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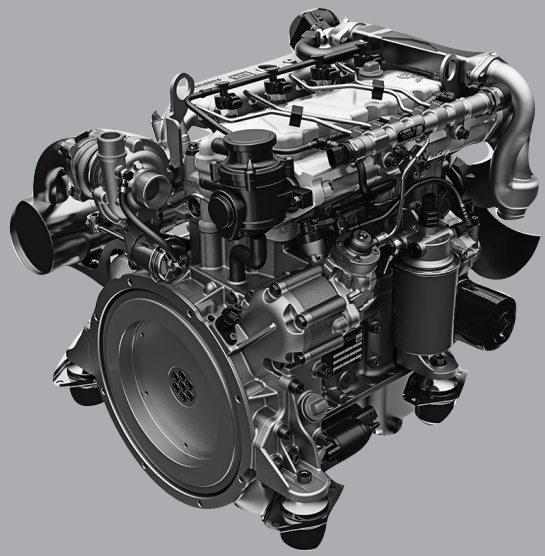

4H50TIC

OPERATOR'S MANUAL
Diesel engine

Hatz Diesel

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EN

CREATING POWER SOLUTIONS.

1 Notices

Contact data

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Copyright

Original Operator's Manual

This Operator's Manual was translated into multiple languages.

The German version is the **original Operator's Manual**. All other language versions are **translations** of the **original Operator's Manual**.

2 General information

Information on the document

This Operator's Manual was created with due care. It is exclusively intended to offer a technical description of the machine and to provide instructions on commissioning, operating and maintaining the machine. When operating the machine, the applicable standards and legal regulations as well as any in-house regulations apply.

Before commissioning, during operation and before maintenance work is begun on the machine, read the Operator's Manual carefully and keep it close by for ready access.

Machine

This Operator's Manual describes the following machine.

Machine name	HATZ diesel engine
Type number	4H50TIC

Customer service

Have service work performed by qualified technicians only. We recommend that you work with one of the more than 500 **HATZ service stations**.Trained specialists there will repair your machine with **Hatz original spare parts** and with **HATZ tools**. The global HATZ service network is at your disposal to advise you and supply you with spare parts. For the address of the **Hatz service station** nearest you, please see the directory enclosed or visit the internet at: **www.hatz-diesel.com**

Problems may occur if unsuitable spare parts are installed. We cannot accept responsibility for damage and secondary damage that result from this.

We therefore recommend the use of **Hatz original spare parts**. These parts are manufactured according to strict Hatz specifications and achieve maximum operational reliability through their perfect fit and functionality. The order number can be found in the enclosed spare parts list or on the internet at: **www.hatz-diesel.com**

Exclusion of liability

The manufacturer cannot be held responsible for personal injury, damage to property, or damage to the machine itself caused by improper use, foreseeable misuse, or failure to follow or adequately follow the safety measures and procedures described in this Operator's Manual. This also applies to changes made to the machine and use of unsuitable spare parts.

Modifications, which serve the technical improvements, are reserved.

3 Safety

3.1 General information

Introduction

This chapter contains the information you need to work safely with this machine.

To prevent accidents and damage to the machine, it is imperative that these safety instructions are followed.

Read this chapter carefully before beginning work.

3.1.1 Intended use and foreseeable misuse

Intended use

The machine described in this Operator's Manual fulfills the following functions:

- Diesel engine intended for installation in a machine or for assembly with other machines to form a machine. See chapter *11 Installation declaration, page 97*.

This engine is intended exclusively for the purpose specified and tested by the manufacturer of the machine into which the engine is installed.

Any other use is not intended and therefore not permitted. Violations compromise the safety of the personnel working with the machine. Responsibility is not accepted by Motorenfabrik HATZ for damage resulting from this situation.

The operational safety of the machine is only guaranteed if it is used as intended.

Use according to the intended purpose also includes observance of the instructions in this Operator's Manual.

Foreseeable misuse

The following is considered to be foreseeable misuse:

- Any use that varies from or extends beyond the uses specified above.
- Failure to comply with the instructions in this Operator's Manual.
- Failure to comply with the safety instructions.
- Failure to immediately eliminate malfunctions that impact safety before continuing work with the machine (working with the machine when it is not in perfect condition, either functionally or in terms of safety).
- Failure to perform the necessary inspection and maintenance work.
- Any unauthorized modification of or removal of safety equipment.
- Use of spare parts and accessories that are unsuitable or have not been approved by HATZ.
- Operation in flammable or hazardous environments.
- Operation in closed-off or poorly ventilated rooms.

- Installation of the machine in moving equipment (e.g. vehicles, trailers) or in closed rooms without additional measures to handle supply air, extract air, and exhaust gas.
- Improper operation at variance with DIN 6271 and DIN ISO 8528 (climate, load, safety).

Residual risks

Residual risks result during daily use and in association with maintenance work.

These residual risks will be pointed out in chapter *3.2.2 Machine-specific safety instructions for operation, page 14* and in chapter *3.2.3 Machine-specific safety instructions for maintenance work, page 15* as well as in the further contents of the manual, directly in front of the descriptions or operating instructions concerned.

3.1.2 Machine user or machine manufacturer obligations

Machine manufacturer obligations

If you have an engine that is not yet installed in a machine, it is imperative that you follow the **Assembly Instructions for HATZ Diesel Engines** before installing the engine. These assembly instructions contain important information on how to safely install the engine and are available at your nearest **HATZ service station**.

It is prohibited to start the engine before it is fully installed.

In addition, please note that it is prohibited to start up the machine before it has been determined that the machine into which this engine is installed fulfills all safety-related requirements and legal regulations.

User obligations

The user is obligated to only operate the machine while it is in perfect condition. The user must check the condition of the machine before using it and ensure that any defects are eliminated before it is taken into service. Running the machine while identified defects exist is not permitted. The user must also ensure that the information contained in the Operator's Manual has been read and understood.

Obligations of the operating and maintenance personnel

Personnel assigned with operating and maintaining the machine must have read and understood the Operator's Manual or must possess the qualifications necessary for working with this equipment, acquired in training/instructional courses. No one may work with the machine without the necessary qualifications, even if for just a brief period.

The operating personnel must not be under the influence of drugs, medication or alcohol.

All work performed on the machine must be in compliance with the information provided in the Operator's Manual.

Storing the Operator's Manual

This Operator's Manual is an integral component of the machine (also when being sold). It must be stored in the direct vicinity of the machine and be accessible to personnel at all times.

3.1.3 Representation of safety notes

Overview

This machine has been designed and built according to state-of-the-art technology and the recognized safety standards. Despite these precautions, risks exist when operating the machine and during maintenance work.

These risks are identified in this manual by means of safety notes.

The safety notes precede the related description or operating step.

Structure of the safety notes

The safety notes consist of:

- Warning symbol
- Signal word
- Description of danger
- Possible consequences
- Preventative measures

General danger symbol

The general danger symbol is used to identify the danger of personal injury.

Signal words

Signal words identify the magnitude of the risk and the seriousness of the possible injuries:

Danger symbol/ signal word	Meaning
DANGER	This signal word is used to indicate imminently dangerous situations which, if not avoided, will lead to serious injury or death.
WARNING	This signal word is used to indicate potentially dangerous situations which, if not avoided, may lead to serious injury or death.
CAUTION	This signal word is used to indicate potentially dangerous situations which, if not avoided, may lead to minor or moderate injury.

Danger symbol/ signal word	Meaning
CAUTION	This signal word, without a danger symbol, is used to indicate the risk of property damage.
NOTICE	This signal word indicates additional useful information, such as operating tips and cross references.

3.1.4 Meaning of safety symbols

Explanation of symbols

The following table describes the meanings of the safety symbols used in this Operator's Manual.

Symbol	Meaning
	Smoking, fire and open flames are prohibited.
	Warning of personal injury!
	Warning of hot surfaces!
	Warning of flammable substances!
	Warning of explosive substances!
	Warning of toxic engine exhaust!
	Warning of corrosive substances!

Symbol	Meaning
	Warning of heavy loads!
	Warning of environmental damage!
	Comply with the Operator's Manual or additional documentation from other manufacturers or the user.
	Additional information that is useful to the reader.

3.2 Safety notes

3.2.1 Operational safety

Introduction

This chapter contains all of the important safety instructions for personal protection and for safe and reliable operation. Additional, task-related safety instructions can be found at the beginning of each chapter.

 **DANGER**	
	**Danger to life, danger of injury, or danger of property damage due to failure to comply with the Operator's Manual and the safety instructions contained therein.** ▪ As the user of the machine, you must ensure that all people working on the machine are familiar with the contents of this Operator's Manual. ▪ Before working on the machine, read this Operator's Manual carefully, paying special attention to the safety notes. ▪ Fulfill all required safety conditions before working on the machine. ▪ Follow all general safety instructions as well as the specific task-related safety instructions contained in the individual chapters.

Using the machine

- Only operate the machine for the purposes described in the chapter *3.1.1 Intended use and foreseeable misuse, page 7*.

Compliance with other regulations

- Adhere to the applicable accident prevention regulations of the trade associations.
- Comply with the regulations concerning the minimum safety and health requirements for the use of work equipment by workers at work.
- In addition, local safety, accident prevention and environmental regulations also apply when operating the machine.

Personal protective equipment

During operation and maintenance of the machine, personal protective equipment must be available and must be used if necessary. The required personal protective equipment is specified in the description of the operating steps.

Personal protective equipment	Pictogram	Function
Safety shoes		Safety shoes offer protection against: ▪ Slipping ▪ Falling objects
Hearing protection		Hearing protection offers protection against ear injuries due to excessive and constant noise.
Safety gloves		Safety gloves protect the hands against injury, e.g. from battery acid.
Safety goggles (with side protection)		Safety goggles protect the eyes from flying objects (e.g. dust particles, spraying liquids, spraying acid).
Working clothes		Wear close-fitting clothing. However, it must not restrict the wearer's freedom of movement.

Warning labels and information signs on the machine

The warning labels and information signs on the machine must be followed (see the chapter "Labels" *3.3 Labels, page 19*).

The warning labels and information signs must be kept legible and must be replaced if necessary. For this purpose, contact your nearest **HATZ service station**.

Maintenance work

Maintenance work that goes beyond the scope described in this manual must only be performed by qualified technicians (see the chapter *2 General information, page 6*).

Independent maintenance work and constructional changes to the machine, especially to the safety equipment, are not permitted.

Safety equipment

Safety equipment must not be modified and must not be rendered ineffective during normal operation.

General safety instructions

DANGER	
	**Danger to life and danger of injury due to failure to follow the warnings on the machine and in the Operator's Manual.** ▪ Heed the warnings on the machine and in the Operator's Manual.

WARNING	
	**Danger of injury and danger of incorrect operation due to inadequate personnel qualifications.** ▪ The personnel must have read and understood this Operator's Manual or must possess the qualifications necessary for working with this equipment, acquired in training/instructional courses. ▪ Only qualified personnel are permitted to operate and maintain this machine. ▪ Failure to comply will cause the warranty to become void.

WARNING

Danger of injury from the failure to follow the operating instructions and from performing unauthorized tasks on the machine.

- Follow all instructions.
- Do not perform activities for which no qualification is available. Contact properly trained personnel if necessary.

CAUTION

Danger of injury from overloading the body.

Lifting the machine to transport it or to move it to another location can lead to injuries (of the back, for example).

- Only lift the machine with a hoist (see the chapter *6.1 Transport - Engine with 2 lifting eyes, page 31*).

3.2.2 Machine-specific safety instructions for operation

Introduction

The machine can pose residual risks during operation. To eliminate these risks, all persons working on the machine must follow the general and machine-specific safety instructions.

If you have an engine that is not yet installed in a machine, it is imperative that you follow the **Assembly Instructions for HATZ Diesel Engines** before installing the engine.

These assembly instructions contain important information on safe installation.

If the engine is installed in a machine or assembled with other machines to form a machine, it is prohibited to start the engine before it has been determined that the newly created machine fulfills all safety-related requirements and applicable legal regulations.

Safe operation

- Before switching on the machine, ensure that no one can be injured when the machine is started up.
- During machine operation, ensure that unauthorized persons do not have access to the area in which the machine has an impact.
- Parts of the exhaust gas system and the surface of the engine become hot during operation. Risk of injury from touching hot parts! Let the engine cool before maintenance.
- Do not refuel during operation.

Faults

- Immediately eliminate faults that compromise safety.
- Switch off the machine and do not take into service again until all faults have been eliminated.

Safety instructions for operation

⚠ DANGER	
	**Danger to life from inhaling exhaust gases.** Toxic engine exhaust gases can lead to loss of consciousness and even death in closed-off and poorly ventilated rooms. ▪ Never operate the machine in closed-off or poorly ventilated rooms. ▪ Do not breathe in the exhaust gases.

⚠ DANGER	
 	**Fire hazard from fuel.** Leaked or spilled fuel can ignite on hot engine parts and cause serious burn injuries. ▪ Only refuel when the engine is switched off. ▪ Never refuel in the vicinity of open flames or sparks that can cause ignition. ▪ Do not smoke. ▪ Do not spill fuel.

3.2.3 Machine-specific safety instructions for maintenance work

Introduction

The machine can pose residual risks during maintenance. To eliminate these risks, all persons working on the machine must follow the general and machine-specific safety instructions.

Maintenance intervals

- Strictly adhere to the maintenance intervals.
- Check the safety equipment regularly to ensure it is in good condition and functioning properly.
- Check connections, cables and fasteners regularly to ensure they are in good condition.

Maintenance work

Maintenance work that goes beyond the scope described in this manual must only be performed by qualified technicians. We recommend that you work with one of the more than 500 **HATZ service stations**.

Replacing parts

- When replacing defective components, we recommend that you use **genuine HATZ original spare parts** (see the chapter *2 General information, page 6*).
- When disposing of parts that can no longer be used, do so in accordance with local environmental regulations or send them to a recycling center.

Measures following maintenance and troubleshooting

- Securely reconnect loose electrical connections; check that the electrical components and equipment are functioning properly.
- Check the entire machine for foreign bodies; remove any foreign bodies.

Safety instructions for maintenance work

⚠ DANGER	
	**Danger of explosion from flammable cleaning agents.** Cleaning with benzene is an explosion hazard. It is highly flammable, can become electrostatically charged and can generate an explosive gas-air mixture. ▪ Use halogen-free, cold cleaners with a high flashpoint for cleaning.

⚠ DANGER	
	**Fire hazard from spontaneous combustion.** Cleaning materials soaked with cold cleaner may produce heat together with atmospheric oxygen and combust spontaneously. ▪ Collect cleaning materials soaked with cold cleaner only in fire-proof, tightly sealed containers. ▪ Do not dispose of cold cleaner residues and used cleaning materials with domestic waste, rather only in accordance with manufacturer instructions. ▪ Comply with the instructions for preventing fire on the safety data sheet for the cold cleaner.

WARNING

Danger of injury from compressed air and dust particles.

Eye injuries may occur when cleaning with compressed air.

- Wear safety goggles.

CAUTION

Danger of injury if maintenance instructions are not followed.

- Only perform maintenance when the engine is switched off.
- For engines with an electric starter:
  Disconnect the negative battery terminal.
  Protect the starting key against unauthorized access.

CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool before maintenance.

