Operation and Maintenance Manual

Translation of the original instructions

Diesel engine

KD27V12

From serial number 2016 16 0001

KOHLER®

EN
33521029401_4_1
08-2018

Preface

Only for the United States of America:

⚠ WARNING:

This product can expose you to chemicals, including carbon monoxide and benzene, which are known to the State of California to cause cancer and birth defects or other reproductive harm.

For more information go to www.p65warnings.ca.gov/.

⚠ WARNING:

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.

- If in an enclosed area, vent the exhaust to the outside.

- Do not modify or tamper with the exhaust system.

- Do not idle the engine except as necessary.

For more information go to www.p65warnings.ca.gov/diesel.

This Operating and Maintenance Manual has been written for the **operator** and **maintenance personnel** of the Diesel engine.

It contains descriptions of the:
– Technical data
– Safety regulations
– Handling and operation
– Maintenance

Anyone involved in working with or on the Diesel engine must read and follow the instructions in the Operating and Maintenance Manual carefully both before the first commissioning and at regular intervals.

Work with the diesel engine includes:
– **Handling**
– **Servicing**, including maintenance, inspection.

The Operating Manual facilitates the operator's familiarization with the diesel engine and prevents faults through incorrect operation.

Kohler Co. will not allow any warranty claims that arise due to incorrect operation, insufficient maintenance, use of unapproved operating fluids or non-compliance with safety regulations.

Kohler Co. will annul any obligations entered into by Kohler Co. and/or their dealers such as warranty assurances, service agreements etc. without prior notice if spare parts other than original Kohler parts or parts purchased from Kohler Co. are used for maintenance and repairs.

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In extreme conditions, more frequent maintenance than scheduled in the inspection plan can be required.

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List of changes

Version	from serial number	Comments	Date
33521029401_1_1	2016 16 0001	First version	December 2016
33521029401_2_1	2016 16 0001	Various changes	April 2017
33521029401_3_1	2016 16 0001	Change of maintenance schedule	August 2017
33521029401_4_1	2016 16 0001	Various changes	August 2018

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Service Assistance

Please contact your nearest Kohler Power Systems distributor or dealer for professional advice on the generator set power requirements and conscientious service.

For Kohler generating sets:

- Visit the web site of Kohler Co. at KOHLERPower.com.
- Pay attention to the labels and decals on your Kohler product or review the appropriate literature or documents included with the product.
- In the USA and Canada, call toll-free 1-800-544-2444.
- Outside the USA and Canada, call the nearest regional office.

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North Asia Regional Office
Tokyo, Japan
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Fax: (813) 3440-2727

Tab. 1

To order special tools, please refer to the cross reference list in the annex.

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For KOHLER-SDMO power generating units:

- Visit the web site of KOHLER-SDMO at www.kohlersdmo.com.
- Pay attention to the labels and stickers on your KOHLER-SDMO product or check the corresponding literature or documents included with the product's scope of delivery.
- Call the nearest regional office.

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FAX: +33 (0) 2 98 41 13 57

MID-WEST

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EGYPT

SDMO KAIRO

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KENYA

SDMO NAIROBI

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SDMO MOSCOW

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TOGO

SDMO WEST AFRICA

TEL.: +228 22 22 65 65

TURKEY

SDMO ISTANBUL

TEL.: +90 53 07 35 09 10

To order special tools, please refer to the cross reference list in the annex.

Tab. 2

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1 Product description

1.1 Technical description

1.1.1 Design overview

This section contains an overview of the diesel engine with the names of the parts shown.

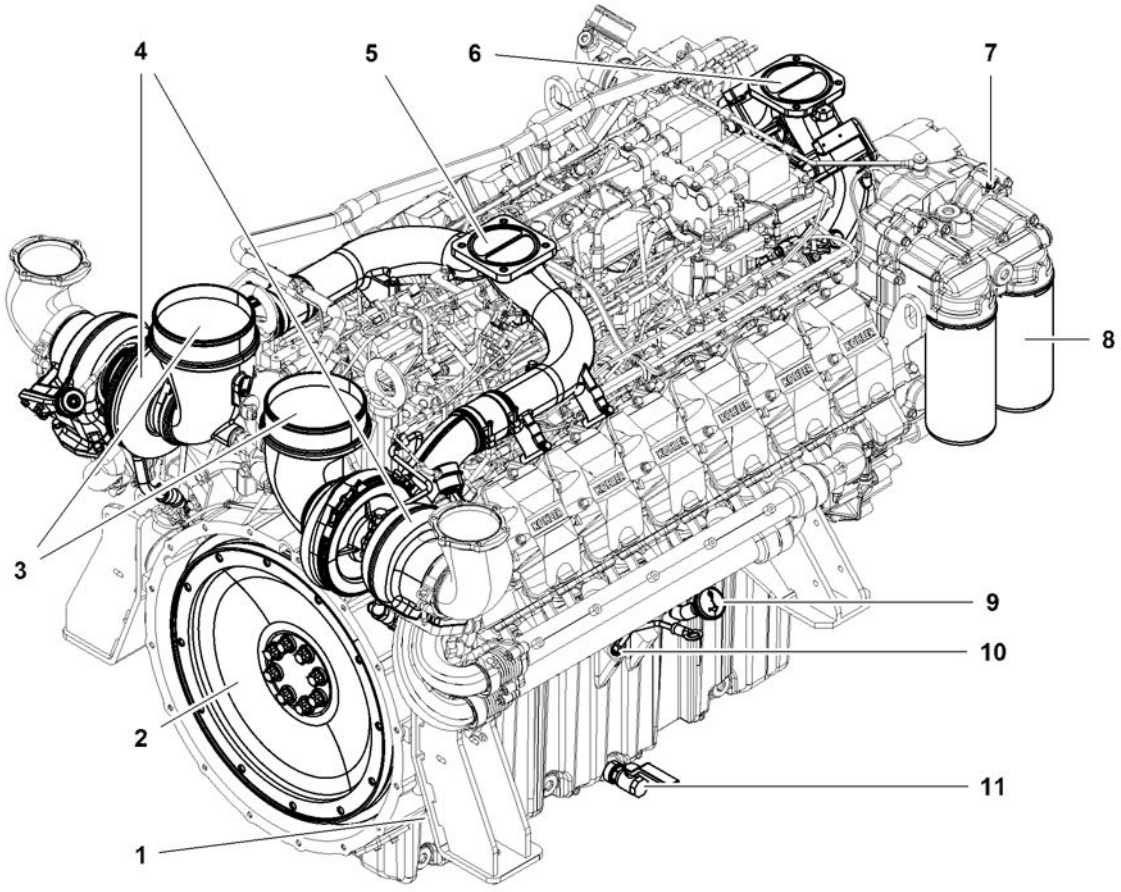

Fig. 1: Overview of flywheel side

1	Fastening point for turning device (behind the fastening piece)	**5**	Air discharge to charge air cooler	**9**	Oil filler neck
2	Flywheel	**6**	Air intake from charge air cooler	**10**	Oil dipstick
3	Combustion air intake	**7**	Oil module	**11**	Oil drain shut-off valve
4	Turbocharger	**8**	Oil filter		

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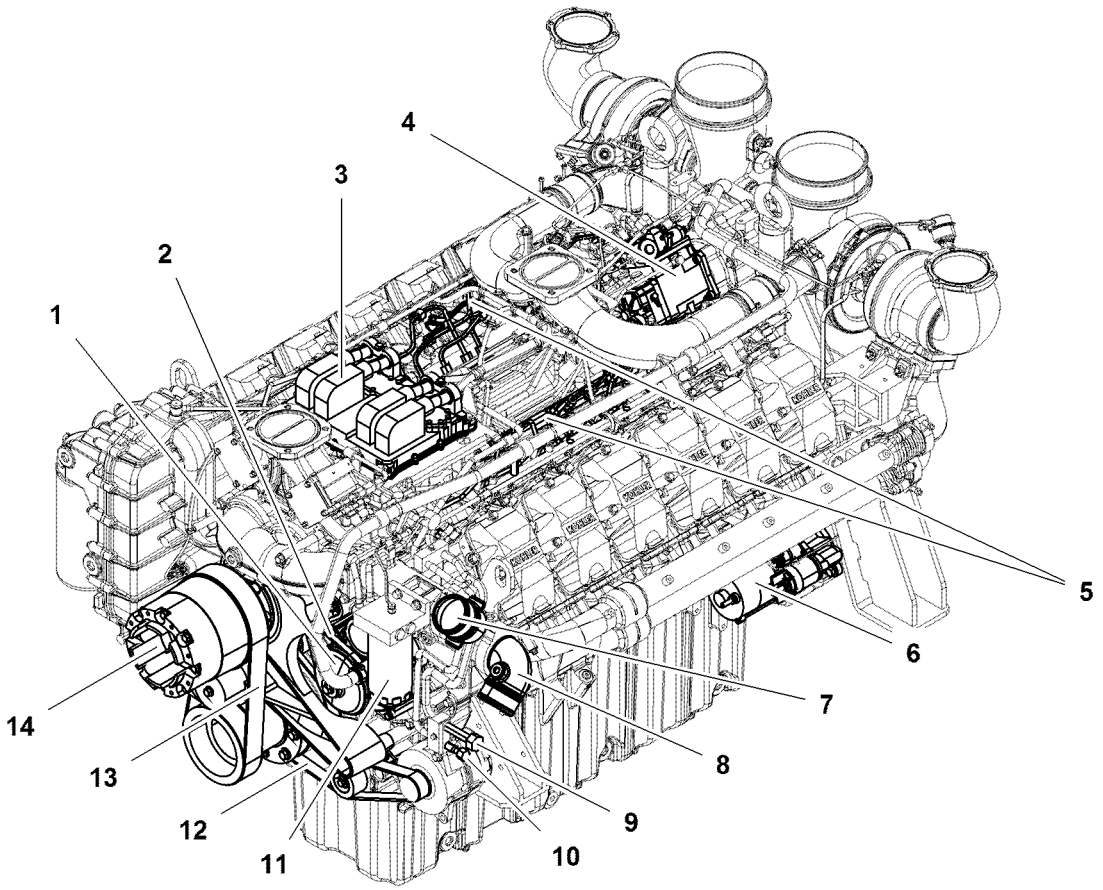

Fig. 2: Overview of power unit support side

1 Crankcase breather
2 Crankcase breather belt
3 Engine control unit
4 High pressure pump
5 High pressure rail
6 Starter
7 Coolant outlet
8 Coolant inlet
9 Fuel pump feed
10 Fuel pump return
11 Main fuel filter
12 Belt for battery charging alternator and water pump
13 V-ribbed fan belt
14 Fan drive

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1.1.2 Overview of sensors

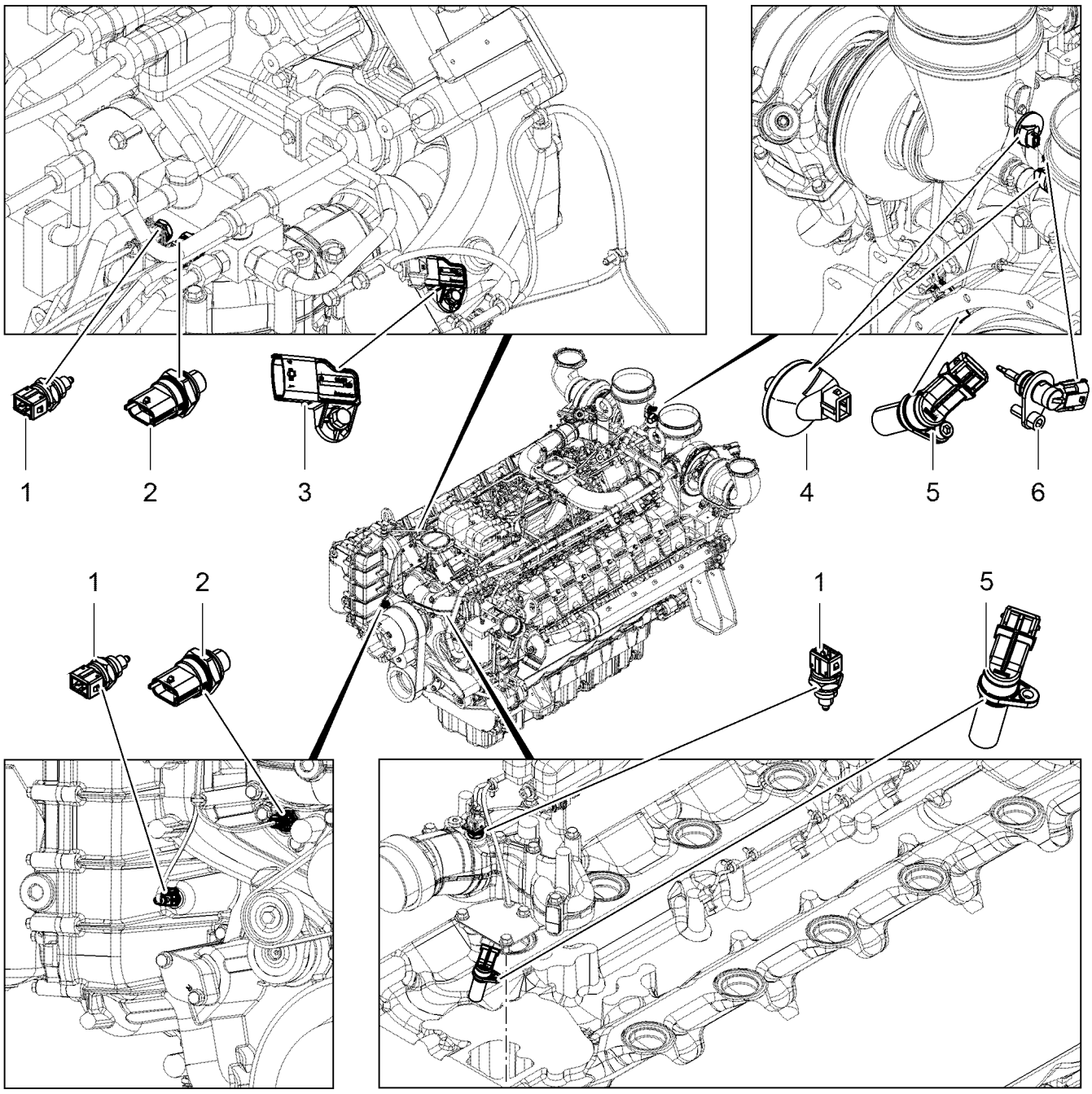

Fig. 3: Overview of sensors

1 Temperature sensor
2 Pressure sensor
3 Temperature sensor
4 Service switch
5 Rotational speed sensor
6 Temperature sensor

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1.1.3 Explanation of the type designation

Type description

K	D	27	V	12	-	5	A	F	C	Engine type designation
K										Manufacturer
	D									Diesel engine
		27								Total displacement: 27 l
			V							V-engine
				12						No. of cylinders
						5				Frequency: 5=50 Hz; 6=60 Hz
							A			Power level: A where A = the lowest power and E = the highest power
								F		Optimization: F = Fuel Optimized; E = Emissions Optimized
									C	Application: C = COP; P = Prime; S = Stand by; D = Data center

Tab. 3

Diesel engine company nameplate

The Diesel engine company nameplate is mounted on the oil sump. A second company nameplate is attached to the device.

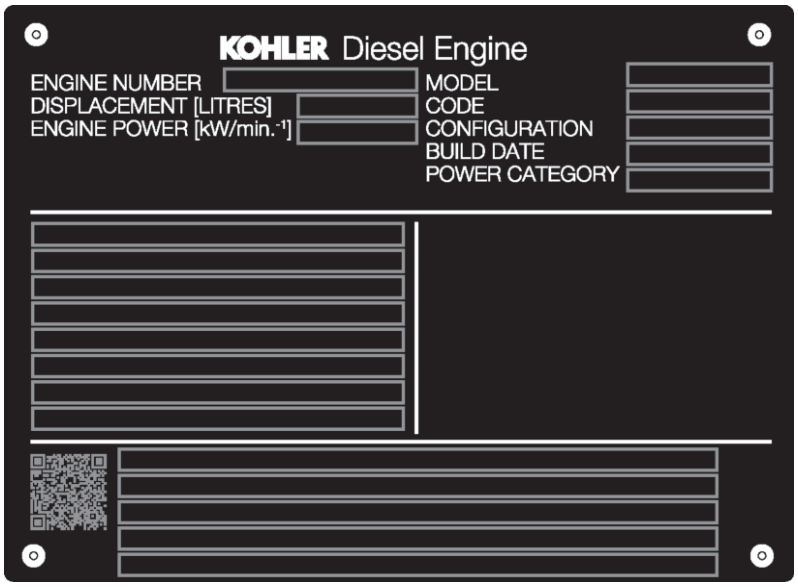

Fig. 4: Company nameplate

Engine serial number

The engine serial number is stamped into the emission control information label and the crankcase.

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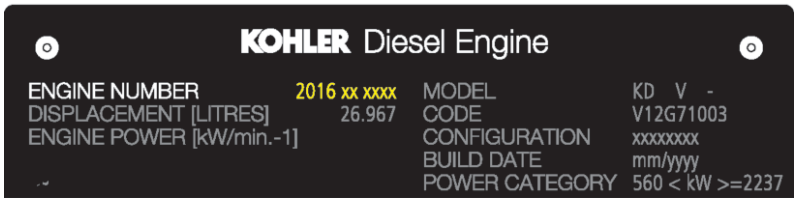

Fig. 5: Engine serial number

2016	16	0001	Engine serial number
2016			Year of manufacture
	16		Engine type code: 16 = KD27V12
		0001	Consecutive production number

Tab. 4

Engine control unit nameplate

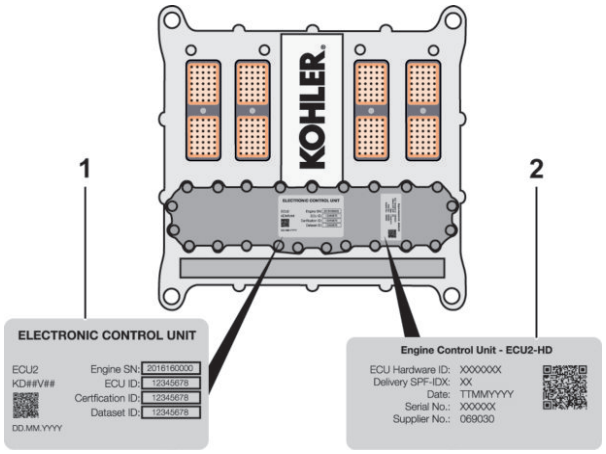

Fig. 6: Position of the engine control unit nameplate

1 Software nameplate

2 Hardware nameplate

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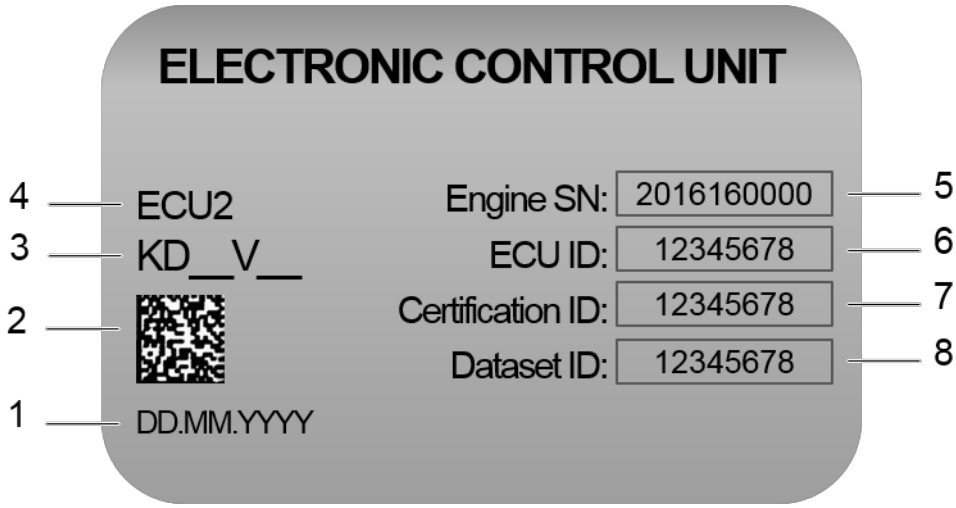

Fig. 7: Example of an engine control unit nameplate

1	Delivery date	**5**	Engine serial number
2	2D code bar	**6**	Control unit ID number
3	Engine type	**7**	ID number certification
4	Control unit description	**8**	ID number parameter set

	Note	The information on the engine control unit nameplate corresponds to the delivery status. Depending on software updates in the field, this information may no longer be up-to-date. The real information can be viewed in the device display or read out using the KODIA diagnosis and service tool.

Tab. 5

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1.2 Technical data

1.2.1 Diesel engine

Description	Unit	Value
Design		V-Diesel engine
No. of cylinders		12
Firing order according to DIN 73021		1–12–2–11–3–10–6–7–5–8–4–9
Firing order according to ISO 1204		B6–A1–B5–A2–B4–A3–B1–A6–B2–A5–B3–A4
Bore	mm in	135 5.31
Stroke	mm in	157 6.18
Displacement	l gal	26.967 7.1239
Compression ratio		15 :1
Direction of rotation of the Diesel engine (seen from flywheel)		Counterclockwise
Power specification as per		ISO 3046–1
Rated power		See emission control information label
Rated speed		See emission control information label
Emission limit stage		See engine emissions nameplate

1.2.2 Cylinder head

Description	Unit	Value
Inlet valve clearance, cold	mm in	0.5 0.019
Outlet valve clearance, cold	mm in	0.6 0.023

1.2.3 Coolant thermostat

Description	Unit	Value
Opening start	°C °F	82 179

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Description	Unit	Value
Completely open	°C °F	92 197

1.2.4 Battery charging alternator

Description	Unit	Value
Voltage	V	28
Current	A	140

1.2.5 Starter

Description	Unit	Value
Voltage	V	24
Output per start system	kW	7.8

1.2.6 Flywheel housing

Description	Unit	Value
Connection		SAE 0

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2 Safety

2.1 Identification of the warnings

	This is a warning sign. It warns you of the risk of possible injury. Follow all of the instructions that accompany this warning sign to avoid any injuries or death.

Tab. 6

This warning sign only appears in conjunction with the signal words:

DANGER
WARNING
CAUTION

	DANGER	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING	indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION	indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
	NOTICE	indicates a hazardous situation which, if not avoided, could result in material damages.

Tab. 7

Additional markings

	Information	indicates useful information and tips.

