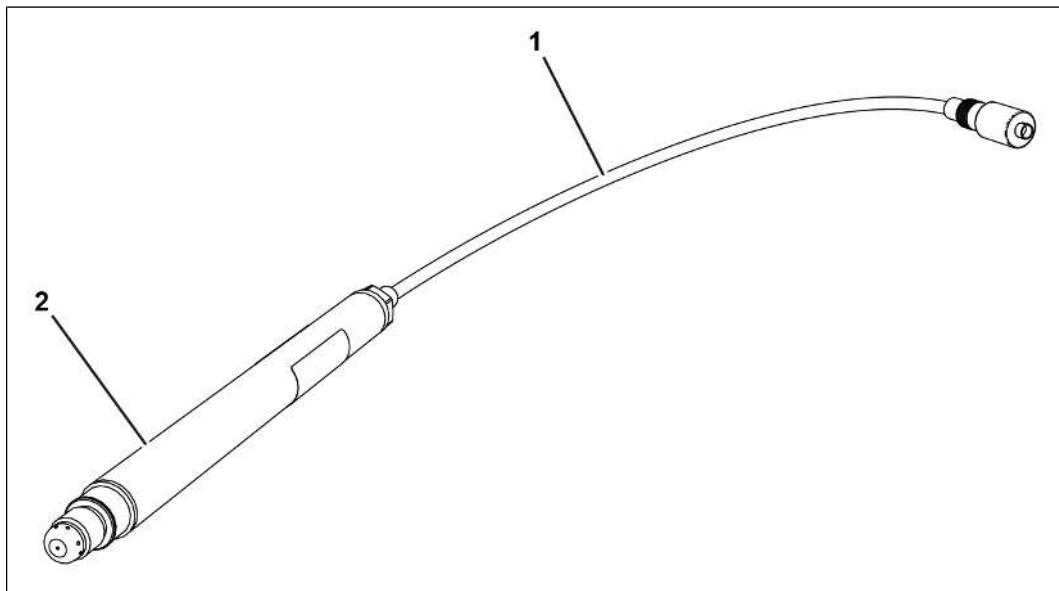
- Do not install the spark plug if the sealing ring is screwed into the spark plug thread.

**CAUTION**

Improperly assembled spark plug

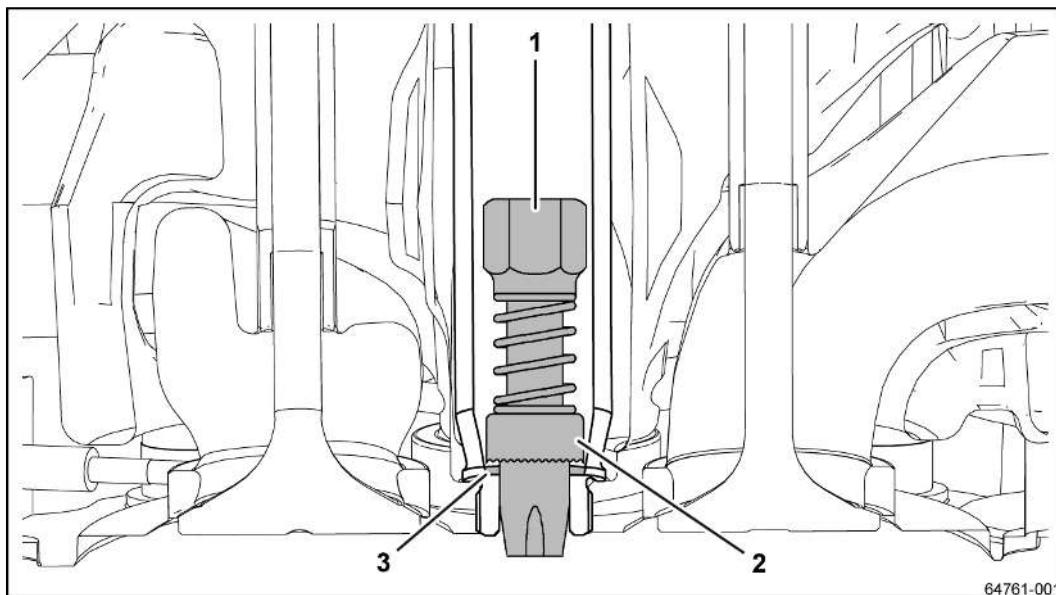
This can lead to minor or severe injuries and property damage.

- 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:

501712395

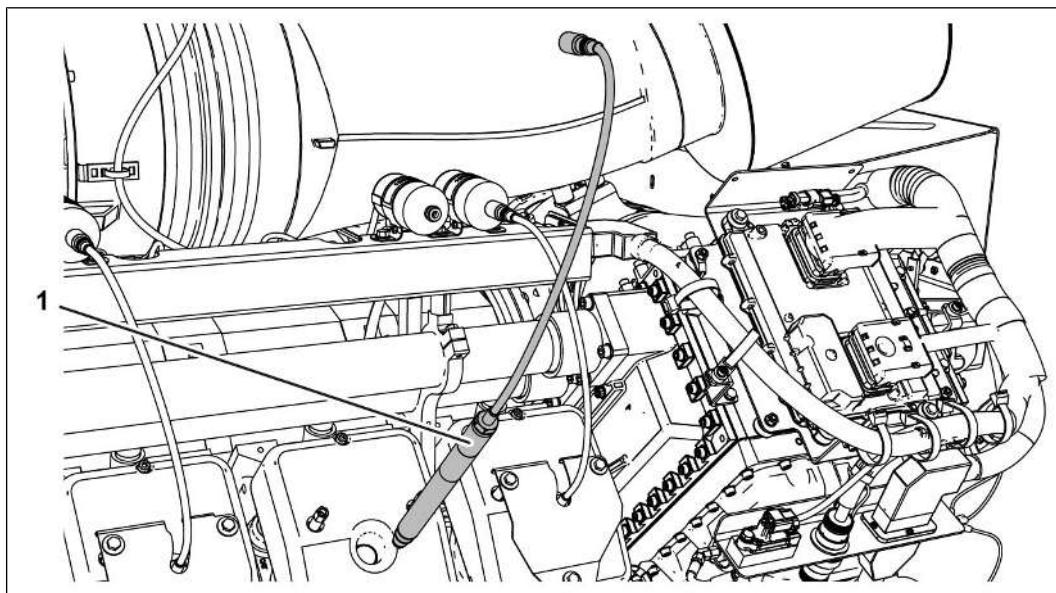
1. Clean components.
2. Check the spark plug (2) and ignition cable (1), see OL-MRA10 / 26-13-01 [Checking the spark plug and ignition cable \[▶ 428\]](#).



501697035

3. 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).

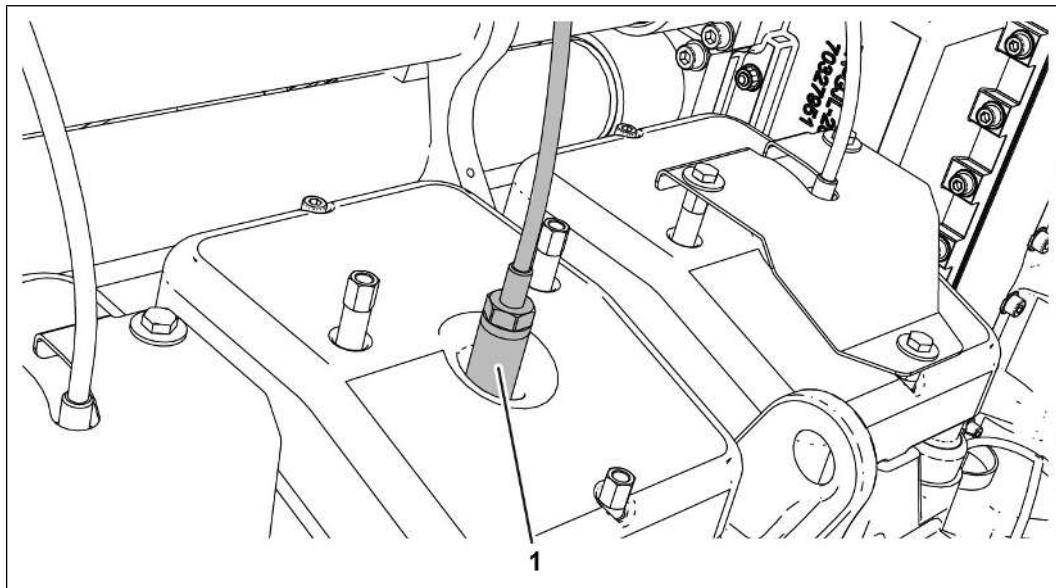


501710475

4. **CAUTION! Tighten spark plug and check for correct fit!** Install the spark plug (1)

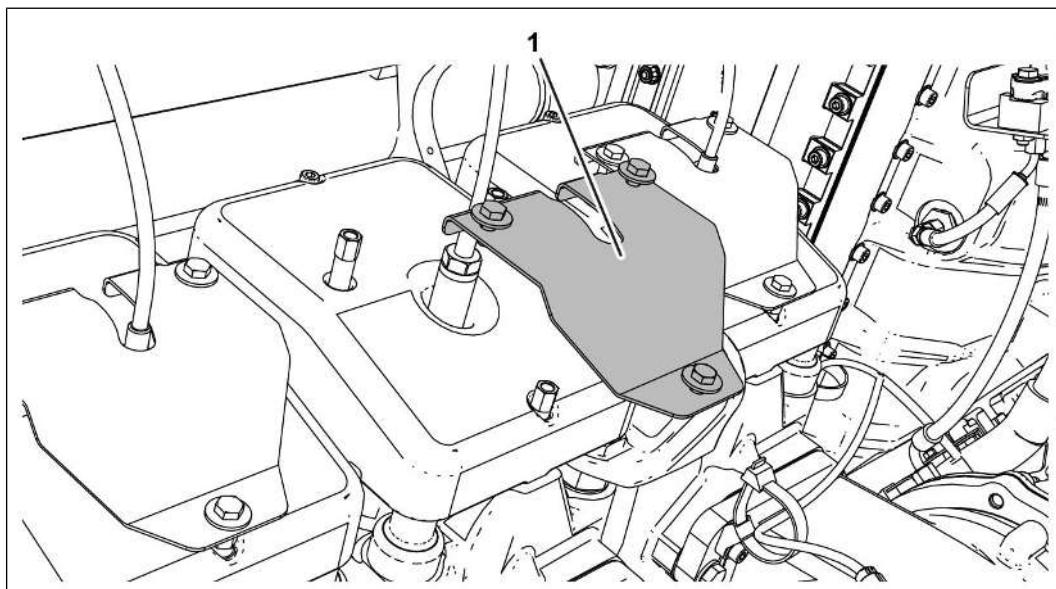
- Replace sealing ring.

- Check that movement of the sealing ring is unobstructed.
- Insert spark plug with ignition cable.



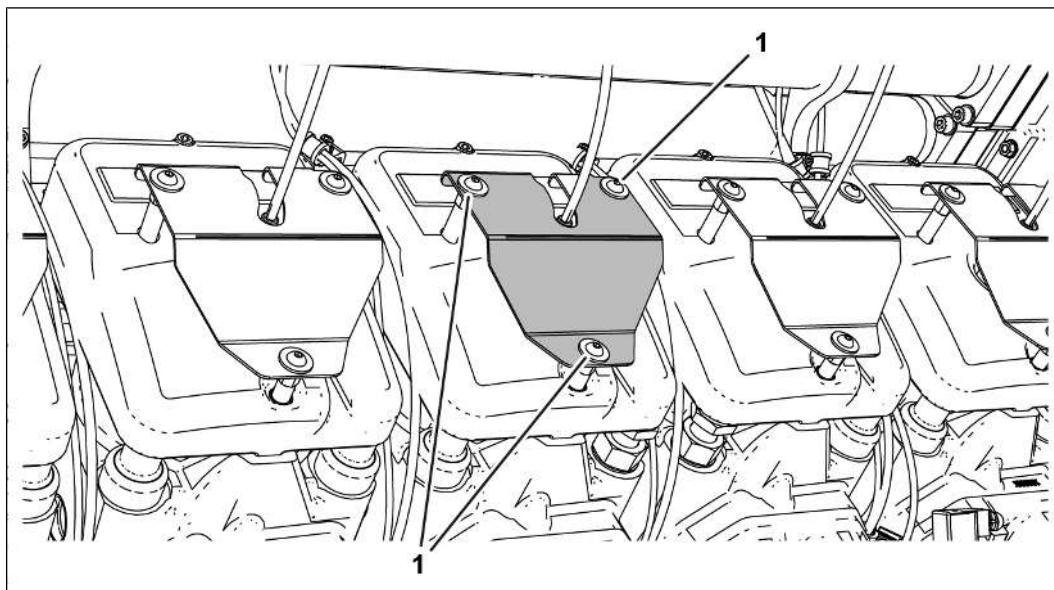
501708555

- Tighten spark plug (1).



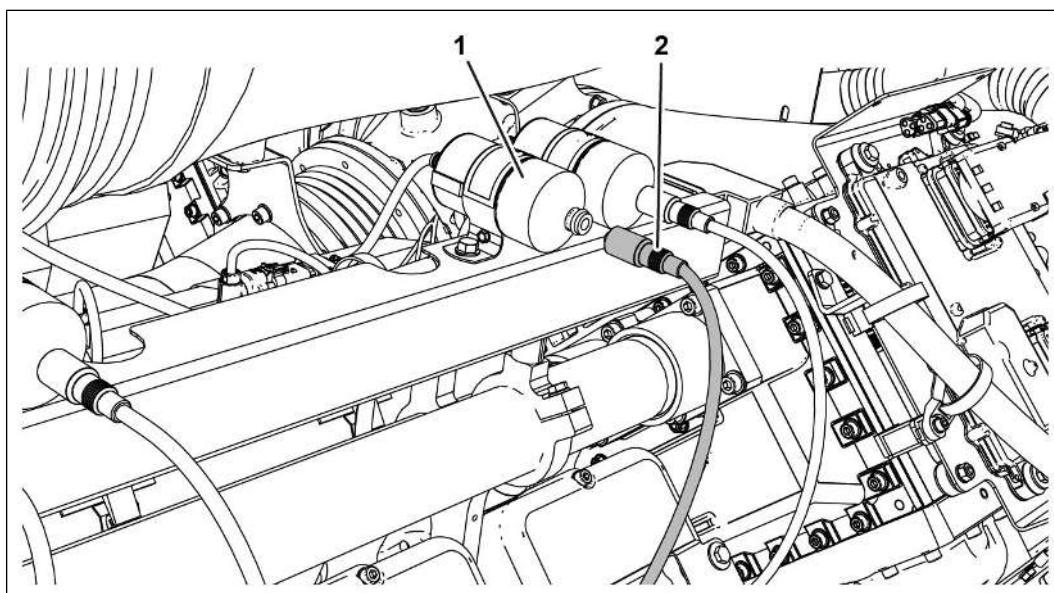
501706635

5. Mount spark plug cover (1).
 - Attach spark plug cover.



501894923

- **NOTE! If the catch guard cannot be mounted correctly, it is possible that the spark plug is not screwed in correctly!** Tighten screws (1).



501702795

6. Connect ignition cable (2) to ignition coil (1).
⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the spark plug and ignition cable

Valid for:

CG170B



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.

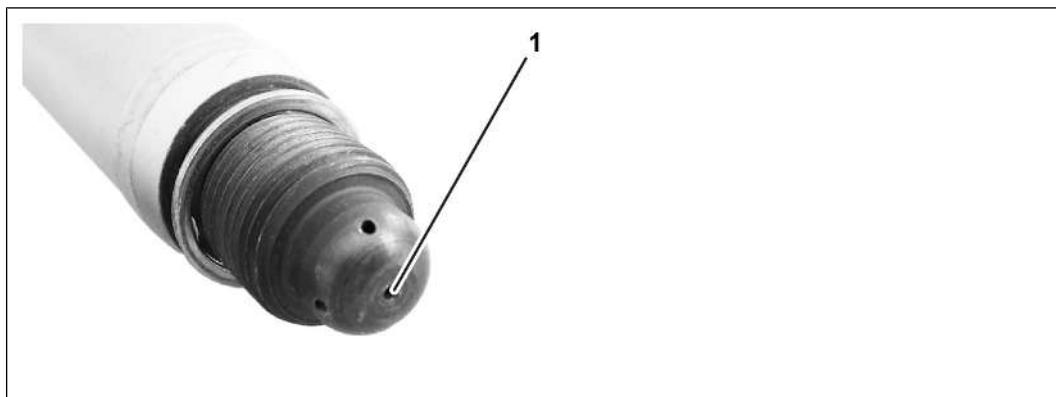
NOTE

The work described below is carried out on one spark plug.

Check all spark plugs in the same way.

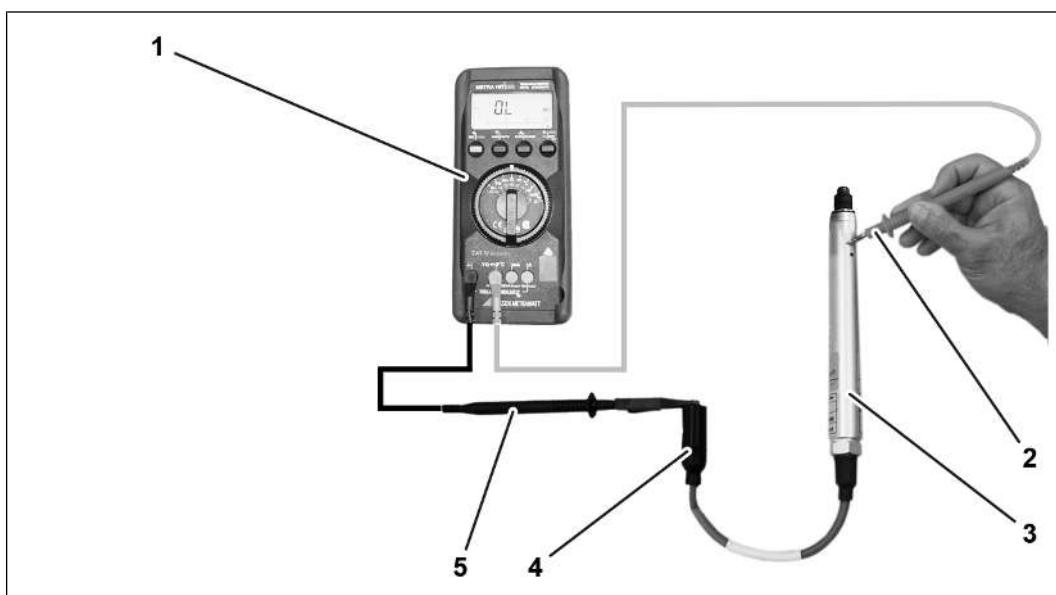
Checking the spark plug and ignition cable:

- ✓ Spark plug dismantled, see OL-MRA10 / 26-10-10 Removing the spark plug [▶ 419]



521695883

1. Check spark plug.
 - Check the spark plug and ignition cable for mechanical damage.
 - **NOTE! Replace any spark plug with clogged bores.** Check the bores (1) of the spark plug for deposits.
 - Replace any damaged spark plug and spark plug with damaged ignition cable.



521700235

2. Connect the measuring device (1) for the electrical test (short-circuit test) to the spark plug.
 - Attach the connector (5) of the measuring device to the connector (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 TPEM.
 - Select the Controller function group.

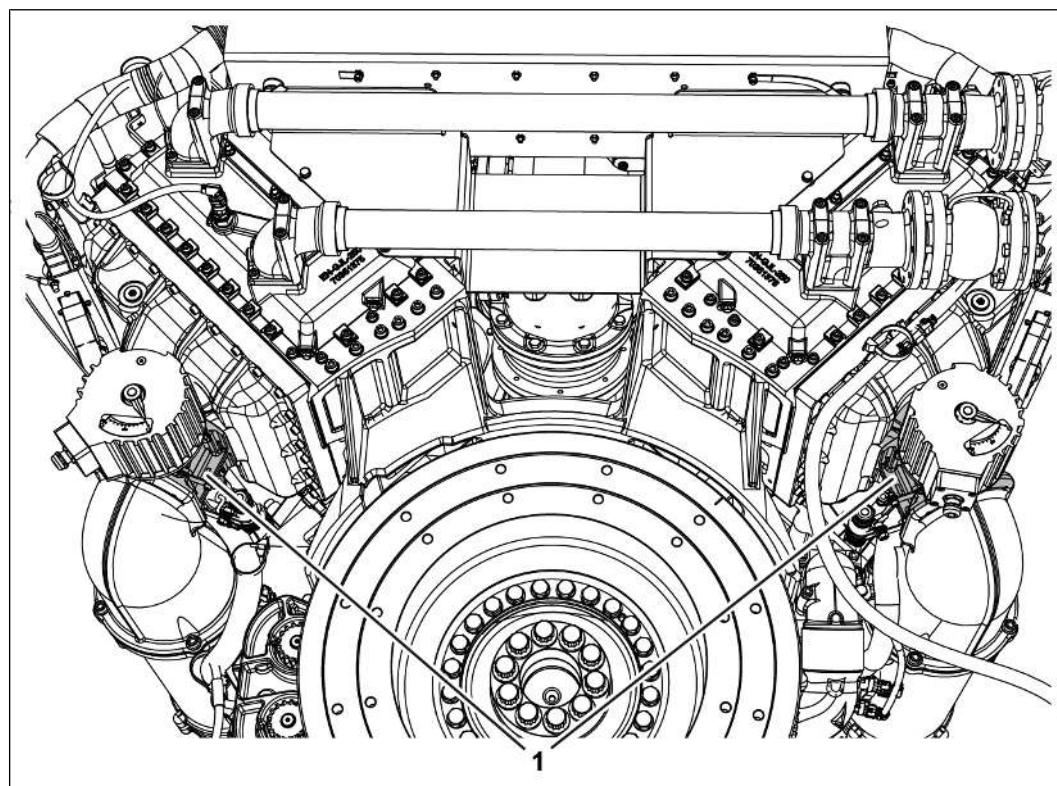
- The Controller mask opens.
 - Tap the Ignition button.
 - The minimum limit values for the cylinder row A and cylinder row B appear in the Diagnostics dialog area.
 - **NOTE! If the minimum limit value has been reached, replace the spark plug.** Compare the displayed minimum limit value of the corresponding 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 \[▶ 422\]](#)

Checking the throttle valve

Valid for:

CG170B

General information



522089739

The engine is equipped with two throttle valves (1). A throttle valve is installed on each side of the cylinder. The throttle valves are in the mixture pipe immediately behind the respective mixture cooler.

NOTE

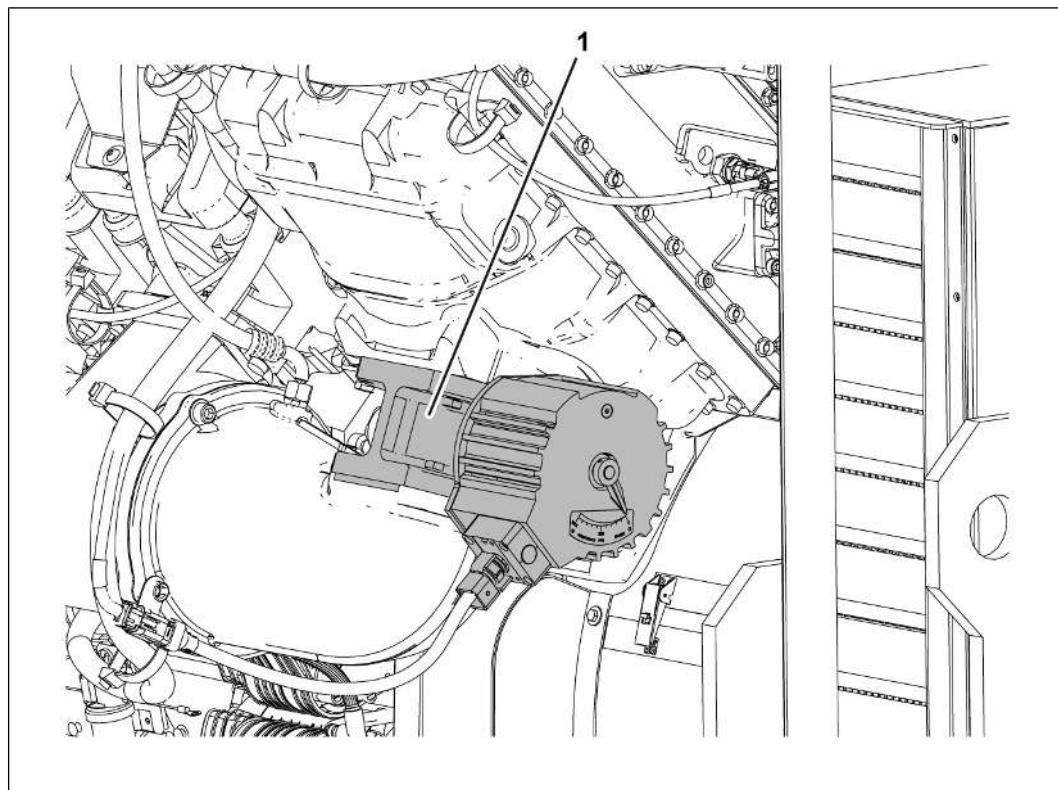
The housing with the throttle valve and actuator form a unit.

They may not be disconnected from each other.

When checking the throttle valve, always check that the actuator is functioning, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \[▶ 433\]](#).

Checking the throttle valve:

- ✓ The genset is operating and has reached the operating temperature.



522095371

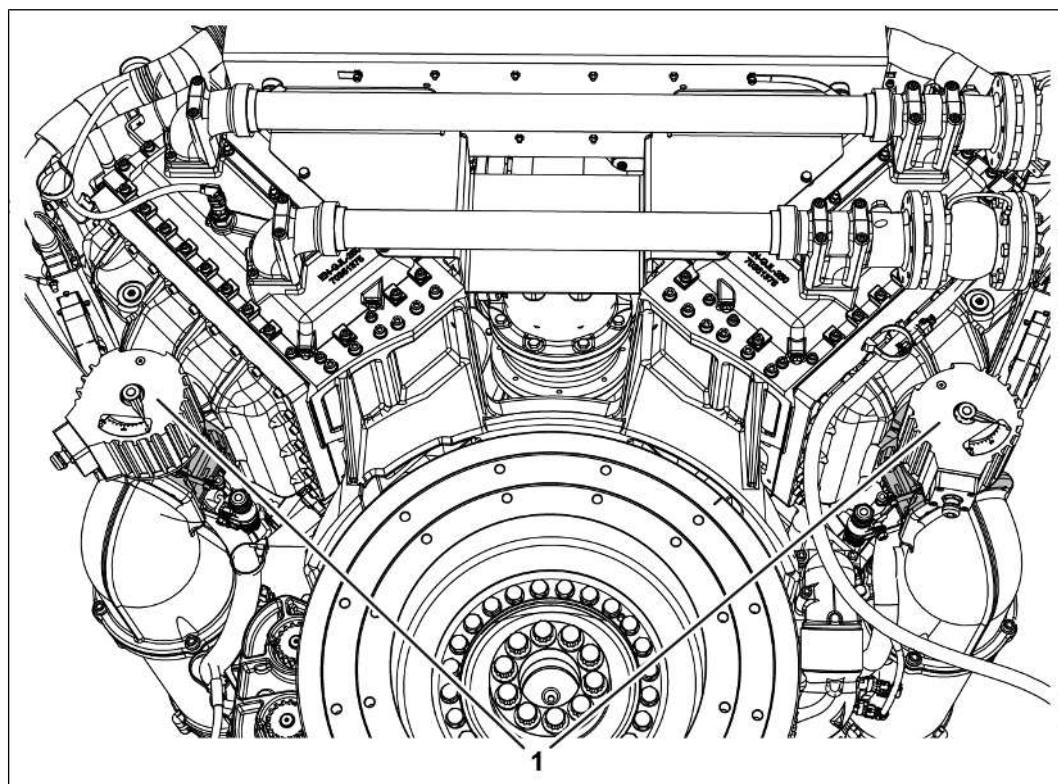
1. **CAUTION! Risk of burns from touching hot components.** Check the throttle valve on cylinder side A (1) for sucking noises and leakages.
 - Check the throttle valve on cylinder side B in the same way.
 - If the sucking noises can be heard or leakages are visible, contact Cat dealer.
- ⇒ Check that the actuator is functioning, see OL-MRA10 / 27-17-01 [Checking the speed control actuator \[▶ 433\]](#)

Checking the speed control actuator

Valid for:

CG170B

General information



527258251

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

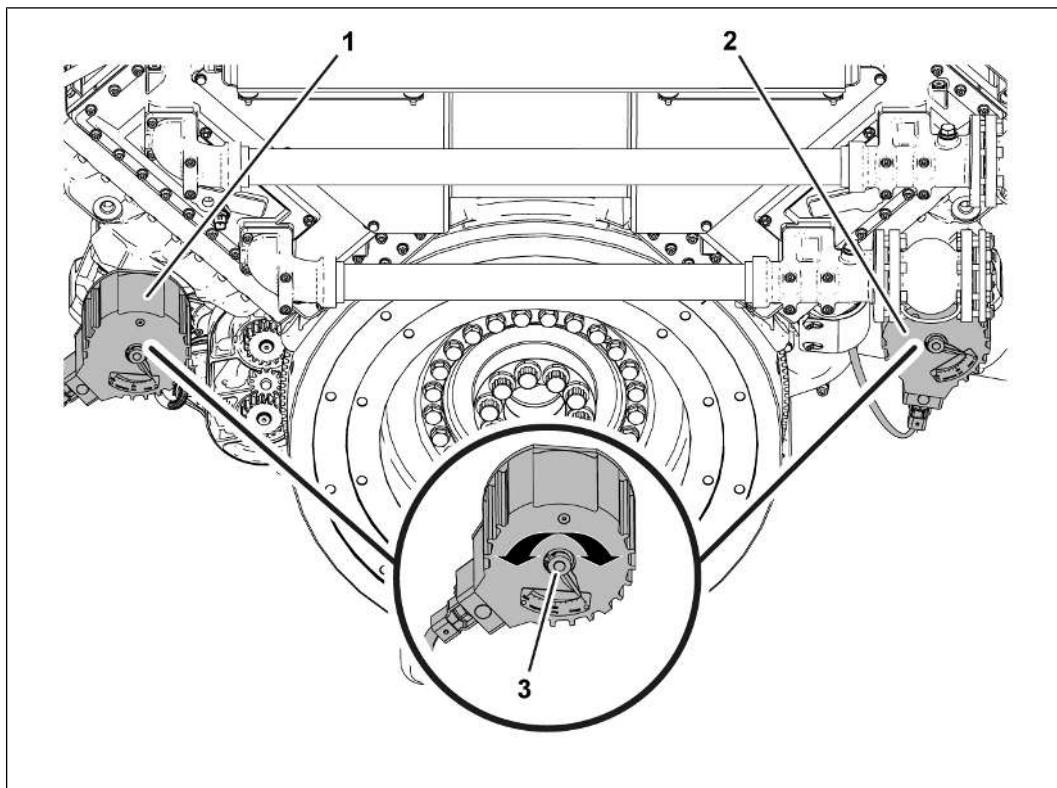
The housing with the throttle valve and actuator form a unit.

They may not be disconnected from each other.

Always check the throttle valve for leaks while checking the actuator, see OL-MRA10 / 27-10-01 [Checking the throttle valve \[▶ 431\]](#).

Check the actuator:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



490846091

1. Check the actuators (1, 2) for ease of movement.
 - Rotate needle (3) 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 Cat dealer.
- ⇒ Check the throttle valve for leaks, see OL-MRA10 / 27-10-01 [Checking the throttle valve \[▶ 431\]](#)
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Emptying and filling the cooling system

Emptying the cooling system

Valid for:

CG170B

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.

The 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.

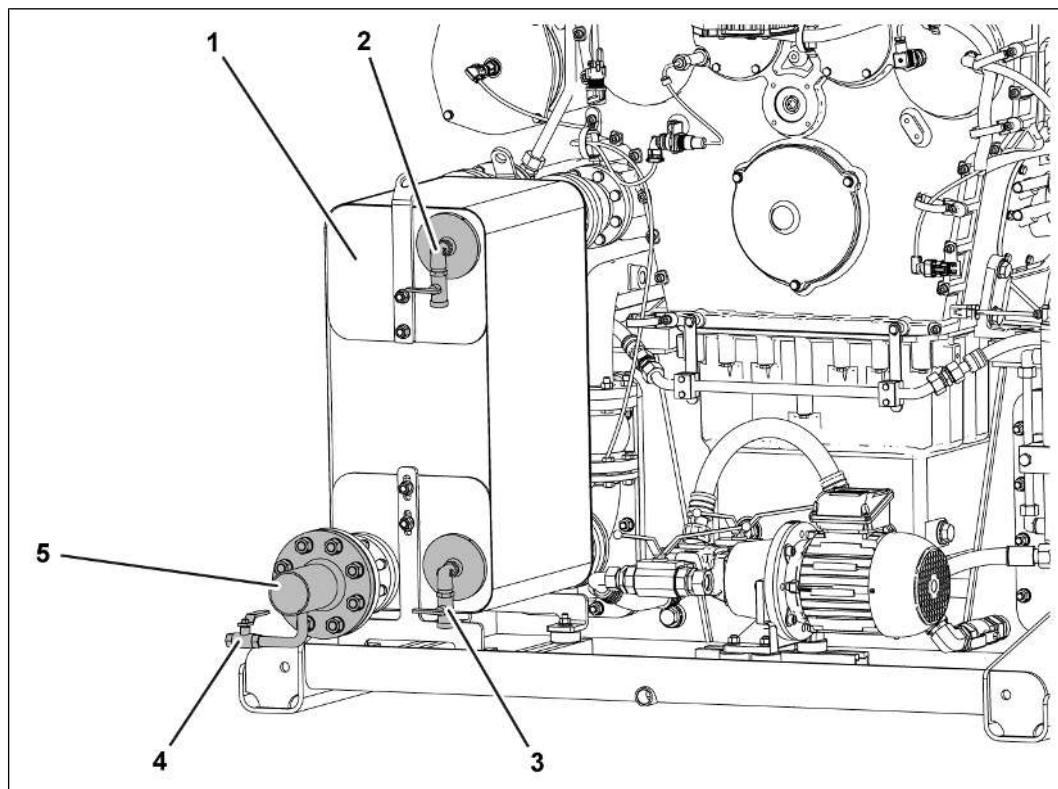
Contamination of the environment.