3.2.4 Electrical equipment

Safety notes

⚠ DANGER
 **Danger to life, danger of injury or danger of property damage due to incorrect use of batteries.** ▪ Do not place tools on the battery. ▪ Before performing work on the electrical equipment, always disconnect the negative terminal of the battery. ▪ Never swap the positive (+) and negative (–) battery terminals. ▪ When installing the battery, first connect the **positive cable** and then the **negative cable**. ▪ When removing the battery, first disconnect the **negative cable** and then the **positive cable**. ▪ It is imperative that you prevent short circuits and mass contact of current-carrying cables. ▪ If faults occur, check the cable connections for good contact.

⚠ DANGER
 **Danger of explosion from flammable substances.** There is a danger of explosion from flammable gases. ▪ Keep batteries away from open flames and incendiary sparks. ▪ Do not smoke when working with batteries.

⚠ CAUTION
 **Danger of chemical burns** Chemical burns can occur when using batteries for the electrical operation. ▪ Protect your eyes, skin, and clothing from corrosive battery acid. ▪ Immediately rinse areas affected by splashed acid with clear water and consult a physician if necessary.

NOTICE

- The necessary wiring diagrams are included with the machine if it is equipped with electrical equipment. Additional wiring diagrams can be requested when needed.
- We cannot be held liable for electrical equipment that is not designed according to HATZ wiring diagrams.

- Promptly replace faulty indicator lamps.
- Do not pull out the starting key during operation.
- Do not disconnect the battery while the machine is running. Resulting voltage peaks could destroy the electronic components.
- When cleaning, do no spray the electrical equipment components with a water jet or high pressure cleaner.
- When performing welding work on the machine, disconnect the battery and place the ground clamp of the welding equipment as close as possible to the welding area. Disconnect the plug-in connection to the voltage regulator.

3.3 Labels

Warning labels and information signs on the engine

Label	Meaning
	Refuel with diesel fuel only. For the specification, see the chapter *4.5 Fuel, page 26* Do not use bio diesel.
	The engine may only be operated with fuel that is "EXTREMELY LOW IN SULFUR OR SULFUR-FREE". The fuel label is located close to the fuel cap. If there is no fuel tank installed on the engine, the label must be applied permanently close to the fuel filler opening.

4 Technical data

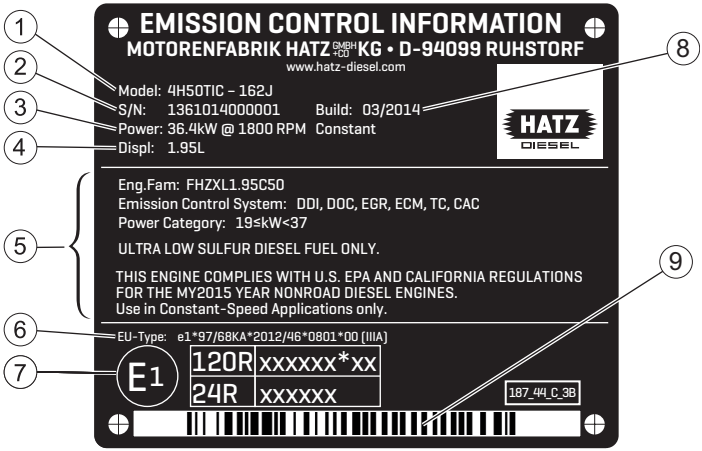
4.1 Engine information and filling quantities

Type		4H50TIC
Type		Liquid-cooled four stroke diesel engine
Combustion system		Direct injection, turbocharger with charge air cooling, cooled exhaust-gas recirculation
Injection system		Bosch common rail
Number of cylinders		4
Bore/stroke	mm	84 / 88
Displacement	cm^3	1,952
Engine oil capacity	Approx. ltr.	7.0 [1)]
Difference between the "max." and "min." marks	Approx. ltr.	1.0 [1)]
Engine oil consumption (after running-in period)	Max.	0.5 % of fuel consumption, pertaining to full load
Engine oil pressure		2.5 bar to 4.5 bar
Coolant quantity	Approx. ltr.	12.5 (HATZ standard radiator with external expansion tank) 13.2 (HATZ OpenPowerUnit radiator with integrated expansion tank)
Sense of rotation		When viewing flywheel: left
Tappet clearance		Automatic valve lash adjustment with hydraulic valve tappets
Max. perm. inclination during continuous operation in every direction		30° [2)] (with HATZ standard radiator) 20° [2)] (with HATZ OpenPowerUnit radiator)
Weight (without operating fluids)	Approx. kg	226 (with HATZ standard radiator and catalytic converter) 260 (with HATZ OpenPowerUnit radiator and catalytic converter)
Battery capacity	Max.	12 V – 110 Ah / 450 A according to DIN 24 V – 66 Ah / 300 A according to DIN

[1] These values are approximations only. The max. mark on the dipstick is decisive in any case (see the chapter *7.6 Checking the oil level and adding oil if necessary, page 47*).

[2] Exceeding these limit values can cause engine damage.

4.2 Engine type plate



The engine type plate is located on the crankcase and contains the following engine information:

1	Model designation of the engine
2	Engine serial number
3	Serial rating (kW) at nominal speed (rpm)
4	Displacement (liters)
5	Information for US emission certification (EPA/CARB)
6	EU type approval
7	EU country of origin (Germany)
8	Model year (month/year)
9	Bar code (engine serial number)

The following data must always be specified for requests and spare part orders

1	Model designation
2	Engine serial number

4.3 Engine oil

Oil quality

All brand name oils that satisfy at least the following specification are suitable:

Engines with catalytic converter or with catalytic converter and particulate filter

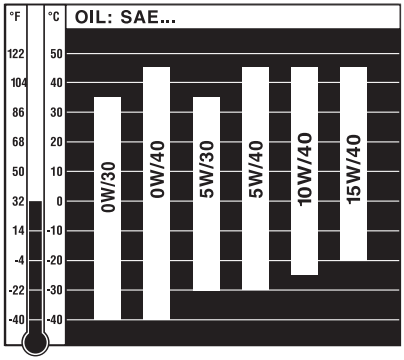
- **ACEA E6 "Low SAPS" (preferred)**
- **ACEA E9**
- **ACEA C3 / C4 (HTHS ≥ 3.5 mPas)**
- **API CJ-4**

	CAUTION
	Damage to the catalytic converter and/or particulate filter from using unsuitable engine oil. Unsuitable engine oil diminishes the functionality and service life of the catalytic converter and/or particulate filter. Only use engine oil that fulfills the specifications stipulated above. In principle, engine oils with low ash (**low SAPS**) are recommended.

Engines without catalytic converter and without particulate filter

- **ACEA E6, E7 or E9**
- **ACEA C1, C2, C3 or C4**
- **API CJ-4 or CI-4**

Oil viscosity



Select the recommended viscosity depending on the ambient temperature in which the engine will be operated.

	CAUTION
	Engine damage from unsuitable engine oil. Unsuitable engine oil considerably reduces engine service life. Only use engine oil that fulfills the specifications stipulated above.

4.4 Coolant

Introduction

Liquid-cooled engines require a coolant specified by HATZ for engine cooling.
Coolant is prepared in accordance with manufacturer's instructions, please comply with the information on the packaging label.

Radiator protection fluids give effective protection against corrosion and freezing. Additionally, the coolant boiling point is significantly raised and deposits of lime in the cooling system are reduced.

Safety notes

	⚠ CAUTION
	**Danger of damage to health** Radiator protection fluids are harmful to health. ▪ Avoid contact to eyes and skin. ▪ Store only in the sealed original container and in a place inaccessible for unauthorized persons. ▪ Comply with manufacturer's instructions.

	⚠ CAUTION
	**Danger of environmental damage from spilled coolant.** Coolant is water-polluting. ▪ Do no allow it to enter the ground water, water bodies, or sewage system. ▪ Collect coolant and dispose of it in an environmentally compatible manner.

	CAUTION
	Danger of engine damage from radiator protection fluid. Use of a radiator protection fluid not approved by HATZ may cause engine damage. ▪ If you have any questions, please contact your nearest **HATZ service station** before commissioning the engine.

	CAUTION
	Danger of engine damage by mixing radiator protection fluids from different manufacturers. The effectiveness may be degraded when different radiator protection fluids are mixed. The consequence may be damage to the water pump, radiator, hoses, and gaskets. ▪ Before changing the product, flush the entire cooling system (see the chapter *8.2.15 Changing coolant, page 82*).

Approved radiator protection fluids

The following radiator protection fluids are approved by HATZ:

Manufacturer	Product name
ARAL	Aral Antifreeze Silikatfrei (silicate-free)
Arteco	Havoline XLC (OF02), Havoline XLC+B
Auto-Teile-Ring	Cartechnic Antifreeze CT 12 plus
BASF	Glysantin® G30®, Glysantin® G40®
Belgin Madeni Yaglar Tic	LUBEX ANTIFREEZE G-12 PLUS
BP	BP Procool
Bucher	MOTOREX COOLANT M4.0
BVG Blume	Mofin Antifreeze M40 Extra
Castrol	Radicool SF, Radicool Si OAT
CCI	LLC C521, LLC L415
CHEMIA-BOMAR	Glidex Extra Premium
Chevron	Caltex Extended Life Coolant, Havoline XLC Concentrate, Ursa ELC NF Concentrate
CLASSIC	CLASSIC KOLDA UE G30, CLASSIC KOLDA UE G40

Manufacturer	Product name
Eurolub	Radiator protection fluid D-30, PROCAR radiator protection fluid silicate-free, radiator protection fluid D-40 SUPER
Exxon	Mobil Delvac ELC Coolant
Fuchs	MAINTAIN FRICOFIN G 12 PLUS, MAINTAIN FRICOFIN LL, MAINTAIN FRICOFIN DP
Gazpromneft-Lubricants	G-ENERGY ANTIFREEZE SNF
Krafft	K-140 Energy - Plus
Kuttenkeuler	Kuttenkeuler Antifreeze K 12 Plus
LUKOIL	OMV coolant SF, OMV coolant SOT
Mitan	Alpine C40, Alpine C12+
MOL-LUB	EVOX Premium Concentrate
Müller Mineralöle	Startol Top G 12 Plus
Neste Markkinointi	Neste Superjäähdytinneste XLC
OAO Technoform	Cool Stream Premium
Old World Industries	Final Charge Global Coolant
Petrol Ofisi Anonim Sirketi	PO EXTENDED LIFE coolant
Tedex	Tedex Antifreeze OT LL
Total	Total Glacelf Auto Supra
Valvoline	Zerex G 30, Zerex G 40-91

NOTICE

Prior approval from HATZ is needed when none of these radiator protection fluids is available or an own-product radiator protection fluid is to be used.

Preparation of the coolant

CAUTION	
	Danger of engine damage from incorrect radiator protection fluid concentration. A too low radiator protection fluid concentration increases the risk of corrosion and also the risk of the cooling system freezing. A radiator protection fluid proportion of over 50 vol% degrades the cooling action and also the protection against frost is reduced. Therefore, serious engine damage may result from exceeding or dropping below the radiator protection fluid concentration.

- The radiator protection fluid must be prepared according to manufacturer's instructions before pouring it into the cooling circuit. Comply with the information on the packaging label.
- If the radiator protection fluid has to be mixed with water, use only clean water that is not too hard. Tap water with as low as possible content of salt, minerals, and suspended matter is ideal. Distilled water is equally ideal.

The coolant mixture ratio is not to be below or exceed the following concentration:

Radiator protection fluid	Water	Frost-resistant to approx.
min. 40 vol%	60 vol%	-27 °C
max. 50 vol%	50 vol%	-38 °C

NOTICE	
	As the corrosion and antifreeze concentration reduces with time, carry out an annual check with a commercially available antifreeze tester. If the concentration is too low, change the coolant independent of the service interval (see the chapter *8.2.15 Changing coolant, page 82*).

4.5 Fuel

Fuel type

All types of diesel fuel that meet the minimum requirements of the following specifications are suitable:

- **Europe: EN 590**
- **UK: BS2869 A1/A2**
- **USA: ASTM D 975-09a 1-D** or **2-D** (engines without catalytic converter and without particulate filter)
  ASTM D 975-09a 1-D S15 or **2-D S15**

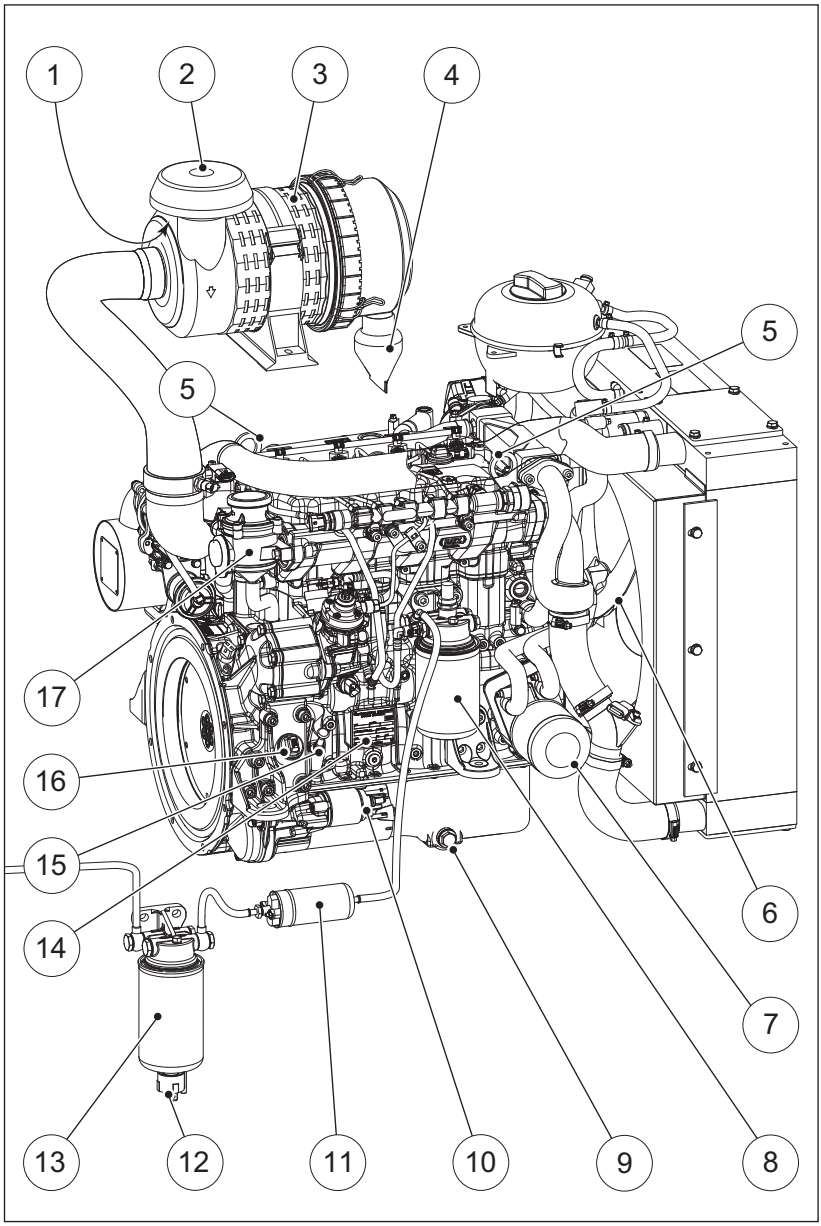
- **Japan: JIS K 2204** (with a maximum HFRR value of 520 µm)

	CAUTION
	Danger of engine damage from low quality fuel. The use of fuel that does not meet the specifications can lead to engine damage. ▪ Only use fuel that is very low in sulfur or that contains no sulfur at all. ▪ The use of fuel that does not meet specifications requires approval by Motorenfabrik HATZ (main plant).