Tab. 8

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2.2 Target audience

Level 1 — Basic Maintenance	Level 2 — Advanced Maintenance
Daily checks, inspection and maintenance tasks which can be carried out in intervals between operation without dismantling parts from engine. For example: oil and fuel refilling	Maintenance tasks involving partial disassembly of the engine on site (mid-life service). For example: change of pump, injectors, heads...
By customer or nearest authorized Kohler service representative.	By customer or nearest authorized Kohler service representative.

Tab. 9: Definition of service levels

Information
The machine's manufacturer is responsible for:

- ▶ Checking the personnel's know-how and skills
- ▶ Defining the necessary additional, refresher and further qualifications
- ▶ Defining the responsibilities and authorizations
- ▶ Applying ILO – "C138 – Minimum Age Convention, 1973" with a minimum age for the work permit of 14 years
- ▶ Providing the necessary tools and spare parts

2.2.1 International standard classification of occupations

In accordance with the International Standard Classification of Occupations (ISCO-08) of the International Labor Office (ILO), the following unit groups are listed as references to define the target audiences, occupations and joint tasks.

2.2.2 Occupational references

The occupations listed perform the following work in accordance with the "General safety instructions" chapter:
– the main tasks described in this manual or these instructions
– the tasks identified as requirements to prepare the main tasks

For the SL1 maintenance of power generation engines:

Maintenance Technician

In relation to ILO – Power Plant or Industrial Machinery Mechanics – unit group 7233 / ISCED-97 level 2)

The work on engines, equipment as well as mechanical and electronic equipment includes:
– Operating the machine and facilities
– Performance of scheduled maintenance work
– Assembly, installation, assessment, adjustment, testing and maintenance
– Location of defects
– Recording the repair and maintenance work performed

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For the SL2 maintenance of power generation engines:

Technician

In relation to ILO – Power Plant or Industrial Machinery Mechanics – unit group 7233 / ISCED-97 on at least one level, from 3 to 4)

The work on engines, equipment as well as mechanical and electronic equipment includes:
– Operating the machine and facilities
– Performance of scheduled maintenance work
– Assembly, installation, assessment, adjustment, testing and maintenance
– Location of defects
– Dismantling and reassembly of the machine as well as the mechanical and electronic equipment
– Ensuring compliance with standards and specifications
– Recording the repair and maintenance work performed

2.2.3 Unauthorized personnel

All other persons, including operators, supervisors and trainees, are classified as "unauthorized personnel" for maintenance work.

They are not allowed to service the engine or access the engine compartment or engine cover.

For the operation of power generation engines:

Operator

In relation to ILO – Power Production Plant Operators – unit group 3131 / ISCED-97 on at least one level, from 2 to 4)

Power production plant operators operate, monitor and maintain switchboards and related equipment in electrical control centers which control the production and distribution of electrical or other power in transmission networks. The work includes:
– Operating, monitoring and inspecting various types of energy-generating power plants
– Operating and controlling power-generating systems and equipment
– Controlling start-up and shut-down of power plant equipment
– Controlling switching operations, regulating water levels
– Communicating with systems operators to regulate and coordinate transmission loads, frequency and line voltages
– Taking readings from charts, meters and gages at established intervals, troubleshooting and performing corrective action as necessary
– Completing and maintaining station records, logs and reports, and communicating with other plant personnel to assess the equipment operating status
– Cleaning and maintaining equipment such as the alternator to charge the battery, pumps or compressors in order to prevent defects or damage to the equipment

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2.3 Intended use

– Only use the diesel engine for its intended purpose.
– Observe the following conditions of the manufacturer:
  • Operating conditions
  • Servicing conditions
  • Maintenance conditions
– Make sure that the following work is only carried out by personnel in accordance with the target audience definition:
  • Using the diesel engine.
  • Servicing the diesel engine.
  • Maintaining the diesel engine.

Please refer to the “Target audience” chapter for additional information.

– Install all of the guards and protective devices and check their functions before commissioning.
– Pay attention to the safety and operating instructions.
– Only operate the engine if it is in perfect working order.
– Only operate the engine in the speed range specified by the manufacturer.
– Bolt the engine to the machine or the corresponding place of use by the fitted engine mounts and the corresponding tensioning instructions.
– If engine mounts are used that have not been fitted by the manufacturer these have to be approved by the manufacturer.
– The engine may only be operated in areas that cannot be accessed by the general public, in other words the engine may only be operated in conjunction with an enclosure or engine compartment cover.

2.4 Foreseeable misuse

The operating and maintenance manual has been drawn up in accordance with applicable standards and regulations in accordance with state-of-the-art technology.

Kohler Co. assumes no liability for:
– Failure to observe these instructions
– Incorrect use
– The employment of personnel who do not satisfy the target audience requirements.
– Alterations and conversions of the diesel engine that have been carried out without the consent of Kohler Co.
– Operating and auxiliary materials that have not been approved by Kohler Co.
– The use of non-Kohler spare parts that have not been officially approved by Kohler Co., including the resulting consequential damages.
– Circumvention of and non-compliance with the safety regulations
– Failure to observe international and national regulations on occupational health and safety
– Failure to observe international and national regulations on environmental protection
– Unauthorized modifications to the diesel engine
– Manipulations to the injection and control system

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2.5 General safety instructions

- Requirements to be met by the target audiences for work. See the “Target audience” chapter.
- To guarantee assistance after an accident: Make sure a second person is in attendance or that the emergency situation is detected and help provided.
- Before any assembly work, make sure that the personnel are familiar with the operating and maintenance manual.
- Only allow personnel undergoing training to work on the diesel engine under the constant supervision of an experienced person
- Check that personnel are conscious of safety and the hazards involved in their work on the following conditions:
  - Observe accident prevention regulations.
  - Observe generally accepted occupational health and safety regulations.
  - Observe the operating and maintenance manual.
- Ensure that the personnel wear safe working clothes.
- Make sure that the following are not worn:
  - Rings
  - Wristwatches
  - Ties
  - Scarves
  - Open jackets
  - Loose clothing
- Make sure that the following equipment is available for assembly and that it is clean, complete and undamaged:
  - Basic tools
  - Necessary devices
  - Necessary special tools
- Replace any damaged tools.
- Keep the workplace clean and tidy.
- Take precautions for any emergency that may occur.
- Keep fire extinguishers and first-aid boxes close by.
- Keep the emergency telephone numbers close by.
- Make sure that the workplace is well lit.
- Only perform assembly work if the diesel engine has been secured.
- Ensure that the diesel engine is not started by unauthorized persons.

2.6 Preventing personal injuries

2.6.1 Bruises

- Do not lift heavy parts by hand.
- Fasten and secure individual parts and larger assemblies carefully with suitable lifting gear during their replacement.
- Use Kohler lifting gear in accordance with its operating manual.
- Observe the regulations on the lifting points.
- Do not use any load handling devices that are damaged or that have an inadequate carrying capacity.
- Make sure that no persons stand or walk under loads.
- If the diesel engine is running, make sure that no objects can come into contact with rotating parts. Objects may be flung back.

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2.6.2 Burns and scalding

The diesel engine is hot at its operating temperature.
– Only work on the diesel engine after it has cooled down.
– Only touch hot parts with suitable thermal protection gloves.

The cooling system is hot and under pressure when the diesel engine is at its operating temperature.
– Only touch hot parts with suitable thermal protection gloves.
– Avoid any contact with parts carrying cooling water.
– Check the cooling water level when the end cover of the expansion tank has cooled down.
– Open the cover carefully to release the excess pressure.

The engine oil is hot when the diesel engine is at its operating temperature.
– Avoid any skin contact with hot oil or parts carrying oil.

2.6.3 Fires and explosions

– Smoking is prohibited in the direct vicinity of the diesel engine.
– Avoid any fires, sparks or open flames when handling fuels and flammable liquids.
– Start the Diesel engine in accordance with the regulations in the operating and maintenance manual and the assembly manual.
– Repair any leaks and replace damaged components.
Fuel and oil that squirts out of leaks can lead to fires.
– Wear safety goggles and gloves when working on batteries.
– Remove any cleaning rags that are soaked with flammable liquids.
– Disconnect the power supply when working on the electrical system.

2.6.4 Poisoning

– Only run the diesel engine in closed rooms if these are sufficiently ventilated.
Open doors and windows if a bigger supply of fresh air is needed.
– Never ingest any operating materials.
– Do not use drinking bottles for storage purposes.

Escaping liquids can penetrate the skin and cause blood poisoning.
– Do not open any pressurized lines or hoses.
– Do not disconnect any pressurized lines or hoses.
– Protect hands, face and body against escaping liquids when looking for leaks in pressurized lines and hoses.

2.6.5 High-pressure injection (liquids at high pressure can squirt out)

When the Diesel engine is running the fuel lines are under a constant fuel pressure of up to 2400 bar. Escaping liquids can penetrate the skin and lead to injuries.

– Only work on the fuel and injection systems when the diesel engine has been switched off.
Wait at least 20 minutes after turning the Diesel engine off until the pressure in the injection system has been released before starting work.
– Check the drop in pressure with the KODIA diagnostic program.
– Use suitable protective equipment during work on the fuel and injection system (e.g. safety gloves, safety goggles, etc.).
– Do not open any pressurized fuel lines or hoses.

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– Do not disconnect any pressurized fuel lines or hoses.
– Protect hands, face and body against escaping liquids when looking for leaks in pressurized lines and hoses.

2.6.6 Electrical energy

– The safety zones around the operational Diesel engine may not be accessed by persons with a heart pacemaker.
– Do not touch any live parts.
– Disconnect the power supply before any work on the electrical system.

2.6.7 Danger due to noise

Permanent hearing impediments are possible at noise levels above 84dB(A).
Sound level up to 110dB(A) possible!

– Keep all sound-absorbing guards on the equipment closed when the engine is running.
– Do not stand near the running engine without hearing protection that is suitable for the noise level.
– Pay attention to the hearing protection measures in accordance with the diesel engine's operating manual.

The operators and unauthorized personnel may not enter the safety zones when the engine is ready for use or running. However, if a technician has to approach an unprotected engine for troubleshooting work he must wear hearing protection suitable for the noise level.

2.7 Personal protective equipment

– Wear protective equipment during direct access to diesel engines.
– Ensure that:
  • The protective equipment is in a good condition.
  • The protective function is guaranteed.

The following protective equipment is necessary to access the diesel engine:

Protective work wear
– Close-fitting, non-tear-resistant protective clothing as protection against injuries and simple chemical substances
Wear protective work gear in the direct vicinity of the engine.

Safety helmet
– Protection against falling or flying objects and against knocks to the head
Wear safety helmet in the direct vicinity of the engine.

Safety shoes
– Protect feet against falling objects and from getting caught in heavy parts.
Additional protection against slipping
Wear safety shoes in the direct vicinity of the engine.

Safety gloves
– Protection against hot elements and chemicals
Wear safety gloves during work with hot parts. (For example: shrink-fitting the crown gear on the flywheel.)

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Wear safety gloves during work with operating materials. (Please refer to the manufacturer's specifications for the operating materials and the safety data sheet for the operating material.)

Hearing protection

– Protection against noise
  Wear hearing protection near running engines.

Safety goggles

– Protection against flying splinters and chemical splashes
  Wear safety goggles when handling operating materials. (Please refer to the manufacturer's specifications for the operating materials and the safety data sheet for the operating material.)
  Wear safety goggles during mechanical operations. (For example when using compressed air)

2.8 Operating areas and maintenance areas

2.8.1 Safety instructions

Trapping hazard and flying mechanical parts hazard when the Diesel engine is ready for use or running.

Risk of severe injury or death.

– Keep away from engines that are ready for use.
– Wear personal protective equipment.
– Technicians may enter the safety zone "A" for measuring purposes unless otherwise indicated by the system manufacturer.

Hot parts when the Diesel engine is ready for use or running.

Risk of burns.

– Keep away from engines that are ready for use.
– Wear personal protective equipment.
– Leave the engine to cool down sufficiently.

Hazardous voltage. May result in severe injury or death.

Risk of burns from electric shock.

– Only those target audiences authorized as per the relevant definitions may enter the safety zones during maintenance.
– Disconnect from the electrical power supply.
– Wear personal protective equipment.

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2.8.2 Operating areas

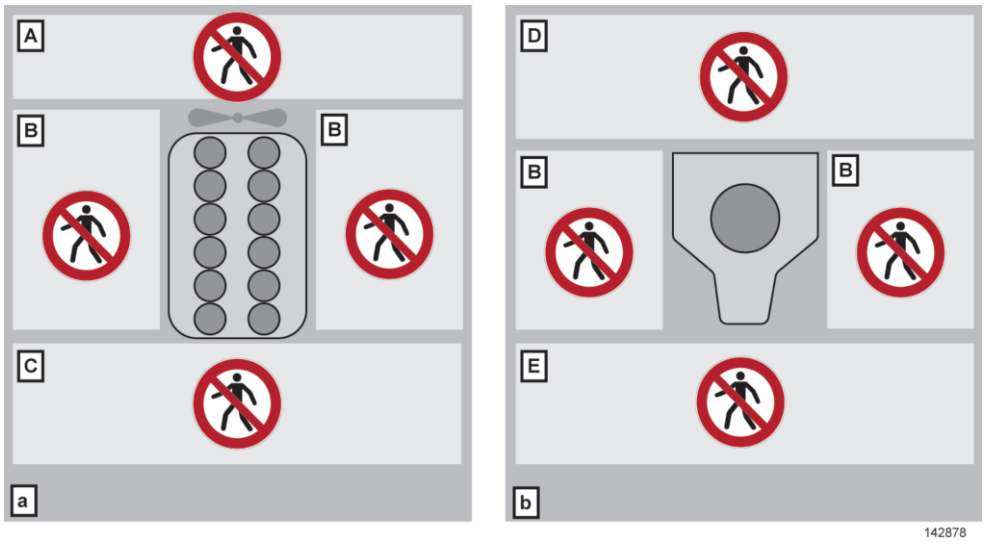

Fig. 20: Safety zones of engines that are ready for use or running

a Horizontal projection (viewed from above)

b Upright projection (viewed from the flywheel side)

Access is prohibited to the following areas:

- Safety zone, unit carrier side **A**
- Safety zone next to engine **B**
- Safety zone, flywheel side **C**
- Safety zone, above engine **D**
- Safety zone, below engine **E**

2.8.3 Maintenance areas

Maintenance areas are the safety zones that have to be accessed for maintenance work and troubleshooting.

WARNING
Hot parts during maintenance work.
Risk of burns! Can cause severe injury or death.

▶ Allow the engine to cool down sufficiently.

▶ Wear personal protective equipment.

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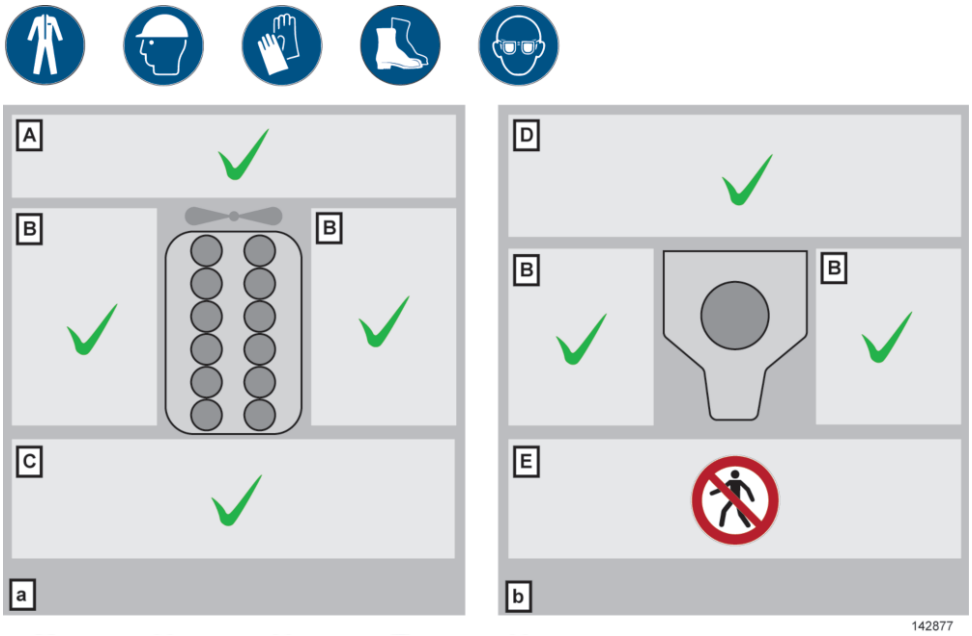

Fig. 21: Safety zones during maintenance and repairs

a Horizontal projection (viewed from above)

b Upright projection (viewed from the flywheel side)

Access is allowed to the following areas:

– Safety zone, unit carrier side **A**
– Safety zone next to engine **B**
– Safety zone, flywheel side **C**
– Safety zone, above engine **D**

Access is prohibited to the following areas:

– Safety zone, below engine **E**

Access to the maintenance areas must be secured against unexpected starting before entering the safety zones.

2.8.4 Secure and release the diesel engine against accidental starting

Access to the maintenance areas must be secured against accidental starting before entering the safety zones.

Procedure:

Secure the diesel engine against any unexpected start-up:
– Disconnect diesel fuel supply.
– Label cut-off point.
– Disconnect electrical power supply and secure against reactivation.
– Label cut-off point.

Make the diesel engine ready for operation (release):
– The following work has been completed:
  • Installation activities
  • Maintenance activities
  • Repair activities
– Make sure that all foreign bodies have been removed.
– All of the protective devices are installed and are working properly.
– Make sure that no external persons stand or walk in the danger zones.

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– Remove the label from the fuel supply.
– Reconnect the fuel supply.
– Remove the label from the electrical power supply.
– Establish the electrical power supply.

2.8.5 Emergency stop

An emergency stop is provided for hazardous situations that call for an immediate shutdown of the Diesel engine. The power supply to the Diesel engine is interrupted immediately. Only the engine control unit still receives current.

Examples of hazardous situations:
– Fire
– Persons having suffered an electric shock
– Diesel engine does not stop
– Diesel engine accelerates uncontrollably

Only use the emergency stop in emergencies. Triggering an emergency stop can cause permanent damage to the Diesel engine. The emergency stop may not be used to stop the Diesel engine for operational purposes.

2.8.6 Signage

Information

▶ The following required signs must be clearly visible and attached in the direct vicinity of the safety zones.

▶ The following required signs must be able to withstand the ambient conditions. The end user must ensure that these are kept visible and legible over the entire life cycle.

▶ Additional warnings or adaptations to product standards (ISO 8528-13) are possible.

ISO 7010 / W012 Warning of dangerous electrical voltage
– Only persons who are familiar with the risks of electricity may work within the identified area.
Unauthorized persons may only enter the safety zone after the electrical power supply has been disconnected.

ISO 7010 / W017 Warning of hot surfaces
– The Diesel engine has hot surfaces that are not immediately recognizable as such.
Wait for a sufficient time until the engine has cooled down.
Only touch components that may be hot with suitable protective gloves.

ISO 7010 / W025 Warning of entanglement hazard
– There are potential trapping hazards on the engine in the area of the V-ribbed belts and alternator to charge the battery.
Attach a warning sign if traps are not secured through guards (optional).
Enter the safety zone only after the Diesel engine has been turned off.
Secure the Diesel engine against any unexpected start-up.

ISO 7010 / P007 No access for persons with heart pacemakers or implanted defibrillators
– Possible EMC radiation that may affect heart pacemakers and implanted defibrillators.
People with a heart pacemaker or implanted defibrillator: keep a minimum distance of 20cm (8 inches) from the operational Diesel engine.

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ISO 7010 / M002 Refer to manual

– In order to ensure that all residual risks are known by the personnel, the system documentation must be read and understood.
Make sure that all residual risks according to the risk assessment of the system manufacturer are reflected in the system documentation.
Provide documentation to the personnel according to the "target audience" definitions without restrictions.

2.9 Prevent material damages

– Replace jointing material (e.g. O-rings, seals etc.).
– Check reusable removed parts for re-usability; see the relevant information in the Service Manual and repair instructions.
– Replace any removed parts that cannot be re-used.
– If no specific torques and tensioning instructions are specified: Screw connections are to be tightened with the standard torques. Additional information can be found in the "Standard torques" chapter.
– Replace self-locking screw connections.
– Clean the diesel engine, connections and screw connections thoroughly of oil, fuel or care products before assembly.
– Use lint-free cleaning rags.
– Do not touch electric contacts. The connection is affected by dirt or components may be destroyed by electrostatic discharges (ESD).
– Before cleaning the Diesel engine, cover or tape shut all openings into which water, steam or detergents must not penetrate due to safety or functional reasons.
– Remove the covers/seals after cleaning.
– Check the fuel lines, Diesel engine oil lines and hydraulic lines for the following defects:
  • Leaks
  • Loose connections
  • Chafe marks
  • Damage
– Make sure the electrical power supply is firmly connected when starting.
– Make sure the engine is switched off before disconnecting the electrical power supply.
– Use suitable test leads for measurements at plug connections.
– Protect the engine control unit against dust and water if no mating plug has been connected.

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3 Handling, operation

3.1 Start-up procedure

3.1.1 Filling the operating fluids

Fill the following operating fluids before the initial commissioning:

– **Diesel engine oil**
  For suitable lubricating oil for the Diesel engine, see the chapter “Lubricants and operating fluids”.
– **Coolant**
  For coolant composition, see the chapter “Lubricants and operating fluids”.
– **Diesel fuel**
  Diesel fuels must comply with the approved fuel specifications, see the chapter “Lubricants and operating fluids”.

After filling the operating fluids, perform the following work:

▶ Vent fuel system. Please refer to the generator operating manual.

3.1.2 Starting the engine

Prerequisites:
❑ The oil level is OK
❑ Engine is filled with coolant
❑ Charge air is connected
❑ Exhaust system is connected
❑ Electrical power supply is ready
❑ Fuel supply is connected

WARNING
Unexpected movement of the equipment.
Can cause serious injuries or the death of persons.

▶ There may be no persons in the safety zones of the diesel engine.

▶ Bring all of the protective devices into their protective position (housing is closed), if equipped.

▶ Secure external parts against unexpected movements. Remove all persons from the danger zones.

Information
Engine damage due to inadequate lubrication.

▶ The oil pressure has to build up immediately after the diesel engine is started (oil-pressure warning lamp goes out).

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If all of the safety instructions in the “Safety” chapter have been taken into account:

▶ Switch on the electrical power supply (battery voltage).

Final check

Once the engine has started, carry out the following checks and top off with operating materials if necessary

▶ Check the oil level.

▶ Check the coolant level.

▶ Perform a visual check for any leaks in the lines.

