Operation and Maintenance Manual

(Translation of the original Operation and Maintenance Manual)

KD18L06

From serial number 2021060001

KOHLER®

EN_US
33521059301_0_1
07-2022

KOHLER®

EMISSION CONTROL WARRANTY STATEMENT (USA)

For the United States only

EMISSION WARRANTY

Kohler warrants to the initial and subsequent owners of a stationary equipment certified diesel engine that such engine is:

- Designed, manufactured and equipped to conform at the time of sale with all applicable emission regulations adopted by the United States Environmental Protection Agency ("EPA") under Section 213 of the Clean Air Act.
- Free from defects in materials and workmanship with respect to the warranted emission control system and components for a period of five (5) years or 3000 hours of total operation by all persons, whichever event occurs first, after date of delivery to the initial owner.

If any warranted part that is scheduled for replacement as required maintenance fails prior to the first scheduled replacement point for that part, that part will be repaired or replaced by Kohler. If a component of the emission control system fails during the warranty period, it will be repaired or replaced under warranty and warranted for the remainder of the warranty period. Kohler will provide the repair or replacement of any component warranted to the stationary equipment engine owner. The warranty period begins on the date the engine (in service) or machine (in production) is delivered to the initial owner, and upon any sale of the engine by such initial owner to a subsequent owner, the warranty period does not restart, but rather the remaining balance of the warranty period transfers to the subsequent owner.

WARRANTED PARTS

The following parts (as equipped) are warranted under this warranty for all Kohler engines:

- Fuel Injection System
- Air Induction System
- Turbocharger System
- Charge Air Cooling System
- Exhaust Gas Recirculation (EGR) System
- EGR Control System
- Exhaust manifold
- Ignition System
- Diesel Particulate Filter System
- Diesel Oxidation Catalyst
- Fuel Additive Devices or Exhaust Aftertreatment Devices
- Selective Catalyst Reduction
- Reductant Containers
- Electronic Control Unit, Sensors, Solenoids, and Wiring Harnesses
- Emission Control Information Label
- Crankcase Ventilation Valves

RESPONSIBILITIES & LIMITATIONS

This warranty is subject to the following conditions.

Kohler's Responsibilities:

In case an emission-related defect is found in a warranted component during the warranty period, Kohler will provide:

- New, remanufactured, or properly repaired components, approved pursuant to applicable regulations, required to correct the defect.
- Reasonable and customary labor as established by Kohler, during normal working hours, required to make the warranted repairs, including labor to remove and install the engine, if so required.
- Parts replaced under this warranty become the property of Kohler.

Owner's Responsibilities:

During the warranty period, the owner of the stationary equipment engine is responsible for:
- Premium or overtime labor costs.
- Costs to investigate engine problems which are not caused by a defect in Kohler's material or workmanship.
- Kohler may deny warranty coverage if the stationary engine or a part thereof has failed due to abuse, neglect, improper maintenance, or unapproved modifications.
- Providing timely notice of a warranted failure to an authorized Kohler Dealer, and to promptly make the equipment or engine available to the Kohler Dealer for repair.
- Proper scheduled and preventive maintenance as outlined in the Operation & Maintenance Manual supplied with the equipment. This includes, but is not limited to, valve adjustment, fuel and oil filter changes, and any other maintenance procedure related to emission control.
- Using the proper fuel in the engine, as specified in the Operator's Manual. Engines other than Tier 4 diesel engines shall only be operated on commercially available diesel fuel. Use of any other fuel may result in the engine no longer operating in compliance with EPA requirements. The Tier 4 diesel engine shall only be operated on ultra-low sulfur diesel fuel.
- The owner is responsible for initiating the warranty process. Owners are advised to contact their local authorized Kohler Dealer to perform warranty service as soon as a problem arises. The warranty repairs should be completed by the authorized Kohler Dealer as expeditiously as possible.

EXCLUSIONS

This warranty does not cover:
- **This warranty shall only apply** to KOHLER Co. engines.
- Malfunctions in any part caused by abuse, misuse, alterations, tampering, disconnection, or improper or inadequate maintenance.
- Attachments, accessories or components not supplied or approved by Kohler.
- Damage resulting from fire, accident, negligence, act of God or other events beyond the control of Kohler.
- Consequential damage such as loss of use of the engine or equipment powered by the engine, towing, machine transportation, loss of time, downtime, inconvenience, telephone, travel, lodging, or any other indirect or direct damage.
- Loss or damage to personal property, loss of revenue, commercial loss or any other matters not specifically included in this warranty statement.
- Any warranted part that was required to be previously replaced as part of required scheduled maintenance.
- Owner's unreasonable delay in making the equipment available after being notified of a potential product problem.
- Engines installed outside United States of America.

This warranty is in addition to the Kohler Standard Warranty and any extended warranty (if applicable) for the equipment and engine involved. Remedies under this warranty are limited to the provisions as specified in this warranty statement.

IN NO EVENT SHALL KOHLER, ITS COMPONENT SUPPLIERS NOR THE SELLING DEALER BE LIABLE FOR ANY DELAY, WORK STOPPAGE, LOSS OF USE OF EQUIPMENT, LOSS OF TIME, INCONVENIENCE, LOSS OF PROFITS, OR ANY INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM OR ATTRIBUTABLE TO, DEFECTS IN KOHLER PRODUCTS OR SERVICE, WHETHER RESULTING FROM NEGLIGENCE (INCLUDING GROSS NEGLIGENCE) OR OTHER TORT WARRANTY, CONTRACT, INDEMNITY, BREACH OF THE PROMISE TO REPAIR OR REPLACE CONTAINED HEREIN, STRICT LIABILITY OR OTHERWISE.

IN ADDITION, KOHLER, ITS COMPONENT SUPPLIERS AND THE SELLING DEALER SHALL NOT BE LIABLE IN TORT OR STRICT LIABILITY FOR ANY ECONOMIC LOSS RESULTING, IN WHOLE OR IN PART, FROM THE MANUFACTURE OR SUPPLY OF THE PRODUCT, PARTS, COMPONENTS AND/OR LABOR.

NOTWITHSTANDING ANYTHING IN THIS WARRANTY TO THE CONTRARY, THE MAXIMUM LIABILITY, IF ANY, OF KOHLER, ITS COMPONENT SUPPLIERS AND THE SELLING DEALER FOR

ALL DIRECT DAMAGES SHALL NOT EXCEED THE PRICE OF THE PARTICULAR DEFECTIVE PRODUCT, PART OR SERVICE, AS APPLICABLE.

THE STANDARD WARRANTY, THE EMISSION CONTROL WARRANTIES, AND THE EXTENDED LIMITED MACHINE AND POWERTRAIN WARRANTIES, IF APPLICABLE, ARE THE ONLY WARRANTIES APPLICABLE TO KOHLER PRODUCTS AND COMPONENTS USED IN KOHLER PRODUCTS AND ARE EXPRESSLY IN LIEU OF ANY WARRANTIES OR CONDITIONS OTHERWISE IMPLIED BY LAW (INCLUDING ANY WARRANTY OTHERWISE IMPLIED BY LAW FOR THE PRODUCT BY THE MANUFACTURER OR ITS COMPONENT SUPPLIERS), INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND IS NOT A WARRANTY OF FUTURE PERFORMANCE.

THE REMEDIES UNDER THIS WARRANTY SHALL BE THE ONLY REMEDIES AVAILABLE TO THE OWNER OF KOHLER PRODUCTS OR ANY OTHER PERSON, AND NEITHER KOHLER NOR THE SELLING DEALER ASSUMES ANY OTHER OBLIGATION OR RESPONSIBILITY WITH RESPECT TO THE CONDITION OF KOHLER PRODUCTS, AND AUTHORIZES NO OTHER PERSON TO ASSUME FOR ANY OF THEM, ANY OTHER OBLIGATION OR LIABILITY.

Kohler reserves the right to make changes in design or add any improvements on its products at any time without incurring any obligation to install same on units previously delivered.

If the original owner sells the engine and machine, the remaining period of this warranty shall be transferred to the new owner.

“Kohler” means both Kohler Co. and its Affiliates, d/b/a Kohler Power Systems.

Kohler request that each owner of the engine and machine complete and provide the following requested information, sign in the space indicated, retain a completed and signed copy of this statement for the owner’s records, and return a completed and signed copy of this statement to Kohler. Failure to complete, sign, or return this form will not affect any owner’s rights or Kohler’s obligations under this warranty statement and will not result in denial of warranty coverage by Kohler.

MODEL: _____	PIN (Prod. Id. No.): _____
NAME OF DEALER	NAME OF OWNER
SIGNATURE OF AUTHORIZED REPRESENTATIVE OF DEALER	SIGNATURE OF AUTHORIZED REPRESENTATIVE OF OWNER
CITY / STATE / ZIP CODE OF DEALER	CITY / STATE / ZIP CODE OF OWNER
DATE MACHINE PLACED INTO SERVICE	

This Emission Control Warranty Statement is applicable to KD18L06, KD27V12, KD36V16, KD45V20, KD62V12, KD83V16 and KD103V20 Engines

Preface

Only for the United States of America:

> ⚠ **WARNING:** This product can expose you to chemical substances, including carbon monoxide and benzene, which are known to the State of California to cause cancer, birth defects and reproductive harm.
> Additional information at https://www.p65warnings.ca.gov/.

> ⚠ **WARNING:** Inhaling diesel engine exhaust exposes you to chemical substances, which are known to the State of California to cause cancer, birth defects and reproductive harm.
> - Engines may only be started and operated in well ventilated areas.
> - In closed rooms, the exhaust must be discharged into the open air.
> - The exhaust system may not be changed or manipulated.
> - Only let the engine run at an idle when it is necessary.
> Additional information at https://www.p65warnings.ca.gov/.

This operation and maintenance manual has been written for the **operator** and **maintenance personnel** of the engine.

It contains descriptions for:
- Technical data
- Safety regulations
- Handling and operation
- Maintenance

The operation and maintenance manual is to be carefully read and applied before the first commissioning and later at regular time intervals by each person who is assigned to work with / on the engine.

Work with or on the engine is, for example:
- **Operation**
- **Servicing**, including maintenance, inspection

This facilitates familiarization with the engine for the operator and prevents malfunctions due to improper handling.

Kohler Co. will not accept any warranty claims that arise due to improper handling, insufficient maintenance, use of unapproved fuel and operating fluids, or failure to observe the safety regulations.

Kohler Co. will cancel all possible obligations undertaken by Kohler Co. and/or its dealers, such as guarantee commitments, service agreements etc., without prior notice if parts other than original Kohler Co. parts or spare parts purchased from Kohler Co. are used for maintenance and repair.

Under extreme conditions, more frequent maintenance than scheduled in the maintenance and inspection schedule can be required.

Changes, conditions, copyright

This document is protected by copyright. The copyright holder is:
– Kohler Co.

Subject to change in the interest of technical progress.

ISO 16016 protection notice: “Transmission and duplication of this document, utilization and communication of its contents are prohibited, unless expressly permitted. Infringements will lead to compensation. All rights reserved in the event of patent, utility model or design registration.”

For further information, contact your nearest authorized Kohler customer service.

Scope

Version	From serial number
0_1	2021 06 0001

Scope

List of changes

Version	Changes included	Issue
0_1	Document newly created	July 2022

List of changes

Contents

1 Product description

1.1 Technical description

1.1.1 Engine components

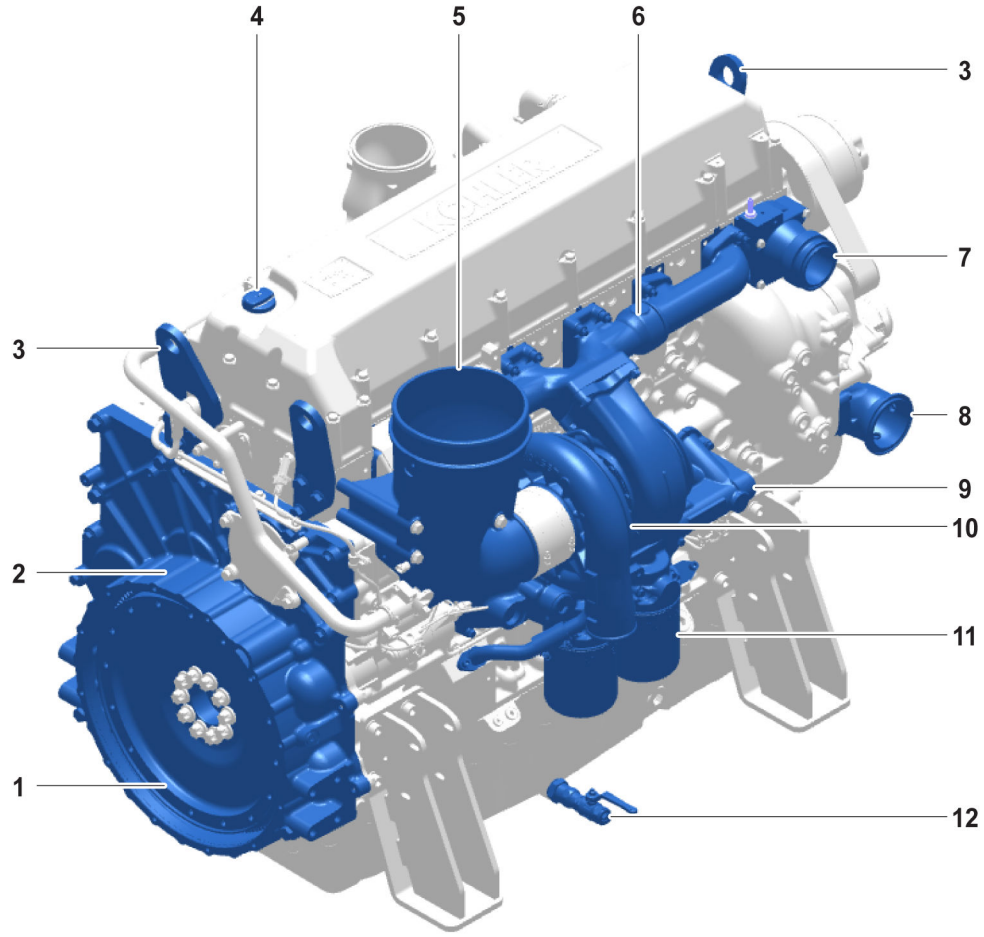


Fig. 1: Flywheel side engine components

1 Flywheel
2 Flywheel housing
3 Lifting device
4 Oil filler cap
5 Intake manifold
6 Exhaust manifold
7 Coolant connection to coolant cooling
8 Coolant connection from coolant cooling
9 Oil module
10 Exhaust gas turbocharger
11 Oil filter (2x)
12 Shut-off valve

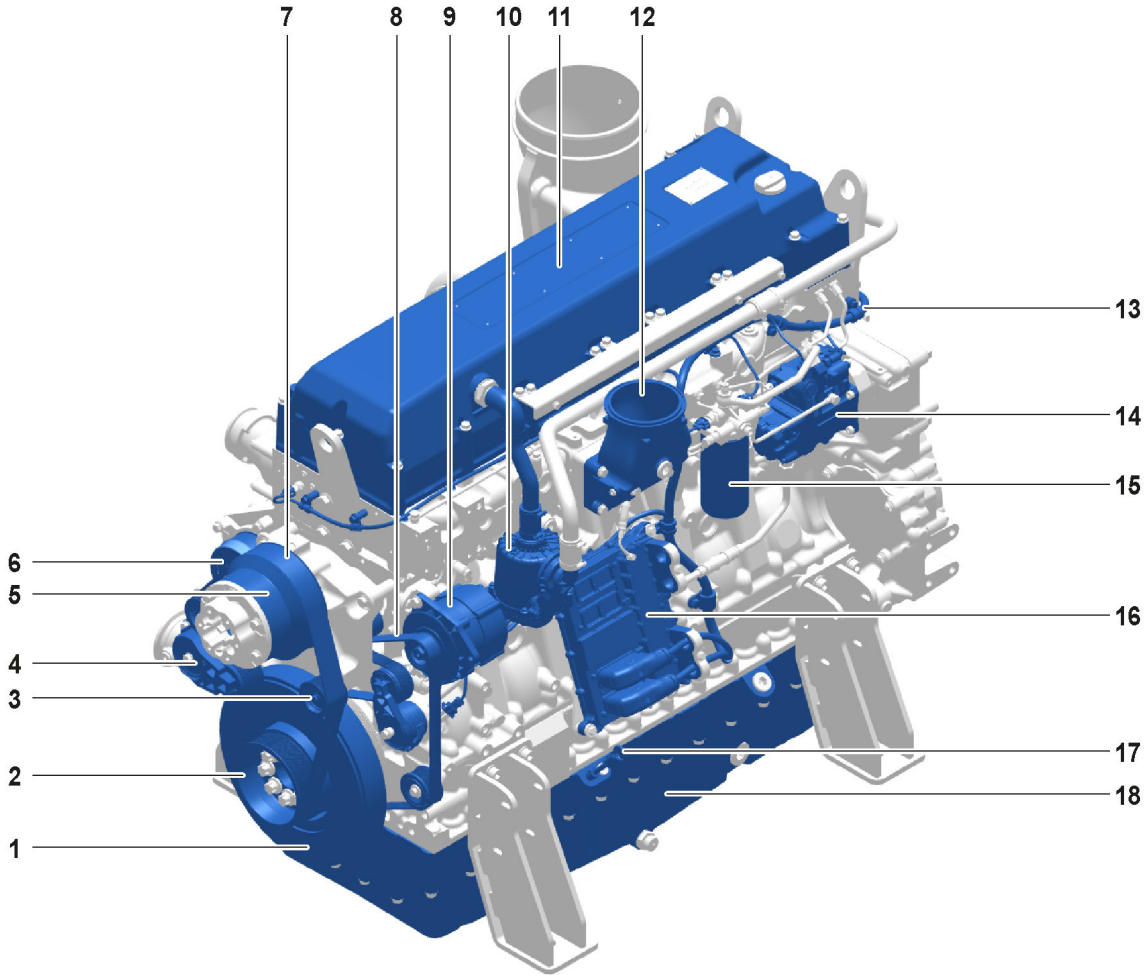


Fig. 2: Ancillary support housing side engine components

1 Torsional vibration damper
2 Crankshaft belt pulley
3 Deflection pulley
4 Tension pulley (self-tensioning)
5 Fan belt pulley
6 Coolant pump
7 Fan drive V-ribbed belt
8 Coolant pump / alternator V-ribbed belt
9 Alternator
10 Crankcase breather system oil mist separator
11 Cylinder head cover
12 Charge air pipe
13 Cable harness
14 Fuel high pressure pump
15 Fuel fine filter
16 Engine control unit
17 Oil dipstick
18 Oil pan

1.1.2 Overview of sensors

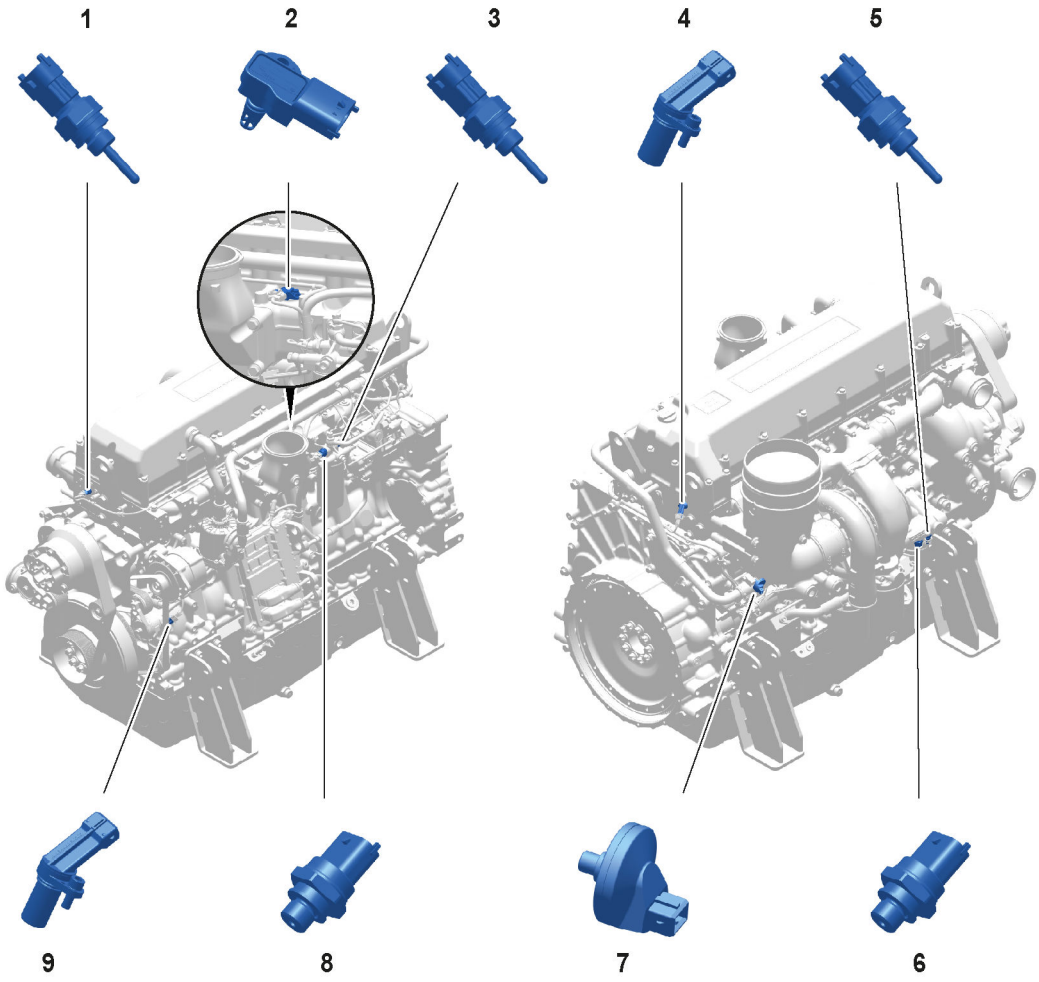


Fig. 3: Overview of sensors

1 Coolant temperature sensor
2 Charge air pressure & temperature sensor
3 Fuel temperature sensor
4 Camshaft speed sensor
5 Oil temperature sensor
6 Oil pressure sensor
7 Maintenance switch
8 Fuel pressure sensor
9 Crankshaft speed sensor

1.1.3 Engine type itemization

Engine type designation									
K	**D**	**18L**	**06**	**-**	**5**	**A**	**F**	**C**	**Description**
K									Manufacturer
	D								Engine
		18L							Total displacement: 18 l
			06						Number of cylinders
					5				Frequency: 5 = 50 Hz; 6 = 60 Hz

Engine type designation									
K	D	18L	06	-	5	A	F	C	Description
						A			Power group: A, wherein A is the smallest power group and E is the largest power group.
							F		Optimization: F = Fuel optimization; E = Exhaust optimization
								C	Application: C = COP; P = Prime; S = Standby; D = Data center

Tab. 1: Engine type designation

1.1.4 Company name plate

The company name plate is attached to the cylinder head cover and crankcase.

