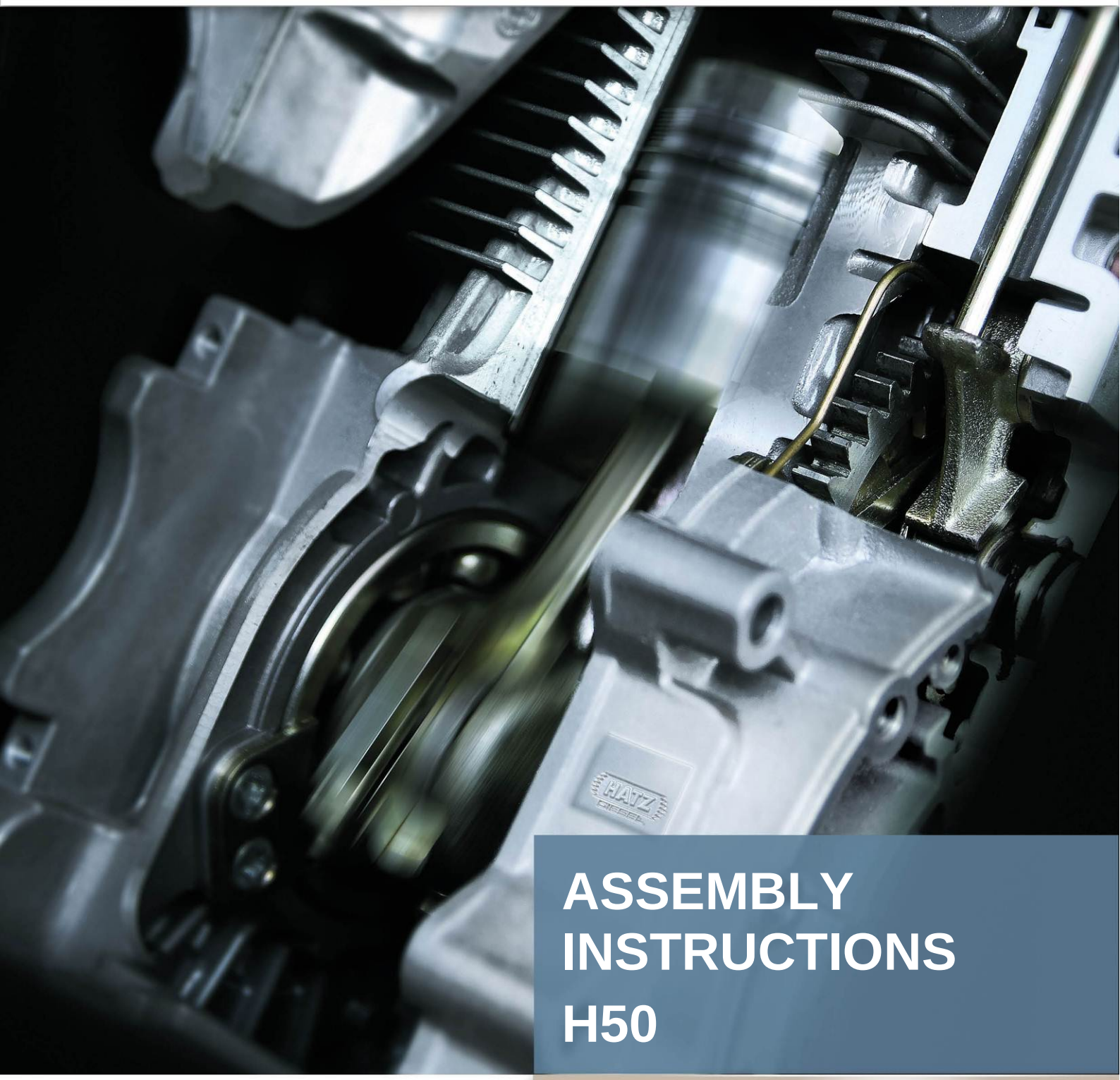
CREATING POWER SOLUTIONS.



ASSEMBLY INSTRUCTIONS H50

Hatz Diesel

This symbol stands for important safety instructions.
Please heed carefully to prevent dangers to persons and material.
In addition, the general statutory safety regulations and those of the responsible professional trade associations apply.

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

These Assembly Instructions have been translated into multiple languages. The original Assembly Instructions are in German. All other language versions are translations of the original Assembly Instructions.

General information

Our engines are state of the art and meet the basic safety and health requirements specified in the EC - Machinery Directive (2006/42/EC)These Assembly Instructions contain important instructions on how to safely assemble the engine. In addition, the rules and regulations for accident preventions applicable for the place of use must be heeded.

The engine provides a high degree of operational safety and a high quality standard which is ensured by a certified quality management system (EN ISO 9001). Proper functioning of all engines is checked prior to leaving the factory.

HATZ diesel engines are efficient, robust, and have a long service life. Therefore, they are usually installed in machines that are used for commercial purposes.

This **HATZ** engine is intended exclusively for the purpose specified and tested by the manufacturer of the machine in which the engine is installed. Any other use is considered improper. Responsibility is not accepted by Motorenfabrik **HATZ** for any danger damage resulting from this situation. The user alone bears the risk. Intended use also includes adherence to the maintenance and repair instructions prescribed for this engine. Non-observance may lead to engine damage. You must read the Operator's Manual before starting the first time. It will help you avoid accidents, operate and maintain the engine correctly and, hence, ensure long term service.

Give the Operator's Manual to any further users or subsequent owner of the engine.

Have service work performed by qualified technicians only. We recommend that you work with one of the more than 500 **HATZ service centers.**

Trained specialists there will repair your engine with **original HATZ 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 your nearest **HATZ service center**, please look on the Internet at **www.hatz-diesel.com.**

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

Modifications without the prior approval of HATZ will invalidate the warranty. Installation must only be carried out by qualified technicians in accordance with these Assembly Instructions, all safety-related measures and statutory regulations. After the installation of the engine, the machine manufacturer is responsible for ensuring that all relevant statutory directives and regulations are fulfilled. The operator must become familiar with the Operator's Manual prior to commissioning in order to avoid danger to personnel and material.

Motorenfabrik HATZ GmbH & Co. KG takes no responsibility for injury to personnel or damage to the machine arising from non-observance of the Assembly Instructions or Operator's Manual. Damage resulting from non-observance of the Assembly Instructions or Operator's Manual will forfeit any warranty on the part of Motorenfabrik HATZ GmbH & Co. KG and responsibility shall be transferred to the machine manufacturer/user.

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, such as:

- Parts of the exhaust gas system and the engine surface naturally become hot and must not be touched during operation or until they cool down after the engine is switched off. Suitable precautions must be taken for this.
- 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.
- It is essential to heed the starting instructions in the Operator's Manual prior to commissioning the engine.
- Prior to starting, ensure that all safety devices provided are attached and functional.
- The engine must only be operated, maintained and repaired by persons who are trained in this work.
- Protect the starting key against unauthorized access.
- Never run the engine in closed or poorly ventilated rooms. Do not breathe in the exhaust gases - danger of poisoning.
- Fuels, lubricants, coolants and cleaning agents can contain toxic elements. Heed the instructions (safety datasheets) of the manufacturer in this regard.
- Only carry out maintenance and repair work when the engine is switched off (disconnect the negative terminal of the battery).
- Only refuel when the engine is switched off. Never smoke in the vicinity of open flames or sparks that can cause ignition.
- Keep explosives and flammable materials away from the engine because the engine surface – and especially the exhaust gas system – becomes very hot during operation.
- Only wear close fitting clothing when working on a running engine. Do not wear necklaces, bracelets or other items that could get caught.
- Comply with all notices 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 center**.
- Any improper modification of the engine results in a loss of liability coverage for resulting damage. Only regular maintenance, as specified in the Operator's Manual, will maintain the operating readiness of the engine.

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

1. Safety

1.1 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 to follow all specified safety instructions.

Read this chapter carefully before beginning work.

1.1.1 Intended use

Intended use

The machine described in these Assembly Instructions fulfills the following functions:

- Diesel engine intended for installation in a machine or for assembly with other machines to form a machine.

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

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 these Assembly Instructions and 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 given here.
- Failure to comply with the safety instructions.
- Operation of the machine when it is not in a functional and technically safe condition.
- 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 do not correspond to HATZ specifications.
- Operation in flammable or hazardous environments.
- Operation in closed-off or poorly ventilated rooms.
- Installation of the machine in a closed-off room without additional measures in the area of the incoming and outgoing air and the exhaust air.
- Improper operation at variance with DIN 6271-3 / ISO 3046-1 and ISO 8528 (climate, load, safety).

Residual risks

Residual risks result during daily use and in association with maintenance work. Reference is made to these residual risks in chapter *1.2.2 Machine-specific safety instructions for operation,* page *13* and in chapter *1.2.3 Machine-specific safety instructions for* maintenance work*,* page *14* as well as in other chapters of these instructions and in the Operator's Manual directly before the relevant descriptions or handling instructions.

1.1.2 Machine user or machine manufacturer obligations

Machine manufacturer obligations

These Assembly Instructions contain important information on how to safely assemble the engine. **It is forbidden to start the engine before it is fully installed.**
In addition, please note that it is forbidden to start up the machine before it has been determined that the machine in which this engine is installed fulfills all safety-related requirements and legal regulations.

User obligations

The operator is obliged to operate the machine only when it is in perfect condition. The operator must check the condition of the machine before use and ensure that any defects are eliminated before it is taken into service. Running the machine while identified defects exist is not permitted. The operator must also ensure that all persons who work on the machine are familiar with the contents of this Operator's Manual.

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.

1.1.3 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 commissioning or operating the machine and during maintenance work. The risks are identified in these instructions by means of safety notes. The safety notes precede the relevant description or operating step.

Structure of the safety notes

The safety notes consist of:

- Danger symbol
- Signal word
- Description of the danger
- Possible consequences
- Preventative measures

SIGNAL WORD

Type and source of the danger.

Consequences of non-compliance

- Action for avoiding/averting the danger

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 possible injury:

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.
CAUTION	This signal word, without a warning symbol, is used to indicate the potential danger of property damage.
NOTE	This signal word indicates additional useful information for the user, such as operating tips and cross references.

1.1.4 Meaning of safety symbols

Explanation of symbols

The following table describes the meanings of the safety symbols used in these Assembly Instructions.

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

1.2 Safety notes

1.2.1 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 Assembly Instructions, Operator's Manual and the safety instructions contained therein.

- As the operator of the machine, you must ensure that all people working on the machine are familiar with the content of these instructions.
- Before working on the machine, read these instructions 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 chapter *1.1.1 Intended use,* 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 use of 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 injury to the hearing due to excessive and constant noise.