- 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 \[▶ 154\]](#)

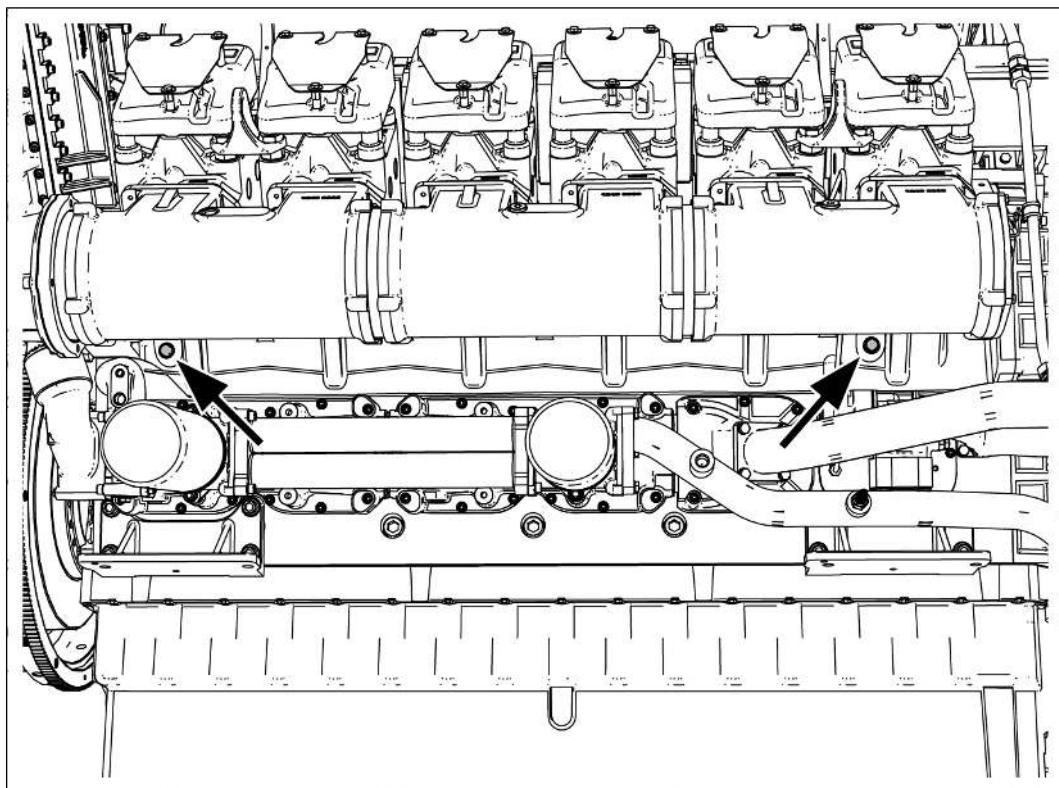
1. Mount the coolant tank with external pump to the plant coolant supply if necessary.



950700683

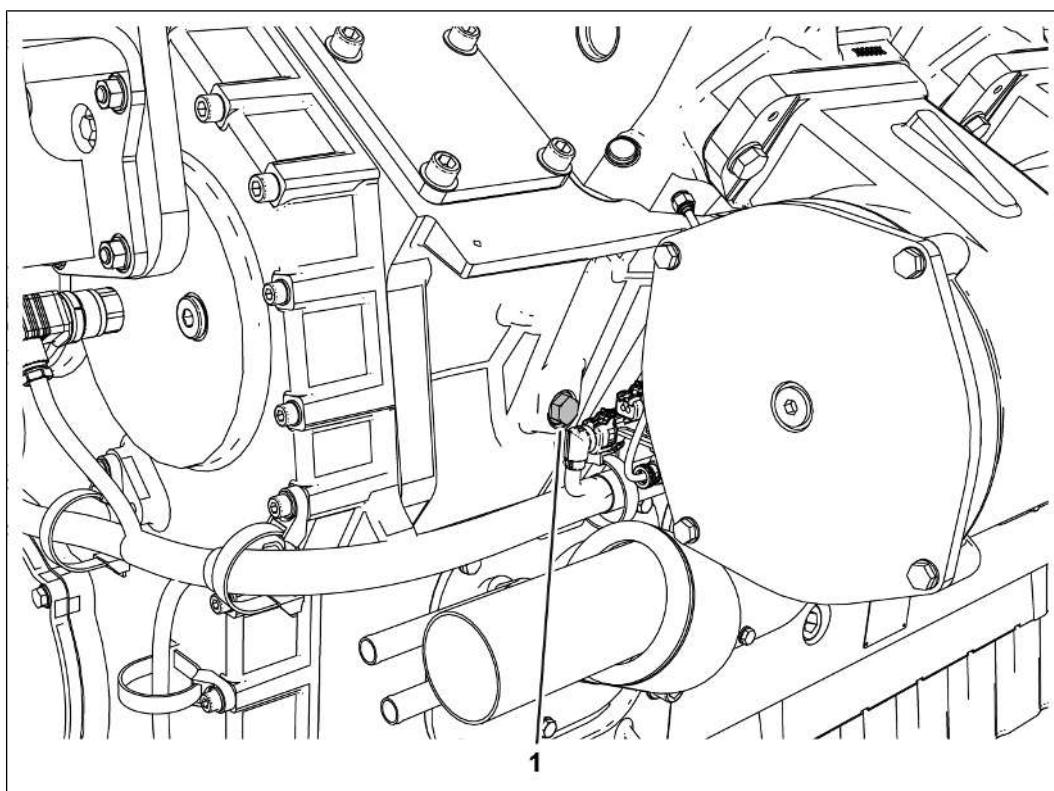
2. Empty the engine cooling circuit.

- Connect the collecting vessel to the coolant connection (5).
- Open the drain valve (4) on the coolant connection (5) of the lube oil cooler (1).
- Drain the coolant completely.
- Place the collecting tray underneath.
- Open the drain valve (3) on the lube oil cooler (1).
- Open the vent valve (2) to drain the coolant completely.



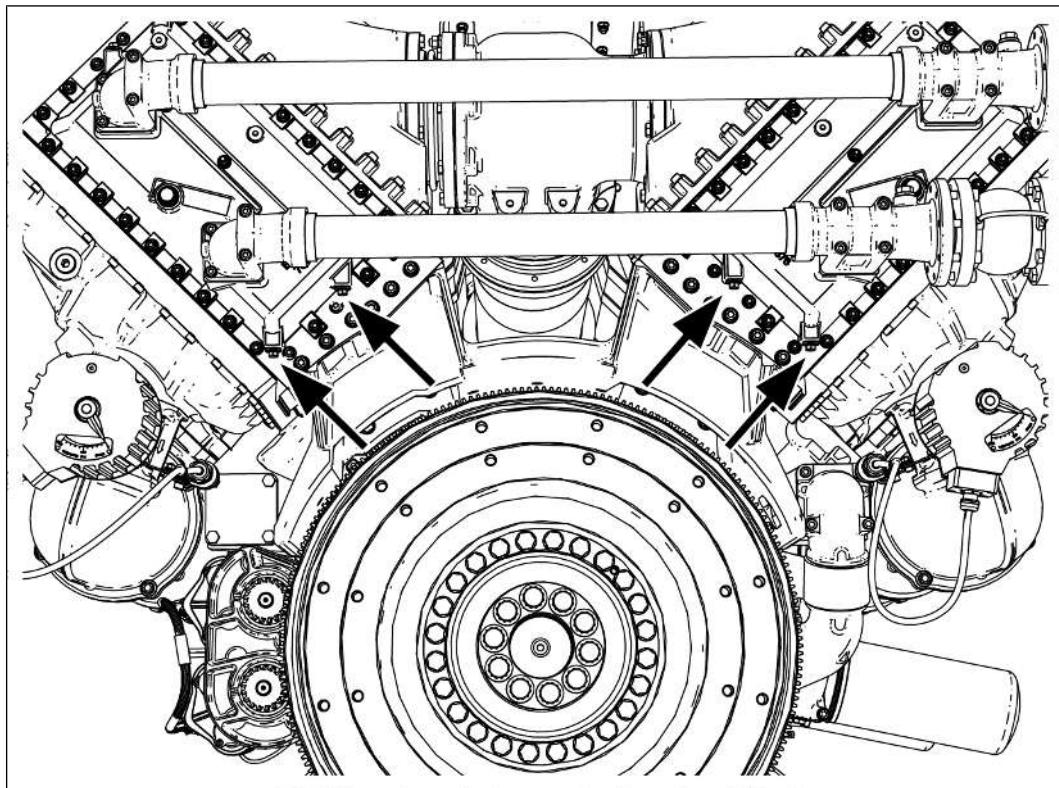
950703115

- Place a collecting tray under the corresponding draining point.
- Unscrew the drain screws (arrows) on the crankcase on cylinder side A.
- Drain the coolant.
- Tighten the drain screws (arrows) with the new seals.



950705547

- Place a collecting tray under the draining point.
- Unscrew the drain screw (1) on cylinder side B above the UPF intake line.
- Drain the coolant.
- Tighten the drain screw (1) with new seals.



950707979

3. Empty the mixture cooling circuit.
 - Place a collecting tray under the draining point.
 - Unscrew the drain screws (arrows) on the mixture cooler.
 - Drain the coolant.
 - Tighten the drain screws (arrows) with the new seals.
 4. Check the coolant chambers.
 - Clean the coolant chambers if necessary. For assistance, contact Cat dealer.
 - Clean the cooling system, see also Service Library, Technical Bulletin ([TR 2091](#)), *Specification for Coolant*.
- ⇒ Check the quality of the drained coolant, see OL-MRA10 / 38-03-01 [Checking the cooling system protection agent \[▶ 449\]](#)

Filling the cooling system

Valid for:

CG170B

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.

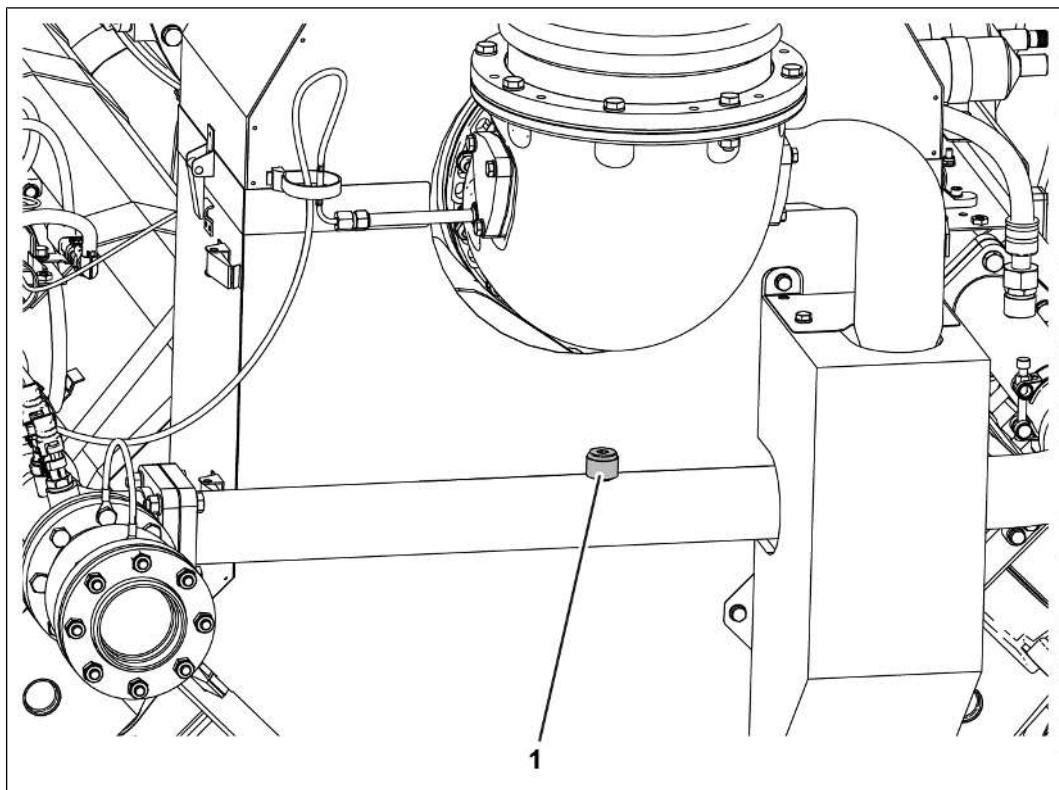
The mixture cooling circuit and engine cooling circuit are completely separated from one another and can be filled singly.

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.

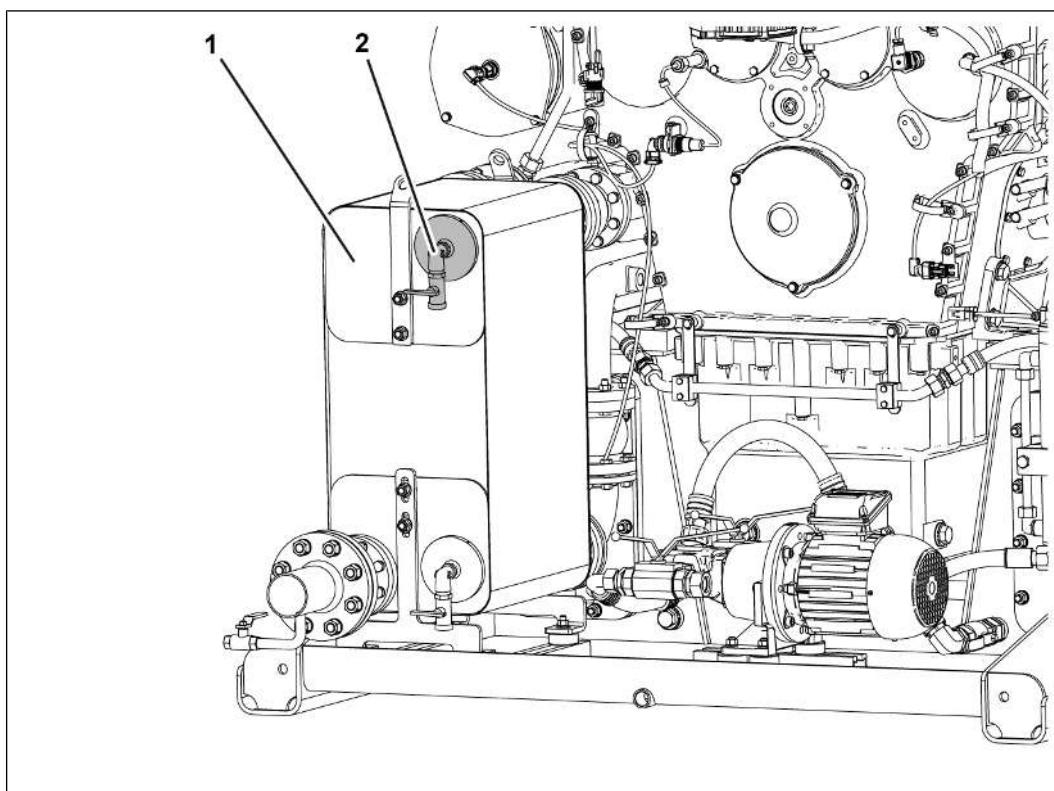
Filling the cooling system:

1. Connect external pump.
2. Open inlet valve on genset.



966247307

3. Open bleed screw (2).
 - Place the collecting tray underneath.



966249739

4. Open the vent valve (2) on the lube oil cooler (1).

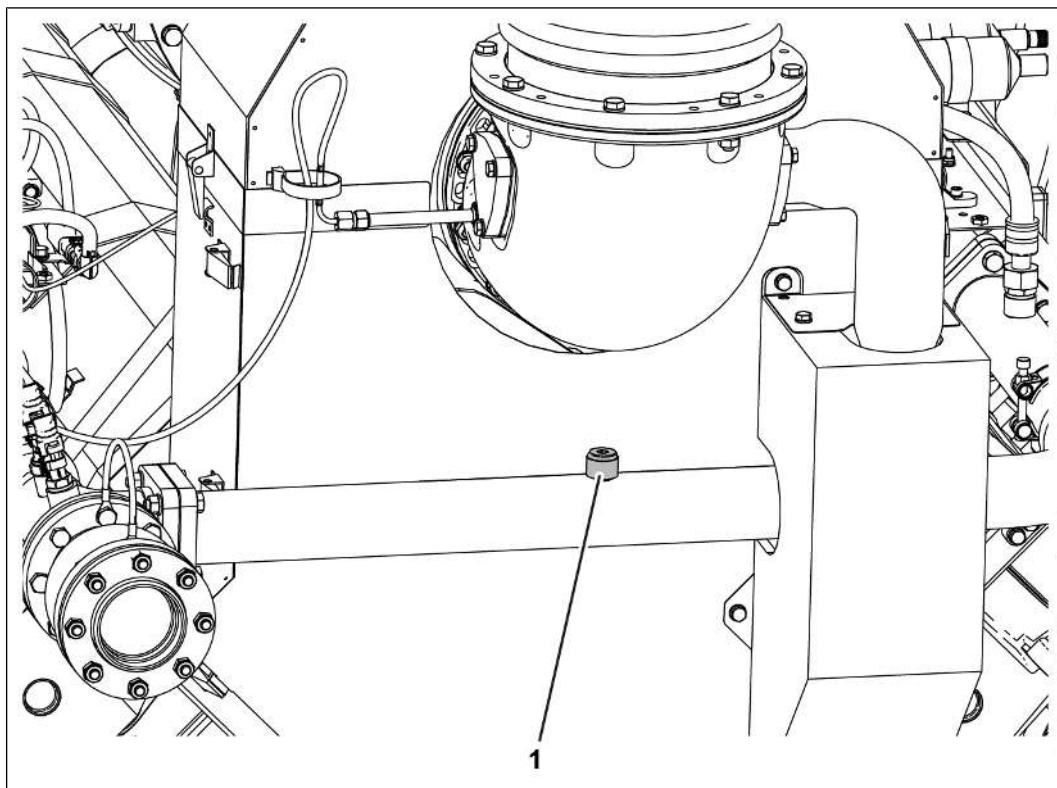
NOTE

The running noises of the external pump audibly change.

The external pump is operating against pressure.

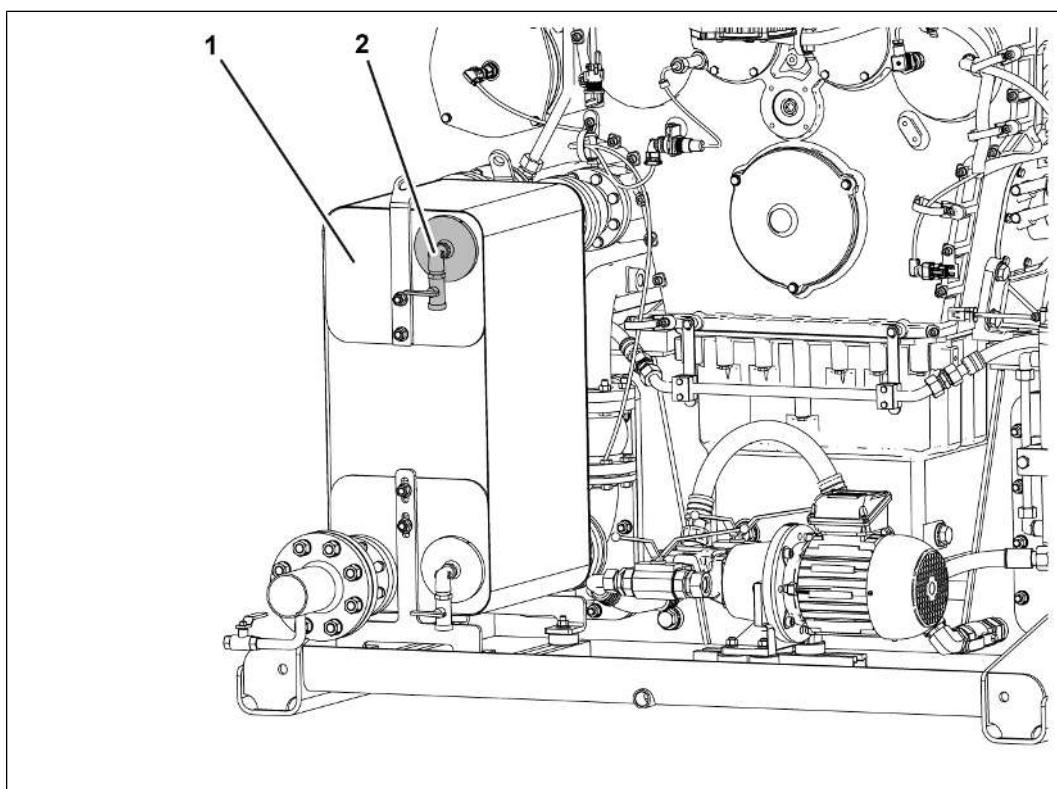
- Switch off the external pump immediately.
- Wait for the pump overrun.

-
5. Switch on external pump.
 - Fill the cooling system with the specified coolant amount.
 6. Switch off external pump.



966247307

7. Close the bleed screw (2).

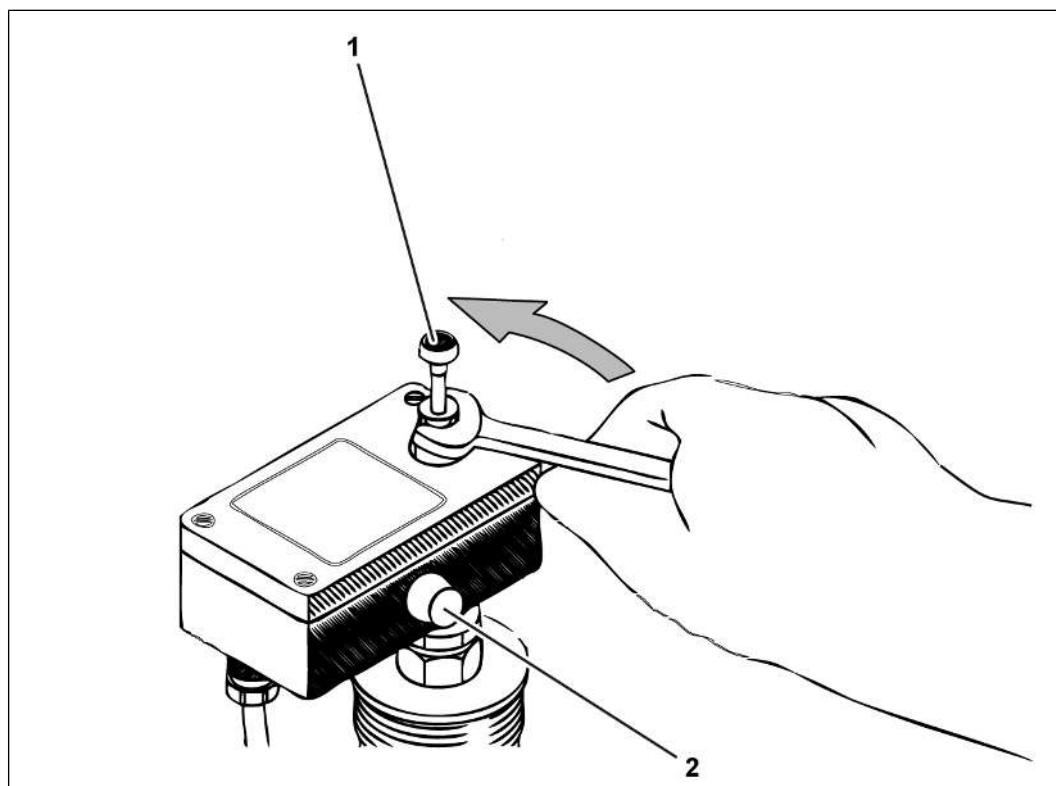


966249739

8. Close the vent valve (2) on the lube oil cooler (1).

9. Vent the cooling system.

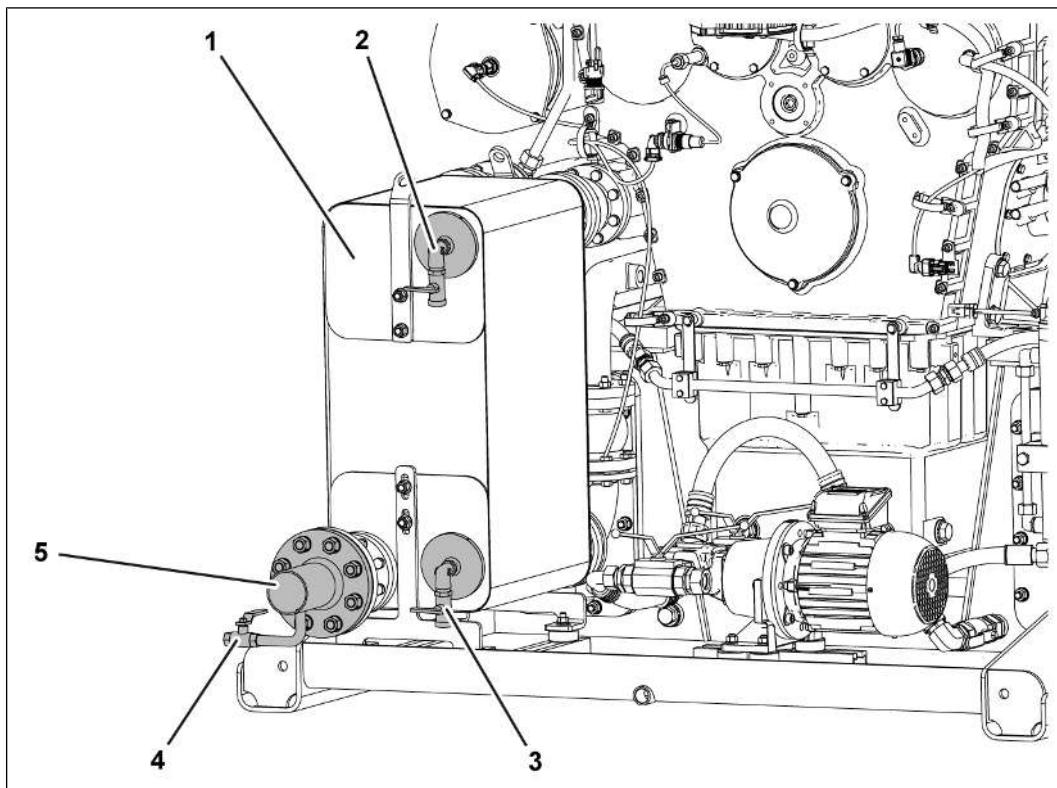
- Open the coolant lines at the highest point and vent until the coolant emerges without bubbles.



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).

10. Check the coolant level and coolant system pressure [Checking coolant level and coolant system pressure \[▶ 446\]](#).



950700683

11. If necessary, dismantle the coolant tank with external pump from the coolant supply in the plant.
12. Dismantle the coolant tank with external pump from lube oil cooler (1).
 - Close vent valve (2).
 - Close drain valves (3, 4).
 - Place the collecting tray underneath.
 - Dismantle the coolant supply line from the coolant connection (5).
13. Dispose of the collected coolant properly.
14. Check the cooling system pressure again if necessary.
⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking coolant level and coolant system pressure

Valid for:

CG170B

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 singly.

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:



9007199563784587

1. Select and open the data subgroup HC, ECC, DCC (2).
2. Read the value of the cooling system pressure in the P497 ECC engine outlet (1) dialog area.
 - The value must be greater than 2.6 bar.
 - Check the value on the pressure gauge in the plant.

3. If the value is not reached, check the lines, connecting elements and engine for leaks.
 - Replace defective components.
4. **NOTE! Only run the coolant pump for a brief time. Press the coolant pump if necessary.** Top up the coolant and check the cooling system pressure again



9007199563779723

1. Switch off coolant pumps.
 - Tap the OFF (3) button.
 - The green dot (1) disappears from the ECC pump dialog area.
 - The green checkmark (2) disappears from the L123, L261 ECC too low dialog area.
 - The green dot (4) disappears from the HC 631 demanded dialog area.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the cooling system protection agent

Valid for:

CG170B

Tools:

- Standard tools
- Closable collecting container (50 to 100 ml)
- Special tool
 - Set for coolant test 1221 7483 [▶ 189]

Auxiliary media:

- Binding agent

Spare parts:

- Cooling system protection agent
 - See Service Library, Technical Bulletin (TR 2091), [Specification for coolant](#)

General information

NOTE

Limit value for coolant

The Technical Bulletin (TR) 2091 [Specification for coolant](#) specifies 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](#) [▶ 154]
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 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](#) [▶ 435].
 - Dispose of the coolant sample properly.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset](#) [▶ 117]

Dismantling and mounting the exhaust turbocharger cover

Dismantling the exhaust turbocharger cover

Valid for:

CG170B



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



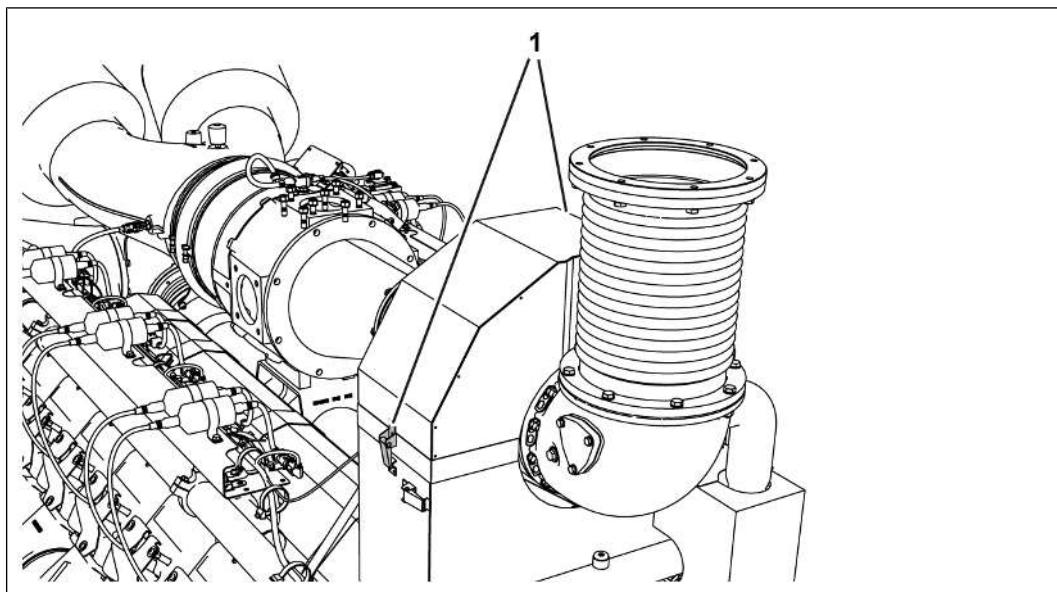
Injury when touching sharp edges

This can lead to minor or severe injuries.

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

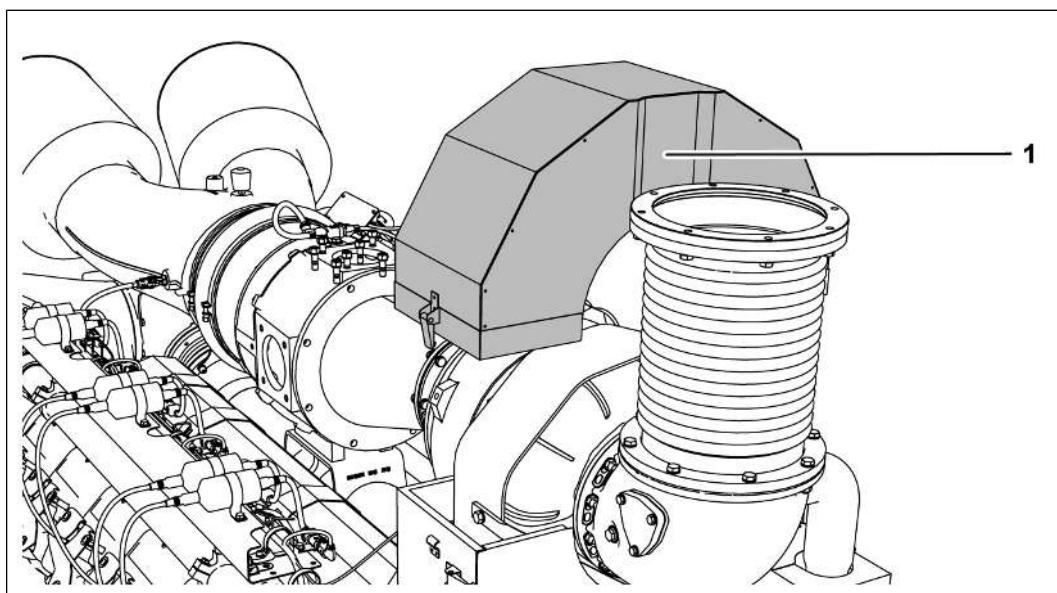
Dismantling the exhaust turbocharger cover (V12 engine):

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



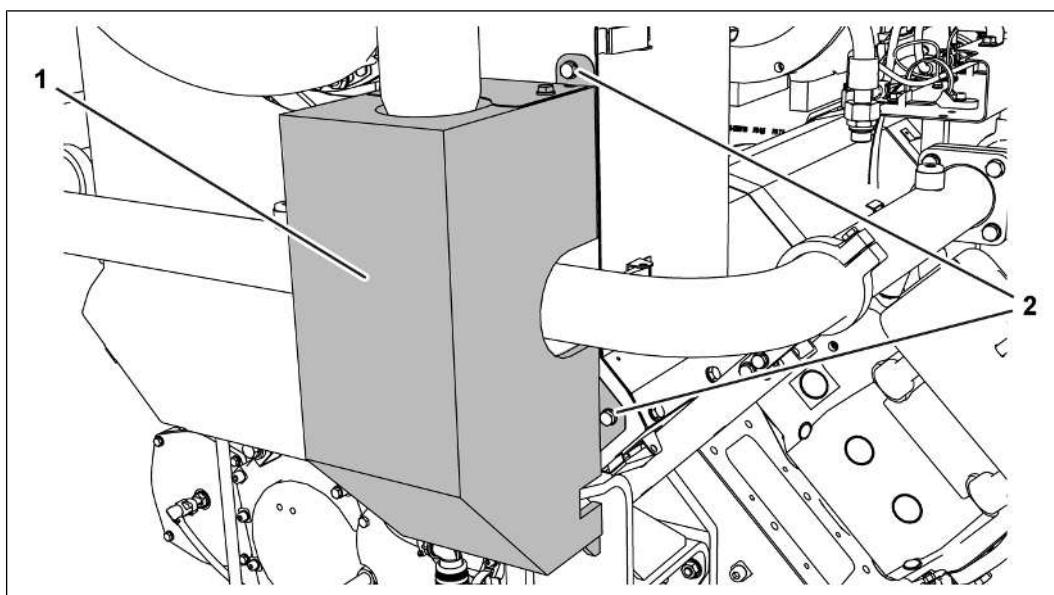
527712267

1. Dismantle cover from exhaust turbocharger.
 - Open locks (1).



527714187

- Remove cover (1) from exhaust turbocharger.