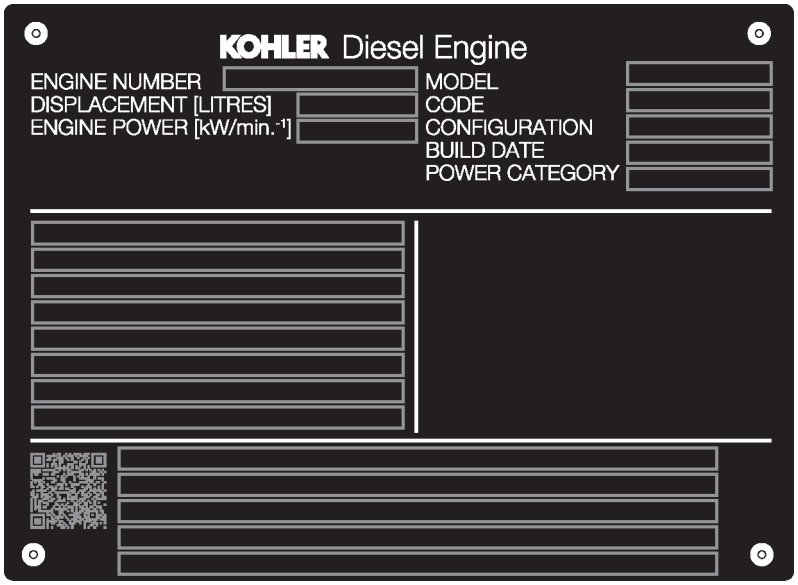


Fig. 4: Company name plate

Mounting position

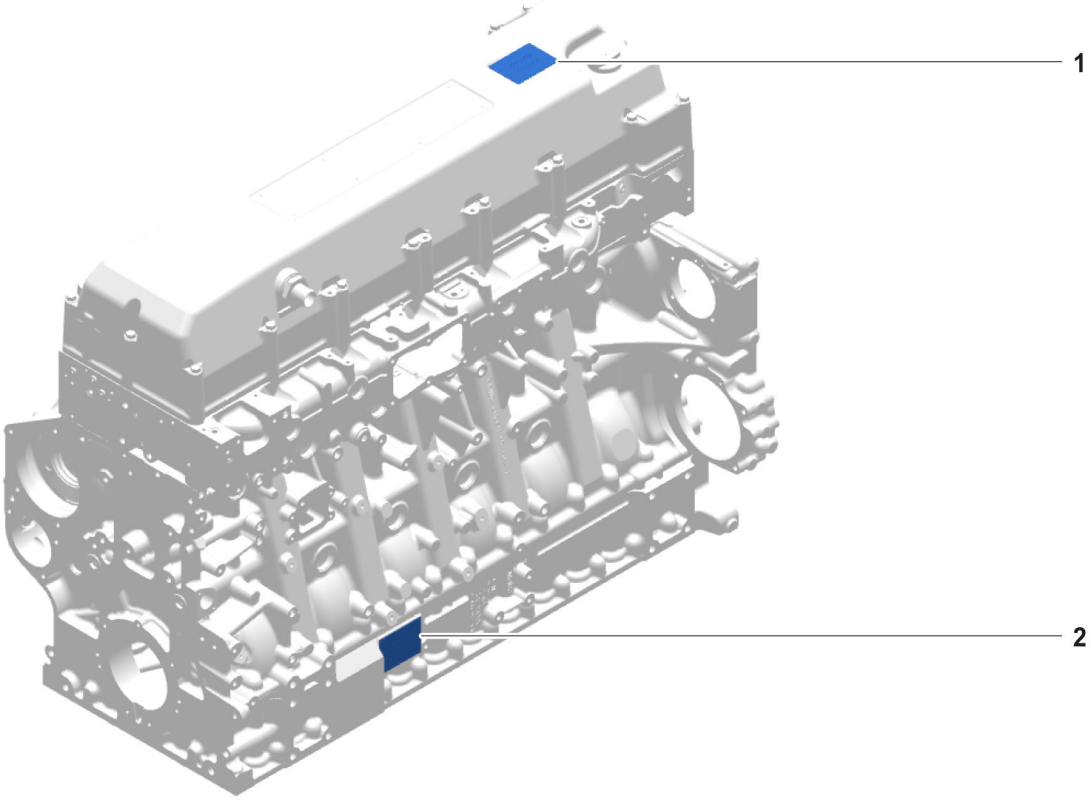


Fig. 5: Company name plate on the engine

1 Company name plate on the cylinder head cover

2 Company name plate on the crankcase

Engine serial number

The engine serial number is cast into the engine labeling and into the crankcase.

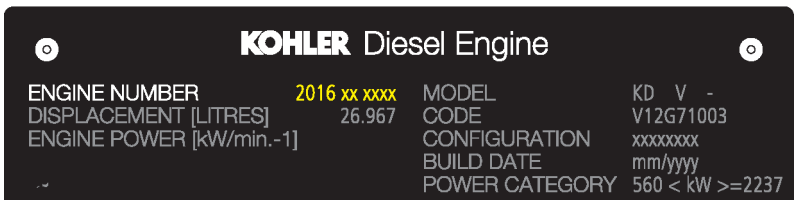


Fig. 6: Engine serial number

2021	06	0001	Engine serial number
2021			Year of manufacture
	06		Engine type code: 06 = KD18L06
		0001	Sequential production number

Tab. 2: Engine serial number

1.1.5 Engine control unit nameplate

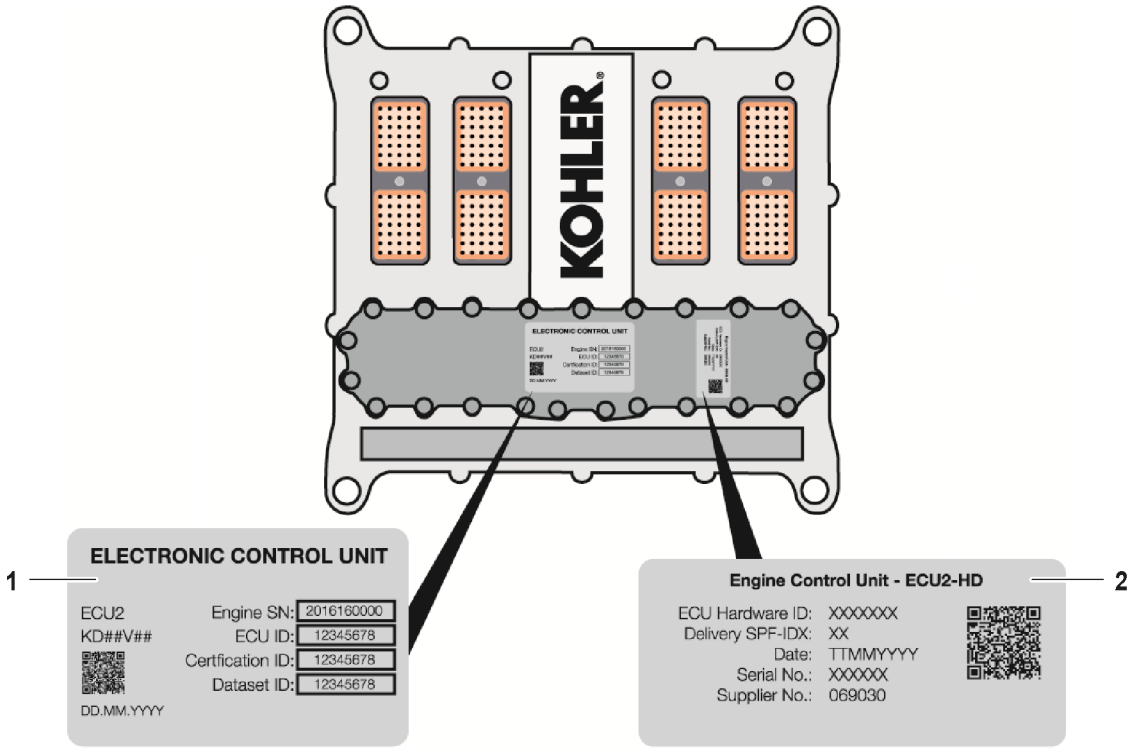


Fig. 7: Position of the engine control unit nameplate

1 Software company name plate

2 Hardware company name plate

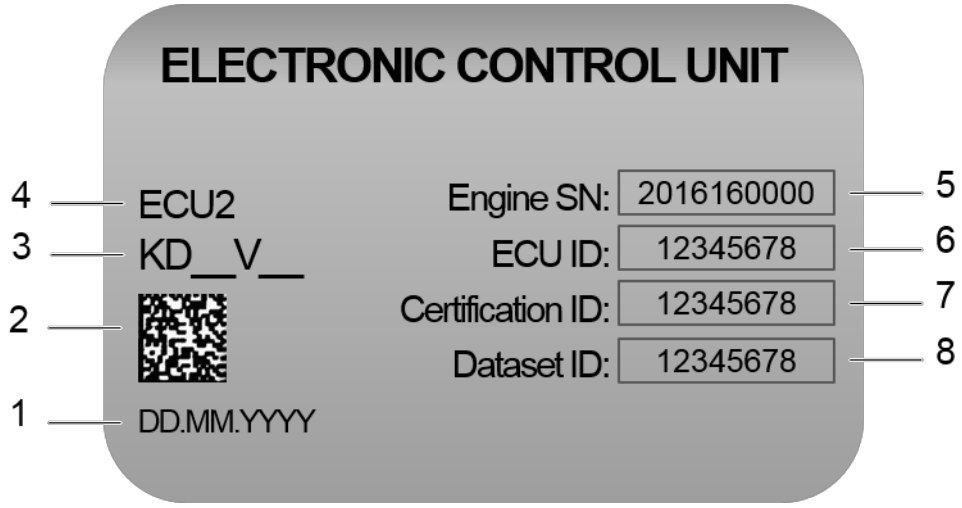


Fig. 8: Example of an engine control unit nameplate

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

Information

The information on the engine control unit nameplate corresponds to the delivery condition. Depending on the software updates in the field, this information may no longer be current. The actual information can be called up on the device display or read out with the KODIA diagnostics and service tool.

1.2 Technical data

1.2.1 Diesel engine

Name	Unit	Value
Construction		In-line diesel engine
Number of cylinders		6
Firing order		1-5-3-6-2-4
Bore	mm in	148 5.82
Stroke	mm in	174 6.85
Displacement	l gal	17.96 4.7551
Compression ratio		16.5: 1
Direction of rotation of the diesel engine (viewed from the flywheel)		counterclockwise
Power rating according to		ISO 3046–1
Rated power		See company nameplate
Rated speed		See company nameplate
Emission limit stage		See company name plate

Tab. 3: Technical data - diesel engine

1.2.2 Coolant thermostat

Name	Unit	Value
Start of opening	°C °F	82 179
Completely opened	°C °F	92 197

Tab. 4: Coolant thermostat

1.2.3 Battery charging alternator

Description	Unit	Value
Voltage	V	28
Current	A	140

1.2.4 Starter motor

Description	Unit	Value
Voltage	V	24
Power output per starter system	kW	7.0

1.2.5 Flywheel housing

Description	Unit	Value
Connection		SAE 1

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. 5

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. 6

2.2 Additional markings

	**Information**	indicates useful information and tips.

Tab. 7

2.3 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 work that requires partial dismantling of the engine on site (service after half the service life). For example: replacing pumps, injection valves, heads etc.
By the customer or the nearest authorized Kohler service representative.	By the customer or the nearest authorized Kohler service representative.

Tab. 8

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

2.3.1 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.

2.3.2 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

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

2.3.3 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 battery charging alternator, pumps or compressors in order to prevent defects or damage to the equipment

2.4 Intended use

Only operate the engine within the intended load range.

Only operate the engine in the device within the test range (NTE range) for the corresponding engine category.

- Use the engine for the intended purpose.

- Observe the following conditions from the manufacturer:
  - Operating conditions
  - Maintenance conditions
  - Servicing conditions
- Ensure that the following activities are only performed by persons according to the target group definition:
  - Use engine.
  - Maintain engine.
  - Service engine.

(For more information see: 2.3 Target audience, page 23.)

- Install contactors and protective devices prior to commissioning and ensure their function.
- Observe safety instructions and operating instructions.
- Operate the engine in flawless condition.
- Operate the engine in the speed range prescribed by the manufacturer.
- Screw the engine with the attached engine brackets to the machine or to the respective operation site with the respective tightening instructions provided by the customer.
- Have engine brackets that were not installed by the manufacturer approved by the manufacturer.
- Only operate the engine in areas that are not publicly accessible.
- Only operate the engine with an enclosure or engine compartment cover.

2.5 Foreseeable misuse

These instructions have been prepared according to the applicable standards and regulations and according to the state of the art.

Kohler Co. assumes no liability for:
- Disregarding the instructions
- Improper use
- Use of personnel that does not meet the requirements according to the target group.
- Changes and conversions to the engine which were carried out without approval from Kohler.
- Use of operating fluids and auxiliary materials that are not approved by Kohler
- Use of spare parts that are not approved by Kohler, including any damages arising as a result
- Circumventing and disregarding safety regulations
- Disregarding international and national regulations for occupational safety
- Disregarding international and national regulations for environmental protection
- Unauthorized changes to the engine
- Manipulation to the injection system and control system
- Emergency operation with limited safety function is deemed improper use. The manufacturer is not liable for damages due to improper use.

EU type approval expires for:
- Manipulation to the engine
- Manipulation to the injection system and control system
- Manipulation to the exhaust aftertreatment system

The actual scope of delivery of the engine can differ from the relevant information in these instructions due to situational adaptations to customer requirements.

2.6 General safety instructions

- Fulfill the requirements of the target groups for the work. (For more information see: 2.3 Target audience, page 23.)
- In order to guarantee help in the event of an accident:
  - A second person is present.
  - Ensure that the emergency situation will be detected and help with take place.
- Ensure that the personnel is familiar with this manual before installation work.
- Only allow the following personnel to work on the engine under the constant supervision and responsibility of a technician in accordance with the target group definition.
  - Personnel to be trained
  - Personnel to be taught
  - Personnel to be instructed
  - Personnel in apprenticeships

  (For more information see: 2.3 Target audience, page 23.)
- Check the safety and hazard-conscious work of the personnel under the following conditions:
  - Observe the accident prevention regulations.
  - Observe the generally recognized safety and occupational health rules.
  - Observe the manual.
- Make sure that the personnel wear the prescribed work clothing. (For more information see: 2.8 Personal protective equipment, page 28.)
- Do not wear the following:
  - Rings
  - Wristwatches
  - Neckties
  - Scarves
  - Open jackets
  - Loose-fitting clothing
- Make sure that the following equipment is available for the assembly, clean, complete and undamaged:
  - Basic tool kit
  - Required devices
  - Required special tools
- Replace damaged tools.
- Keep the workplace clean and orderly.
- Make preparations for emergencies that could occur.
- Have a fire extinguisher and first aid kit ready.
- Have emergency telephone numbers available.
- Make sure that the workplace has sufficient lighting.
- Perform installation work only when the engine is secured.
- Ensure that the engine is not started by unauthorized individuals.

2.7 Preventing personal injuries

2.7.1 Crushing

- Do not lift heavy parts by hand.
- Fasten and simultaneously secure individual parts and larger assemblies carefully to lifting device during the replacement.
- Use Kohler lifting gear. Use Kohler lifting gear according to the operation and maintenance manual.
- Comply with the provisions for lifting points.
- Only use undamaged load handling attachments.
- Only use load handling attachments with sufficient load bearing capacity.
- Make sure that no persons reside under loads.
- When the engine is running, objects can be flung back: Make sure that no objects come in contact with moving parts.

2.7.2 Burns and scalds

The engine at operating temperature is hot.
- Only work on the cooled down engine.
- Touch hot parts with thermal protection gloves for repair purposes.

Before work on the cooling system:
- Let the engine cool down
- Release the pressure in the cooling system on the device side.
- Avoid contact with parts carrying coolant.

When the engine is at operating temperature, the engine oil is hot.
- Avoid any skin contact with hot engine oil or parts carrying engine oil.

2.7.3 Fires and explosions

- Smoking is prohibited in the immediate vicinity of the engine.
- Avoid fires, sparks and open flames when handling fuels and flammable liquids.
- Start the engine according to the provisions of the repair instructions and assembly instructions.
- Repair any leaks and replace damaged components. Fuel and lubricating oil that squirts out from leaks can lead to fires.
- When working on batteries: Put on safety goggles and safety gloves.
- After maintenance and repair work, remove and clean residues of operating fluids (e.g: lubricating oils, lubricating greases, fuel, coolant).
- Remove rags that are soaked with flammable liquids.
- When working on the electrical system: Disconnect the electrical power supply.

2.7.4 Poisoning

- Only allow the engine to run in closed rooms when there is sufficient ventilation.
- Never ingest operating fluids.
- Do not use beverage bottles to store operating fluids.

Escaping liquids can penetrate the skin and will lead to blood poisoning:
- Do not open any lines and hoses that are under pressure.
- Do not remove any lines and hoses that are under pressure.

- Protect hands, face and body against escaping liquids when searching for leaks on lines and hoses that are under pressure. (For more information see: 2.8 Personal protective equipment, page 28.)

2.7.5 High pressure injection (ejection of liquids under high pressure)

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

Only work on the fuel and injection system when the engine is turned off. If the engine has been turned off:
- Wait at least 20 minutes until the pressure in the injection system has been relieved.
- Check pressure reduction with the diagnostic program (must have dropped below 20 bar).
- Use suitable protective equipment when working on the fuel and injection system (for example, protective gloves, safety goggles etc.).
- Do not open any fuel lines and fuel hoses that are under pressure.
- Do not remove any fuel lines and fuel hoses that are under pressure.
- When searching for leaks, do not touch pressurized fuel lines and fuel hoses with your hands. No body parts near possible leaks.
- Bring the engine into a clean area of the workshop, in which no work is being performed that could cause dust to be dispersed (grinding, welding work, brake repairs, brake and power tests etc.).

2.7.6 Electrical energy

- People with pacemakers have no access to the safety zones around the operational engine.
- Do not touch live parts.
- Before work on the electrical system, disconnect the electrical power supply and secure it against being switched back on.

2.7.7 Danger due to noise

Possible permanent hearing loss due to noise levels above 84dB(A). Sound levels up to 110dB possible!
- Keep all sound-insulating protective devices for the system closed when the engine is running.
- Only reside near the running engine with hearing protection matched to the noise level.
- Observe the hearing protection measures according to the repair instructions of the generator manufacturer.

Access to the safety zones is prohibited for the operator and unauthorized personnel when the engine is ready for operation or in operation.

2.8 Personal protective equipment

- Wear protective equipment for direct access to engines.
- Make sure that:
  - Protective equipment is in good condition.
  - Protective function is guaranteed.

The following protective equipment is required to access the engine:

Protective work clothing
- Tight-fitting protective clothing that is not tear-resistant to protect against injuries and simple chemical substances

Wear protective work clothing in the immediate vicinity of the engine.

Safety helmet
- Protection against
  - Falling or flying object
  - Bumping your head

Wear a safety helmet in the immediate vicinity of the engine.

Safety shoes
- Foot protection against
  - Falling objects
  - Pinching of the foot in heavy parts
  - Against slipping

Wear safety shoes in the immediate vicinity of the engine.

Safety gloves
- Protection against hot elements and chemicals

  Wear safety gloves when working with hot parts, for example,
  - shrinking the gear ring onto the flywheel.
  - Working with operating fluids (See manufacturer's specifications for the operating fluids and safety data sheet for the operating fluid.)

Safety goggles
- Protection against:
  - Flying fragments
  - Chemical splashes
- Wear safety goggles when:
  - Handling operating fluids (See manufacturer's specifications for the operating fluids and safety data sheet for the operating fluid.)
  - Wear during mechanical interventions, for example, using compressed air.

Hearing protection
- Protection against noise
  - Wear hearing protection around the diesel engine when it is running.

Respirator
- Protection against breathing in harmful substances

2.9 Operating areas and maintenance areas

2.9.1 Safety instructions

Trapping points and mechanical parts flying around when the engine is ready for operation or in operation

Serious injuries and risk of death:
- Keep away from the operational engine.
- Wear personal protective equipment.
- Technicians may reside in safety zone “A” for measurement purposes, if nothing else has been stated by the generator manufacturer.

Hot parts when the engine is ready for operation or in operation.

Risk of burns:
- Keep away from the operational engine.
- Wear personal protective equipment.
- Let the engine cool down sufficiently.

High electric short-circuit currents during maintenance work

Risk of burns from electric shock:
- Access to safety zones in maintenance condition, according to target group definition
- Disconnect the electrical power supply.
- Wear personal protective equipment.

2.9.2 Operating areas

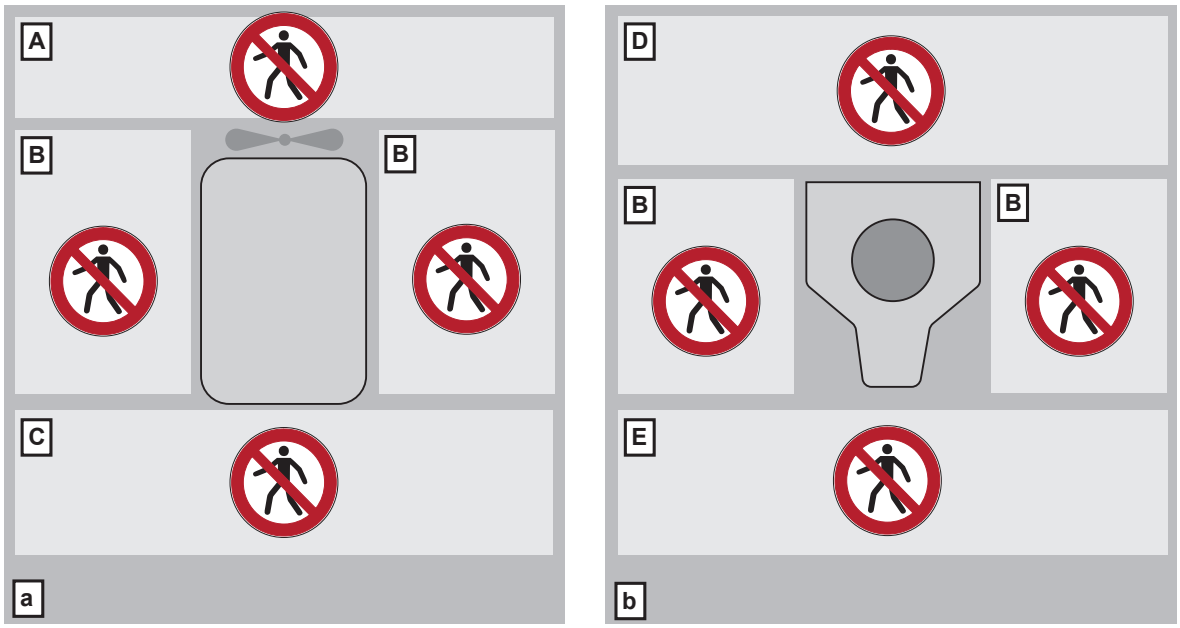


Fig. 21: Safety zones for the engine that is ready for operation or in operation

a Horizontal plan (view from above)

b Vertical plan (view from driving end)

Do not enter the following zones:
- Safety zone for free end **A**
- Safety zone next to the engine **B**
- Safety zone for driving end **C**
- Safety zone above the engine **D**
- Safety zone below the engine **E**

2.9.3 Maintenance areas

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

WARNING
Hot components!
Serious burns possible.

- ▶ Let the engine cool down to below 50 °C.
- ▶ Wear heat-resistant safety gloves and heat-resistant work clothes.