Personal protective equipment	Pictogram	Function
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. It must not restrict the wearer's freedom of movement, however.

Warning labels and information signs on the machine

The warning labels and information signs on the machine must be followed (see chapter *1.3 Labels,* page *17*).

Comply with all notices and warning labels on the engine and keep them in a legible condition. If a label should become detached or difficult to read, it must be replaced promptly. For this purpose, contact your nearest **HATZ service center**.

Maintenance work

Maintenance work that goes beyond the scope described in this Operator's Manual must only be performed by qualified technicians (see chapter *General information,* page *5*). 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 Assembly Instructions/Operator's Manual.

- Heed the warnings on the machine and in the Assembly Instructions/Operator's Manual.

WARNING

Danger of injury and danger of incorrect operation due to inadequate personnel qualifications.

- The personnel assigned with operating and maintaining the machine must have read and understood the Assembly Instructions/Operator's Manual and must possess the qualifications necessary for working with this equipment, acquired in training/instructional courses.
- Only qualified personnel is permitted to operate, maintain and service this machine.
- Failure to comply will cause the warranty to become void.

WARNING

Danger of injury due to non-compliance with the handling instructions and due to unauthorized activities.

- 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 injury (of the back, for example).

- Only lift the machine with a hoist (see chapter *3 Transport,* page *23*).

1.2.2 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 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.
- The exhaust gas system and the surface of the engine become hot during operation. Risk of injury due to 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 machines 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.

1.2.3 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 the Operator's Manual must only be performed by qualified technicians. We recommend that you work with one of the more than 500 **HATZ service centers**.

Replacing parts

- When replacing defective components, we recommend that you use **HATZ original spare parts** (see chapter *General information*, page *5*).
- 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 flash point 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 can 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.
- 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.

1.2.4 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 battery terminal.
- 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 to 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 cleaning agents.

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 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.

NOTE

- 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.
- The components of the electrical equipment are protected against rain and spray water. Cleaning with a hose is permitted when using a high pressure cleaner; maintain a minimum distance of one meter. The engine must then be kept in operation until it is completely dry.
- 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 connections to the voltage regulator.

1.3 Labels

Warning labels and information signs on the engine

Label	Meaning
	Refuel with diesel fuel only. For the specification, see chapter *4.6.2 Fuel* specifications, page *37)* Do not use bio-diesel.
	The engine may only be operated with fuel that is "EXTREMELY LOW IN SULFUR OR SULFUR FREE".

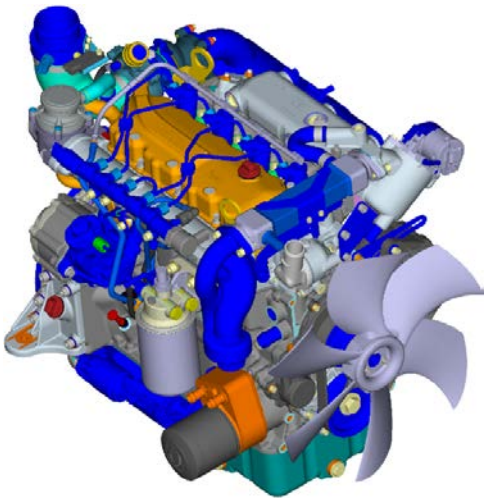
NOTE

The "Fuel sticker" and the '"No bio-diesel sticker" must be placed close to the fuel cap.

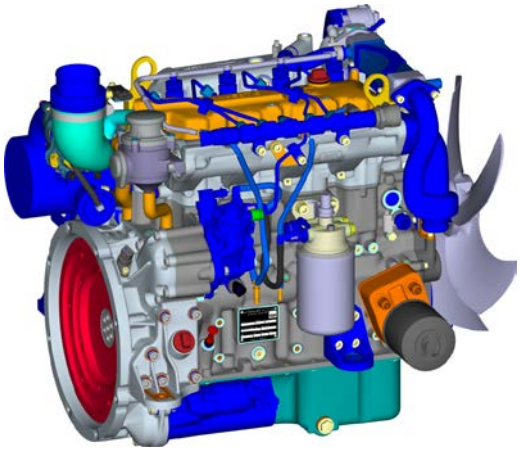
2. General information about the H50 engine

The H series

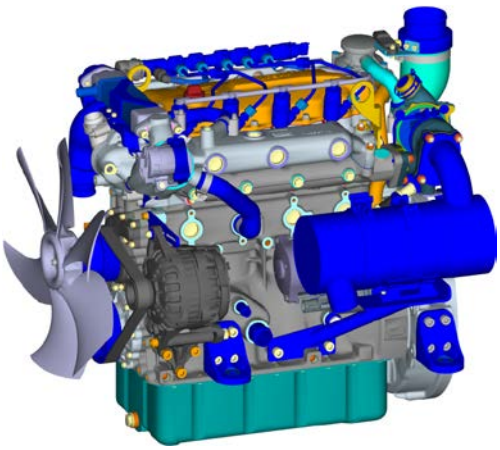
Beginning with the water-cooled 4-cylinder 4H50TIC model, the new generation from Hatz focuses on common rail technology, exhaust gas turbocharger with charge air cooling and external exhaust gas return and oxidation catalytic converter or particle filter with oxidation catalytic converter.



Top view of the H50



Maintenance side (operating side)



Exhaust gas side

Available exhaust gas relevant engine variations	Exhaust gas standard
without EGR, without DOC, without DPF	EPA TIER 2 EU IIIa (<37 kW) / EU II (>37 kW)
with EGR, with DOC, without DPF	EPA TIER 4 final / EU IIIb
with EGR and DOC/DPF combination filter	EPA TIER 4 final / EU IIIb plus emission-sensitive places of use (e.g. Switzerland, tunnel construction)
EGR	Exhaust gas return
DOC	Diesel oxidation catalytic converter
DPF	Diesel particulate filter

2.1 Technical data

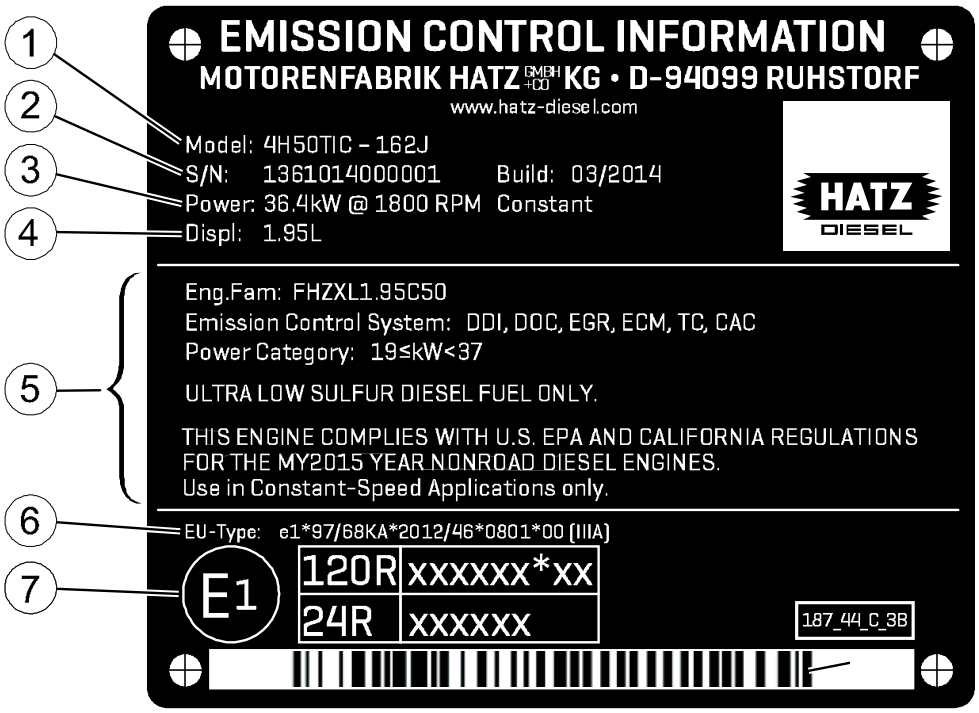
2.1.1 Engine information and filling quantities

Type		4H50 TIC
Type		Liquid-cooled four stroke diesel engine
Combustion system		Direct injection, exhaust gas 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." mark	Approx. ltr.	1.0 [1)]
Engine oil consumption (after the running-in period)	Max.	0.5 % of fuel consumption (full load)
Engine oil pressure at oil temperature (100 ± 20 °C)		2.5 bar to 4.5 bar
Coolant quantity	Approx. ltr.	12.5 (standard HATZ radiator with external expansion tank) 13.2 (HATZ OpenPowerUnit radiator with integrated expansion tank)
Sense of rotation		When viewing flywheel: left
Tappet clearance		Automatic hydraulic valve adjustment with hydraulic valve tappets (maintenance-free)
Max. perm. continuous sloping position		**HATZ standard radiator:** DOC-low: 20°, rest: 30° **HATZ OpenPowerUnit radiator:** DOC-low: 20°, radiator-low: 20°, rest 30°
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 as per DIN 24 V - 66 Ah / 300 A as per DIN

[1)] These values are approximations only. The max. mark on the dipstick is decisive in any case.