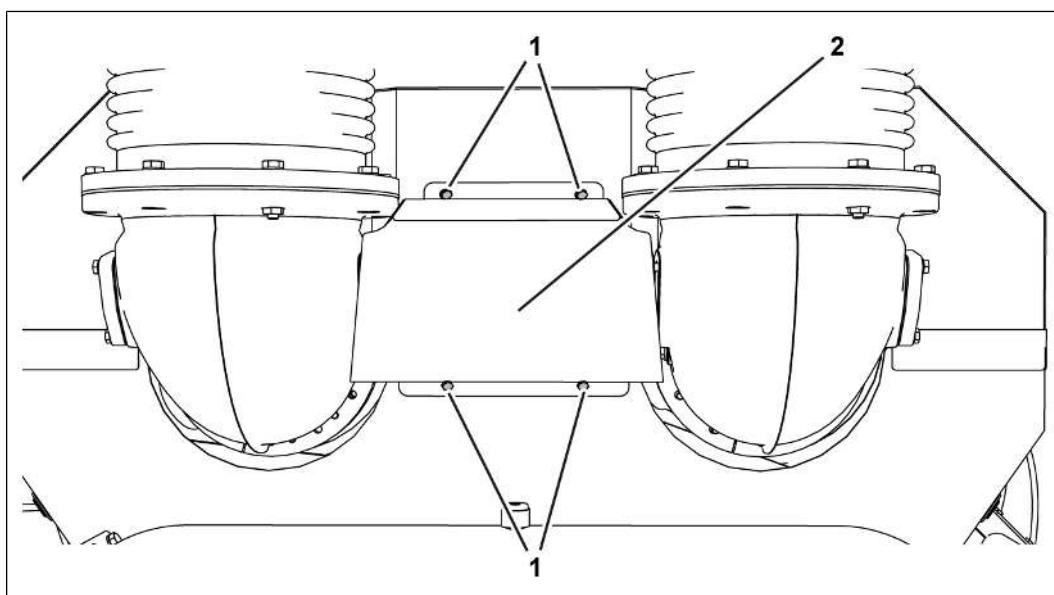


527716107

2. Dismantle cover (1).
 - Unscrew screws (2).
 - Remove cover.

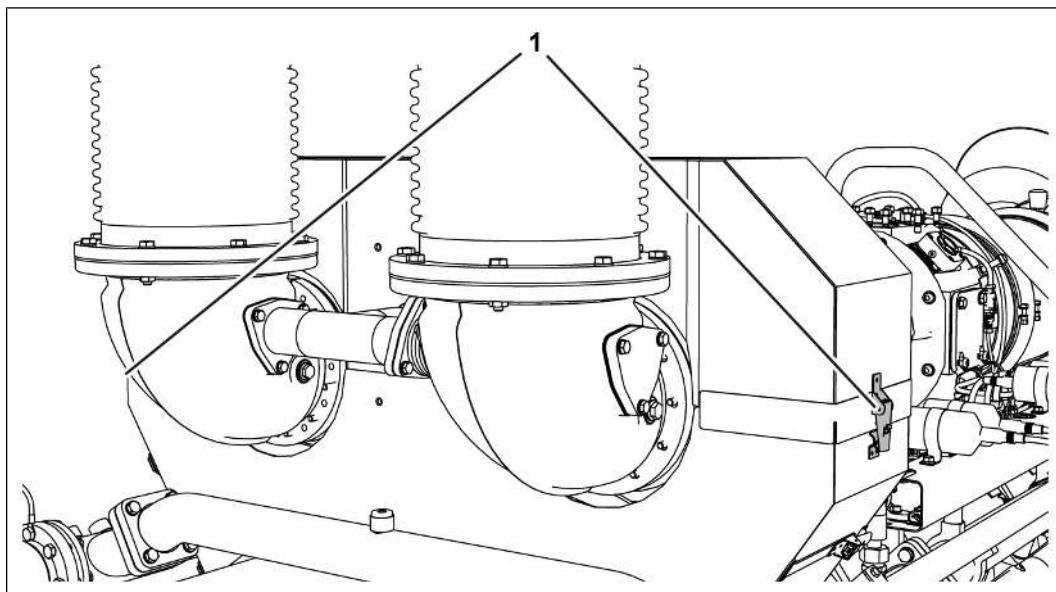
Dismantling the exhaust turbocharger cover (V16/V20 engine):

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



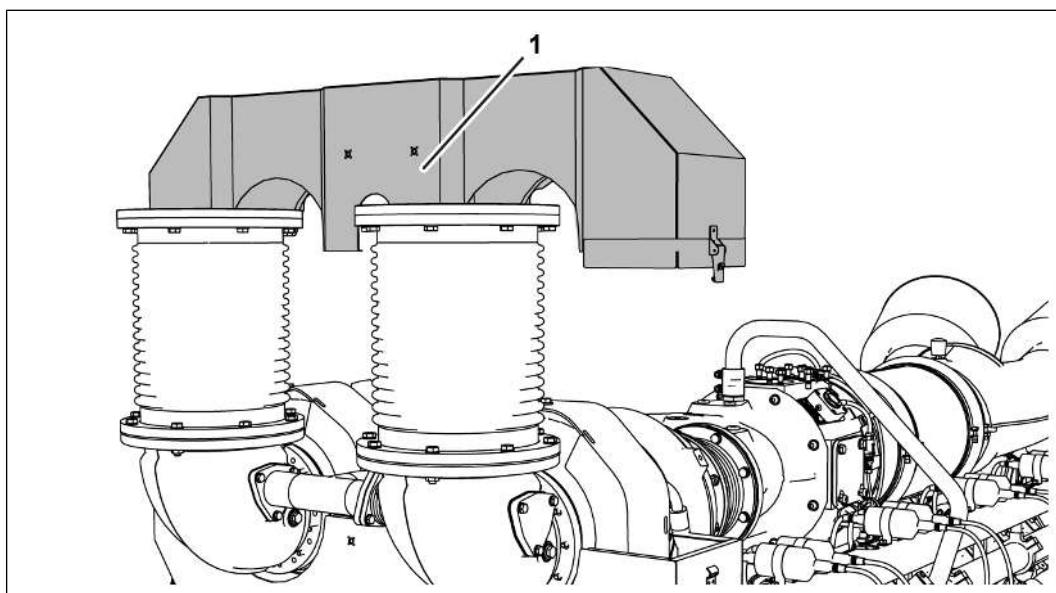
528295435

1. Dismantle cover (2) from exhaust turbocharger.
 - Unscrew screws (1).
 - Remove cover.



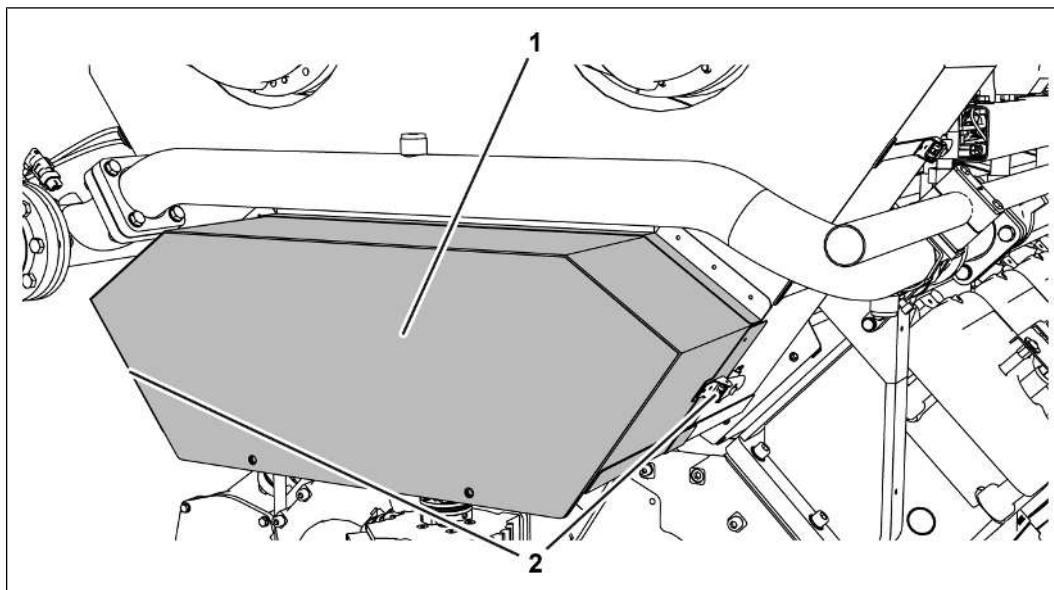
528297355

2. Dismantle cover from exhaust turbocharger.
 - Open locks (1).



528299275

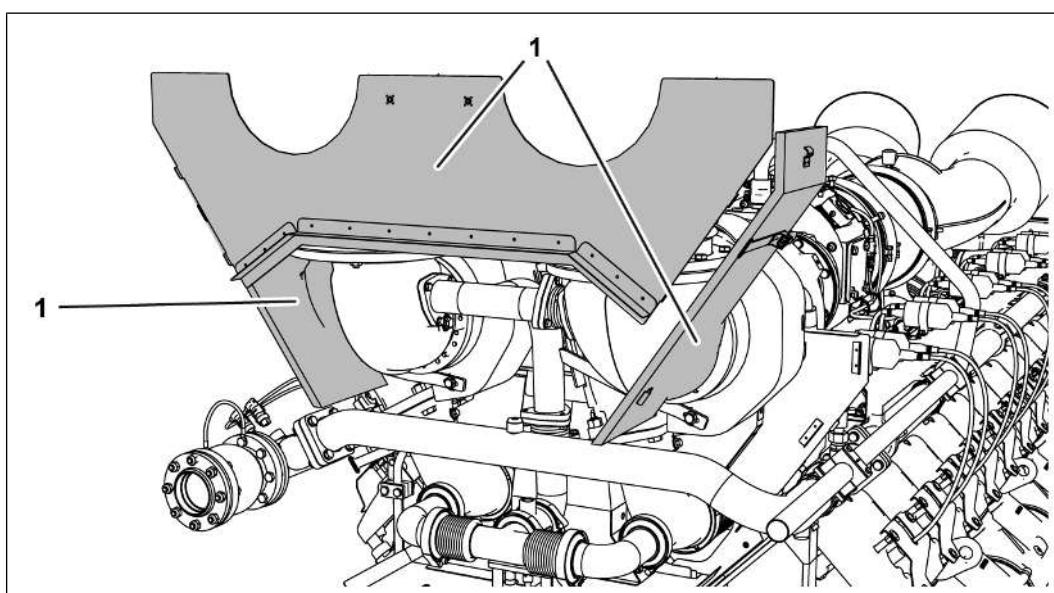
- Remove cover (1).



528301195

3. Dismantle cover (1).

- Unscrew screws.
- Open locks (2).
- Remove cover.



528303115

4. Dismantle cover (1) from exhaust turbocharger.

- Open locks.
- Remove cover from exhaust turbocharger.

Mounting the exhaust turbocharger cover

Valid for:

CG170B



Tools:

- Standard tools

General information

CAUTION



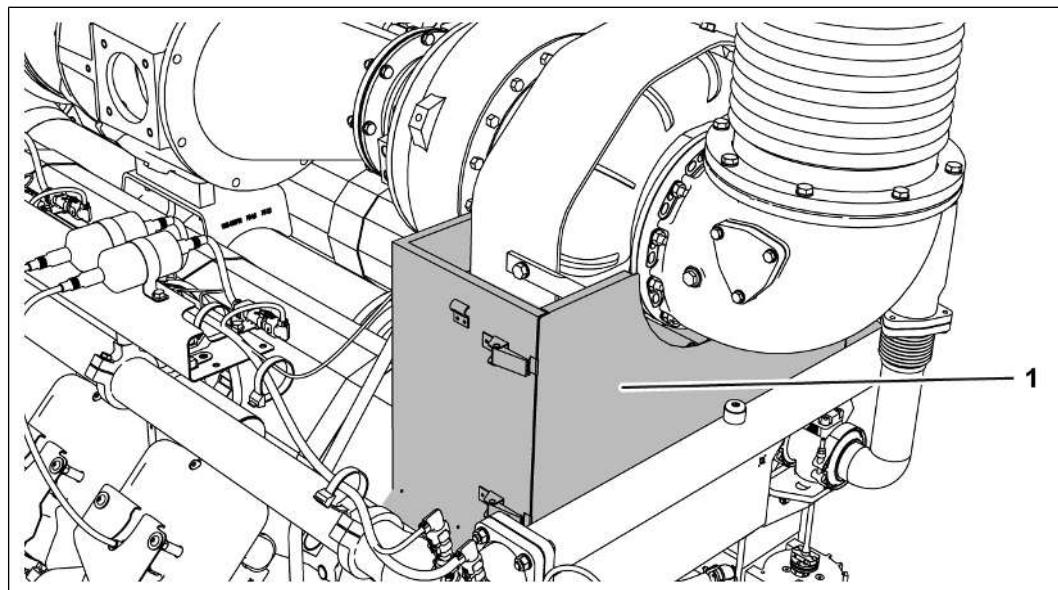
Injury when touching sharp edges

This can lead to minor or severe injuries.

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

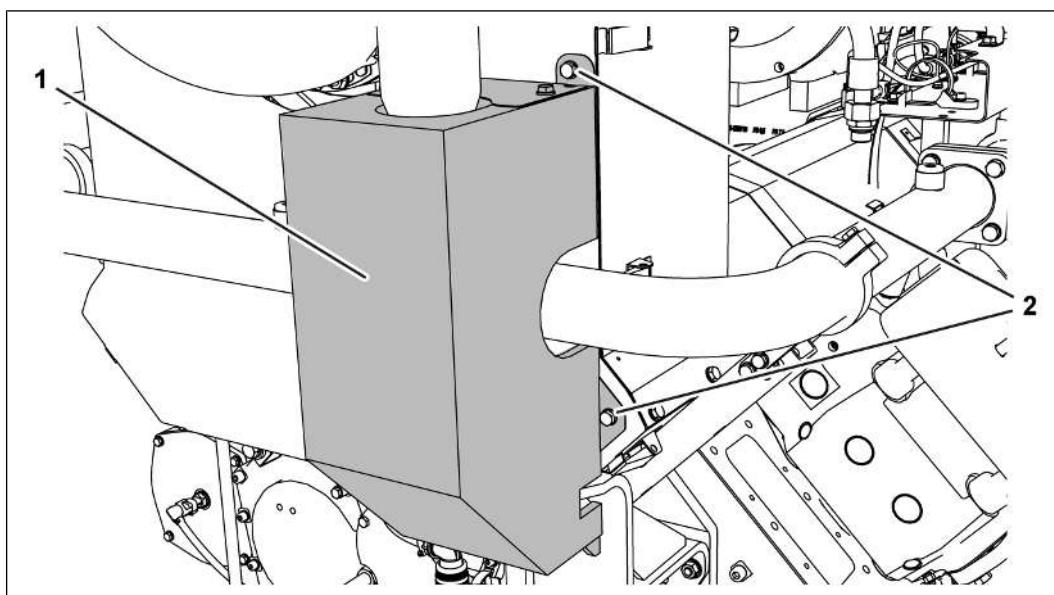
Mounting the exhaust turbocharger cover (V12 engine):

1. Clean and visually inspect all components.



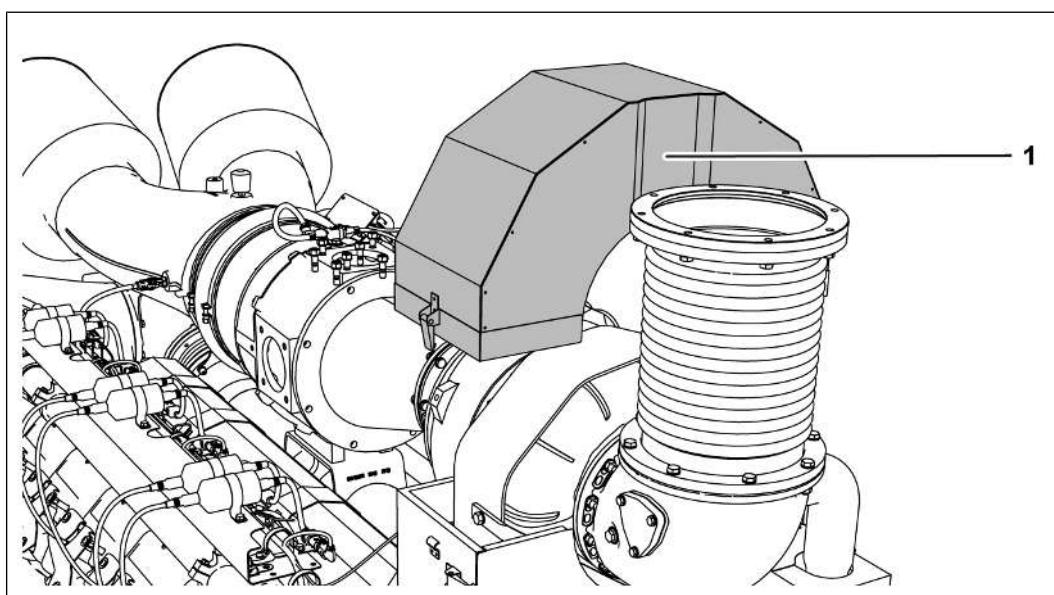
527718027

1. Mount cover (1) on exhaust turbocharger.
 - Attach cover.
 - Tighten screws.
 - Close locks.



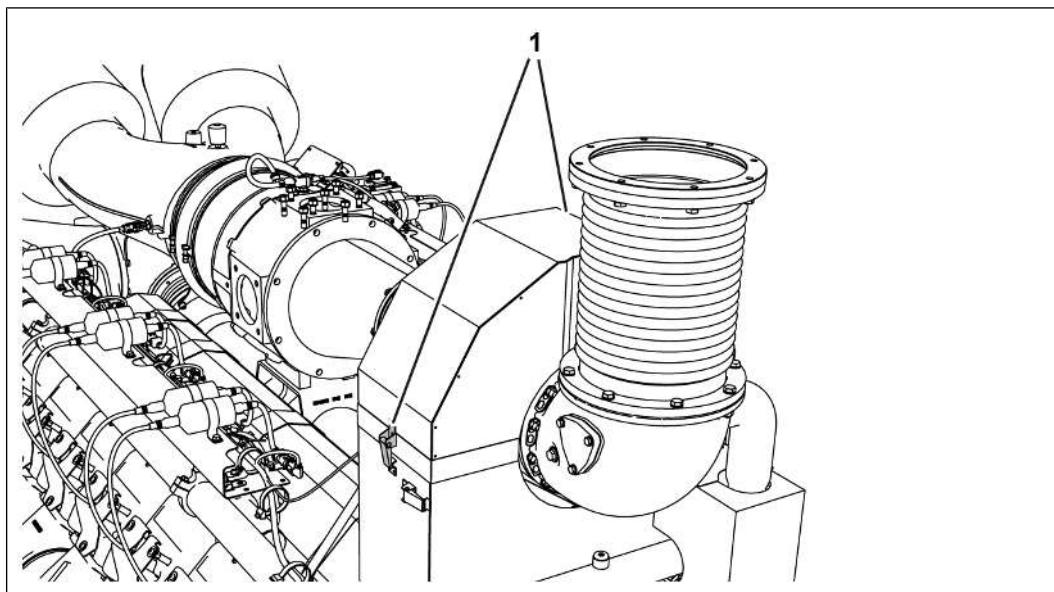
527716107

2. Mount cover (1).
 - Attach cover.
 - Tighten screws (2).



527714187

3. Mount cover (1) on exhaust turbocharger.
 - Attach cover to exhaust turbocharger.

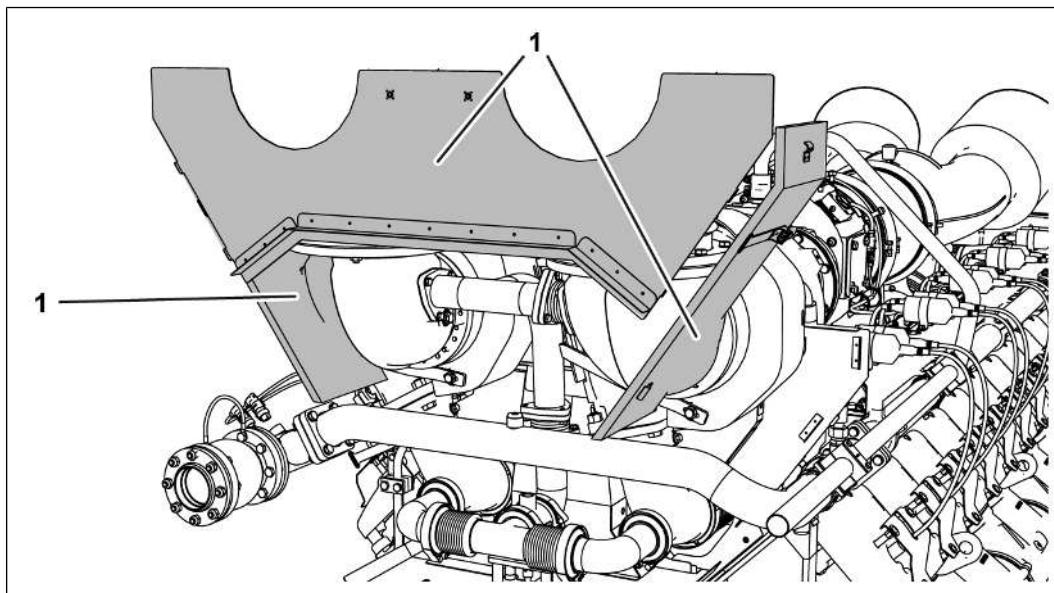


527712267

- Close locks (1).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

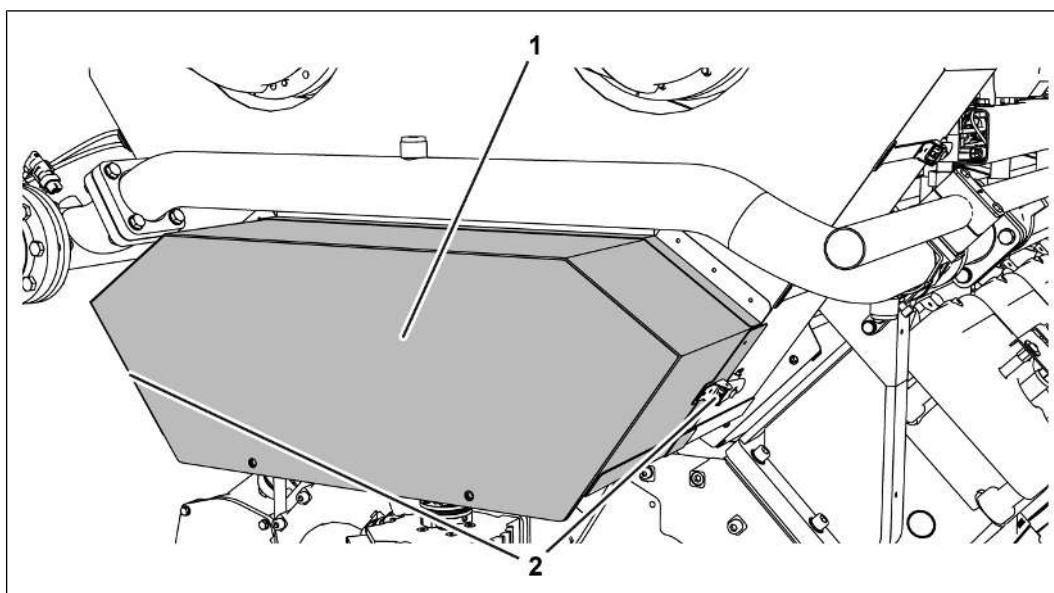
Dismantling the exhaust turbocharger cover (V16/V20 engine):

1. Clean and visually inspect all components.



528303115

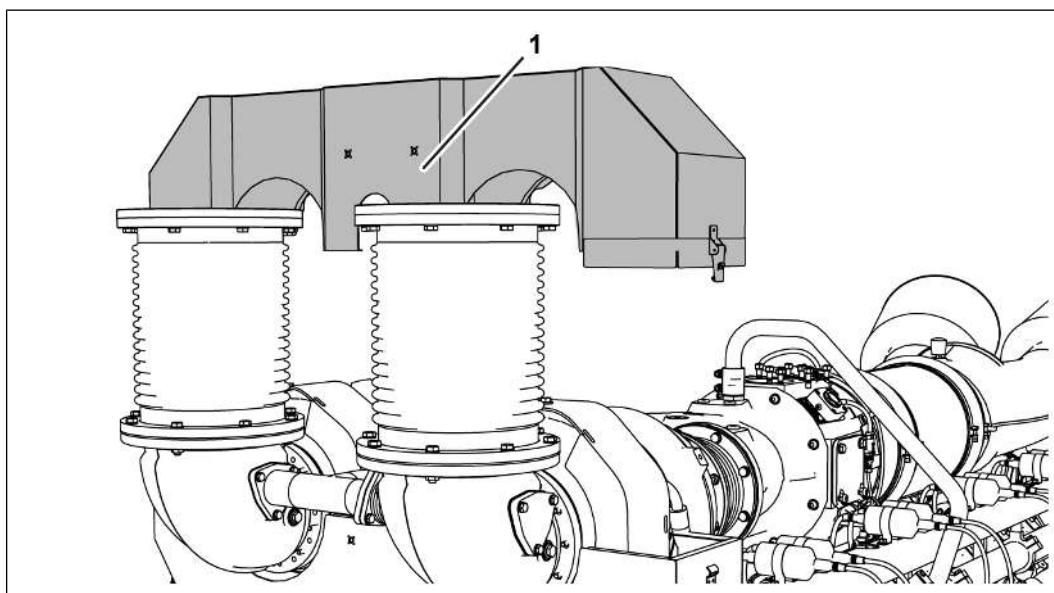
2. Mount cover (1) on exhaust turbocharger.
 - Attach cover to exhaust turbocharger.
 - Close locks.



528301195

3. Mount cover (1).

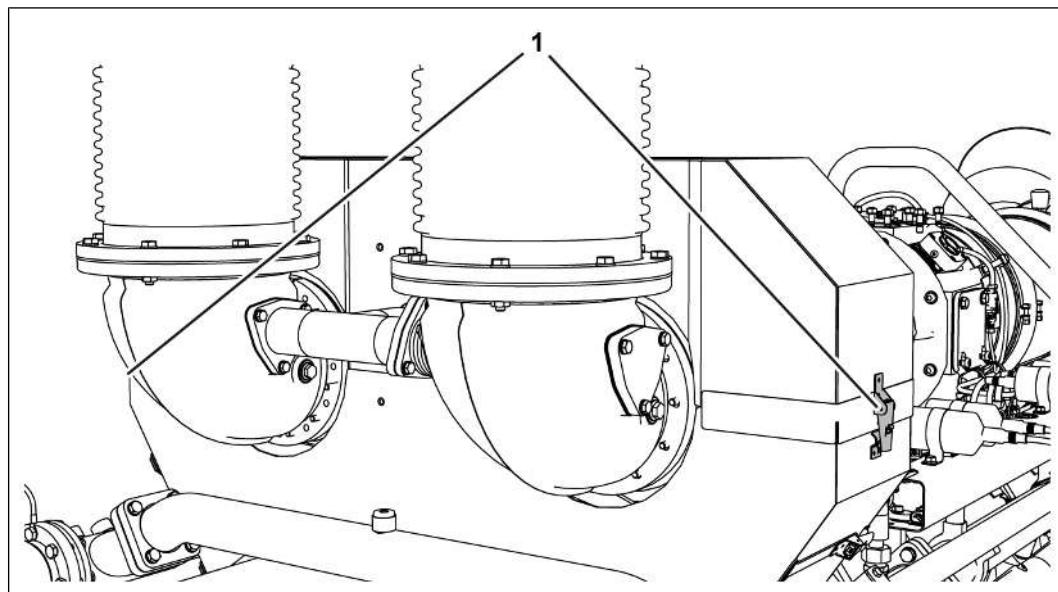
- Attach cover.
- Tighten screws.
- Close locks (2).



528299275

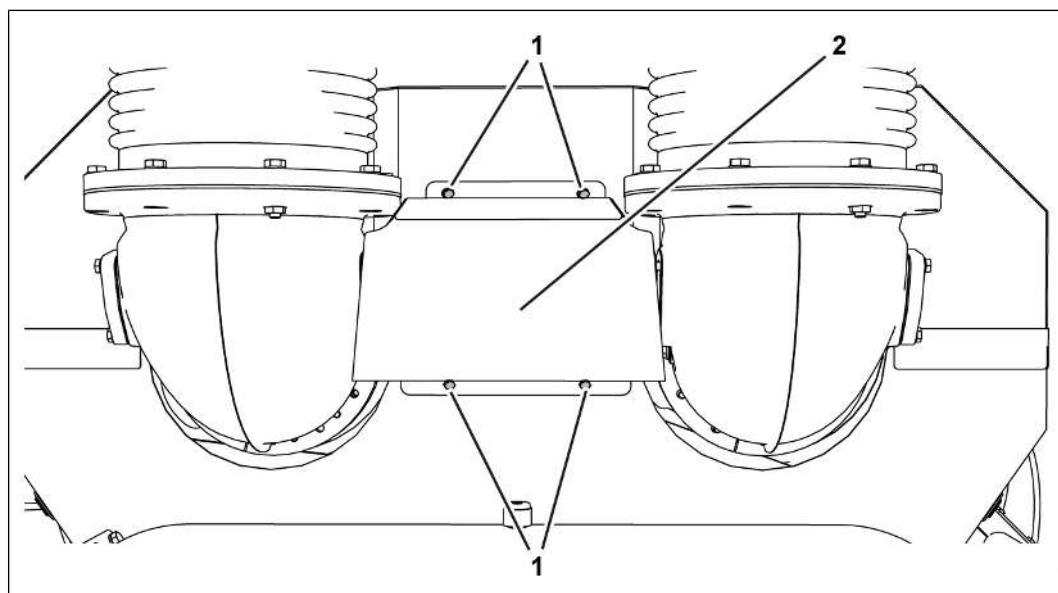
4. Mount cover (1) on exhaust turbocharger.

- Attach cover.



528297355

- Close locks (1).



528295435

5. Mount cover (2) on exhaust turbocharger.
 - Attach cover.
 - Tighten screws (1).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the wastegate

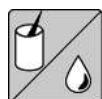
Valid for:

CG170B



Tools:

- Standard tools

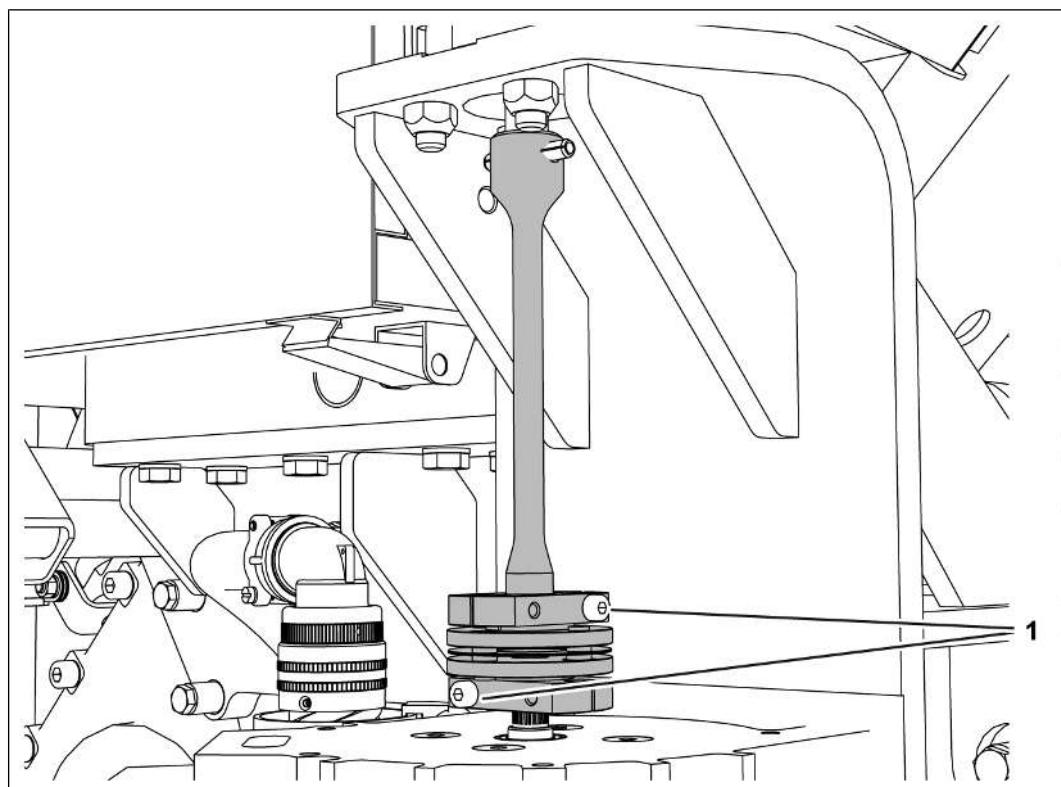


Auxiliary media:

- Cleaning agent

– See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).

Technical data



572637451

General information

All components must be visually inspected.

- Replace worn or damaged components.