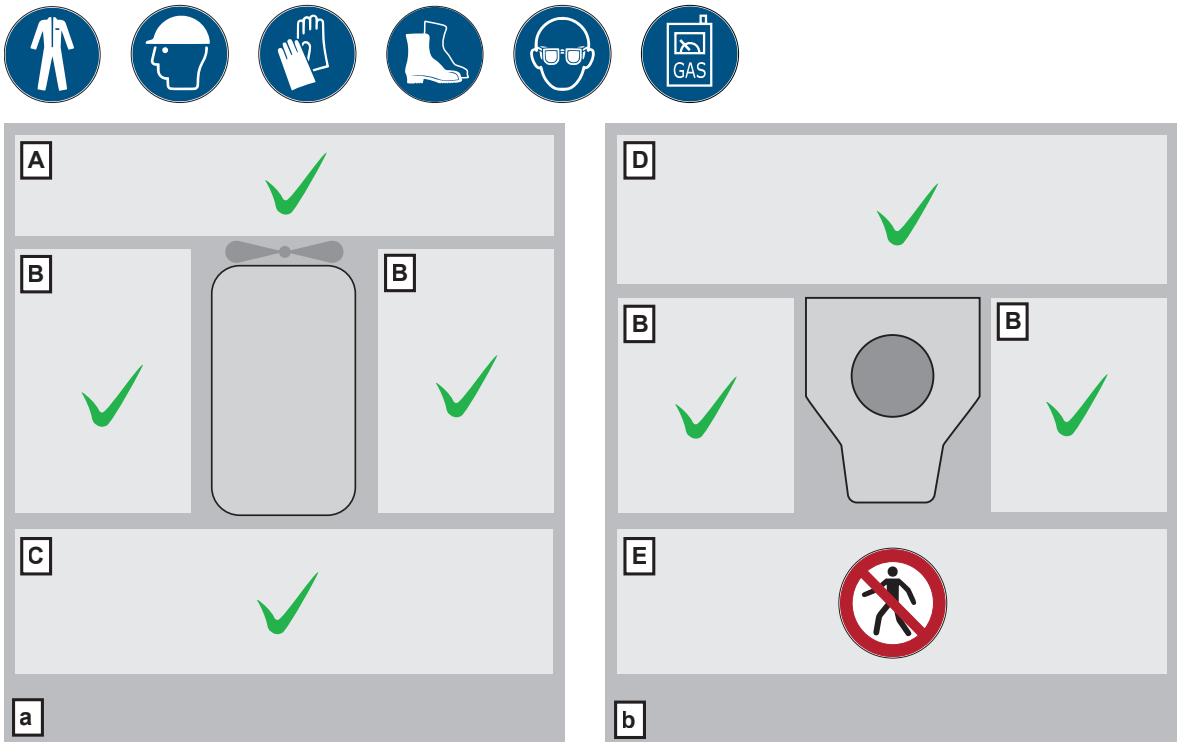


Fig. 22: Safety zones for maintenance and repairs

a Horizontal plan (view from above)

b Vertical plan (view from driving end)

The following zones are accessible:
- Safety zone for free end **A**
- Safety zone next to the engine **B**
- Safety zone for driving end **C**
- Safety zone above the engine **D**

Do not enter the following zones:
- Safety zone below the engine **E**

2.9.4 Securing the engine against unexpected start-up and releasing it

Access to the engine must be secured against unexpected start-up before entering the safety zones.

Procedure:

Secure the engine against unexpected start-up:
- Disconnect the diesel fuel supply.
- Mark the cut-off point with a tag.
- Disconnect the electrical power supply and secure it against being switched back on.
- Mark the cut-off point with a tag.

Make the engine operational (release it):
- The following activities have been completed:

  - Installation activities
  - Maintenance activities
  - Repair activities
- All foreign objects are removed.
- All protectives devices are installed and are functioning.
- No outsiders are residing in the danger zones.
- The tags for the fuel supply are removed.
- Fuel supply is connected.
- The tag for the electrical power supply is removed.
- The electrical power supply is established.

2.9.5 Emergency stop

An emergency stop is available for hazardous situations which require an immediate shutdown of the engine. The power supply to the engine is interrupted immediately. The engine control unit continues to have power.

Examples of hazardous situations:
- Fire
- Person suffers an electric shock
- Engine will not stop
- Engine accelerates uncontrollably

Only actuate the emergency stop in emergency situations. Actuating the emergency stop can permanently damage the engine. The emergency stop may not be used for an operational stop of the engine.

2.10 Signage

Information

▶ Signs must be attached so they are clearly visible and are in the immediate vicinity of the safety zones.

▶ Signs must withstand the environmental conditions. The end user must ensure that signs remain visible and legible during the entire life cycle.

▶ Additional warning symbols or adaptations to product standards (ISO 8528–13) are possible.

ISO 7010 / W012 Warning against dangerous electrical voltage:
- Only personnel who know the dangers of electricity may work in the designated area. Unauthorized individuals may only enter the safety zone if the electrical power supply is disconnected.

ISO 7010 / W017 Warning against hot surfaces:
- There are hot surfaces on the engine which are not immediately apparent.
  Wait a sufficient cooling time.
  Touch any potentially hot components using suitable protective gloves.

ISO 7010 / W025 Warning of entanglement hazard:
- Possible trapping points exist on the engine in the area of the V-ribbed belt and the alternator for battery charging.
  Attach a warning sign if trapping points are not secured by protective devices (optional).
  Enter safety zone only after engine is turned off.
  Secure the engine against unexpected start-up.

ISO 7010 / P007 No access for people with pacemakers or implanted defibrillators:
- Possible EMC radiation, which can affect pacemakers and implanted defibrillators.

ISO 7010 / M002 Observe instructions:
- To ensure that personnel is familiar with all residual risks, the system documentation must be read and understood.
  Ensure that all residual risks according to the risk assessment of the generator manufacturer are reflected in the system documentation.
  Make documentation available to the personnel without restrictions according to the “target group”. (For more information see: 2.3 Target audience, page 23.)

2.11 Preventing property damage

Preventing property damage:
- Replace sealing material, for example, o-rings and seals.
- Check removed, reusable parts for reusability, see corresponding information in the repair instructions.
- Replace removed, not reusable parts.
- If no specific tightening torques and tightening instructions are specified: Tighten screwed assemblies according to the standard tightening torques. (For more information see: 8.1 Tightening torques, page 110.)
- Replace self-locking screwed assemblies.
- Thoroughly clean the engine, connections and screwed assemblies of engine oil, combustion residues or care products before installation.
- Use lint-free cleaning cloths.
- Do not touch electrical contacts. Connection will be affected by contamination or components will be destroyed by electrostatic discharge.
- Before cleaning the engine: Cover or seal openings into which no water, steam or cleaning agents may enter due to safety or functional reasons.
- Remove covers or adhesives after cleaning.
- Check gas-conveying lines, engine oil lines and hydraulic lines for the following defects:
  - Leaks
  - Loose connections
  - Abrasion points
  - Damage
- Make sure that the electrical power supply is securely connected when starting.
- Before disconnecting the electrical power supply: Turn off engine.
- Use suitable test leads for measurements on plug connections.
- If no mating connector is attached: Protect the engine control unit against dust and water.
- When working on the electrical system: Disconnect the battery (if present).
- Disconnect the negative pole first and connect it last.
- During electric welding on the machine, remove the plug from the control unit.

3 Handling, operation

3.1 Filling the operating fluids

Fill the following operating fluids before the initial commissioning:

- **Lubricating oil**
  Use suitable lubricating oil for the engine. (For more information see: 5.1.3 Engine oils, page 43.)
- **Coolant**
  Observe coolant composition. (For more information see: 5.1.4 Coolant, page 45.)
- **Diesel fuel**
  Diesel fuels must comply with the approved fuel specifications. (For more information see: 5.1.2 Diesel fuels, page 42.)

After the operating fluids are filled, perform the following work:

▶ Ventilate fuel system, see documentation for the generator set.

3.2 Starting the engine

Make sure that the following prerequisites are met:
- ❑ Oil level is OK.
- ❑ Coolant is filled.
- ❑ Charge air is connected.
- ❑ Exhaust gas disposal is ensured.
- ❑ The electrical power supply is ready.
- ❑ Fuel supply is connected.

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

- ▶ Make sure that no one is in the safety zones of the engine.
- ▶ Move all protective devices into protective position (enclosure, if present, is closed).
- ▶ Secure external parts against unexpected movements. Remove all persons from the danger zones.

Information
Engine damage due to insufficient lubrication!

- ▶ The oil pressure must build up immediately after starting the engine (oil pressure warning light goes out).

Information

Low load duration

Kohler Diesel engines have been approved for running at low loads. Operating the engine at low loads for extended periods of time can increase deposits/carbon buildup (Intensified at low ambient temperature).

This can be detrimental to the longevity and compliance of the engine.

If your operating profile has a prolonged low load duration, it is necessary to contact your genset supplier to take the necessary precautions.

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

After successful engine start, perform the following checks and, if necessary, refill operating fluids.

- ▶ 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 sets' error messages.

4 Operating faults

See Faults - Cause - Remedy table for engine problems and corrective measures. (For more information see: 4.1 Errors – Cause – Remedy, page 36.)

Information

- Engine errors are shown on the diagnosis and service tool as an error code for diagnostic purposes.
- The electronic control unit has an error memory. Error entries are stored in the error memory. The remedy for the errors is described in the device documentation.

The following are available for error identification:
- Warning lights in the device display
- Diagnostics software

4.1 Errors – Cause – Remedy

Malfunction / error	Cause	Remedy
Starter motor does not turn.	Main fuse is blown.	Replace the fuse.
	Battery connections are loose or corroded.	Clean and tighten the loose connections.
	Battery voltage is too low.	Charge or replace the battery.
	Starter circuit is defective or the contacts are corroded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Starter is defective.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Starter motor turns slowly.	Battery voltage is too low.	Charge or replace the battery.
	Battery connections are loose or corroded.	Clean and tighten the loose connections.
	Outside temperature is too low.	Take appropriate action for Winter operation.

Malfunction / error	Cause	Remedy
Engine will not start and/or stops again immediately.	Fuel tank is empty.	Refuel and vent the fuel system.
	Main fuel filter is clogged.	Replace the fuel filter.
	Fuel line, pre-cleaner or sieve in fuel tank is clogged.	Clean and vent the fuel system.
	Fuel system or filter is leaking.	Seal and ventilate.
	Outside temperature is too low.	Take appropriate action for winter operation.
Engine is difficult to start.	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 to have the engine checked. See "Service Assistance" section.
	Compression of the engine is too low.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Fault in the electronics.	Read out the error memory of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Engine suddenly switches off.	Voltage supply was 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 to have the engine checked. See "Service Assistance" section.
	Fault in the electronics.	Read out the error memory of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

Malfunction / error	Cause	Remedy
Power of the engine is too low (lack of power).	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.
	Charging pressure is too low.	V-band clamps are loose, seals and hoses are defective, air filter is contaminated, exhaust gas turbo-charger defective. Contact your nearest Kohler customer service. See “Service” section.
	Charge air temperature is too high.	Charge air cooler is contaminated, fan power is reduced, ambient temperature is too high. Contact your nearest Kohler customer service. See “Service” section.
	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.
	Fuel temperature is too high.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Injectors are defective or do not vaporize.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Compression of the engine is too low.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Fault in the electronics.	Read the error logs of the engine control unit. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Engine is too hot (according to coolant temperature display).	Coolant level is too low.	Fill up with coolant.
	Cooler is contaminated or calcified.	Clean or decalcify cooler. Contact your nearest Kohler customer service. See “Service” section.
	Thermostat has a fault.	Check this and replace if necessary. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

Malfunction / error	Cause	Remedy
Charging current display illuminates when engine is running.	Tension of the V-ribbed belt is insufficient.	Check the tension of the V-ribbed belt and replace the tightening roller if necessary.
	V-ribbed belt is worn.	Replace the V-ribbed belt.
	Cable connections are loose or disconnected.	Fasten or replace the cable.
	Battery charging alternator, rectifier or regulator is defective.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Black smoke is coming out of the engine.	Injectors are defective or inefficient.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Exhaust gas turbocharger has a fault (too low charging pressure).	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Engine is overloaded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Exhaust gases are blue.	Oil level in 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.
	Bearing seal on exhaust gas turbocharger is defective.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Ventilation of the crankcase is defective.	Check this and replace if necessary.
Exhaust gases are white.	Injection starts too late.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Operating temperature is not reached.	Run the engine until it reaches its operating temperature.
	Water in the fuel system.	Check the fuel system and the drain pre-filter.
	Charge air cooler has a leak.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.

Malfunction / error	Cause	Remedy
Engine knocks.	Fault during combustion.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Error in valve clearance.	Adjust the valve clearance.
	Injectors 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.
	Piston rings are worn or defective, pistons are eroded.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Abnormal noises.	Intake lines and exhaust pipes are leaking, causing a whistling noise.	Seal the leaks and replace the gaskets if necessary.
	Turbine or compressor wheel is rubbing on the housing; foreign objects have entered into the compressor or turbine; bearings may have seized.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Engine oil pressure is too low.	Oil level in oil pan is too low.	Fill oil to prescribed mark.
	Lubricating oil is too thin (oil diluted by diesel fuel).	Drain the oil and refill with the specified oil.
	Pressure sensor has a fault.	Check the oil pressure and replace the damaged pressure transducer. Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Pressure control valve does not work correctly or is contaminated.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Engine oil is in the cooling system.	Oil cooler or oil cooler plate is leaking.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Coolant is in the engine oil.	Cylinder gaskets are leaking.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Oil cooler or oil cooler plate is leaking.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
Charge air temperature is too high.	Charge air cooler is contaminated.	Contact your nearest authorized Kohler service representative. See "Service Assistance" section.
	Air inlet temperature is too high.	Check the fan, air supply and breather.

Malfunction / error	Cause	Remedy
Charge air pressure is too low.	Air filter is clogged.	Check the air filter’s service display, if equipped.
	Charge air cooler is contaminated.	Contact your nearest authorized Kohler service representative. See "Service Assistance” section.
	Exhaust gas turbocharger outlet is defective.	Contact your nearest authorized Kohler service representative. See "Service Assistance” section.

5 Operating fluids and maintenance

5.1 Lubricants and operating fluids

5.1.1 Fill quantities

Name	Quantity
Lubricating oil	87 l (1.5 l per filter)
	22.9 US gal (0.1 US gal per filter)
Coolant (engine)	39.5 l
	10.4 US gal

Tab. 9: Fill quantities for oil change (reference values)

5.1.2 Diesel fuels

Approved fuel qualities

Due to the different sulfur contents of these fuels, the change interval of the engine oil and its quality must be observed during selection.

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 exhaust system
On-road diesel	ASTM D 975 1D-S5000	HFFR < 460 µm without exhaust system
On-road diesel	ASTM D 975 2D-S15	HFFR < 460 µm
On-road diesel	ASTM D 975 2D-S500	HFFR < 460 µm without exhaust system
On-road diesel	ASTM D 975 2D-S5000	HFFR < 460 µm without exhaust system
EU diesel	EN 590	Max. 10 % biodiesel content
Fuel oil	DIN 51603-1	Without exhaust system
NATO fuel	NATO F-54	HFFR < 460 µm without exhaust system with additive S-1750
NATO fuel	XF-10	HFFR < 460 µm without exhaust system
NATO fuel	XF-51	HFFR < 460 µm max. 10% biodiesel
UK diesel	BS 2869 A2	Max. 10 % biodiesel content
Biodiesel	ASTM D97467	Biodiesel < 10 % ASTM D6751

Tab. 10: Approved fuel qualities

Minimum requirement for quality

Specification	Parameter
Lubrication capability at 60 °C (HFRR)	460 µm
Minimum cetane number	45
Purity class according to ISO 4406 in the fuel tank	18/16/12
Purity class according to ISO 4406 after fuel fine filter	12/9/6

Tab. 11: Minimum requirement for diesel fuels

5.1.3 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.

Engine oil category	Minimum standards	Recommended viscosity class	Engine oil type	Oil change
Engine oil Category 1	ACEA E5-02 or API CH-4 or DHD-1	Not allowed	Mineral oil (Group 1 & 2 base oils)	-
Engine oil Category 2	ACEA E4 ACEA E7 or API CI-4 Plus or DHD-1 or JASO DH-1	SAE 5W-30; SAE 10W-40	Synthetic (Group 2 and / or 3 base oils)	500 h
Engine oil Category 2.1	ACEA E6 or ACEA E9 or API CJ-4 or JASO DH-2	SAE 5W-30; SAE 10W-40	Synthetic (Group 2 and / or 3 base oils)	500 h
Engine oil Category 3 (current standard)	ACEA E4-16 or both ACEA E4 and ACEA E7	SAE 5W-30; SAE 5W-40; SAE 10W-40	Synthetic (Group 3 and / or 4), VI > 160, and Longlife additive	1000 h
Engine oil Category 3.1 (current standard)	ACEA E6-12 or both ACEA E6 and ACEA E9 or API CK-4	SAE 5W-30; SAE 5W-40; SAE 10W-40	Synthetic (Group 3 and / or 4), VI > 160, and Longlife additive	100 h

Tab. 12: Engine oil 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.

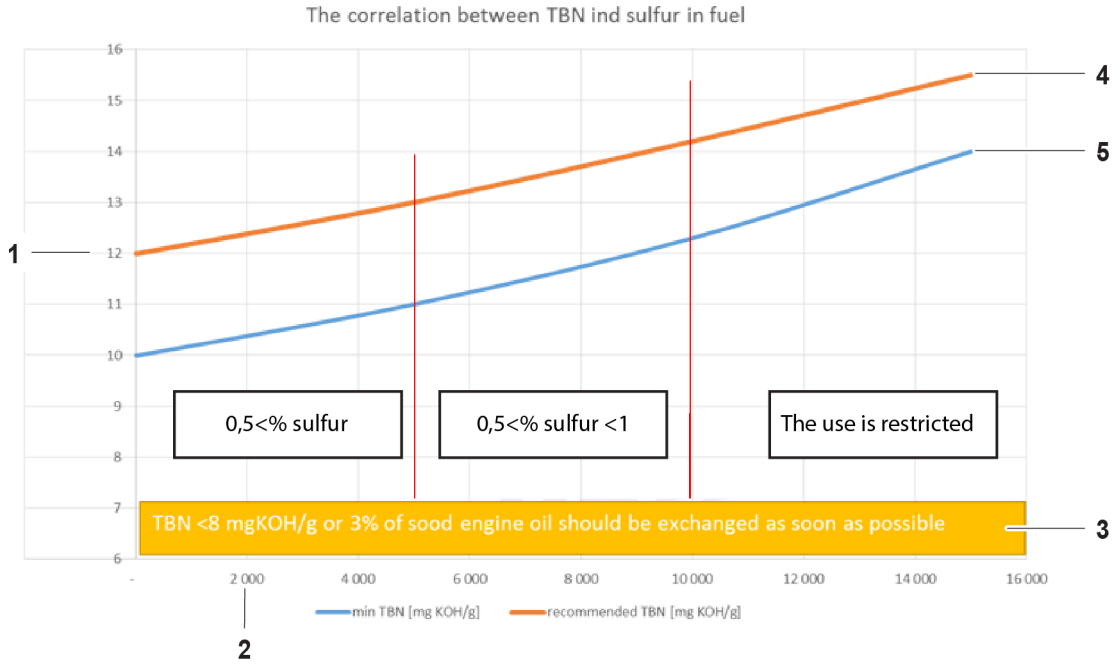


Fig. 28: The correlation between TBN and sulfur in fuel

1 TBN
2 ppm sulfur
3 For TBN < 8 mgKOH/g (recommendation only for HA engine oils)
4 recommended TBN [mg KOH/g]
5 minimum TBN [mg KOH/g]

Information

From small amounts of sulfur, only high-ash engine oils may be used. Changing the engine oil must be observed according to the specifications. The TBN curves shown are for informational purposes only and are not binding. The values do not apply to engine oils with a low ash content.

Viscosity class

The viscosity class must be selected based on the cold start temperature. The following viscosity classes are permitted for the engines: 5W30, 5W40, 10W30, and 10W40. The change intervals according to the 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 change interval is defined in the maintenance tables.

The basic change interval is defined in special maintenance tables according to the genset applications (ESP, PRP and COP) and engine injection calibration (EO or FO).

If there are difficulty factors or more difficult operating conditions, the oil change interval must be validated through an engine oil analysis.

Difficulty factors can be:

- Frequent cold starts
- Environmental influences
- Operating temperature
- Dust
- High humidity
- Long downtimes

Sulfur content in %	Sulfur content
0 < Sulfur content ≤ 0.5	No change of the maintenance interval
0.5 < Sulfur content ≤ 1 Limited to engine oil category 2 and 3	**Not approved!**
1 < Sulfur content ≤ 1.5 Limited to engine oil category 2 and 3	**Not approved!**

Tab. 13: 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.

5.1.4 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

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		mg/l	< 100
Sulfate		mg/l	< 100
Bacteria and toxic components			without

Tab. 14: Control parameter

5.2 Maintenance schedule

Using the maintenance schedule

The time intervals during which a component can remain in operation between two maintenance operations are divided as follows:

Interval is the operating time in hours.
Limit interval is the maximum operating time in years.

A maintenance activity is performed as soon as an interval (operating hours or period) is reached. The first interval that occurs applies.

5.2.1 Nominal values of the power generator

Power generators that fulfill the requirements of ISO 8528-1:2005 are used to produce electricity for continuous, peak load and standby applications. The classifications according to ISO 8528-1:2005 are intended to help improve the understanding between the manufacturer and customer.

Emergency power system (ESP)

The maximum available power during a variable power sequence under the specified operating conditions, which a power generator is capable of delivering in the event of a power failure or under test conditions for up to 200 hours of operation per year, wherein the maintenance intervals and work are executed in accordance with the manufacturer's instructions. The permissible average power output during 24 hours of operation should not exceed 85 percent of the ESP rating.

Main operating power (PRP)

The maximum power that a power generator is capable of delivering continuously for an unlimited number of hours per year under the agreed operating conditions with a variable electrical load, wherein the maintenance intervals and work are executed in accordance with the manufacturer's instructions. The permissible average power output during 24 hours of operation should not exceed 75 percent of the PRP rating.

Time between overhauls (TBO)

The designation for the average length of time until the engines are overhauled.

5.2.2 Definition of service levels

Information

The information on the engine company name plate corresponds to the delivery condition (ex works Kohler Co.). Based on the engine name, it can be determined which maintenance schedule must be used.

Preventive maintenance		Corrective maintenance
Level 0 & 1 – Basic maintenance	Level 2 – Extended maintenance	Troubleshooting and repair

Preventive maintenance		Corrective maintenance
Daily checks, inspections and maintenance measures that can be performed at operating intervals without removing engine parts. For example: Refilling lubricating oil and fuel	Maintenance measures, including partial disassembly of the engine on site (maintenance after half of the service life). For example: Replacement of the pump, injection, cylinder heads.	Repair work, such as the replacement of components to correct errors or malfunctions, including parts and labor
By the customer or authorized Kohler service representative	By an authorized Kohler service representative	By an authorized Kohler service representative

Tab. 15: Definition of service levels

The descriptions of the maintenance work are included in the following documents:
- Level 0 and 1 in this **operation and maintenance manual**
- Level 2 in the **service and repair manual**

Task designations

To facilitate orientation, the tasks are numbered according to the following conventions.

Itemization of task designations

Designation						Description
SL2	-	1	2	3	4	Task code
SL2	-					Service level
		1				System (see: tab. 17, page 48)
			2			Group (unit, cylinder head, etc.)
				3		Subgroup (injector, main fuel filter, etc.)
					4	Part (piston ring, o-ring, etc.)

Tab. 16: Itemization of task designations in the maintenance schedule

System directory

Designation	Description
1000	Engine
2000	Lubrication system
3000	Cooling system
4000	Fuel system
5000	Exhaust system
6000	Electrics and engine control unit
7000	Accessories

Tab. 17: System directory

5.2.3 Maintenance schedule – Service level 0

ESP, ESP (TOP POWER), PRP, COP - Version: MS2022/04-1

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL0- 1011	Diesel engine		1 day	X		The activity is performed before starting or when the engine is not running. Visual inspection (tightness, damages, loose parts). Identify and report anomalies.
SL0- 1021	Diesel engine when idling		1 day	X		Inspect engine operation. Identify and report all anomalies (tightness, incorrect parameters, unusual noises, vibrations, exhaust gas color).
SL0- 1022	Diesel engine in operation (only emergency power system - ESP application)		1 month	X		Test run at more than 1/3 load (if parameters are in range) and at least until steady-state temperature is reached. Identify and report all anomalies (tightness, incorrect parameters, unusual noises, vibrations, exhaust gas color).
SL0- 2011	Engine oil		1 day	X		The activity is performed before starting or when the engine is not running. Check oil level. Refill if necessary. Take corrective measures if there is a defect.
SL0- 3011	Cooling system		1 day	X		The activity is performed before starting or when the engine is not running. Check drainage holes on air supply lines (free of deposits, free of coolant). Check drainage holes on LT and HT coolant pumps (free of oil, free of water).
SL0- 4011	Fuel system		1 day	X		The activity is performed before starting or when the engine is not running. Check fuel level. Refill if necessary. Check overall condition of engine fuel system. Check water separator on the primary fuel filter. Drain water if necessary. Replace prefilter insert if it is clogged or defective. Check differential pressure gauge of primary fuel filter / display for control monitoring (if present). Take corrective measures if there is a defect.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL0- 5011	Air filter		1 day	X		The activity is performed before starting or when the engine is not running. Replace air filter if necessary. If the air filter is clogged, damaged or improperly installed, inspect charge air pipe and exhaust gas turbo-charger.