▶ Check for KODIA error messages.

▶ Check for generator system error messages.

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4 Operating faults

Please consult the table “Errors – Cause – Remedy” for certain engine problems with possible causes and corrective action.

Information

Engine errors are shown on the diagnosis and service tool as an error code for diagnostic purposes.

The following table shows basic logical steps to diagnose the problem:
– Familiarize yourself with the engine and related systems.
– Investigate the problem carefully.
– Correlate the symptoms with your current knowledge of the engine and systems.
– Diagnose the problem, starting with the most obvious assumptions.
– Carry out detailed analyses before taking the engine apart.
– Identify the causes and thoroughly perform any repair work.

After the repair:
– run the engine in accordance with the User Manual.
– Check that the causes have been eliminated.
– Cancel the fault.

4.1 Errors – Cause – Remedy

Malfunction / error	Cause	Remedy
The starter does not turn over.	The main fuse has blown.	Replace the fuse.
	The battery connections are loose or corroded.	Clean and tighten the loose connections.
	The battery voltage is too low.	Charge or replace the battery.
	The starter’s circuit is faulty or the contacts are corroded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The starter is faulty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
The starter turns over slowly.	The battery voltage is too low.	Charge or replace the battery.
	The battery connections are loose or corroded.	Clean and tighten the loose connections.
	The outside temperature is too low.	Take appropriate action for Winter operation.

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Errors – Cause – Remedy

Malfunction / error	Cause	Remedy
The Diesel engine cannot be started and/or stops again immediately.	The fuel tank is empty.	Refuel and vent the fuel system.
	The fuel filter is blocked.	Replace the fuel filter.
	The fuel line, pre-cleaner or screen in the fuel tank are blocked.	Clean and vent the fuel system.
	There is a leak in the fuel system or filter.	Seal this and vent the system.
	The outside temperature is too low.	Take appropriate action for Winter operation.
Trouble starting the Diesel engine.	There is a leak in the low-pressure circuit or the pressure is too low.	Carry out a leak test (visual inspection). Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The Diesel engine’s compression is too low.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	There is a fault in the electronic system.	Read out the error memory of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
The Diesel engine switches off suddenly.	The power supply has been interrupted.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	There is a leak in the low-pressure circuit or the pressure is too low.	Carry out a leak test (visual inspection). Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	There is a fault in the electronic system.	Read out the error memory of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

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Malfunction / error	Cause	Remedy
Low output of the Diesel engine (reduced performance).	There is a fault in the fuel system (blockage, leak).	Carry out a visual inspection for leaks, replace the filter. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The charge pressure is too low.	The terminals are loose, the seals and hoses are faulty, the air filter is dirty, the turbocharger is faulty. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The charge air temperature is too high.	The charge air cooler is dirty, the fan’s performance is low, the ambient temperature is too high., Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The coolant temperature is too high.	Check the cooler for soiling, check the fan and thermostat, check the coolant level. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The fuel temperature is too high.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The injection nozzles are faulty or do not vaporize.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The Diesel engine’s compression is too low.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	There is a fault in the electronic system.	Read out the error logs of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
The Diesel engine is too hot (according to the coolant temperature display).	The coolant level is too low.	Fill up with coolant.
	The cooler is dirty or calcified.	Clean or descale. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The thermostat is faulty.	Check this and replace if necessary. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

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Malfunction / error	Cause	Remedy
The charge current display comes on when the Diesel engine is running.	Inadequate tension of the V-ribbed belt.	Check the tension of the V-ribbed belt and replace the tightening roller if necessary.
	The V-ribbed belt is worn.	Replace the V-ribbed belt.
	The cable connections are loose or separated.	Fasten or replace the cable.
	The alternator to charge the battery, rectifier or controller are faulty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Black smoke emitted from the Diesel engine.	The injection nozzles are faulty or inefficient.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Fault in the turbocharger (charge pressure too low).	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The engine is overloaded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
The exhaust gases are blue.	The oil level in the Diesel engine is too high.	Check and correct the oil level.
	Lubricant enters the combustion chamber and is burnt.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The bearing gasket on the turbocharger is faulty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The crankcase breather is faulty.	Check this and replace if necessary.
The exhaust gases are white.	Fuel injection begins too late.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The operating temperature is not achieved.	Run the engine until it reaches its operating temperature.
	There is water in the fuel system.	Check the fuel system and the drain pre-filter.
	There is a leak in the charge air cooler.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

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Malfunction / error	Cause	Remedy
The Diesel engine knocks.	There is a fault in the combustion.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	There is an error in the valve clearance.	Adjust the valve clearance.
	The injection nozzles are damaged or carbonized.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Bearing damages.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The piston rings are worn or faulty, the pistons are eroded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Abnormal noises from the engine.	There are leaks in the intake and exhaust gas lines that cause a whistling noise.	Seal the leaks and replace the gaskets if necessary.
	The turbine or compressor wheel rubs against the housing; foreign bodies have penetrated the compressor or turbine; bearings may be jammed.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
The lubricant pressure is too low.	The oil level in the oil sump is too low.	Fill oil to prescribed mark.
	The lubricant is too thin (oil diluted by Diesel fuel).	Drain the oil and refill with the specified oil.
	The pressure sensor is faulty.	Check the oil pressure and replace the damaged oil pressure transducer. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The pressure limiting valve does not work properly or is dirty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
There is lubricant in the cooling system.	Leak in the oil cooler or oil cooler plate.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
There is coolant in the lubricant.	Leaks in the cylinder seals.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Leak in the oil cooler or oil cooler plate.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

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Errors – Cause – Remedy

Malfunction / error	Cause	Remedy
The charge air temperature is too high.	The charge air cooler is dirty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The inlet air temperature is too high.	Check the fan, air supply and breather.
The charge air pressure is too low.	The air filter is blocked.	Check the air filter’s service display, if equipped.
	The charge air cooler is dirty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	The turbocharger outlet is faulty.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

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5 Operating fluids and maintenance

5.1 Fill quantities

5.1.1 Lubricants and operating materials

Description	Quantity
Engine oil	101 l (1.5 l per filter)
	26.68 US gal (0.4 US gal per filter)
Coolant	55 l
	14.5 US gal

Tab. 10: Fill quantities in the Diesel engine (guide values)

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5.2 Lubricants and operating materials

5.2.1 Diesel fuels

Approved fuel qualities

Due to different sulfur content of these fuels, the engine oil change interval and quality must be taken into account when selected.

Fuel	Fuel quality	Description
On-Road Diesel	ASTM D 975 1D-S15	HFFR < 460 µm
On-Road Diesel	ASTM D 975 1D-S500	HFFR < 460 µm without AEG
On-Road Diesel	ASTM D 975 1D-S5000	HFFR < 460 µm without AEG
On-Road Diesel	ASTM D 975 2D-S15	HFFR < 460 µm
On-Road Diesel	ASTM D 975 2D-S500	HFFR < 460 µm without AEG
On-Road Diesel	ASTM D 975 2D-S5000	HFFR < 460 µm without AEG
On-Road Diesel	ASTM D 975 4D	HFFR < 460 µm without AEG
EU Diesel	EN 590	Max 10% biodiesel content
Heating oil	DIN 51603	Without AEG
GTL	DIN 15940	If ASTM D 975 approved
NATO fuel	NATO F-34	HFFR < 460 µm without AEG with additive S-1750
NATO fuel	NATO F-35	HFFR < 460 µm without AEG with additive S-1750
NATO fuel	NATO F-54	HFFR < 460 µm
NATO fuel	NATO F-63	HFFR < 460 µm without AEG with additive S-1750
NATO fuel	XF-63	HFFR < 460 µm without AEG with additive S-1750
NATO fuel	XF-10	HFFR < 460 µm without AEG
NATO fuel	XF-51	HFRR < 460 µm max. 10% Biodiesel
Aviation kerosene	Jet A-1	HFFR < 460 µm without AEG with additive S-1750
UK Diesel	BS 2869 A2	Max 10% biodiesel content

Tab. 11: Approved fuel qualities

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Minimum requirement for quality

Requirement for the fuel	Parameter
Lubrication capability at 60°C (HFRR)	460 µm
Minimum cetane number	45
Purity class according to ISO 4406	20/17/14

Tab. 12: Minimum requirement for Diesel

5.2.2 Engine oils

Performance requirements of the quality categories

Engine oil additives are not approved, since if they are incorrectly matched with the engine oil they may cause damage.

Lubricant category	Minimum standards	Recommended viscosity class	Type of lubricant	Oil change factor
Lubricant category 1	ACEA E5-02 or API CH-4 or DHD-1	SAE 10W-40; SAE 10W-30; SAE 15W-40	Mineral oil (Group 1 & 2 Base oils)	1/4
Lubricant category 2	ACEA E4 ACEA E7 or API CI-4 Plus or DHD-1 or JASO DH-1	SAE 10W-40; SAE 10W-30; SAE 5W-30	Synthetic (Group 2 and / or 3 Base oils)	1
Lubricant category 2.1	ACEA E6 or ACEA E9 or API CJ-4 or JASO DH-2	SAE 5W-30; SAE 10W-40; SAE 10W-30	Synthetic (Group 2 and / or 3 Base oils)	1
Lubricant category 3 (standard today)	ACEA E4-12 or both ACEA E4 and ACEA E7	SAE 5W-30; SAE 10W-40; SAE 10W-30; SAE 5W-40	Synthetic (Group 3 and / or 4), VI > 160, and Longlife additive	2
Lubricant category 3.1 (standard today)	ACEA E6-12 or both ACEA E6 and ACEA E9 or API CK-4	SAE 5W-30; SAE 10W-40; SAE 10W-30; SAE 5W-40	Synthetic (Group 3 and / or 4), VI > 160, and Longlife additive	2

Tab. 13: Lubricant category

Selecting the engine oil

Effect caused by the sulfur content in the fuel

The following table is intended to help select the right engine oil based on the total base number (TBN). This measurement value is important for reducing combustion gases that are greatly influenced by the sulfur content in the fuel.

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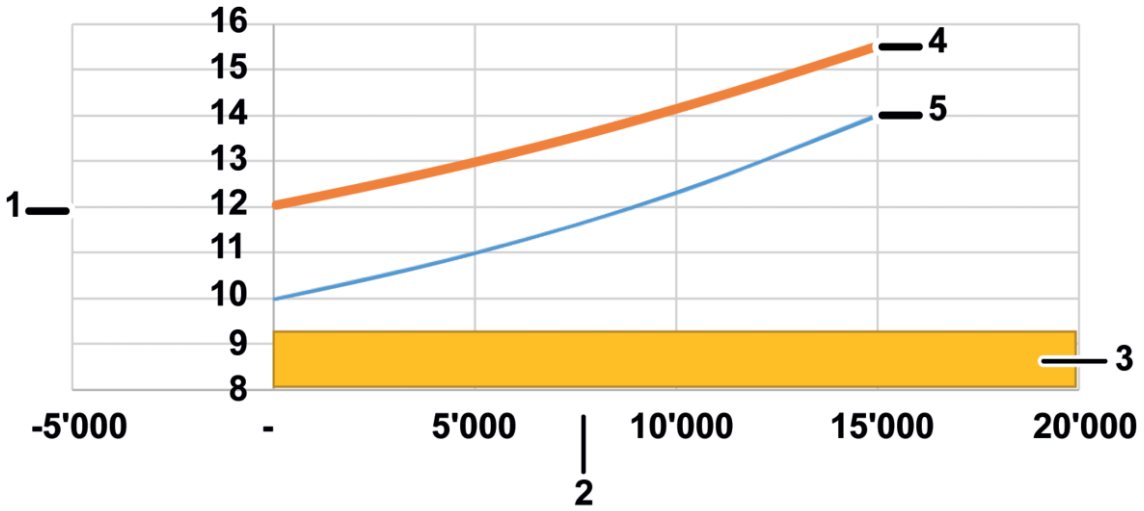

Fig. 27: The correlation between TBN and sulfur in fuel

1 TBN

2 ppm sulfur

3 If TBN <8 mgKOH/g, the engine oil should be replaced as soon as possible.

4 with TBN [mg KOH/g]

5 recommended TBN [mg KOH/g]

Viscosity class:

The viscosity class has to be selected on the basis of the cold start temperature. The following viscosity classes are permitted for the engines: 5W30, 5W40, 10W30, 10W40 and 15W40. The change intervals according to oil category must be observed.

Difficulty factors

Difficulty factors can be:
– Frequent cold starts
– Environmental influences
  • Operating temperature
  • Dust
  • High humidity
  • Long standstill times

If there are difficulty factors or difficult usage conditions, the oil change and filter change must be performed according to the following table.

Engine oil change intervals:

The change intervals are defined as follows:

Basic oil change interval * Factor **oil category** * Factor **sulfur content** = **change interval**

The basic oil change interval is defined in the maintenance tables.

The factor “oil category”:

Factor “sulfur content”:

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Sulfur content in %	Oil change factor (factor 2)
0 < sulfur content ≤ 0.5	"**1**" => no change on the maintenance interval
0.5 < sulfur content ≤ 1 limited to lubricant category 2 and 3	"**1/2**" => reduces the maintenance interval by one half
1 < sulfur content ≤ 1.5 limited to lubricant category 2 and 3	"**1/4**" => reduces the maintenance interval by one quarter. The use of sulfur in the ratio of more than 1% requires an additional approval of the engine manufacturer to ensure that all engine options, the used lubricant, and the maintenance schedule are compatible with this very high sulfur content. Special lubrication oil must be used => TBN > 12 MgKOH/g.

Tab. 14: Sulfur content table

Engine oil analysis

The engine oil can be monitored by means of an engine oil analysis and the change interval can be adjusted if required.

5.2.3 Coolant

Information

Mixing different anticorrosion antifreeze agents can make the properties of the coolant worse.

▶ Do not combine different products!

▶ Silicate-based and non-silicate based coolants must never be mixed; this may damage the cooling system!

Requirements for water

Make sure that the water used meets the following requirements:
– Fully de-ionized water should be used.
– Corresponds to the 2006 WHO (World Heath Organization) guideline for drinking water.

The cooling circuit must remain within the following parameters:
– Hardness of water < 12 dH
– pH value 6.7 to 9.0
– Chloride and sulfate < 100 mg/l

Requirements of the coolant

Use only pre-mixed cooling water of the same kind to avoid problems with the cooling circuit.

An SI-OAT or hybrid technology with ethylene glycol is to be used as coolant, since this technology provides the necessary cooling performance and cooling function for engines.

Approved products:
– BASF GLYSANTIN® G40™ change interval 6 years

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– BASF GLYSANTIN® G48™ change interval 4 years

The recommended coolant concentration is 40% to 50%.

The coolant can be monitored by means of an coolant analysis and the change interval can be adjusted if required. Control parameter for the coolant:

Analysis	**Standard**	**Unit**	**Value**
Visual appearance			Typical color, clear, normal smell, like new coolant
pH value	DIN EN ISO 10523:2012-04		6.7 — 9.0
Chloride (ions)		mg/l	< 100
Sulfate		mg/l	< 100
Bacteria and toxic constituents			without

Tab. 15: Control parameter

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5.3 Maintenance

5.3.1 Maintenance schedule

Using the maintenance schedule

The intervals during which a component can remain in operation between two maintenances are in classified as follows:

Interval is the operating period in hours.

Limit interval is the maximum operating period in years.

Maintenance work is performed as soon as an interval (operating hours or time period) is reached. The first interval that occurs applies.

Nominal values for the power generating unit

Power generating units that satisfy the requirements of ISO 8528-1:2005 are used to generate current for continuous, peak load and stand-by applications. The classifications according to ISO 8528-1:2005 should help improve the understanding between manufacturer and customer.

Emergency standby power system (ESP)

The maximum available output that a power generating unit is able to supply if the mains current fails or under test conditions up to 200 hours of operation a year during variable power sequencing under the given operating conditions, whereby the maintenance intervals and work are carried out in accordance with the manufacturer’s specifications. The permissible average power output with 24-hour operation should not be more than 85 percent of the nominal ESP value.

Prime power (PRP)

The maximum output that a power generating unit is able to supply continuously over an unlimited number of hours a year under the agreed operating conditions with a variable electric load, whereby the maintenance intervals and work are carried out in accordance with the manufacturer’s specifications. The permissible average power output with 24-hour operation should not be more than 75 percent of the nominal ESP value.

Continuous operating power (COP)

The maximum output that the power generating unit is able to supply continuously over an unlimited number of hours a year under the agreed operating conditions with a constant electric load, whereby the maintenance intervals and work are carried out in accordance with the manufacturer’s specifications.

Time between overhauls (TBO)

The average period until Diesel engines have to be overhauled.

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5.3.2 Daily, weekly and monthly maintenance work - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL000	Diesel engine	Daily				X	Perform visual inspection (leaks, damage, loose components). Perform before start.
SL001	Engine oil and coolant	Daily				X	Check engine oil and coolant level. Refill if necessary. Perform before start.
SL002	Cooling system	Daily				X	Inspect low temperature circuit, intercooler, water pump and vent line. Perform before start.
SL004	Fuel system	Daily				X	Check water trap on the preliminary fuel filter and drain water if necessary. Perform before start.
SL006	Air filter	Daily				X	Check the air filter's display. Perform before start. See the generator set's operating manual.
SL007	Engine in operation	Daily				X	Observe the engine operation. Record and report any abnormality found (faulty parameters, unusual noises, vibrations, exhaust gas color). See the generator set's operating manual.
	Diesel engine	Weekly				X	Perform visual inspection (leaks, contamination, damage, belt drive, cable harness)
SL008		Monthly				X	Test run at more than 1/3 load. See the generator set's operating manual.

Tab. 16: Maintenance schedule — Daily maintenance activities — Service level 1

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5.4 Maintenance schedule — ESP Fuel optimized

5.4.1 ESP Fuel optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	1			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2	X			Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	4000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL107	Crankcase breather	4000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump		2	X			Check state of belt drive, replace if necessary.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.
SL116	Coolant (Glysantin G48)		4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.

Tab. 17: ESP Fuel optimized — Service level 1

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5.4.2 ESP Fuel optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL209	High pressure pump	4000	10	X			Replace the HP pump.
SL215	Water pump	4000		X			Replace the water pump.
SL223	Battery charging alternator	4000		X			Replace the battery charging alternator.
SL225	Viscous damper	4000		X			Replace the viscous damper.
SL205	Injection	4500		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	4500		X			Replace the exhaust gas turbocharger.
SL219 -A	Exhaust gas turbocharger		1	X			Replace the exhaust gas turbocharger rubber sleeve.
SL219 -B	Coolant lines		4	X		X	Check and replace coolant lines and hoses if necessary.

Tab. 18: ESP Fuel optimized — Service level 2

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5.5 Maintenance schedule — ESP Emission optimized

5.5.1 ESP Emission optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	1			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2	X			Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	2000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL107	Crankcase breather	2000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump		2	X			Check state of belt drive, replace if necessary.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.
SL116	Coolant (Glysantin G48)		4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.

Tab. 19: ESP Emission optimized — Service level 1

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5.5.2 ESP Emission optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL225	Viscous damper	4000		X			Replace the viscous damper.
SL209	High pressure pump	4000	10	X			Replace the HP pump.
SL215	Water pump	4000		X			Replace the water pump.
SL223	Battery charging alternator	4000		X			Replace the battery charging alternator.
SL205	Injection	4500		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	4500		X			Replace the exhaust gas turbocharger.
SL219 -A	Exhaust gas turbocharger		1	X			Replace the exhaust gas turbocharger rubber sleeve.
SL219 -B	Coolant lines		4	X		X	Check and replace coolant lines and hoses if necessary.

Tab. 20: ESP Emission optimized — Service level 2

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5.6 Maintenance schedule — ESP 50Hz emission optimized top power

5.6.1 ESP 50Hz emission optimized top power — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL121	Engine oil and oil filter with lubricant “Category 1”	125	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL100	Oil analysis	250	1			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 2”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 3”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2	X			Replace the primary fuel filter.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	2000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL107	Crankcase breather	2000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump		2	X			Check state of belt drive, replace if necessary.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.
SL116	Coolant (Glysantin G48)		4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.

Tab. 21: ESP 50Hz emission optimized top power — Service level 1

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5.6.2 ESP 50Hz emission optimized top power — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL225	Viscous damper	4000		X			Replace the viscous damper.
SL209	High pressure pump	4000	10	X			Replace the HP pump.
SL215	Water pump	4000		X			Replace the water pump.
SL223	Battery charging alternator	4000		X			Replace the battery charging alternator.
SL205	Injection	4500		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	4500		X			Replace the exhaust gas turbocharger.
SL219 -A	Exhaust gas turbocharger		1	X			Replace the exhaust gas turbocharger rubber sleeve.
SL219 -B	Coolant lines		4	X		X	Check and replace coolant lines and hoses if necessary.

Tab. 22: ESP 50Hz emission optimized top power — Service level 2

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5.7 Maintenance schedule — PRP Fuel optimized

5.7.1 PRP Fuel optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	2			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2				Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	4000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL107	Crankcase breather	4000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump	4000	2	X			Check state of belt drive, replace if necessary.
SL116	Coolant (Glysantin G48)	6000	4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.

Tab. 23: PRP Fuel optimized — Service level 1

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5.7.2 PRP Fuel optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL225	Viscous damper	7500		X			Replace the viscous damper.
SL219 -A	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger rubber sleeve.
SL205	Injection	7500		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger.
SL215	Water pump	7500	8	X			Replace the water pump.
SL219 -B	Coolant lines	7500	4	X		X	Check and replace coolant lines and hoses if necessary.
SL223	Battery charging alternator	7500		X			Replace the battery charging alternator.

Tab. 24: PRP Fuel optimized — Service level 2

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5.8 Maintenance schedule — PRP Emission optimized

5.8.1 PRP Emission optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	2			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2				Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL107	Crankcase breather	2000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump	4000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	4000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.
SL116	Coolant (Glysantin G48)		4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.

Tab. 25: PRP Emission optimized — Service level 1

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5.8.2 PRP Emission optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL225	Viscous damper	7500		X			Replace the viscous damper.
SL219 -A	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger rubber sleeve.
SL205	Injection	7500		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger.
SL215	Water pump	7500	8	X			Replace the water pump.
SL219 -B	Coolant lines	7500	4	X		X	Check and replace coolant lines and hoses if necessary.
SL223	Battery charging alternator	7500		X			Replace the battery charging alternator.

Tab. 26: PRP Emission optimized — Service level 2

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5.9 Maintenance schedule — COP Fuel optimized

5.9.1 COP Fuel optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	2			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2				Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	4000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL107	Crankcase breather	4000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump	4000	2	X			Check state of belt drive, replace if necessary.
SL116	Coolant (Glysantin G48)	6000	4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.