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

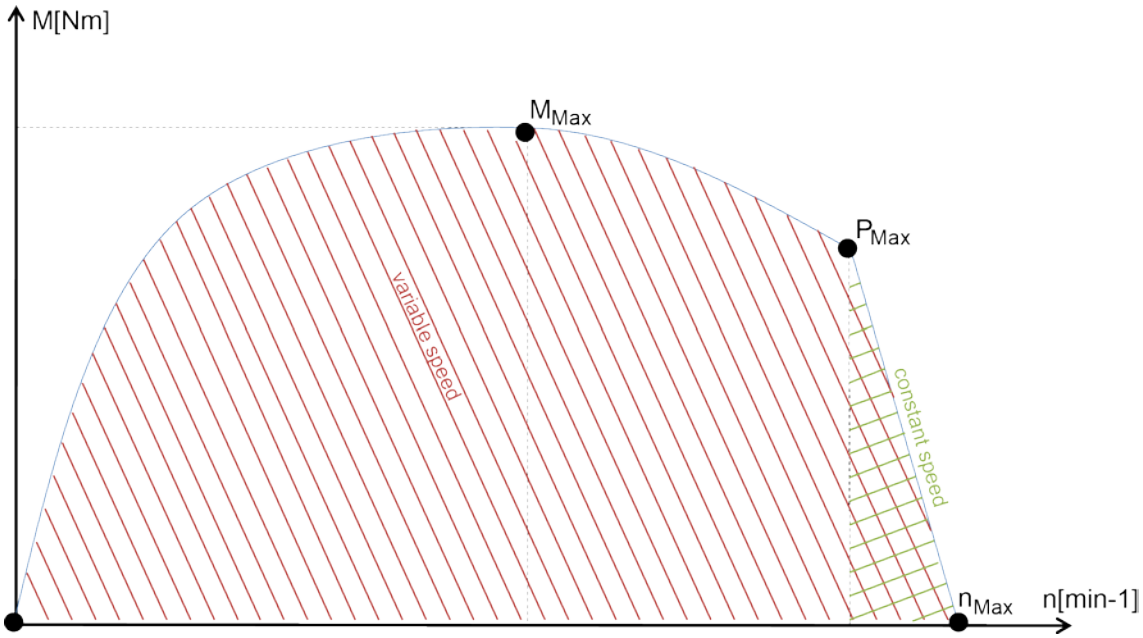
2.1.2 Engine type plate



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	ECE - type approval numbers
10	Code for type plate variants
11	Barcode (engine serial number)

2.1.3 Speed application - constant speed / variable speed (P-degree 0, 3, 5, 10 %)

2.1.3.1 Definition of constant speed / variable speed



Constant speed applications are machines where the operating speed is between the nominal speed and the upper idle speed. In contrast, variable speed applications are used in the entire speed range (e.g. on the full load curve).

2.1.3.2 Overview of variable speed / constant speed

UPM	Tier IV final	EU 3b	EU 3a	LRV Switzerland
3,000	-	-	-	-
2,800	VS	VS	-	VS*2
2,700	VS	VS	-	VS*2
2,600	VS	VS	-	VS*2
2,500	VS	VS	-	VS*2
2,400	VS	VS	-	VS*2
2,300	VS	VS	-	VS*2
2,200	-	-	-	-
2,100	-	-	-	-
2,000	-	-	-	-
1,900	-	-	-	-
1,800	CS	-	CS*1	CS*2
1,500	CS	-	CS*1	CS*2
VS = variable speed		CS = constant speed		

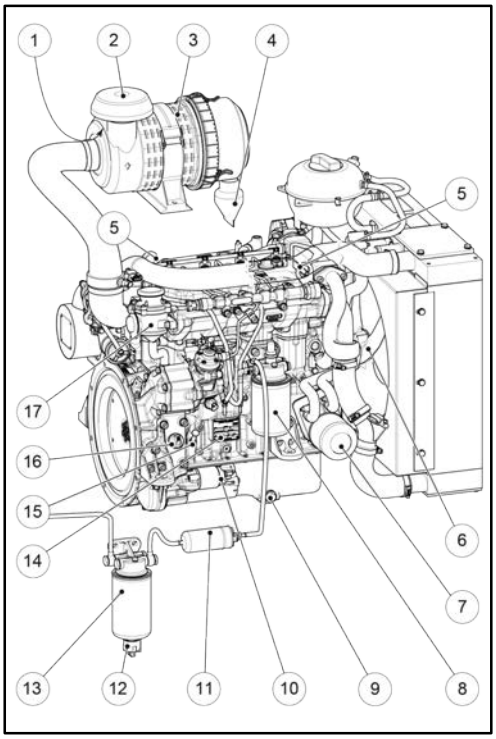
*1 = Certification in engine variation 4H50TI

*2 = Certification in engine variation 4H50TIC with DOC/DPF from LM43

2.2 Engine design

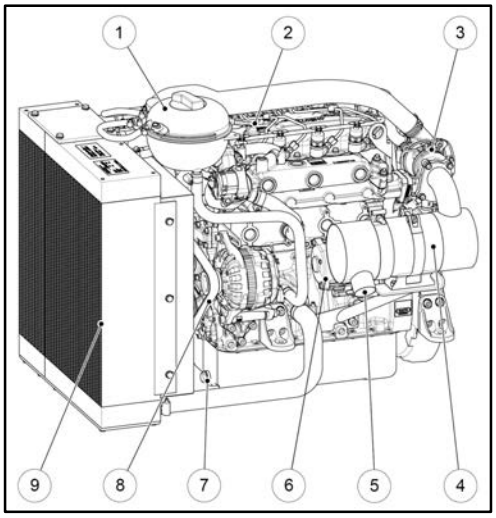
2.2.1 Intake side

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	Main fuel filter
9	Side oil drain screw
10	Starter (low mounting position, standard)
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



2.2.2 Exhaust side

1	Expansion tank for coolant (optional)
2	Oil filler plug, top
3	Exhaust gas turbocharger
4	Diesel oxidation catalytic converter (DOC)
5	Exhaust outlet
6	Starter (high mounting position)
7	Oil drain screw, front
8	Poly v belt
9	Combination radiator (coolant/charge air) (option)



3. Transport

WARNING

Danger of injury from improper lifting and transport.

Danger of crushing from falling or tipping of the engine.

- Only use the lifting eyes already mounted on the machine for lifting.
- Before lifting the engine, check the lifting eyes for deformation. Lifting with deformed lifting eyes is forbidden.
- Only use a suitable hoist with a sufficient carrying capacity.
- Do not remain under suspended loads.
- Use all lifting eyes for lifting.
- Lifting and transporting the engine must only be carried out in the installation position.
- When lifting into/lifting out of the application, do not exceed the maximum allowable skew.

CAUTION

Only use the lifting eyes for transporting the engine.

- Do not use for lifting when attaching drive units or entire machines.
- Hydraulic power take off permitted.

CAUTION

Danger of injury from overloading the body.

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

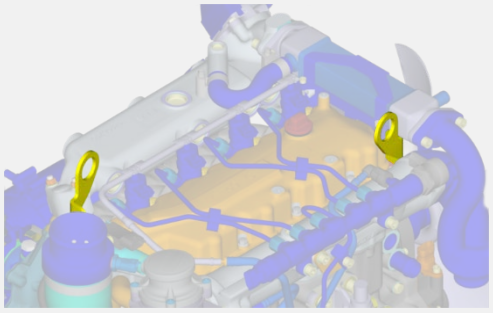
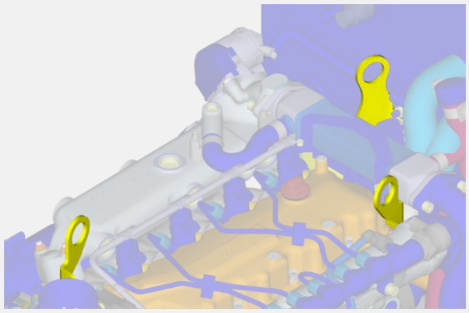
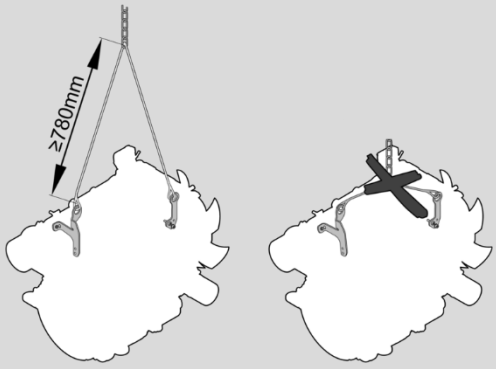
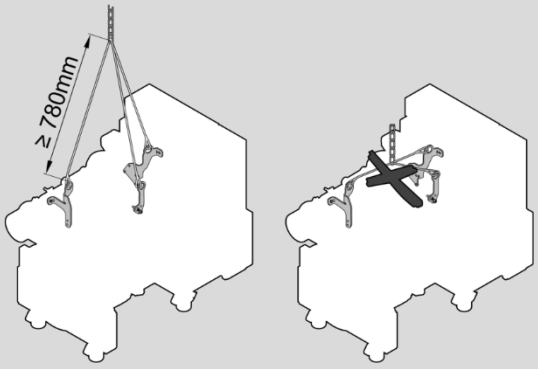
- Only lift the machine with a hoist.

NOTE

Danger of environmental damage from leaking fluid.

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

- Transport the machine in an upright position.

Lifting eyes F2F (standard)	Lifting eyes OPU
	
	
Maximum weight	
185 kg	270 kg

3.1 Transport conditions

- Only lift the engine at the lifting eyes fitted as standard.
- Use existing lifting eyes (Hatz condition when delivered).
- 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 center.**

3.2 Transport damage

- Inspect the product for transport damage.
- Document any transport damage in the shipping documents, have them countersigned by the shipping agent and immediately inform the manufacturer.

3.3 Transport safety

- Select means of transport according to the weight and packaging of the engine (see shipping documents).
- Secure the load properly and transport carefully.
- Use lifting eyes when transporting by crane.

3.4 Temporary stoppage

Take the following stoppage measures if you intend to take the machine out of service for a lengthy period (3-12 months):

Step	Measures for stoppage
1	Drain the fuel tank until it is nearly empty and fill with FAME*-free fuel. Operate the engine for a few minutes so that only FAME-free fuel is still in the fuel system. FAME*-free fuel was used during the factory test run.
2	Change the engine oil in accordance with the Operator's Manual.
3	Change the pre- and main fuel filters in accordance with the Operator's Manual.
4	Check the coolant level and concentration and top up if necessary or change in accordance with the Operator's Manual.
5	Remove the battery in accordance with the machine operator's manual and store at ambient temperature. Comply with the local regulations as well as the regulations of the battery manufacturer for the storage of batteries.
6	Close and seal all engine openings (air intake openings, air outlet openings and the exhaust gas opening) so that no foreign bodies can enter, but a small amount of air can still be exchanged. This avoids condensation.
7	After the machine has cooled down, cover it to protect it against dirt and store it in a dry, dust-free and clean place.
***FAME = Fatty Acid Methyl Ester**	

Ambient conditions during storage:

- Max. permissible storage temperature: -25 °C to +60 °C
- Max. permissible humidity: 70 %
- Protect the engine from direct sunlight.

Step	Measures for recommissioning:
1	Remove all covers used for the temporary stoppage.
2	Check the cables, hoses and lines for cracks and leak tightness.
3	Check the engine oil level.
4	Check the coolant level.
5	Install the battery in accordance with the Operator's Manual for the machine.

The brand new engine can normally be stored for up to 12 months. The protection lasts up to approx. 6 months at very high humidity and with sea air.

For stoppage periods of more than 12 months, please contact the nearest **HATZ service center**.

3.5 Packaging

- Dispose of packaging material (cardboard, wood, PET tape,…) as per national regulations.