Tab. 18: Maintenance schedule – Daily, weekly and monthly maintenance activities – Service Level 0

5.2.4 Maintenance schedule – ESP Service Level 1

ESP-High Power Node (50Hz) - Version: MS2022/04-1

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant		4 years		X	Replace coolant.
SL1- 3021	Coolant analysis		1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.
SL1- 3281	Belt drive for coolant pump and alternator for battery charging		1 year			Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump		2 years	X	X	Check V-ribbed belt condition, replace if necessary.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump		4 years		X	Check belt tensioning device, replace if necessary.
SL1- 4012	Fuel system		1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5411	Exhaust gas turbo-charger		1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening		1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors		1 year	X		Check sensors.
SL1- 6411	Cable harness		1 year	X		Check cable harness connections.
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 19: ESP-High Power Node (50Hz) - Version: MS2022/04-1 – Service Level 1

ESP max. 710kW (50Hz) - Version: MS2022/04-2

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	4000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis		1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.
SL1- 3281	Belt drive for coolant pump and alternator for battery charging		1 year			Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump		2 years	X		Check V-ribbed belt condition, replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump		4 years		X	Check belt tensioning device, replace if necessary.
SL1- 4012	Fuel system		1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange		1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 5201	Exhaust system		1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 5411	Exhaust gas turbocharger		1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening		1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors		1 year	X		Check sensors.
SL1- 6411	Cable harness		1 year	X		Check cable harness connections.
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 20: ESP max. 710kW (50Hz) - Version: MS2022/04-2 – Service Level 1

ESP-High Power Node (60Hz) - Version: MS2022/04-5

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 3020	Coolant		4 years		X	Replace coolant.
SL1- 3021	Coolant analysis		1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.
SL1- 3281	Belt drive for coolant pump and alternator for battery charging		1 year			Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump		2 years	X	X	Check V-ribbed belt condition, replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump		4 years		X	Check belt tensioning device, replace if necessary.
SL1- 4012	Fuel system		1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange		1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system		1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 5411	Exhaust gas turbo-charger		1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening		1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors		1 year	X		Check sensors.
SL1- 6411	Cable harness		1 year	X		Check cable harness connections.
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 21: ESP-High Power Node (60Hz) - Version: MS2022/04-5 – Service Level 1

ESP max. 820kW (60Hz) - Version: MS2022/04-6

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	4000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis		1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 3281	Belt drive for coolant pump and alternator for battery charging”		1 year			Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump		2 years	X	X	Check V-ribbed belt condition, replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump		4 years		X	Check belt tensioning device, replace if necessary.
SL1- 4012	Fuel system		1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange		1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system		1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 5411	Exhaust gas turbocharger		1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening		1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors		1 year	X		Check sensors.
SL1- 6411	Cable harness		1 year	X		Check cable harness connections.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 22: ESP max. 820kW (60Hz) - Version: MS2022/04-6 – Service Level 1

5.2.5 Maintenance schedule – ESP Service Level 2

ESP-High Power Node (50Hz) - Version: MS2022/04-1

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber		8 years		X	Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper		18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3210	Coolant pump		18 years		X	Replace coolant pump.
SL2- 3310	Coolant thermostat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)		8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbocharger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt		8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing		18 years		X	Replace mechanical fan drive bearing.

Tab. 23: ESP-High Power Node (50Hz) - Version: MS2022/04-1

ESP max. 710kW (50Hz) - Version: MS2022/04-2

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber		8 years		X	Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper		18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3210	Coolant pump		18 years			Replace coolant pump.
SL2- 3310	Coolant thermostat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)		8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbocharger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt		8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing		18 years		X	Replace mechanical fan drive bearing.

Tab. 24: ESP max. 710kW (50Hz) - Version: MS2022/04-2

ESP-High Power Node (60Hz) - Version: MS2022/04-5

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber		8 years		X	Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper		18 years		X	Replace torsional vibration damper including fastening screws.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 3210	Coolant pump		18 years		X	Replace coolant pump.
SL2- 3310	Coolant thermo-stat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)		8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbo-charger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt		8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing		18 years		X	Replace mechanical fan drive bearing.

Tab. 25: ESP-High Power Node (60Hz) - Version: MS2022/04-5

ESP max. 820kW (60Hz) - Version: MS2022/04-6

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber		8 years		X	Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper		18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3210	Coolant pump		18 years		X	Replace coolant pump.
SL2- 3310	Coolant thermo-stat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)		8 years		X	Replace injector(s).

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 5410	Exhaust gas turbo-charger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt		8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing		18 years		X	Replace mechanical fan drive bearing.

Tab. 26: ESP max. 820kW (60Hz) - Version: MS2022/04-6

5.2.6 Maintenance schedule – PRP Service Level 1

PRP max. 645kW (50Hz) - Version: MS2022/04-3

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	5000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis	3000	1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 3281	Belt drive for coolant pump and alternator for battery charging	1000	1 year	X		Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump	2000	2 years		X	Check V-ribbed belt condition, replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump	4000	4 years		X	Check belt tensioning device, replace if necessary.
SL1- 4012	Fuel system	1000	1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange	7500	1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system	7500	1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 5411	Exhaust gas turbocharger	7500	1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening	1000	1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors	500	1 year	X		Check sensors.
SL1- 6411	Cable harness	1500	1 year	X		Check cable harness connections.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 27: PRP max. 645kW (50Hz) - Version: MS2022/04-3 – Service Level 1

PRP max. 745kW (60Hz) - Version: MS2022/04-7

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	5000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis	3000	1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.
SL1- 3281	Belt drive for coolant pump and alternator for battery charging	1000	1 year	X		Check V-ribbed belt, belt tensioning device and belt pulleys, replace if necessary.
SL1- 3282	Belt for alternator for battery charging and coolant pump	2000	2 years		X	Check V-ribbed belt condition, replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump	4000	4 years		X	Check belt tensioning device, replace if necessary.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 4012	Fuel system	1000	1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange	7500	1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system	7500	1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 5411	Exhaust gas turbocharger	7500	1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening	1000	1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors	500	1 year	X		Check sensors.
SL1- 6411	Cable harness	1500	1 year	X		Check cable harness connections.
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 28: PRP max. 745kW (60Hz) - Version: MS2022/04-7 – Service Level 1

5.2.7 Maintenance schedule – PRP Service Level 2

PRP max. 645kW (50Hz) - Version: MS2022/04-3

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber	7500	8 years		X	Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper	7500	18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3310	Coolant thermostat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 3210	Coolant pump		18 years		X	Replace coolant pump.
SL2- 4210	Injector(s)	7500	8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbocharger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt	7500	8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing	7500	18 years		X	Replace mechanical fan drive bearing.

Tab. 29: PRP max. 645kW (50Hz) - Version: MS2022/04-3

PRP max. 745kW (60Hz) - Version: MS2022/04-7

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber	7500	8 years		X	Check combustion chambers. Take corrective measures if there is a defect.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1340	Torsional vibration damper	7500	18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3310	Coolant thermo-stat(s)		18 years		X	Replace coolant thermostat(s).
SL2- 3210	Coolant pump		18 years		X	Replace coolant pump.
SL2- 4210	Injector(s)	7500	8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbo-charger		18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt	7500	8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing	7500	18 years		X	Replace mechanical fan drive bearing.

Tab. 30: PRP max. 745kW (60Hz) - Version: MS2022/04-7

5.2.8 Maintenance schedule – COP Service Level 1

COP max. 538kW (50Hz) - Version: MS2022/04-4

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	5000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis	3000	1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.
SL1- 3281	Belt drive for coolant pump and alternator for battery charging	1000	1 year	X		Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump	2000	2 years		X	Check V-ribbed belt condition. Replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump	4000	4 years		X	Check belt tensioning device. Replace if necessary.
SL1- 4012	Fuel system	1000	1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange	10000	1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system	10000	1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 5411	Exhaust gas turbo-charger	10000	1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening	1000	1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors	500	1 year	X		Check sensors.
SL1- 6411	Cable harness	1500	1 year	X		Check cable harness connections.
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 31: COP max. 538kW (50Hz) - Version: MS2022/04-4 – Service Level 1

COP max. 621kW (60Hz) - Version: MS2022/04-8

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 2020	Engine oil	1000	2 years		X	Change engine oil.
SL1- 2021	Oil analysis	1000	2 years		X	Take oil sample. Perform oil analysis. Take recommended measures according to analysis results.
SL1- 2110	Oil filter	1000	2 years		X	Replace oil filter. Clean engine side seal area before and after filter removal.
SL1- 3020	Coolant	5000	4 years		X	Replace coolant.
SL1- 3021	Coolant analysis	3000	1 year	X		Take a coolant sample. Perform coolant analysis. Take recommended measures according to analysis results.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 3281	Belt drive for coolant pump and alternator for battery charging	1000	1 year	X		Check V-ribbed belt, belt tensioning device and belt pulleys. Take corrective measures if there is a defect.
SL1- 3282	Belt for alternator for battery charging and coolant pump	2000	2 years		X	Check V-ribbed belt condition. Replace if necessary.
SL1- 3283	Tension pulley for alternator for battery charging and coolant pump	4000	4 years		X	Check belt tensioning device. Replace if necessary.
SL1- 4012	Fuel system	1000	1 year		X	Check fuel system. Take corrective measures if there is a defect.
SL1- 4110	Fuel pre-filter	1000	2 years		X	Replace fuel pre-filter.
SL1- 4120	Fuel fine filter	1000	2 years		X	Replace fuel fine filter.
SL1- 5013	Charge air pipe		1 year	X		Check charge air pipe, tubes, hoses (also those for Wastegate / ventilation) and exhaust gas turbocharger (compressor blades, housing, connections, fastening). Take corrective measures if there is a defect.
SL1- 5191	Heating flange	10000	1 year		X	Check heating flange connections and resistance. Take corrective measures if there is a defect.
SL1- 5201	Exhaust system	10000	1 year		X	Check exhaust system (leaks, cracks, fastenings). Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 5411	Exhaust gas turbocharger	10000	1 year		X	Check exhaust gas turbocharger (compressor and turbine blades, shaft play, connections, housing). Identify and report anomalies. Take corrective measures if there is a defect. New interval is established according to the result of the field test.
SL1- 6311	Engine control unit fastening	1000	1 year	X		Check engine control unit fastening. Take corrective measures if there is a defect.
SL1- 6321	Sensors	500	1 year	X		Check sensors.
SL1- 6411	Cable harness	1500	1 year	X		Check cable harness connections.

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL1- 7221	Fan belt	500	1 year	X		Check fan belt. Take corrective measures if there is a defect.

Tab. 32: COP max. 621kW (60Hz) - Version: MS2022/04-8 – Service Level 1

5.2.9 Maintenance schedule – COP Service Level 2

COP max. 538kW (50Hz) - Version: MS2022/04-4

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber	7000	8 years	X		Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper	10000	18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3210	Coolant pump	10000	18 years		X	Replace coolant pump.
SL2- 3310	Coolant thermostat(s)	10000	18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)	7000	8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbocharger	10000	18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt	7000	8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing	7000	18 years		X	Replace mechanical fan drive bearing.

Tab. 33: COP max. 538kW (50Hz) - Version: MS2022/04-4

COP max. 621kW (60Hz) - Version: MS2022/04-8

Activity identification	Component	Maintenance schedule		Maintenance activity		Description
		Operating hours (h)	Calendar interval (Day - Month - Year)	Check / clean	Replace	
SL2- 1211	Combustion chamber	7000	8 years	X		Check combustion chambers. Take corrective measures if there is a defect.
SL2- 1340	Torsional vibration damper	10000	18 years		X	Replace torsional vibration damper including fastening screws.
SL2- 3210	Coolant pump	10000	18 years		X	Replace coolant pump.
SL2- 3310	Coolant thermostat(s)	10000	18 years		X	Replace coolant thermostat(s).
SL2- 4210	Injector(s)	7000	8 years		X	Replace injector(s).
SL2- 5410	Exhaust gas turbocharger	10000	18 years		X	Replace exhaust gas turbocharger.
SL2- 6210	Starter motor		18 years		X	Replace the starter motor at the specified time or according to the documentation for the generator set.
SL2- 7220	Fan belt	7000	8 years		X	Replace fan belt.
SL2- 7212	Mechanical fan drive bearing	7000	18 years		X	Replace mechanical fan drive bearing.

Tab. 34: COP max. 621kW (60Hz) - Version: MS2022/04-8

5.3 Preliminary work

5.3.1 Bringing the engine into maintenance position

Safety measures for maintenance

The following safety regulations are to be observed when performing maintenance work! See “Safety” chapter (For more information see: 2 Safety, page 22.) .

Maintenance position

The engine is in maintenance position if:
- The engine is horizontal.
- The engine is turned off.
- The engine is cooled down to ambient temperature.
- Disconnect the electrical power supply and secure it against being switched back on.
- Mark the cut-off point with a tag.

5.3.2 As needed

Preliminary work which must be performed for the various activities.

Removing the fan drive V-ribbed belt

Removing the V-ribbed belt

Make sure that the following prerequisites are met:
❑ Fan is removed, see documentation for the generator set.
❑ 1/2” socket wrench transition piece (external square) with lever is available.

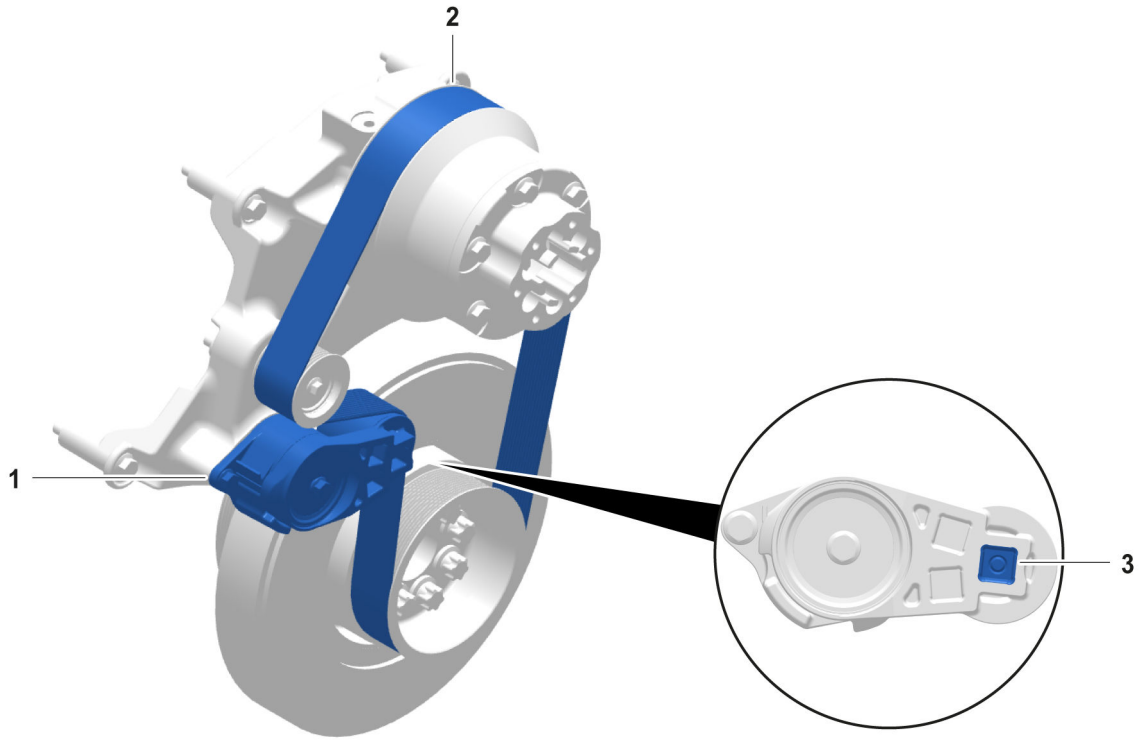


Fig. 29: Fan drive V-ribbed belt

1 Belt tensioning device (self-tensioning)
2 V-ribbed belt
3 Internal square

▶ Attach 1/2” socket wrench transition piece (external square) with lever to square drive **3** of the belt tensioning device (self tensioning) **1**.

WARNING
Unexpected recoil of the tensioner (self tensioning)!
Injuries.

▶ Make sure that the tool is correctly connected to tension pulley (self-tensioning).

▶ Carefully swivel tensioner (self tensioning).

▶ When V-ribbed belt is loose, do not let go of tool on tension pulley (self-tensioning).

▶ Swivel back belt tensioning device (self-tensioning) **1** counterclockwise to the limit stop.
▷ V-ribbed belt **2** is relaxed.

▶ Remove V-ribbed belt **2**.

▶ Turn back belt tensioning device (self-tensioning) **1**.

Installing the V-ribbed belt

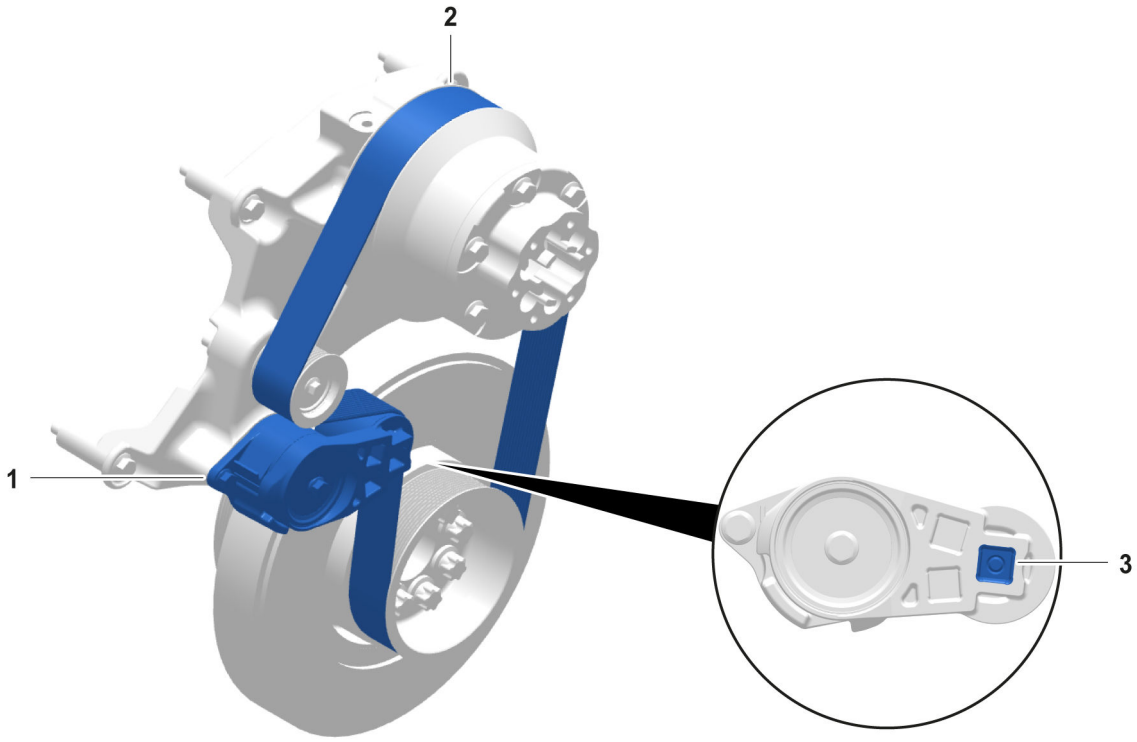


Fig. 30: V-ribbed belt on the fan drive

1 Belt tensioning device (self-tensioning)
2 V-ribbed belt
3 Internal square

▶ Swivel back belt tensioning device (self-tensioning) **1** counterclockwise against the spring force to the limit stop.

▶ Install V-ribbed belts **2** on belt pulleys and deflection pulley.

▶ Turn belt tensioning device (self-tensioning) **1** carefully to original position.
▷ Belt tensioning device (self-tensioning) **1** is tensioned.

5.4 1000 - Engine

5.4.1 Visual inspection (tightness, damage, loose parts) – SL0-1011

WARNING
Hot components!
Serious burns possible.

- ▶ Let the engine cool down to below 50 °C.
- ▶ Wear heat-resistant safety gloves and heat-resistant work clothes.

- ▶ Check components for leaks.

If components are leaking:
- ▶ Do not start engine.
- ▶ Replace components, see engine repair instructions or documentation from the generator manufacturer.
- ▶ Check components for proper fastening.

If components are loose:
- ▶ Do not start engine.
- ▶ Tighten components according to tightening instruction, see service and repair manual.
- ▶ Check components for damage.

If components are damaged:
- ▶ Do not start engine.
- ▶ Replace damaged components, see engine repair instructions or documentation from the generator manufacturer.

5.4.2 Observing the engine when idling – SL0-1021

- ▶ Watch out for incorrect parameters when idling.
- ▶ Watch out for unusual noises when idling.
- ▶ Watch out for unusual vibrations when idling.
- ▶ Watch out for unusual discoloration of the exhaust gases when idling.

5.4.3 Observing the engine in operation (only emergency power system - ESP application) – SL0-1022

- ▶ Watch out for incorrect parameters during operation.
- ▶ Watch out for unusual noises during operation.
- ▶ Watch out for unusual vibrations during operation.
- ▶ Watch out for unusual discoloration of the exhaust gases during operation.

5.5 2000 - Lubrication system

5.5.1 Checking the lubricating oil level – SLO-2011

CAUTION
When opening the lines of the engine oil system, possible lubricant contact with the environment, eyes, mouth or skin!
Poisoning or skin reaction possible. Harmful to aquatic organisms with continuing effects.

- ▶ Wear chemical safety gloves.
- ▶ Wear chemical safety glasses.
- ▶ Wear chemical safety shoes.
- ▶ Wear chemical work clothing.
- ▶ Avoid releasing into the environment.
- ▶ Dispose of contents and container in accordance with local regulations.

WARNING
Dangerous behavior of the engine if the oil level is not correct!
Unintended acceleration up to disintegration of the engine possible.

- ▶ Prozedur entsprechend Kapitel Motoröl einfüllen beziehungsweise Motorölstand prüfen befolgen.