**CAUTION**

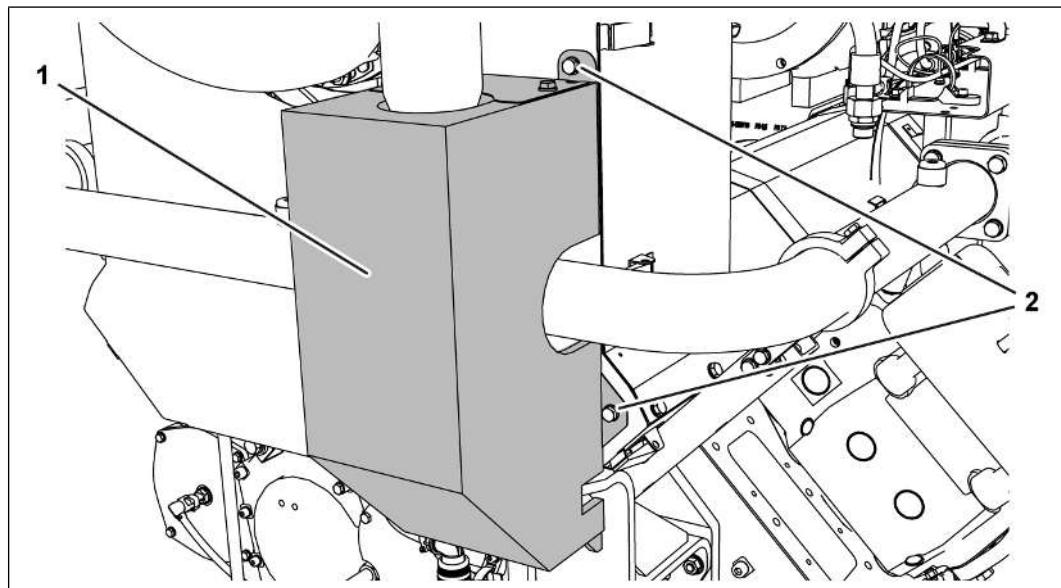
Risk of burns from touching hot operating media or hot components

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:

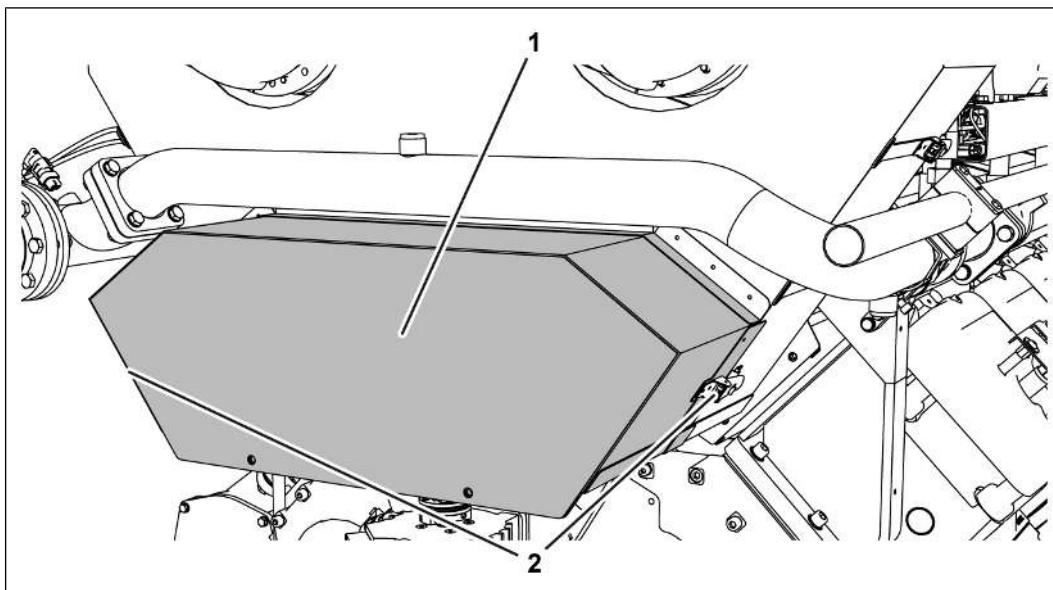
- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



530044555

1. Dismantle the cover from the wastegate (1) (V12 engine).

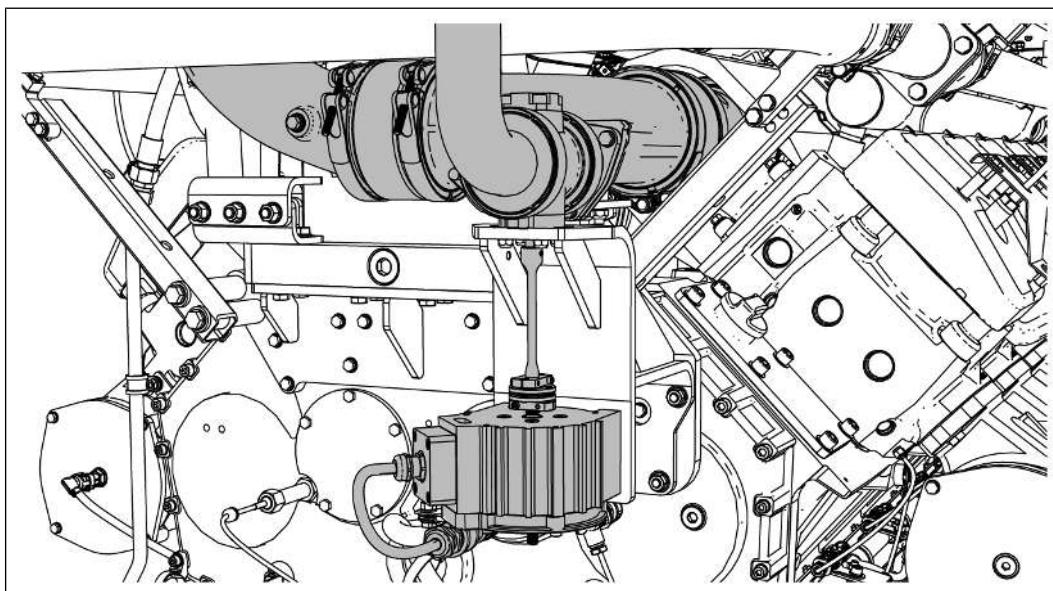
- Unscrew screws (2).
- Remove cover.



530046475

2. Dismantle the cover from the wastegate (1) (V16/V20 engine).

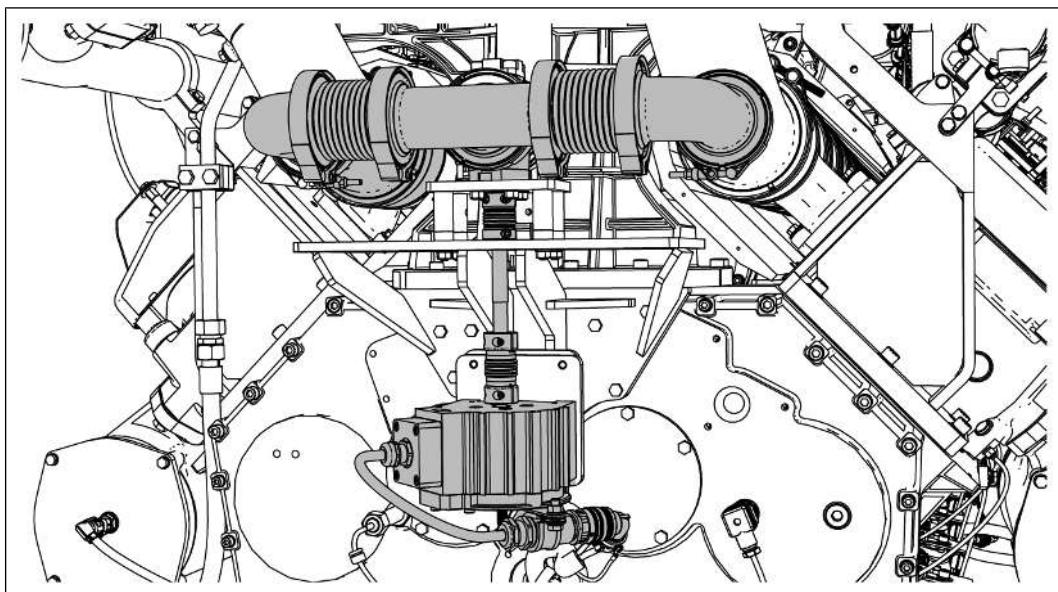
- Open locks (2).
- Remove cover.



530278155

3. Check wastegate (V12 engine).

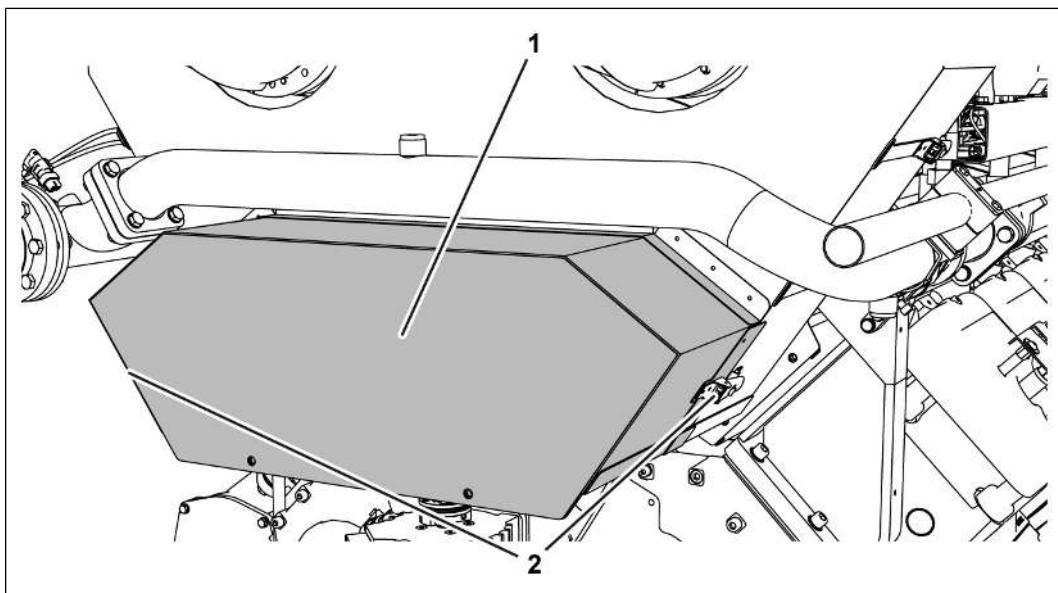
- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Retighten screw connections if necessary.
- Check cable bundle and connections.
- Replace worn or damaged components; contact Cat dealer if necessary



530280587

4. Check wastegate (V16/V20 engine).

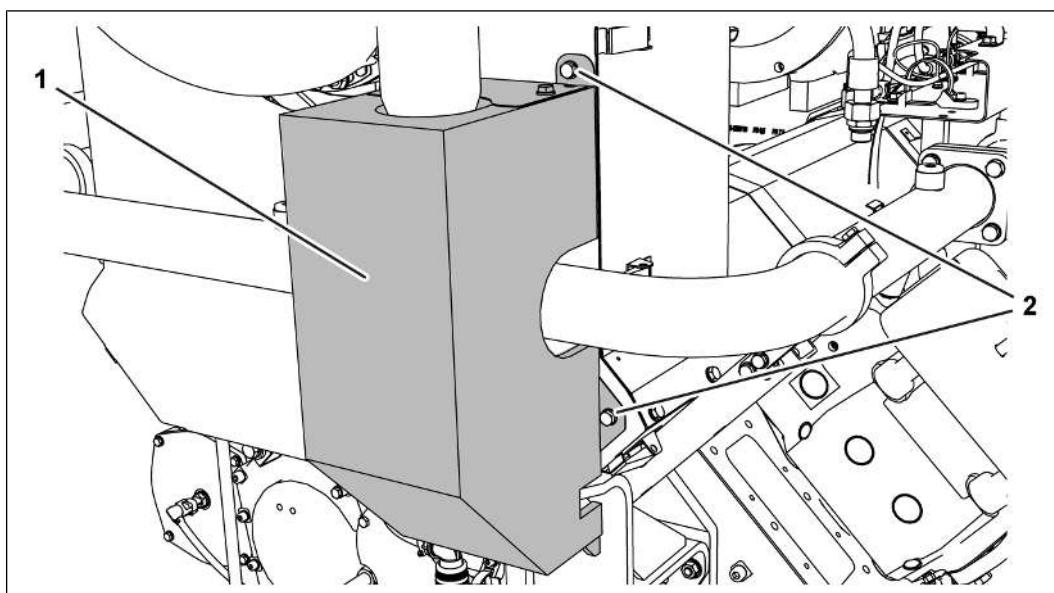
- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Retighten screw connections if necessary.
- Check cable bundle and connections.
- Replace worn or damaged components; contact Cat dealer if necessary



530046475

5. Mount wastegate cover (1) (V16/V20 engine).

- Attach cover.
- Close locks (2).



530044555

6. **Mount wastegate cover (1) (V12 engine).**

- Attach cover.
- Tighten screws (2).

⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Visually inspecting the wastegate

Valid for:

CG170B



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.

- Replace worn or damaged components.



CAUTION

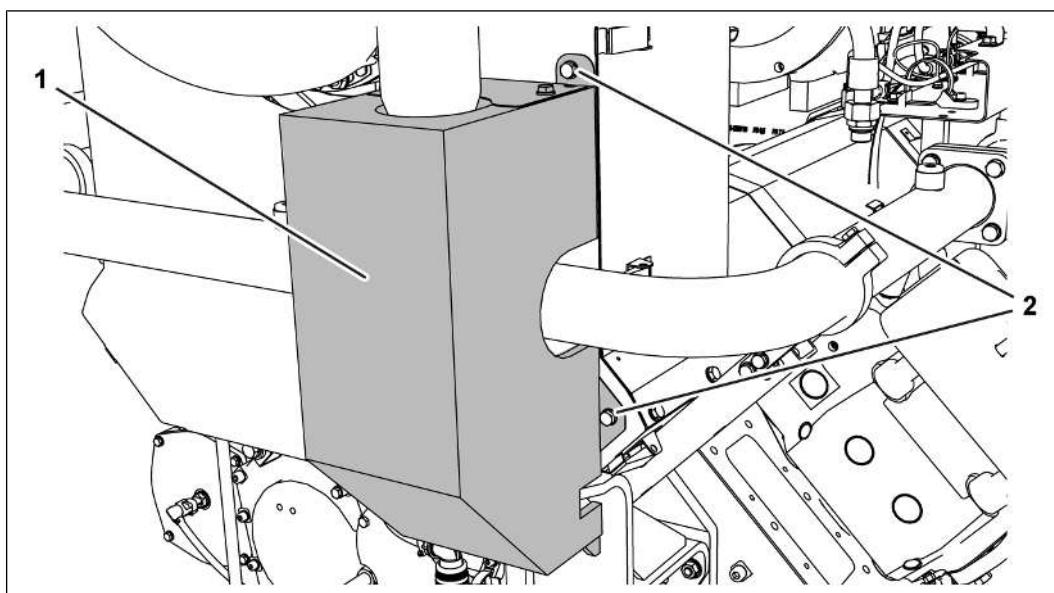
Risk of burns from touching hot operating media or hot components

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:

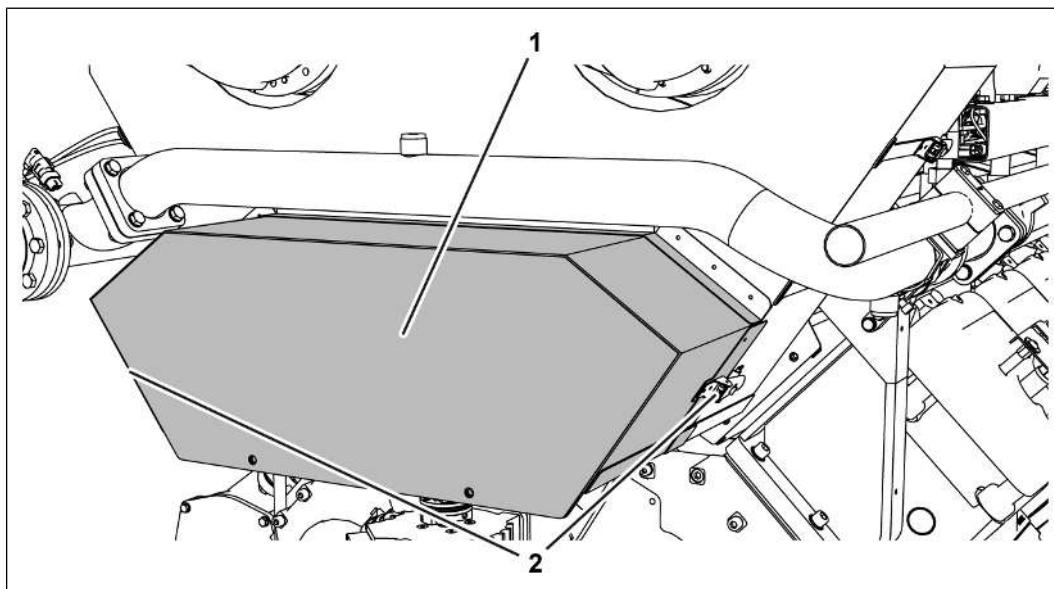
- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset](#) [▶ 154]



530044555

1. Dismantle cover (1) (V12 engine).

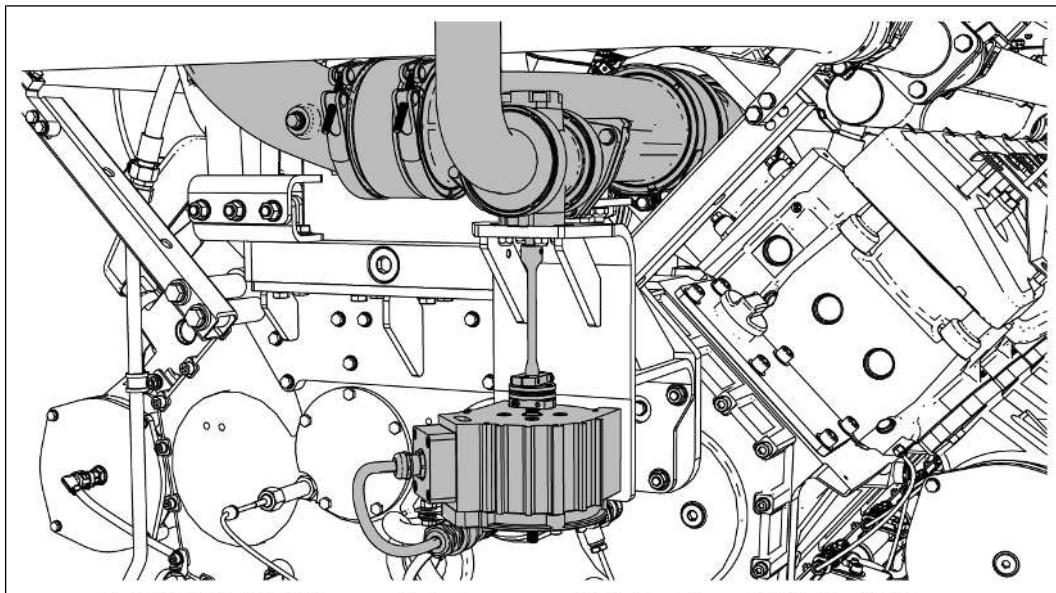
- Unscrew screws (2).
- Remove cover.



530046475

2. Dismantle cover (1) (V16/20 engine).

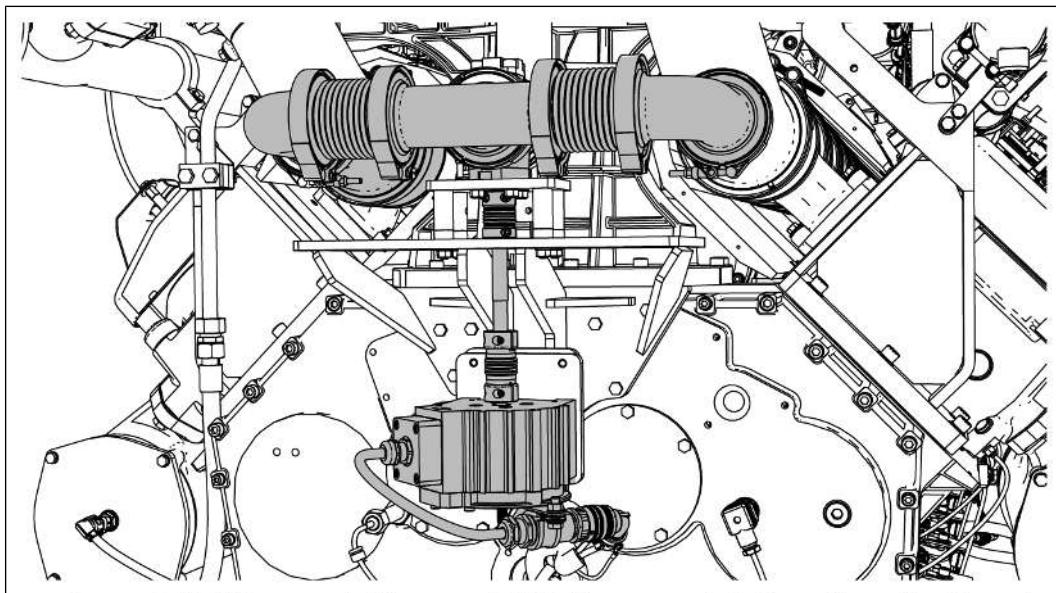
- Open locks (2).
- Remove cover.



530278155

3. Visually inspect wastegate (V12 engine).

- 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.
- Replace worn or damaged components, also contact Cat dealer

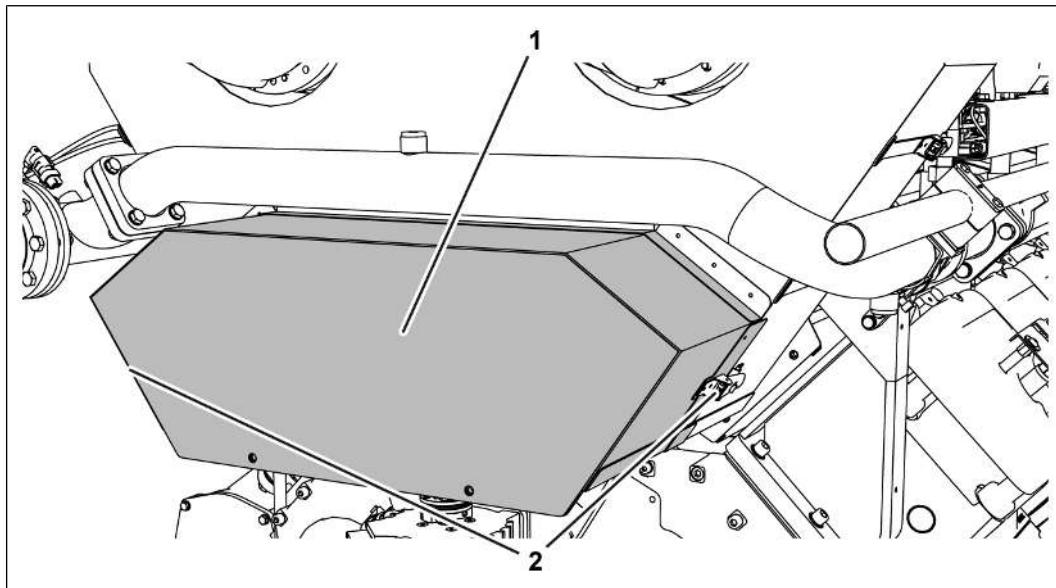


530280587

4. Visually inspect wastegate (V16/V20 engine).

- All components must be visually inspected.
- Check connection parts, drive shaft, couplings and plug-in connections.
- Retighten screw connections if necessary.

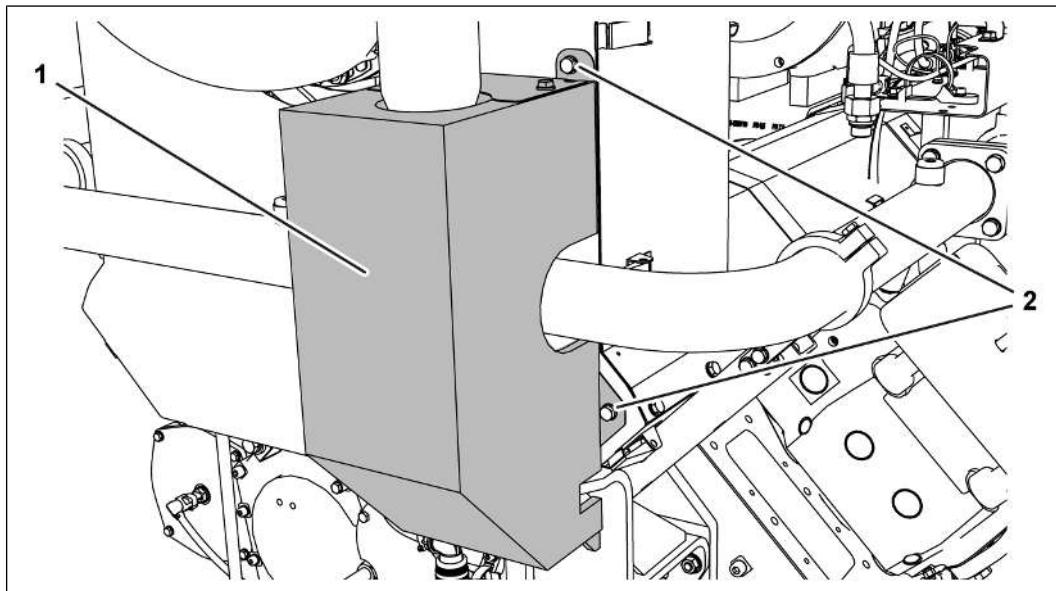
- Check cable bundle and connections.
- Replace worn or damaged components, also contact Cat dealer



530046475

5. Mount cover (1) (V16/20 engine).

- Attach cover.
- Close locks (2).



530044555

6. Mount wastegate cover (1) (V12 engine).

- Attach cover.
 - Tighten screws (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Dismantling and mounting the starter relay

Dismantling the starter relay

Valid for:

CG170B



Tools:

- Standard tools

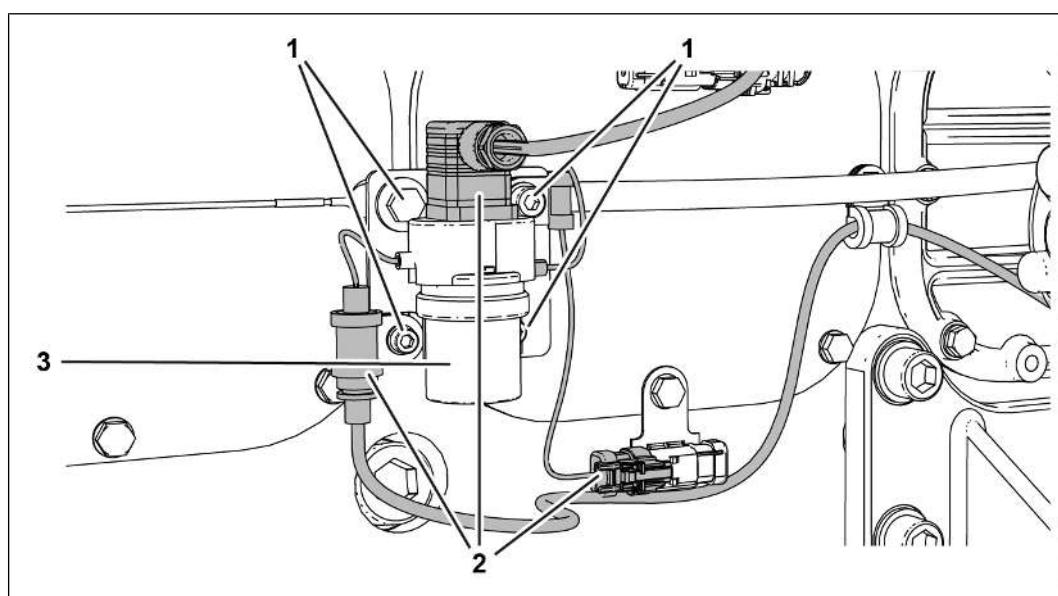
General information

The component must be visually inspected.

- Replace worn or damaged component.

Dismantling the starter relay:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



593352331

1. Dismantle the connector (2).
2. Unscrew screws (1).
3. Remove the starter relay (3).
4. Visually inspect the connector.
 - Clean components.
 - If necessary, repair the connector. Contact Cat dealer to do this.

Mounting the starter relay

Valid for:

CG170B



Tools:

- Standard tools

Auxiliary media:

- Cleaning agent

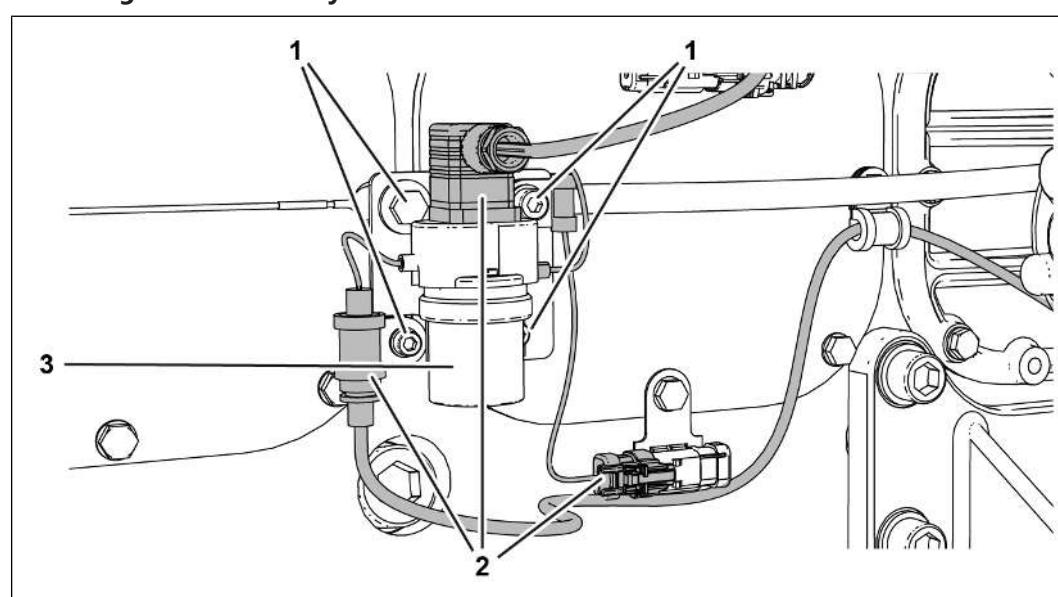
– See Service Library, Technical Bulletin (TR 2147), [Specification for auxiliary media](#).



Spare parts:

- Starter relay

Mounting the starter relay:



593352331

1. Clean components.
 2. Attach the starter relay (3).
 3. Tighten screws (1).
 4. Mount the connector (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Checking the lugs

Valid for:

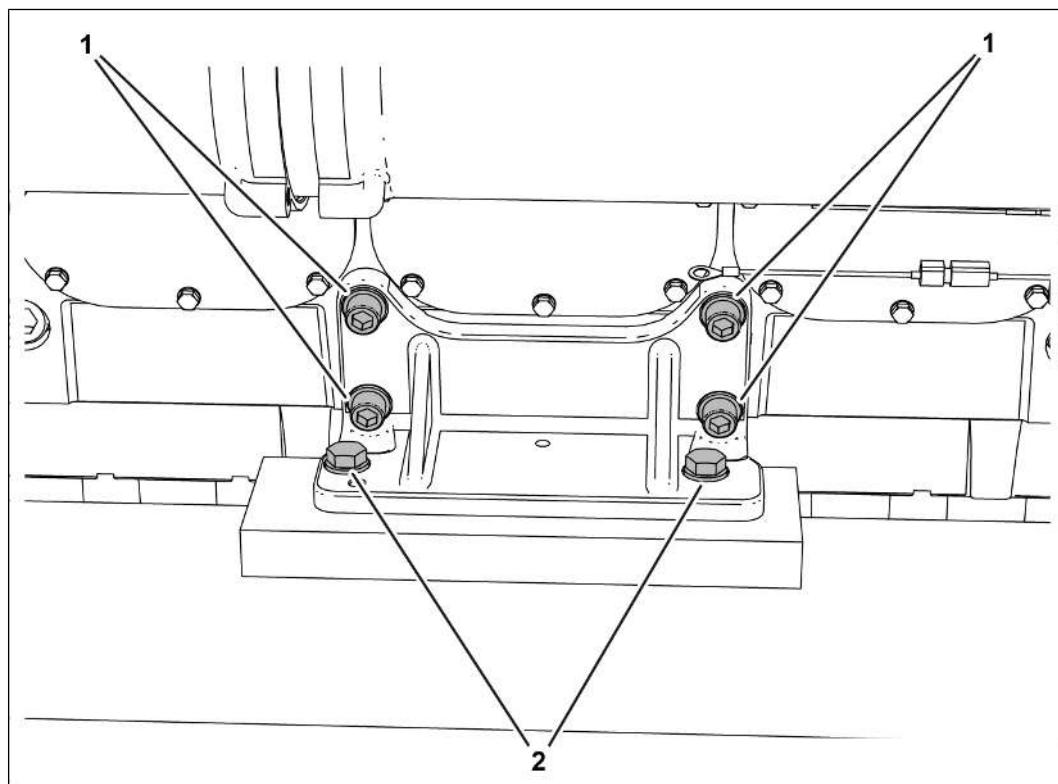
CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)

Technical data



532487947

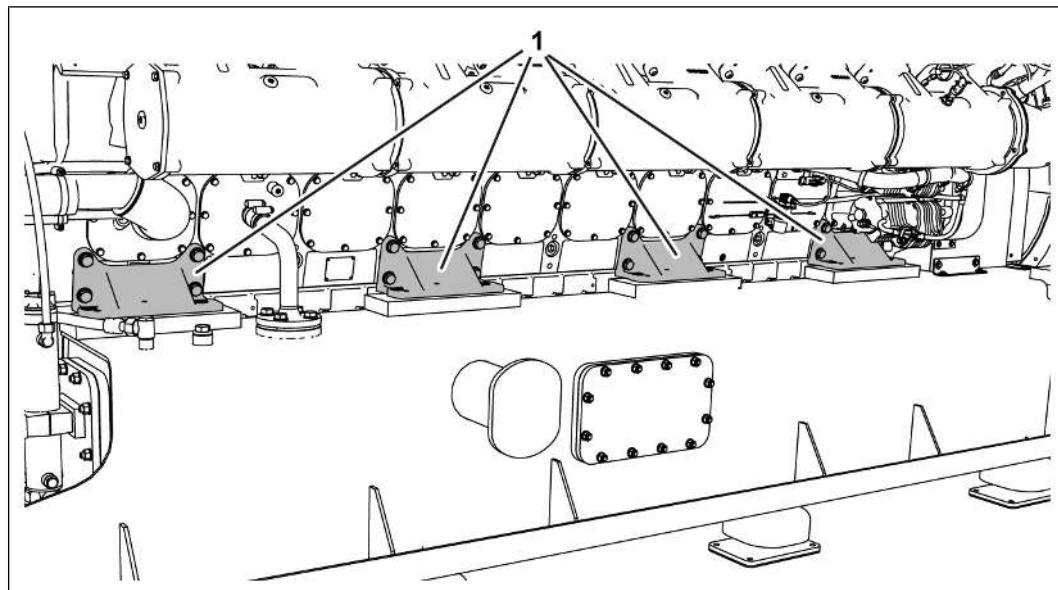
Lug on crankcase		
1.	Screw	M16 x 40 - 10.9
		180 Nm
<hr/>		
Lug on base frame		
2.	Screw	M16 x 40 - 8.8
		210 Nm
<hr/>		

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:



532485515

1. Check the screws of the lug (1).
 - Tap the adapters of the mount or attachments (including those that are difficult to access).
 - Retighten screw connections according to the specifications in the technical data.