5 Engine design

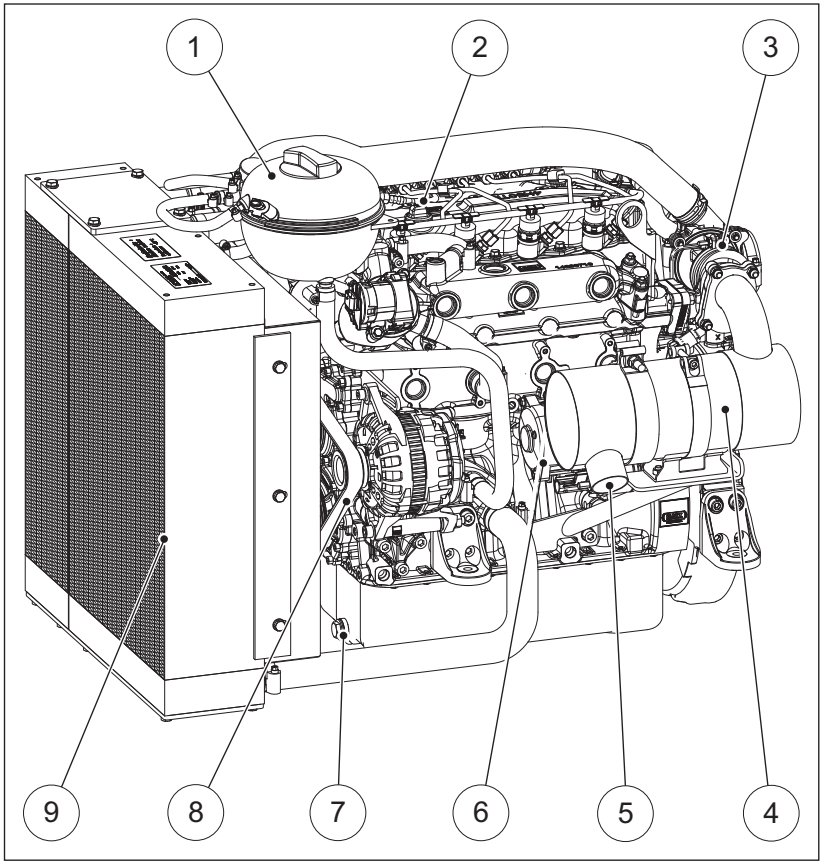
5.1 Overview

Intake side



1	Intake opening for combustion air
2	Rain cap
3	Air filter (optional)
4	Dust discharge valve
5	Lifting eyes
6	Fan
7	Oil filter
8	Fuel fine filter
9	Side oil drain screw
10	Starter (low mounting position)
11	Electric fuel pump
12	Drain plug on fuel prefilter
13	Fuel prefilter
14	Engine type plate
15	Dipstick
16	Oil filler plug, bottom
17	Crankcase ventilation

Exhaust side



1	Expansion tank for coolant
2	Oil filler plug, top
3	Turbocharger
4	Oxidation catalytic converter
5	Exhaust outlet
6	Starter (high mounting position)
7	Oil drain screw, front
8	Poly v belt
9	Cooler

6 Transport, assembly and commissioning

6.1 Transport - Engine with 2 lifting eyes

Safety notes

⚠ WARNING

Danger of injury from improper lifting and transport.

Danger of crushing from falling or tipping of the engine.

- Only use the lifting eye already mounted on the machine for lifting.
- Only use a suitable hoist with a sufficient carrying capacity.
- Do not remain under suspended loads.

⚠ CAUTION

Only use lifting lugs for transporting the engine.

Do not use for lifting the entire machine.

⚠ CAUTION

Danger of injury from overloading the body.

Lifting the machine to transport it or to move it to another location can lead to injuries (of the back, for example).

- Only lift the machine with a hoist.

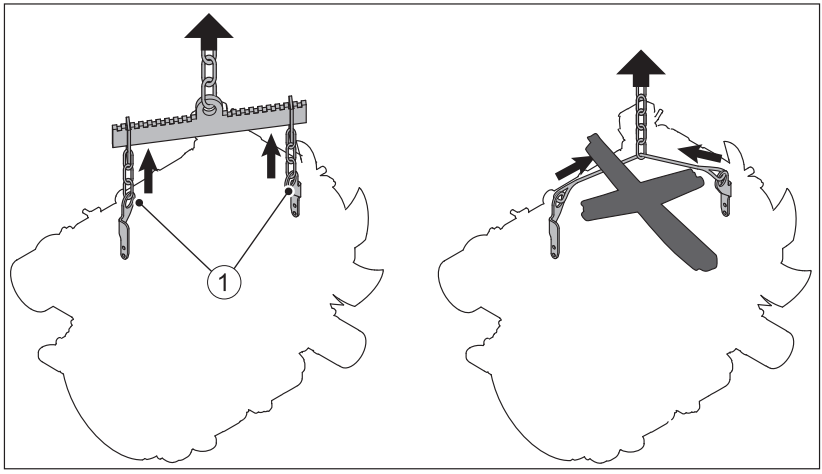
NOTICE

Danger of environmental damage from leaking fluid.

If the machine is tilted, engine oil and fuel can run out.

- Only transport the machine in an upright position.

Lifting points



1	Lifting point

Transport conditions

- Two lifting eyes (1) are used on engines with a HATZ standard radiator. Ensure that the load on the lifting eyes is always vertical.
- The lifting eyes deform when they are overloaded. If this happens, the lifting eyes must be replaced and if necessary additional lifting points must be used.
- When transporting the machine, follow the safety instructions.
- When transporting, follow the applicable safety and accident prevention regulations of the trade associations.
- After delivery, check the machine for completeness and transport damage.
- Only transport the machine when it is switched off and has cooled down.
- If you have questions on transporting the machine, please contact your nearest **HATZ service station**. For contact data, see the chapter *1 Impressum, page 5* or **www.hatz-diesel.com**.

6.2 Assembly instructions

Assembly notes

HATZ diesel engines are efficient, robust and long-lived. Therefore, they are usually installed in machines that are used for commercial purposes.

The machine manufacturer must follow the applicable regulations regarding machine safety – the engine is a part of a machine.

Depending on the use and installation of the engine, it may be necessary for the machine manufacturer and machine user to install safety equipment to prevent inappropriate use. Note the following:

- Parts of the exhaust gas system and the engine surface become hot during operation and should not be touched until they cool down after the engine is switched off.
- Incorrect cable connections and incorrect operation of the electrical equipment can lead to sparking and must be avoided.
- After the engine is installed in the machine, rotating parts must be protected against contact.
  HATZ safety equipment is available for the belt drive of the cooling fan and alternator.
- Comply with all notice and warning labels on the engine and keep them in a legible condition. If a label should become detached or be difficult to read, it must be replaced promptly. For this purpose, contact your nearest **HATZ service station**.
- Any improper modification of the engine results in a loss of liability coverage for resulting damage.

Only regular maintenance, as specified in this Operator's Manual, will maintain the operating readiness of the engine.

The assembly instructions contain important information on how to safely assemble the engine. They are available from any **Hatz service station**.

If you have any questions, please contact your nearest **HATZ service station** before commissioning the engine.

6.3 Preparations for commissioning

- Check the delivered parts for completeness, damage, and other noticeable issues.
- Ensure that the setup location is adequately ventilated.

⚠ DANGER	
	**Danger to life from inhaling exhaust gases.** Toxic engine exhaust gases can lead to loss of consciousness and even death in closed-off and poorly ventilated rooms. ▪ Never operate the machine in closed-off or poorly ventilated rooms. ▪ Do not breathe in the exhaust gases.

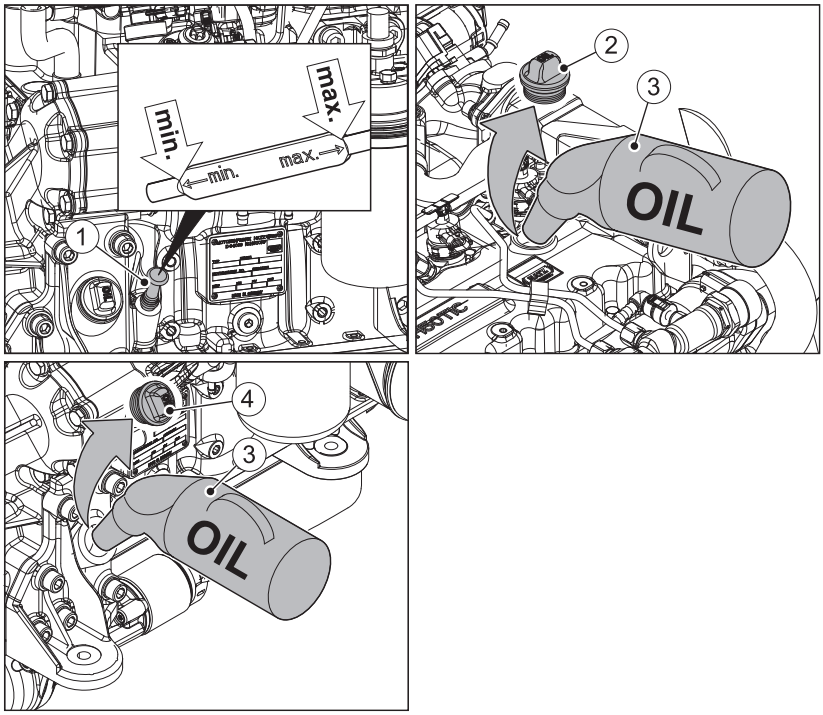
6.4 Filling engine oil

Engines are normally delivered without an engine oil filling.

Safety note

	CAUTION
	Danger of later engine damage. ▪ Operating the engine with an oil level below the **min.** mark or above the **max.** mark can lead to engine damage. ▪ When checking the oil level, the engine must be horizontal and have been switched off for a few minutes.

Overview



1	Dipstick
2	Oil filler plug, top
3	Oil refilling container
4	Oil filler plug, bottom

Procedure

Step	Activity
1	Pull out the dipstick (1) and clean it.

Step	Activity
2	Depending on accessibility, unscrew oil filler plug (2) or (4).
3	Fill engine oil. For the specification, viscosity and filling quantity, see the chapter *4.3 Engine oil, page 22*.
4	Reinsert the dipstick.
5	Pull out the dipstick and check the oil level.
6	If required, top up engine oil to the max. mark.
7	Reinsert the dipstick.
8	Screw in the oil filler plug.

6.5 Filling the cooling system

Safety notes

⚠ CAUTION

Danger of burns.

There is a danger of burns when working on a hot cooling system. The cooling system is pressurized.

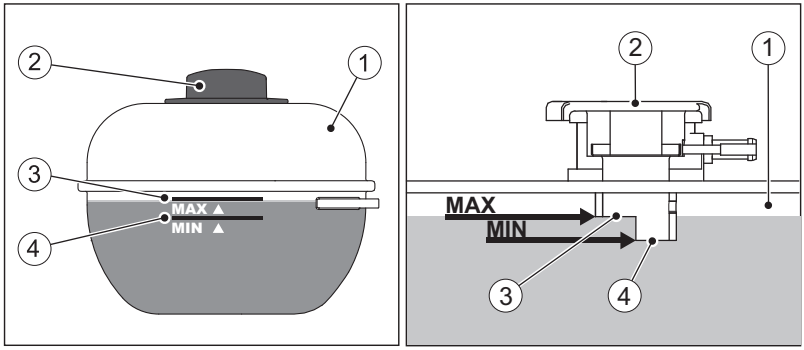
- Let the engine cool.
- Wear safety gloves.

CAUTION

Danger of later engine damage.

- Operating the engine with a coolant level below the **MIN.** mark can lead to engine damage.
- When checking the coolant level, the engine must be horizontal and be switched off.

Overview



1	Expansion tank for coolant
2	Sealing cap
3	**MAX** - Maximum coolant level
4	**MIN** - Minimum coolant level

Procedure

Step	Activity
1	Open the sealing cap (2).
2	For the HATZ standard radiator: Top up coolant to the **MAX** mark on the expansion tank. For the HATZ OpenPowerUnit radiator: Top up coolant to the edge of the pipe cut-out. Preparation of the coolant, see the chapter *4.4 Coolant, page 23*.
3	Tighten the sealing cap (2) by hand all the way.
4	Start the engine (see the chapter *7 Operation and use, page 38*).
5	Warm up the engine until the coolant has reached a temperature of approx. 85°C. Above this temperature the coolant is pumped through the entire cooling system and forces out remaining air bubbles.
6	Switch off the engine and let it cool down completely (see the chapter *7 Operation and use, page 38*).
7	Check the coolant level again. The coolant must be seen between the **MIN** and **MAX** mark; for a warm engine the level can also be slightly above the **MAX** mark.

Step	Activity
8	Check the cooling system for leaks, retighten the hose clips if necessary (see the chapter *8.2.4 Checking the cooling system, page 57*).

7 Operation and use

7.1 Safety notes

NOTICE
 **Comply with the safety chapter!** Follow the basic safety instructions in the chapter *3 Safety, page 7*.

WARNING
 **Danger of injury from damage and defects on the machine.** ▪ Do not take the machine into service if damage has been localized and identified. ▪ Replace faulty components.

WARNING
 **Danger of injury from the failure to follow the operating instructions and from performing unauthorized tasks on the machine.** ▪ Define the responsibilities of the personnel taking the machine into service. ▪ Replace faulty machine parts immediately. ▪ Check the installation conditions when the machine is first taken into service and after the machine has been inactive for a lengthy period.

CAUTION
Danger of engine damage from low load operation. Operating the engine at no load or at very low load for an extended period can impair the running characteristics of the engine. ▪ Make sure that the engine load is at least 15 %. ▪ Before switching off the engine following low load operation, briefly operate it at a considerably higher load.

7.2 Performing tests

Before starting

Before starting the engine, several tests need to be performed to ensure the machine is working properly.

Procedure

Step	Test
1	The machine is standing securely and on a level surface.
2	The installation location is adequately ventilated.
3	There is a sufficient amount of fuel in the fuel tank (see the chapter *7.7 Refueling, page 49*).
4	There is a sufficient amount of engine oil in the engine housing (see the chapter *7.6 Checking the oil level and adding oil if necessary, page 47*).
5	There is a sufficient amount of coolant in the expansion tank (see the chapter *8.2.4 Checking the cooling system, page 57*).
6	Radiator and radiator hoses are free from leaks (see the chapter *8.2.4 Checking the cooling system, page 57*).
7	No persons are located in the danger zone of the engine or machine.
8	All safety equipment is in place.

7.3 Starting the engine

Safety notes

DANGER

Danger to life from inhaling exhaust gases.

Toxic engine exhaust gases can lead to loss of consciousness and even death in closed-off and poorly ventilated rooms.

- Never operate the machine in closed-off or poorly ventilated rooms.
- Do not breathe in the exhaust gases.