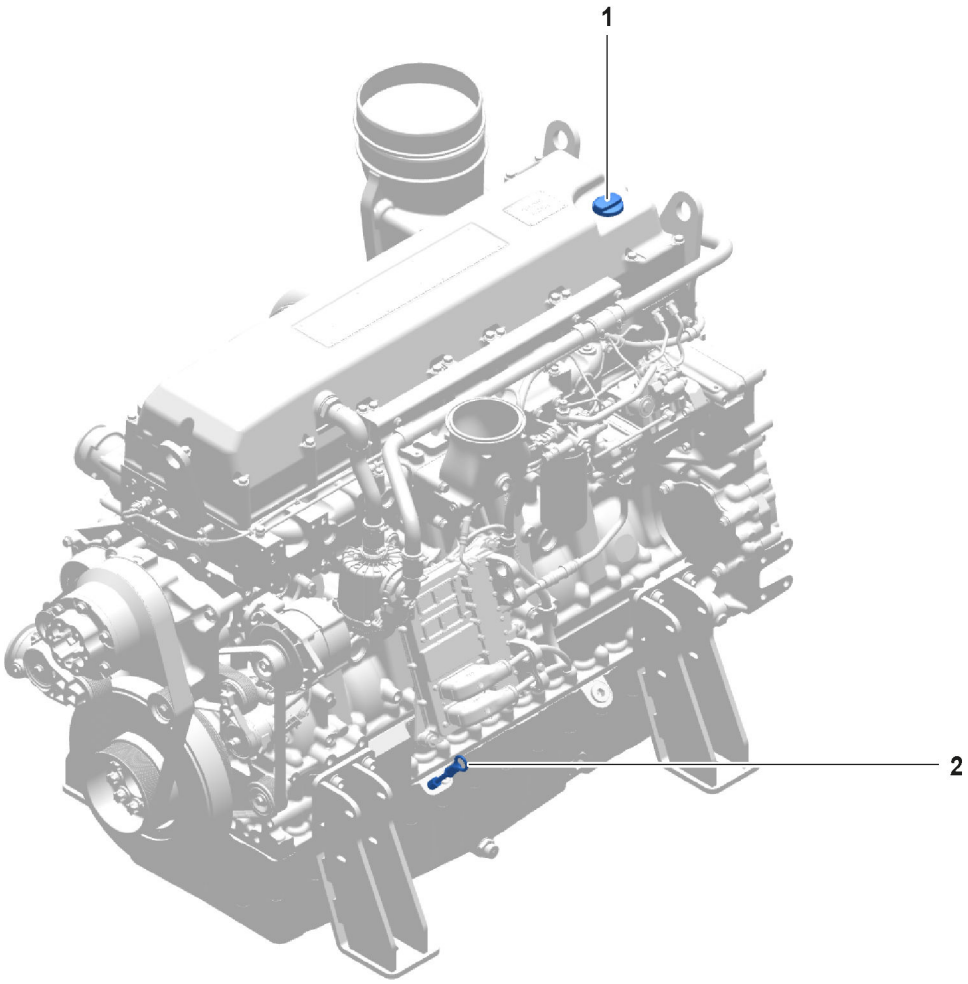


Fig. 31: Checking the lubricating oil level

1 Oil filler cap **2** Oil dipstick

- ▶ Start engine.
- ▶ Bring engine to operating temperature 80 ±2 °C.
- ▶ Turn off engine.
- ▶ Wait 5 minutes.
- ▶ Pull out oil dipstick **2**.
- ▶ Wipe engine oil off of oil dipstick **2** with a clean cloth.
- ▶ Insert oil dipstick **2**.
- ▶ Pull out oil dipstick **2**.

Fig. 32: Oil dipstick

1 Maximum **2** Minimum

▶ Check that the oil level is between Maximum **1** and Minimum **2** on the oil dipstick **2**.

If the oil level is above the Maximum **1** mark:
▶ Drain oil.

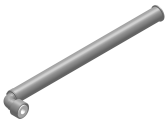
If the oil level is below the Minimum **2** mark:
▶ Refill oil.

▶ Insert oil dipstick **2**.

▶ Check oil level again.

5.5.2 Changing the lubricating oil – SL1-2020

Draining the lubricating oil

Graphic representation	Description	Required number	Part number
	Drain hose 90°	1	12690423

Tab. 35: Special tool

Make sure that the following prerequisites are met:
❑ Engine is in maintenance position.
❑ The engine temperature is at least 20°C or ambient temperature.
❑ A collection container for lubricating oil is available.
❑ Lubricating oil according to lubricating oil specification is available. (For more information see: 5.1.3 Engine oils, page 43.)

WARNING
Hot components!
Serious burns possible.

▶ Let the engine cool down to below 50 °C.

▶ Wear heat-resistant safety gloves and heat-resistant work clothes.

CAUTION
When opening the lines of the engine oil system, possible lubricant contact with the environment, eyes, mouth or skin!
Poisoning or skin reaction possible. Harmful to aquatic organisms with continuing effects.

- ▶ Wear chemical safety gloves.
- ▶ Wear chemical safety glasses.
- ▶ Wear chemical safety shoes.
- ▶ Wear chemical work clothing.
- ▶ Avoid releasing into the environment.
- ▶ Dispose of contents and container in accordance with local regulations.

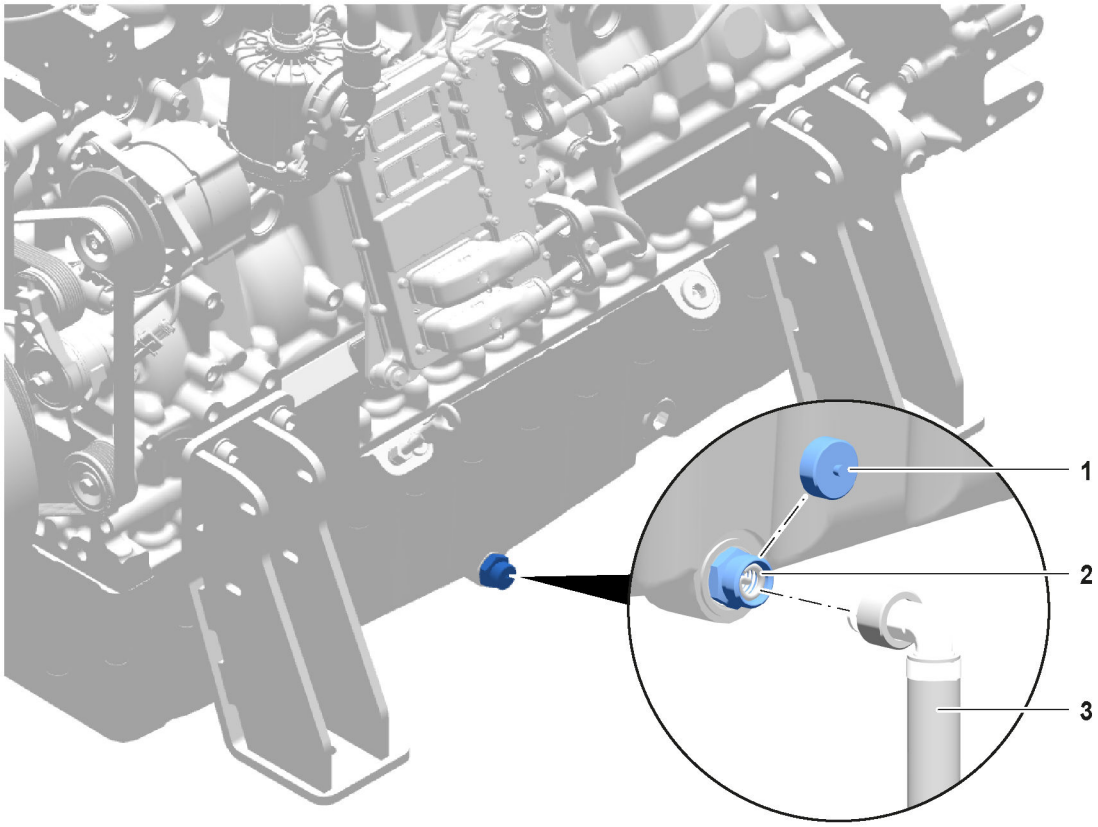


Fig. 34: Draining the lubricating oil

1 Sealing cap
2 Oil drain valve
3 Drain hose

- ▶ Place end of drain hose **3** in collection container.
- ▶ Unscrew sealing cap **1** from oil drain valve **2**.
- ▶ Install drain hose **3** on oil drain valve **2**.
  - ▷ Oil drain valve **2** opens.
  - ▷ Lubricating oil runs out.
- ▶ Remove drain hose **3**.
- ▶ Tighten sealing cap **1** on oil drain valve **2**.
- ▶ Clean oil drain valve **2** with a lint-free cloth.

Filling the lubricating oil

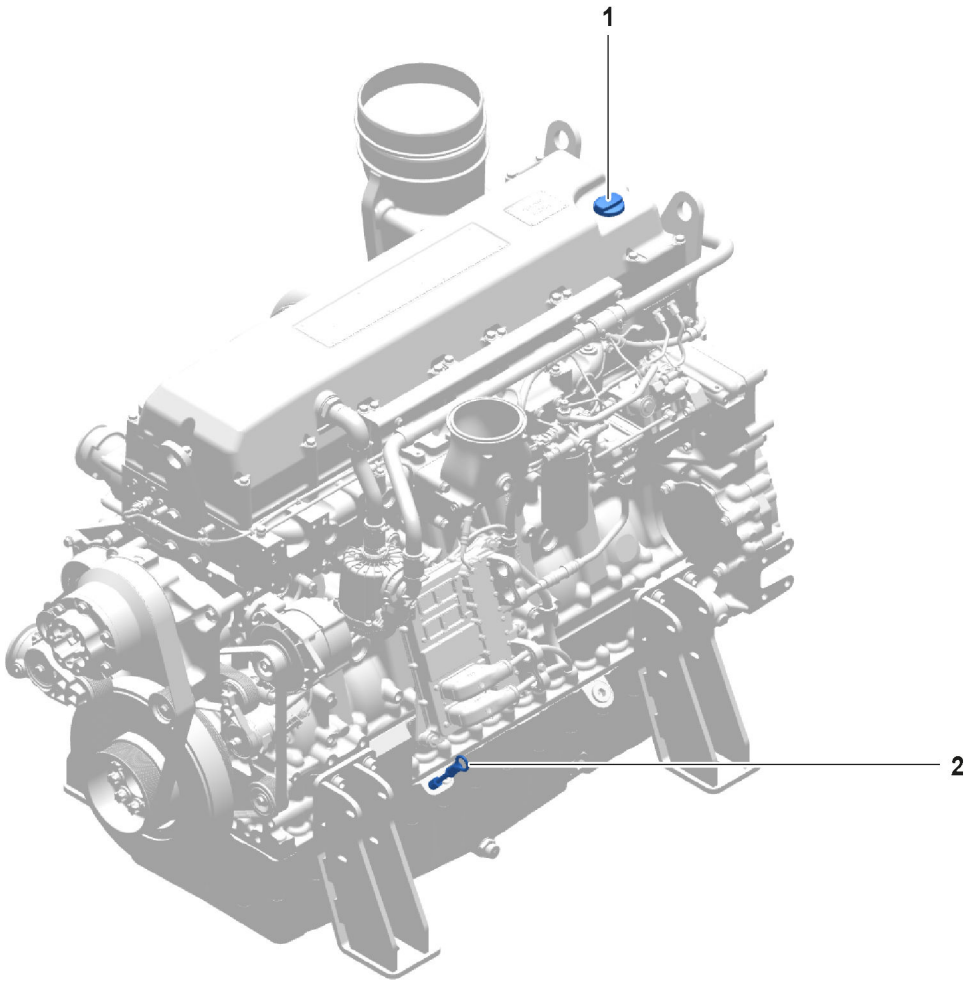


Fig. 35: Filling the lubricating oil

1 Oil filler cap **2** Oil dipstick

- ▶ Unscrew oil filler cap **1**.
- ▶ Fill the lubricating oil to within the minimum and maximum on the oil dipstick **2**.
- ▶ Clean oil filler cap **1**, put it on and tighten it.
- ▶ Start engine.
- ▶ Check oil pressure (diesel lubricating oil pressure display unit) and tightness on the oil filter.
- ▶ Turn off engine.
- ▶ Wait 10 minutes.
- ▶ Check lubricating oil level. (For more information see: 5.5.1 Checking the lubricating oil level – SL0-2011, page 75.)

5.5.3 Taking an oil sample and performing an oil analysis – SL1-2021

Make sure that the following prerequisites are met:
- ❑ A collection container for lubricating oil is available.
- ❑ A suitable sample bottle is available.

WARNING
Hot components!
Serious burns possible.

- ▶ Let the engine cool down to below 50 °C.
- ▶ Wear heat-resistant safety gloves and heat-resistant work clothes.

CAUTION
When opening the lines of the engine oil system, possible lubricant contact with the environment, eyes, mouth or skin!
Poisoning or skin reaction possible. Harmful to aquatic organisms with continuing effects.

- ▶ Wear chemical safety gloves.
- ▶ Wear chemical safety glasses.
- ▶ Wear chemical safety shoes.
- ▶ Wear chemical work clothing.
- ▶ Avoid releasing into the environment.
- ▶ Dispose of contents and container in accordance with local regulations.

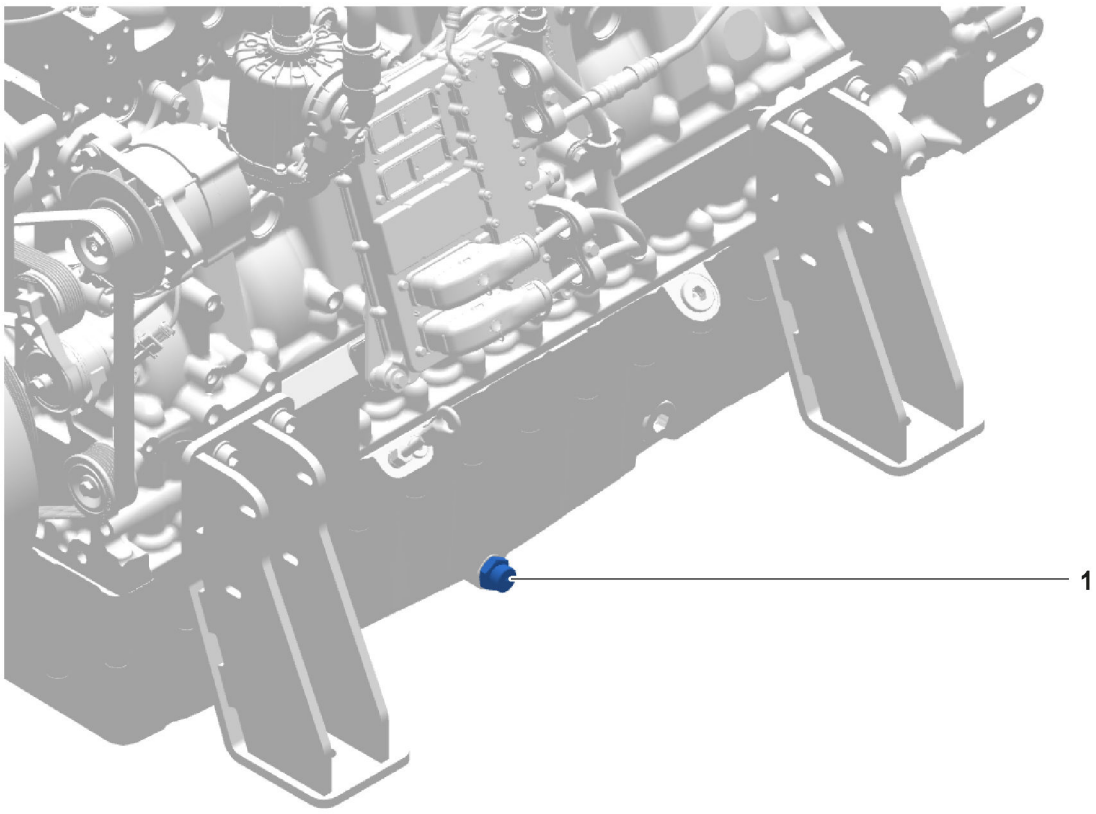


Fig. 36: Oil drain valve

1 Oil drain valve

- ▶ Take oil sample and perform oil analysis, see documentation for the generator set.

5.5.4 Replacing the oil filter – SL1-2110

Make sure that the following prerequisite is met:
❑ A collection container for lubricating oil is available.

WARNING
Hot components!
Serious burns possible.

- ▶ Let the engine cool down to below 50 °C.
- ▶ Wear heat-resistant safety gloves and heat-resistant work clothes.

CAUTION
When opening the lines of the engine oil system, possible lubricant contact with the environment, eyes, mouth or skin!
Poisoning or skin reaction possible. Harmful to aquatic organisms with continuing effects.

- ▶ Wear chemical safety gloves.
- ▶ Wear chemical safety glasses.
- ▶ Wear chemical safety shoes.
- ▶ Wear chemical work clothing.
- ▶ Avoid releasing into the environment.
- ▶ Dispose of contents and container in accordance with local regulations.

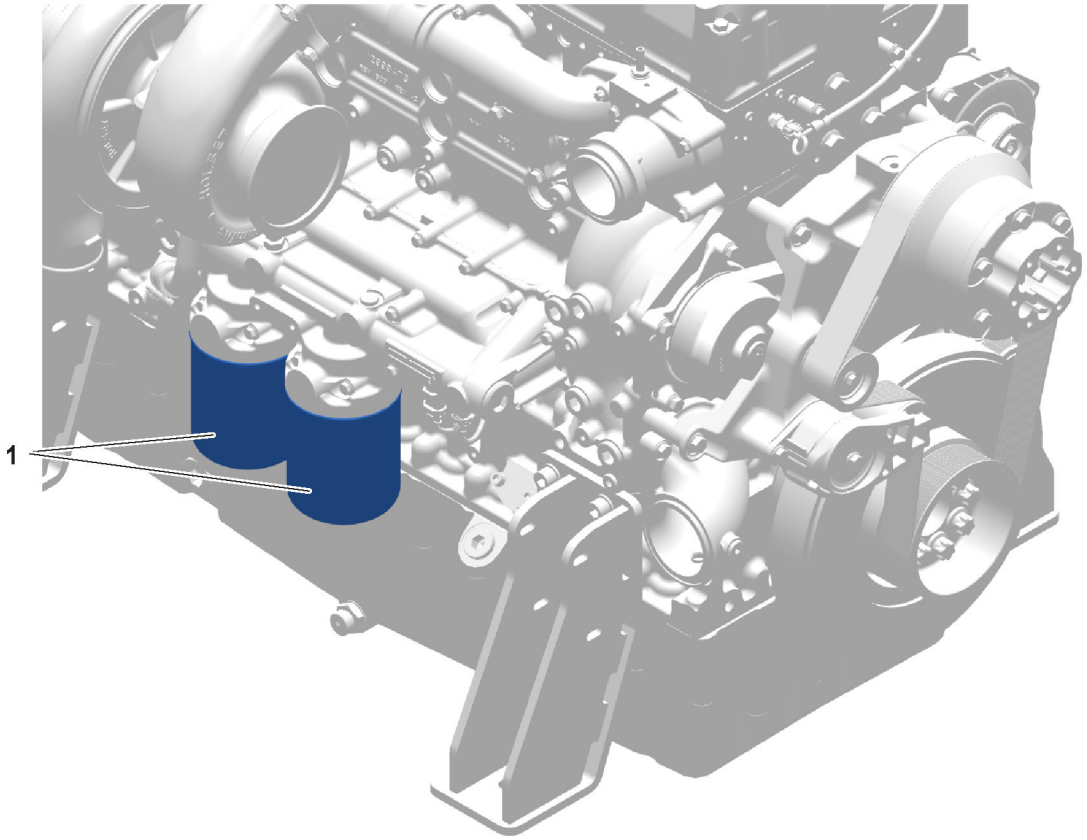


Fig. 37: Replacing the oil filter

1 Oil filter

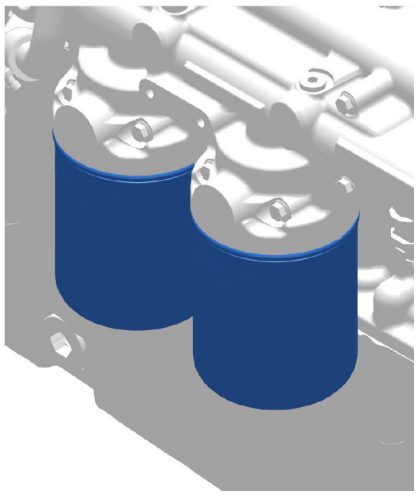
▶ Unscrew oil filter **1** using a strap wrench or similar tool.

▶ Dispose of oil filter in accordance with the country-specific regulations.

▶ Lubricate oil filter seal with lubricating oil.

▶ Screw on oil filter **1** until sealing ring rests against oil module.

Tightening instruction	
Lubricant	Engine oil
Locking agent	-
Part contact surfaces	-
Screws	-
Stage	**Tightening torque**
1.	Screw on by hand until the seal is in contact



Tightening instruction		
2.	1/2 revolution (25 $^{\pm 5}$ Nm)	

Tab. 36: Tightening instruction

▶ Tighten oil filter **1** according to tightening instruction.

5.6 3000 - Cooling system

5.6.1 Checking the coolant level – SL0-3011

WARNING
Hot cooler parts and hot coolant!
Serious burns possible.

- ▶ Let engine cool down to below 50 °C before all work.
- ▶ Wear protective gloves and safety goggles.

- ▶ For procedure to check the coolant level, see documentation for the generator set.

If the coolant level is too low or too high:
- ▶ Do not start engine.
- ▶ Refill coolant, see documentation for the generator set.

5.6.2 Replacing the coolant – SL1-3020

- ▶ Replace coolant, see documentation for the generator set.

5.6.3 Taking a coolant sample and performing a coolant analysis – SL1-3021

Make sure that the following prerequisite is met:
- ❑ A collection container for coolant sample is available.

WARNING
Hot cooler parts and hot coolant!
Serious burns possible.

- ▶ Let engine cool down to below 50 °C before all work.
- ▶ Wear protective gloves and safety goggles.

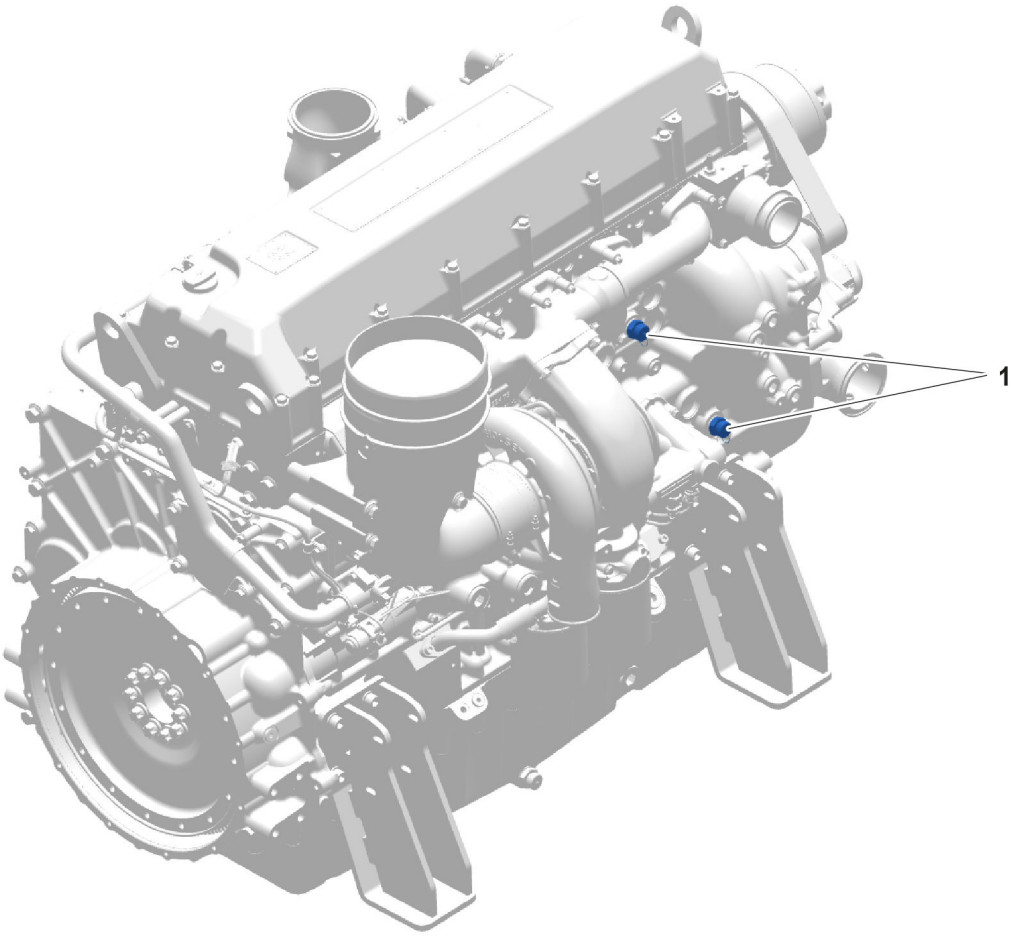


Fig. 39: Coolant drain valves

1 Coolant drain valves

▶ Remove coolant, see documentation for the generator set.