Removing and installing the intake air temperature sensor

Removing intake air temperature sensor

Valid for:

CG170B



Tools:

- Standard tools

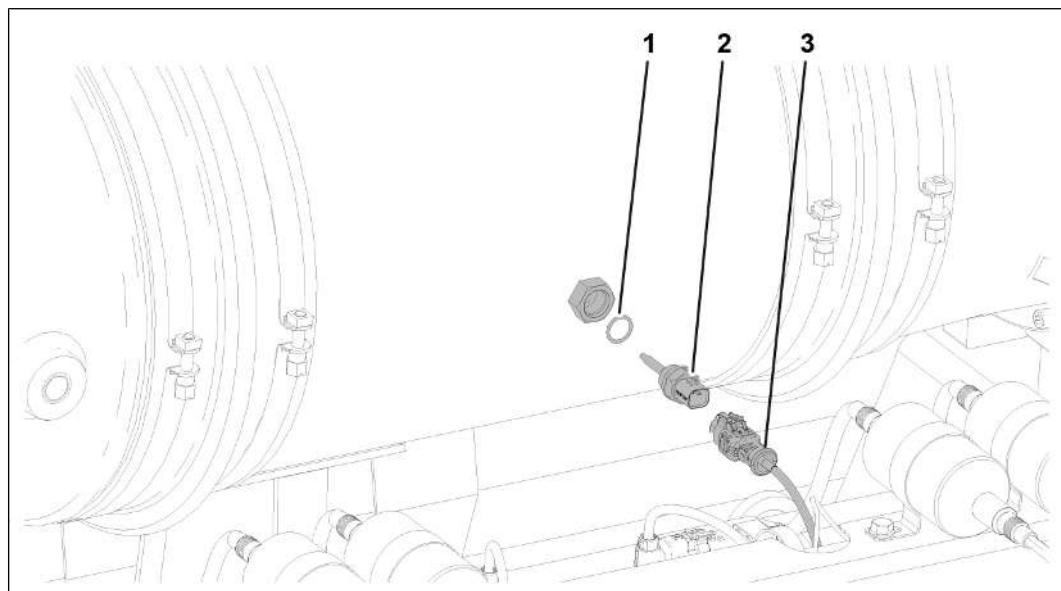
General information

The component must be visually inspected.

- Replace worn or damaged component.
- Replace sealing ring.

Removing the intake air temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



536443147

1. Dismantle the connector (3) from sensor (2).
2. Remove sensor (2).
3. Remove sealing ring (1).

Installing intake air temperature sensor

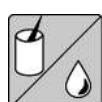
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

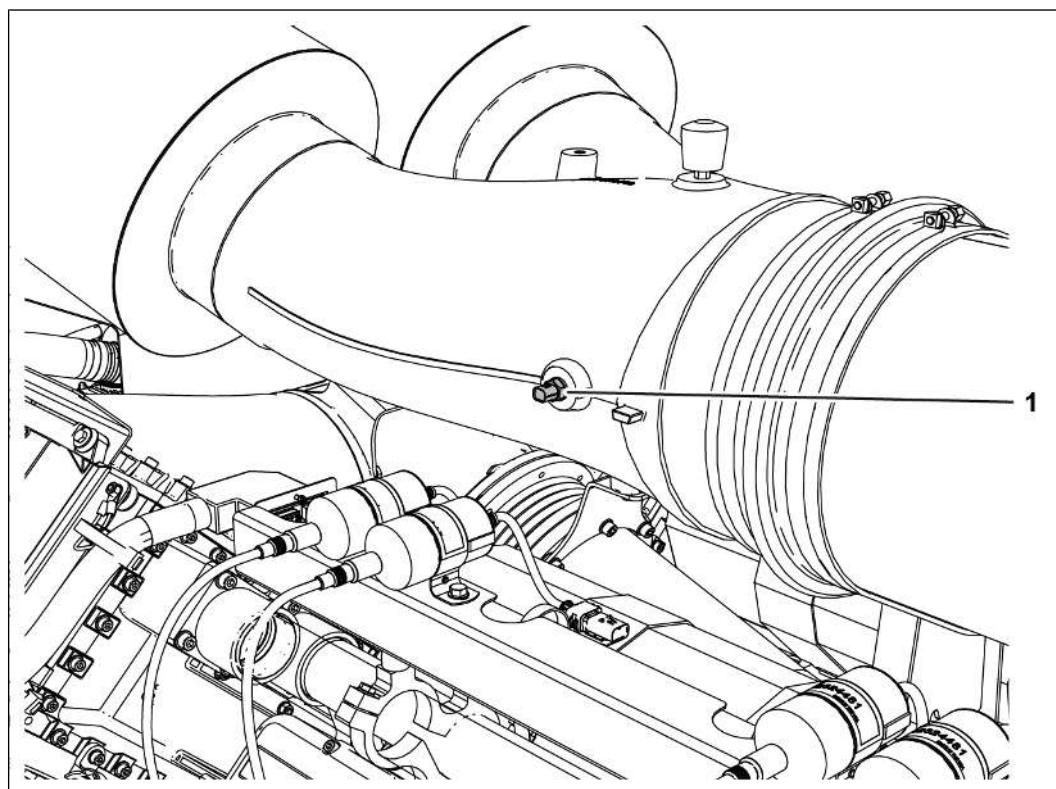
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#)



Spare parts:

- Sealing ring
- Temperature sensor, if necessary

Technical data



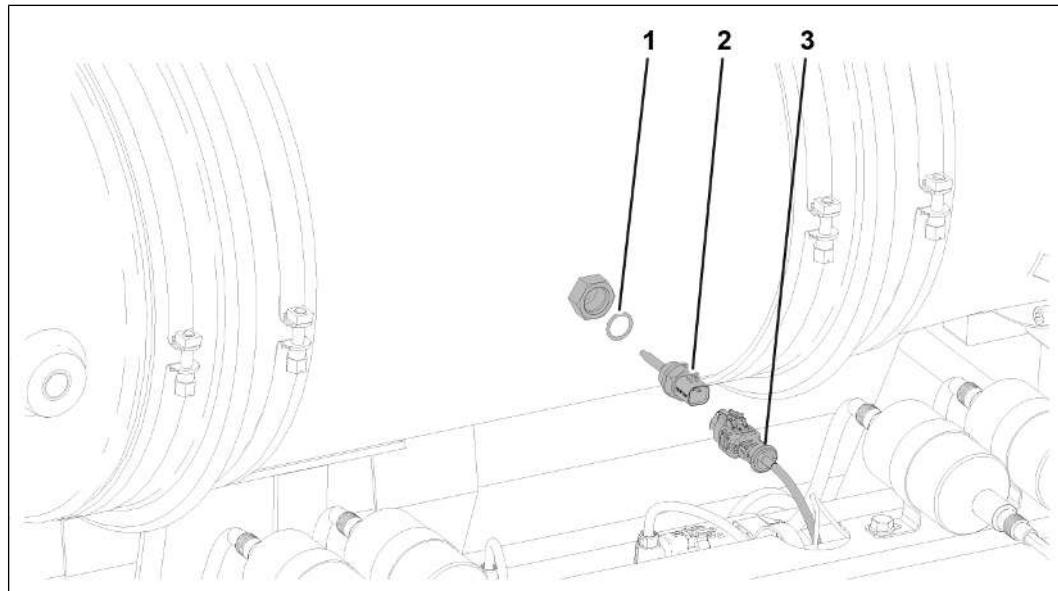
536440715

Intake air temperature sensor on manifold

- | | | | |
|----|----------------------------------|-----------------|-------|
| 1. | Temperature sensor ¹⁾ | G3/4 - 16 - 2 A | 20 Nm |
|----|----------------------------------|-----------------|-------|

¹⁾ Replace sealing ring.

Installing the intake air temperature sensor:



536443147

1. Clean components.
 2. Insert sensor (2) with new sealing ring (1) and tighten it.
 3. Visually inspect the connector (3).
 4. Mount the connector (3) to the sensor (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the differential pressure sensor (throttle valve)

Removing the differential pressure sensor

Valid for:

CG170B



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace worn or damaged component.
- Replace sealing ring.

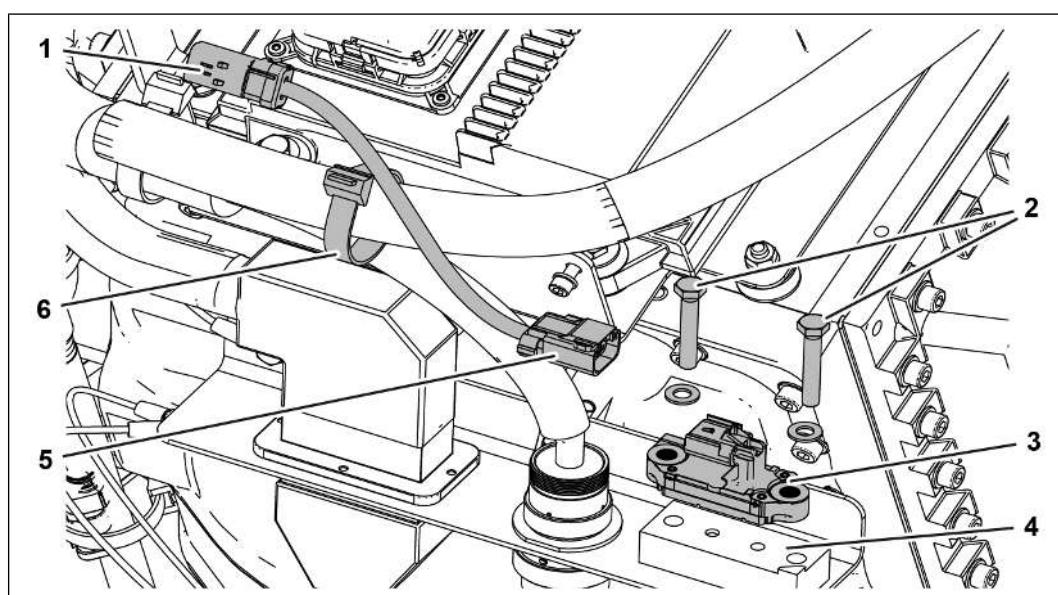
NOTE

The work described below is performed on one pressure sensor.

Proceed in the same way on the opposite engine side.

Removing the differential pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



538196875

1. Dismantle cable bundle.
 - Undo cable ties (6).
 - Dismantle the connector (1).

- Dismantle the connector (5).
 - Remove cable bundle.
2. Unscrew screws (2).
3. Remove the sensor (3) from the pressure sensor (4).

Installing the differential pressure sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



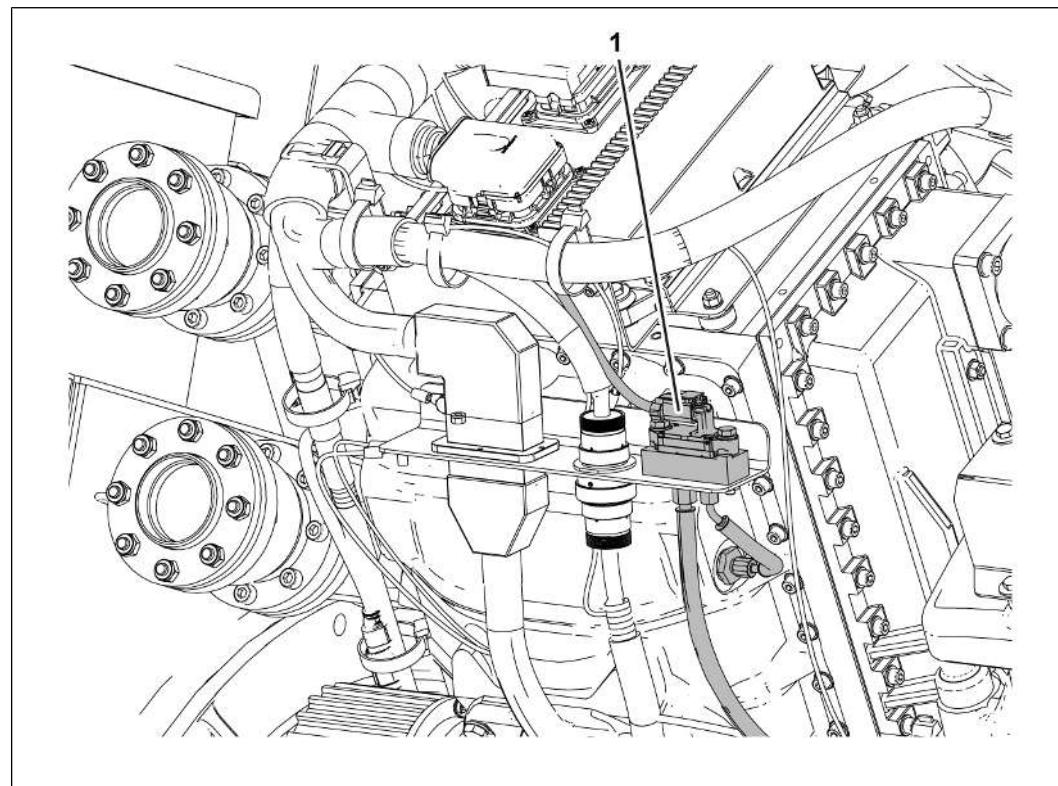
Auxiliary media:

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



Spare parts:

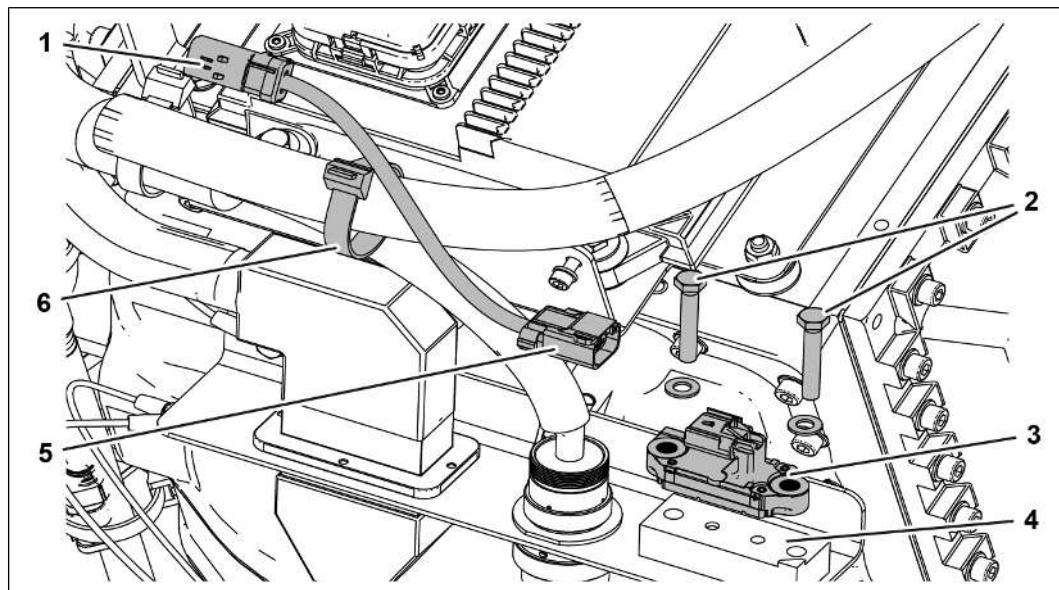
- Pressure sensor, if applicable

Technical data

538192523

Differential pressure sensor on holder

1	Screw dimensions	M8 x 1.25	20 Nm

Installing the differential pressure sensor:


538196875

1. Clean components.
 2. Attach the sensor (3) to the pressure sensor (4).
 - The sensor connection must point in direction of the generator.
 3. Tighten screws (2).
 4. Check cable bundle.
 - Visually inspect the connector (1).
 - Visually inspect the connector (5).
 5. Mount the connector (5) to the sensor (3).
 6. Mount the connector (1).
 7. Fix the cable bundle with cable tie (6).
 - Lay the cable bundle so that it is free of tension and abrasion.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the crankcase pressure sensor

Removing the crankcase pressure sensor

Valid for:

CG170B



Tools:

- Standard tools

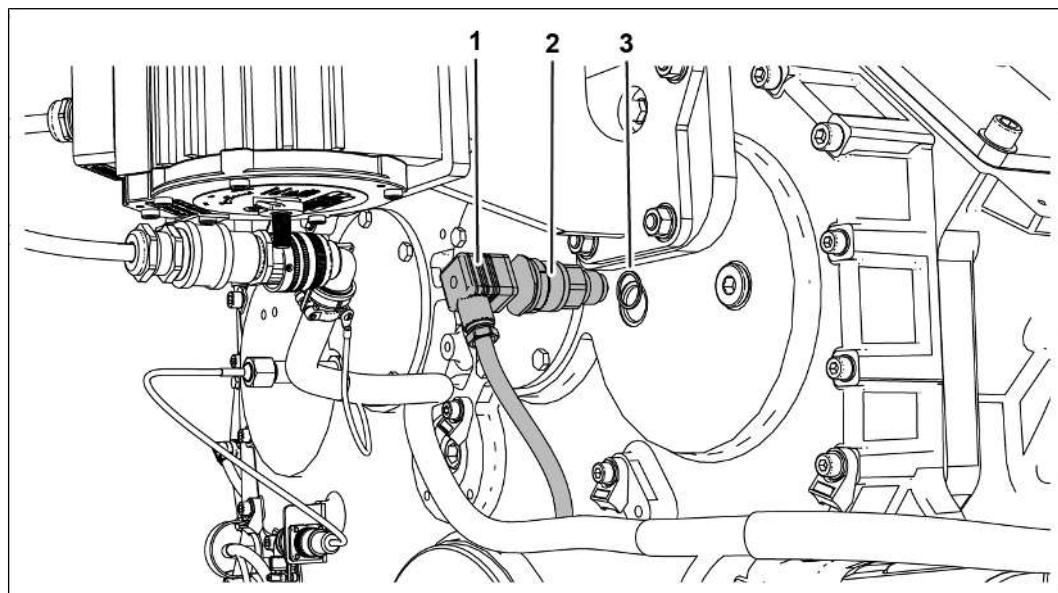
General information

The component must be visually inspected.

- Replace worn or damaged component.
- Replace sealing ring.

Removing the crankcase pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



538144267

1. Dismantle the connector (1) from sensor (2).
2. Remove sensor (2).
3. Remove sealing ring (3).

Installing the crankcase pressure sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

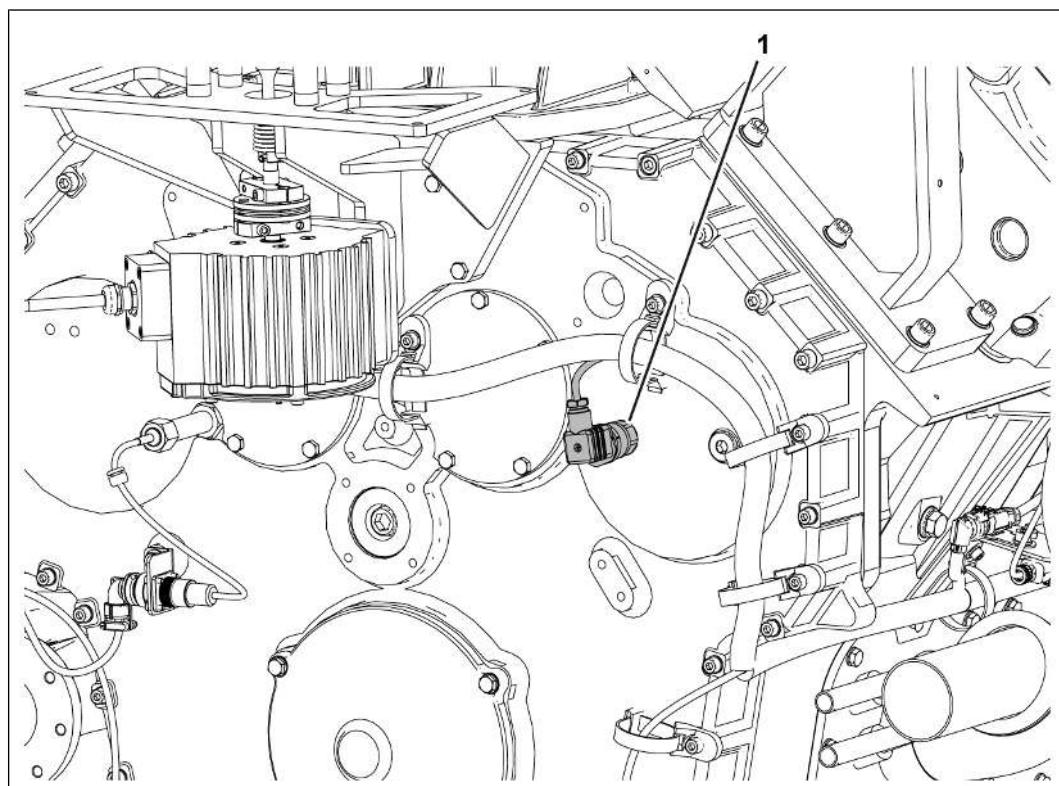
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Sealing ring
- Pressure sensor, if applicable

Technical data



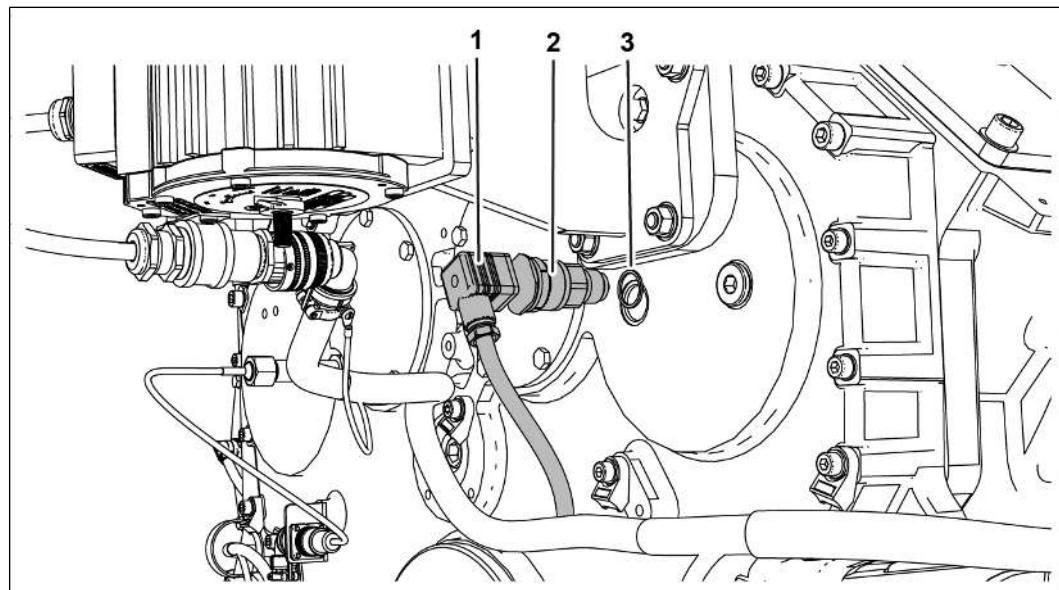
538139915

Crankcase pressure sensor on timing gear cover

1	Pressure sensor ¹⁾	M14 x 1.5	20 Nm
---	-------------------------------	-----------	-------

¹⁾ Replace sealing ring.

Installing the crankcase pressure sensor:



538144267

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
 5. Check the crankcase chamber pressure, see MRA10 / 01-01-01 [Checking the crankcase chamber pressure \[▶ 322\]](#).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the mixture temperature sensor

Removing the mixture temperature sensor

Valid for:

CG170B



Tools:

- Standard tools

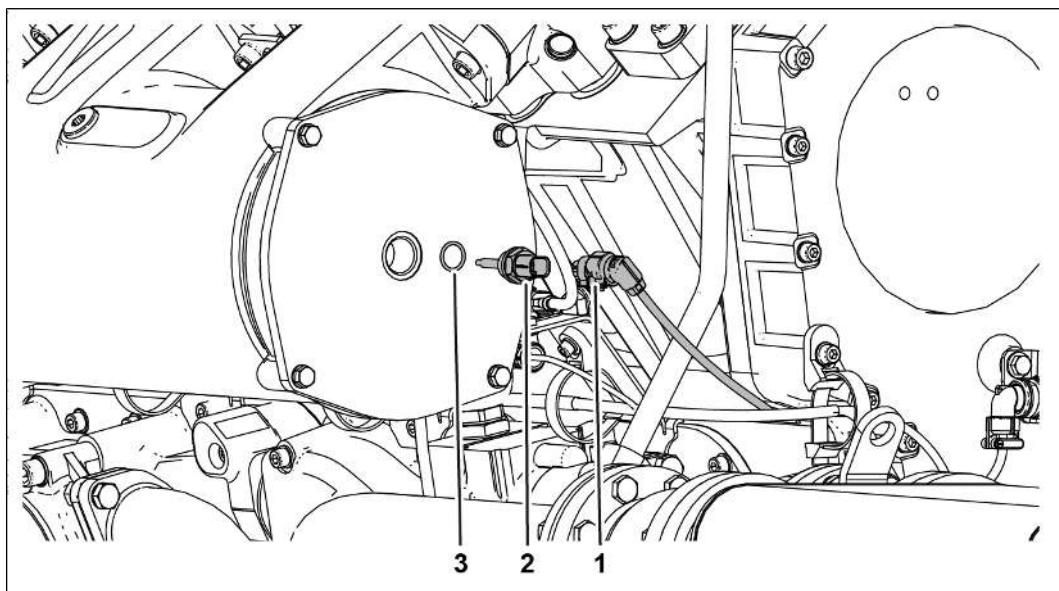
General information

The component must be visually inspected.

- Replace worn or damaged component.
- Replace sealing ring.

Removing the mixture temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



536615051

1. Dismantle the connector (1) from sensor (2).
2. Remove sensor (2).
3. Remove sealing ring (3).

Installing the mixture temperature sensor

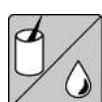
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

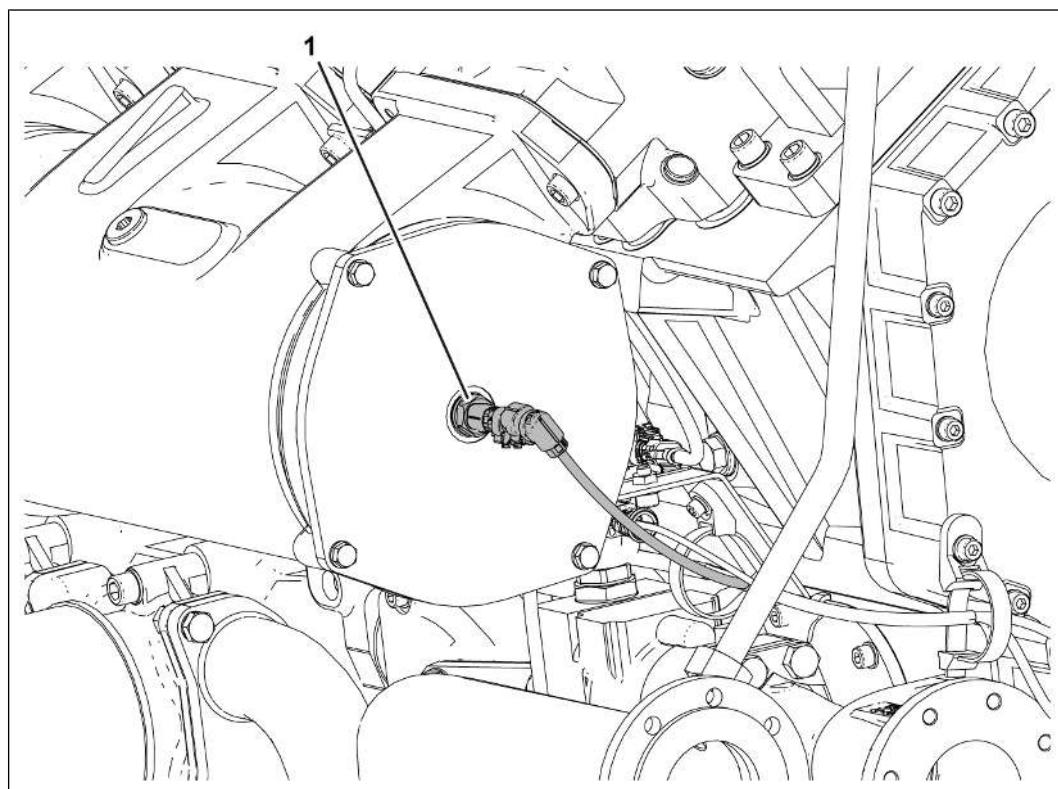
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

- Sealing ring
- Temperature sensor, if necessary

Technical data



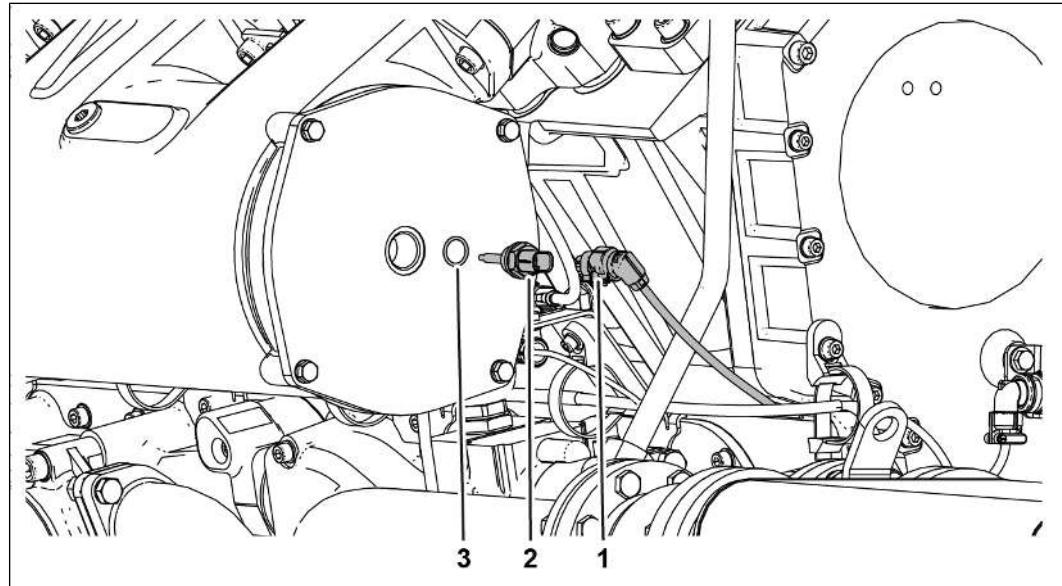
536612619

Mixture temperature sensor on the mixture pipe

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.

Installing the mixture temperature sensor:



536615051

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the mixture pressure sensor

Removing the mixture pressure sensor

Valid for:

CG170B



Tools:

- Standard tools

General information

The component must be visually inspected.

- Replace worn or damaged component.
- Replace sealing ring.

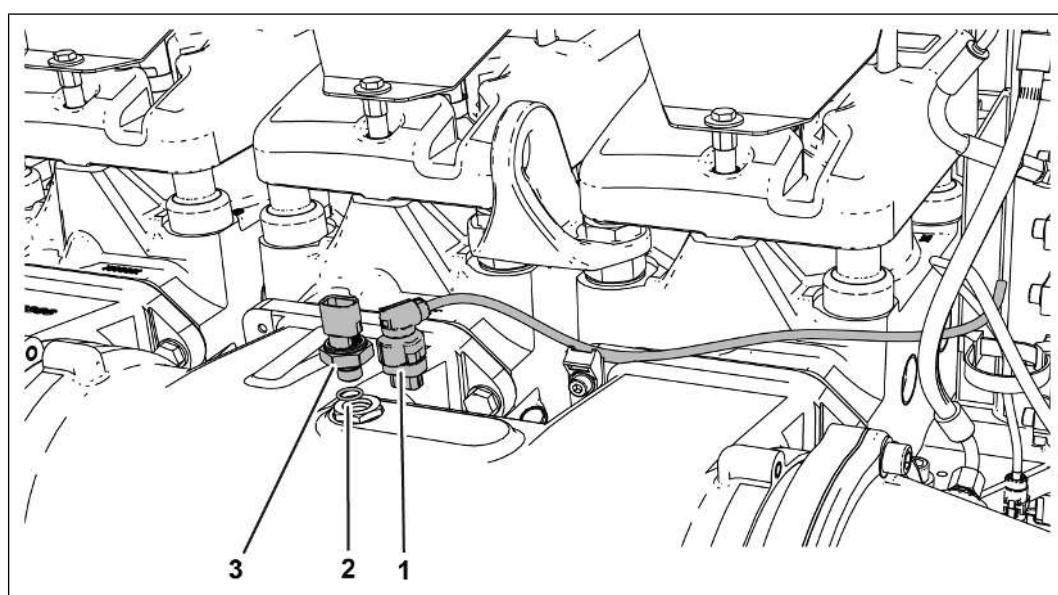
NOTE

The work described below is performed on one pressure sensor.