4. Assembly Instructions

It is forbidden to start the engine before it is fully installed. Modifications without the prior approval of HATZ will invalidate the warranty.

The installation must only be carried out by qualified personnel in accordance with these Assembly Instructions, all safety-related measures and statutory regulations. After the installation of the engine, the machine manufacturer is responsible for ensuring that all relevant statutory directives and regulations, including functional safety, are fulfilled.

The operator must become familiar with the Operator's Manual prior to commissioning to avoid danger to personnel and material.

Motorenfabrik HATZ GmbH & Co. KG takes no responsibility for injury to personnel or damage to the machine arising from non-observance of the Assembly Instructions or Operator's Manual. Damage resulting from non-observance of the Assembly Instructions or Operator's Manual will forfeit any warranty on the part of Motorenfabrik HATZ GmbH & Co. KG and the responsibility shall be transferred to the machine manufacturer/user.

4.1 Assembly notes – general information

HATZ diesel engines are efficient, robust, and have a long service life. 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 may 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. Protective devices from HATZ (e.g. belt driver) are available for this.
- Comply with all notices and warning labels on the engine and keep them in a legible condition. If a label should become detached or illegible, it must be replaced promptly. For this purpose, contact your nearest **HATZ service center**.
- Any improper modification of the engine results in a loss of liability coverage for resulting damage.
- If the engine is speed limited via the CAN bus, care must be taken that the maximum machine speed is not exceeded.

The Assembly Instructions contain important instructions on how to safely assemble the engine. They are available from any **Hatz service center**. If you have any questions, please contact your nearest **HATZ service center** before commissioning the engine.

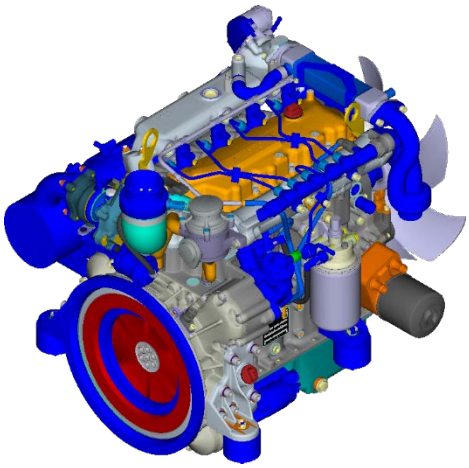
4.2 Engine suspension, installation

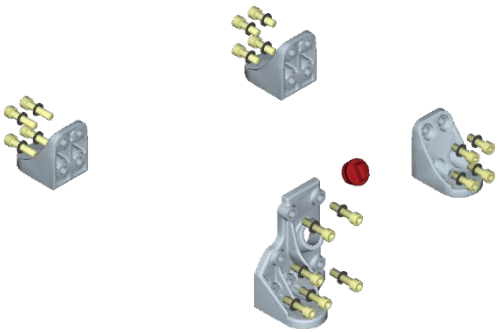
Good operating performance of the machine can be realized neither by the engine nor by the machine to be driven alone, rather the two components must be appropriately and properly matched to each other.

Generally, flexible mounting of the engine should be aimed at.
Uniform loading must also be ensured (see chap. *4.2.3.2 Uniform bearing* load, page *32*).
If there is any doubt, please contact your nearest **HATZ service center**.

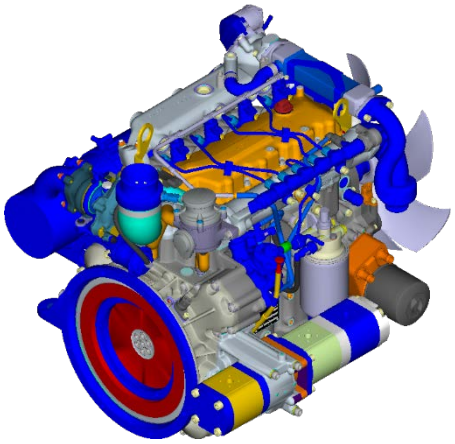
4.2.1 Engine brackets

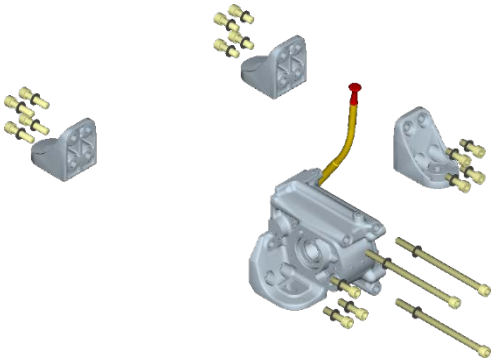
4.2.1.1 Standard



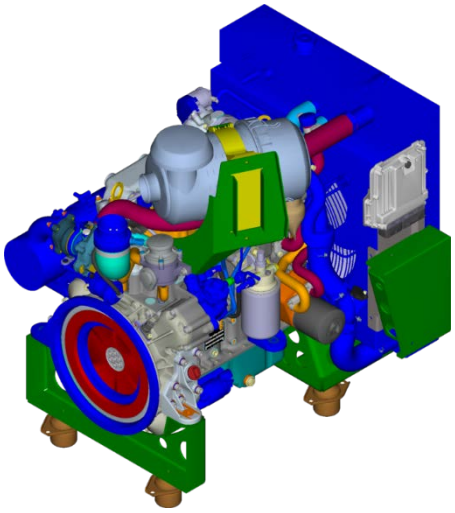


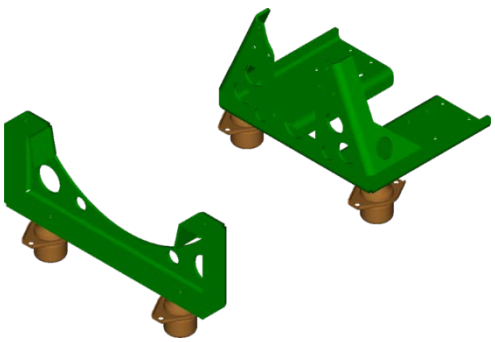
4.2.1.2 for hydraulic power take off





4.2.1.3 OpenPowerUnit (OPU)



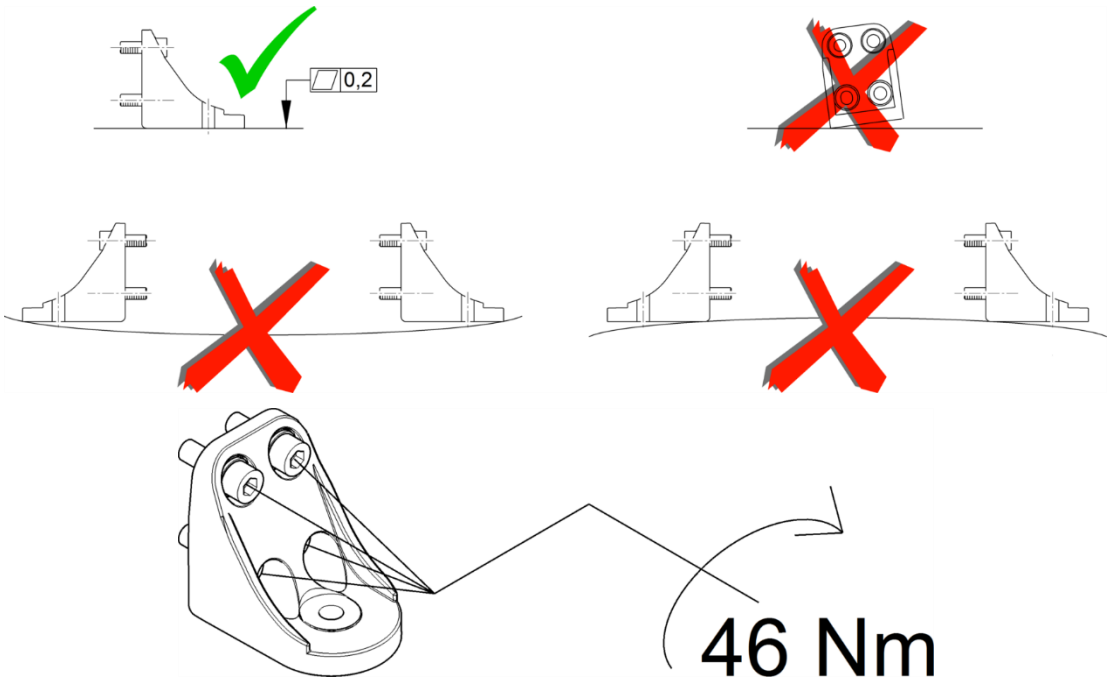


4.2.2 Rigid engine suspension

CAUTION

Danger of injury

- With a rigid engine mounting, the engine brackets/base plate must be installed free of tension (flatness tolerance of the bearing surface 0.2 mm must be observed).
- Non-observance can lead to a risk of injury, breaking of the engine brackets/base plate, and thus engine damage.



In order for the engine to also be installed absolutely free of stress, one of the 3 identical engine brackets must be adjusted/aligned to the bearing surface.

Rigid mounting can only be allowed up to an engine speed of approx. 1,800 rpm. In addition, the free mass forces are typically so large that a flexible support now makes sense.
The most important prerequisite for any engine mounting is that the frame or the mount is rigid and of sufficient size in terms of strength. Parts of the frame that are not rigid act like springs and must be stiffened by braces.

If the engine speed in a rigid structure is to be > 1,800 rpm, HATZ must always be consulted to determine whether the application can be approved.

4.2.3 Flexible engine mounting

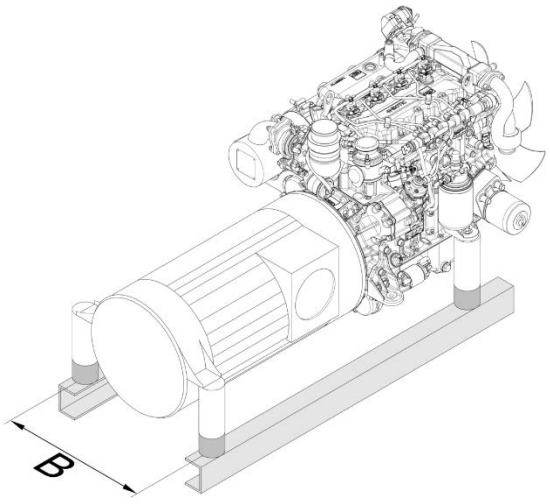
It is generally recommended to mount the engine in a flexible manner.

For noise reasons too, flexible mounting can be advantageous because when rubber is used as a bearing element, very little structure borne noise is passed on.

The connections for fuel, exhaust gas, exhaust air for flexibly mounted engines must be designed so that the vibrations which occur can be absorbed, i.e. they must be flexible.