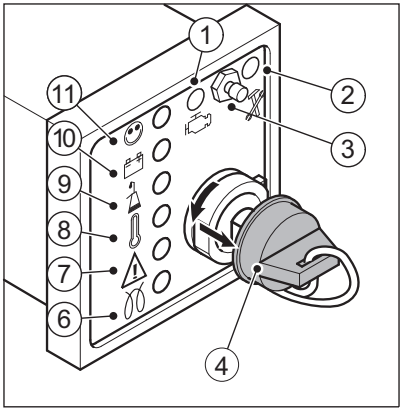
CAUTION

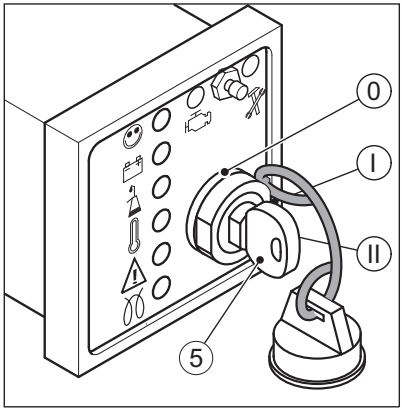
Danger of engine damage from the use of starting fluid.

- The use of engine damage from the use of starting fluid can lead to uncontrolled ignition.
- Engine damage from uncontrolled ignitions.
- Never use starting fluid.

NOTICE	
	See also starting instructions in the documentation for the complete machine.

Overview — HATZ instrument boxes





Pos.	Designation
1	Error diagnosis display
2	Service interval indicator
3	Button for error interrogation
4	Protective cap
5	Starting key
6	Pre glow display
7	Air filter service required
8	Engine temperature display
9	Oil pressure display
10	Charge control
11	Operating display
Ignition lock	
0	Off
I	Operation
II	Starting

Procedure

	NOTICE
	▪ After approx. 20 seconds the start procedure cuts off automatically to protect the starter. If the engine is still not running after that, turn the starting key back to position "0" and eliminate the cause (see the chapter *9.1 Fault table, page 86*). ▪ Turn the starting key to position "0" every time you want to start the engine. ▪ The anti repeat device in the ignition lock makes it impossible for the starter to engage while the engine is running and become damaged.

Step	Activity
1	Remove the protective cap (4) from the ignition lock.
2	Insert the starting key all the way and turn to position "I". Depending on the model, the following indicators light up: ▪ Charge control (10) ▪ Oil pressure display (9) ▪ Pre glow display (6) *NOTE:* If the optional engine temperature display (8) lights up, the coolant temperature is impermissibly high. Do not start the engine; eliminate the cause. When the optional pre glow display (6) goes out, continue with step 3.
3	Turn the starting key to position "II".
4	As soon as the engine is running, release the starting key. ▪ The starting key springs back to position "I" and remains in this position during operation. ▪ The charge control (10) and oil pressure display (9) go out. ▪ The operating display (11) lights up.

	NOTICE
	▪ In case of irregularities, switch off the engine immediately. ▪ Identify the fault and eliminate it. ▪ For details of troubleshooting, see the chapter *9.1 Fault table, page 86*.

7.4 Starting the engine for the first time/after a filter change

Safety notes

DANGER

Danger to life from inhaling exhaust gases.

Toxic engine exhaust gases can lead to loss of consciousness and even death in closed-off and poorly ventilated rooms.

- Never operate the machine in closed-off or poorly ventilated rooms.
- Do not breathe in the exhaust gases.

CAUTION

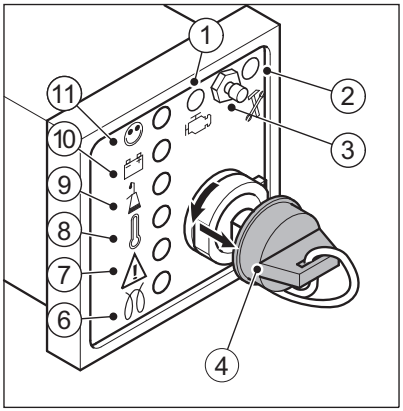
Danger of engine damage from the use of starting fluid.

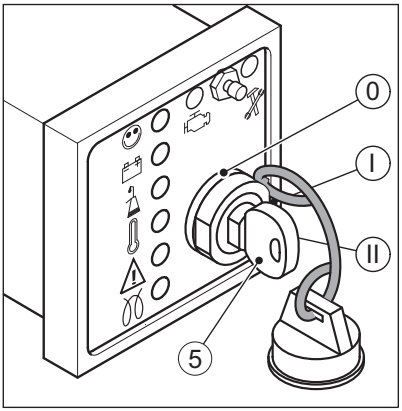
- The use of engine damage from the use of starting fluid can lead to uncontrolled ignition.
- Engine damage from uncontrolled ignitions.
- Never use starting fluid.

NOTICE

See also starting instructions in the documentation for the complete machine.

Overview — HATZ instrument boxes





Pos.	Designation
1	Error diagnosis display
2	Service interval indicator
3	Button for error interrogation
4	Protective cap
5	Starting key
6	Pre glow display
7	Air filter service required
8	Engine temperature display
9	Oil pressure display
10	Charge control
11	Operating display
Ignition lock	
0	Off
I	Operation
II	Starting

Procedure

	NOTICE
	▪ After approx. 20 seconds the start procedure cuts off automatically to protect the starter. If the engine is still not running after that, turn the starting key back to position "0" and eliminate the cause (see the chapter *9.1 Fault table, page 86*). ▪ Turn the starting key to position "0" every time you want to start the engine. ▪ The anti repeat device in the ignition lock makes it impossible for the starter to engage while the engine is running and become damaged.

Step	Activity
1	Remove the protective cap (4) from the ignition lock.

Step	Activity
2	Insert the starting key all the way and turn to position "I". Depending on the model, the following indicators light up: ▪ Charge control (10) ▪ Oil pressure display (9) ▪ Pre glow display (6) *NOTE:* If the optional engine temperature display (8) lights up, the coolant temperature is impermissibly high. Do not start the engine; eliminate the cause. When the optional pre glow display (6) goes out, continue with step 3.
3	Leave the starting key at position "I" until you hear the fuel feed pump switches off (approx. 30 seconds).
4	Turn the starting key to position "II". The start procedure takes longer than normal as air is still in the fuel system.
5	As soon as the engine is running, release the starting key. ▪ The starting key springs back to position "I" and remains in this position during operation. ▪ The charge control (10) and oil pressure display (9) go out. ▪ The operating display (11) lights up. *NOTE:* There is air in the fuel system when starting the engine for the first time/after a filter change. The engine therefore starts in the emergency program (reduced power and speed).
6	Run the engine for approx. 2 minutes in the emergency program to make sure there is no more air in the fuel system.
7	Switch off the engine and leave it switched off for at least 2 minutes. At the next start the engine again runs in the normal program.

	NOTICE
	▪ In case of irregularities, switch off the engine immediately. ▪ Identify the fault and eliminate it. ▪ For details of troubleshooting, see the chapter *9.1 Fault table, page 86*.

7.5 Switching off the engine

Safety notes

CAUTION

Danger of injury from unauthorized access.

There is a danger of injury if unauthorized persons handle the machine.

- Protect the starting key against unauthorized access during breaks in operation or after completing work.

CAUTION

Protect the ignition lock against dirt and moisture.

- With the starting key pulled out, seal the ignition lock with the protective cap.

NOTICE

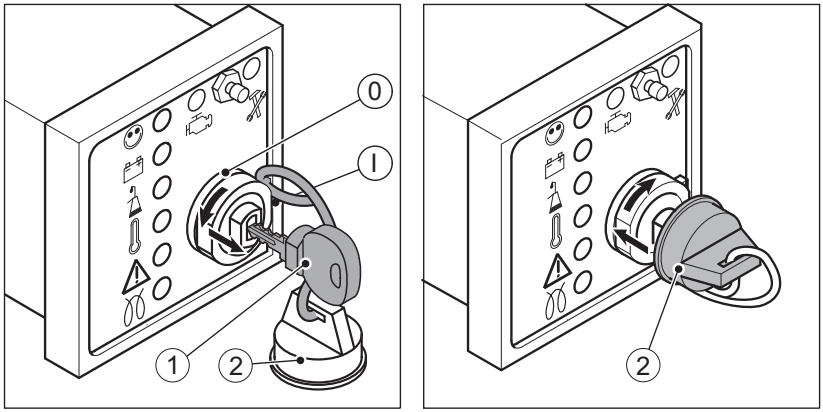
Danger of overheating and full battery discharge.

- To prevent damage due to overheating, cool down the engine before switching it off by running it for approx. 5 minutes at a reduced speed and load.
- When the machine is switched off, always turn the starting key to position "0" or else the battery may become fully discharged.

NOTICE

See also instructions in the documentation for the complete machine.

Overview — HATZ instrument boxes



Pos.	Designation
1	Starting key
2	Protective cap
Ignition lock	
0	Off
I	Operation

Procedure

Step	Activity
1	Turn the starting key (1) to position "0". The engine switches off. All indicator lamps go out.
2	Remove the starting key.
3	Seal the ignition lock with the protective cap (2).

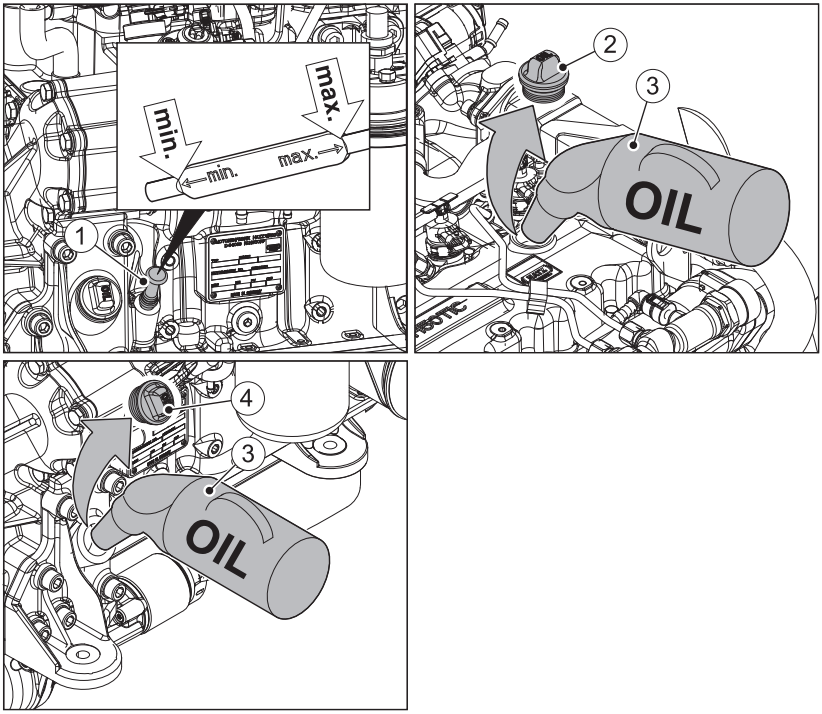
7.6 Checking the oil level and adding oil if necessary

Safety notes

	CAUTION
 	**Danger of burns.** There is a danger of burns when working on a hot engine. ▪ Wear safety gloves.

	CAUTION
	Danger of later engine damage. ▪ Operating the engine with an oil level below the **min.** mark or above the **max.** mark can lead to engine damage. ▪ When checking the oil level, the engine must be horizontal and have been switched off for a few minutes.

Overview



1	Dipstick
2	Oil filler plug, top
3	Oil refilling container
4	Oil filler plug, bottom

Procedure — Checking oil level/adding oil

Step	Activity
1	Switch off the engine and wait several minutes for the engine oil to collect in the crank housing. Engine must be level.
2	Remove contamination on the engine in the area of the dipstick (1).
3	Pull out the dipstick and clean it.
4	Reinsert the dipstick.
5	Pull out the dipstick and check the oil level.

Step	Activity
6	If the oil level is close to the **min.** mark, add engine oil to the **max.** mark. For the specification and viscosity, see the chapter *4.3 Engine oil, page 22*.
7	Reinsert the dipstick.

7.7 Refueling

This diesel engine is intended for installation in a machine or for assembly with other machines to form a machine and does not have its own fuel tank. Follow the instructions from the manufacturer and comply with the following safety information.

	NOTICE
	If possible, never run the fuel tank empty, otherwise air can enter the fuel system and the engine switches to the emergency program. There is also the risk that damage is caused in the fuel high-pressure section. If the fuel tank is nevertheless run empty, the procedure described under "*7.4 Starting the engine for the first time/after a filter change, page 42*" must be adhered to.

Safety notes

	DANGER
 	**Fire hazard from fuel.** Leaked or spilled fuel can ignite on hot engine parts and cause serious burn injuries. ▪ Only refuel when the engine is switched off. ▪ Never refuel in the vicinity of open flames or sparks that can cause ignition. ▪ Do not smoke. ▪ Do not spill fuel.

	CAUTION
	**Danger of environmental damage from spilled fuel.** Do not overfill the fuel tank and do not spill fuel. ▪ Collect emerging fuel and dispose of it in an environmentally compatible manner.

	CAUTION
	Engine damage from using low quality fuel. The use of fuel that does not meet the specifications can lead to engine damage. ▪ Only use the fuel specified in the chapter *4.5 Fuel, page 26*. ▪ The use of fuel that does not meet specifications requires approval by Motorenfabrik HATZ (main plant).

8 Maintenance

8.1 General maintenance instructions

Safety notes

⚠ WARNING
 **Danger of injury from the failure to follow the operating instructions and from performing unauthorized tasks on the machine.** ▪ Follow all instructions. ▪ Do not perform activities for which no qualification is available. Contact properly trained personnel if necessary.

NOTICE
 **Comply with the safety chapter!** Follow the basic safety instructions in the chapter *3 Safety, page 7*.

- Maintenance tasks may only be performed by trained personnel.
- Accident prevention measures must be in accordance with the local accident prevention regulations.
- Perform setting and maintenance work at the specified intervals.
- Replace faulty machine parts as soon as possible.
- Always use personal protective equipment.
- Only use fully functional tools.
- Problems may occur if unsuitable spare parts are installed. We cannot accept responsibility for damage and secondary damage that result from this. We therefore recommend the use of **Hatz original spare parts**.
- Closely adhere to the maintenance conditions prescribed in this Operator's Manual.
- Only make changes on the machine in agreement with the manufacturer.
- Only perform maintenance when the engine is switched off.
- Adhere to legal regulations when handling and disposing of used oil, filters, coolants, and cleaning agents.
- Protect the starting key against unauthorized access.
- Disconnect the negative battery terminal before carrying out maintenance work.
- After completing maintenance work, check that all tools, bolts, aids and other objects are removed from the machine and that all safety equipment has been replaced.

- Before starting, ensure that no persons are located in the danger zone of the engine or machine.

Performance of maintenance work

The entire machine is designed to be maintenance friendly. Parts that require maintenance are easily accessible.

- Perform maintenance work faithfully at the specified intervals to prevent premature wear of the machine.
- Follow the notice and warning labels on the machine.
- Always retighten screw connections loosened during maintenance work.
- After the necessary maintenance and repair work is completed, perform a function test (test run).
- For maintenance work that is not listed and described in the maintenance documentation, please contact your nearest **HATZ service station**.