5.6.4 Checking the belt drive for coolant pump and alternator for battery charging – SL1-3281

Damages to the V-ribbed belt are:
- Broken ribs
- Rubber lumps on the bottom of the belt
- Deposits of dirt or stones
- Ribs detached from the bottom of the belt
- Transverse cracks on the back
- Transverse cracks in multiple ribs

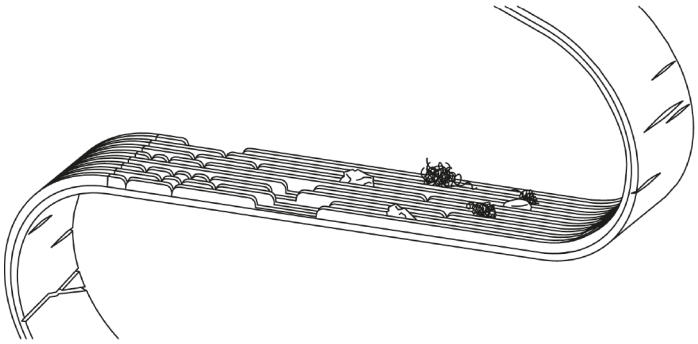


Fig. 40: Damage to the V-ribbed belt

1 Fuel fine filter

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

▶ Turn off engine.

▶ Secure the engine against unexpected start-up.

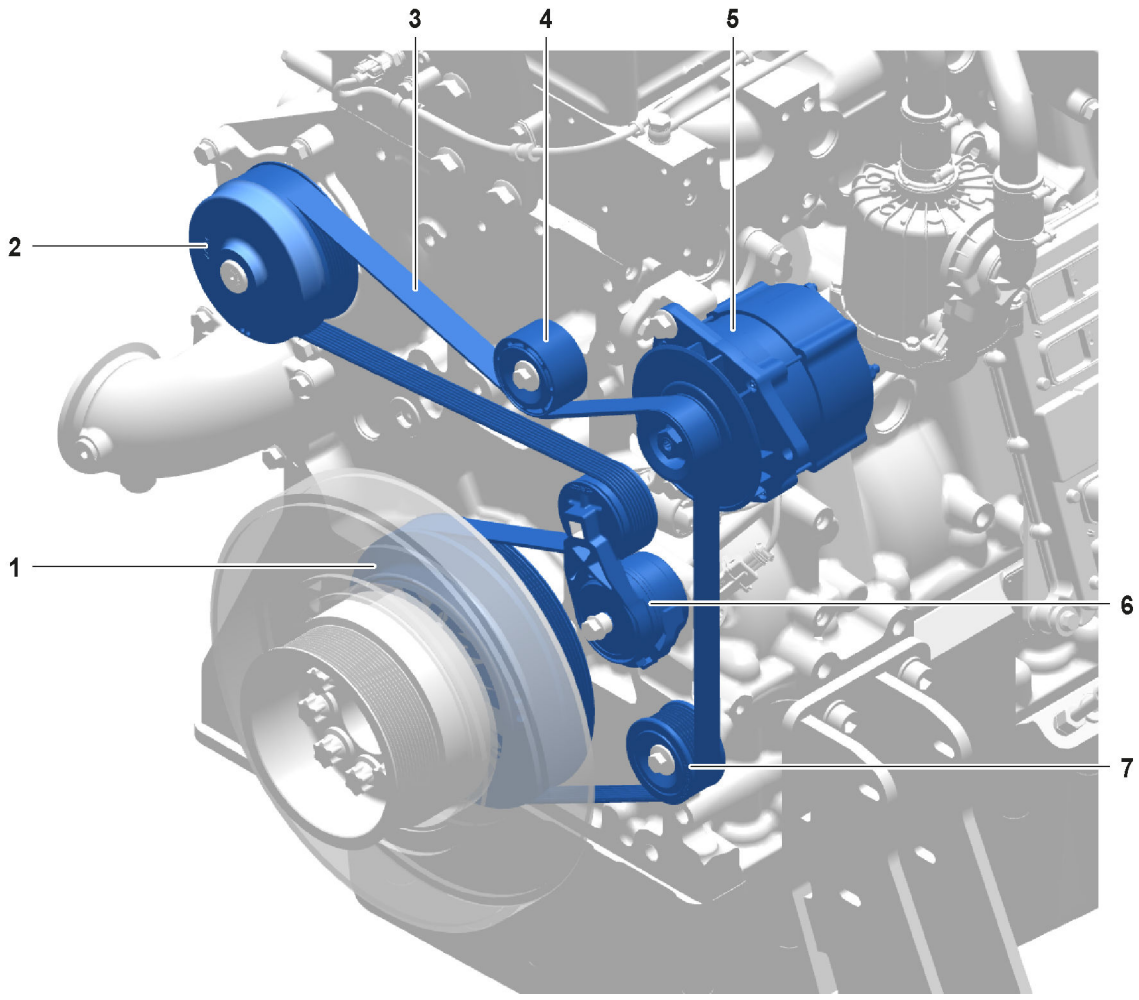


Fig. 41: Checking the belt drive for coolant pump and alternator for battery charging

1 Belt pulley on crankshaft

5 Battery charging alternator

See next page for continuation of the image legend

2 Belt pulley
3 V-ribbed belt
4 Deflection pulley
6 Tension pulley (self-tensioning)
7 Deflection pulley

▶ Check belt pulley on crankshaft **1** for damage.

▶ Check belt pulley **2** for damage.

▶ Check belt pulley **2** and tension pulley (self tensioning) **6** for faultless condition and play (e.g. worn out bearings of deflection pulley **4** and deflection pulley **7** as well as tread wear of belt pulley on crankshaft **1** and belt pulley **2**).

▶ Replace damaged parts. Contact nearest authorized Kohler customer service.

5.6.5 Replacing the belt for alternator for battery charging and coolant pump – SL1-3282

Removing the belt for the alternator for battery charging and coolant pump

Make sure that the following prerequisite is met:
❑ Fan drive V-ribbed belt is removed. (For more information see: Removing the fan drive V-ribbed belt, page 71.)
❑ 1/2” socket wrench transition piece (external square) with lever is available.

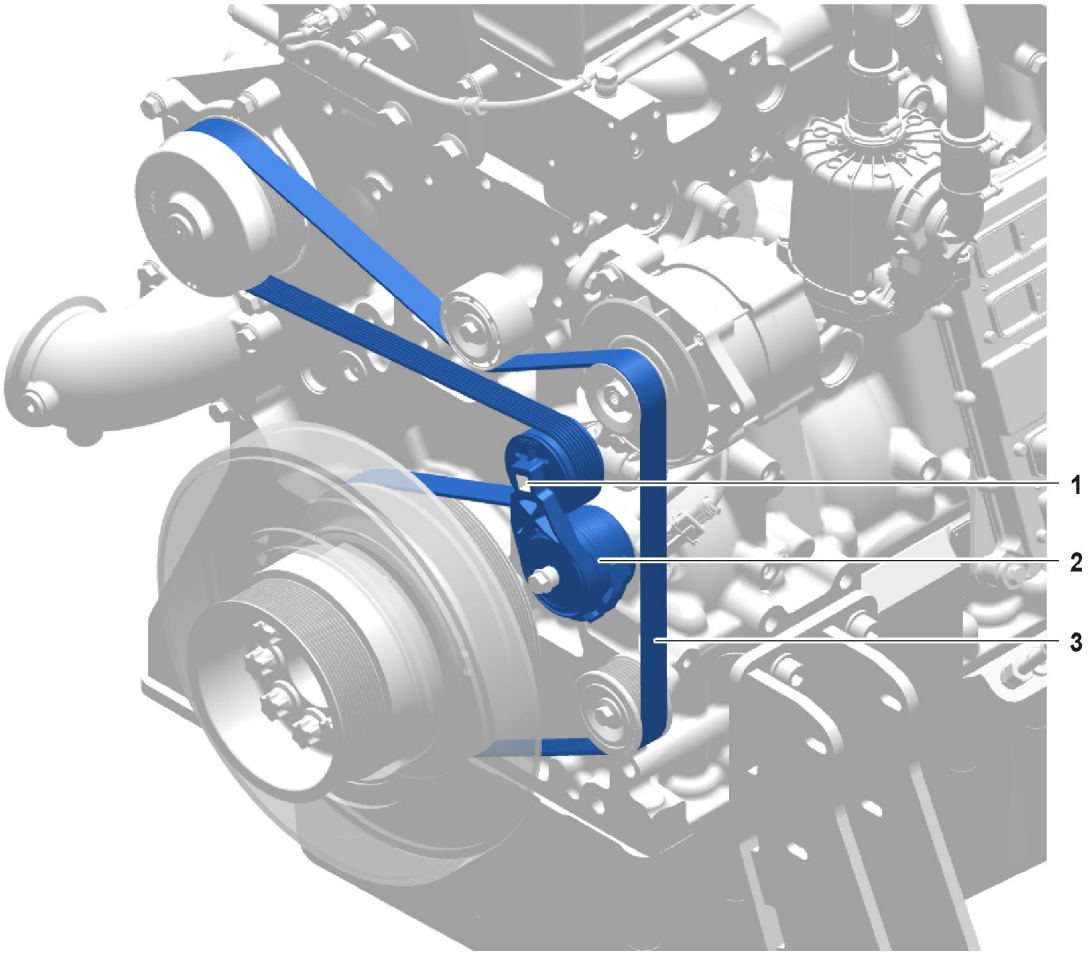


Fig. 42: Removing the belt for the alternator for battery charging and coolant pump

1 Internal square

2 Tension pulley (self-tensioning)

3 Belt for alternator for battery charging and coolant pump

▶ Attach 1/2" socket wrench transition piece (external square) with lever to internal square **1** of the tension pulley (self-tensioning) **2**.

WARNING
Unexpected recoil of the tensioner (self tensioning)!
Injuries.

▶ Make sure that the tool is correctly connected to tension pulley (self-tensioning).

▶ Carefully swivel tensioner (self tensioning).

▶ When V-ribbed belt is loose, do not let go of tool on tension pulley (self-tensioning).

▶ Swivel back tension pulley (self-tensioning) **2** counterclockwise against the spring force to the limit stop.
▷ Belt for alternator for battery charging and coolant pump **3** is relaxed.

▶ Remove belt for alternator for battery charging and coolant pump **3**.

▶ Turn back tension pulley (self-tensioning) **2**.

Installing the belt for the alternator for battery charging and coolant pump

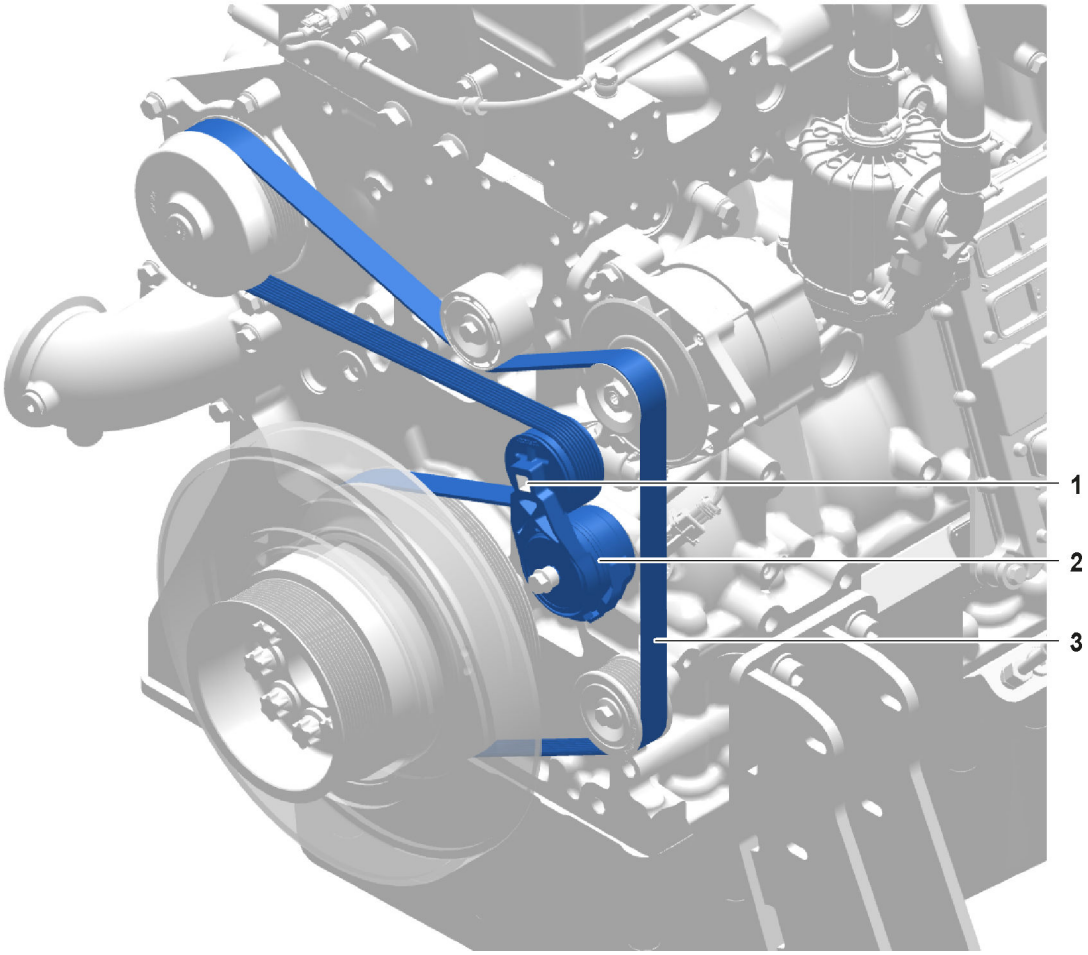


Fig. 43: Installing the belt for the alternator for battery charging and coolant pump

1 Internal square

2 Tension pulley (self-tensioning)

3 Belt for alternator for battery charging and coolant pump

▶ Attach 1/2” socket wrench transition piece (external square) with lever to internal square **1** of the tension pulley (self-tensioning) **2**.

WARNING
Unexpected recoil of the tensioner (self tensioning)!
Injuries.

▶ Make sure that the tool is correctly connected to tension pulley (self-tensioning).

▶ Carefully swivel tensioner (self tensioning).

▶ When V-ribbed belt is loose, do not let go of tool on tension pulley (self-tensioning).

▶ Swivel back tension pulley (self-tensioning) **2** counterclockwise against the spring force to the limit stop.

▶ Fit belt for alternator for battery charging and coolant pump **3** on belt pulley of crankshaft, coolant pump and deflection pulleys.

▶ Turn tension pulley (self-tensioning) **2** carefully to original position.
▷ Belt for alternator for battery charging and coolant pump **3** is tensioned.

5.6.6 Replacing the tension pulley for alternator for battery charging and coolant pump – SL1-3283

Replacing the tension pulley (self-tensioning)

Make sure that the following prerequisite is met:
❑ V-ribbed belt is removed. (For more information see: Removing the belt for the alternator for battery charging and coolant pump, page 87.)

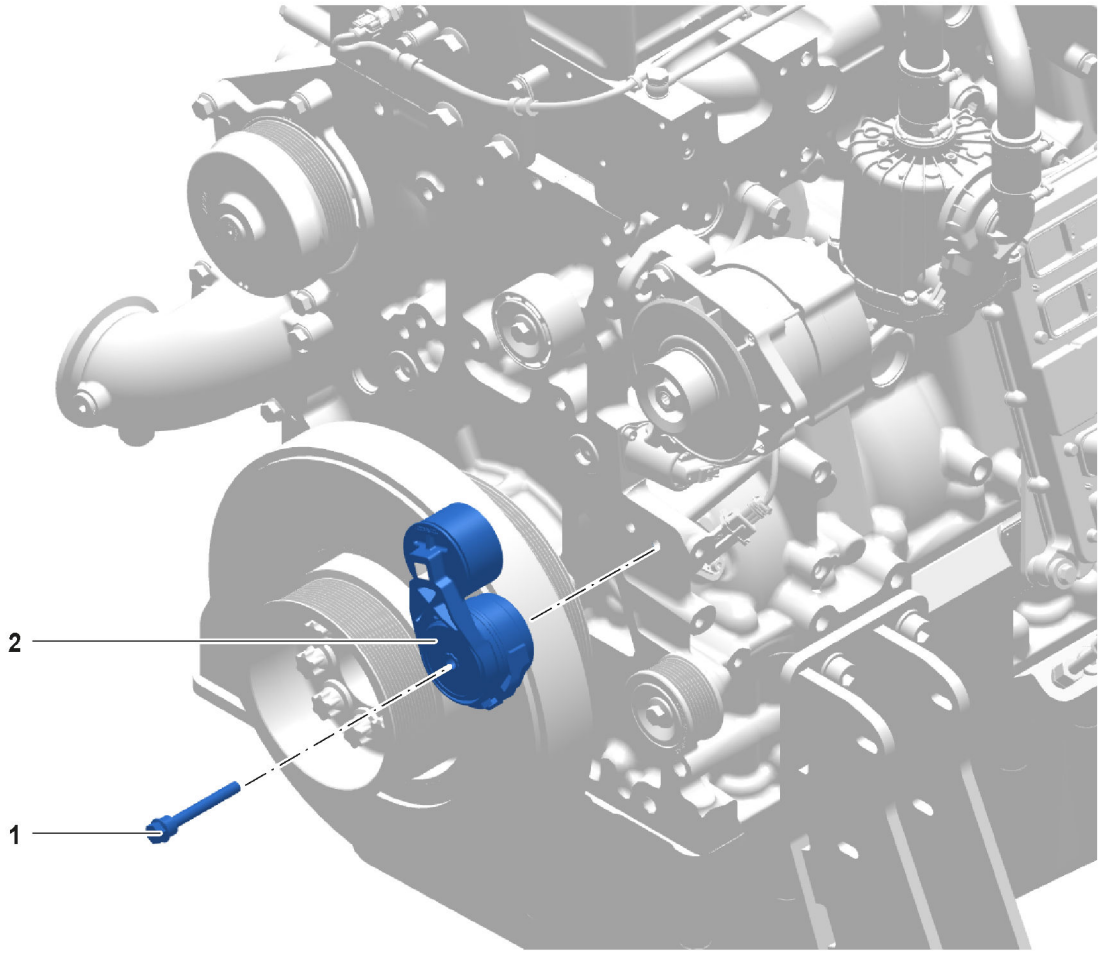


Fig. 44: Replacing the tension pulley (self-tensioning)

1 Hex head screw
2 Tension pulley (self-tensioning)

▶ Unscrew hex head screw **1**.
▶ Remove tension pulley (self-tensioning) **2**.
▶ Check tension pulley (self-tensioning) **2** for damage.

If the tension pulley (self-tensioning) **2** is damaged:
▶ Replace tension pulley (self-tensioning) **2**.
▶ Install tension pulley (self-tensioning) **2**.
▶ Tighten hex head screw **1**.

5.7 4000 - Fuel system

5.7.1 Checking the fuel level and checking / draining the water separator on the fuel prefilter – SL0-4011

Information

The fuel pre-filter with water separator is not attached directly to the diesel engine and is installed differently depending on the device design, see documentation for the generator set.

▶ Check water separator on fuel pre-filter, see documentation for the generator set.

If there is water in the water separator:
▶ Drain the water.

5.7.2 Replacing the fuel prefilter – SL1-4110

Make sure that the following prerequisites are met:
❑ A collection container with the required capacity is available.
❑ A primary fuel filter insert is available.

For procedure to replace the primary fuel filter, see operation and maintenance manual for the generator set.

WARNING
Open flames!
Injuries, fire and explosion! Can cause severe injury 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 engine has been turned off.

5.7.3 Replacing the fuel fine filter – SL1-4120

Make sure that the following prerequisite is met:
❑ A collection container for fuel is available.

NOTICE
Dirt!
Damage to common rail system.

▶ Make sure that no dirt comes in contact with fuel-carrying parts.

▶ Do not reuse fuel prefilter and fuel fine filter.

▶ Observe instructions for work on the Common Rail System.

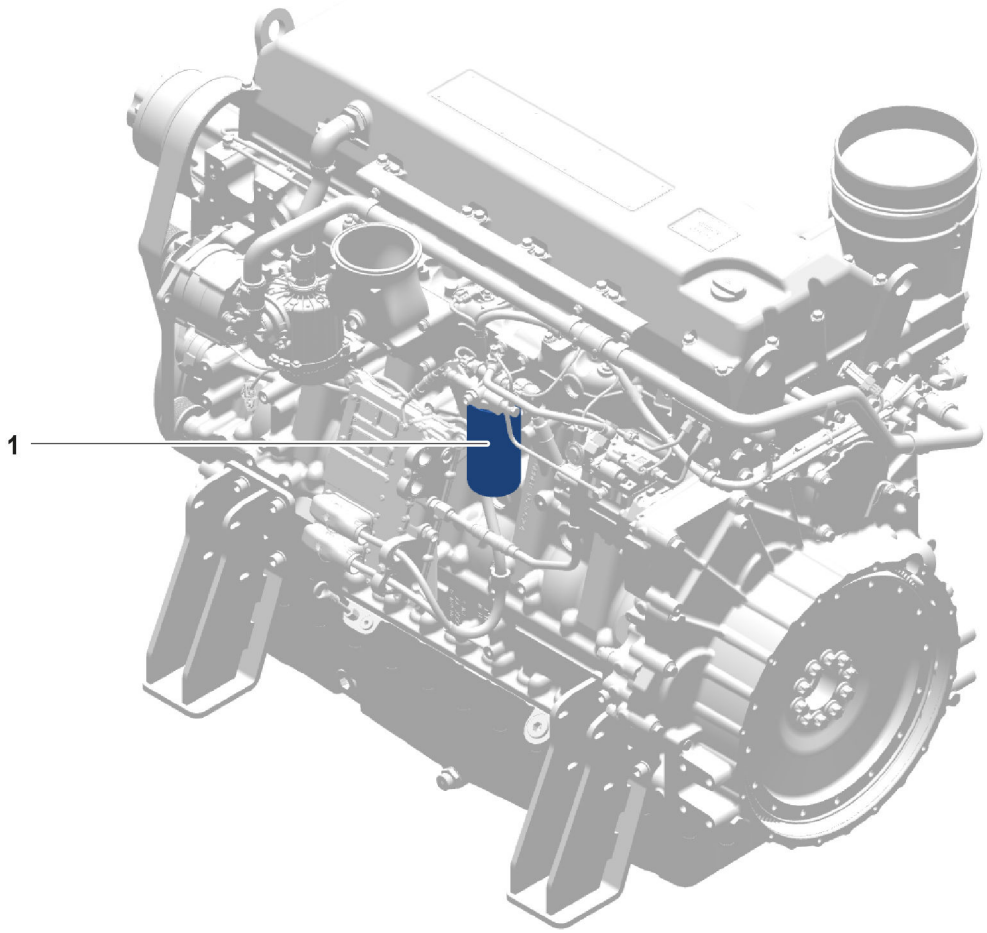


Fig. 45: Replacing the fuel fine filter

1 Main fuel filter

▶ Put collection container under main fuel filter.

▶ Thoroughly clean main fuel filter **1** and surrounding area.

▶ Unscrew main fuel filter **1** using a strap wrench or similar tool.