For flexible mounting, basically the installation base B should be as wide as possible because the vibration amplitudes and thus the forces can also be kept small.

In the case of hydro mounts, the max. load on the engine mount must be 4 g.
For cylindrical rubber buffers the load on the engine mount must be 2 g in the push direction and 0.5 g in the thrust direction, where the total weight must be evenly distributed over the 4 cylindrical rubber buffers and must not exceed the total weight of max. 300 kg.



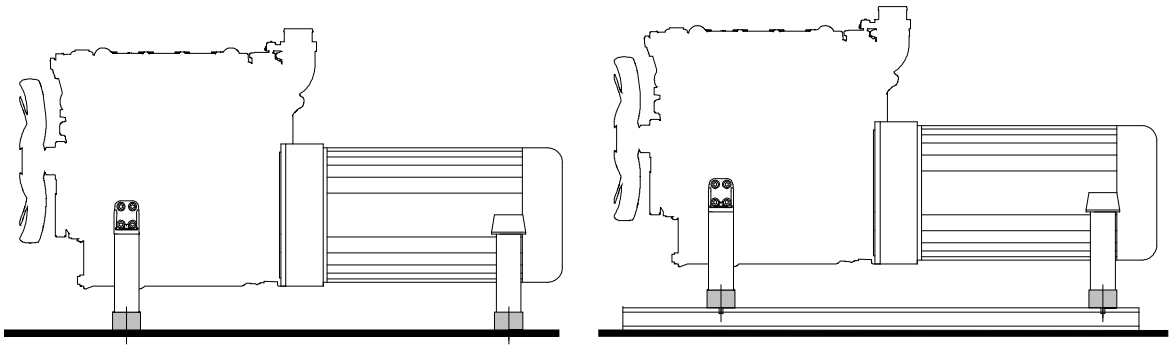
Depending on the type of machine, a decision must be made between

a) flexible mounting for flange-mounted force sensors and

b) flexible mounting for non-flange-mounted force sensors.

a) Flexible mounting for flange-mounted force sensors

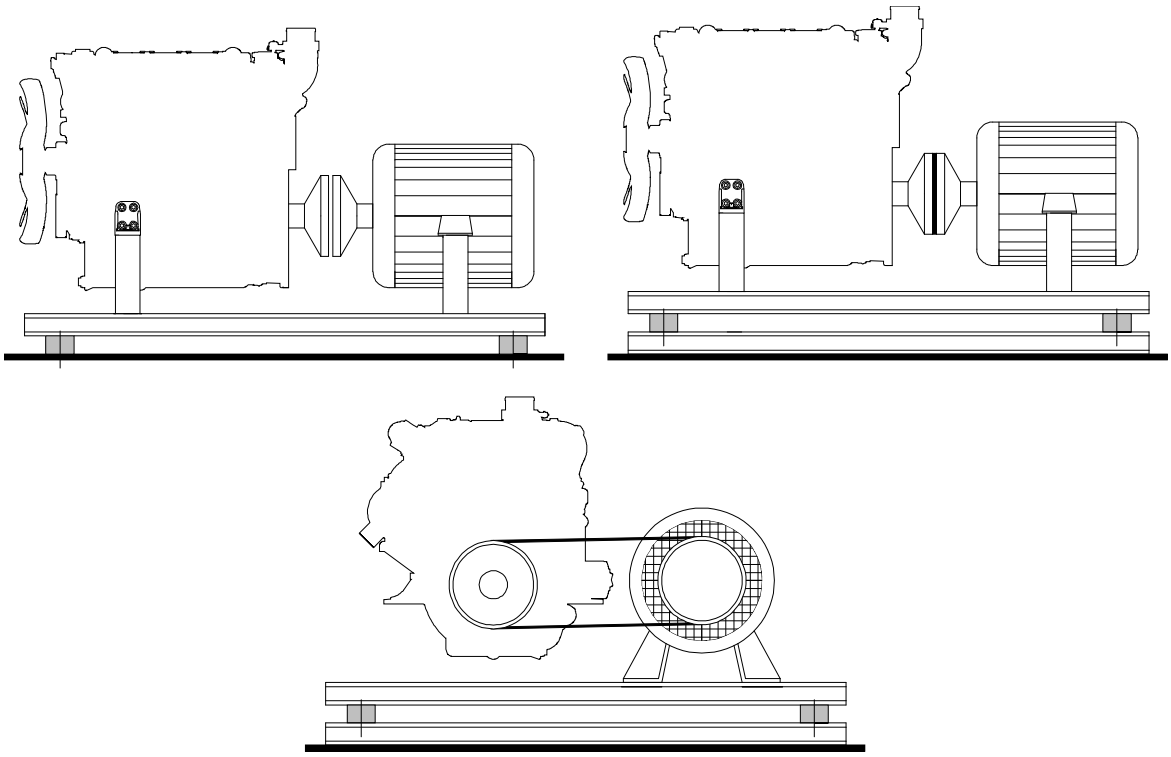
The engine is flange-mounted on the driven force sensors and constitutes a common vibration system. If a corresponding base is available, a frame can be dispensed with because the engine and force sensor already make up a rigid frame.



b) Flexible mounting for non-flange-mounted force sensors:

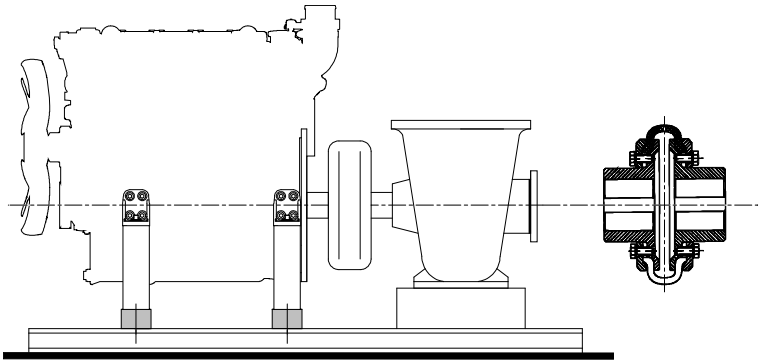
In place of the housing connection to flange-mounted force sensors, there is now a frame onto which the engine and the machine to be driven are rigidly screwed.

Either flexible couplings or even belts serve as power transmission elements. The frame with rigidly mounted engine and rigidly mounted machine to be driven is now placed on rubber elements or springs, thus constituting a vibration system.



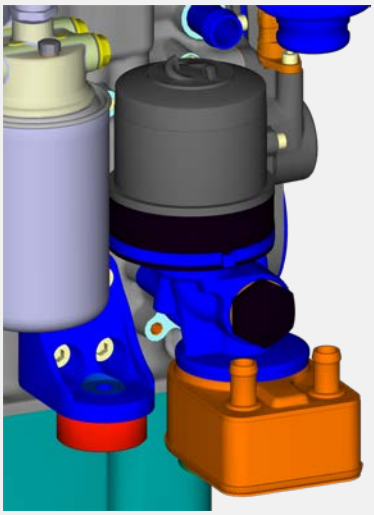
Special case:

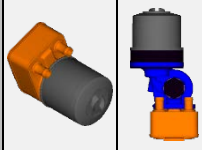
Due to the open, non-flange-mounted construction, a HIGHLY FLEXIBLE coupling must be used as the shaft connection between the flexibly mounted engine and rigidly mounted pump.



In contrast, the two variants in the picture below are not permitted because the engine and machine form separate vibration systems which work against each other and damage the flexible coupling or belt.

4.2.3.1 spacer discs to engine mounting

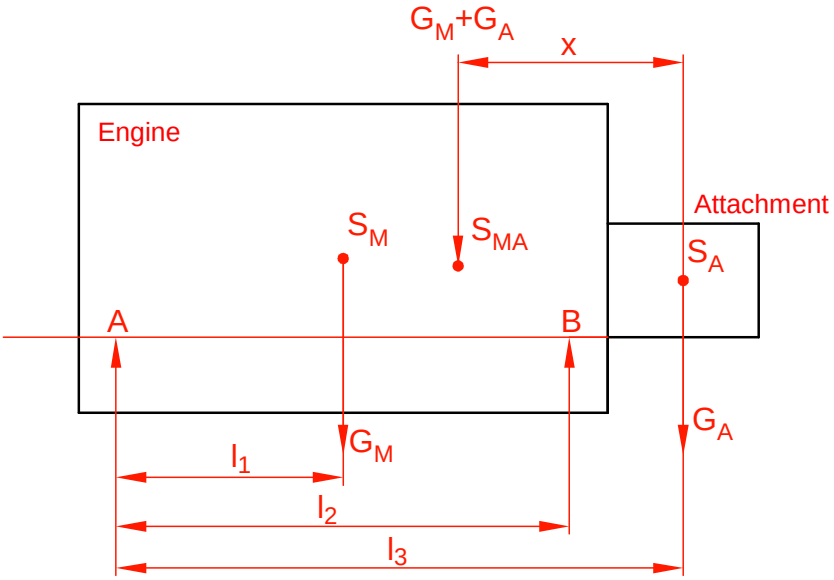
For the optional mounting options of a vertical oil filter, A/C compressor or hydraulic pump, the clamping position must be corrected using spacers as otherwise there will be a component collision. The following overview shows how many spacers are needed.	

Vibration damper variant	Number of spacers			
				
6	1	2	1	2
8/9	0	Not permitted		
10/11	0	0	0	0
12	0	2	0	2

4.2.3.2 Uniform bearing load

When using bearing elements, ensure the bearing load is uniform. Of the total weight, no more than 60 % must be on A or B.