8.2 Maintenance work

Safety note

⚠ CAUTION	
	**Danger of injury if maintenance instructions are not followed.** ▪ Only perform maintenance when the engine is switched off. ▪ Protect the starting key against unauthorized access. ▪ Disconnect the negative terminal of the battery. ▪ After the maintenance work is completed, ensure that all tools have been removed from the machine.

8.2.1 Maintenance plan

Symbol	Maintenance interval	Maintenance activity/Check	Chapter
	Every 8-15 operating hours or every day before starting	Check the oil level.	*7.6 Checking the oil level and adding oil if necessary, page 47*
		Check the intake area of the combustion air.	*8.2.2 Checking the intake area of the combustion air, page 54*

Symbol	Maintenance interval	Maintenance activity/Check	Chapter
		Check the radiator fins for dirt accumulation.	*8.2.3 Checking the radiator fins for dirt accumulation, page 55*
		Checking the cooling system	*8.2.4 Checking the cooling system, page 57*
500h	Every 500 operating hours or every 2 years	Change the engine oil and oil filter[1)]	*8.2.5 Changing the engine oil and oil filter, page 59*
		Change the fuel prefilter[1)]	*8.2.12 Changing the fuel prefilter, page 74*
		Change the fuel fine filter[1)]	*8.2.13 Changing the fuel fine filter, page 77*
		Check the poly v belt[1)]	*8.2.7 Tensioning the poly v belt, page 67*
		Change the oil separator of the crankcase ventilation[1)]	*8.2.9 Changing the oil separator of the crankcase ventilation, page 71*
		Check the screw connections[1)]	*8.2.10 Checking the screw connections, page 72*
		Clean the radiator fins[1)]	*8.2.6 Cleaning the radiator fins, page 64*
	Every 500 operating hours or when indicated, at least every 2 years	Change the air filter cartridges	*8.2.14 Servicing the air filter (optional), page 80*
	When indicated	Drain the water separator[1)]	*8.2.11 Draining the water separator, page 73*

Symbol	Maintenance interval	Maintenance activity/Check	Chapter
	If necessary, every 3000 operating hours at the latest	Replacing the poly v belts	*8.2.8 Replacing the poly v belts, page 69*
	Every 4000 operating hours	Clean the entire EGR section (EGR precooler, EGR valve, EGR main cooler as well as EGR mixing nozzle) (To be carried out by a trained specialist)	

[1] Service according to service interval or after 2 years depending on which criteria is first.

In new and generally overhauled engines, after 50 operating hours:

- Change the engine oil and oil filter. See the chapter *8.2.5 Changing the engine oil and oil filter, page 59*.
- Check the screw connections (do not retighten the screws for attaching the cylinder head). See the chapter *8.2.10 Checking the screw connections, page 72*.

8.2.2 Checking the intake area of the combustion air

Safety notes

CAUTION

Danger of burns.

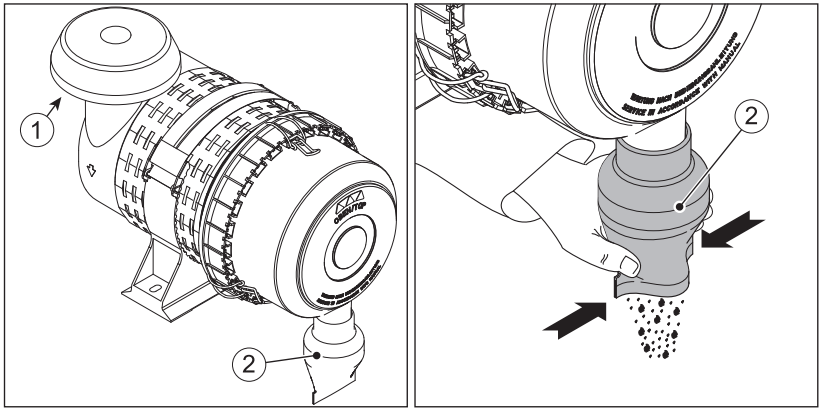
There is a danger of burns when working on a hot engine.

- Let the engine cool.
- Wear safety gloves.

NOTICE

In case of heavy contamination, shorten the maintenance intervals accordingly (see the chapter *8.2.1 Maintenance plan, page 52*).

Overview (HATZ air filter)



1	Intake opening for combustion air
2	Dust discharge valve

Procedure

Step	Activity
1	Check the intake opening (1) for coarse contamination such as leaves, heavy dust deposits, etc., and clean if necessary.
2	Check that the dust discharge valve (2) is clear. Remove dust seals by pressing them together.

8.2.3 Checking the radiator fins for dirt accumulation

Safety notes

CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool.
- Wear safety gloves.

CAUTION

Danger of injury.

When working with compressed air, foreign bodies may fly into your eyes.

- Wear safety goggles.
- Never direct the compressed air jet toward people or toward yourself.

CAUTION

Danger of engine damage from overheating.

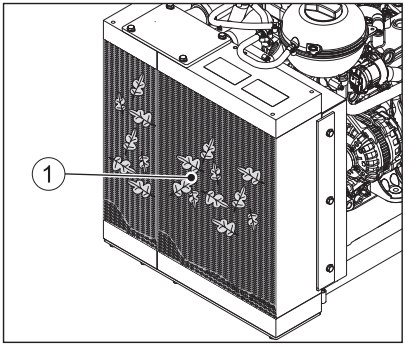
The engine temperature display (option) lights up as soon as the engine becomes impermissibly hot.

- Switch off the engine immediately and eliminate the cause.

NOTICE

In case of heavy contamination, shorten the maintenance intervals accordingly (see the chapter *8.2.1 Maintenance plan, page 52*).

Overview



1	Radiator fins

Procedure

Step	Activity
1	Check the radiator fins (1) for coarse contamination such as leaves, heavy dust deposits, etc., and clean if necessary (see the chapter *8.2.6 Cleaning the radiator fins, page 64*).

8.2.4 Checking the cooling system

Safety notes

⚠ CAUTION

Danger of scalding and risk of environmental damage due to hot coolant.

- Excessive coolant is blown off from the sealing cap on the expansion tank. After topping up the cooling system never move parts of your body or face close to the sealing cap.
- Never top up coolant above the MAX - mark on the expansion tank.
- Never stop escaping coolant with your bare hands.

⚠ CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool before maintenance.

⚠ CAUTION

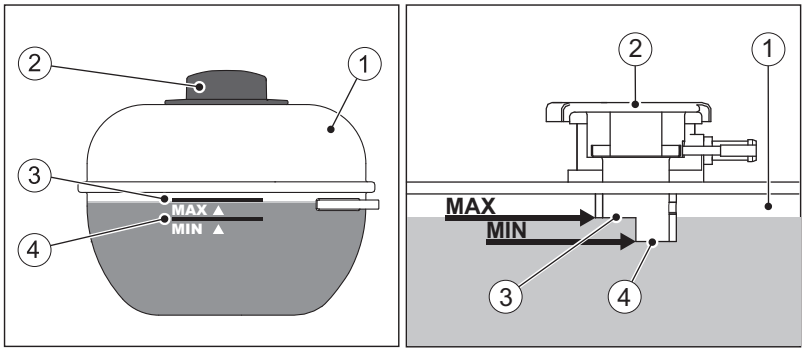
Danger of burns.

There is a danger of burns when working on a hot cooling system. The cooling system is pressurized.

- Let the engine cool.
- Wear safety gloves.

	CAUTION
	Danger of later engine damage. ▪ Operating the engine with a coolant level below the **MIN.** mark can lead to engine damage. ▪ When checking the coolant level, the engine must be horizontal and be switched off.

Overview



1	Expansion tank for coolant
2	Sealing cap
3	**MAX** - Maximum coolant level
4	**MIN** - Minimum coolant level

Procedure for checking the coolant level

Step	Activity
1	The coolant must be between the **MIN** and **MAX** marks on a switched-off and cooled-down engine. For a warm engine, the level can also be slightly above the **MAX** mark.

Procedure for topping up coolant

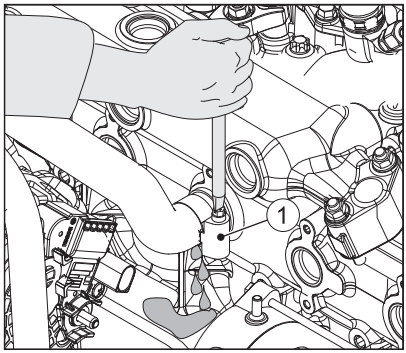
Step	Activity
1	Open the sealing cap (2).
2	Top up prepared coolant to the **MAX** mark on the expansion tank. Preparation of the coolant, see the chapter *4.4 Coolant, page 23*.
3	Tighten the sealing cap (2) by hand all the way.

Checking the cooling system for leaks

Coolants losses are mostly caused by leaks in the cooling system.

On a non-leaking cooling system, losses only occur when the coolant boils and this then causes coolant to be pressed out of the cooling system at the sealing cap on the expansion tank. The cause of this can be contamination in the area of the radiator fins (see the chapter *8.2.3 Checking the radiator fins for dirt accumulation, page 55*).

Overview



1	Hose clip

Procedure

Step	Activity
1	Check the cooling system for leaks and rectify the cause immediately - in case of doubt consult **HATZ Service** for advice.
2	When hose connections are loose, retighten the hose clips (1).

8.2.5 Changing the engine oil and oil filter

Safety notes

CAUTION	
 	**Danger of burns.** When working on the engine there is a danger of burns from hot oil. ▪ Wear personal protective equipment (gloves).

CAUTION

Danger of environmental damage from spilled used oil.

Used oil is water-polluting.

- Do no allow it to enter the ground water, water bodies, or sewage system.
- Collect the used oil and dispose of it according to local environmental regulations.

CAUTION

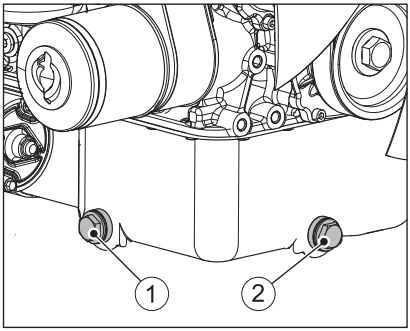
Danger of later engine damage.

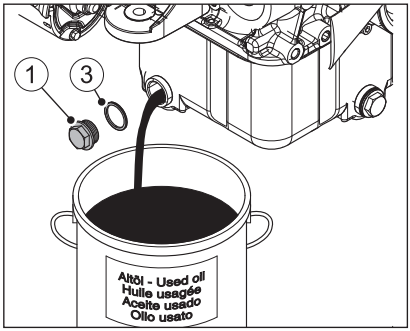
- Operating the engine with an oil level below the **min.** mark or above the **max.** mark can lead to engine damage.
- When checking the oil level, the engine must be horizontal and have been switched off for a few minutes.

NOTICE

- The engine must be level.
- The engine must be switched off.
- Only drain engine oil while it is warm.

Overview of draining engine oil



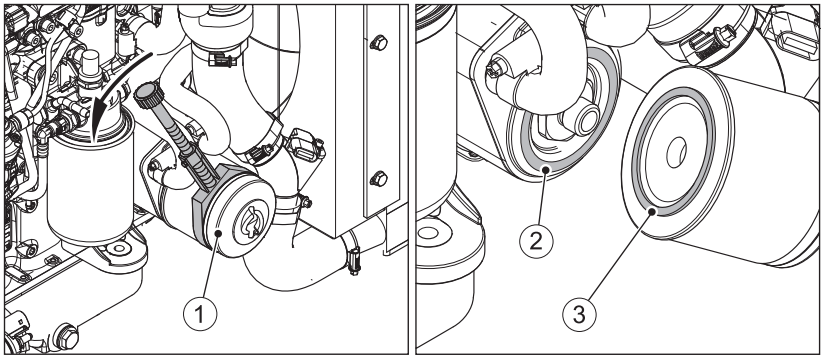


1	Oil drain screw (side)
2	Oil drain screw (front)
3	Gasket

Procedure

Step	Activity
1	Depending on accessibility, the engine oil can be drained at oil drain screw (1) or (2). Unscrew the oil drain screw and drain the used oil entirely.
2	Screw in the cleaned oil drain screw with the new gasket (3) and tighten.

Overview of changing the oil filter (horizontal installation)

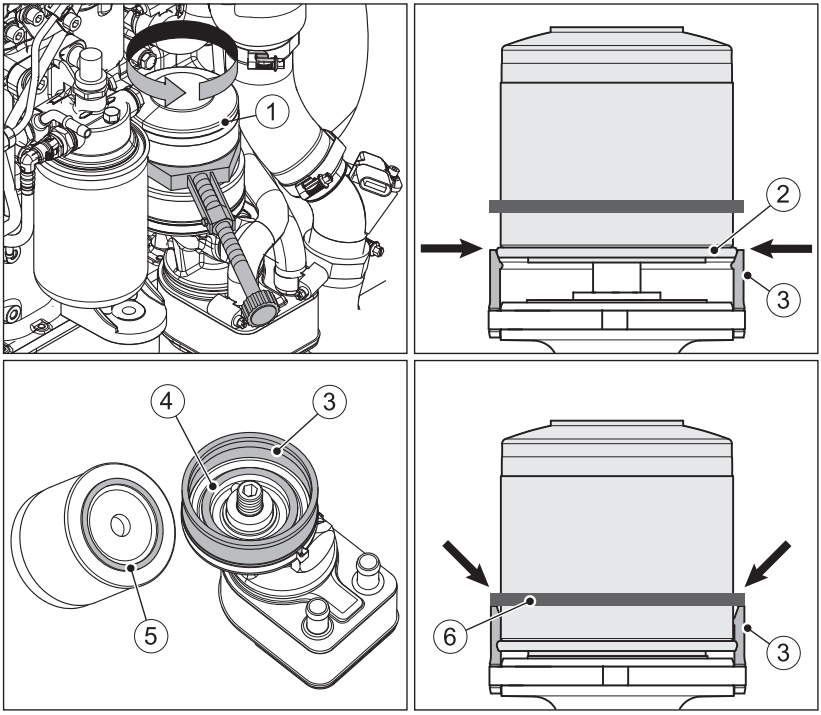


1	Oil filter
2	Sealing surface
3	Gasket

Procedure

Step	Activity
1	Loosen the oil filter (1) with a strap wrench or similar and unscrew it.
2	Dispose of the old filter in accordance with local environmental regulations.
3	Thoroughly clean the sealing surface (2).
4	Lightly oil the sealing lip (3) of the new oil filter.
5	Screw in the oil filter and **tighten it by hand**.