Tab. 27: COP Fuel optimized — Service level 1

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5.9.2 COP Fuel optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL219 -A	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger rubber sleeve.
SL225	Viscous damper	10000		X			Replace the viscous damper.
SL205	Injection	10000		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	10000		X			Replace the exhaust gas turbocharger.
SL215	Water pump	10000	8	X			Replace the water pump.
SL219 -B	Coolant lines	10000	4	X		X	Check and replace coolant lines and hoses if necessary.
SL223	Battery charging alternator	10000		X			Replace the battery charging alternator.
SL209	High pressure pump	20000		X			Replace the HP pump.

Tab. 28: COP Fuel optimized — Service level 2

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5.10 Maintenance schedule — COP Emission optimized

5.10.1 COP Emission optimized — Service level 1 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL100	Oil analysis	250	2			X	Take oil sample and perform oil analysis. Carry out after 500 h for category 3 and 2 lubricant.
SL121	Engine oil and oil filter with lubricant “Category 1”	250	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). At the latest after one year.
SL121	Engine oil and oil filter with lubricant “Category 2”	500	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL105	Main fuel filter	1000	2	X			Replace main fuel filter.
SL106	Primary fuel filter	1000	2				Replace the primary fuel filter.
SL121	Engine oil and oil filter with lubricant “Category 3”	1000	2	X			Replace Diesel engine oil and oil filter insert (at least every 2 years). Perform once after 250 hours. At the latest after one year.
SL118	V-ribbed fan belt	2000	2	X			Check state of belt drive, replace if necessary.
SL107	Crankcase breather	2000	2	X			Replace oil separator filter insert (at latest when the belt for the crankcase breather is replaced).
SL109	Belt for battery charging alternator and water pump	4000	2	X			Check state of belt drive, replace if necessary.
SL117	Crankcase breather belt	4000	2	X			Replace belt (at the latest when the oil separator filter insert is replaced).
SL116	Coolant (Glysantin G48)	6000	4	X			Replace coolant. For coolant formulated with Glysantin G40, the extension up to 8000h / 6Y is possible after analysis.
SL120	Coolant analysis		2			X	Take coolant sample and perform coolant analysis.

Tab. 29: COP Emission optimized — Service level 1

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5.10.2 COP Emission optimized — Service level 2 - Version: 2018/06-1

Task identification	Component	Schedule		Service Type			Task description
		Time limit (hrs)	Calendar limit (year)	Replacement	Overhaul	Inspection / Clean Repair / Adjustment	
SL204	Cylinder head valves	1000	2			X	Check / set valve clearance.
SL219 -A	Exhaust gas turbocharger	7500		X			Replace the exhaust gas turbocharger rubber sleeve.
SL225	Viscous damper	10000		X			Replace the viscous damper.
SL205	Injection	10000		X			Replace fuel lines and injectors.
SL213	Exhaust gas turbocharger	10000		X			Replace the exhaust gas turbocharger.
SL215	Water pump	10000	8	X			Replace the water pump.
SL219 -B	Coolant lines	10000	4	X		X	Check and replace coolant lines and hoses if necessary.
SL223	Battery charging alternator	10000		X			Replace the battery charging alternator.
SL209	High pressure pump	20000		X			Replace the HP pump.

Tab. 30: COP Emission optimized — Service level 2

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5.11 Special tools for maintenance activities

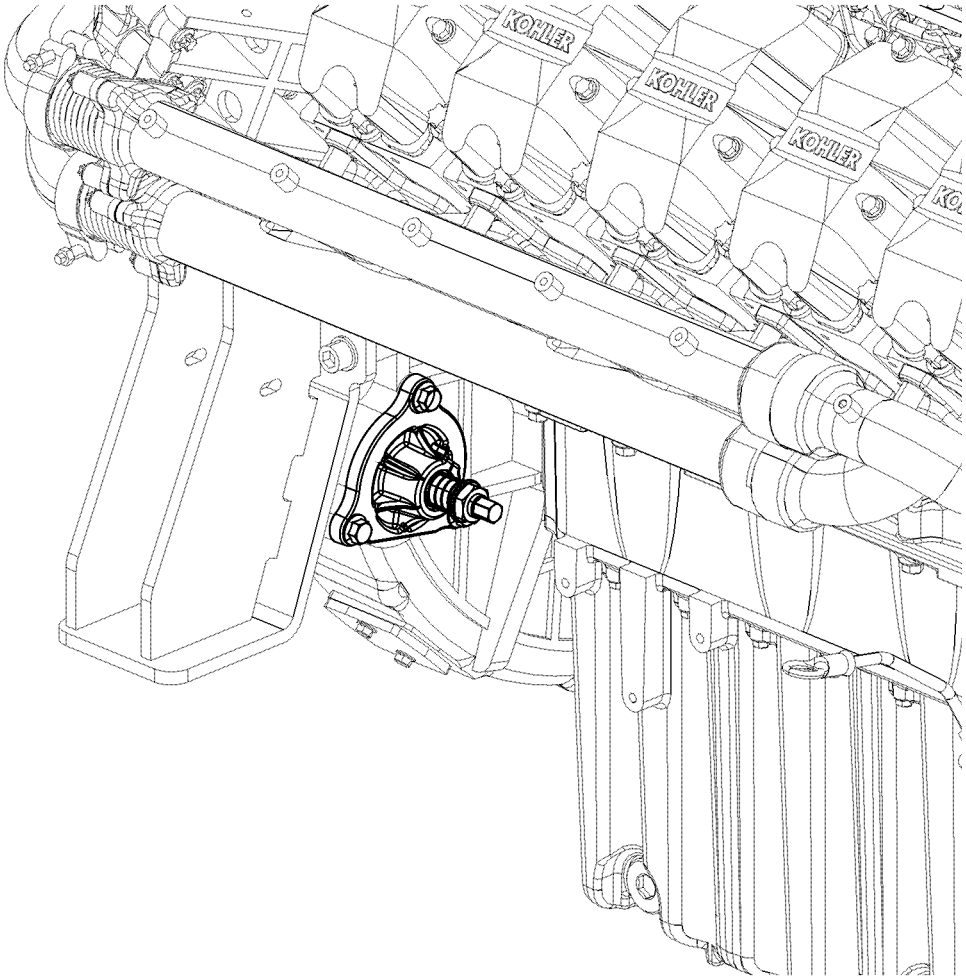

Fig. 43: Turning device

ID no.	Description
10123791	Turning device

Tab. 31

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5.12 Preparatory maintenance activities

Safety precautions for maintenance

The safety regulations must be observed while performing maintenance work! See the “Safety” chapter.

Maintenance position

The diesel engine is in the maintenance position when:
– The Diesel engine is horizontal.
– The Diesel engine is turned off.
– The diesel engine has cooled down to the ambient temperature.
– Disconnect electrical power supply and secure against reactivation.
– Label cut-off point.

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5.13 Daily, weekly and monthly maintenance work

Make sure that:
❑ The Diesel engine is in the maintenance position.

5.13.1 Perform visual inspection (leaks, damage, loose components) — SL000

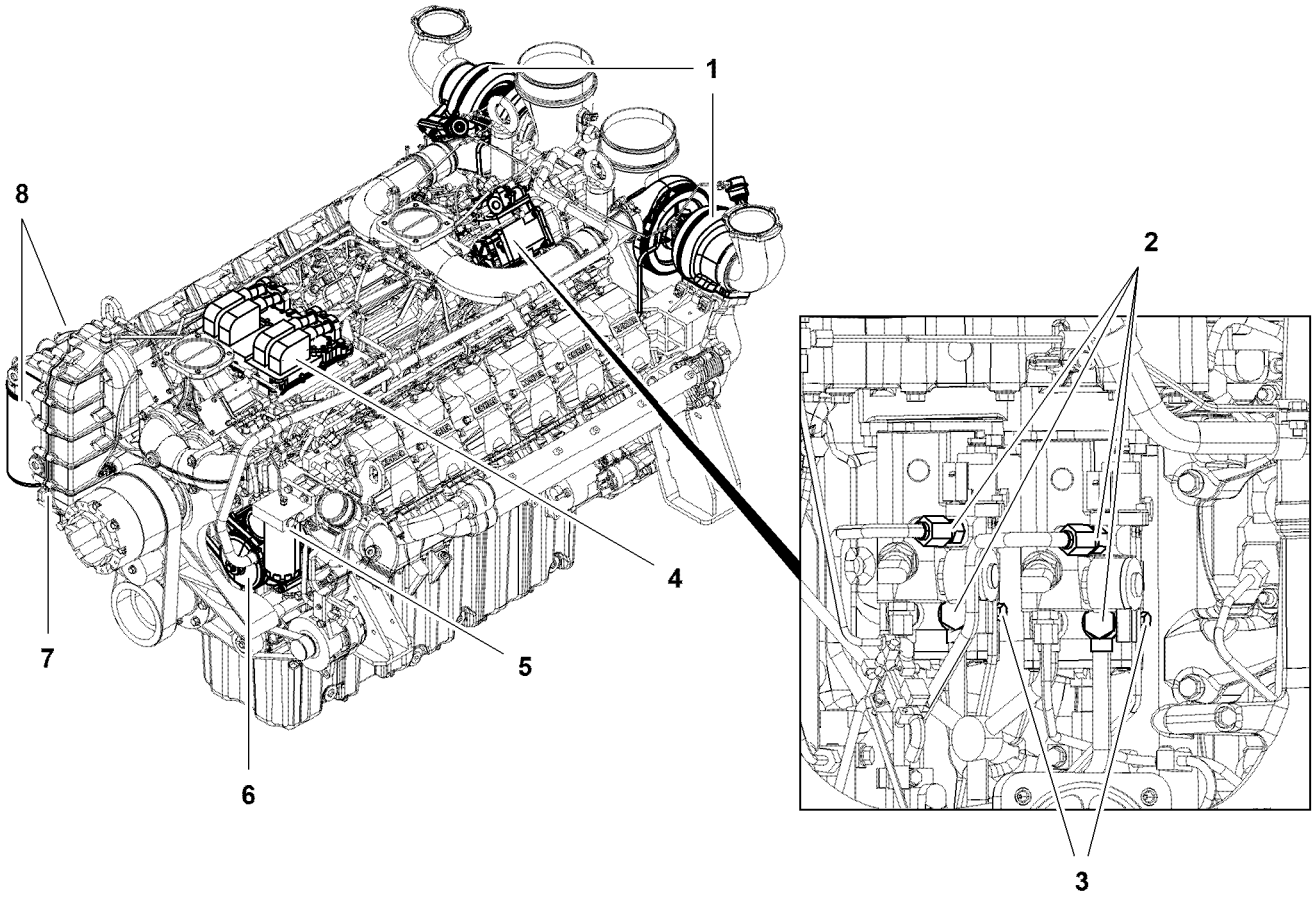

Fig. 44: Overview of visual inspection

1	Turbocharger	**4**	Engine control unit	**7**	Oil module
2	High pressure pump connectors	**5**	Main fuel filter	**8**	Oil filter
3	High pressure pump leakage	**6**	Crankcase breather		

▶ Visually check Diesel engine for leaks, ensure that it is not damaged and that the fastenings comply with regulations.

▶ Visually check V-space (area under high pressure pump and lines) for moisture.

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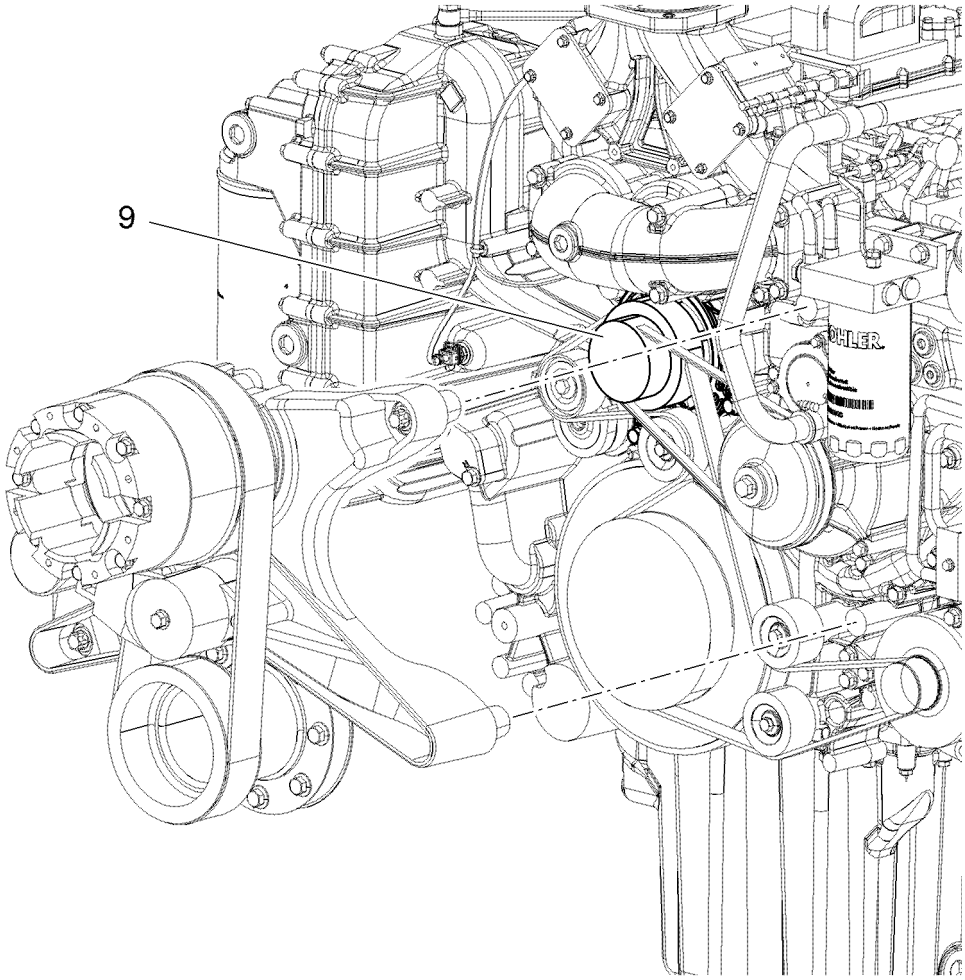

Fig. 45: Water pump location

9 Water pump

▶ Check area around water pump **9** for leaks.

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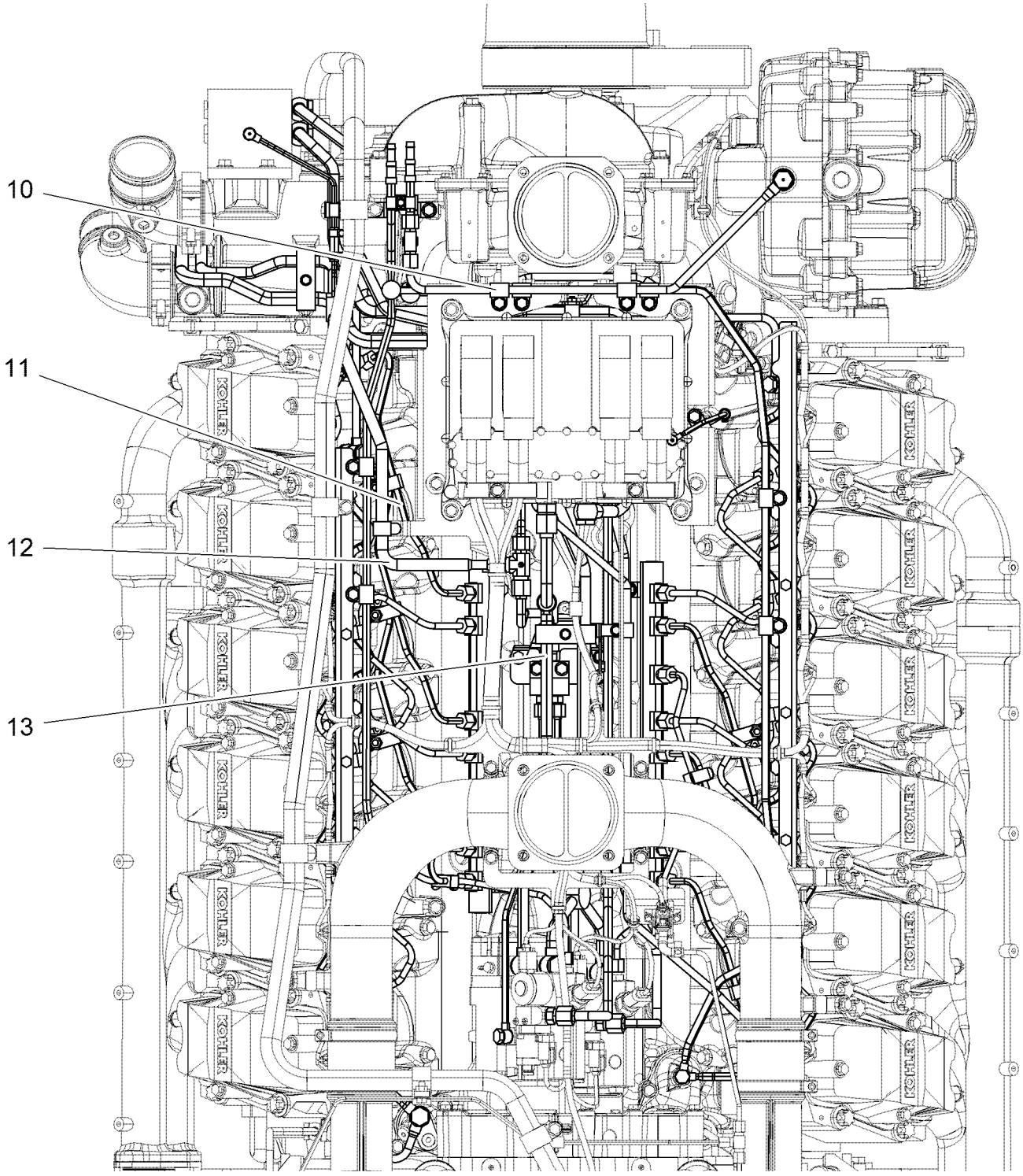

Fig. 46: Inspection overview

10 Vent line
11 Pressure line
12 Overflow-oil line
13 Fuel line

▶ Visually check hoses for leaks, ensure that they are not damaged, installed friction-free, and that fastening is in compliance with regulations.

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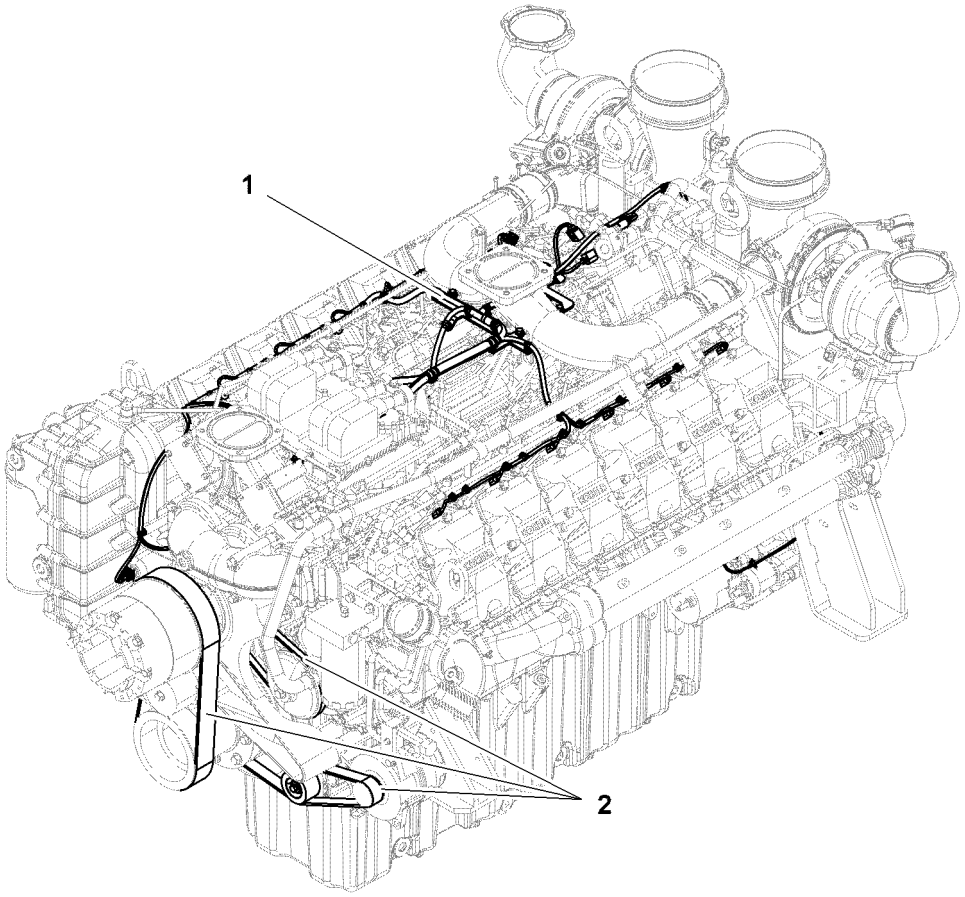

Fig. 47

1 Cable harness **2** V-ribbed belt

- ▶ Visually check cable harness **1** for damage, friction-free installation, and regulation-compliant fastening.
- ▶ Visually check belt drive **2** for damage, friction-free installation, and regulation-compliant fastening.

5.13.2 Checking the engine oil level — SL001

Oil dipstick and oil filler neck are located on the right as seen from the flywheel.