Proceed in the same way on the opposite engine side.

Removing the mixture pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset ▶ 154](#)



538017035

1. Dismantle the connector (1) from sensor (2).
2. Remove sensor (2).
3. Remove sealing ring (3).

Installing the mixture pressure sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

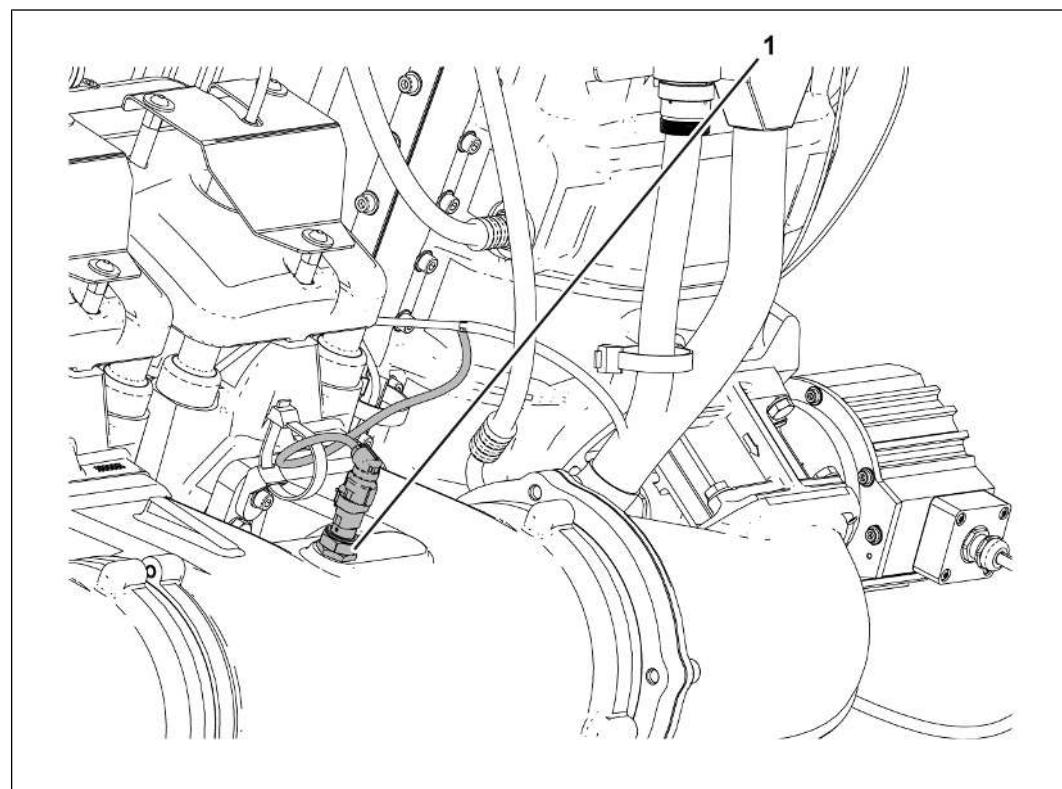
- Cleaning agent
 - See Service Library, Technical Bulletin ([TR 2147](#)), [Specification for auxiliary media](#).



Spare parts:

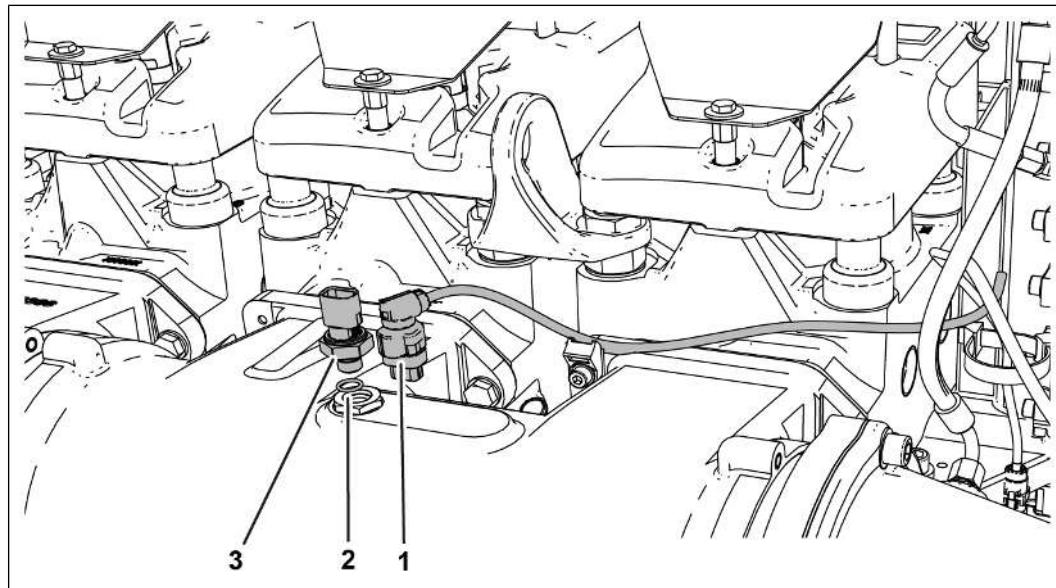
- Pressure sensor, if applicable
- Pressure sensor, if applicable

Technical data



538012683

Mixture pressure sensor on mixture pipe

1 Pressure sensor¹⁾ M14 x 1.5 10 Nm¹⁾ Replace sealing ring.**Installing the mixture pressure sensor:**

538017035

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the lube oil temperature sensor

Removing the lube oil temperature sensor

Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

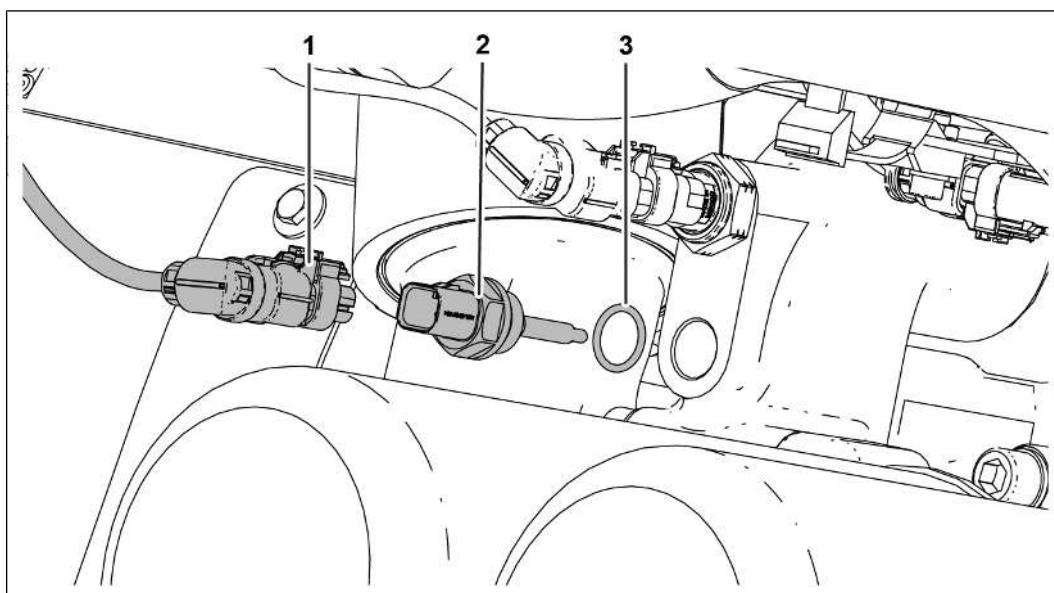
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the lube oil temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



536740235

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (1) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (3).

Installing the lube oil temperature sensor

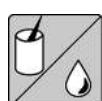
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



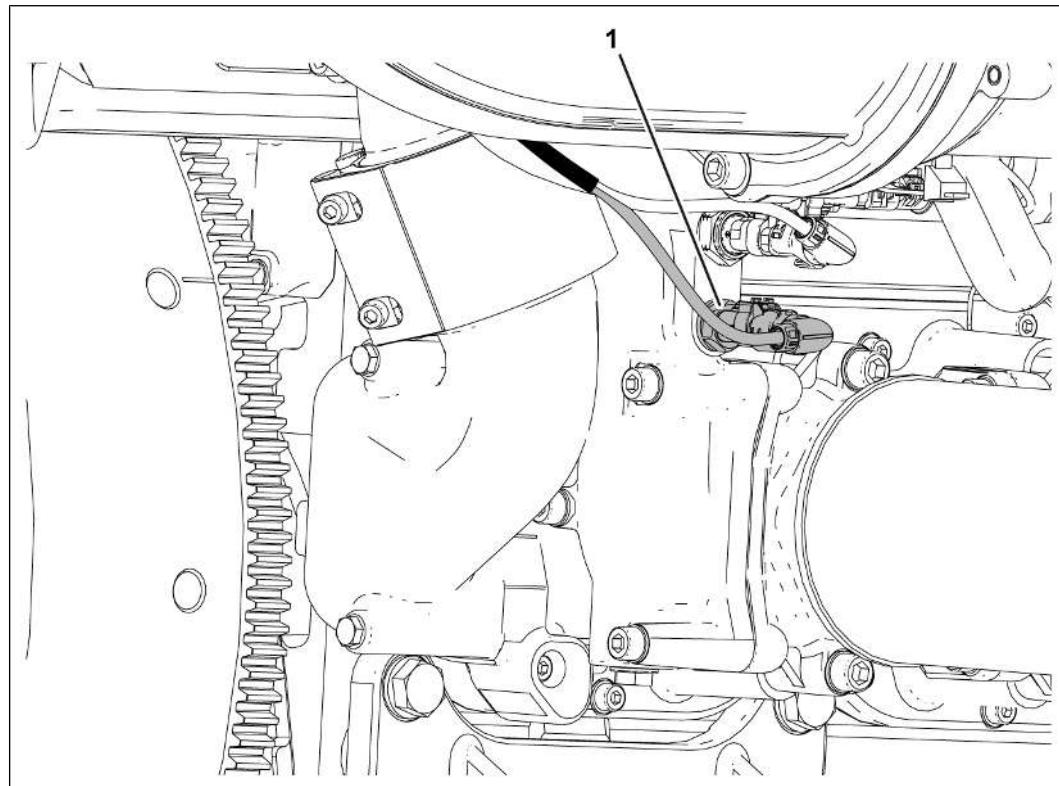
Auxiliary media:

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



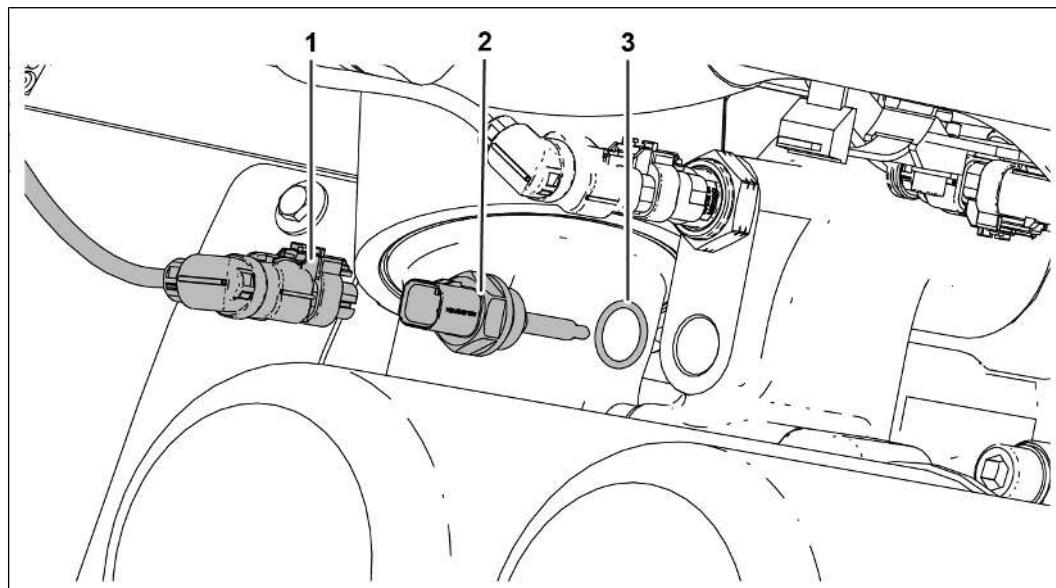
Spare parts:

- Sealing ring
- Temperature sensor, if necessary

Technical data

536737803

Lube oil temperature sensor on lube oil pipe			
1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
¹⁾ Replace sealing ring.			

Installing the lube oil temperature sensor:

536740235

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the lube oil pressure sensor

Removing the lube oil pressure sensor

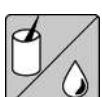
Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

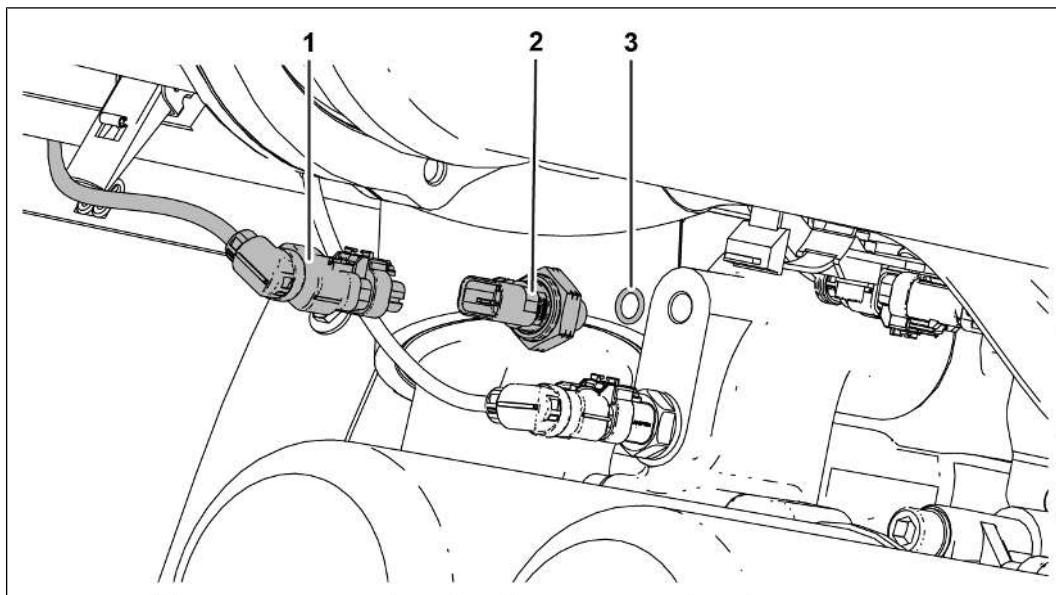
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the lube oil pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



537415051

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (1) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (3).

Installing the lube oil pressure sensor

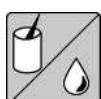
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



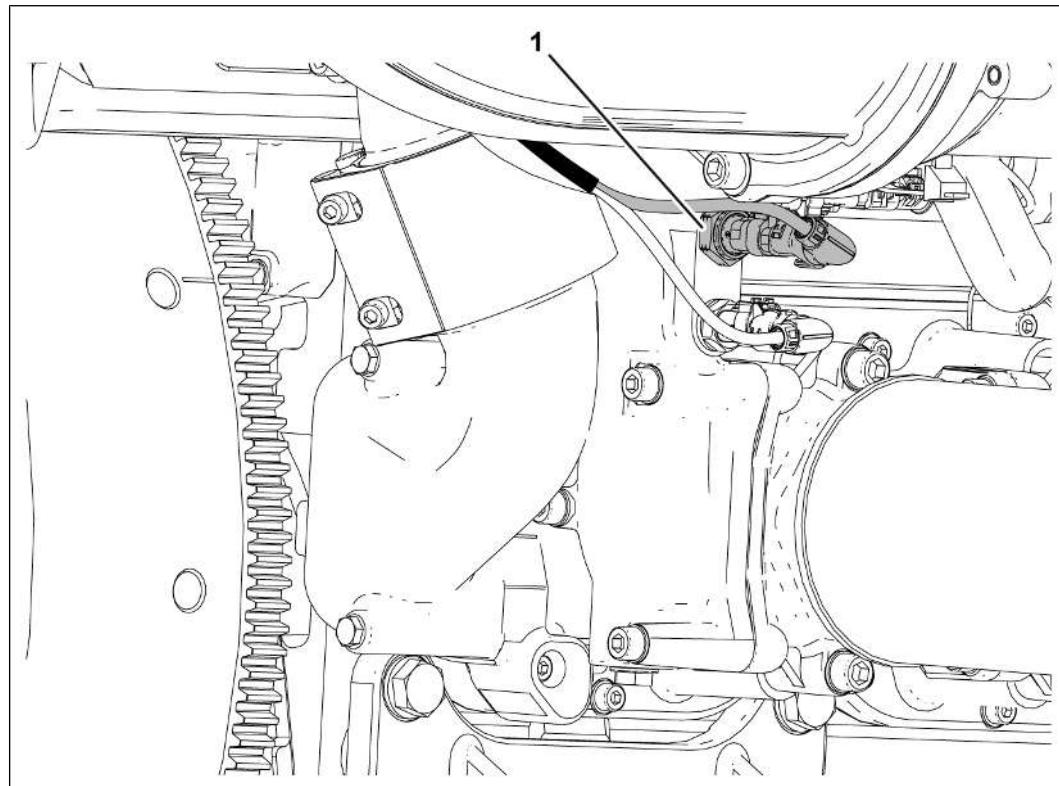
Auxiliary media:

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



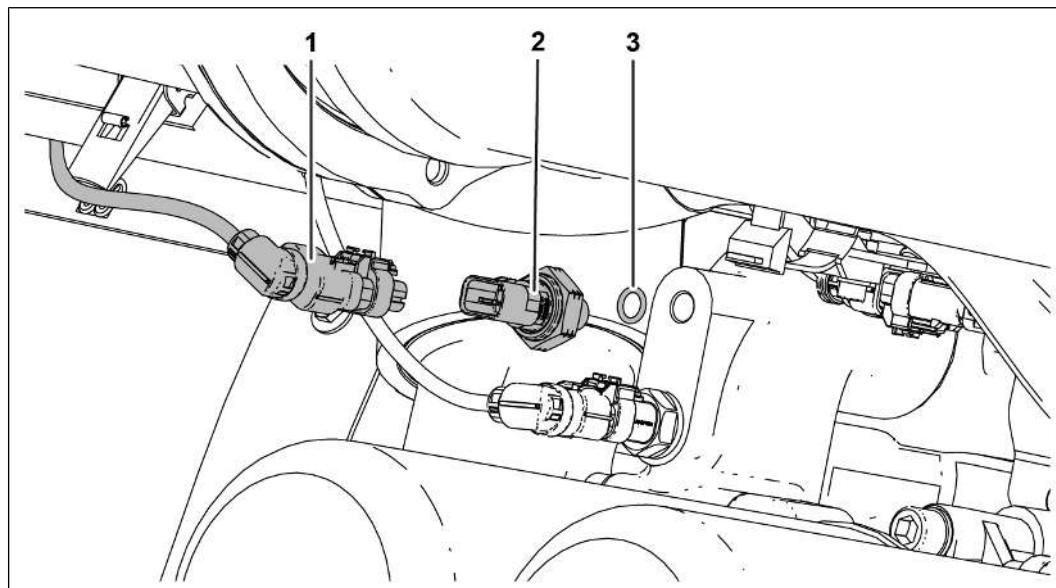
Spare parts:

- Sealing ring
- Pressure sensor, if applicable

Technical data

537412619

Lube oil pressure sensor on lube oil pipe			
1	Pressure sensor ¹⁾	M12 x 1.5	10 Nm
¹⁾ Replace sealing ring.			

Installing the lube oil pressure sensor:

537415051

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the coolant temperature sensor

Removing the coolant temperature sensor

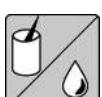
Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

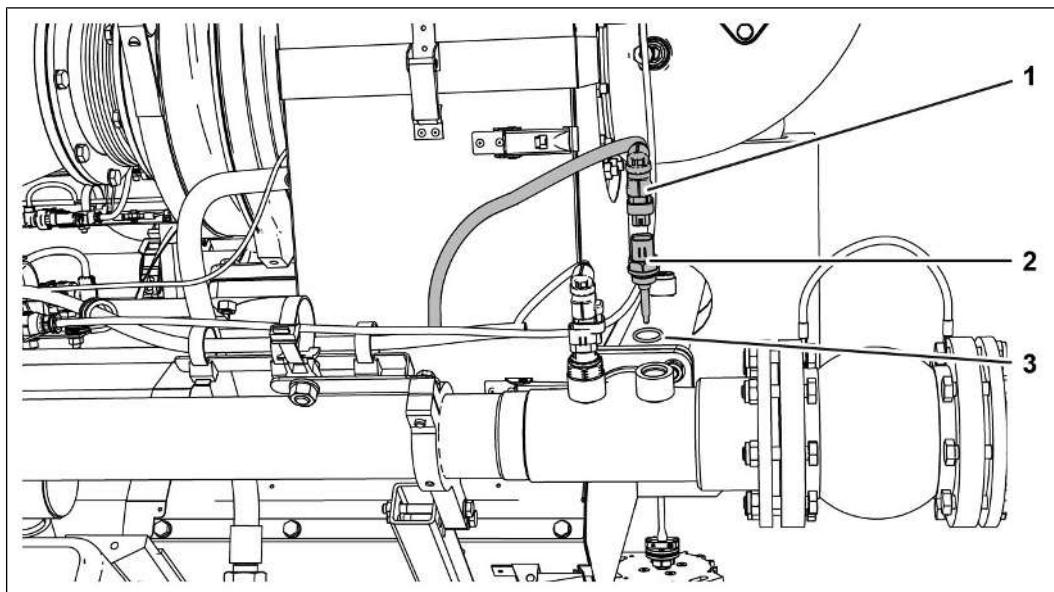
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the coolant temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



536882699

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (1) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (3).

Installing the coolant temperature sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



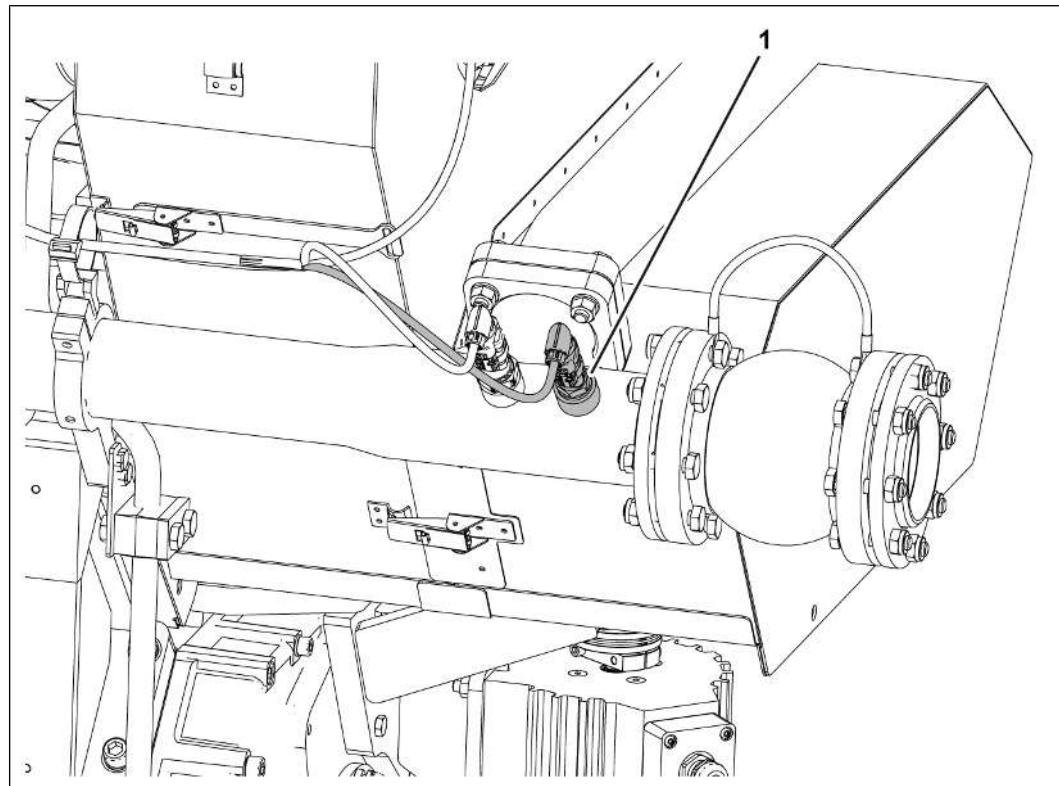
Auxiliary media:

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



Spare parts:

- Sealing ring
- Temperature sensor, if necessary

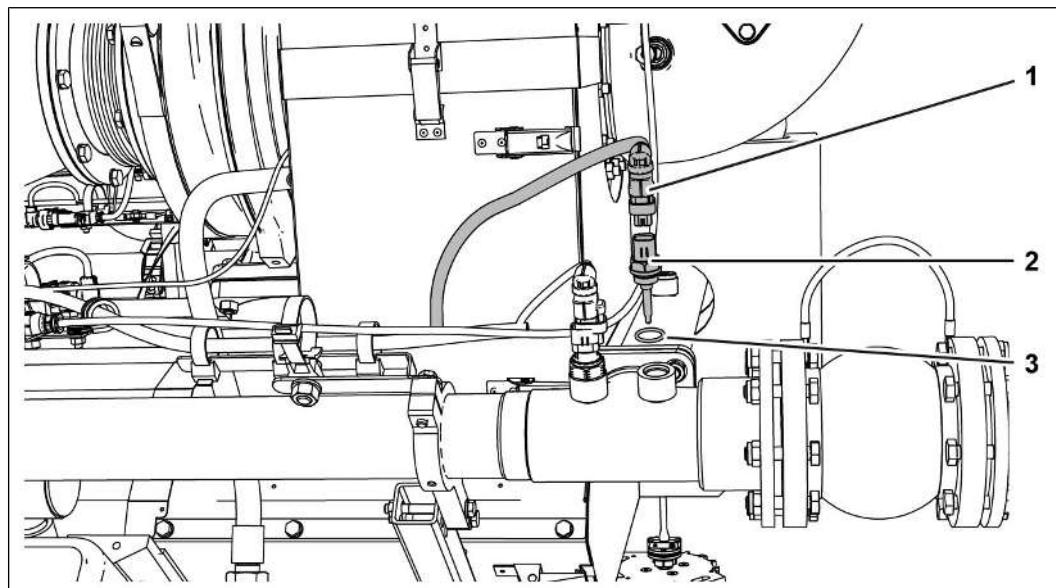
Technical data

536885131

Coolant temperature sensor on coolant pipe

1.	Temperature sensor ¹⁾	G3/4 - 16 - 2 A	20 Nm
----	----------------------------------	-----------------	-------

¹⁾ Replace sealing ring.

Installing the coolant temperature sensor:

536882699

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the coolant temperature sensor (mixture cooler)

Removing the coolant temperature sensor

Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

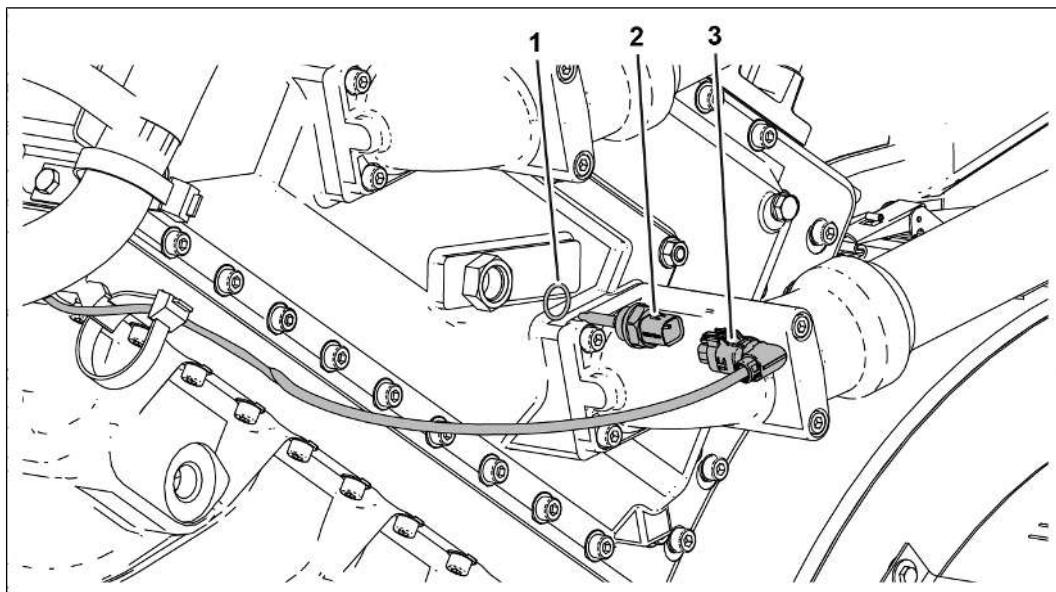
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the coolant temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



537207819

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (3) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (1).

Installing the coolant temperature sensor

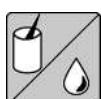
Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



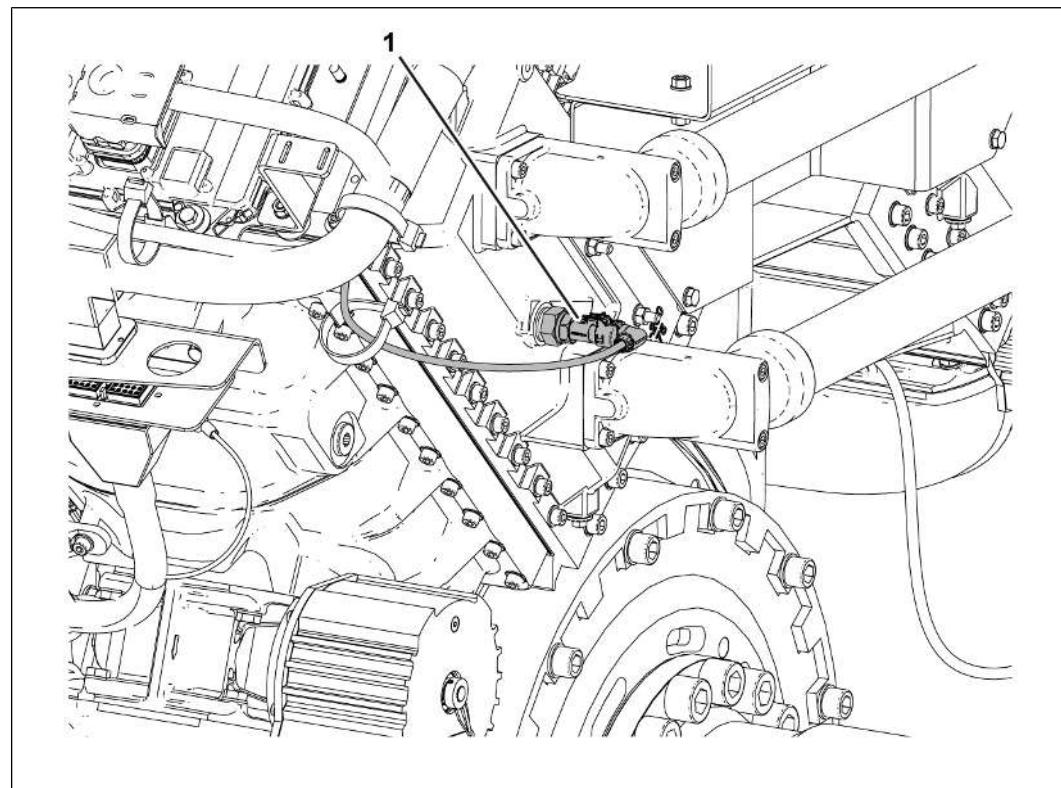
Auxiliary media:

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



Spare parts:

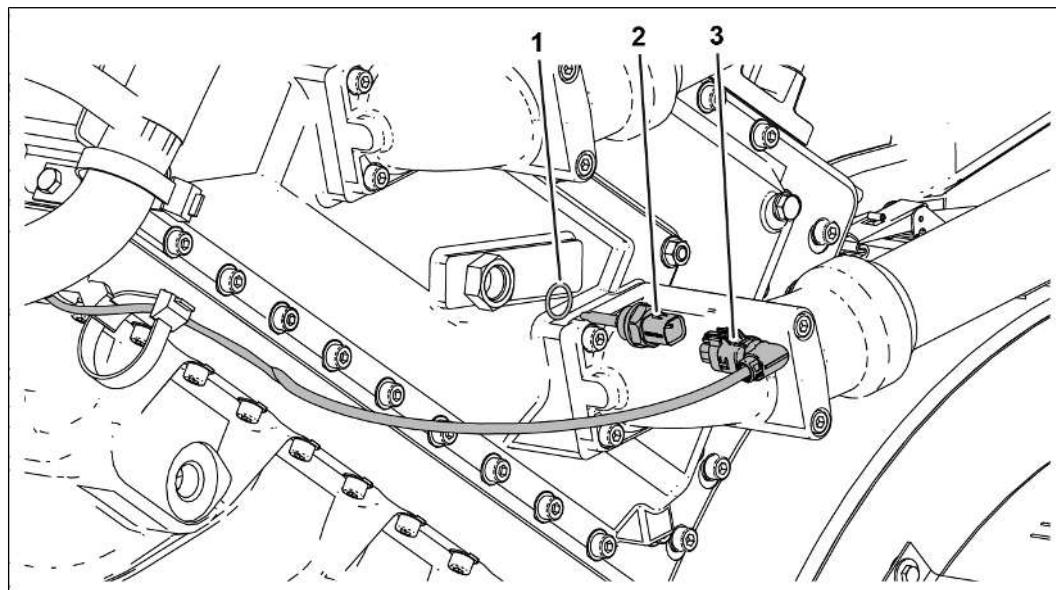
- Sealing ring
- Temperature sensor, if necessary

Technical data

537192587

Coolant temperature sensor on mixture cooler

1. Temperature sensor¹⁾ G3/4 - 16 - 2 A 20 Nm¹⁾ Replace sealing ring.

Installing the coolant temperature sensor:

537207819

1. Clean components.
 2. Insert sensor (2) with new sealing ring (1) and tighten it.
 3. Visually inspect the connector (3).
 4. Mount the connector (3) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the coolant temperature sensor (engine inlet)

Removing the coolant temperature sensor

Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

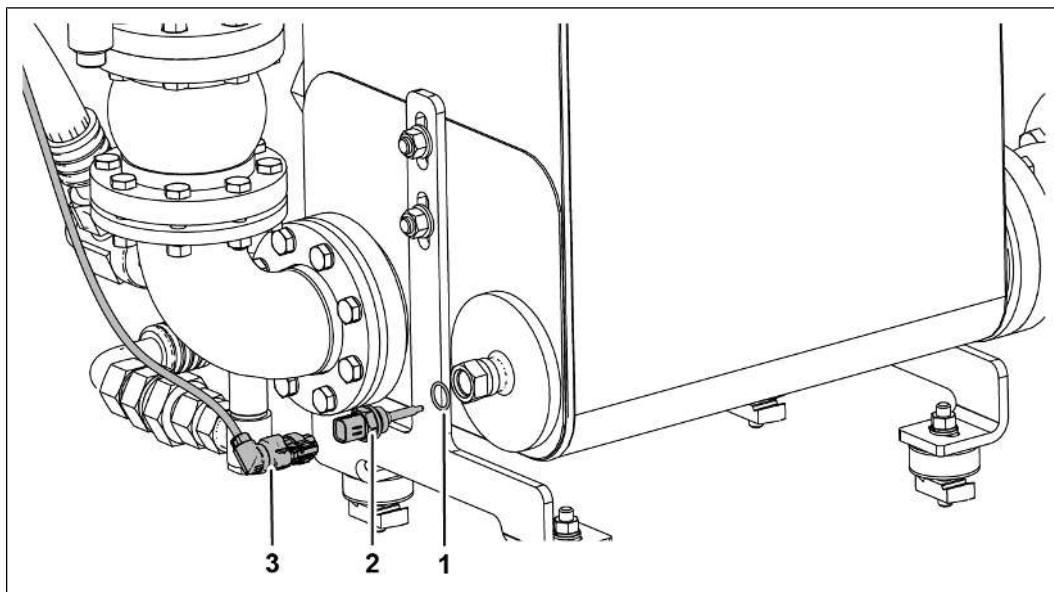
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the coolant temperature sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



536959499

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (3) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (1).