Overview of changing the oil filter (vertical installation)



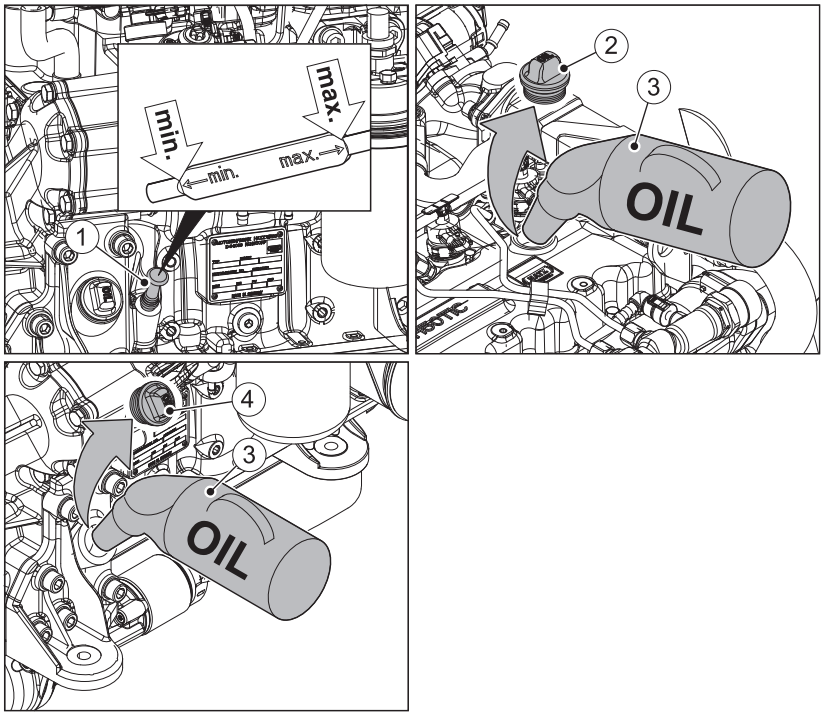
1	Oil filter
2	Collar on the oil filter
3	Shaped element
4	Sealing surface
5	Gasket
6	Guard ring

Procedure

Step	Activity
1	Loosen the oil filter (1) with a strap wrench or similar and unscrew it until the collar (2) of the oil filter is at the same level as the shaped element (3). In this position, a valve releases the oil return into the crankcase which allows the oil filter to empty.
2	Fully unscrew the oil filter after a waiting period of approx. 30 seconds.

Step	Activity
3	Dispose of the old filter in accordance with local environmental regulations.
4	Thoroughly clean the shaped element (3) and sealing surface (4).
5	Lightly oil the sealing lip (5) of the new oil filter.
6	Screw in the oil filter and **tighten it by hand**.
7	Make sure that the guard ring (6) seats fully on the shaped element (3). The guard ring prevents dirt from accumulating between the oil filter and shaped element.

Overview of filling the engine oil



1	Dipstick
2	Oil filler plug, top
3	Oil refilling container
4	Oil filler plug, bottom

Procedure

Step	Activity
1	Pull out the dipstick (1) and clean it.
2	Depending on accessibility, unscrew oil filler plug (2) or (4).
3	Fill engine oil. For the specification, viscosity and filling quantity, see the chapter *4.3 Engine oil, page 22*.
4	Reinsert the dipstick.
5	Pull out the dipstick and check the oil level.
6	If required, top up engine oil to the max. mark.
7	Reinsert the dipstick.
8	Screw in the oil filler plug.

Concluding inspection work

Step	Activity
1	Check the oil level after a short test run and correct if necessary.
2	Check the oil filter for tightness and retighten by hand if necessary.

8.2.6 Cleaning the radiator fins

Safety notes

	DANGER
	**Danger of explosion from flammable cleaning agents.** Cleaning with benzene is an explosion hazard. It is highly flammable, can become electrostatically charged and can generate an explosive gas-air mixture. ▪ Use halogen-free, cold cleaners with a high flashpoint for cleaning.

DANGER

Fire hazard from spontaneous combustion.

Cleaning materials soaked with cold cleaner may produce heat together with atmospheric oxygen and combust spontaneously.

- Collect cleaning materials soaked with cold cleaner only in fire-proof, tightly sealed containers.
- Do not dispose of cold cleaner residues and used cleaning materials with domestic waste, rather only in accordance with manufacturer instructions.
- Comply with the instructions for preventing fire on the safety data sheet for the cold cleaner.

CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool.
- Wear safety gloves.

CAUTION

Danger of injury.

When working with compressed air, foreign bodies may fly into your eyes.

- Wear safety goggles.
- Never direct the compressed air jet toward people or toward yourself.

CAUTION

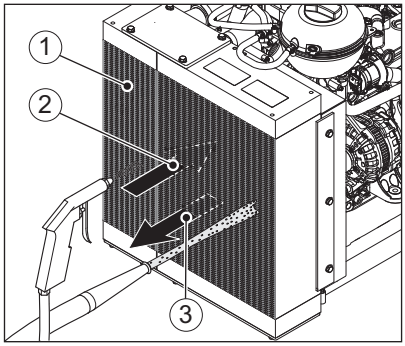
Danger of damage to the machine from incorrect engine cleaning.

- Let the engine fully cool down before cleaning.
- Do not spray components of the electrical equipment with a water jet or high pressure jet during cleaning.
- Do not use gasoline or acid-based cleaning agents.

	CAUTION
	Damage to the radiator fins through improper cleaning. ▪ Never spray the radiator fins with a high pressure jet. ▪ Never clean the radiator fins with a tool such as a spatula or screwdriver. A reduction in radiator performance through bent radiator fins or radiator leaks may be the result.

	NOTICE
	In case of heavy contamination, shorten the maintenance intervals accordingly (see the chapter *8.2.1 Maintenance plan, page 52*).

Overview



1	Radiator fins
2	Direction of flow of the cooling air with suction fan
3	Direction of flow of the cooling air with forced-draught fan

Procedure

Step	Activity
Cleaning in case of dry dirt contamination	
1	Clean the radiator fins either with compressed air or flush with a water jet - depending on the amount of accumulated dirt. Work first against the direction of flow of the cooling air and then in the direction of flow.
Cleaning of wet or oily dirt contamination	

Step	Activity
1	Spray the entire area with a suitable cold cleaner according to the manufacturer's instructions and then clean off with a water jet. Work first against the direction of flow of the cooling air and then in the direction of flow.
2	Identify the cause of the oiling and seal the leak.

8.2.7 Tensioning the poly v belt

Safety note

CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

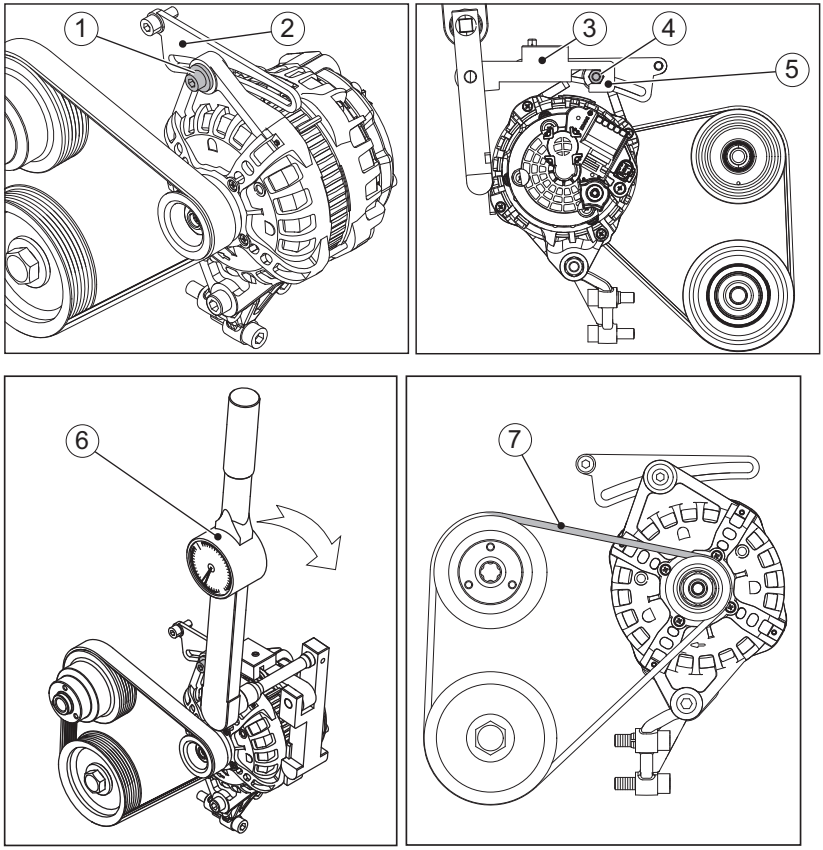
- Let the engine cool before maintenance.

NOTICE

- Regularly check poly v belts for wear. Replace the poly v belt immediately when the ribbed profile (inside of the belt) is worn or broken off.
- The cause of running noises for the poly v belt is mostly that the pretension on the belt is too low.
- A too low belt pretension causes early wear of the poly v belt. Regularly check the belt tension, in case of doubt re-tension the poly v belt.
- The vibration frequency is decisive for adjustment of the belt tension. The torque values are only a guide value.

	Pretension force (belt)	Torque (belt tensioner)	Frequency (frequency meter)
New belt	480 N (+ 50 N)	80 Nm (+ 10 Nm)	210 Hz (+ 10 Hz)
Belt after service	250 N (+ 30 N)	70 Nm (+ 10 Nm)	150 Hz (+ 10 Hz)
Minimum tension	170 N		125 Hz

Overview



1	Alternator mounting bolt
2	Bracket
3	Belt tensioner
4	Hex nut
5	Clamping claw
6	Torque wrench with dial gage display
7	Measurement point for frequency measurement

Procedure

Step	Activity
1	Check the poly v belt for wear. Do not retension a worn poly v belt, but immediately replace it.

Step	Activity
2	Loosen the alternator mounting bolt (1) one or two revolutions.
3	Position the belt tensioner (3) with the guiding groove on the bracket (2).
4	Feed in the hexagon nut (4) of the mounting bolt into the clamping claw (5). Move the belt tensioner for this.
5	**Adjusting the belt tension with a torque wrench:** Place the torque wrench (with dial gage) on the belt tensioner, lay the counter support on the alternator housing.
6	Tighten the torque wrench (6) until the required torque is reached.
7	Hold the torque wrench and tighten the alternator mounting bolt at this position.
8	**Checking the belt tension with a frequency meter:** Vibrate the end of the belt between the alternator and fan by lightly hitting it with the hand.
9	Measure the frequency with a commercially available optical or acoustic frequency meter by following the meter manufacturer's instructions.
10	If necessary, retension the belt by using a belt tensioner as described above.

8.2.8 Replacing the poly v belts

Safety note

CAUTION

Danger of burns.

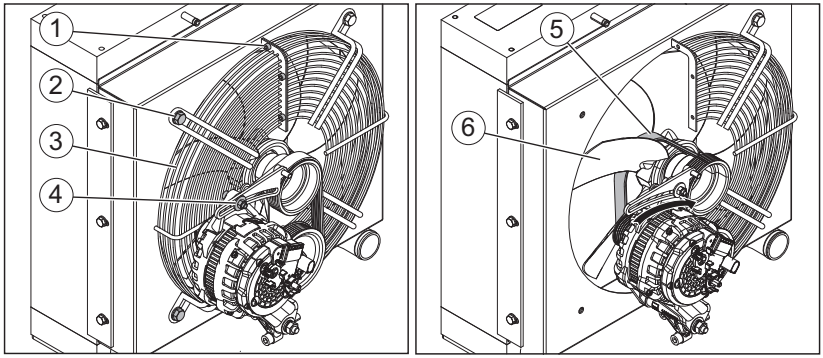
There is a danger of burns when working on a hot engine.

- Let the engine cool before maintenance.

NOTICE

- The poly v belt must be replaced after 3000 operating hours at the latest. If wear is detected, the poly v belt must be immediately replaced.

Overview



1	Connecting screws, protective guard halves (top and bottom)
2	Fixing screw, protective guard (top and bottom)
3	Protective guard (left half)
4	Alternator mounting bolt
5	Poly v belt
6	Fan blade

Procedure

Step	Activity
1	Disassemble the left half of the protective guard (3) by unscrewing the screws (1) and (2) (at the top and bottom).
2	Loosen the alternator mounting bolt (4) one or two revolutions.
3	Manually press the alternator towards the water pump, slide the loose poly v belt from the belt wheels.
4	Carefully lift the poly v belt over a fan blade. Turn the fan further in the counterclockwise direction and lift the belt over the remaining fan blades until it is completely free.
5	Feed a new poly v belt over the fan blade in the same way from the radiator side.
6	Lay the poly v belt over the belt wheels and tension (see *8.2.7 Tensioning the poly v belt, page 68*).
7	Reassemble the protective guard.

8.2.9 Changing the oil separator of the crankcase ventilation

Safety note

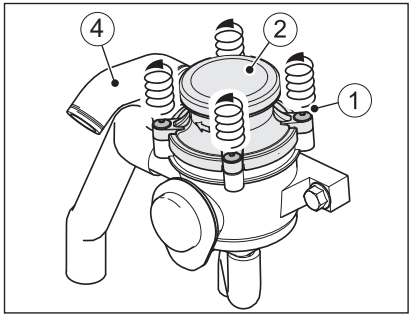
CAUTION

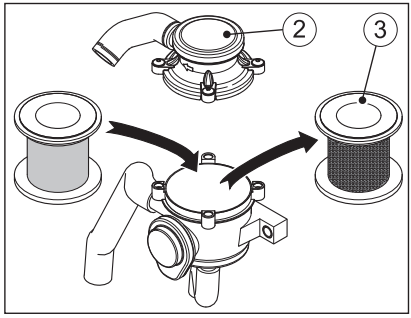
Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool before maintenance.

Overview





1	Mounting bolts (captive)
2	Breather cap
3	Oil separator cartridge
4	Vent hose

Procedure

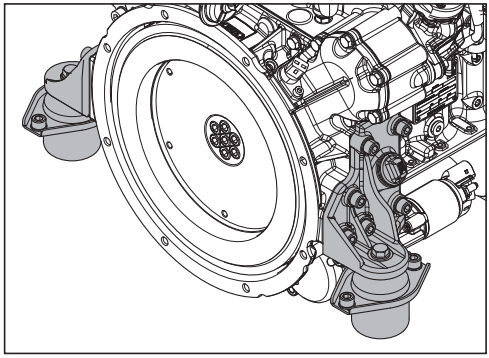
Step	Activity
1	Release the four mounting bolts (1) on the breather cap (2).
2	Carefully lift the breather cap. If necessary, release the vent hose (4).
3	Remove the used oil separator cartridge dispose of it according to local environmental regulations.
4	Wipe out the breather housing with a clean cleaning cloth. Make sure that dirt is not brought into the breather housing.
5	Insert a new oil separator cartridge.
6	Put on the breather cap and tighten the four mounting bolts (max. 4 Nm). If necessary, reattach the vent hose.

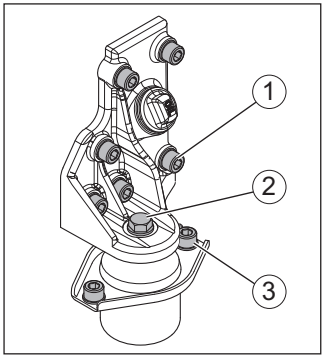
8.2.10 Checking the screw connections

Safety note

NOTICE	
	▪ Only retighten loose screw connections. Screw connections can be secured with thread locking adhesive or tightened to a defined torque. Retightening tight screw connections can cause damage. ▪ The adjustment screws on the injection system are secured with locking varnish and are not permitted to be tightened or adjusted. ▪ Do not retighten the screws for attaching the cylinder head.