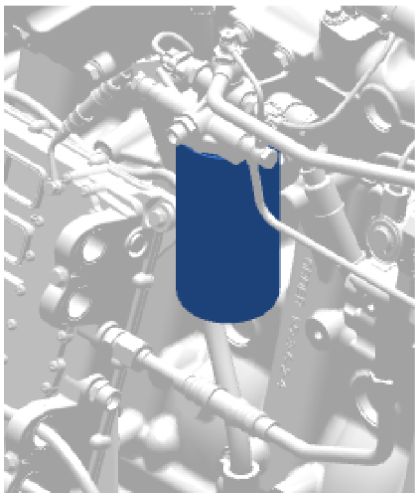
▶ Dispose of fuel fine filter according to country-specific regulations.

If the main fuel filter module is contaminated:

▶ Clean thread and sealing surface of main fuel filter module with a lint-free cloth.

▶ Lightly lubricate sealing ring of fuel fine filter with engine oil.

▶ Screw on main fuel filter until sealing ring rests against filter module.

Tightening instruction		
Lubricant	Engine oil	
Locking agent	-	
Part contact surfaces	-	
Screws	-	
Stage	**Tightening torque**	
1.	Screw on by hand until the seal is in contact	
2.	3/4 - 1 revolution (20 $^{\pm 5}$ Nm)	

Tab. 37: Tightening instruction

- ▶ Tighten fuel fine filter according to tightening instruction.
- ▶ Ventilate fuel system, see documentation for the generator set.

5.8 5000 - Exhaust system and charge air system

5.8.1 Checking the air filter – SL0-5011

▶ Check air filter, see documentation for the generator set.

5.8.2 Checking the charge air system – SL1-5013

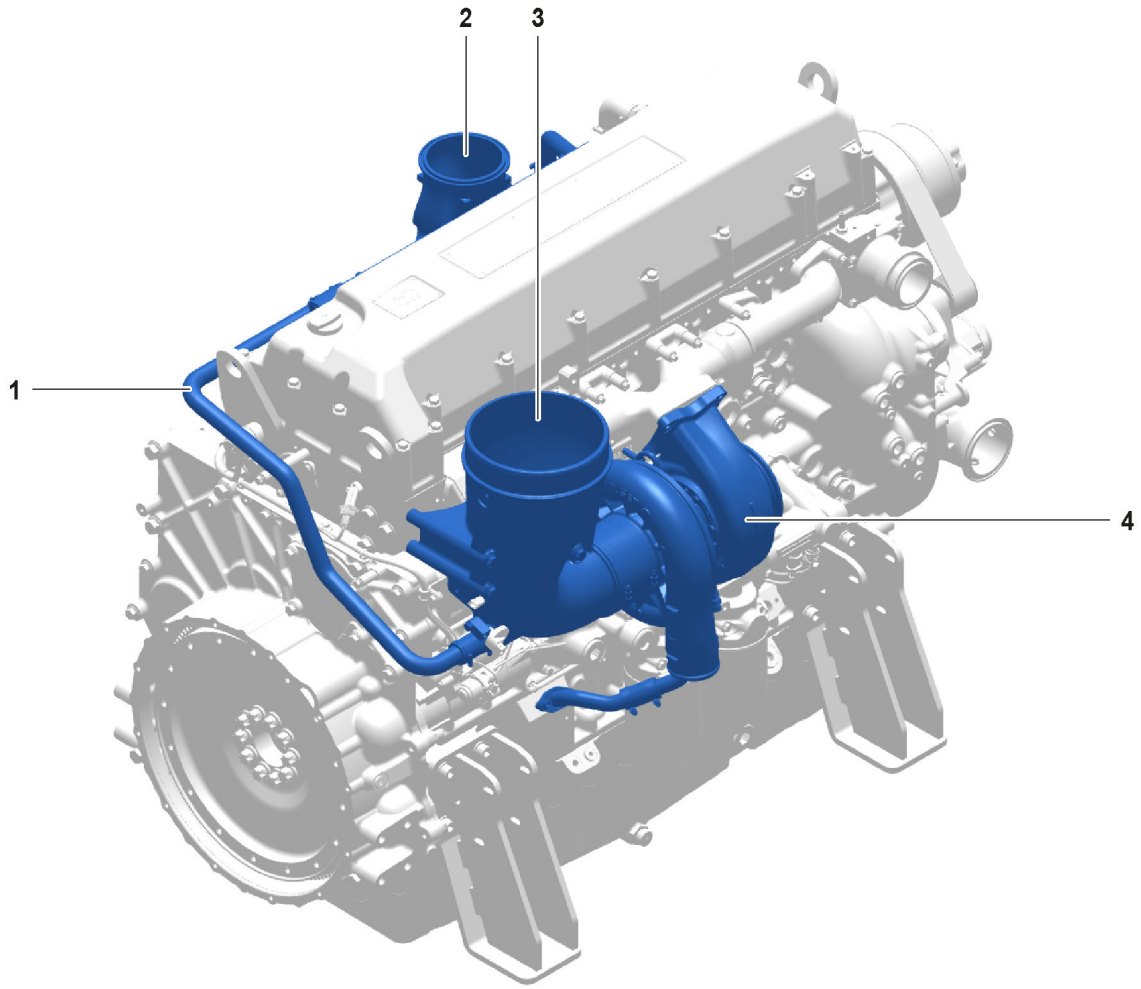


Fig. 47: Components to be checked

1 Pipeline
2 Charge air pipe
3 Intake manifold
4 Exhaust gas turbocharger

▶ Check components for leaks.

If components are leaking:
▶ Do not start engine.

▶ Replace components, see repair instruction.

▶ Check components for proper fastening.

If components are loose:
▶ Do not start engine.

▶ Tighten components according to tightening instruction, see service and repair manual.

▶ Check components for damage.

If components are damaged:
▶ Do not start engine.

▶ Replace damaged components, see repair instructions.

5.8.3 Checking the exhaust manifold – SL1-5201

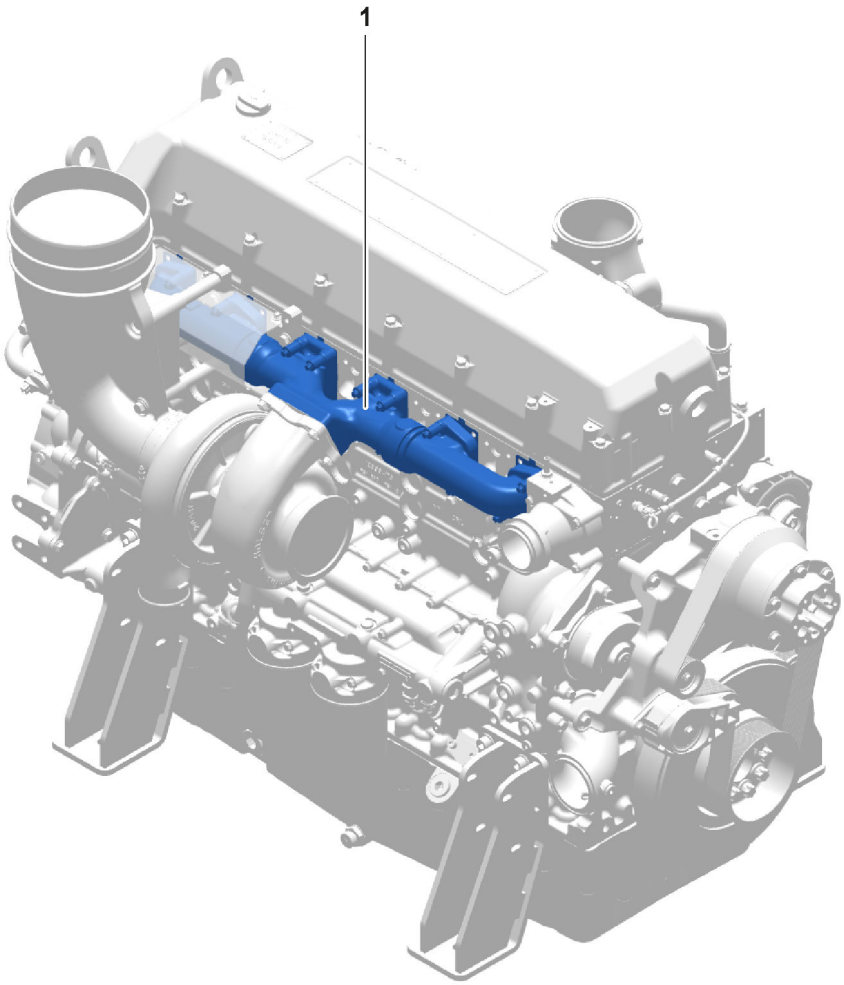


Fig. 48: Exhaust manifold

1 Exhaust manifold

▶ Check exhaust manifold for leaks.

If exhaust manifold is leaking:
▶ Do not start engine.

▶ Replace exhaust manifold, see service and repair manual.

▶ Check exhaust manifold for proper fastening.

If exhaust manifold is loose:
▶ Do not start engine.

▶ Tighten exhaust manifold according to tightening instruction, see service and repair manual.

▶ Check exhaust manifold for damage.

If exhaust manifold is damaged:
▶ Do not start engine.

▶ Replace damaged exhaust manifold, see service and repair manual.

5.8.4 Checking the exhaust gas turbocharger – SL1-5411

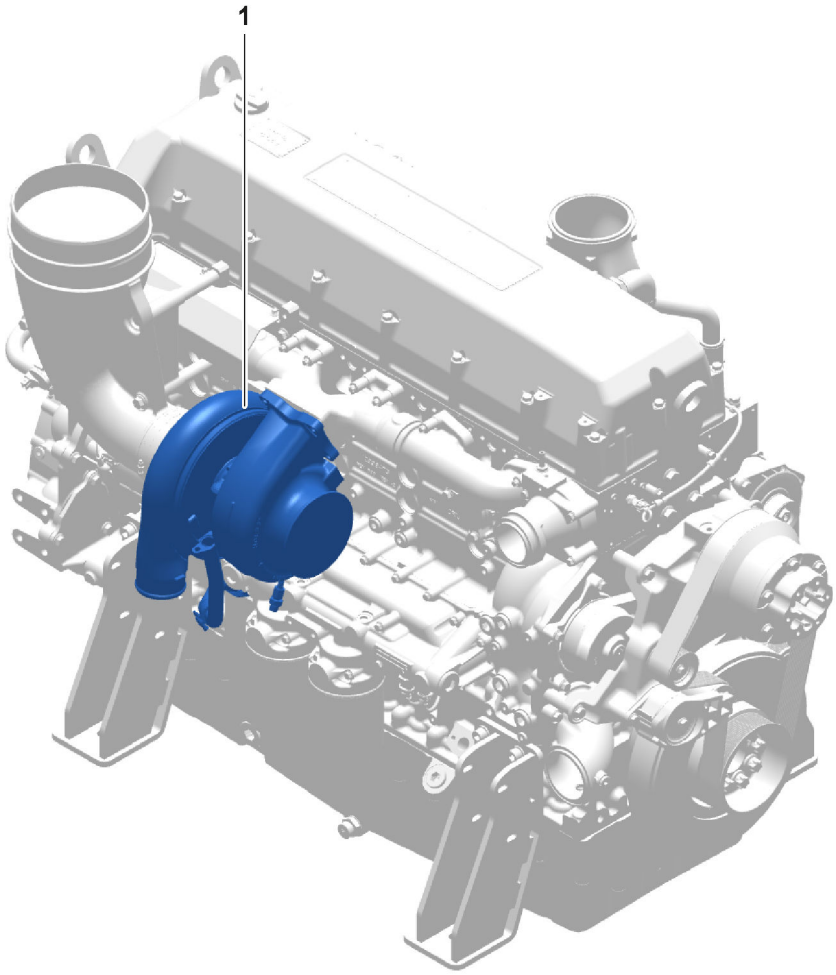


Fig. 49: Exhaust gas turbocharger

1 Exhaust gas turbocharger

▶ Check components for leaks.

If components are leaking:
▶ Do not start engine.

▶ Replace components, see repair instruction.

▶ Check components for proper fastening.

If components are loose:
▶ Do not start engine.

▶ Tighten components according to tightening instruction, see service and repair manual.

▶ Check components for damage.

If components are damaged:

- ▶ Do not start engine.
- ▶ Replace damaged components, see repair instructions.

5.9 6000 - Electrics and engine control unit

5.9.1 Checking the engine control unit fastening – SL1-6311

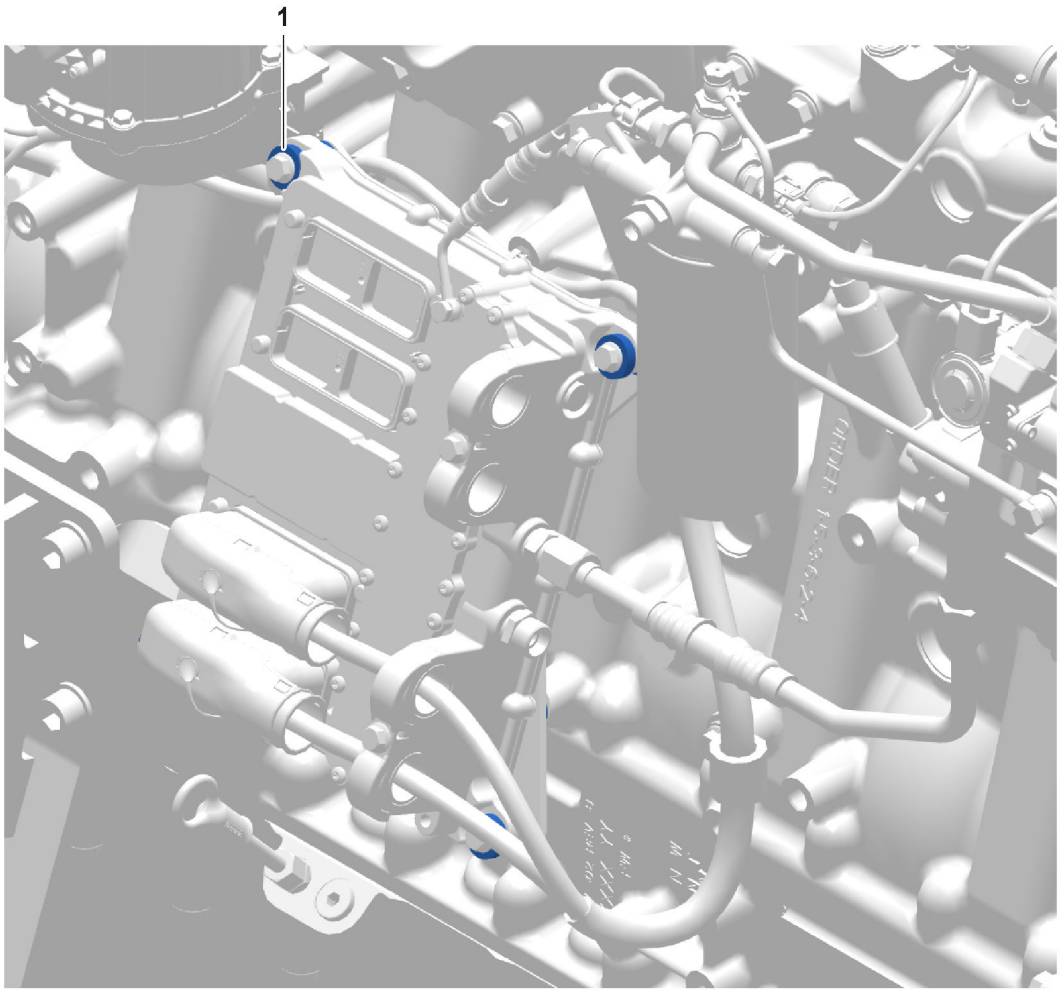


Fig. 50: Checking the engine control unit fastening

1 Engine control unit fastening (4x)

▶ Check engine control unit fastening **1** for damage.

▶ Check engine control unit fastening **1** for tight fit.

If engine control unit fastening is damaged or worn:

▶ Do not start engine.

▶ Replace engine control unit fastening, see repair instructions.

5.9.2 Checking sensors, actuators, cable holders and plugs – SL1-6321

NOTICE
Disconnected plug connections!
Damage to plug connections.

▶ Leave plug connections plugged in during the visual inspection.

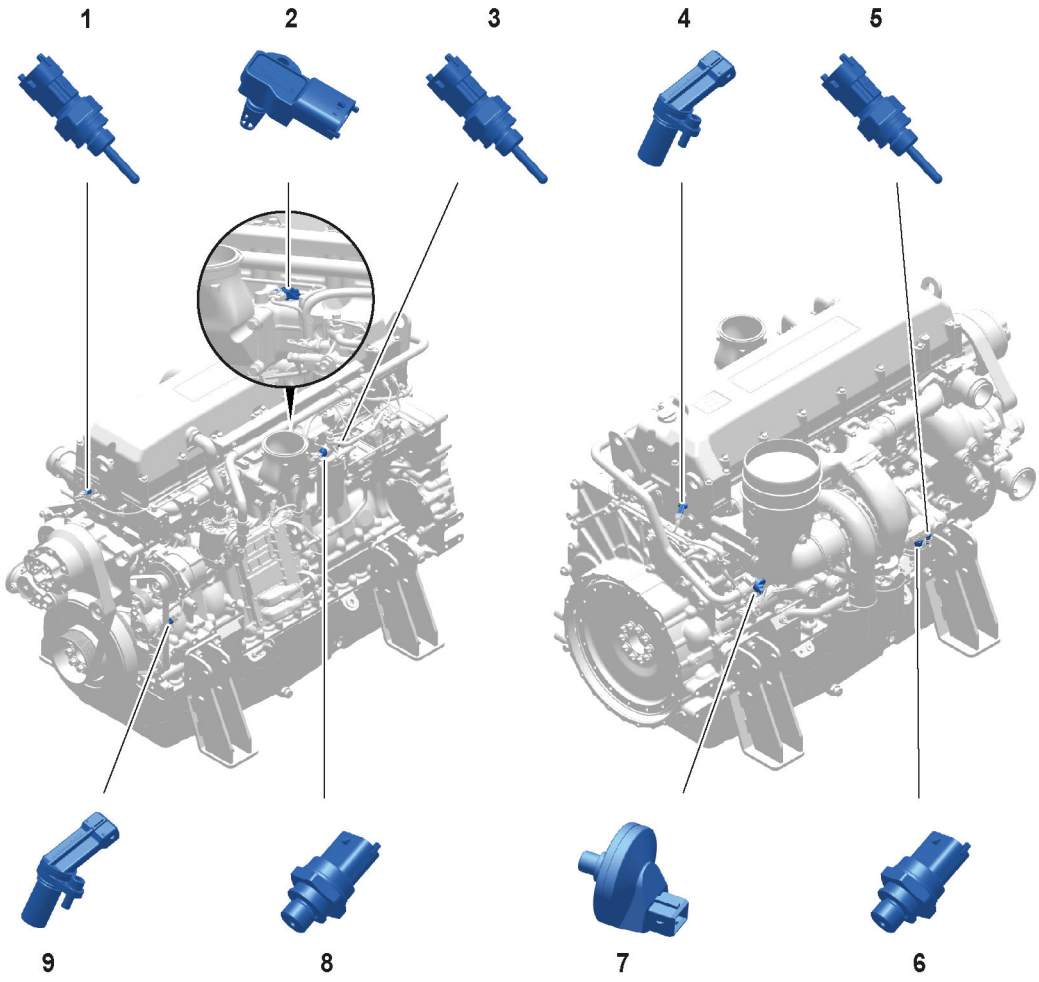


Fig. 51: Overview of sensors

1 Coolant temperature sensor
2 Charge air pressure & temperature sensor
3 Fuel temperature sensor
4 Camshaft speed sensor
5 Oil temperature sensor
6 Oil pressure sensor
7 Maintenance switch
8 Fuel pressure sensor
9 Crankshaft speed sensor

▶ Check sensors for tight fit.

▶ Check sensors for damage.

If sensors are damaged:

▶ Do not start engine.

▶ Replace damaged sensors, see service and repair manual.

▶ Check sensors for proper fastening.

▶ Check sensors for contamination through lubricating oil, fuel, and coolant.

5.9.3 Checking the cable harness and connections – SL1-6411

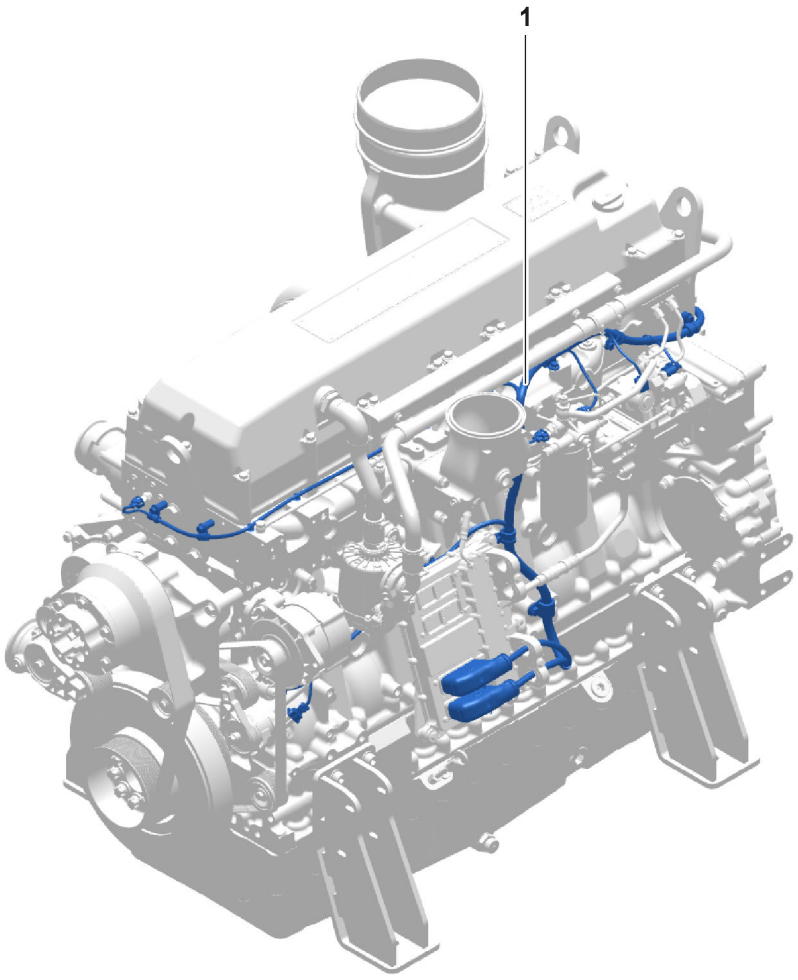


Fig. 52: Cable harness

1 Cable harness

- ▶ Check cable harness **1** for damage.
- ▶ Check cable harness **1** for tight fit.
- ▶ Check connections for damage.
- ▶ Check connections for tight fit.

If bearings are damaged or worn:

- ▶ Do not start engine.
- ▶ Replace cable harness **1**, see repair instruction.

5.10 7000 - Accessories

5.10.1 Checking the fan drive belt drive – SL1-7221

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

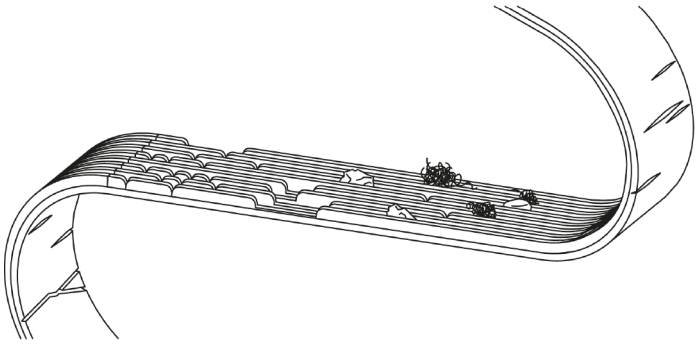


Fig. 53: Damage to the V-ribbed belt

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

▶ Turn off engine.

▶ Secure the engine against unexpected start-up.