Installing the coolant temperature sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



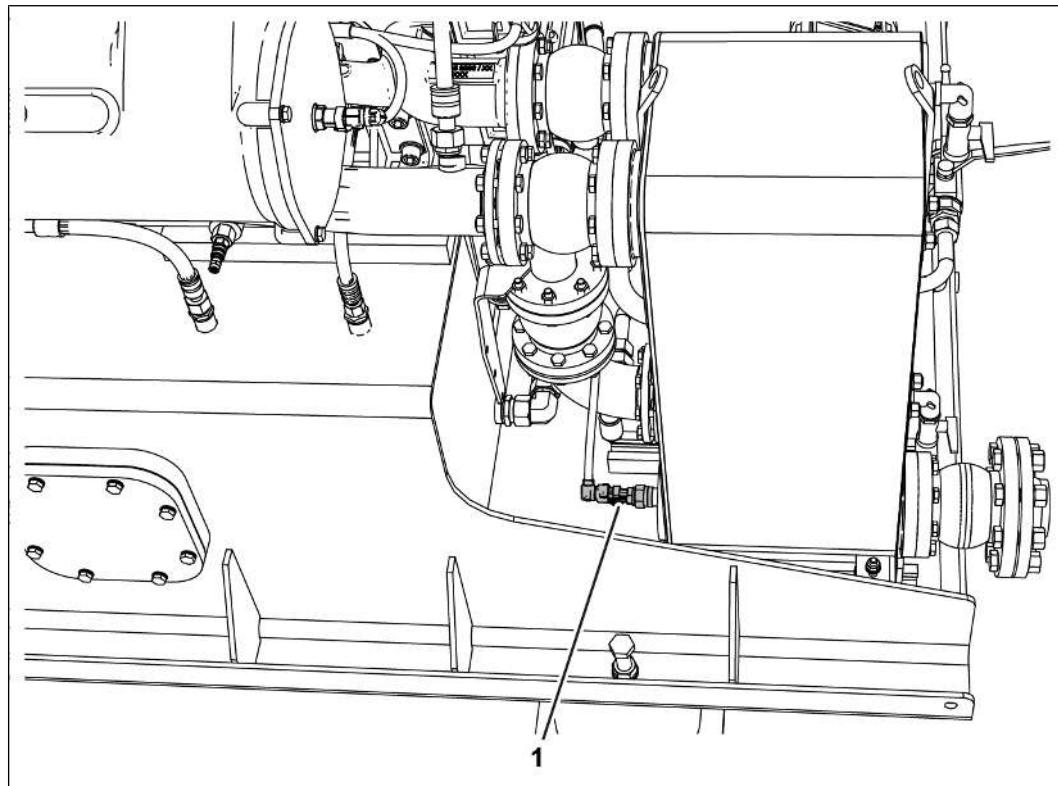
Auxiliary media:

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



Spare parts:

- Sealing ring
- Temperature sensor, if necessary

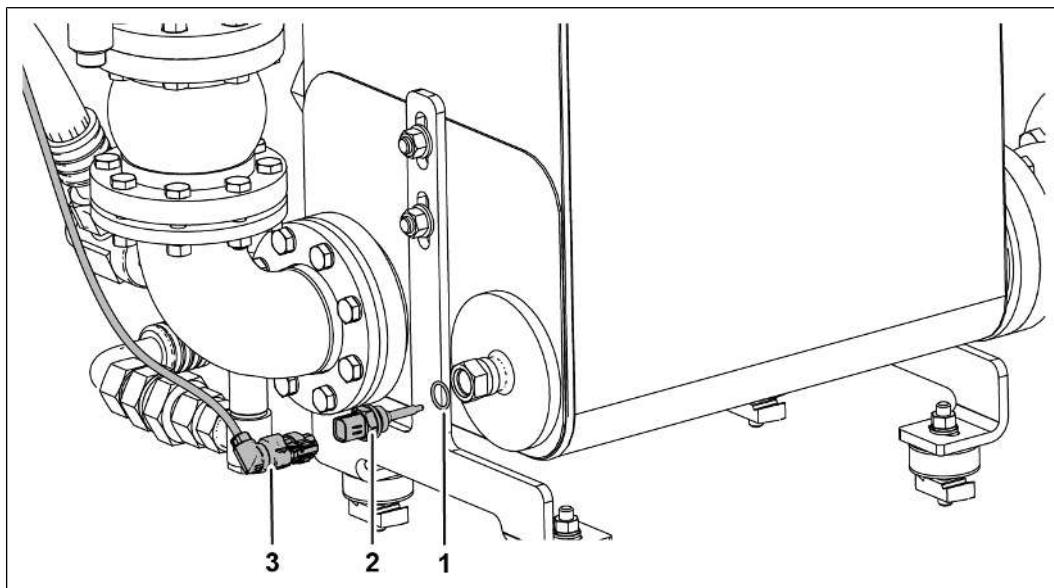
Technical data

536957067

Coolant temperature sensor on lube oil cooler

- | | | | |
|----|----------------------------------|-----------------|-------|
| 1. | Temperature sensor ¹⁾ | G3/4 - 16 - 2 A | 20 Nm |
|----|----------------------------------|-----------------|-------|

¹⁾ Replace sealing ring.

Installing the coolant temperature sensor:

536959499

1. Clean components.
 2. Insert sensor (2) with new sealing ring (1) and tighten it.
 3. Visually inspect the connector (3).
 4. Mount the connector (3) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Removing and installing the coolant pressure sensor

Removing the coolant pressure sensor

Valid for:

CG170B



Tools:

- Standard tools



Auxiliary media:

- Binding agent

General information

The component must be visually inspected.

- Replace worn or damaged component.
- 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

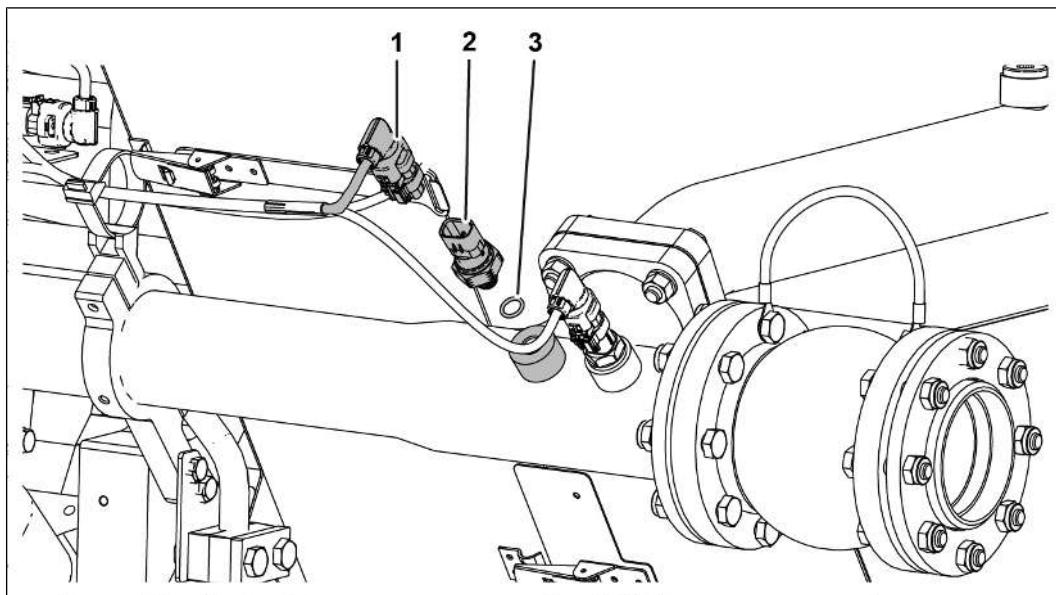
Due to escaping operating media that enter the environment.

Contamination of the environment.

- Collect escaping operating media.
 - Dispose of operating media properly.
-

Removing the coolant pressure sensor:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



591202443

1. Place the collecting tray underneath.
 - If necessary, collect any escaping operating media.
2. Dismantle the connector (1) from sensor (2).
3. Remove sensor (2).
4. Remove sealing ring (3).

Installing the coolant pressure sensor

Valid for:

CG170B



Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



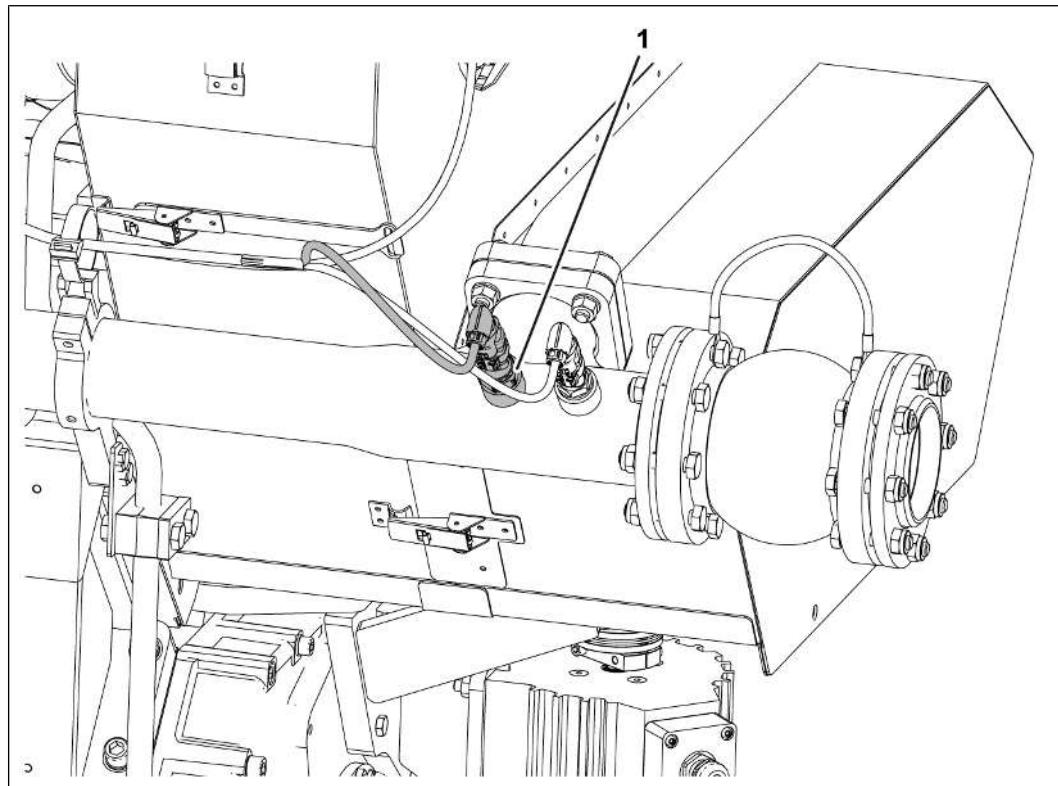
Auxiliary media:

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



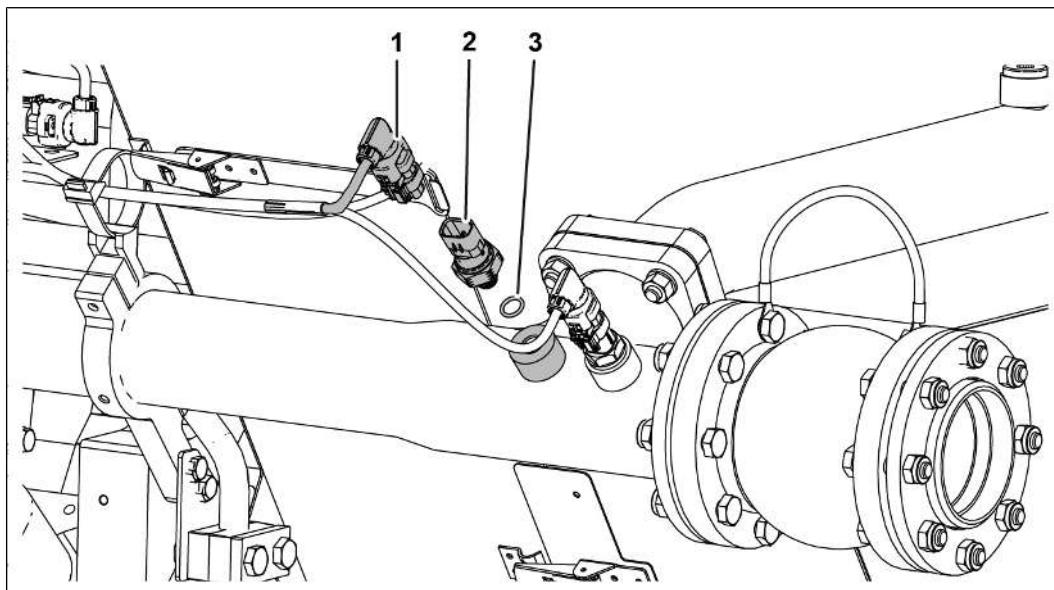
Spare parts:

- Sealing ring
- Pressure sensor, if applicable

Technical data

591200011

Coolant pressure sensor on coolant pipe			
1	Pressure sensor ¹⁾	M14 x 1.5	10 Nm
¹⁾ Replace sealing ring.			

Installing the coolant pressure sensor:

591202443

1. Clean components.
 2. Insert sensor (2) with new sealing ring (3) and tighten it.
 3. Visually inspect the connector (1).
 4. Mount the connector (1) to the sensor (2).
 5. Remove the collecting tray.
 - Properly dispose of collected operating medium.
- ⇒ Commission the genset, see Commissioning/Genset [Start the genset \[▶ 117\]](#)

Mounting and dismantling the engine turning gear

Mounting the engine turning gear

Valid for:

CG170, CG170 (K), CG170B



Tools:

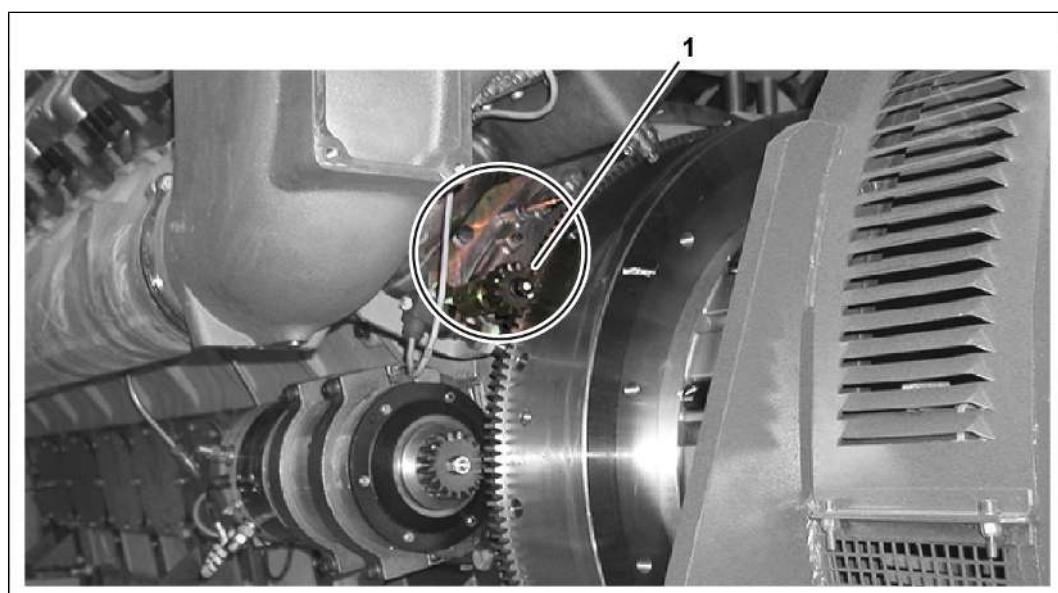
- Standard tools
- Special tool
 - Engine turning gear 1244 1150 [▶ 188]

General information

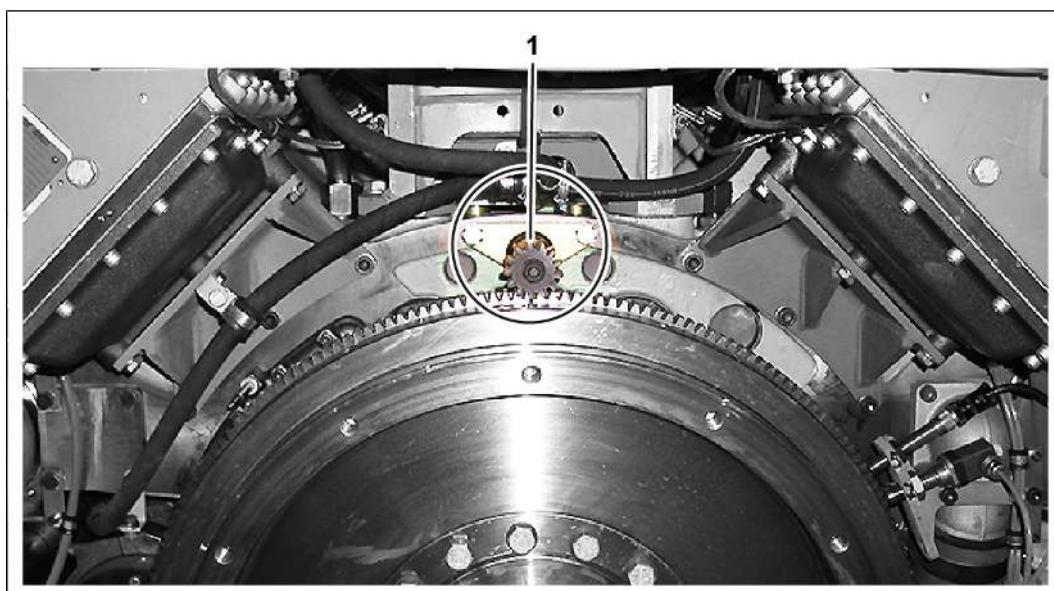
Alternatively, the engine turning rod can also be used for turning.

The installation position of the engine turning gear depends on the number of cylinders.

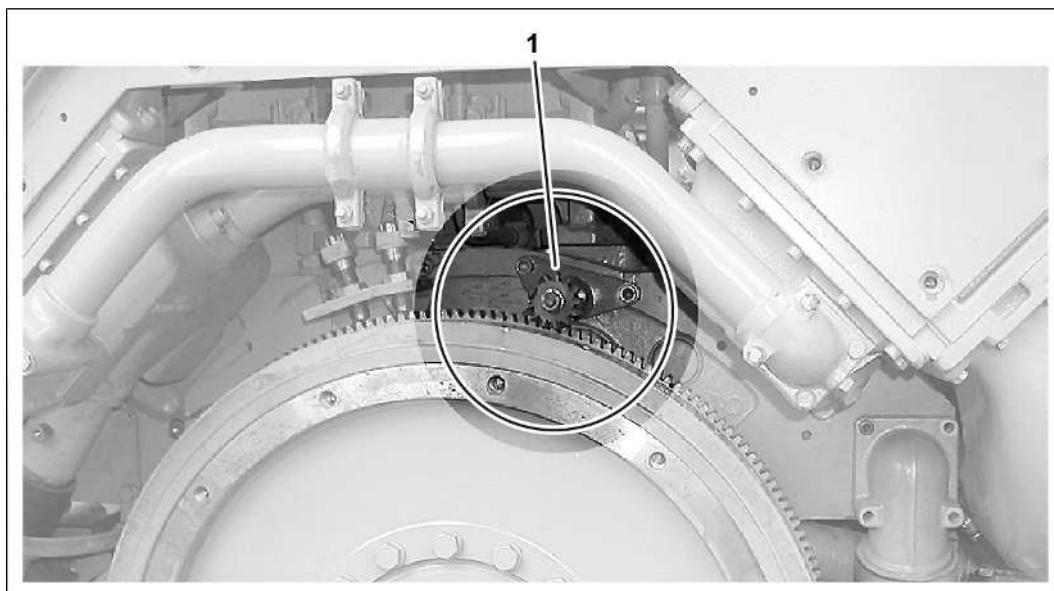
- The different installation situations are described below.



532870411: Variant 1 for mounting the engine turning gear (1)

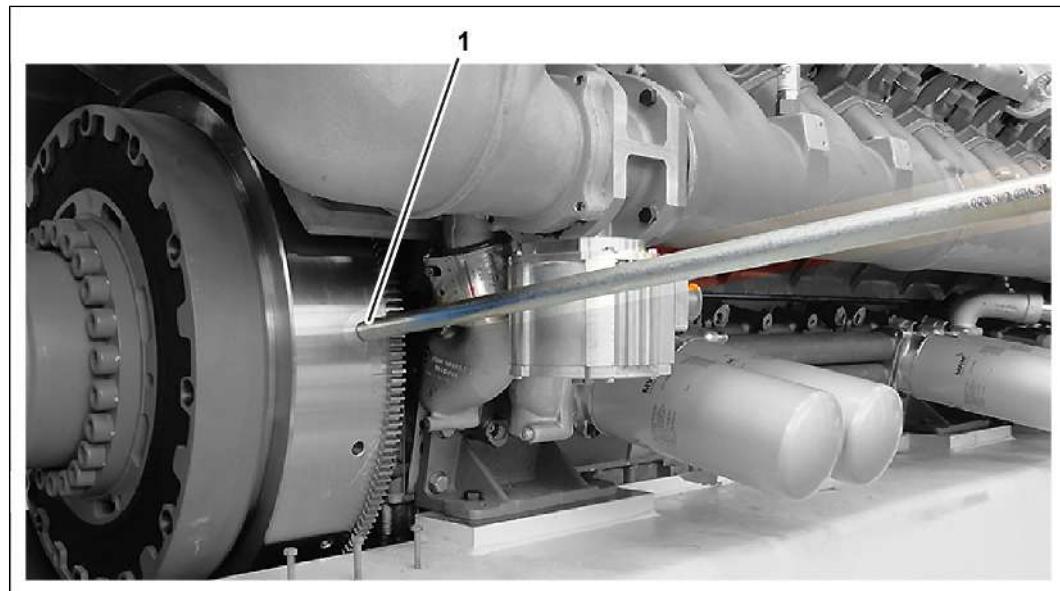


532872843: Variant 2 for mounting the engine turning gear (1)



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).

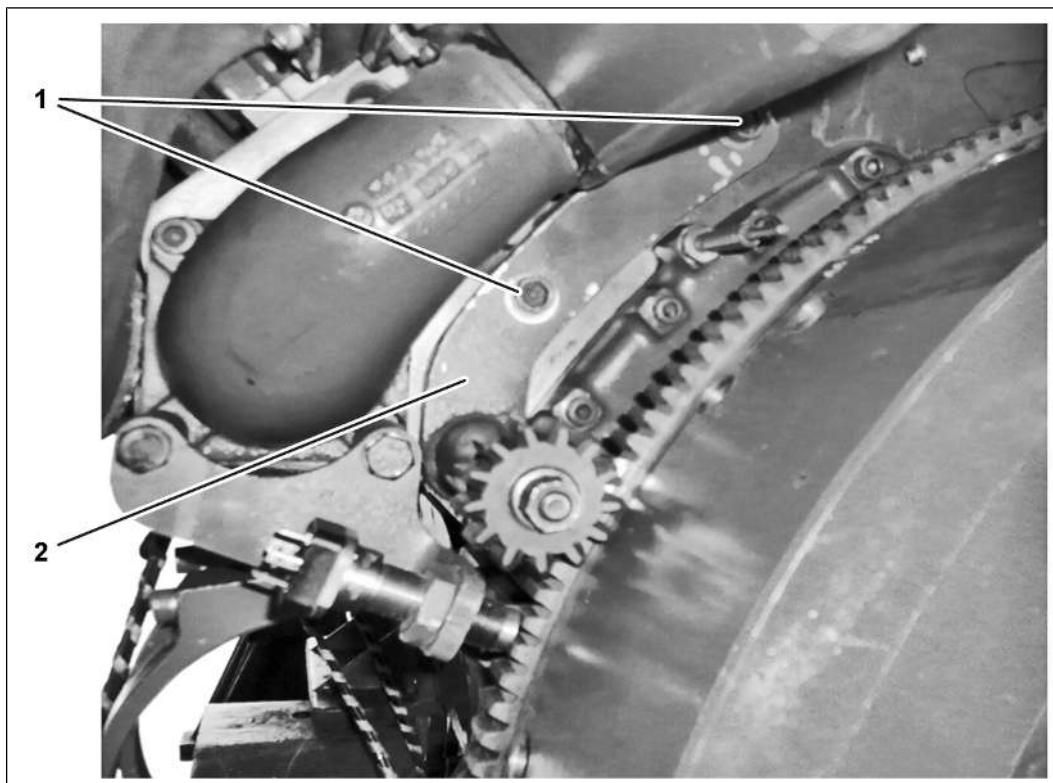
To turn it with the engine turning rod, the terminal box must be loosened and moved in the slotted holes.

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](#) [▶ 419]
- ✓ The protective cover is dismantled from the flywheel, see OL-MRA10 / 52-90-12 [Dismantling the protective cover](#) [▶ 522]



532892939

1. Attach engine turning gear (2).
2. Tighten screws (1).

Working with the engine turning gear

Valid for:

CG170, CG170 (K), CG170B



Tools:

- Special tool
 - Engine turning gear 1244 1150 [▶ 188]

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.

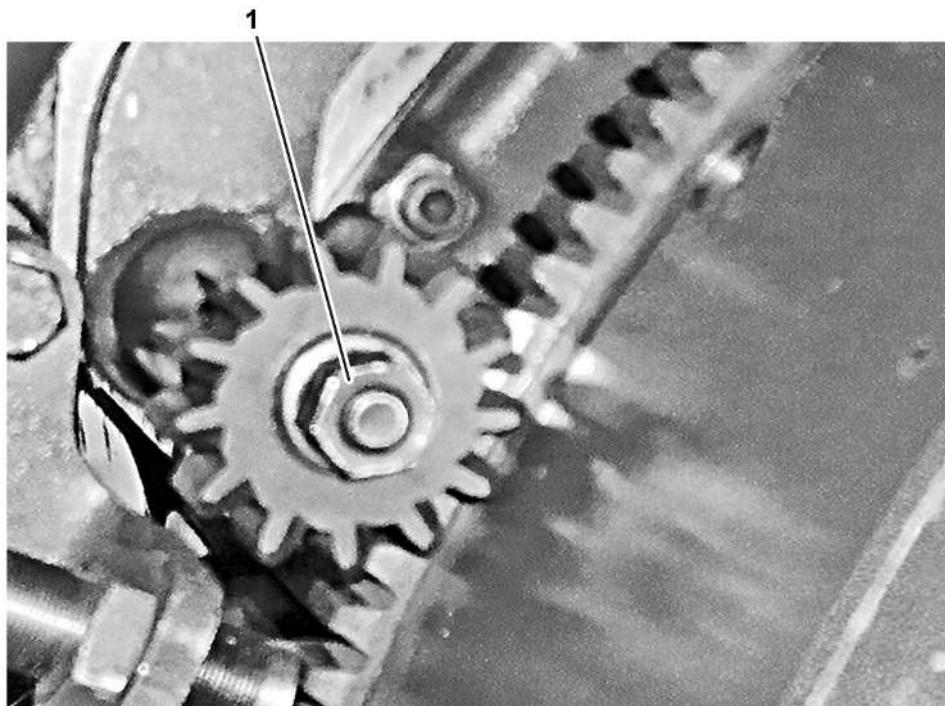
- Only turn the crankshaft in the direction of rotation of the engine.
- Remove all spark plugs before turning.

**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:

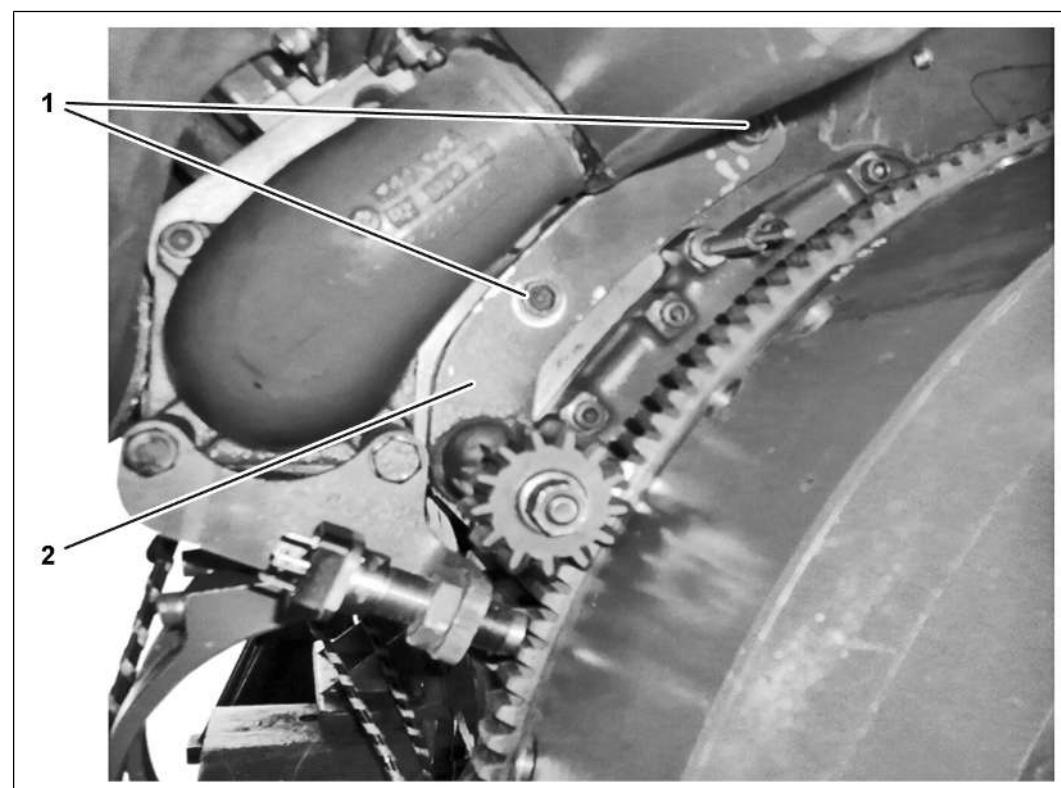
CG170, CG170 (K), CG170B



Tools:

- Standard tools
- Special tool
 - [Engine turning gear 1244 1150 \[▶ 188\]](#)

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 \[▶ 527\]](#)
 - ⇒ Install all spark plugs, see OL-MRA10 / 26-10-10 [Installing the spark plug \[▶ 422\]](#)

Visually inspecting the coupling

Valid for:

CG170B



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

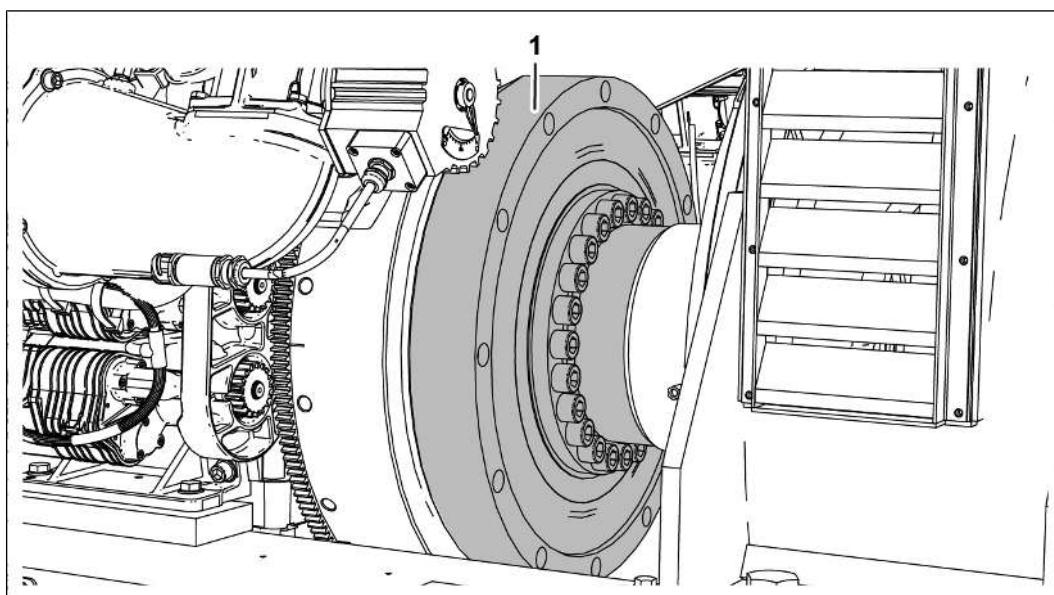
[Operating manual - Maintenance information - Genset add-on parts - Coupling](#)

All components must be inspected visually.