Overview





1	Engine base mounting bolts
2	Vibration damper mounting bolt
3	Chassis frame mounting bolts

Procedure

Step	Activity
1	Check the mounting bolts of the engine mountings (4x) and tighten if needed.
2	Check the condition of all remaining screw connections and ensure that they are tight (for exceptions, see note).
3	Tighten any lose screw connections.

8.2.11 Draining the water separator

Safety note

CAUTION

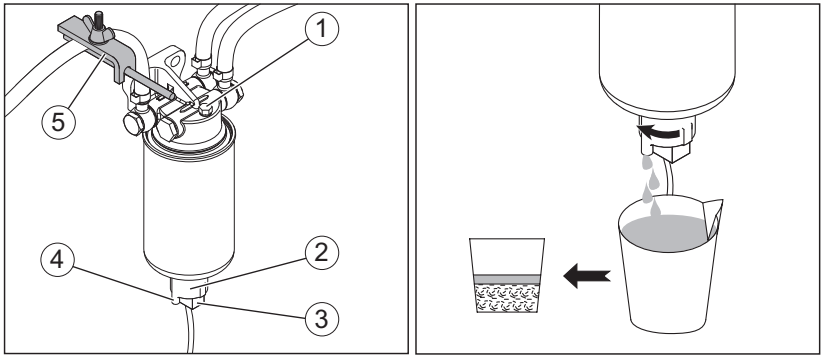
Danger of environmental damage from spilled fuel.

When water is drained from the water separator, a small amount of fuel is drained as well.

- Catch the emerging water-fuel mixture and dispose of it in an environmentally compatible manner.

The fuel prefilter has a water separator. An electronic water level sensor signals when the maximum permissible water level is reached in the water separator. A corresponding fault message is displayed on the instrument box or CAN display.

Overview



1	Bleed screw
2	Drain plug
3	Water level sensor connector
4	Drain socket for extension hose
5	Hose clip (for a fuel tank positioned low)

Procedure

Step	Activity
1	Place a suitable container under the drain socket (4) of the drain plug (2). *NOTE:* In inaccessible locations, an extension hose can be connected to the drain socket on the drain plug.

Step	Activity
2	Open the drain screw (2) and drain the water into the container.
3	If not enough liquid escapes, undo additional bleed screw (1). *NOTE:* If the fuel tank lies lower than the fuel prefilter, the fuel feed line must be clamped off with a hose clip (5). Otherwise fuel runs back into the fuel tank after the drain plug has been unscrewed.
4	As soon as fuel escapes, close the drain plug (2) and bleed screw (1). *NOTE:* First water escapes then fuel. This can be seen by a clear separator.
5	If necessary, release the fuel feed line, dispose of the water-fuel mixture in an environmentally compatible manner.

8.2.12 Changing the fuel prefilter

Safety notes

DANGER

Fire hazard from fuel

Leaked or spilled fuel can ignite on hot engine parts and cause serious burn injuries.

- Do not spill fuel.
- No open flames when working on the fuel system.
- Do not smoke.

CAUTION

Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool.
- Wear safety gloves.

CAUTION

Danger of injury

Repeated contact with diesel fuel can cause chapped and cracked skin.

- Wear safety gloves.

CAUTION

Danger of environmental damage from spilled fuel.

When the filter is removed, a small amount of fuel is drained as well.

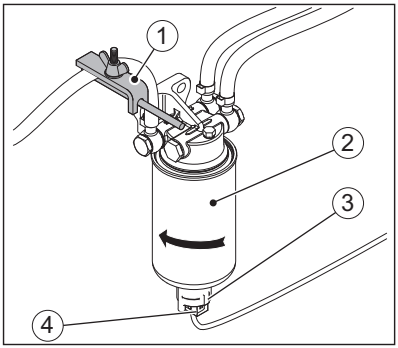
- Collect emerging fuel and dispose of it in an environmentally compatible manner.

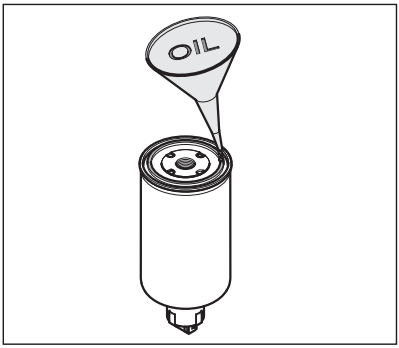
CAUTION

Dirt particles can damage the injection system.

- Maintain clean conditions to ensure that dirt does not enter the fuel line.
- Only install fuel filters dry and do not prefill in order to avoid contamination.

Overview





1	Hose clip (fuel feed line)
2	Fuel prefilter
3	Drain plug with integrated water level sensor

4	Water level sensor cable

Procedure

Step	Activity
1	Block the fuel feed line (1) between the fuel tank and fuel prefilter.
2	Place a suitable container under the filter to collect emerging fuel.
3	Disconnect the water level sensor cable (4) from the drain plug (3).
4	Release the drain screw (3) and drain the fuel.
5	Unscrew the fuel prefilter, fully unscrew the drain plug with integrated water level sensor.
6	Dispose of the used fuel prefilter according to local environmental regulations.
7	Clean the drain plug with integrated water level sensor and lightly oil the sealing surfaces. Screw in the drain plug into the new fuel prefilter.
8	Lightly oil the gasket of the new fuel prefilter, fit the filter and tighten it by hand.
9	Release the fuel feed line and connect the cable of the water level sensor.
10	Start the engine and perform a test run. *NOTE*: When starting the engine, adhere to the procedure under "*7.4 Starting the engine for the first time/after a filter change, page 42*".
11	After the test run, check the fuel prefilter and drain plug for leaks.

8.2.13 Changing the fuel fine filter

Safety notes

DANGER


Fire hazard from fuel

Leaked or spilled fuel can ignite on hot engine parts and cause serious burn injuries.

- Do not spill fuel.
- No open flames when working on the fuel system.
- Do not smoke.

WARNING


Danger of injury from fuel escaping under pressure.

Large quantities of fuel under high pressure may escape when changing the fuel fine filter.

- Never open the bleed screw on the fuel fine filter.
- Wear safety goggles.

CAUTION


Danger of burns.

There is a danger of burns when working on a hot engine.

- Let the engine cool.
- Wear safety gloves.

CAUTION

Danger of injury

Repeated contact with diesel fuel can cause chapped and cracked skin.

- Wear safety gloves.

CAUTION

Danger of environmental damage from spilled fuel.

When the filter is removed, a small amount of fuel is drained as well.

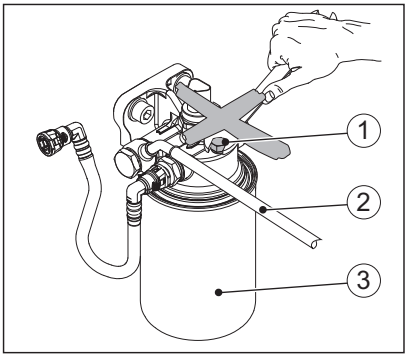
- Collect emerging fuel and dispose of it in an environmentally compatible manner.

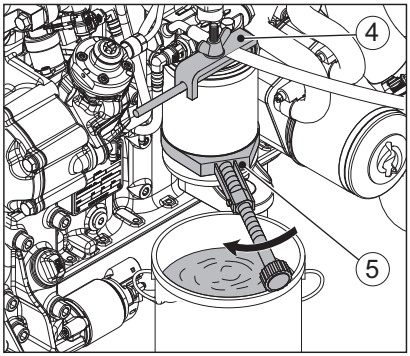
CAUTION

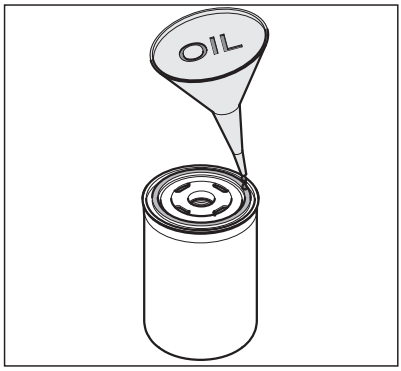
Dirt particles can damage the injection system.

- Maintain clean conditions to ensure that dirt does not enter the fuel line.
- Only install fuel filters dry and do not prefill in order to avoid contamination.

Overview







1	Bleed screw (not open!)
2	Fuel feed line
3	Fuel fine filter
4	Hose clip
5	Strap wrench

Procedure

Step	Activity
1	Block the fuel feed line (2) using the hose clip (4).
2	Place a suitable container under the filter to collect emerging fuel.
3	Unscrew the fuel fine filter (3) and according to local environmental regulations.
4	Lightly oil the gasket of the new fuel fine filter, fit the filter and tighten it by hand.
5	Release the fuel feed line.
6	Start the engine and perform a test run. *NOTE*: When starting the engine, adhere to the procedure under "*7.4 Starting the engine for the first time/after a filter change, page 42*".
7	After the test run, check the fuel fine filter for leaks.

8.2.14 Servicing the air filter (optional)

Safety notes

CAUTION

Danger of injury.

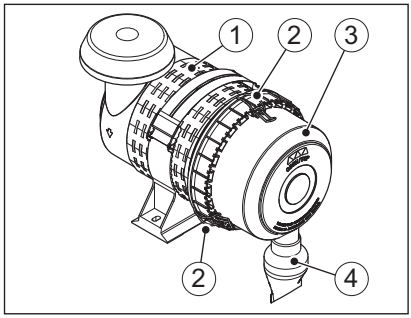
When working with compressed air, foreign bodies may fly into your eyes.

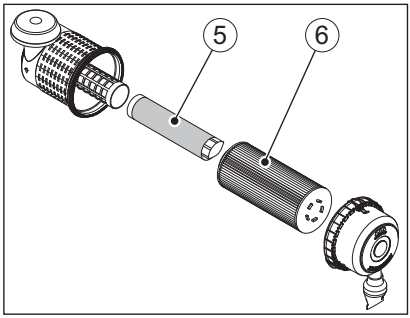
- Wear safety goggles.
- Never direct the compressed air jet toward people or toward yourself.

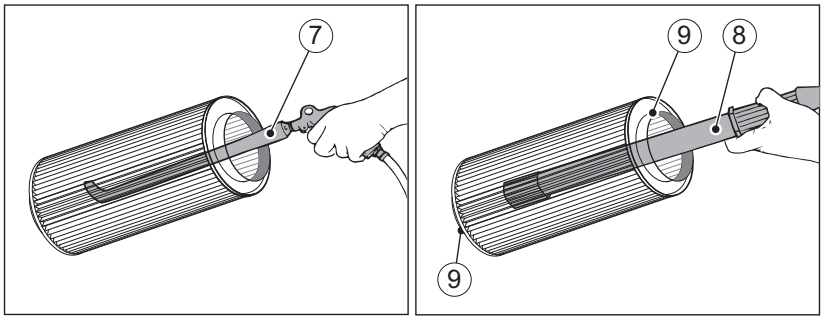
NOTICE

- Change the filter elements when there is oily or damp dirt contamination, cleaning is not possible.
- Even minor damage in the areas of the sealing surface, filter paper, or filter cartridge makes reuse impossible.
- The filter cartridge may not be washed out or beaten out.
- The filter cartridge may be blown out only in exceptional cases. The pressure must not exceed 5 bar.

Overview







1	Air filter housing
2	Retaining clips
3	Air filter cover
4	Dust discharge valve
5	Secondary filter
6	Primary filter
7	Air gun with extension tube (tip bent)
8	Lamp
9	Sealing surfaces

Replacing the primary/secondary filters

Step	Activity
1	Open the retaining clips (2) and remove the air filter cover (3).
2	Pull out the primary filter (6) and either replace (recommended) or clean (see below). Replace or clean the primary filter according to the service interval indicator. The primary filter must be replaced every two years at the latest however, cleaning is no longer possible after this time.
3	Remove dirt adhering to the inside of the air filter housing (1), air filter cover (3), and dust discharge valve (4).
4	Pull out and check the secondary filter (5), replace if required. The secondary filter can not be cleaned. The secondary filter must be replaced after every fifth replacement of the primary filter, though no later than every two years.
5	Carefully insert new filter elements.

Step	Activity
6	Place the air filter cover on the air filter housing and lock all retaining clips making sure that the dust discharge valve points vertically downwards.

Cleaning the primary filter

Step	Activity
1	Blow out the primary filter (6) with dry compressed air from the inside to the outside until dust no longer emerges. Use an air gun with an extension tube (7) with the end bent by approx. 90°. The end of the extension tube must not touch the filter paper.
2	Check the sealing surfaces (9) of the filter cartridge for damage.
3	Check the filter cartridge for tears or other damage in the filter paper by holding it against the light at a slant or shining light from a lamp (8) through it. In case of doubt, always replace the primary filter. *NOTE*: The primary filter may only be cleaned once, then it must be replaced.

8.2.15 Changing coolant

Safety notes

⚠ CAUTION

Danger of scalding and risk of environmental damage due to hot coolant.

- Excessive coolant is blown off from the sealing cap on the expansion tank. After topping up the cooling system never move parts of your body or face close to the sealing cap.
- Never top up coolant above the MAX - mark on the expansion tank.
- Never stop escaping coolant with your bare hands.

⚠ CAUTION

Danger of burns.

There is a danger of burns when working on a hot cooling system. The cooling system is pressurized.

- Let the engine cool.
- Wear safety gloves.

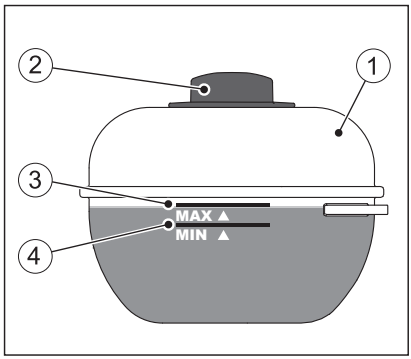
CAUTION

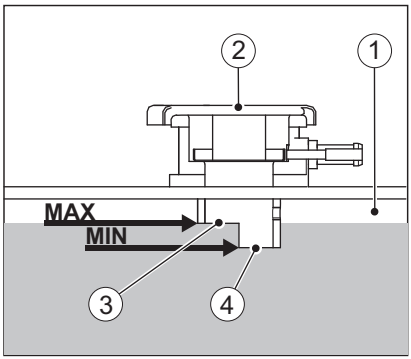
Danger of environmental damage from spilled coolant.

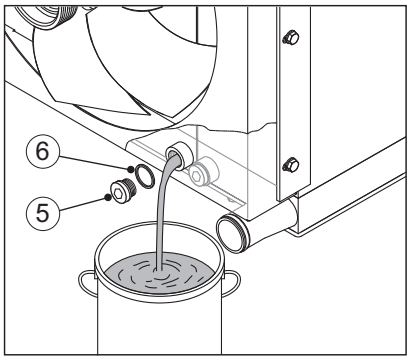
Coolant is water-polluting.

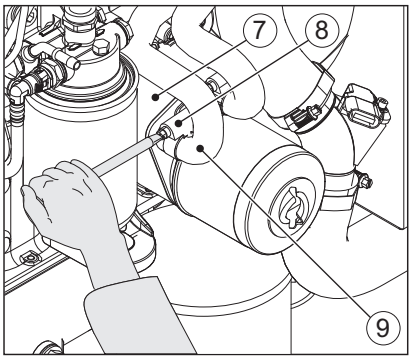
- Do no allow it to enter the ground water, water bodies, or sewage system.
- Collect coolant and dispose of it in an environmentally compatible manner.