Determination of bearing forces (if centers of gravity of the engine, attachments such as hydraulic pump, alternator, ... and their intrinsic weights are known)



$$A = \frac{G_M \times (l_2 - l_1) - G_A \times (l_3 - l_2)}{l_2}\ [N] \qquad B = \frac{(G_M \times l_1) + (G_A \times l_3)}{l_2}\ [N]$$

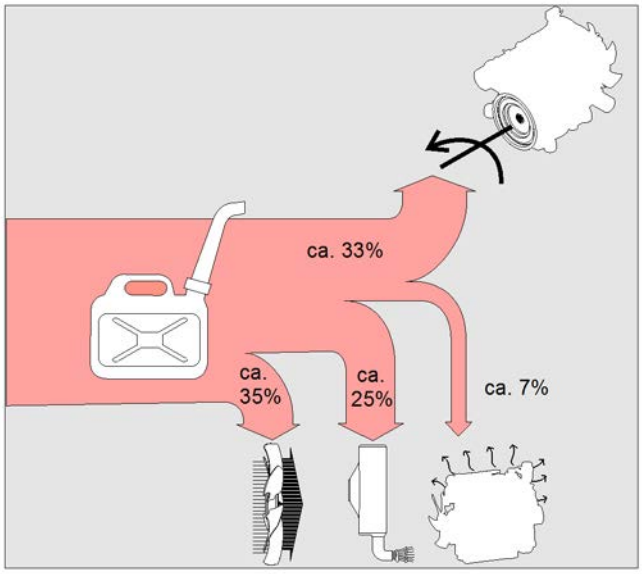
Abbreviation	Meaning
S_M	Center of gravity of engine
S_A	Center of gravity of attachment (e.g. hydraulic pump, alternator,…)
S_{MA}	Overall center of gravity (engine + attachment)
G_M	Weight force of engine [N]
G_A	Weight force of attachment [N] (e.g. hydraulic pump, alternator,…)
A	Bearing load A
B	Bearing load B
$L_{1,2,3}$	Distances [m]

For the position of the overall center of gravity (engine with attachment):

$$x = \frac{l_2 - l_1}{1 + \frac{G_A}{G_M}}\ [m]$$

4.3 Energy balance

The energy balance looks something like this:
Approx. 33 % of the engine power available for effective work
Approx. 25 % contained in the exhaust gas
Approx. 35 % contained in the cooling air or cooling water
The remainder (approx.7%) is radiated via the engine surface



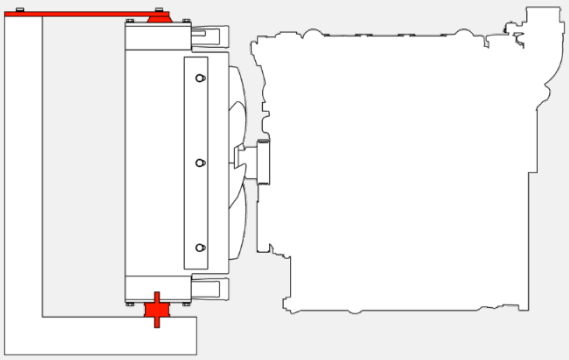
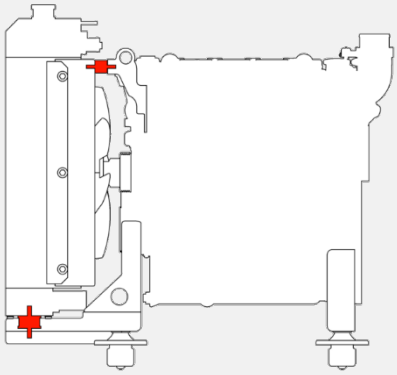
4.4 Installation of engines under a cowling

To successfully enclose a system, it is necessary to dissipate the radiated heat of the engine, the exhaust pipe and the applied machines from the engine compartment again. In most cases, the natural circulation of air through the fan is sufficient. However, if the radiator is mounted away from the engine, forced ventilation is often necessary. It is important that the air passing through the fan can flow unhindered and there is no heat build-up in the engine interior. It is advantageous if the exhaust pipe is located in the air flow. A temperature of + 100 °C should not be exceeded in the engine interior because certain (electronic) components can otherwise be impaired and damaged in their function.

4.5 Engine cooling

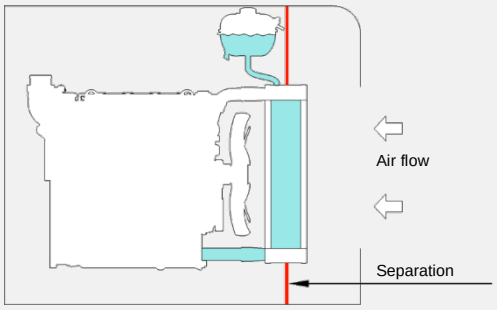
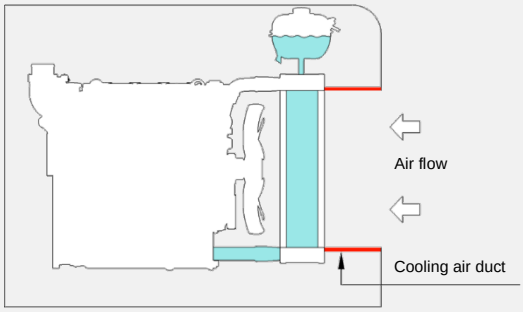
4.5.1 General: Attachment of the water cooler

The engine radiator must be decoupled from the engine vibrations.
The radiator (from HATZ) must be subjected to maximum vibration values of 5 g only.
With the OpenPowerUnit (OPU), the radiator is vibration-decoupled with rubber buffers ex-works.
If using third party radiators, please consult and come to agreement with the radiator manufacturer.

F2F	OPU
	

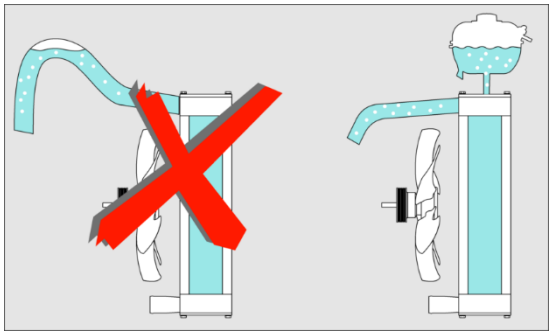
The engine radiator should be protected against external soiling. In addition, during installation ensure that accessibility for maintenance work is not restricted.

4.5.1.1 Installation under a cowling

Extractor fan example	
	

The connections of the separator plates to the radiator must be flexible in design (e.g. rubber sealing lip).The separator plates must not have an air gap to the radiator and must have a flexible range of min. 10 mm.

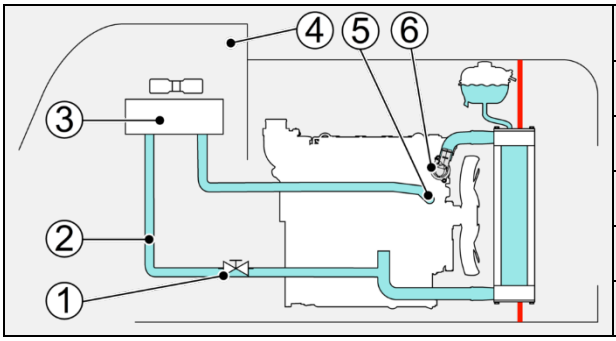
4.5.1.2 Cooling water hoses



Cooling water hoses in accordance with DIN 73411 / EPDM must be used. 4 mm min. thickness, pressure resistance of 2 bar, temperature resistance of 120 °C.

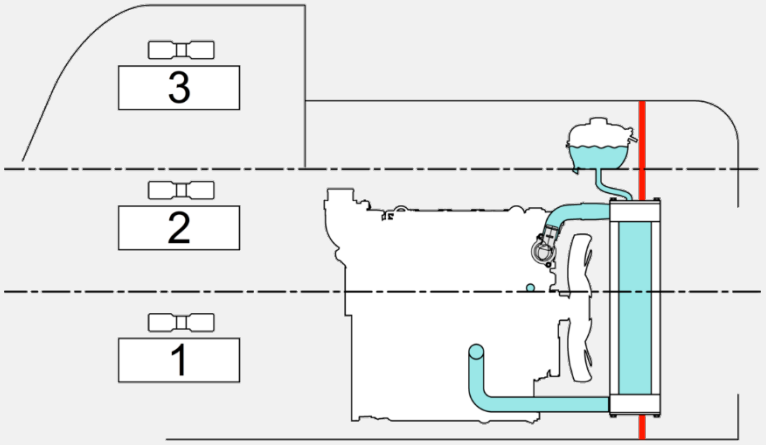
Avoid air pockets when laying the hoses.

4.5.1.3 Installation in combination with a cab heater



1	Closing valve
2	Cab heater return
3	Cab heater
4	Cab
5	Cab heater supply
6	Thermostat

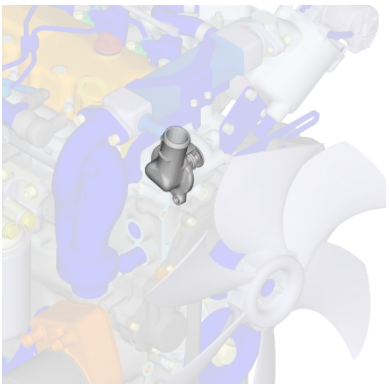
Cab heater variants

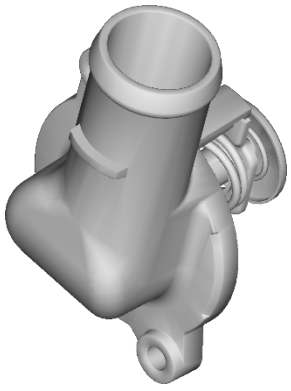


Variant	Additional measures when filling
1	No additional measures required when filling
2	Attach breather plug or vacuum filling necessary
3	Vacuum filling necessary
Consultation with HATZ required for variants 2 and 3	

4.5.1.4 The thermostat

The wax element of the thermostat opens at 80 °C and is fully open at 95 °C.
The HATZ thermostat supplied with the engine must always be used.





4.5.2 Coolant

See Operator's manual, chapter Coolant

4.6 Fuel system

4.6.1 Fuel

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.
- Only use pure fuel and clean filling containers.
- Do not spill fuel.

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. Sulfur content max. 50 ppm
- Do not use bio-diesel.
- The use of fuels that do not meet specifications require approval by **Motorenfabrik HATZ (main plant)**.

NOTE

Max. permitted fuel temperature is +80 °C. If exceeded, the engine switches to engine emergency run program. Therefore, place the tank in a cool area of the machine.

NOTE

The "Fuel sticker" and the '"No bio-diesel sticker" must be placed close to the fuel cap.

- Do not use components containing zinc and copper in the fuel system (tank, lines, gaskets, and feed pumps).
  Zinc flake coating and hot-dip galvanizing produces a bare zinc surface and must be avoided.
- Zinc ions lead to accelerated clogging of the injection holes in the injectors.

- In combination with the FAME (**F**atty **A**cid **M**ethyl **E**ster) present in today's standard fuels at a level of up to 7%, copper acts as a catalyst, massively reducing the oxidation stability of the fuel and thus also leading to accelerated clogging of the injectors with combustion residues.

Galvanized (passivated) components may be used.