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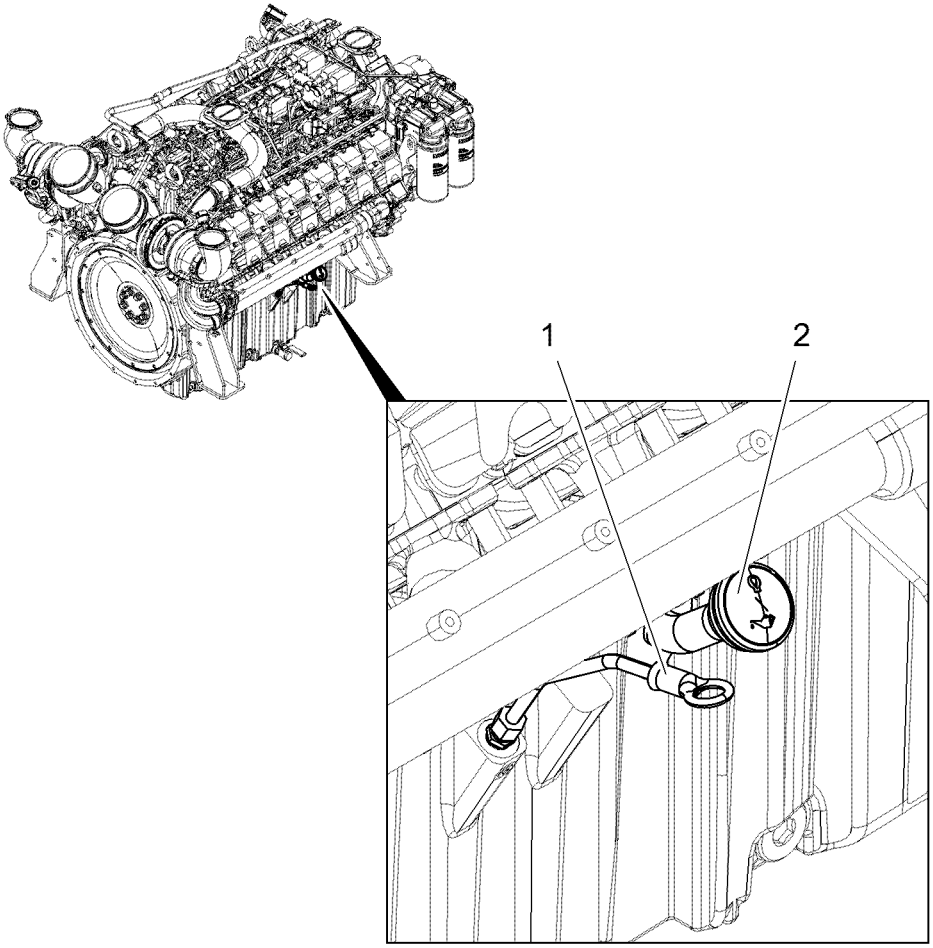

Fig. 48: Example of oil dipstick / oil filler neck

▶ Pull out oil dipstick **1**, wipe with a clean cloth and reinsert to the limit stop.

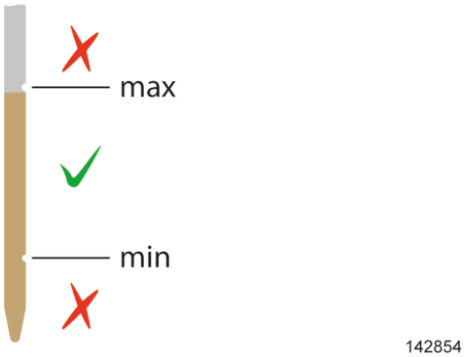

Fig. 49

▶ Remove the oil dipstick again and check the oil level. The oil level must be between the “min” and “max” marks.

If the oil level is too low:

▶ Remove the oil refueling cap and top off with oil.

▶ Fill the oil through the oil filler neck **2**.

▶ Do not fill the Diesel engine with oil to above the “max” mark.

▶ Clean the refueling cap, place on the filler neck and tighten.

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5.13.3 Check coolant level — SL001

DANGER
Hot cooler parts and hot cooler fluid!
Risk of burns! Will cause serious injuries and death.

- ▶ Perform maintenance and inspection work on the cooling system only when the Diesel engine has cooled down.
- ▶ Wear protective equipment.

Fig. 50

See generator set manual for procedure to check coolant level.

5.13.4 Check/drain water trap on the primary fuel filter — SL004

Make sure that:
❑ A reservoir with the required capacity is ready.

The primary fuel filter with water trap and manual fuel feed pump is some distance from the Diesel engine and is attached differently depending on the device design.

See the generator sets' operating manual for the procedure.

WARNING
Open flames!
Injuries, fire and explosion! Can cause serious injury and death.

- ▶ Avoid open flames or other ignition sources when performing maintenance or inspection work on the fuel system.
- ▶ Perform maintenance and inspection work only when the Diesel engine has been shut down.

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5.14 Maintenance activities

Make sure that:
- ❑ The Diesel engine is in the maintenance position.

5.14.1 Take oil sample and perform oil analysis — SL100

Ensure that:
- ❑ A reservoir with the required capacity is ready.
- ❑ A suitable sample bottle is ready.

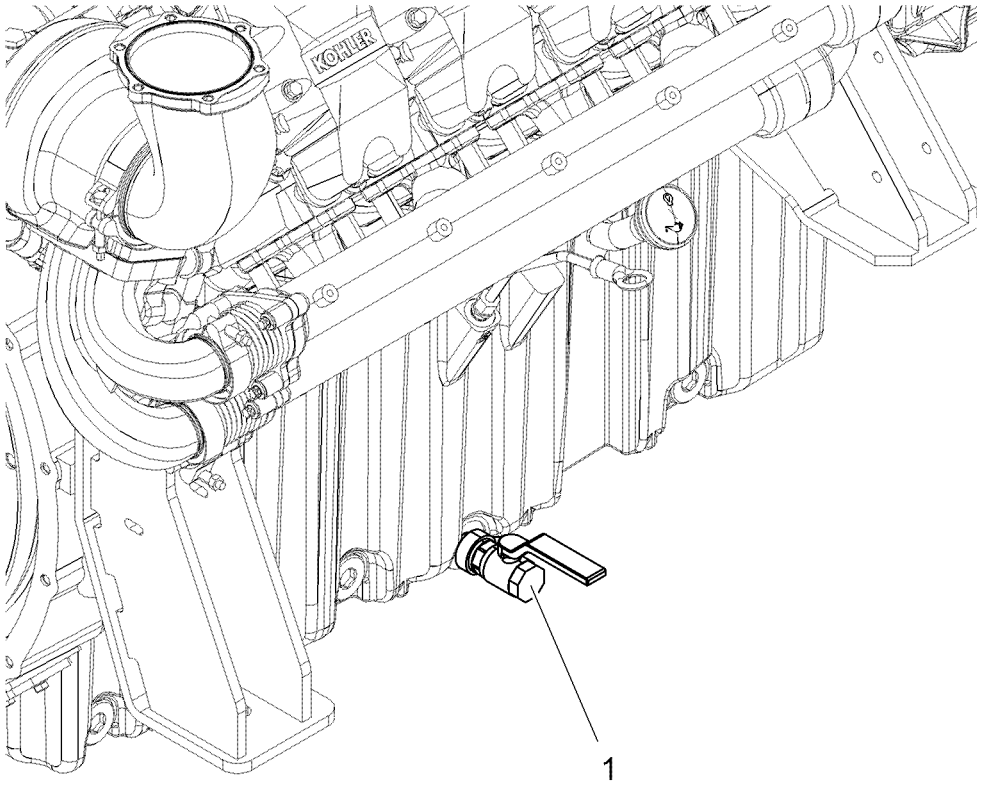

Fig. 51: Oil removal point

1 Oil removal point

▶ Refer to the generator set manual for procedure when taking oil sample and performing oil analysis.

5.14.2 Replace diesel engine oil and oil filter — SL 121

Make sure that:
- ❑ The Diesel engine is horizontal.
- ❑ The Diesel engine is turned off.

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- ❑ The Diesel engine is warm, unlike in the maintenance position.
- ❑ Strap wrench or similar tool is on hand.
- ❑ A reservoir with the required capacity is ready.
- ❑ Oil filters (2 pcs.) with seals are on hand.
- ❑ Diesel engine oil is on hand. Diesel engine oil amount, see the “Fill quantities table” chapter. Please refer to the “Lubricants and operating fluids” chapter for the lube oil specifications.

Draining the diesel engine oil

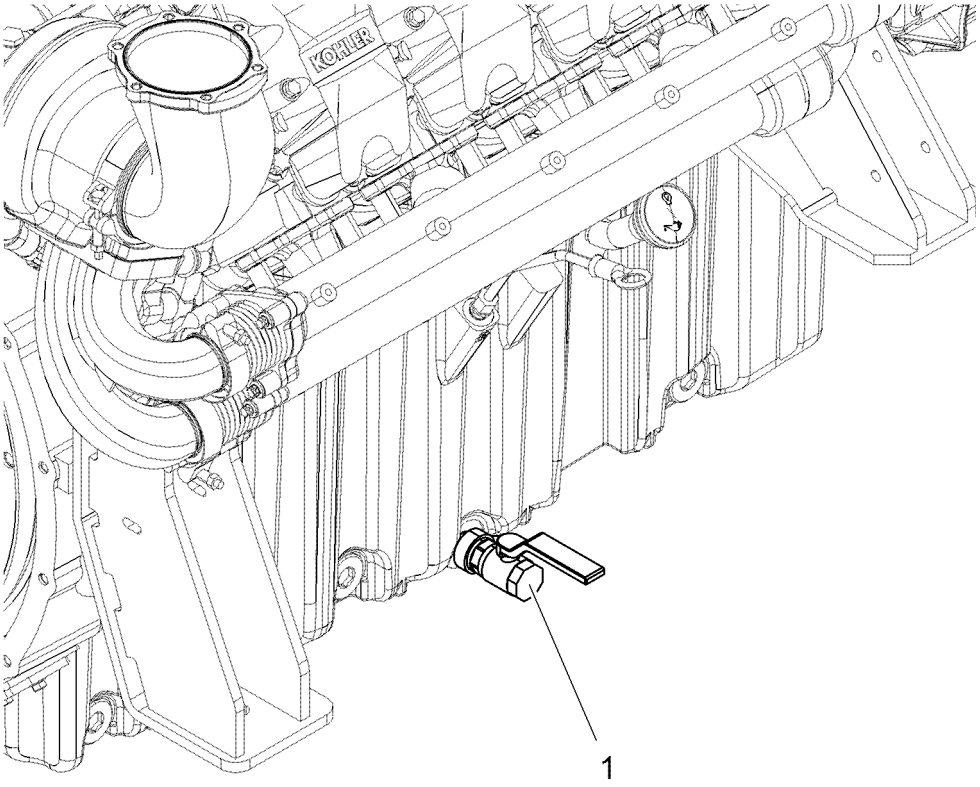

Fig. 52: Oil drain shut-off valve

- ▶ Open oil drain shut-off valve **1**.
- ▶ Drain the oil into the container provided.
- ▶ Close oil drain shut-off valve **1**.
- ▶ Dispose of oil (observe country-specific regulations).

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Replacing the oil filter

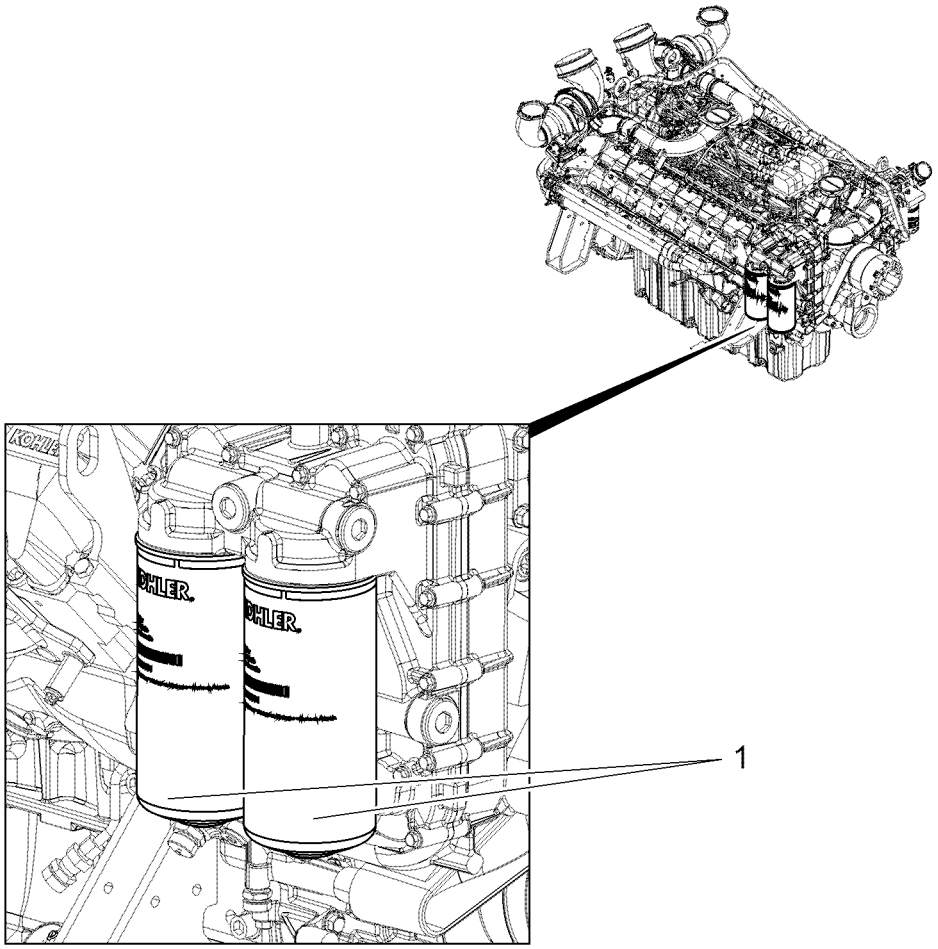

Fig. 53: Oil filter

▶ Loosen the oil filter **1** with a strap wrench or similar tool and unscrew.

CAUTION
Hot engine oil!
Risk of burns! Can cause injuries.

▶ Avoid skin contact with the engine oil.

▶ Wear protective gloves when changing the engine oil.

▶ Dispose of oil filter (observe country-specific regulations).

▶ Oil seal on the oil filter. (Use engine oil.)

▶ Screw on new oil filter **1** until the sealing contacts the oil module.

▶ Tighten oil filter **1** by hand 1/2 of a revolution.
▷ Torque 25 Nm.

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Filling with diesel engine oil

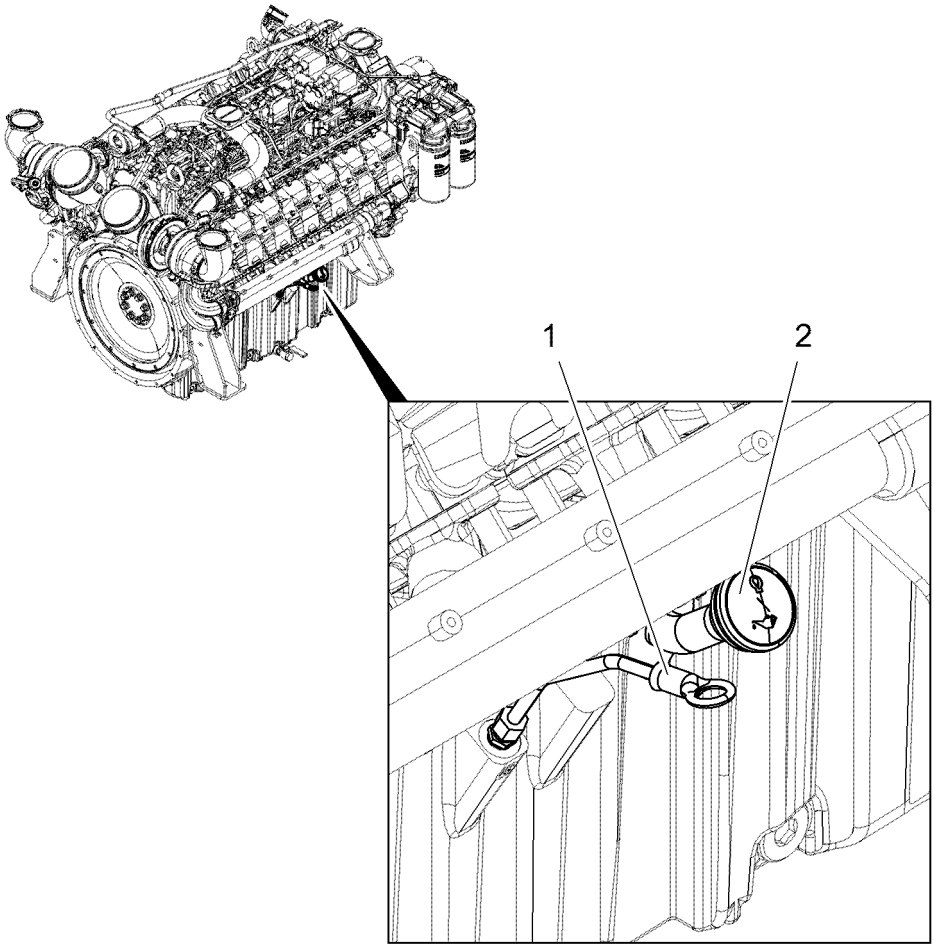

Fig. 54: Example of oil dipstick and oil filler neck

- ▶ Fill with oil through the oil filler neck **2** up to between the min and max marks on the dipstick **1**.
- ▶ Clean the refueling cap, place on the oil filler neck **2** and tighten.
- ▶ Start the diesel engine.
- ▶ Check the oil pressure (diesel engine oil pressure display unit) and check the oil filter for leaks.
- ▶ Turn the Diesel engine off.
- ▶ Check the oil level on the dipstick after 10 minutes.

If the engine oil level is not between min and max:
- ▶ Correct the oil level.

5.14.3 Replace the oil separator filter insert of the crankcase breather — SL107

Make sure that:
- ❑ A new V-ribbed belt is on hand.
- ❑ A new filter insert is on hand.
- ❑ Another person is present.

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❑ Turning device ID no. 10123791 is available.

WARNING
Rotating parts!
Risk of injury! Can cause serious injuries.

▶ Turn the Diesel engine off.

▶ Secure the engine against unexpected starting.

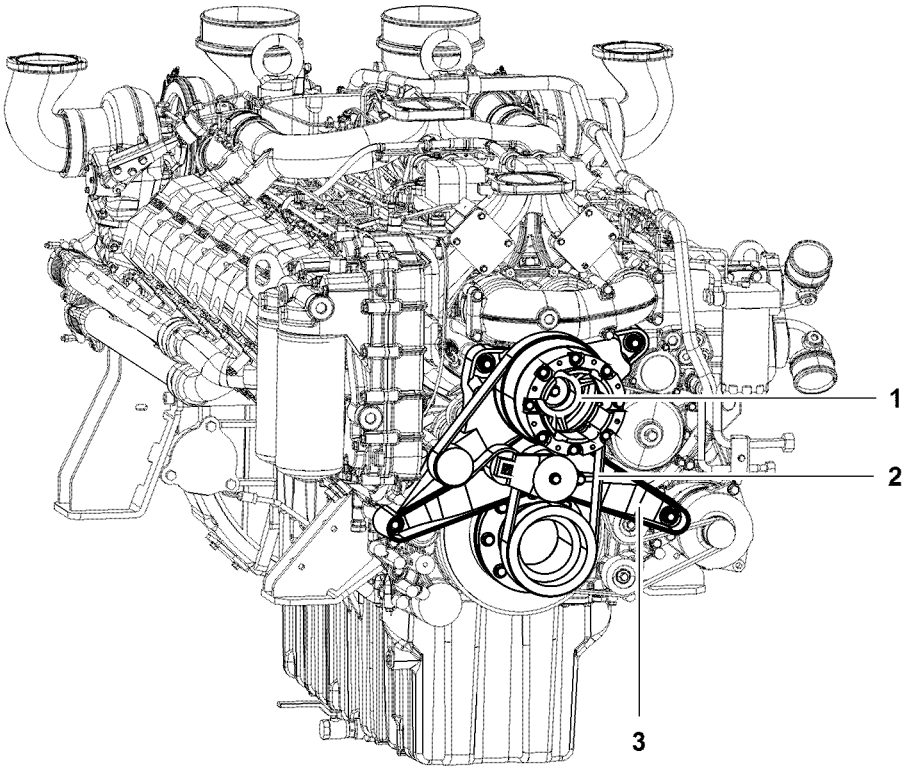

Fig. 55: V-ribbed belt drive

▶ Remove fan from the fan drive **1**. See the generator set's operating manual.

▶ Remove the V-ribbed belt (fan) **2**. (For the procedure, please refer to the chapter "Check state of fan drive belt drive, replace if necessary".)

▶ Dismantle the bracket **3**. (Please refer to the chapter on "Changing the crankcase breather belt" for the procedure.)

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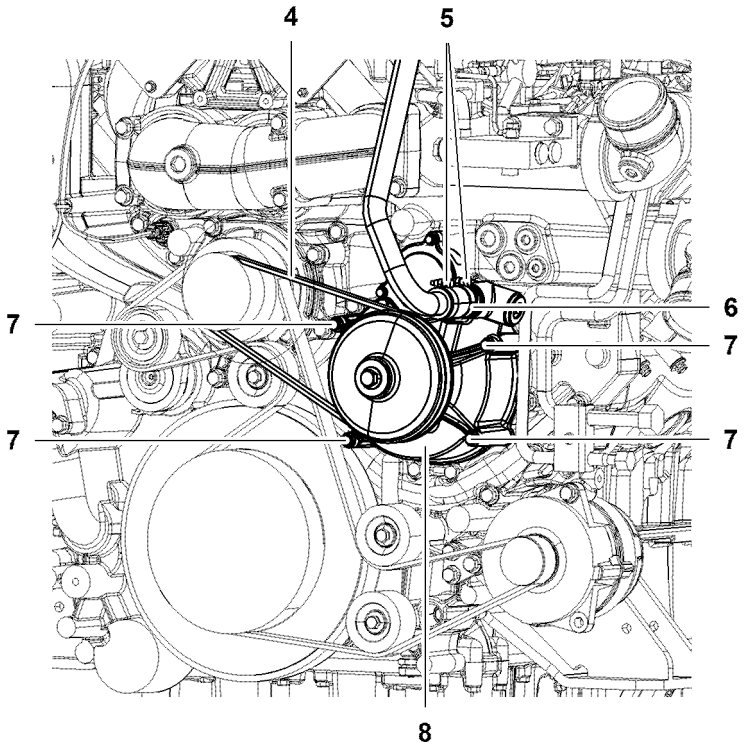

Fig. 56: Crankcase breather

While another person operates the turning device,

- ▶ Remove the V-ribbed belt (crankcase ventilation) **4**.
- ▶ Loosen hose clips **5**.
- ▶ Remove line **6**.
- ▶ Release hex screws **7** (M8 8.8).
- ▶ Remove the crankcase ventilation **8**.