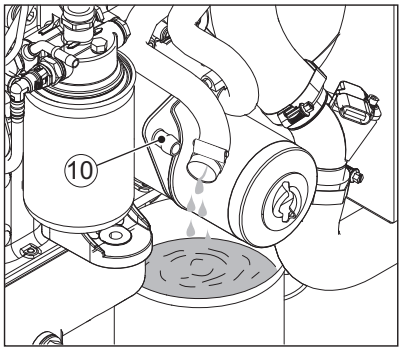
Overview











1	Expansion tank for coolant
2	Sealing cap
3	**MAX** - Maximum coolant level
4	**MIN** - Minimum coolant level
5	Drain plug on the radiator
6	Gasket
7	Oil cooler
8	Hose clamp
9	Bottom coolant hose
10	Connector on the oil cooler

Procedure

Step	Activity
1	Position a suitable container to collect the used coolant (approx. 12.5 liters for the Hatz standard radiator or 13.2 liters for the HATZ OpenPowerUnit radiator).
2	Open the sealing cap (2) of the expansion tank (1).
3	Unscrew the drain plug (5) and drain the coolant into the container.
4	Screw in the drain plug (5) with a new gasket (6) and tighten.
5	Place the collecting contain under the oil cooler (7).
6	Release the hose clamp (8) on the bottom coolant hose (9) and pull off the hose.
7	Drain coolant out of the oil cooler (10) and then reconnect the bottom coolant hose.

Step	Activity
8	Filling the cooling system (see the chapter *6.5 Filling the cooling system, page 35*).

9 Faults

9.1 Fault table

General troubleshooting notes

If the cases listed below have been worked through but the fault continues to persist, please contact your nearest **Hatz service station**.

Type of fault	Possible causes	Remedy	Chapter
The engine does not start or does not start immediately, but it can be turned with the starter.	No fuel at the high pressure pump.	Refuel.	*7.7 Refueling, page 49*
		Systematically check the entire fuel supply. If this does not yield results: ▪ Open the shutoff valve. ▪ Check the feed line to the engine. ▪ Check the fuel prefilter. ▪ Check the fuel fine filter. ▪ Check the function of the feed pump.	*8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77*
	Insufficient compression.	Contact Hatz service.	
	Cylinder and/or piston ring wear.	Contact Hatz service.	
	Injector not fully functional.	Contact Hatz service.	
	Hydraulic load too high (especially for multiple hydraulic pumps).	Reduce the hydraulic load – if possible.	
For low temperatures (engine does not start)	Pre-glow system defective.	Contact Hatz service.	

Type of fault	Possible causes	Remedy	Chapter
	Fuel gelled due to insufficient cold resistance.	Check whether the fuel that emerges from the fuel feed line directly in front of the high pressure pump is clear and not cloudy. If the fuel has gelled, either warm the engine or drain the entire fuel supply system. Fill with a temperature-resistance fuel mixture.	*4.5 Fuel, page 26* *8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77*
	Oil is too viscous causing a too low starter speed.	Change the engine oil and add oil of the right viscosity class.	*8.2.5 Changing the engine oil and oil filter, page 59* *4.3 Engine oil, page 22*
	Insufficiently charged battery.	Check the battery and contact the service center if necessary.	*3.2.4 Electrical equipment, page 18*
	Machine is not uncoupled.	If possible, separate the engine from the machine by uncoupling it.	

Type of fault	Possible causes	Remedy	Chapter
The starter does not switch on and the engine does not turn.	Irregularities in the electrical equipment: ▪ Battery and/or other cable connections are incorrectly connected. ▪ Cable connections are loose and/or oxidized. ▪ Ground connection between the chassis and engine is corroded. ▪ Battery is faulty and/or not loaded. ▪ Faulty starter. ▪ Faulty relay, monitoring elements, etc.	Check the electrical equipment and their components. Contact Hatz service.	*3.2.4 Electrical equipment, page 18*
The engine starts, but does not continue running after the starter is switched off.	Machine is not uncoupled.	If possible, separate the engine from the machine by uncoupling it.	
	Fuel prefilter is clogged.	Change the fuel prefilter.	*8.2.12 Changing the fuel prefilter, page 74*
	Fuel fine filter is clogged.	Change the fuel fine filter.	*8.2.13 Changing the fuel fine filter, page 77*
	Fuel supply is interrupted.	Systematically check the entire fuel supply.	

Type of fault	Possible causes	Remedy	Chapter
	Stop signal from monitoring elements that are associated with the automatic switch-off (optional): ▪ No oil pressure. ▪ Dirty air filter unit. ▪ Fuel pressure too low. ▪ Coolant level too low. ▪ Excess coolant temperature. ▪ Excess charge air temperature. ▪ Faulty three phase alternator.	▪ Check the oil level. ▪ Check the degree of dirt contamination of the air filter, and clean or renew it if necessary. ▪ Check the fuel flow, if necessary change the fuel prefilter and fine filter. ▪ Top up coolant. ▪ Check radiator fins and clean if needed. ▪ Contact Hatz service.	*7.6 Checking the oil level and adding oil if necessary, page 47* *8.2.14 Servicing the air filter (optional), page 80* *8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77* *8.2.4 Checking the cooling system, page 57* *8.2.6 Cleaning the radiator fins, page 64*
Engine switches off spontaneously during operation.	The tank ran out of fuel during operation	Fill with fuel.	*7.7 Refueling, page 49*
	Fuel prefilter or fine filter is clogged	Change the fuel filter.	*8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77*

Type of fault	Possible causes	Remedy	Chapter
	Poly v belt torn.	Renew the poly v belt.	*8.2.8 Replacing the poly v belts, page 69*
	Mechanical faults.	Contact Hatz service.	
Engine switches off by the automatic electrical switch-off.	Stop signal of monitoring elements for: ▪ Oil pressure too low. ▪ Dirty air filter unit. ▪ Fuel pressure too low. ▪ Coolant level too low. ▪ Excess coolant temperature. ▪ Excess charge air temperature. ▪ Faulty three phase alternator.	▪ Check the oil level. ▪ Check the degree of dirt contamination of the air filter, and clean or renew it if necessary. ▪ Check the fuel flow, if necessary change the fuel prefilter and fine filter. ▪ Top up coolant. ▪ Check radiator fins and clean if needed. ▪ Contact Hatz service.	*7.6 Checking the oil level and adding oil if necessary, page 47* *8.2.14 Servicing the air filter (optional), page 80* *8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77* *8.2.4 Checking the cooling system, page 57* *8.2.6 Cleaning the radiator fins, page 64*

Type of fault	Possible causes	Remedy	Chapter
	Irregularities in the electrical equipment, such as: ▪ Loose contacts on cable connections. ▪ Faulty three phase alternator. ▪ Faulty relay.	Check the electrical equipment and its components, contact Hatz service if necessary.	*3.2.4 Electrical equipment, page 18*
The engine loses power and speed.	Engine runs due to an error in the emergency program.	Switch off the engine, wait for a min. of 2 minutes, then restart the engine. (This deletes minor errors).	*7.5 Switching off the engine, page 45* *7.3 Starting the engine, page 39*
	The fuel supply is impaired ▪ The tank ran out of fuel during operation. ▪ Fuel prefilter or fine filter is clogged. ▪ Inadequate tank venting. ▪ Line connections are not leak tight.	Add fuel. Change the filter. Ensure that the tank is sufficiently vented. Check the line screw connections for leak tightness.	*7.7 Refueling, page 49* *8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77*
The engine loses power and speed, and black smoke emerges from the exhaust.	Dirty air filter unit.	Check the degree of dirt contamination of the air filter, and clean or renew it if necessary.	*8.2.14 Servicing the air filter (optional), page 80*
	Turbocharger faulty or leaking hoses.	Check hoses or contact Hatz service.	
	Injector not fully functional.	Contact Hatz service.	

Type of fault	Possible causes	Remedy	Chapter
Engine becomes very hot. Indicator light for excess coolant temperature lights up.	Too much engine oil in the engine.	Drain the engine oil to the **max** mark on the dipstick.	*7.6 Checking the oil level and adding oil if necessary, page 47*
	Inadequate cooling: ▪ Contamination in the entire area of the cooling air guides. ▪ Radiator fins dirty, or radiator blocked. ▪ Thermostat or water pump faulty.	▪ Clean the cooling air area. ▪ Clean the radiator fins, ensure air flow through radiator is not hindered. ▪ Contact Hatz service.	*8.2.6 Cleaning the radiator fins, page 64* *8.2.4 Checking the cooling system, page 57*
Combined indicator on instrument box flashes.	Various errors in different assemblies.	Use the flash code table to identify and rectify errors.	

Flash code table

Flash signal Short – Long	Possible causes	Remedy	Chapter
1 – 1 *Area affected:* Monitoring of indicating and control elements	▪ Indicator(s) or cabling faulty. ▪ Insufficient control unit power supply. ▪ Other errors not specified in more detail.	▪ Check the function and cabling of the indicators. ▪ Check the power supply of the control unit.	
1 – 2 *Area affected:* Speed sensor system	▪ Crankshaft or camshaft sensor cabling faulty.	▪ Check the cabling.	

Flash signal Short – Long	Possible causes	Remedy	Chapter
1 – 3 *Area affected:* Air supply	▪ Air filter is dirty. ▪ Charge air after charge air cooler too high. ▪ Charge air sensor/intake low pressure sensor cabling faulty.	▪ Service the air filter ▪ Clean the radiator fins. ▪ Check the cabling.	*8.2.14 Servicing the air filter (optional), page 80* *8.2.6 Cleaning the radiator fins, page 64*
1 – 4 *Area affected:* Exhaust gas recirculation	▪ EGR sensor cabling faulty. ▪ EGR radiator/valve clogged by deposits.	▪ Check the cabling. ▪ Clean the EGR radiator/valve.	
2 – 1 *Area affected:* Fuel low pressure system	▪ Water in fuel. ▪ Fuel pressure too low. ▪ Fuel temperature too high. ▪ Fuel pump or sensor cabling faulty.	▪ Drain water from the fuel prefilter. ▪ Check the fuel tank level, refuel if required. ▪ Replace both fuel filters. ▪ Ensure the fuel is sufficiently cooled. ▪ Check the cabling.	*8.2.11 Draining the water separator, page 73* *7.7 Refueling, page 49* *8.2.12 Changing the fuel prefilter, page 74* *8.2.13 Changing the fuel fine filter, page 77*
2 - 2 *Area affected:* Fuel high pressure system	▪ Sensor system (injectors, rail pressure sensor, pressure control valve, high pressure pump) cabling faulty.	▪ Check the cabling.	

Flash signal Short – Long	Possible causes	Remedy	Chapter
2 – 3 *Area affected:* Engine oil temperature/engine oil pressure	▪ Engine oil pressure too high/too low. ▪ Engine oil temperature too high. ▪ Sensor cabling faulty.	▪ Check the oil level, top up engine oil if required. ▪ Use engine oil with a suitable viscosity. ▪ Check the water hoses for the oil cooler (hose kinked). ▪ Clean the oil cooler if required. ▪ Check the cabling.	*7.6 Checking the oil level and adding oil if necessary, page 47* *4.3 Engine oil, page 22*
3 – 1 *Area affected:* Liquid cooling	▪ Coolant level too low. ▪ Coolant temperature too high. ▪ Coolant temperature sensor cabling faulty. ▪ Temperature sensor faulty.	▪ Top up coolant. ▪ Clean the radiator fins. ▪ Check the cabling. ▪ Replace the temperature sensor.	*8.2.4 Checking the cooling system, page 57* *8.2.6 Cleaning the radiator fins, page 64*
3 – 2 *Area affected:* Pre-glow system	▪ Glow plugs cabling faulty. ▪ One or multiple glow plugs faulty. ▪ Glow control unit (GCU) faulty.	▪ Check the cabling. ▪ Check the function of the glow plugs.	

10 Storage and disposal

10.1 Storing the machine

NOTICE	
	**Comply with the safety chapter!** Follow the basic safety instructions in the chapter *3 Sicherheit, page 7*. In addition, follow all safety instructions in the manufacturer documentation (see the list of documentation in the Appendix).

Storing the machine for a lengthy period

Take the following measures if you intend to take the machine out of service for a lengthy period:

Step	Activity
1	Drain the fuel tank until it is nearly empty and fill with RME-free fuel. Run the engine for a few minutes so that only RME-free fuel is still in the fuel system.
2	After the machine has cooled down, cover it to protect it against dust and store it in a dry and clean place.

The machine can normally be stored for up to 1 year.

The protection lasts up to approx. 6 months at very high humidity and with sea air.

If the storage time is longer, please contact the nearest **Hatz service**.

10.2 Disposing of the machine

Disposal information

Dispose of the machine (including machine parts, engine oil, coolant, and fuel) according to the local disposal regulations and the environmental laws in the country of use.

Because of the danger of possible environmental damage, only permit an approved specialist company to dispose of the machine.

	NOTICE
	When the machine has reached the end of its lifecycle, ensure that it is disposed of safely and properly, especially parts and substances that can be dangerous to the environment. These also include fuel, coolant, lubricants, plastics, and batteries (if present). ▪ Do not dispose of the battery with the household trash. ▪ Dispose of the battery at a collection point for possible recycling.

11 Installation declaration

Extended Declaration of Incorporation
EC Machinery Directive 2006/42/EC

The manufacturer: **Motorenfabrik Hatz GmbH & Co.KG**
Ernst-Hatz-Straße 16
D-94099 Ruhstorf a. d. Rott

hereby declares that the incomplete machine: product description: **Hatz diesel engine**
Type designation and as of serial number:
4H50TIC = 13610

satisfies the following basic safety and health protection requirements in acc. with Annex I to the above-mentioned Directive.

- Annex I, General principles no. 1
- Nr. 1.1.2., 1.1.3., 1.1.5., 1.2.1., 1.2.2., 1.2.3., 1.2.4.1., 1.2.4.2., 1.3.1., 1.3.2., 1.3.3., 1.3.4., 1.3.7., 1.3.8.1., 1.4.1., 1.5.1., 1.5.2., 1.5.8., 1.5.9., 1.6.1., 1.6.2., 1.6.4., 1.7.

All relevant basic safety and health protection requirements down to the interfaces described
- ☒ in the operating manual
- ☒ in the enclosed data sheets
- ☒ in the enclosed technical documents

have been complied with.

The special technical documents in acc. with Annex VII B of the Directive 2006/42/EC have been prepared.

The following standards have been used (completely or partially):
- EN 1679-1: 092011
- EN ISO 12100: 032011
- EN ISO 13857: 062008
- EN 60204-1: 062007
- EN ISO 13849-1: 122008

The Operating Manual has been enclosed to the incomplete machine and the Assembly Instructions have been provided to the customer electronically together with the order confirmation.

Commissioning has been prohibited until it has been established, if applicable, that the machine into which the above-mentioned incomplete machine is to be incorporated, satisfies the provisions of the Machinery Directive.

Wolfgang Krautloher / see "Manufacturer"
Name / address of EC documentation officer

03.04.2014	Krautloher / Directives official	i.V. Krautloher
Date	Signature and information on the undersigned	Signature