- Replace worn or damaged components.
- Contact Cat dealer if necessary.

Visually inspecting the coupling:

- ✓ Protective cover dismantled from flywheel, see [OL-MRA10 / 52-90-12 Dismantling the protective cover \[▶ 522\]](#)



535457035

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 Cat dealer.
 4. Replace worn and damaged components. For assistance, contact Cat dealer.
- ⇒ Mount protective cover, see OL-MRA10 / 52-90-12 **Mounting the protective cover**
[▶ 527]

Dismantling and mounting the protective cover (flywheel)

Dismantling the protective cover

Valid for:

CG170B



Tools:

- Standard tools

General information

Do not individually replace the captive screws.

- If a captive screw is damaged, the complete component, including the captive screws, must be replaced.

CAUTION



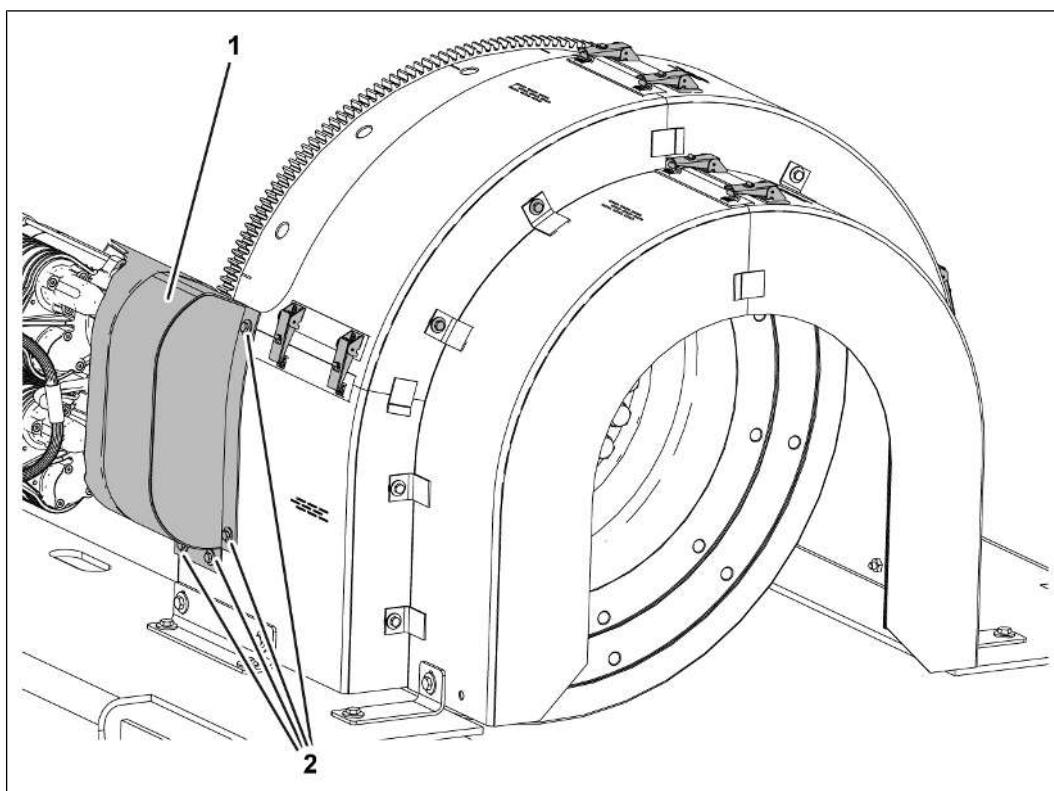
Injury when touching sharp edges

This can lead to minor or severe injuries.

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

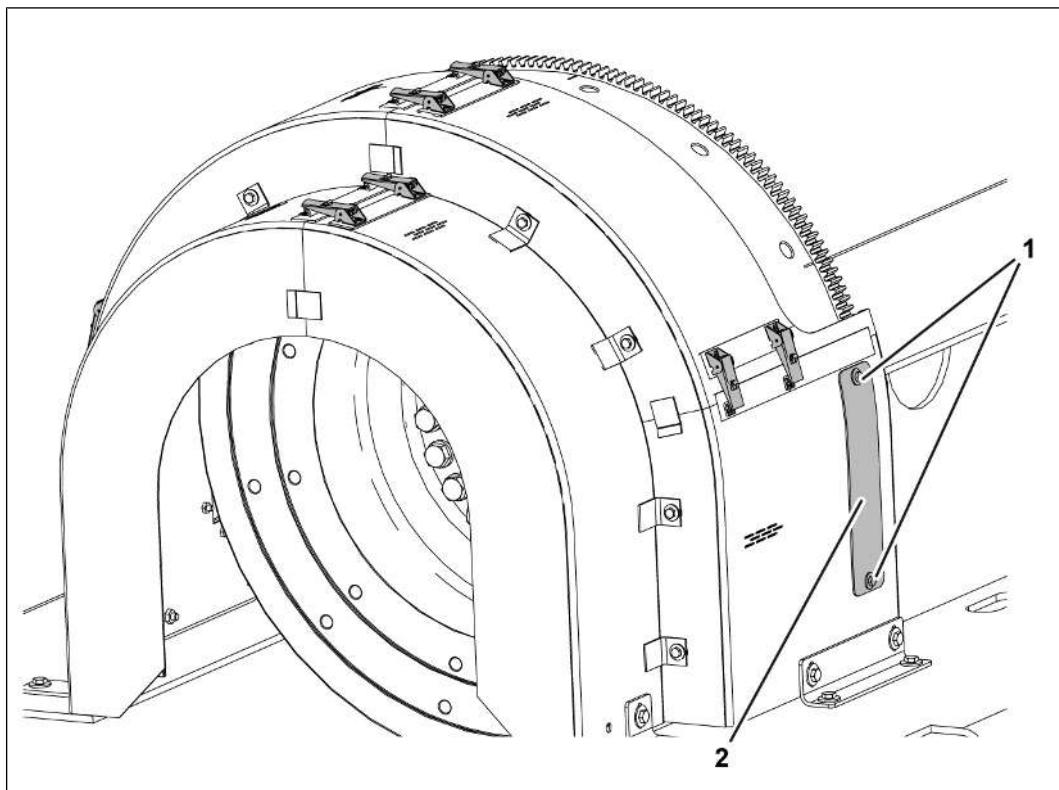
Dismantling the protective cover:

- ✓ Decommission the genset, see Decommissioning/Genset [Stopping the genset \[▶ 154\]](#)



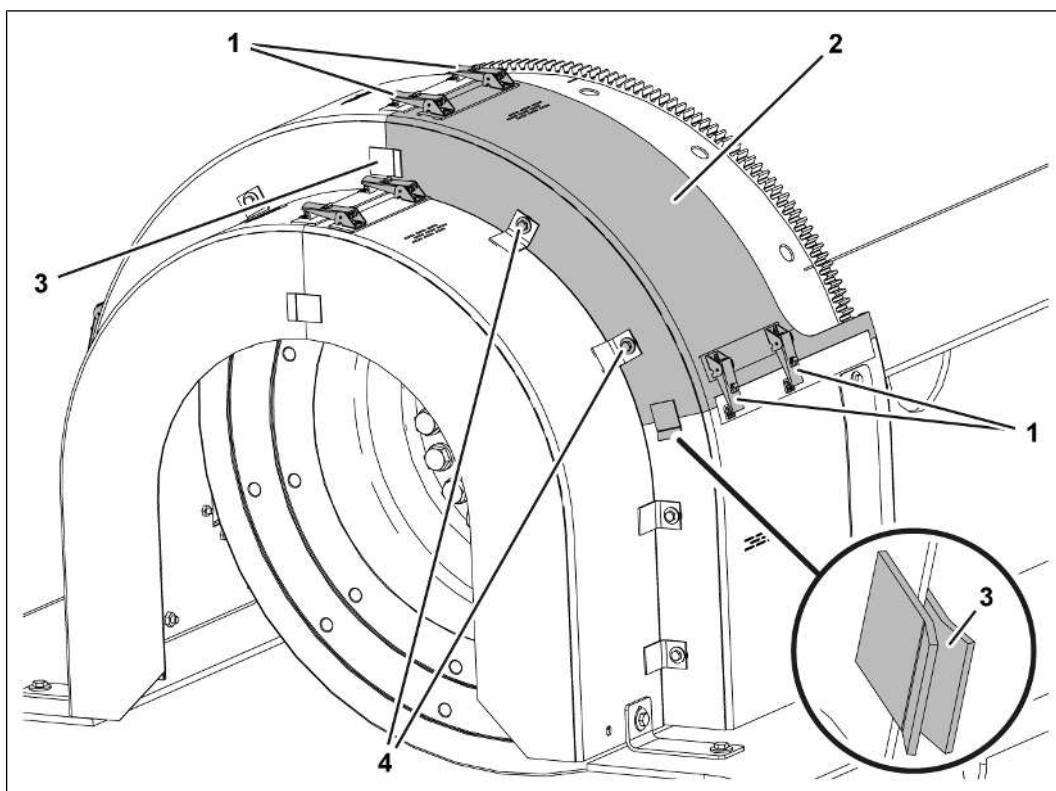
535581451

1. Dismantle starter pinion guard cover (1).
 - Unscrew screw connections (2).
 - Remove starter pinion guard cover.



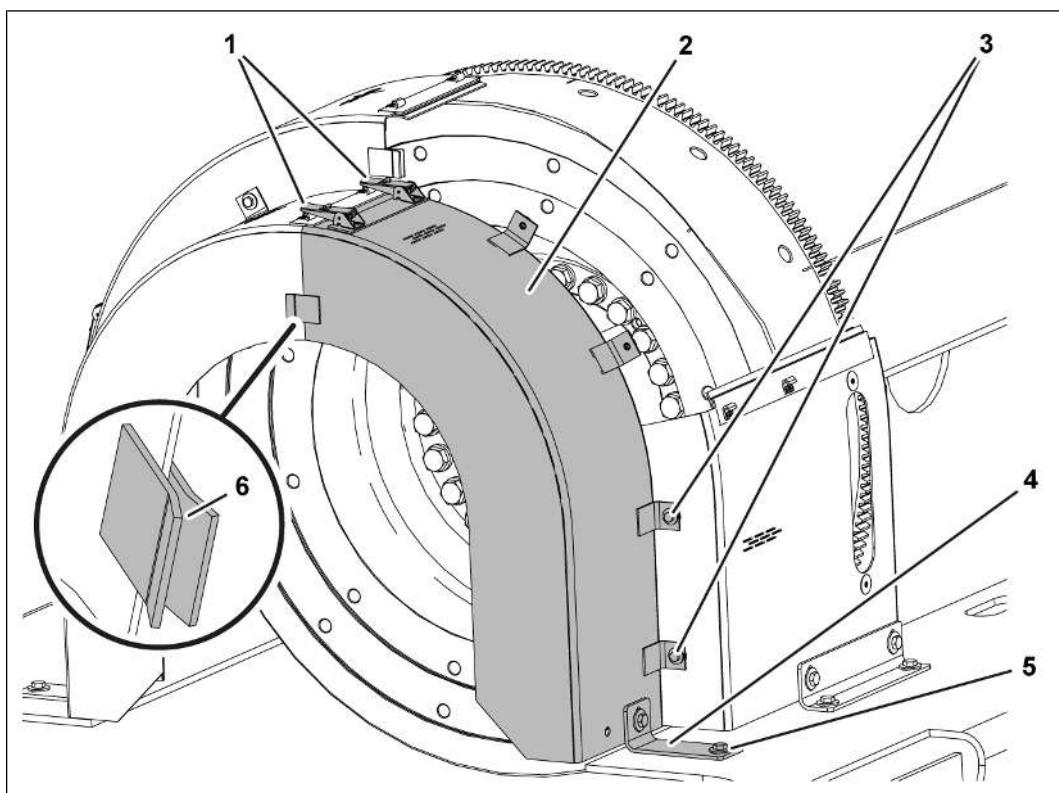
535583371

2. Dismantle engine turning rod cover (2).
 - Unscrew screw connections (1).
 - Remove the engine turning rod cover.



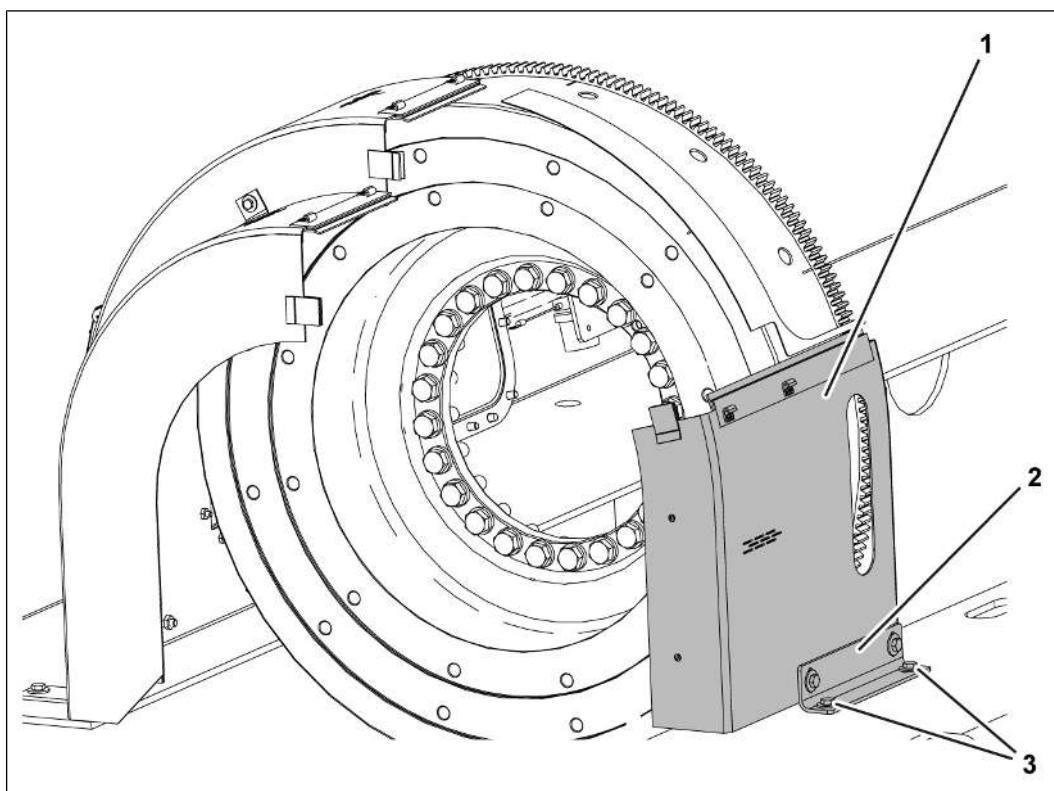
535589131

3. Dismantle the upper flywheel guard cover (2).
 - Open the 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.



535587211

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.



535585291

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:

CG170B



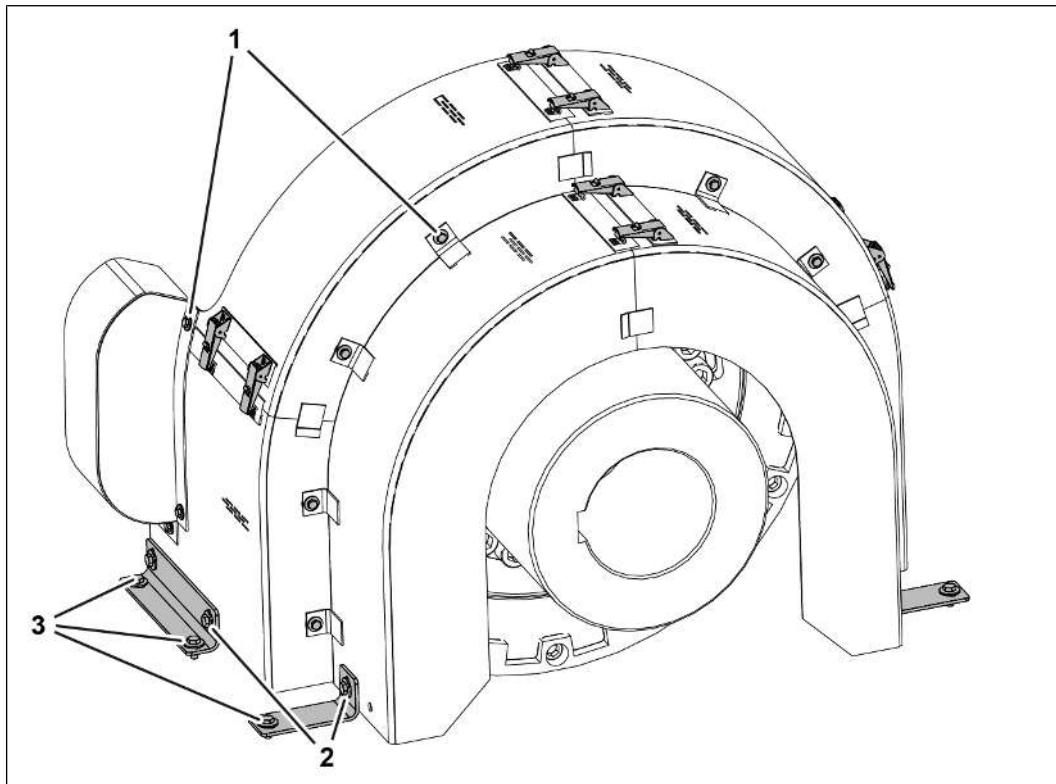
Tools:

- Standard tools
- Special tool
 - [Torque wrench 1203 0350 \[▶ 186\]](#)



Auxiliary media:

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

Technical data


535579531

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 replace the captive screws.

- If a captive screw is damaged, the complete component, including the captive screws, must be replaced.

**CAUTION**

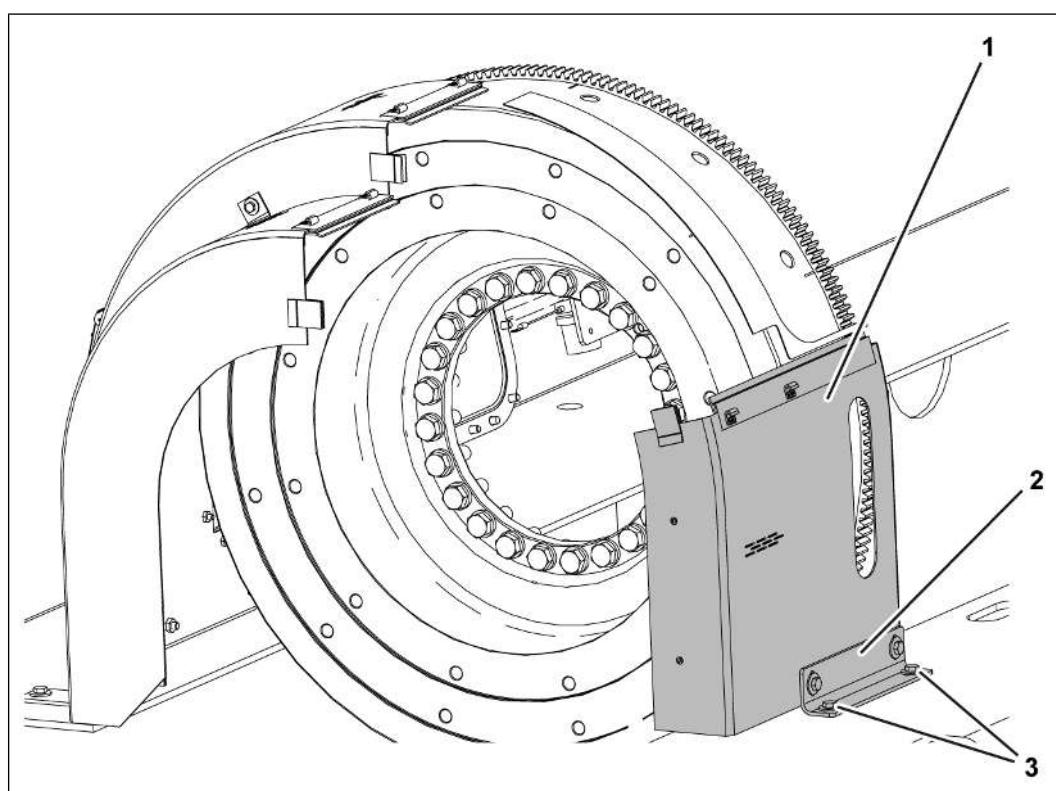
Injury when touching sharp edges

This can lead to minor or severe injuries.

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

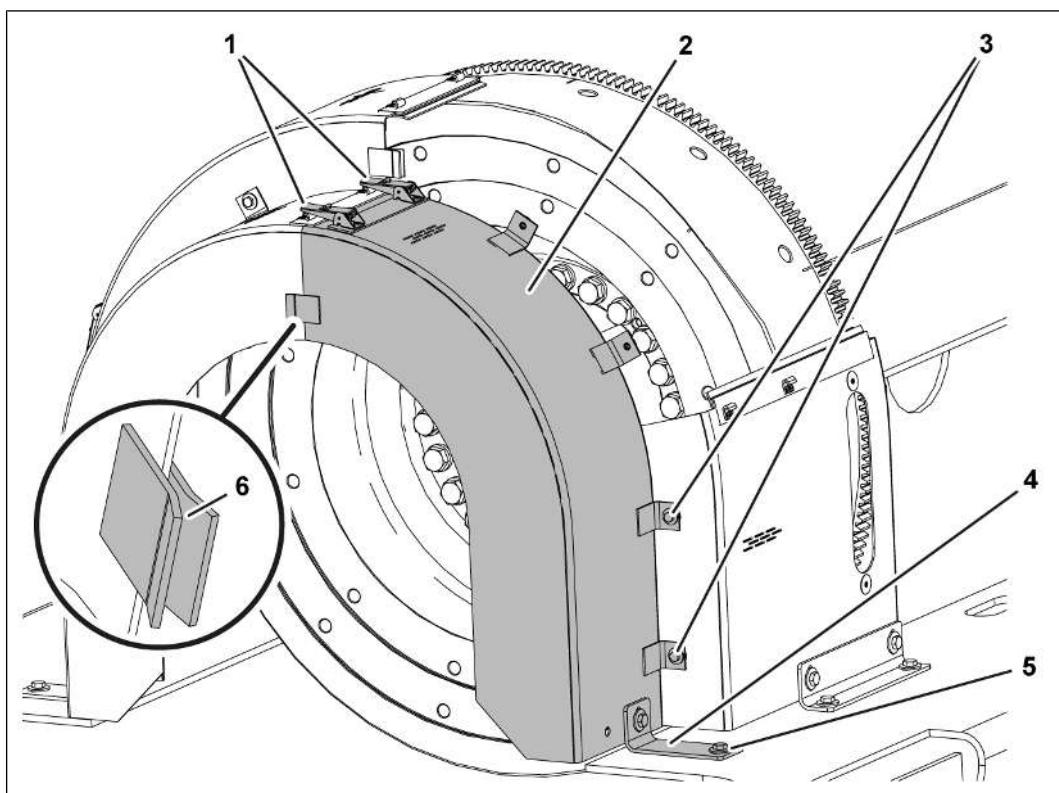
Mounting the protective cover:

1. Clean and visually inspect all components.



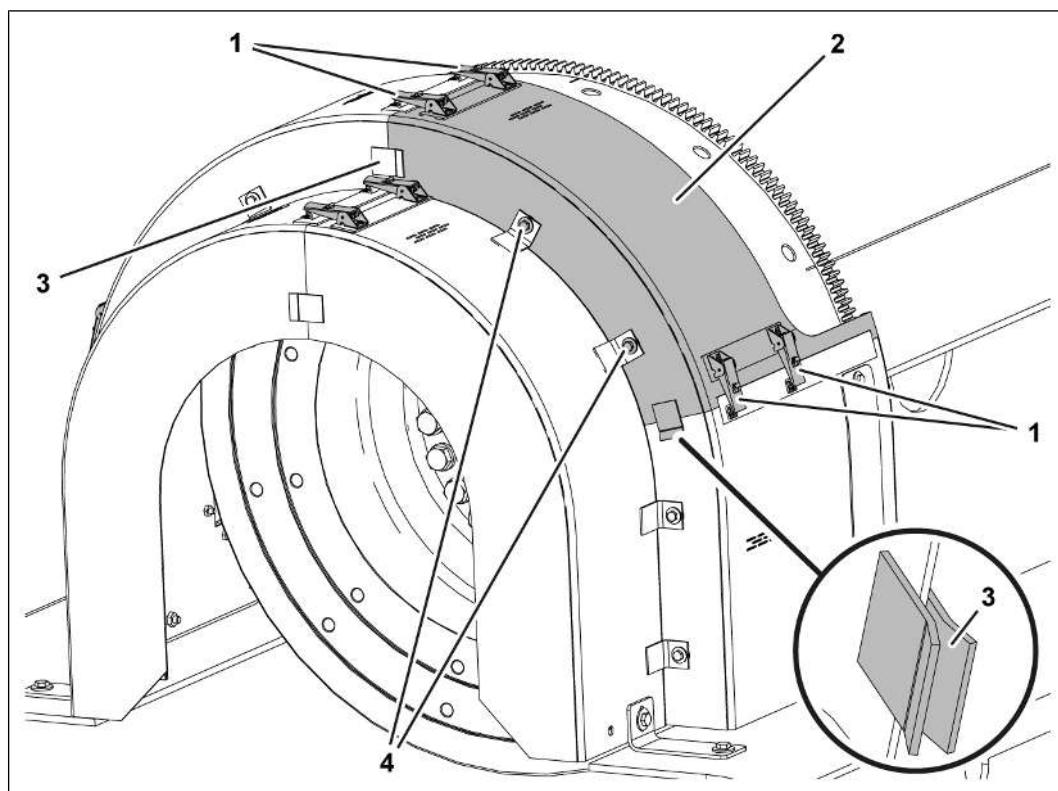
535585291

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.



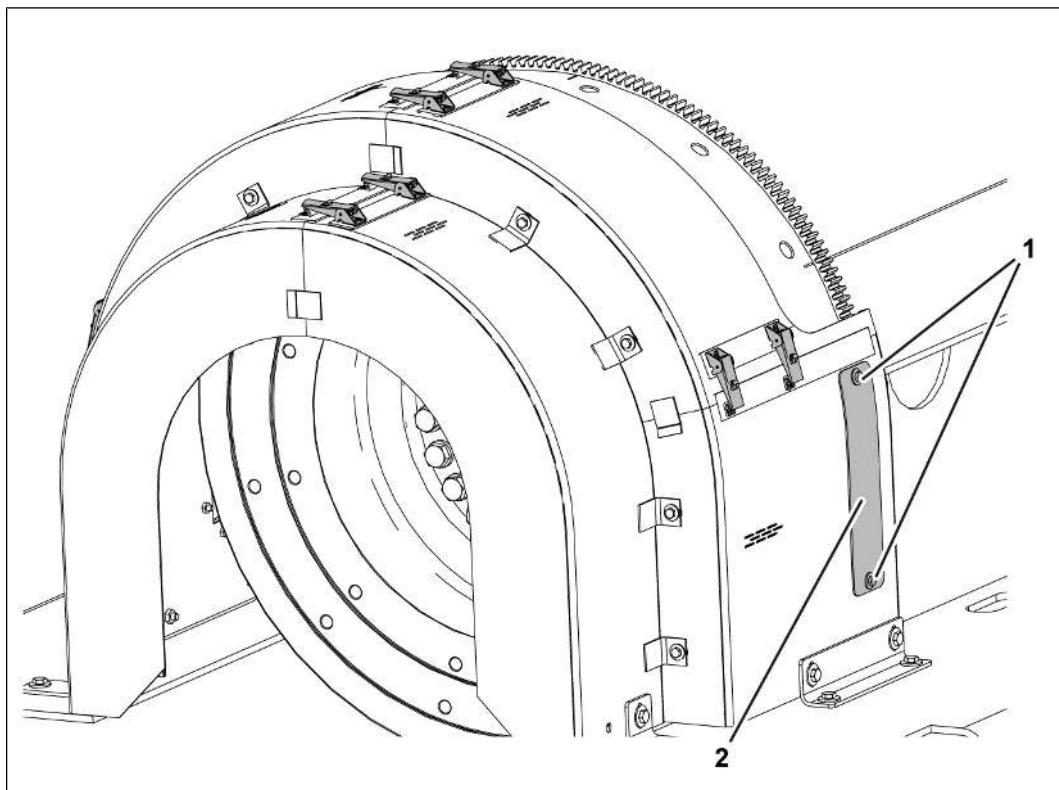
535587211

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.



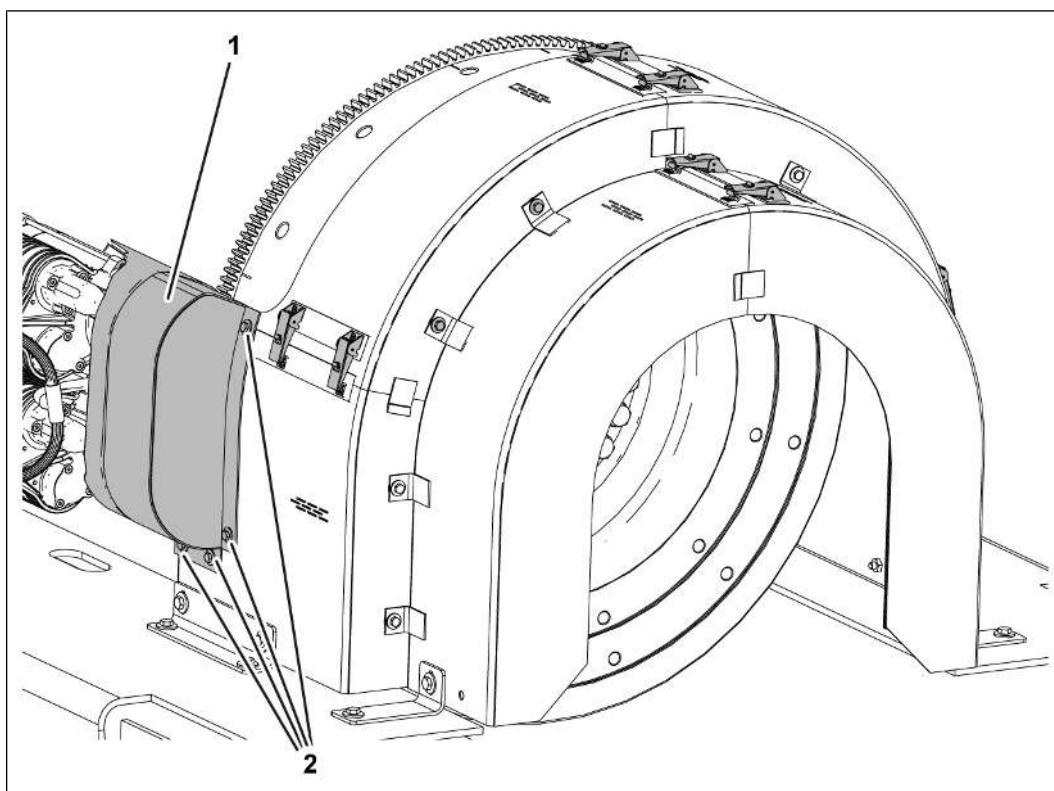
535589131

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.



535583371

5. Mount the engine turning rod cover (2).
 - Attach the engine turning rod cover.
 - Tighten the screw connections (1).



535581451

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 \[▶ 117\]](#)

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:

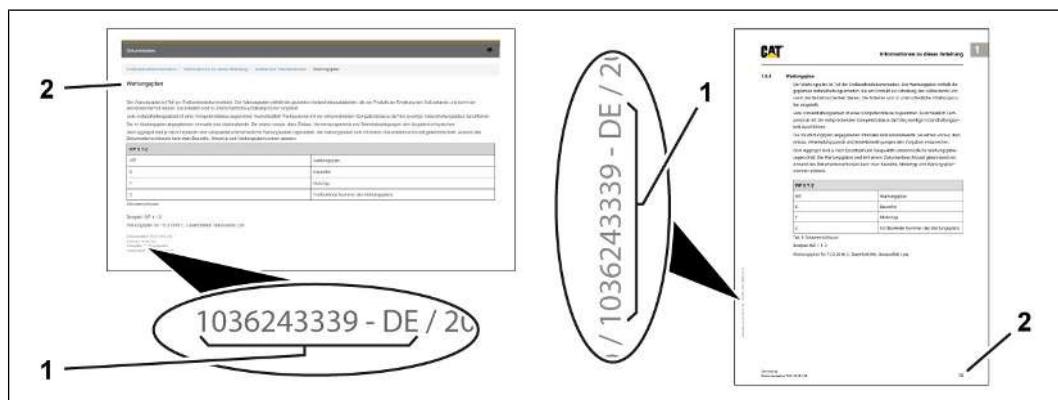
1. Scrap metals
2. Recycle plastic elements
3. Sort the remaining components as per the material properties and dispose of them properly

14 Feedback on documentation

Do you have any praise, criticism or suggestions for improvement for this document?

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Describe your request as precisely as possible. So that we can categorize your feedback, please also provide the following information:



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- Document number and language (1)
- 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

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

TPEM

TPEM-System: Steuerungssystem für jeweils ein Aggregat und einige dazugehörige Hilfssysteme in einer Energieversorgungsanlage.

TPEM I/O

TPEM I/O Controller

TR

Technisches Rundschreiben