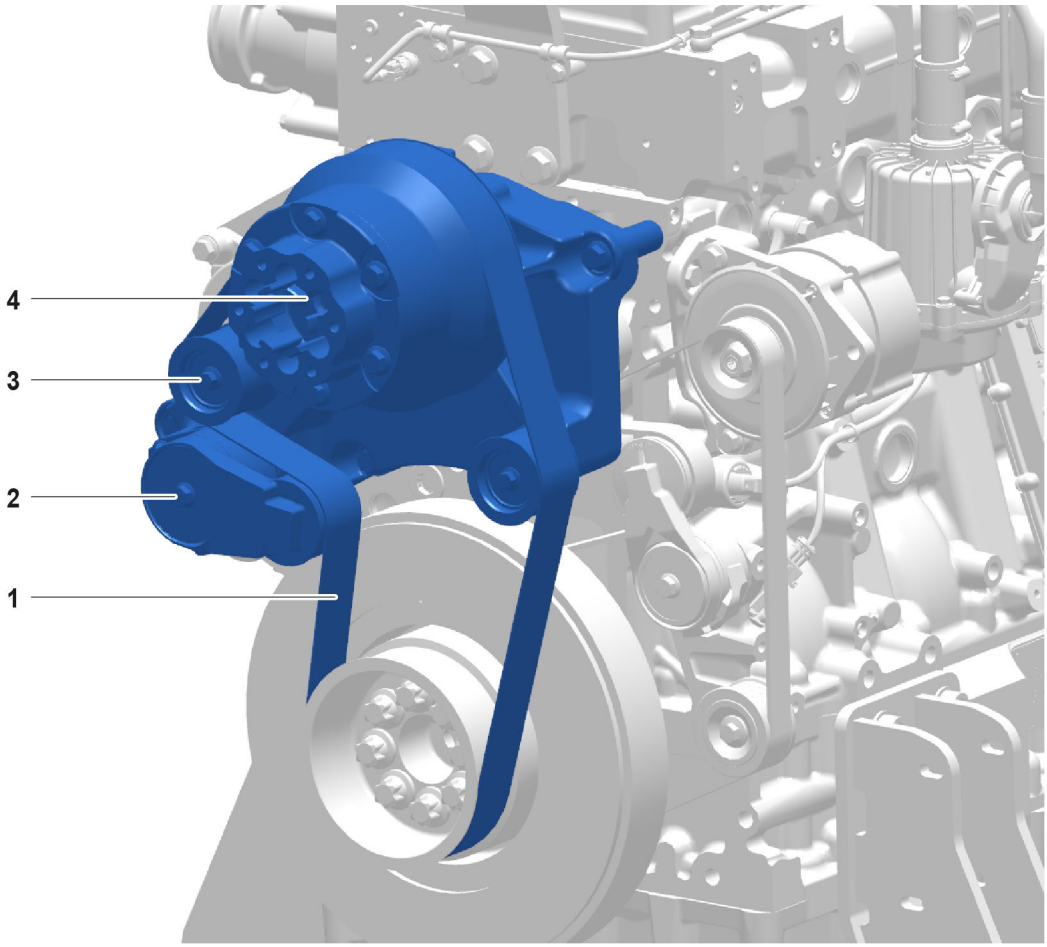


Fig. 54: Checking the fan drive belt drive

1 Fan drive V-ribbed belt
2 Tension pulley (self-tensioning)
3 Deflection pulley (2x)
4 Belt pulley

▶ Check fan drive V-ribbed belt **1** for damage.

▶ Check that the belt pulley **4** and tension pulley (self-tensioning) **2** are in perfect working order and check their play (for example, worn out bearings on deflection pulleys **3** or tread wear on belt pulley **4**).

▶ Replace damaged parts. Please contact the nearest authorized Kohler Co. customer service.

6 Transport and storage

DANGER
Protective atmosphere against oxidation damage inside the protective foil!
Risk of death, risk of suffocation. Can cause serious injuries or death.

- ▶ Remove and store protective foil only in well ventilated areas.
- ▶ Protective foil must be stored in areas that are inaccessible to children.

CAUTION
Incorrect waste disposal!
Environmental and health hazards.

- ▶ Observe national and international guidelines for disposal of waste materials.
- ▶ Dispose of all waste in appropriate containers.
- ▶ Store waste in designated areas.

NOTICE
Incorrect setting down of the engine.
Engine damage.

- ▶ Do not place engine on oil pan.
- ▶ Place engine on appropriate engine feet.

NOTICE
Improper storage.
Oxidation damage.

- ▶ Only store the engine in dry locations.
- ▶ Do not expose the engine to severe temperature fluctuations.
- ▶ Only remove the transport protective foil shortly before installation.

When the engine is removed:
- ▶ Apply new protective foil and observe climatic conditions for storage.

Information
Storage conditions are the responsibility of the system manufacturer.

- ▶ Observe standard ISO 6749-1984 for transport and storage.
- ▶ In the event of uncertainties, contact Kohler customer service.

Information
The machine owner is responsible for observing the maximum floor load.

- ▶ Check maximum floor load before setting down the engine.
- ▶ Weight data can be found in the technical data sheet.

Information

▶ Only use preservatives approved by Kohler Co.

6.1 Transport

6.1.1 Transport attachment

Fig. 55: Example of transport attachment

DANGER
Instability during transport!
Leads to death or serious injuries.

- ▶ Only use the original transport device.
- ▶ Secure the transport device, including the mounted engine, against slipping and falling down.
- ▶ Make sure that transport device is in technically perfect condition.
- ▶ Secure the transport device against slipping and falling down in all directions.
- ▶ Observe the center of gravity.
- ▶ Bolt engine securely to transport device.

DANGER
Tipping of engine during loading or unloading!
Leads to death or serious injuries.

- ▶ Make sure that only authorized personnel load/unload the engine.
- ▶ Make sure that the crane or forklift is suitable for the weight to be lifted.

If the engine is being lifted with a crane:

- ▶ Use a lifting traverse.
- ▶ Make sure that no persons reside in the danger zone during the loading / unloading.
- ▶ Observe information on the center of gravity.

6.1.2 Wood transport device

Fig. 56: Wood transport device

DANGER
Instability during transport!
Leads to death or serious injuries.

- ▶ Only use the original transport device.
- ▶ Secure the transport device, including the mounted engine, against slipping and falling down.
- ▶ Make sure that transport device is in technically perfect condition.
- ▶ Secure the transport device against slipping and falling down in all directions.
- ▶ Observe the center of gravity.
- ▶ Bolt engine securely to transport device.

Information

- ▶ Wood transport devices do not need to be returned to Kohler Co. Keep for later use.

6.2 Storage

6.2.1 Storage for up to 6 months

The engine is conserved as of the date it is ready for delivery; for normal storage in a dry, ventilated place, the duration of the conservation protection is 6 months.

If the engine is additionally covered with a film cover, it can even be situated outdoors for up to one month.

The cover must be waterproof and lie loosely against the engine so that the air can circulate around the engine and the formation of condensation is prevented.

If the aforementioned stipulations are deviated from, in which the conserved engine is subjected to more unfavorable conditions (longer placement outdoors or storage in damp, unventilated places etc.), a shortening of the duration of the conservation protection is to be expected.

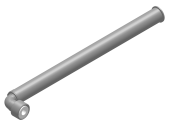
6.2.2 Storage for over 6 and up to 24 months

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

7 Tools and devices

7.1 Tools

7.1.1 Special tools

Representation	Description	Required number	Part number
	Drain hose 90°	1	12690423

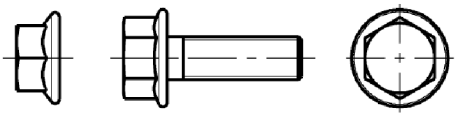
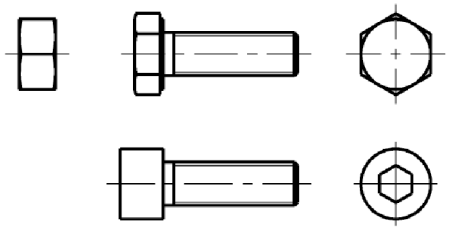
Tab. 38: Special tool

8 Standard torques

8.1 Tightening torques

8.1.1 Hex head screws / hexagon socket screws / hexalobular flange head screws

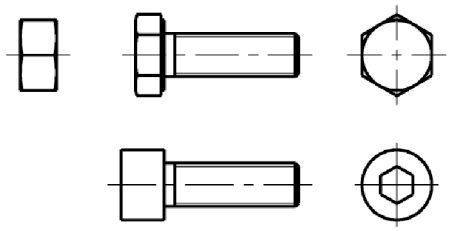
The standard tightening torques listed apply to screws with standard threads. A specific tightening instruction is specified for screws used with fine threads.

Head shape or shape of the nut	Surface treatment
	All screws
	All screws except FLZN/480H (matte gray)

Tab. 39: Head shapes

Standard thread	Tightening torque	
Strength class	**8.8**	**10.9**
M4	3 Nm	4 Nm
M5	6 Nm	8 Nm
M6	10 Nm	14 Nm
M8	23 Nm	34 Nm
M10	46 Nm	68 Nm
M12	79 Nm	117 Nm
M14	125 Nm	185 Nm
M16	195 Nm	280 Nm
M18	280 Nm	390 Nm
M20	390 Nm	560 Nm

Tab. 40: Tightening torques for metric standard thread

Head shape or shape of the nut	Surface treatment
	FLZN/480H (matte gray)

Tab. 41: Head shapes

Standard thread	Tightening torque	
Strength class	**8.8**	**10.9**
M4	2.4 Nm	3.6 Nm
M5	4.8 Nm	7 Nm
M6	8.3 Nm	12 Nm
M8	20 Nm	29 Nm
M10	40 Nm	59 Nm
M12	69 Nm	101 Nm
M14	110 Nm	161 Nm
M16	166 Nm	244 Nm
M18	240 Nm	340 Nm
M20	335 Nm	480 Nm

Tab. 42: Tightening torques for metric standard thread

8.1.2 High temperature screws

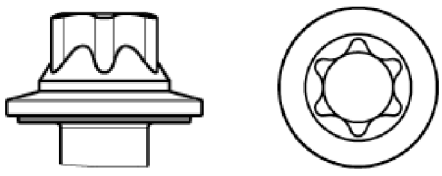


Fig. 61: High temperature screws

High temperature screws with special markings and screw heads according to DIN 34801.

Standard thread	Tightening torque		
Marking	**GA**	**SD**	**VW**
M6	9 Nm	10 Nm	13 Nm
M8	23 Nm	25 Nm	30 Nm
M10	45 Nm	50 Nm	60 Nm

Standard thread	Tightening torque		
M12	75 Nm	85 Nm	100 Nm

Tab. 43: Tightening torques for high temperature screws

8.1.3 Screw plugs and banjo bolts with separate seal

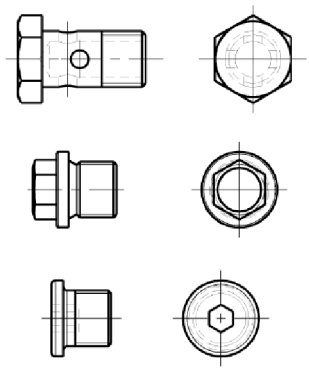


Fig. 62: Screw plugs and banjo bolts

Screw plugs according to DIN 908

Banjo bolts according to DIN 7643

Screw plugs and banjo bolts with copper seal according to DIN 7603 or BS sealing ring

Standard thread	Tightening torque	Standard thread	Tightening torque
M6	7 Nm	**M24**	68 Nm
M8	7.5 Nm	**M26**	75 Nm
M10	15 Nm	**M27**	87 Nm
M12	20 Nm	**M30**	115 Nm
M14	30 Nm	**M33**	120 Nm
M16	40 Nm	**M36**	155 Nm
M18	40 Nm	**M38**	171 Nm
M20	47 Nm	**M39**	215 Nm
M22	57 Nm	**M42**	240 Nm

Tab. 44: Tightening torques for screw plugs and banjo bolts

8.1.4 VSTI screw plugs

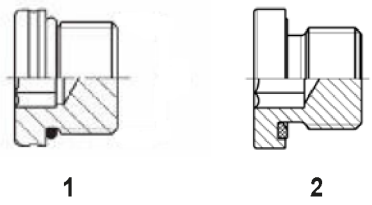


Fig. 63: VSTI screw plugs

1 Screw plug with o-ring

2 Screw plug with ED seal

Standard thread	Tightening torque	Standard thread	Tightening torque
M10 x 1	10 Nm	**M26 x 1.5**	100 Nm
M12 x 1.5	20 Nm	**M27 x 2**	120 Nm
M14 x 1.5	30 Nm	**M30 x 1.5**	120 Nm
M16 x 1.5	40 Nm	**M33 x 2**	200 Nm
M18 x 1.5	50 Nm	**M38 x 1.5**	280 Nm
M20 x 1.5	60 Nm	**M42 x 2**	350 Nm
M22 x 1.5	80 Nm	**M48 x 2**	400 Nm
M24 x 1.5	90 Nm		

Tab. 45: Tightening torques for VSTI screw plugs

8.1.5 Threaded union for steel or cast iron mating materials

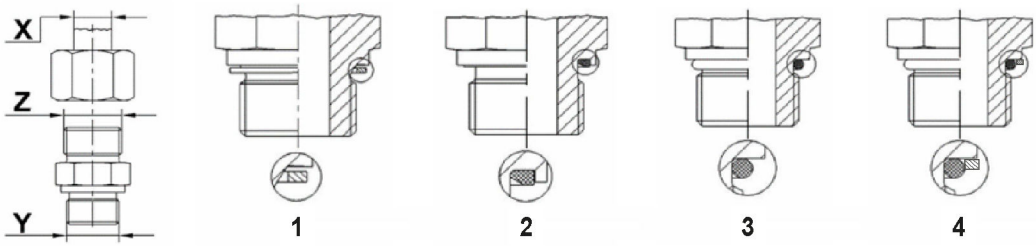


Fig. 64: Overview of threaded union

1 Form A - With sealing ring (washer)

2 Form E - Flat (ED) seal

3 Form F - O-ring

4 Form F - O-ring plus washer

Information

Tightening torques apply for steel or cast iron mating materials.

- ▶ For screw-in studs in stainless steel, lubricate thread with new engine oil before screwing in.
- ▶ Define series L or S through dimensioning of pipe diameter X and thread Y.

Metric screw fittings series L (light)

Pipe diameter X	Thread Y	Form A with sealing ring (washer)	Form E with flat (ED) seal	Form F with o-ring	Form F with o-ring plus washer
		Tightening torque			
6 mm	**M10 x 1.0**	9 Nm	18 Nm	15 Nm	18 Nm
8 mm	**M12 x 1.5**	20 Nm	25 Nm	25 Nm	35 Nm
10 mm	**M14 x 1.5**	35 Nm	45 Nm	35 Nm	45 Nm
12 mm	**M16 x 1.5**	45 Nm	55 Nm	40 Nm	55 Nm
15 mm	**M18 x 1.5**	55 Nm	70 Nm	45 Nm	70 Nm
18 mm	**M22 x 1.5**	65 Nm	125 Nm	60 Nm	180 Nm
22 mm	**M26 x 1.5**	90 Nm	180 Nm	100 Nm	250 Nm
28 mm	**M33 x 2.0**	150 Nm	310 Nm	160 Nm	310 Nm
35 mm	**M42 x 2.0**	240 Nm	450 Nm	210 Nm	450 Nm
42 mm	**M48 x 2.0**	290 Nm	540 Nm	260 Nm	540 Nm

Tab. 46: Tightening torques for metric screw fittings series L (light)

Metric screw fittings series S (heavy)

Pipe diameter X	Thread Y	Form A with sealing ring (washer)	Form E with flat (ED) seal	Form F with o-ring	Form F with o-ring plus washer
		Tightening torque			
6 mm	**M10 x 1.0**	-	23 Nm	-	-
6 mm	**M12 x 1.5**	20 Nm	40 Nm	35 Nm	35 Nm
8 mm	**M14 x 1.5**	35 Nm	40 Nm	45 Nm	60 Nm
10 mm	**M16 x 1.5**	45 Nm	70 Nm	55 Nm	95 Nm
12 mm	**M18 x 1.5**	55 Nm	90 Nm	70 Nm	120 Nm
14 mm	**M20 x 1.5**	55 Nm	125 Nm	80 Nm	-
16 mm	**M22 x 1.5**	65 Nm	135 Nm	100 Nm	190 Nm
20 mm	**M27 x 2.0**	90 Nm	180 Nm	170 Nm	190 Nm
25 mm	**M33 x 2.0**	150 Nm	310 Nm	310 Nm	500 Nm
30 mm	**M42 x 2.0**	240 Nm	450 Nm	330 Nm	600 Nm
38 mm	**M48 x 2.0**	290 Nm	540 Nm	420 Nm	600 Nm

Tab. 47: Tightening torques for metric screw fittings series S (heavy)

8.1.6 Threaded union for aluminum mating material

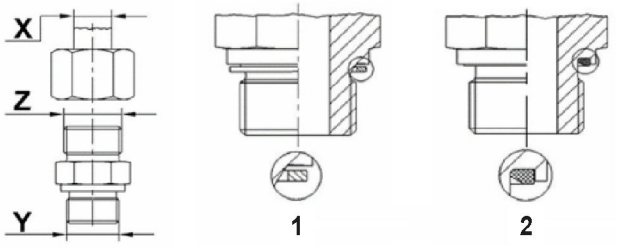


Fig. 65: Overview of threaded union

1 Form A - With sealing ring (washer) **2** Form E - Flat (ED) seal

Information
Tightening torques apply for aluminum mating material.

▶ For screw-in studs in stainless steel, lubricate thread with new engine oil before screwing in.

Metric screw fittings series L (light) for aluminum

Pipe diameter X	Thread Y	Form A with sealing ring (washer)	Form E with flat (ED) seal
		Tightening torque	
6 mm	**M10 x 1.0**	15 Nm	12 Nm
8 mm	**M12 x 1.5**	-	20 Nm
10 mm	**M14 x 1.5**	30 Nm	30 Nm
12 mm	**M16 x 1.5**	40 Nm	40 Nm
15 mm	**M18 x 1.5**	-	50 Nm
18 mm	**M22 x 1.5**	80 Nm	90 Nm
22 mm	**M26 x 1.5**	80 Nm	130 Nm
28 mm	**M30 x 1.5**	-	180 Nm
28 mm	**M33 x 2.0**	-	220 Nm
35 mm	**M42 x 2.0**	-	320 Nm
42 mm	**M48 x 2.0**	-	380 Nm

Tab. 48: Tightening torques for metric screw fittings series L for aluminum

8.1.7 Nut for cutting ring screw fittings

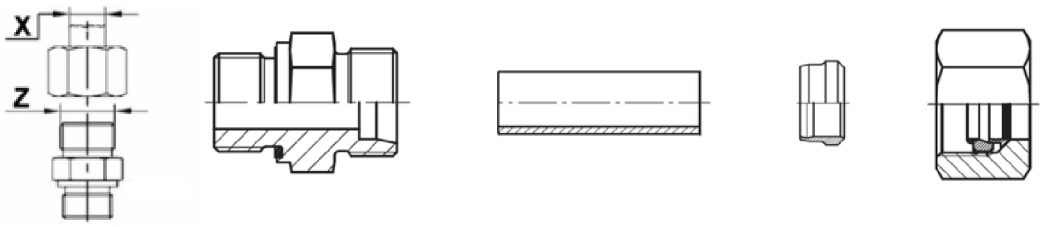


Fig. 66: Cutting ring screw fittings

Series	Pipe diameter X	Standard thread Z	Tightening torque
LL	**6 mm**	**M10 × 1**	14 Nm
L	**6 mm**	**M12 x 1.5**	14 Nm
	8 mm	**M14 x 1.5**	20 Nm
	10 mm	**M16 x 1.5**	30 Nm
	12 mm	**M18 x 1.5**	60 Nm
	15 mm	**M22 x 1.5**	105 Nm
	18 mm	**M26 x 1.5**	150 Nm
	22 mm	**M30 x 2**	200 Nm
	28 mm	**M36 x 2**	250 Nm
	35 mm	**M45 x 2**	450 Nm
	42 mm	**M52 x 2**	600 Nm
S	**16 mm**	**M24 x 1.5**	150 Nm
	20 mm	**M30 x 2**	250 Nm
	25 mm	**M36 x 2**	450 Nm
	30 mm	**M45 x 2**	600 Nm
	38 mm	**M52 x 2**	750 Nm

Tab. 49: Tightening torques for cutting ring screw fittings

8.1.8 Nut for Triple Lok® screw fittings

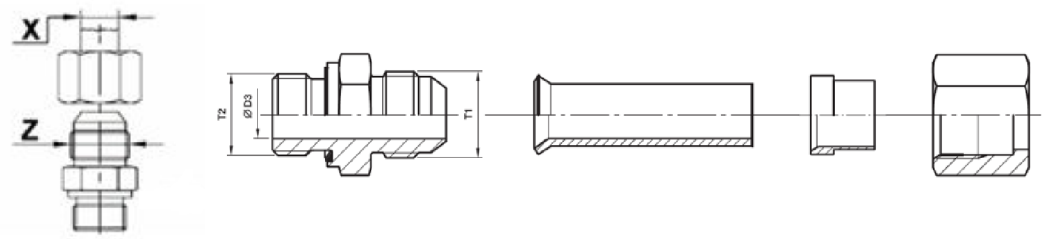


Fig. 67: Triple Lok® screw fittings

Information

▶ For stainless steel threaded unions, lubricate thread and sealing cone with new engine oil before screwing in.

Series	Pipe diameter X	Standard thread Z	Steel	Stainless steel
		UN/UNF	Tightening torque	
4	**6 mm**	**7/17-20**	15 Nm	30 Nm
5	**8 mm**	**1/2-20**	20 Nm	40 Nm
6	**10 mm**	**9/16-18**	30 Nm	60 Nm
8	**12 mm**	**3/4-16**	60 Nm	115 Nm
10	**14 mm** **15 mm** **16 mm**	**7/8-14**	75 Nm	145 Nm
12	**18 mm** **20 mm**	**1 1/16-12**	110 Nm	180 Nm
16	**22 mm**	**1 5/16-12**	135 Nm	225 Nm
	25 mm	**1 5/16-12**	175 Nm	255 Nm
	28 mm	**1 5/8-12**	260 Nm	295 Nm
20	**30 mm** **32 mm**	**1 5/8-12**	260 Nm	295 Nm
	35 mm	**1 7/8-12**	340 Nm	345 Nm
24	**38 mm**	**1 7/8-12**	340 Nm	345 Nm
28	**42 mm**	**2 1/4-12**	380 Nm	400 Nm
32	**50 mm**	**2 1/2-12**	450 Nm	470 Nm

Tab. 50: Tightening torques for Triple Lok® screw fittings

8.1.9 Adapter for plastic quick couplings

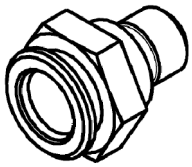


Fig. 68: Adapter for plastic quick couplings

Standard thread	Tightening torque
M8 x 1	7 Nm
M10 x 1	12 Nm
M12 x 1.5	20 Nm
M14 x 1.5	30 Nm
M16 x 1.5	35 Nm
M18 x 1.5	45 Nm

Tab. 51: Tightening torques for adapter for plastic quick couplings

8.1.10 Stud bolts

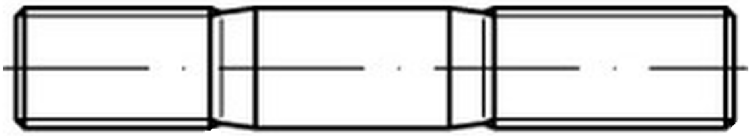


Fig. 69: Stud bolts

Standard thread	Tightening torque
M6	5 Nm
M8	10 Nm
≥M10	15 Nm

Tab. 52: Tightening torques for stud bolts

33521059301_0_1 EN_US 2022-07