4.6.2 Fuel specifications

The following diesel fuels may be used:

Fuel type	
EN 590	Europe
BS2869 A1/A2	Great Britain
ASTM D 975-09a 1-D S15 or 2-D S15	USA
JIS K 2204 with a maximum HFRR value of 520 µm)	Japan
Engines without DOC and without DPF	
ASTM D 975-09a 1-D or 2-D	USA

These fuels can be used without restriction and without deviation from the Operator's Manual.

Special approval for fuels with different specifications

CAUTION

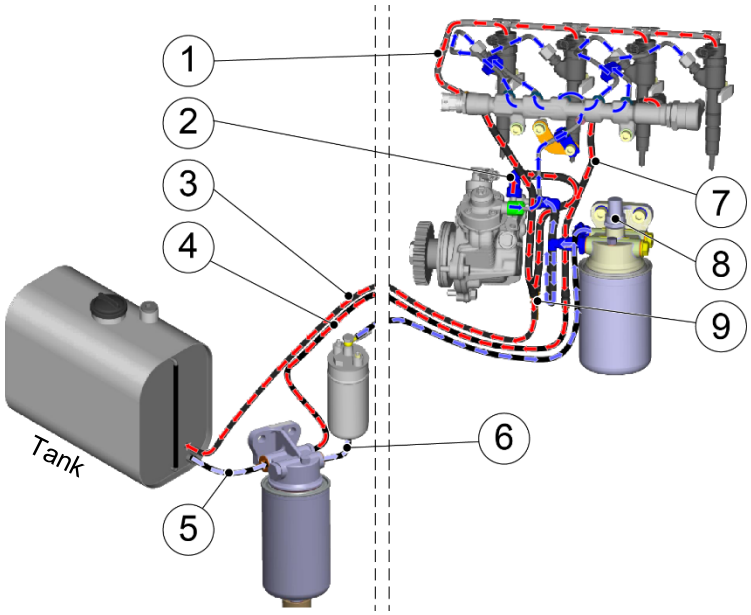
Danger of serious engine damage.

If the additional maintenance work is not carried out during operation with fuels that have a sulfur content above the released standards, serious engine damage can be expected. In this event, any warranty on the part of Hatz is excluded.

If the engine is operated with fuels that have a sulfur content higher than the released standards (but maximum 5000 ppm), the following points must be observed:

1. Any attached oxidation catalytic converter or particulate filter will be destroyed by operating with these fuels. An oxidation catalytic converter destroyed in this way does not impair the operation of the engine and can therefore remain on the engine, whereas a particulate filter will be clogged by the sulfur content of the fuel and the exhaust system blocked. Thus, the particulate filter must be removed before operation with such fuels in order to ensure trouble-free running of the engine. Engines with destroyed oxidation catalytic converters or destroyed particulate filters no longer comply with the original emissions level and also may no longer be operated in areas with corresponding emissions regulations for this reason.
2. The oil change/oil filter change interval is reduced to 250 h.
3. The EGR precooler/valve/main cooler and mixing nozzle must be checked for dirt accumulation after 1000 h and cleaned if necessary.
4. A power loss of 10-15 % can occur due to carbonized injectors. In this case, but after 1000 h at the latest, the injectors must be disassembled and inspected for carbonization. If necessary, the injectors must be cleaned with a soft cloth. Because of possible damage, cleaning with brushes is not permitted. The injectors must be used on the same cylinder again. Basically, the injector could also be operated on other cylinders, but the injector-dependent IMA code would then have to be newly created using the diagnostic software. Disassembly and assembly work can be taken from the repair book.

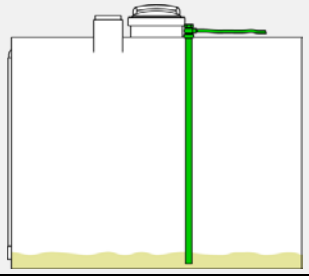
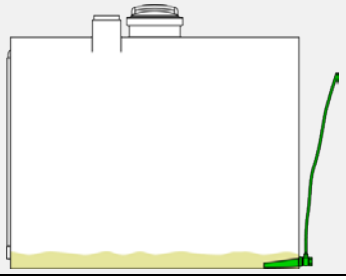
4.6.3 Fuel schematic with prefilter, water separator and feed pump



1	Injector return
2	HP pump return
3	Return to tank
4	Return to pre-filter
5	Intake from tank
6	Metering point ΔP
7	Rail return
8	Metering point for feed pressure
9	Metering point for fuel return pressure to tank
specification full hose	DIN 73379 - 8x3 - A1

Position the fuel pre-filter and fuel feed pump as close as possible to the tank.

Since the engine has a special cold-running control, no fuel filter heating is necessary. During a cold start, the high-pressure pump pumps the maximum feed amount into the rail. The fuel heated in this way is discharged through the pressure control valve to the fuel pre-filter and heats it. Once the engine and fuel are heated sufficiently, the feed amount is regulated back to the actual required amount.

Tank variants	
Return at the top (with standpipe)	**Return below the fuel level**
	

4.6.3.1 Electrical fuel feed pump

Supply/return length with Ø 8 mm	Max. 5 m
Perm. negative pressure on feed pump	0.3 bar (tank level + flow resistance line & loaded prefilter) pos. 6
Feed pressure	4.5 bar (can be read via diagnostics) pos. 8
Engine stop	≤ 3.5 bar
Feed volume required	~ 80 l/h
Pmax	7 bar
Max. pressure in return	0.3 bar (measurement point for return pressure) pos. 9

4.6.4 Fuel filtration

WARNING

Danger of injury from fuel escaping under pressure.

- Bleed screw on the filter head of the main fuel filter must **NOT** be opened.

After changing the main fuel filter and/or the primary fuel filter, the ignition key must be set to the "Ignition on" position for a few seconds so the feed pump fills the filter with fuel and the air is pushed out of the system as the high-pressure pump is very sensitive to dry-running.
See Operator's Manual chapter "Starting the engine for the first time/after a filter change".

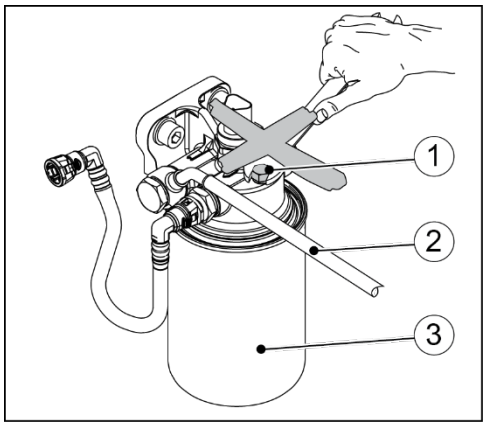
4.6.4.1 Main fuel filter

WARNING

Danger of injury from fuel escaping under pressure.

Large quantities of fuel under high pressure can escape when changing the main fuel filter.

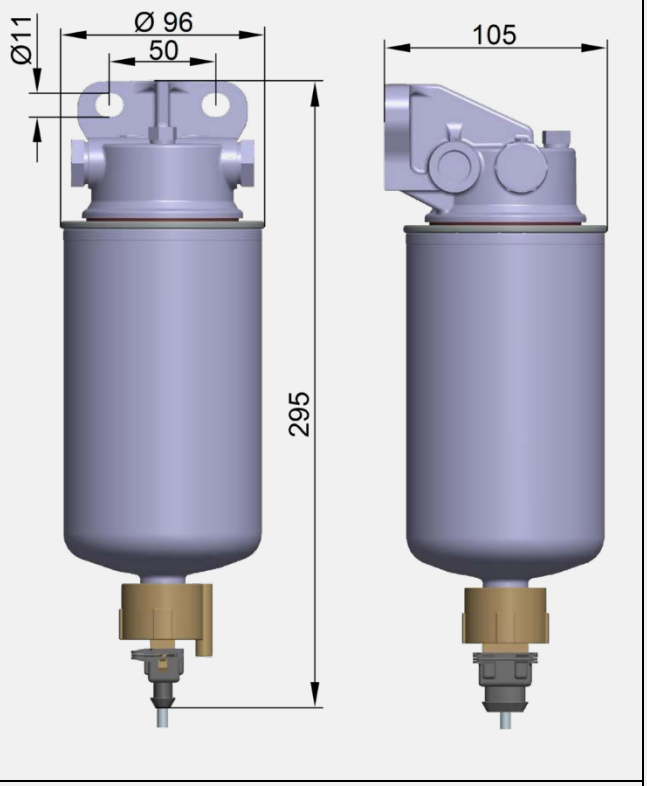
- Never open the bleed screw on the main fuel filter.
- Wear safety goggles.



1	Bleed screw (not open!)
2	Fuel feed line
3	Main fuel filter

4.6.4.2 Fuel prefilter

Due to the different ways of storing fuel in the various fields of application, the fuel cleanliness cannot always be guaranteed. Condensation and deposits can therefore occur. It is therefore necessary to install a fuel prefilter with water separator (and water level sensor). The filter lifetime is significantly prolonged by this measure. This must be a Hatz fuel prefilter because the water sensor inside it is incorporated in the engine control.



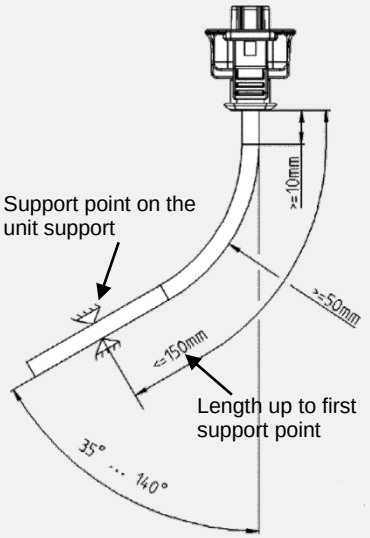
Separating volume until signal:
74 cm³ to max. 30° skew

Installation instructions:

Fuel line:

Neither copper nor zinc compounds are permissible in the tank, lines, gaskets and feed pumps. Exception: Galvanized components with a passivated surface may be used.

Water level sensor:



4.6.4.3 Fuel tank

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

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.
- Only use pure fuel and clean filling containers.
- 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 any escaping fuel and do not spill the fuel.

When a fuel tank is installed, make sure that it does not have any processing residues, impurities, water etc.

The fuel return line to the tank must be introduced under the fuel level to prevent the lines emptying. If this is not possible, a check valve must be installed. A check valve in the fuel supply before the electric fuel pump (EFP) is not permitted.

A discharge port is provided on the fuel tank to drain water and dirt when needed. This is due to deposits and EN 590 fuels with a FAME content of max. 7%. Due to the penetration of water (hygroscopic action of FAME) in the fuel tank, biocultures (fungi) can occur in the transition layer between the fuel and water. This can cause damage to the injection system, which can lead to failure of the system. It is therefore imperative to keep the fuel tank clean.