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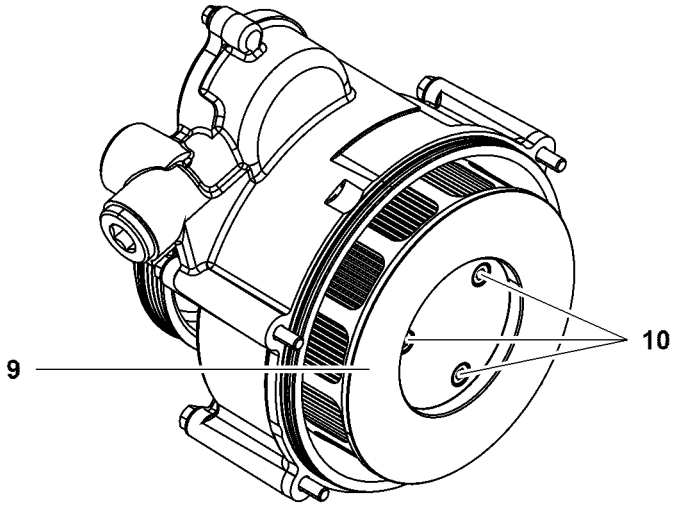

Fig. 57: Filter insert

- ▶ Release socket head screws **10** (M8 10.9).
- ▶ Remove filter insert **9**.
- ▶ Dispose of filter insert **9** (observe country-specific regulations).
- ▶ Fit the new filter insert **9** and sealing rings.
- ▶ Tighten socket head screws **10** (M8 10.9).
- ▶ Install the crankcase ventilation **8**.
- ▶ Tighten hex screws **7** (M8 8.8).
- ▶ Fasten line **6**.
- ▶ Tighten hose clips **5**.

While another person operates the turning device,

- ▶ lay on new V-ribbed belt (crankcase breather) **4** and ensure it is correctly seated.
- ▶ Install the bracket **3**. (Please refer to the chapter on “Changing the crankcase breather belt” for the procedure.)
- ▶ Mount belt (fan) **2**. (For the procedure, please refer to the chapter “Check state of fan drive belt drive, replace if necessary”.)
- ▶ Mount fan on the fan drive **1**. See the generator set’s operating manual.

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5.14.4 Replace main fuel filter — SL105

Make sure that:
- ❑ A reservoir with the required capacity is ready.
- ❑ The main fuel filter is on hand.
- ❑ Strap wrench or similar tool is on hand.

The main fuel filter is on the left as seen from the flywheel.

WARNING
Open flames!
Injuries, fire and explosion! Can cause injuries or death.

- ▶ Avoid open flames or other ignition sources when performing maintenance or inspection work on the fuel system.
- ▶ Perform maintenance and inspection work only when the Diesel engine has been shut down.

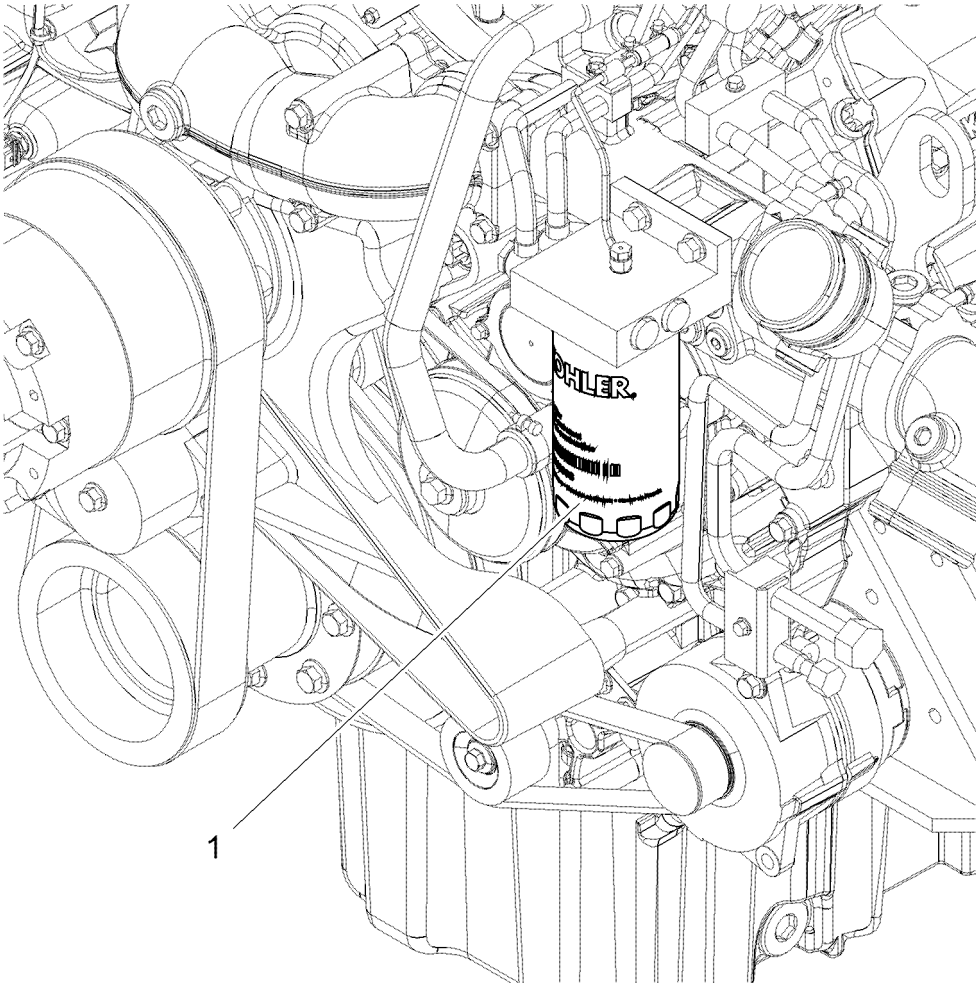

Fig. 58: Main fuel filter

- ▶ Place a reservoir beneath the main fuel filter.
- ▶ Clean the main fuel filter and surrounding area carefully.
- ▶ Loosen the main fuel filter **1** with a strap wrench or similar tool and unscrew.
- ▶ Dispose of used main fuel filter (observe country-specific regulations).

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▶ Check that the filter module is clean and make sure that the thread adapter fits firmly in the filter module.

If the filter module is dirty:
▶ Clean filter module.

Information
Dirt!
Can destroy the common rail system.

▶ Make sure that no dirt enters the clean side of the filter.

▶ Leave the residual diesel fuel in the filter housing.

▶ Never reuse a main fuel filter after it has been used once.

▶ Pay attention to the special instructions for working on the common rail system, see the “Safety” chapter.

▶ Lightly oil the sealing ring on the main fuel filter. (Use engine oil.)

▶ Screw on new main fuel filter until the sealing ring contacts the filter module.

▶ Tighten main fuel filter by hand 3/4 of a revolution.

▶ Vent fuel system.

5.14.5 Replace the primary fuel filter — SL106

Make sure that:
❑ A reservoir with the required capacity is ready.
❑ A primary fuel filter insert is on hand.

The primary fuel filter with water trap and manual fuel feed pump is at some distance from the diesel engine and is mounted differently depending on the device design.

See the generator sets' operating manual for the procedure.

WARNING
Open flames!
Injuries, fire and explosion! Can cause injuries or death.

▶ Avoid open flames or other ignition sources when performing maintenance or inspection work on the fuel system.

▶ Perform maintenance and inspection work only when the Diesel engine has been shut down.

5.14.6 Take coolant sample and perform coolant analysis — SL120

CAUTION
Hot coolant!
Risk of burns! Can cause injuries.

▶ Turn off engine and let it cool down.

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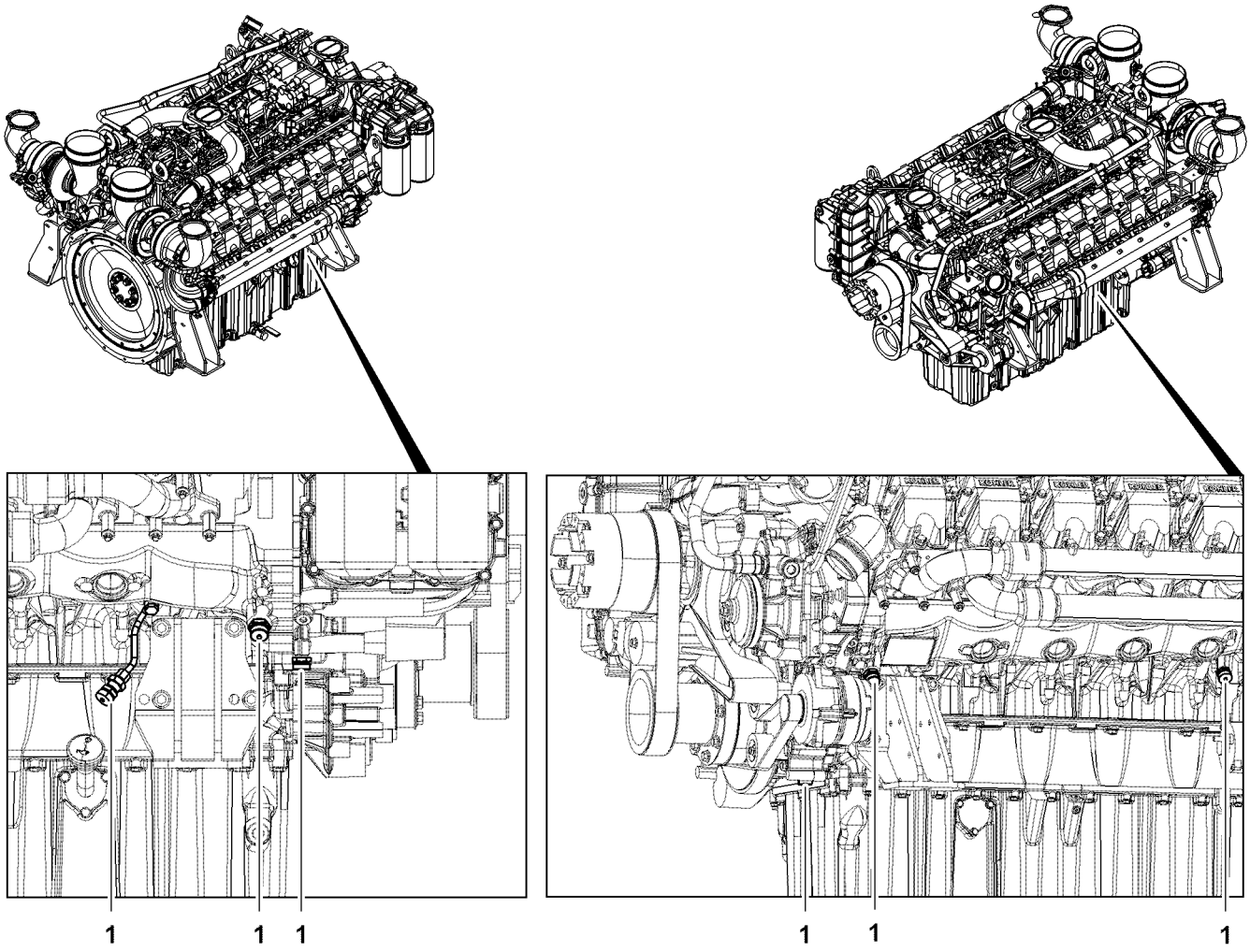

Fig. 59: Coolant sampling point

▶ See generator set manual for procedure to take coolant sample.

5.14.7 Check state of fan drive belt drive and replace if necessary — SL118

Damage to the V-ribbed belt includes:
– Broken ribs
– Rubber nodules in the base of the belt
– Dirt and/or stone deposits
– Ribs broken off the base of the belt
– Transverse cracks on the back
– Transverse cracks in several ribs

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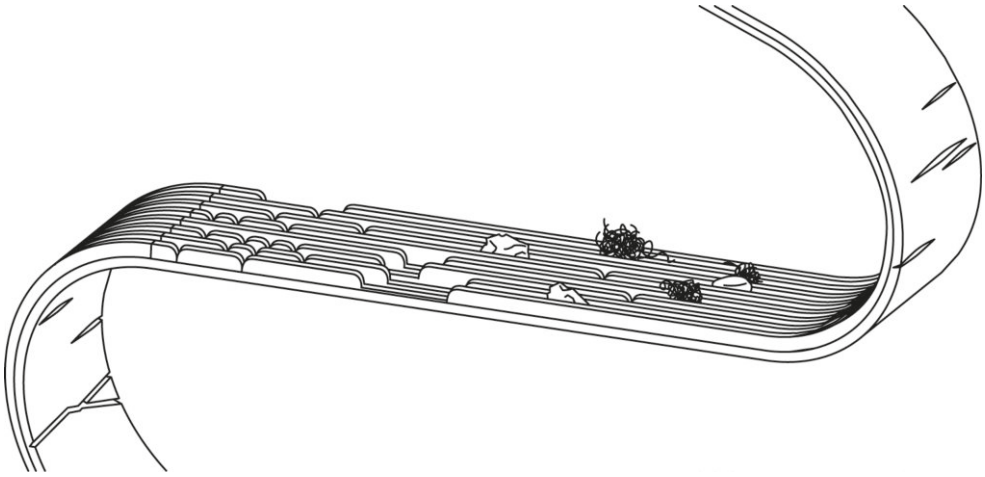

Fig. 60: Damage to the V-ribbed belt

The belt attachment is self-tensioning and maintenance-free.

Checking the V-ribbed belt

WARNING
Rotating parts!
Risk of injury! Can cause serious injuries.

▶ Turn the Diesel engine off.

▶ Secure the engine against unexpected starting.

▶ Check the belt for damage.

▶ Check that the belt pulleys and tightening roller are in perfect working order and check their play (for example, worn out bearings on the tightening roller or tread wear on the belt pulleys).
  ▷ Replace the damaged parts. Please contact the nearest authorized Kohler Co. customer service.

Replacing the belt

Make sure that:
❑ A new belt is on hand.
❑ An Allen key set with lever is at hand.

WARNING
Rotating parts!
Risk of injury! Can cause serious injuries.

▶ Turn the Diesel engine off.

▶ Secure the engine against unexpected starting.

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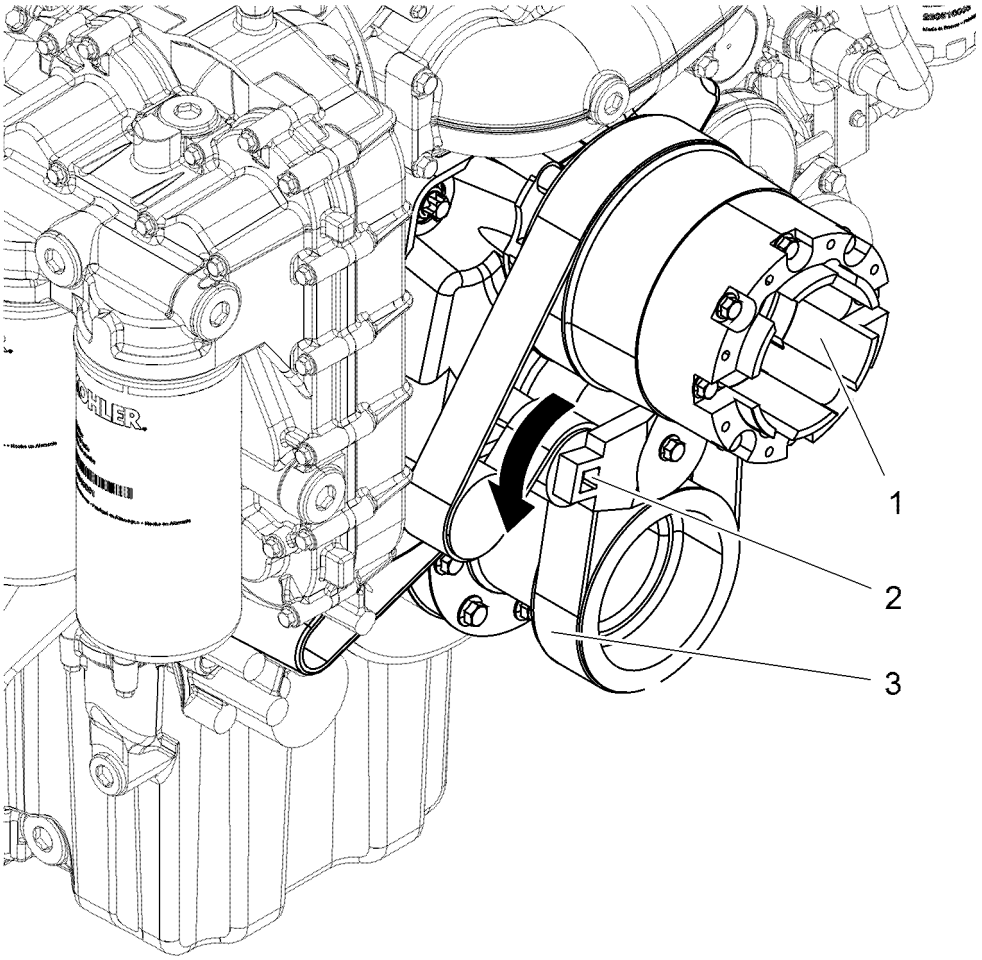

Fig. 61: V-ribbed belt drive

- ▶ Remove fan from the fan drive **1**. See the generator set's operating manual.
- ▶ Insert a 3/4" socket wrench transition piece with lever on the tensioning pulley screw **2**(tensioning pulley screw has a left-handed thread).
- ▶ Pivot the tensioning device back in a clockwise direction against the spring force up to the limit stop.
- ▶ Remove the V-ribbed belt **3**.
- ▶ Check that the belt pulleys and tensioning device are in perfect working order and check their play (for example, tread wear on the belt pulleys).
  ▷ Replace the damaged parts.
- ▶ With the tightening device pivoted back, place new V-ribbed belt on all belt pulleys and tightening roller, making sure that it is properly seated.
- ▶ Mount fan on the fan drive **1**. See the generator set's operating manual.

5.14.8 Changing the crankcase breather V-ribbed belt — SL117

Damage to the V-ribbed belt includes:
– Broken ribs
– Rubber nodules in the base of the belt
– Dirt and/or stone deposits

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– Ribs broken off the base of the belt
– Transverse cracks on the back
– Transverse cracks in several ribs

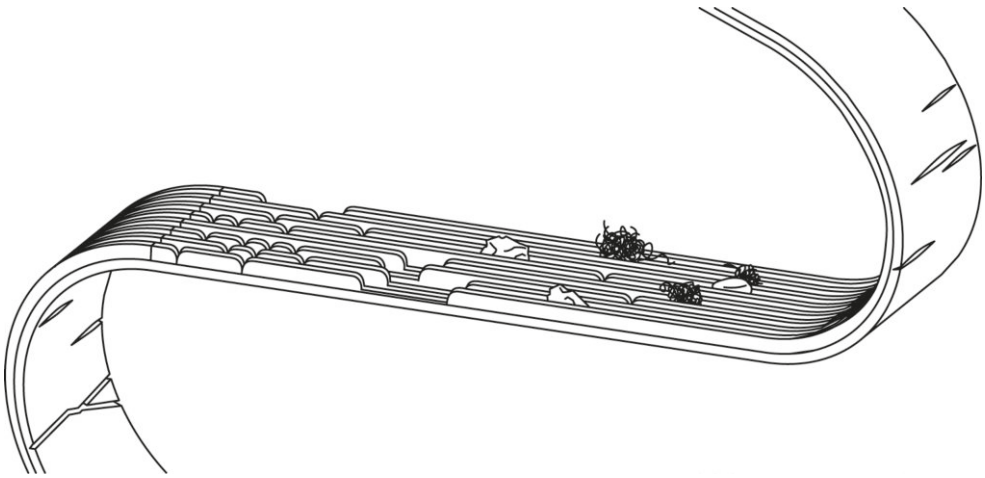

Fig. 62: Damage to the V-ribbed belt

The belt attachment is self-tensioning and maintenance-free.

Replacing the V-ribbed belt

Make sure that:
❑ A new V-ribbed belt is on hand.
❑ Turning device ID no. 10123791 is available.
❑ Another person is present.

WARNING
Rotating parts!
Risk of injury! Can cause serious injuries.

▶ Turn the Diesel engine off.

▶ Secure the engine against unexpected starting.

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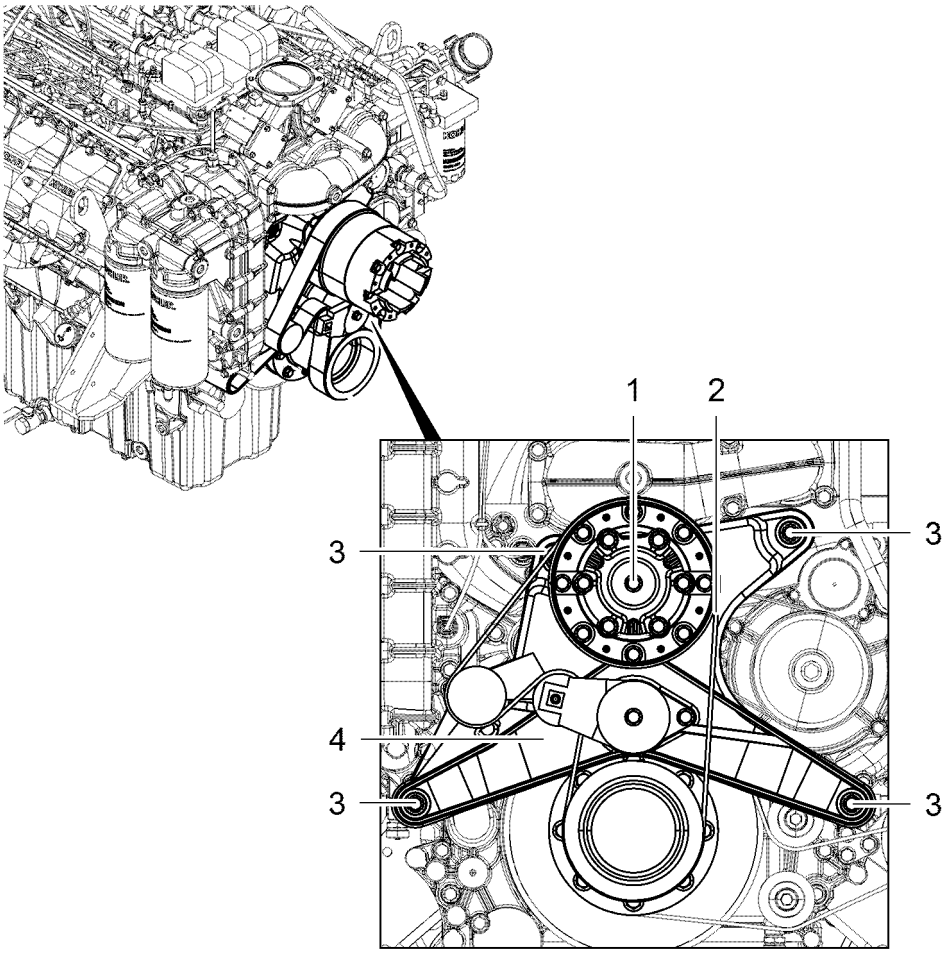

Fig. 63: V-ribbed belt drive

- ▶ Remove fan from the fan drive **1**. See the generator set's operating manual.
- ▶ Remove the V-ribbed belt (fan) **2**. (For the procedure, please refer to the chapter "Check state of fan drive belt drive, replace if necessary".)

Procedure for removing the fan drive assembly **4**:

- ▶ Loosen external hexalobular screws **3** (M18 10.9 E24).
- ▶ Remove fan drive assembly **4**.

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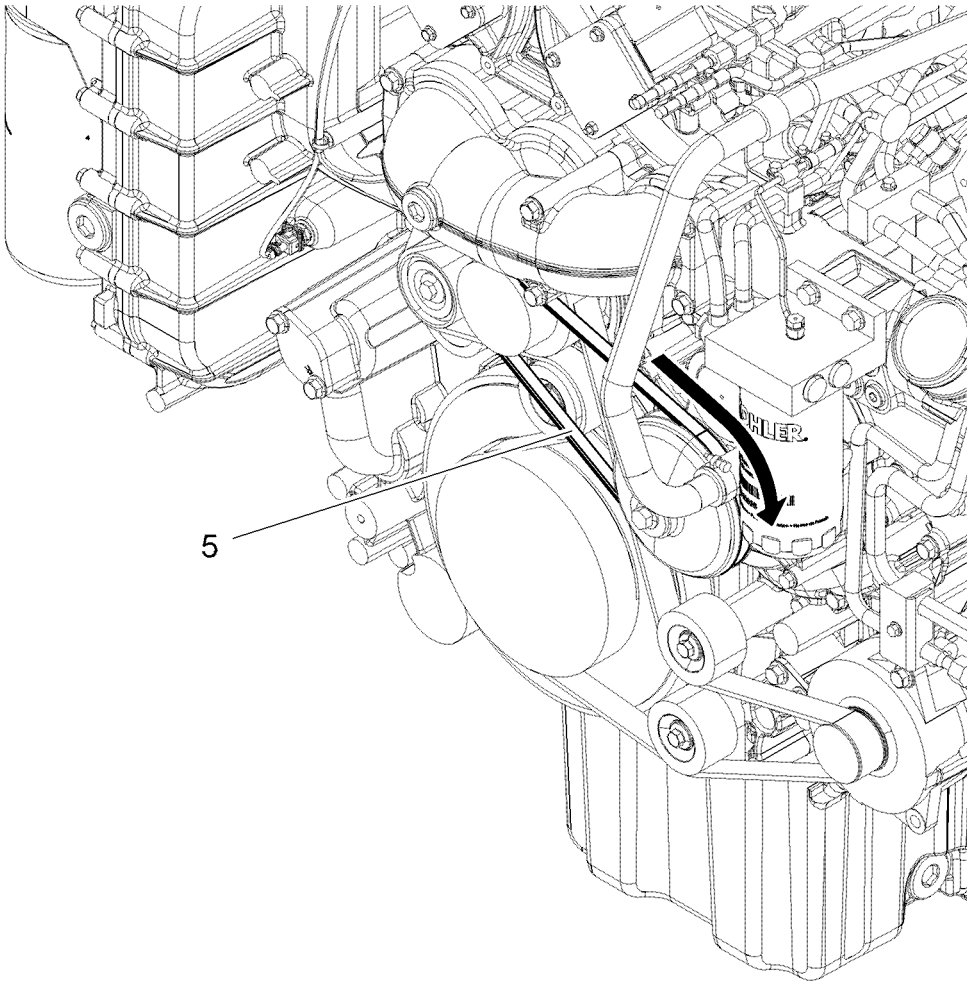

Fig. 64

While another person operates the turning device,
▶ Remove the V-ribbed belt (crankcase ventilation) **5**.

Perform maintenance work “change oil separator filter insert of the crankcase breather”.

While another person operates the turning device,
▶ fit the new V-ribbed belt, making sure that it is properly seated.

Procedure for mounting the fan drive assembly **4**:

▶ Mount fan drive assembly **4**.

▶ Tighten external hexalobular screws **3** (M18 10.9 E24).

Tightening instructions for external hexalobular screws (M18 10.9 E24)	
Step	Torque
1.	125 Nm
	92 ft lb
2.	250 Nm
	184 ft lb

Tab. 32: Tightening instructions

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▶ Mount belt (fan) **2**. (For the procedure, please refer to the chapter “Check state of fan drive belt drive, replace if necessary”.)

▶ Mount fan on the fan drive **1**. See the generator set’s operating manual.

5.14.9 Checking and replacing the water pump belt drive and battery charging alternator — SL109

Damage to the V-ribbed belt includes:
– Broken ribs
– Rubber nodules in the base of the belt
– Dirt and/or stone deposits
– Ribs broken off the base of the belt
– Transverse cracks on the back
– Transverse cracks in several ribs

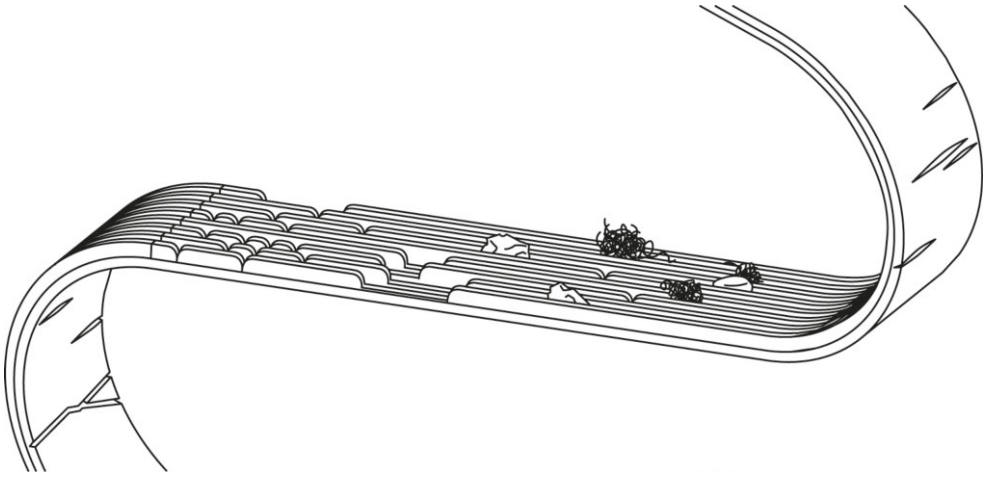

Fig. 65: Damage to the V-ribbed belt

The belt attachment is self-tensioning and maintenance-free.

Replacing the V-ribbed belt

Make sure that:
❑ A new V-ribbed belt is on hand.
❑ Another person is present.
❑ Turning device ID no. 10123791 is available.

WARNING
Rotating parts!
Risk of injury! Can cause serious injuries.

▶ Turn the Diesel engine off.

▶ Secure the engine against unexpected starting.

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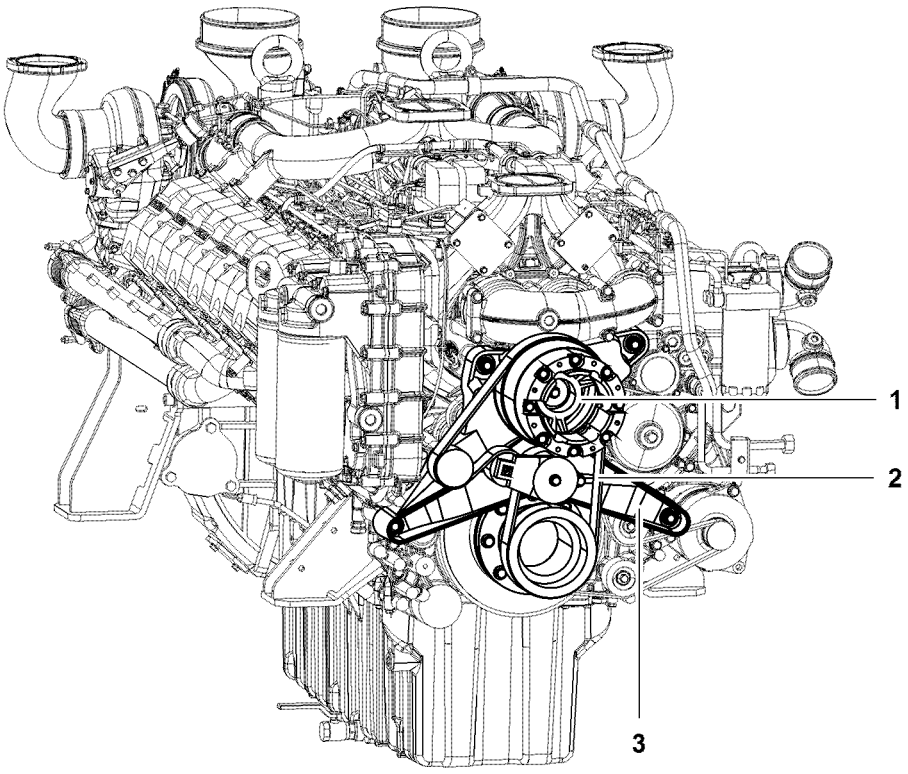

Fig. 66: V-ribbed belt drive

- ▶ Remove fan from fan drive **1**, see the generator set's operating manual.
- ▶ Remove the V-ribbed belt (fan) **2**. (For the procedure, please refer to the chapter "Check state of fan drive belt drive, replace if necessary".)
- ▶ Dismantle the bracket **3**. (Please refer to the chapter on "Changing the crankcase breather belt" for the procedure.)

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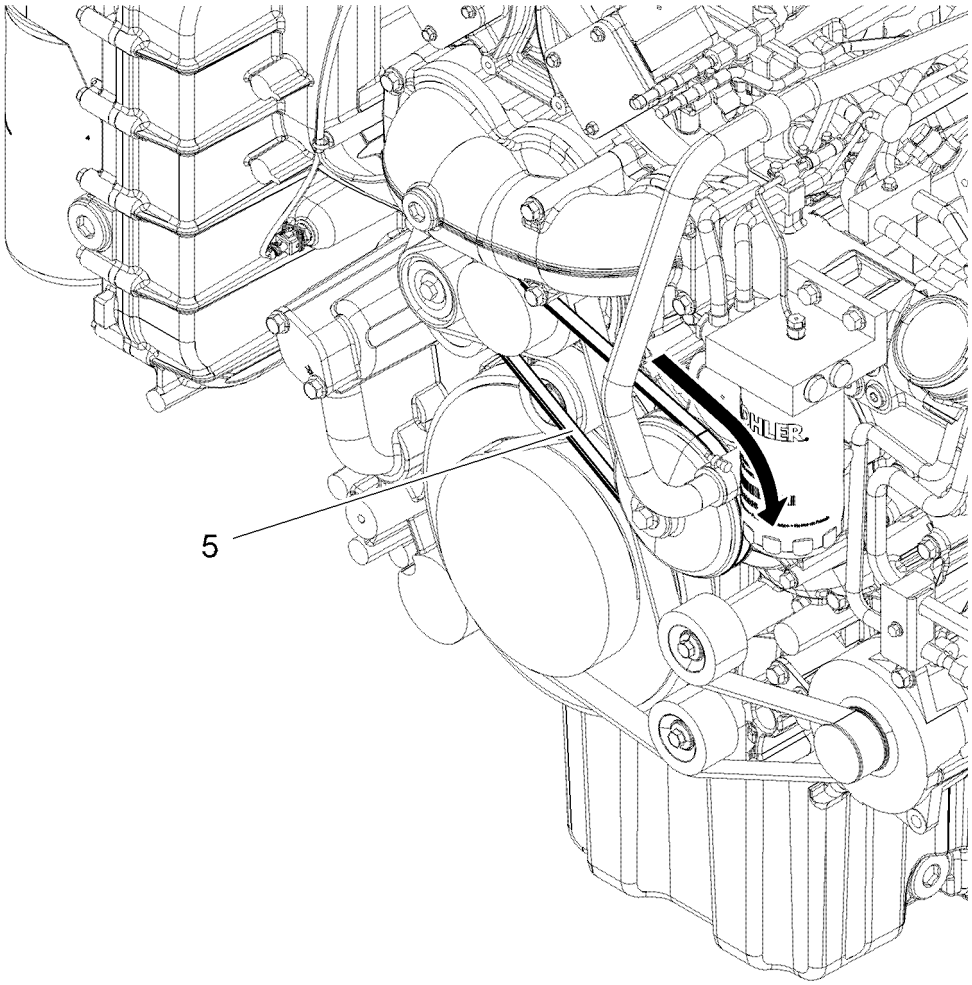

Fig. 67

While another person operates the turning device,

▶ Remove the V-ribbed belt (crankcase ventilation) **5**.

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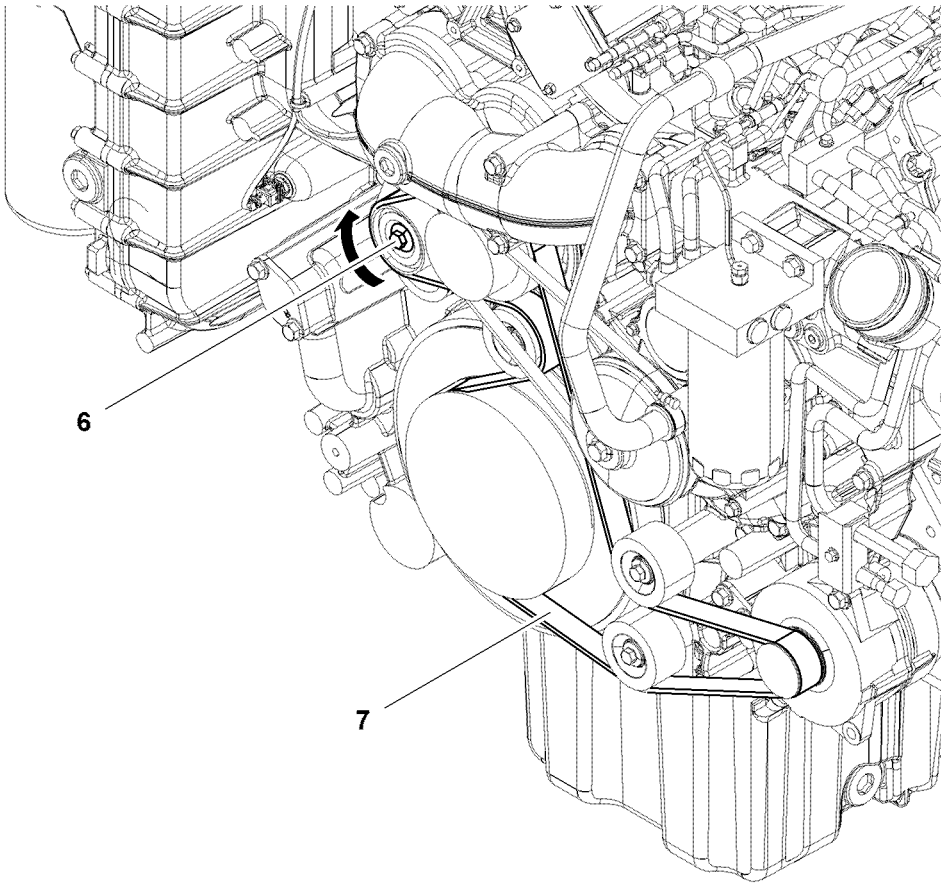

Fig. 68

- ▶ Put a hexagon Allen key insert size 13 mm with lever on the tensioning pulley screw **6** (the tensioning pulley screw has a left-handed thread).
- ▶ Pivot the tensioning device back in a clockwise direction against the spring force up to the limit stop.
- ▶ Remove the V-ribbed belt (water pump and battery charging alternator) **7**.
- ▶ Check that the belt pulleys and tightening roller are in perfect working order and check their play (for example, worn out bearings on the tightening roller or tread wear on the belt pulleys).
  - ▷ Replace the damaged parts. Please contact the nearest authorized Kohler Co. customer service. Refer to the chapter on “Service Assistance”.
- ▶ With the tightening device pivoted back, place new V-ribbed belt on all belt pulleys and tightening roller, making sure that it is properly seated.

While another person operates the turning device,

- ▶ Mount the V-ribbed belt (crankcase ventilation) **5**. (Please refer to the chapter on “Changing the crankcase breather belt” for the procedure.)
- ▶ Mount belt (fan) **2**. (For the procedure, please refer to the chapter “Check state of fan drive belt drive, replace if necessary”.)
- ▶ Mount fan on the fan drive **1**. See the generator set’s operating manual.

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6 Transport and storage

DANGER
Protective atmosphere against damage by oxidation inside the protective film.
Mortal danger, risk of suffocation! Will cause serious injuries or death.

- ▶ Remove and store the protective film only in a well-ventilated area.
- ▶ The protective film may be stored only in areas that are out of the reach of children.

CAUTION
Incorrect waste disposal.
Environmental and health hazard.

- ▶ Pay attention to national and international regulations on the disposal of waste substances.
- ▶ Dispose of all wastes in suitable containers.
- ▶ Store wastes in dedicated storage places.

NOTICE
Incorrect setting down of the Diesel engine.
Engine damage.

- ▶ Do not stand the Diesel engine on the oil sump.
- ▶ Place the Diesel engine on the appropriate fastening pieces.

NOTICE
Incorrect storage.
Damage by oxidation.

- ▶ Store the Diesel engine only in dry places.
- ▶ Do not expose the Diesel engine to great fluctuations in temperature.
- ▶ Remove the transport protection film only shortly before installation.

When the Diesel engine is removed:
- ▶ Cover with a new protective film and observe the climatic conditions for storage.

NOTICE
Storage conditions are part of the device manufacturer.

- ▶ Comply with the standard ISO 6749-1984 for transportation and storage.
- ▶ Please contact the Kohler customer service if anything is unclear.

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NOTICE
The equipment owner is responsible for compliance with the maximum floor load.

- ▶ Check the maximum floor load before setting the Diesel engine down on the floor.
- ▶ The weight data can be found in the technical data sheet.

Information

- ▶ Use only preservation media approved by Kohler.

6.1 Fastening during transport

Fig. 69: Example of fastening during transport

DANGER
Mortal danger due to instability during transportation of the Diesel engine. The engine can come loose during transportation.
Mortal danger! Will cause serious injuries or death.

- ▶ Transport the Diesel engine only with the transport stand.
- ▶ The transport stand used must be in perfect technical condition.
- ▶ Secure the transport stand against slipping and toppling over in every direction.
- ▶ Pay attention to the center of gravity.

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DANGER
Mortal danger due to the Diesel engine falling down/over. Incorrect handling during loading/unloading of the Diesel engine.
Mortal danger! Will cause serious injuries or death.

- ▶ The Diesel engine may only be loaded/unloaded by suitably trained and authorized personnel.
- ▶ If a crane or forklift truck is used this must be designed for the weight to be lifted.
- ▶ If a crane is used, please use the hoisting beam.
- ▶ There may be no persons within the danger zones of the Diesel engine during loading and unloading.
- ▶ Pay attention to the center of gravity.

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6.2 Wooden transport stand

Fig. 70: Wooden transport stand

DANGER
Mortal danger due to instability during transportation of the Diesel engine. The engine can come loose during transportation.
Mortal danger! Will cause serious injuries or death.

▶ The Diesel engine must be securely bolted to the transport stand.

Information

▶ Wooden transport stands do not have to be returned to Kohler Co. Keep for later use.

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6.3 Steel transport stand

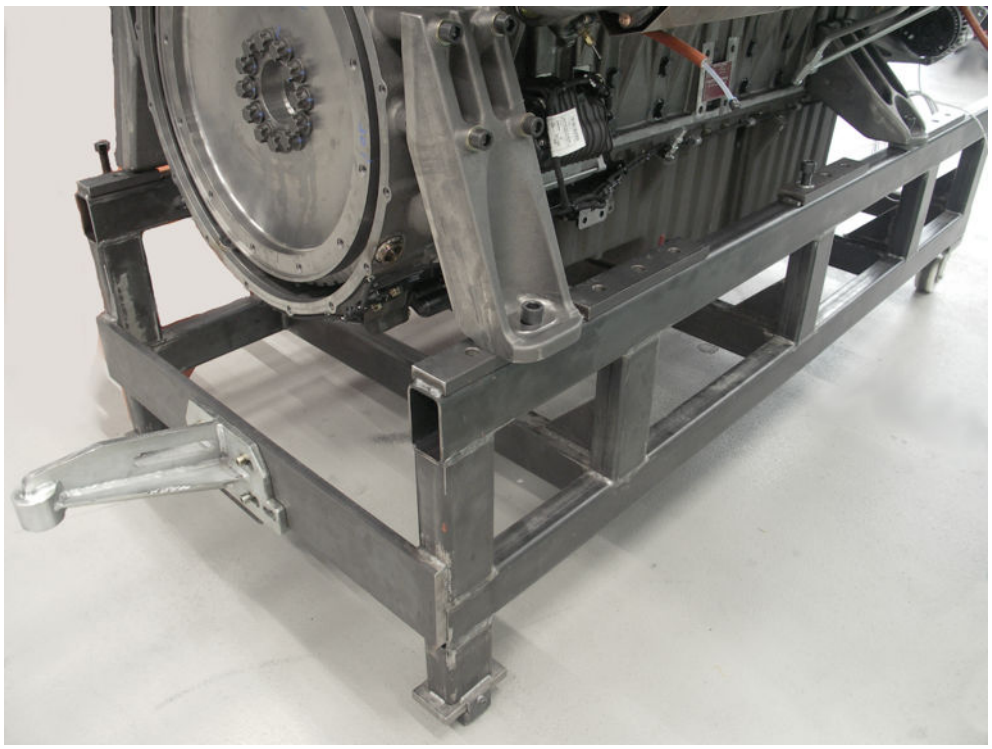

Fig. 71: Steel transport stand

DANGER
Mortal danger due to instability during transportation of the Diesel engine. The engine can come loose during transportation.
Mortal danger! Will cause serious injuries or death.

▶ The Diesel engine must be securely bolted to the transport stand.

Information

▶ Return the steel transport stand to Kohler Co.

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6.4 Suspension device

DANGER
Falling load.
Mortal danger! Will cause serious injuries or death.

- ▶ Pay attention to the maximum weight for lifting points!
- ▶ Observe a maximum deviation of 10° between the perpendicular and the engine axis.
- ▶ Use the Kohler lifting device.
- ▶ Dismantle the generator or other add-on parts before lifting the Diesel engine.
- ▶ Pay attention to the safety instructions / warnings in the Operating Manual for the hoisting beam!
- ▶ Do not work under suspended loads!

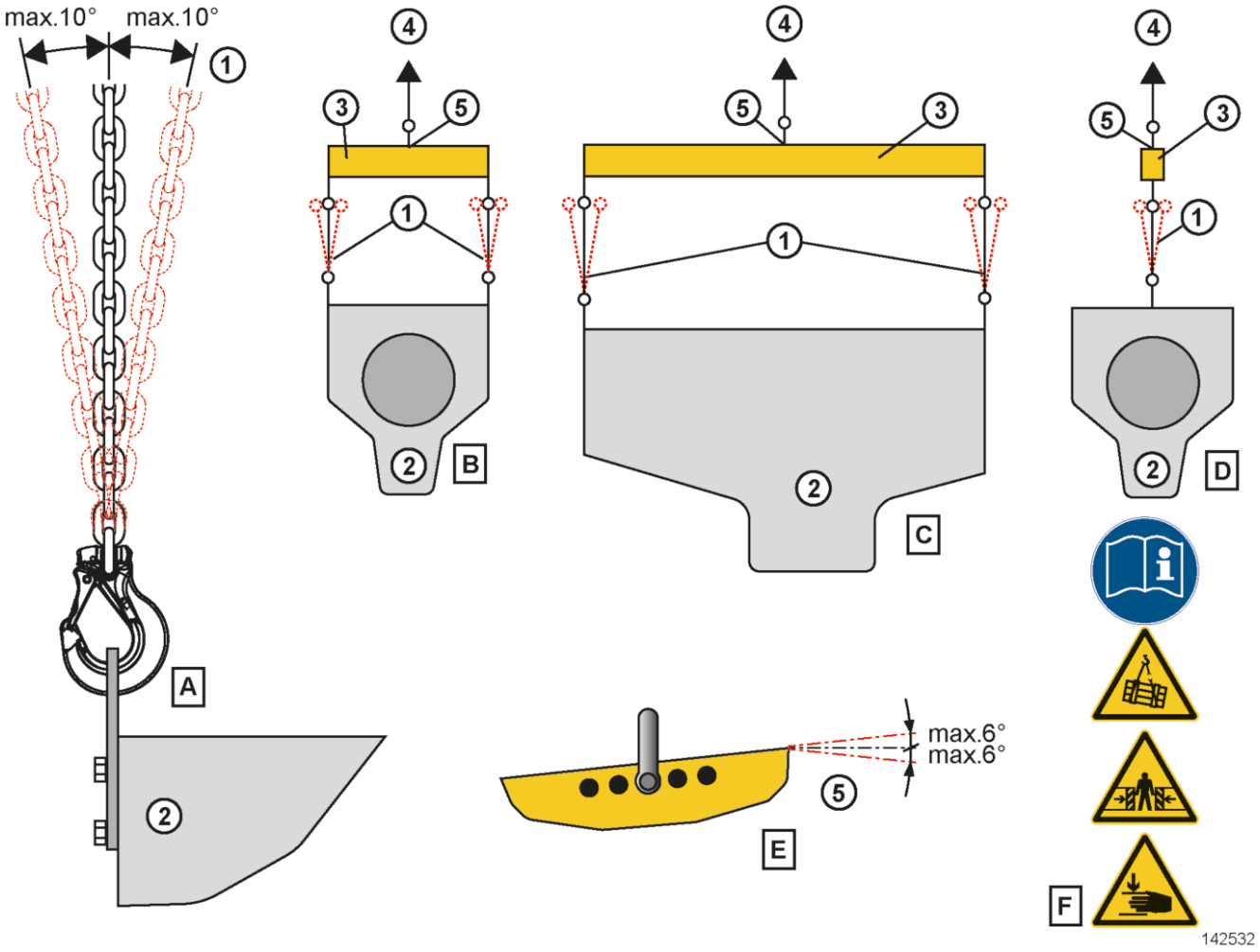

Fig. 72: Suspension device

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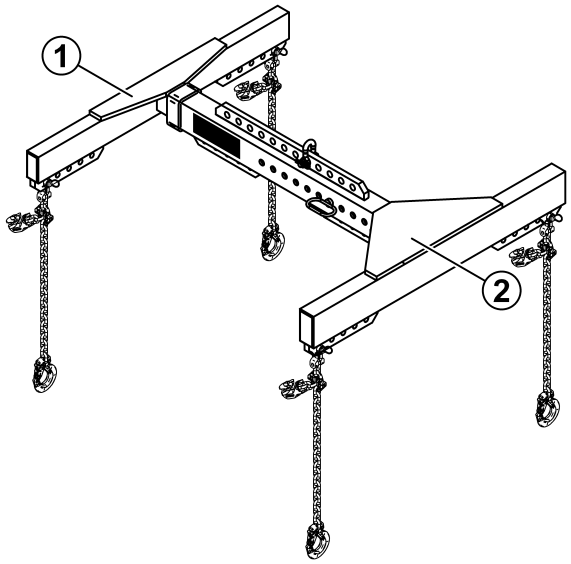

Fig. 73: Hoisting beam

1 Hoisting beam ID no. 10815480 (for 3-point suspension)

2 Receiving tube ID no. 11213360 (for 4-point suspension)

Information

▶ Please read and observe the safety instructions in the system description before commissioning the hoisting beam.

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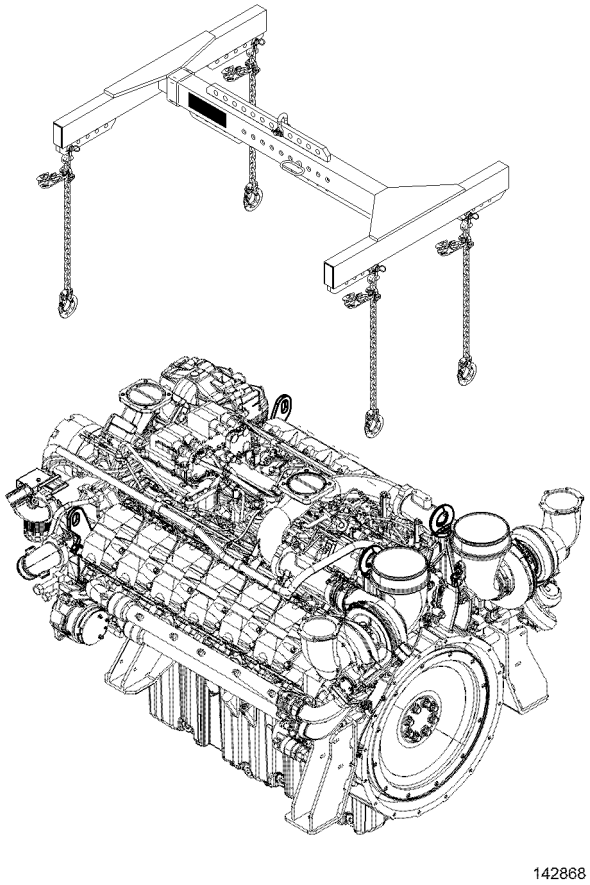

Fig. 74: Lifting lugs for 4-point suspension

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6.5 Storage

6.6.1 Storage for up to 6 months

The Diesel engine is preserved from the shipping date; under normal storage conditions in a dry, well ventilated place, the conservation protection normally lasts for 6 months.

If the Diesel engine is covered with an additional foil hood, it can also be stored outdoors for up to one month.

The cover must be waterproof and rest loosely against the Diesel engine so that air can circulate around the Diesel engine, thus preventing the formation of any condensation.

A shorter conservation protection period can be expected if these measures are ignored and the conserved Diesel engine is exposed to less favorable conditions (situated outdoors for longer periods of time or stored in damp, unventilated locations etc.).

6.7.1 Storage for over 6 and up to 24 months

Please contact Field Service if planning storage over 6 months up to 24 months.

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Storage

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7.1 Standard torques

7.1.1 Standard torques for screw connections

For hex screws in accordance with:

– ISO 4014
– ISO 4017
– ISO 8765
– ISO 8676

For socket head screws in accordance with: ISO 4762.

For hexalobular internal screws (Torx screws) in accordance with: DIN 34800.

Values for a mean friction coefficient of μ = 0.12.

Standard thread	Nm	ft lb	Nm	ft lb	Nm	ft lb
	8.8		10.9		12.9	
M 4	3	2.2	4	3	5	3.7
M 5	6	4.4	8	6	10	7.4
M 6	10	7.4	14	10	17	12
M 7	16	12	23	17	27	20
M 8	23	17	34	25	40	29
M 10	46	34	68	50	79	58
M 12	79	58	117	86	135	100
M 14	125	92	185	140	215	160
M 16	195	140	280	210	330	240
M 18	280	210	390	290	460	340
M 20	390	290	560	410	650	480
M 22	530	390	750	550	880	650
M 24	670	490	960	710	1120	830
M 27	1000	740	1400	1030	1650	1220
M 30	1350	1000	1900	1400	2250	1660
M 33	1850	1360	2600	1920	3000	2210
M 36	2350	1730	3300	2430	3900	2880
M 39	3000	2210	4300	3170	5100	3770

Tab. 33

Fine thread	Nm	ft lb	Nm	ft lb	Nm	ft lb
	8.8		10.9		12.9	
M 8 x 1	25	18	36	27	43	32
M 9 x 1	36	27	53	39	62	46

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Fine thread	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 10 x 1	52	38	76	56	89	66
M 10 x 1.25	49	36	72	53	84	62
M 12 x 1.25	87	64	125	92	150	110
M 12 x 1.5	83	61	122	90	145	107
M 14 x 1.5	135	100	200	150	235	173
M 16 x 1.5	205	150	300	220	360	2 70
M 18 x 1.5	310	230	440	320	520	380
M 18 x 2	290	210	420	310	490	360
M 20 x 1.5	430	320	620	460	720	530
M 22 x 1.5	580	430	820	600	960	710
M 24 x 1.5	760	560	1090	800	1270	940
M 24 x 2	730	540	1040	770	1220	900
M 27 x 1.5	1110	820	1580	1170	1850	1370
M 27 x 2	1070	790	1500	1110	1800	1330
M 30 x 1.5	1540	1140	2190	1610	2560	1890
M 30 x 2	1490	1100	2120	1560	2480	1830
M 33 x 1.5	2050	1510	2920	2150	3420	2520
M 33 x 2	2000	1470	2800	2060	3300	2430
M 36 x 1.5	2680	1980	3820	2820	4470	3300
M 36 x 3	2500	1840	3500	2580	4100	3020
M 39 x 1.5	3430	2530	4890	3610	5720	4220
M 39 x 3	3200	2360	4600	3390	5300	3910

Tab. 34

7.1.2 Standard torques for screw plugs and hollow screws

For hollow screws in accordance with DIN 7643 with copper sealing ring in accordance with DIN 7603

Screw plug in accordance with DIN 910 with copper sealing ring in accordance with DIN 7603

Screw plug in accordance with DIN 908 with copper sealing ring in accordance with DIN 7603.

Thread	Nm	ft lb	Thread	Nm	ft lb
M 6 x 1	7	5.2	**M 36 x 1.5**	155	110
M 8 x 1	7.5	5.5	**M 36 x 2**	155	110
M 8 x 1.5	7.5	5.5	**M 38 x 1.5**	171	130
M 10 x 1	15	11	**M 38 x 2**	215	160
M 10 x 1.25	15	11	**M 42 x 1.5**	240	180
M 12 x 1.5	20	15	**M 42 x 2**	240	180

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Thread	Nm	ft lb	Thread	Nm	ft lb
M 14 x 1.5	27	20	**M 45 x 1.5**	270	200
M 16 x 1.5	37	27	**M 45 x 2**	270	200
M 18 x 1.5	40	30	**M 48 x 1.5**	300	220
M 20 x 1.5	47	35	**M 48x 2**	300	220
M 22 x 1.5	57	42	**M 52 x 1.5**	380	280
M 24 x 1.5	68	50	**M 52 x 2**	380	280
M 26 x 1.5	75	55	**M 56 x 2**	430	320
M 27 x 2	87	64	**M 60 x 2**	510	380
M 30 x 1.5	115	85	**M 64 x 2**	570	420
M 30 x 2	115	85	**M 65 x 2**	620	460
M 33 x 2	120	88			

Tab. 35

7.1.3 Standard torques for flange joints

Information

- ▶ Tightening torques apply for mating material: steel.
- ▶ Tolerance for the tightening torques specified in the table: + 10 %.
- ▶ Oil the screw-in thread with engine oil before screwing in.

Metric flange joints, series L (light)

Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal		Form F with 0-ring	
		Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**M 10 x 1.0**	9	6.6	18	13	18	13	15	11
8	**M 12 x 1.5**	20	15	30	22	25	18	25	18
10	**M 14 x 1.5**	35	26	45	33	45	33	35	26
12	**M 16 x 1.5**	45	33	65	48	55	41	40	29
15	**M 18 x 1.5**	55	41	80	59	70	52	45	33
18	**M 22 x 1.5**	65	48	140	100	125	92	60	44
22	**M 26 x 1.5**	90	66	190	140	180	130	100	74
28	**M 33 x 2.0**	150	110	340	250	310	230	160	120
35	**M 42 x 2.0**	240	180	500	370	450	330	210	150
42	**M 48 x 2.0**	290	210	630	460	540	400	260	190

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Standard torques

Tube diameter X	Thread Y	WH		TH		SWVE	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**M 10 x 1.0**	18	13	18	13	18	13
8	**M 12 x 1.5**	45	33	45	33	35	26
10	**M 14 x 1.5**	55	41	55	41	50	37
12	**M 16 x 1.5**	80	59	80	59	60	44
15	**M 18 x 1.5**	100	74	100	74	80	59
18	**M 22 x 1.5**	140	100	140	100	120	89
22	**M 26 x 1.5**	320	240	320	240	130	96
28	**M 33 x 2.0**	360	270	360	270		
35	**M 42 x 2.0**	540	400	540	400		
42	**M 48 x 2.0**	700	520	700	520		

Tab. 37

Metric flange joints, series S (heavy)

Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**M 12 x 1.5**	20	15	35	26	40	29
8	**M 14 x 1.5**	35	26	55	41	40	29
10	**M 16 x 1.5**	45	33	70	52	70	55
12	**M 18 x 1.5**	55	41	110	81	90	66
14	**M 20 x 1.5**	55	41	150	110	125	92
16	**M 22 x 1.5**	65	48	170	120	135	100
20	**M 27 x 2.0**	90	66	270	200	180	130
25	**M 33 x 2.0**	150	110	410	300	310	230
30	**M 42 x 2.0**	240	180	540	400	450	330
38	**M 48 x 2.0**	290	210	700	520	540	400

Tab. 38

Tube diameter X	Thread Y	WH		TH		SWVE	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**M 12 x 1.5**	45	33	45	33	35	26
8	**M 14 x 1.5**	55	41	55	41	50	37
10	**M 16 x 1.5**	80	59	80	59	60	44
12	**M 18 x 1.5**	100	74	100	74	80	59
14	**M 20 x 1.5**	125	92	125	92	110	81
16	**M 22 x 1.5**	135	100	135	100	120	88
20	**M 27 x 2.0**	320	240	320	240	135	100

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Tube diameter X	Thread Y	WH		TH		SWVE	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
25	**M 33 x 2.0**	360	270	360	270		
30	**M 42 x 2.0**	540	400	540	400		
38	**M 48 x 2.0**	700	520	700	520		

Tab. 39

Imperial flange joints, series L (light)

Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**G 1/8A**	9	6.6	18	13	18	13
8	**G 1/4A**	35	26	35	26	35	26
10	**G 1/4A**	35	26	35	26	35	26
12	**G 3/8A**	45	33	70	52	70	52
15	**G 1/2A**	65	48	140	100	90	66
18	**G 1/2A**	65	48	100	75	90	66
22	**G 3/4A**	90	66	180	130	180	130
28	**G 1A**	150	110	330	240	310	230
35	**G 1 1/4A**	240	180	540	400	450	330
42	**G 1 1/2A**	290	210	630	470	540	400

Tab. 40

Tube diameter X	Thread Y	WH		TH		SWVE	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**G 1/8A**	18	13	18	13	18	13
8	**G 1/4A**	45	33	45	33	40	29
10	**G 1/4A**	45	33	45	33	40	29
12	**G 3/8A**	70	52	70	52	65	48
15	**G 1/2A**	120	88	120	88	90	66
18	**G 1/2A**	120	88	120	88	90	66
22	**G 3/4A**	230	170	230	170	125	92
28	**G 1A**	320	240	320	240		
35	**G 1 1/4A**	540	400	540	400		
42	**G 1 1/2A**	700	520	700	520		

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Imperial flange joints, series S (heavy)

Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**G 1/4A**	35	26	55	41	40	29
8	**G 1/4A**	35	26	55	41	40	29
10	**G 3/8A**	45	33	90	66	80	59
12	**G 3/8A**	45	33	90	66	80	59
14	**G 1/2A**	65	48	150	110	115	85
16	**G 1/2A**	65	48	130	96	115	85
20	**G 3/4A**	90	66	270	200	180	130
25	**G 1A**	150	110	340	250	310	230
30	**G 1 1/4A**	240	180	540	400	450	330
38	**G 1 1/2A**	290	210	700	520	540	400

Tab. 42

Tube diameter X	Thread Y	WH		TH		SWVE	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**G 1/4A**	45	33	45	33	40	29
8	**G 1/4A**	45	33	45	33	40	29
10	**G 3/8A**	70	52	70	52	65	48
12	**G 3/8A**	70	52	70	52	65	48
14	**G 1/2A**	120	88	120	88	90	66
16	**G 1/2A**	120	88	120	88	90	66
20	**G 3/4A**	230	170	230	170	125	92
25	**G 1A**	320	240	320	240		
30	**G 1 1/4A**	540	400	540	400		
38	**G 1 1/2A**	700	520	700	520		

Tab. 43

7.1.5 Metric flange joints, series L (light) for aluminum

Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
6	**M 10 x 1.0**	15	11			12	8.8
8	**M 12 x 1.5**						
10	**M 14 x 1.5**	30	22			30	22
12	**M 16 x 1.5**	40	29	40	29	40	29
15	**M 18 x 1.5**						
18	**M 22 x 1.5**	80	59			80	59

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Tube diameter X	Thread Y	Form A with sealing ring		Form B with edge seal		Form E with flat (ED) seal	
		Nm	ft lb	Nm	ft lb	Nm	ft lb
22	**M 26 x 1.5**	80	59			150	111
28	**M 33 x 2.0**						
35	**M 42 x 2.0**						
42	**M 48 x 2.0**						

Tab. 44

7.1.6 Standard torques for cutting ring flange joints

Series	Tube diameter X	Thread Z	Nm	ft lb
LL	**6**	**M 10 × 1**	14	10
L	**6**	**M 12 × 1.5**	14	10
	8	**M 14 × 1.5**	20	15
	10	**M 16 × 1.5**	27-30	20 - 22
	12	**M 18 × 1.5**	60	44
	15	**M 22 × 1.5**	105	77.44
	18	**M 26 × 1.5**	150	110.63
	22	**M 30 × 2**	200	150
	28	**M 36 × 2**	250	180
	35	**M 45 × 2**	450	330
	42	**M 52 × 2**	600	440
S	**16**	**M 24 × 1.5**	150	110
	20	**M 30 × 2**	250	180
	25	**M 36 × 2**	450	330
	30	**M 42 × 2**	600	440
	38	**M 52 × 2**	750	550

Tab. 45

Information

Tighten screw-on connection with set torque.

- ▶ Secure with screw-on connection.
- ▶ Screw on box nut up to clearly noticeable increase in force (without wrench extension).
- ▶ Tighten box nut to aforementioned torque.

7.1.7 Standard torques for Triple Lok® flange joints

Series	Tube diameter X		Thread Z	Nm	ft lb	Nm	ft lb
	mm	inch	UN/UNF	Steel		Stainless steel	

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4	**6**	**1/4**	**7/17-20**	15	11	30	22
5	**8**	**5/16**	**1/2-20**	20	15	40	29
6	**10**	**3/8**	**9/16-18**	30	22	60	44
8	**12**	**1/2**	**3/4-16**	60	44	115	85
10	**14, 15, 16**	**5/8**	**7/8-14**	75	55	145	110
12	**18, 20**	**3/4**	**1 1/16-12**	110	81	180	130
16	**22**	**7/8**	**1 5/16-12**	135	100	225	170
16	**25**	**1**	**1 5/16-12**	175	130	255	190
	28		**1 5/8-12**	260	190	295	220
20	**30, 32**	**1 1/4**	**1 5/8-12**	260	190	295	220
	35		**1 7/8-12**	340	250	345	250
24	**38**	**1 1/2**	**1 7/8-12**	340	250	345	250
28	**42**	**-**	**2 1/4-12**	380	280	400	290
32	**-**	**2**	**2 1/2-12**	450	330	470	350

Tab. 46

Information

Tighten screw-on connection with set torque.

- ▶ Secure with screw-on connection.
- ▶ Screw on box nut up to clearly noticeable increase in force (without wrench extension).
- ▶ Tighten box nut to aforementioned torque.

7.1.8 Standard torques for VSTI screw plugs

Thread	Nm	ft lb	Thread	Nm	ft lb
M 10 x 1	10	7.4	**M 26 x 1.5**	100	74
M 12 x 1.5	20	15	**M 27 x 2**	120	88
M 14 x 1.5	30	22	**R 3/4”**	120	88
M 16 x 1.5	40	29	**M 30 x 1.5**	120	88
M 18 x 1.5	50	37	**M 33 x 2**	200	150
M 20 x 1.5	60	44	**M 38 x 1.5**	280	210
M 22 x 1.5	80	59	**M 42 x 2**	350	260
M 24 x 1.5	90	66	**M 48 x 2**	400	290

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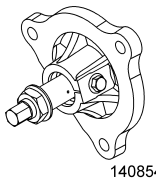
7.2 Special tool

	Description	ID no.	Order number
 **10123791**	TURNING DEVICE	10123791	230610006
	1 HOISTING BEAM	10815480	230610025
	2 RECEIVING TUBE F.4-POINT RETAINER	11213360	230610026

Tab. 48: Special tool with identification number

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7.3 Terms used (glossary)

Term	Explanation
Ready for use	The engine is ready for starting.
Emission optimized	Exhaust gas optimized
Fuel optimized	Fuel optimized
Device manufacturer	The manufacturer of the overall plant in which the Diesel engine is installed.
In operation	The engine is running.
Safety zone	Designated area around the engine, access to which in the various operating modes is described in the chapter on "Operating and maintenance areas".
Maintenance areas	Maintenance areas are the safety zones that have to be accessed for maintenance work and troubleshooting.

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