This also applies to the fuel pre-filter for which (despite the water level sensor) the maintenance intervals must be carried out in accordance with the Operator's Manual, especially before extended storage periods (e.g. winter breaks).

CAUTION

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. A fuel level sensor should be implemented here (with possibly several warning levels) in order to exclude possible damage in advance.

4.7 Exhaust gas system

WARNING

Danger of burns from hot exhaust gas system.

Hot surfaces on the entire exhaust system.

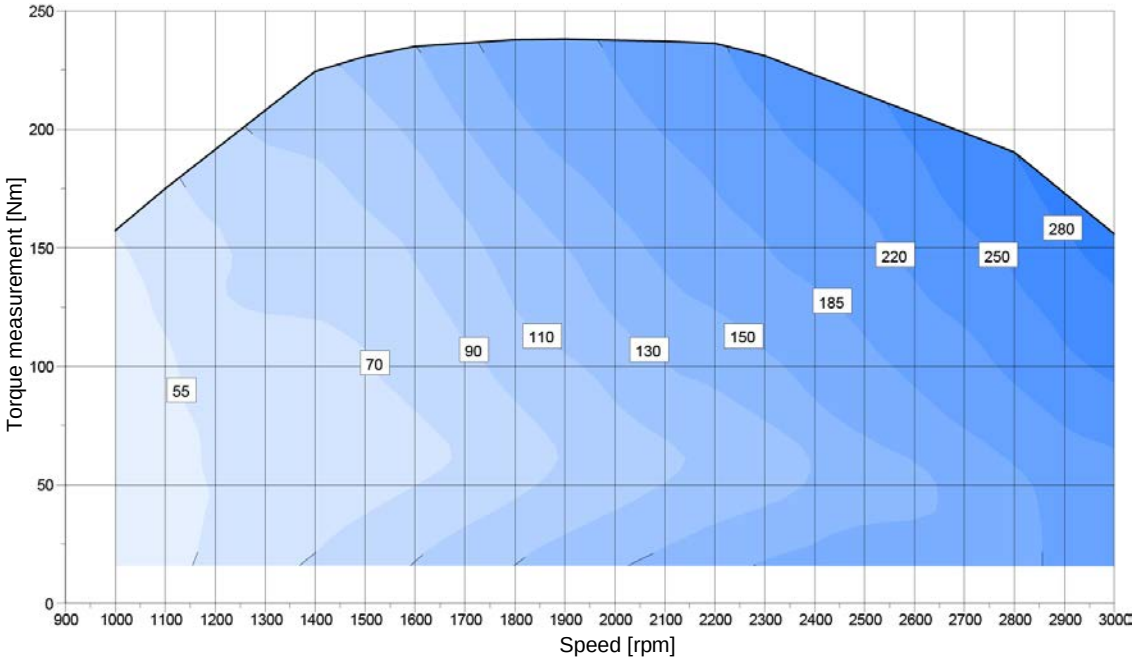
- Keep explosives and flammable materials away from the engine.
- Attach safety devices.
- Wear safety gloves.

IMPORTANT NOTE

It is the duty of machine manufacturer to ensure that all safety precautions (e.g. heat protection for the diesel oxidation catalytic converter) are taken for the whole machine so that injury from hot surfaces is excluded.

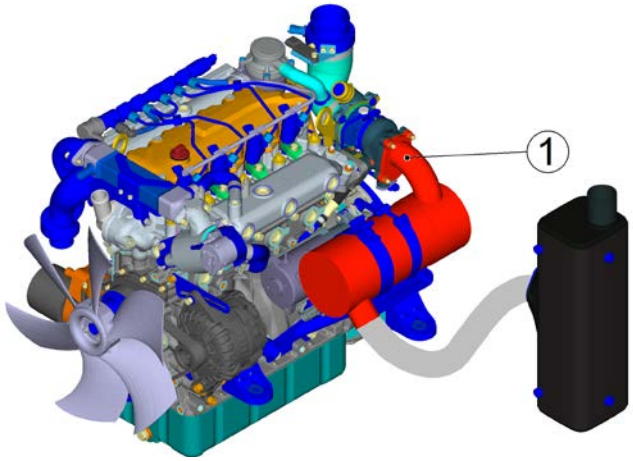
The protective devices are available from HATZ (see chapter *9 Contact* protection for machine safety, page *78*)

4.7.1 Exhaust gas volume flow



4.7.2 Permissible exhaust gas back pressure

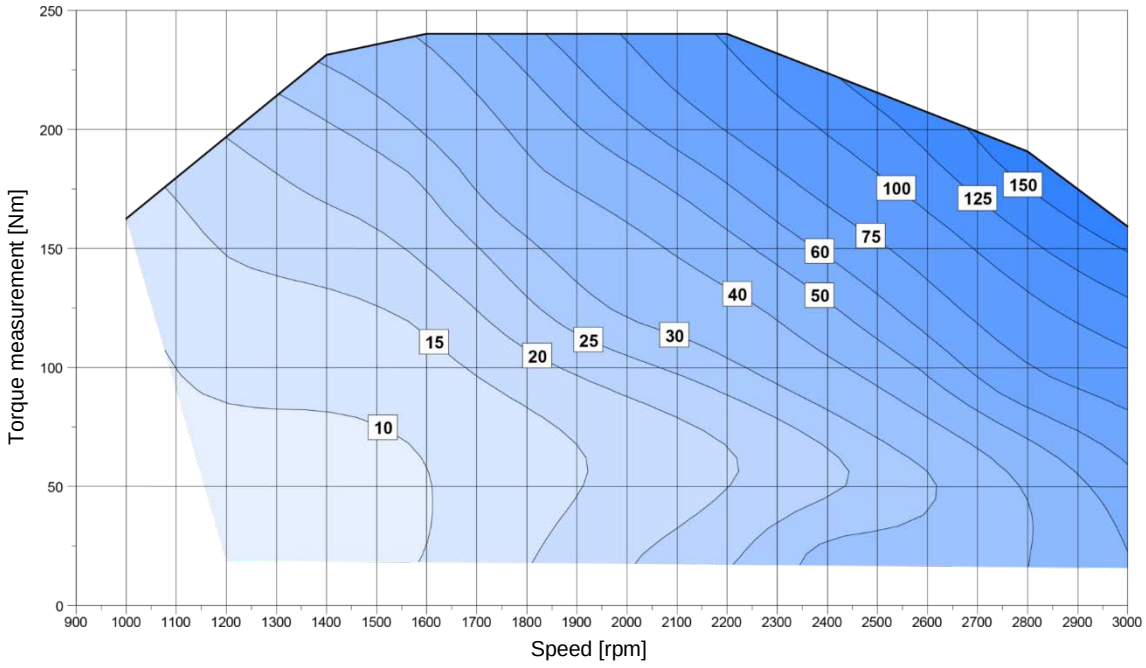
If additional silencers are used, but also if the exhaust gas is transferred from the engine compartment through pipe bends or flexible lines, pay attention to the permissible exhaust back pressure. The measuring point of the exhaust back pressure is located directly behind the exhaust gas turbocharger.



1	Measurement point for exhaust gas back pressure

	Constant speed			Variable speed					
Speed n [rpm]	3,000	1,800	1,500	2,800	2,700	2,600	2,500	2,400	2,300
* Exhaust gas back pressure [mbar]	170	40	20	150	130	120	100	90	80
* Exhaust gas back pressures apply to DOC + silencer at the measurement point.									

Exhaust gas back pressure characteristic map [mbar]



Exhaust back pressures are setpoints, not maximum values, tolerance ± 15%, for constant speed applications (for 1500 rpm, 1800 rpm) ± 5 mbar back pressure DOC at 2800 RPM/full load 100 mbar

4.7.3 Diesel oxidation catalytic converter (DOC)

IMPORTANT NOTE

The DOC is mandatory for operation of the engine variations that are certified according to EU Stage IIIb or IV TIER EPA final.
There are two methods of mounting:

- DOC mounted on the engine side
- DOC separated

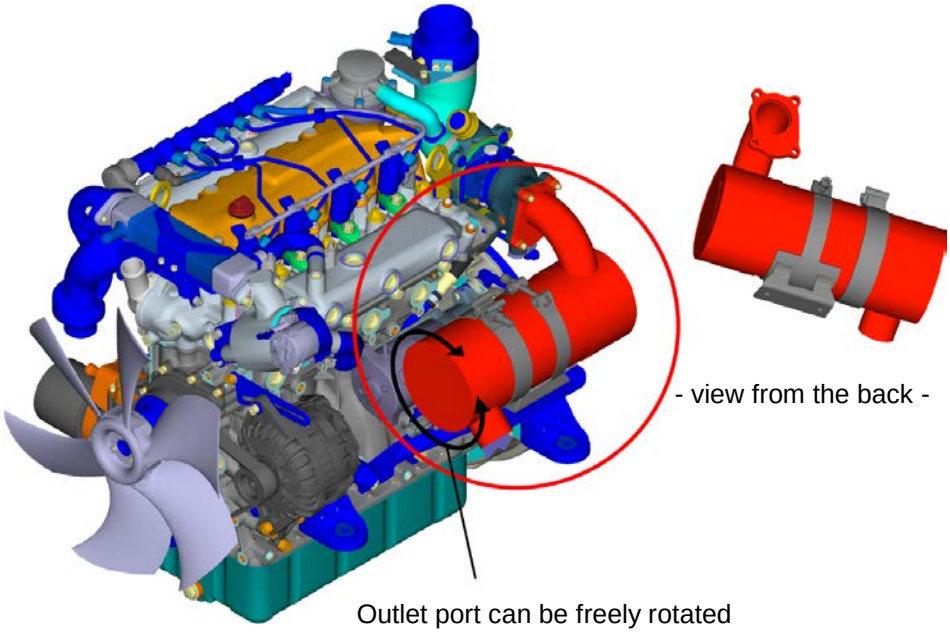
4.7.3.1 DOC mounted on the engine side

CAUTION

Danger of burns from hot exhaust gas system.

Hot surfaces on the entire exhaust system!

- Keep explosives and flammable materials away from the engine.
- Attach safety devices.
- Wear safety gloves.



- view from the back -

Outlet port can be freely rotated

The outlet port of the diesel oxidation catalytic converter can be freely rotated, the angle of rotation must be limited only to the extent that the exhaust gas stream is not directed to the engine or the outlet port collides with the engine.

IMPORTANT NOTE

If the outlet port of the DOC is rotated after commissioning, it must be resealed with a special thermal paste.

For details, contact a **HATZ service center**.

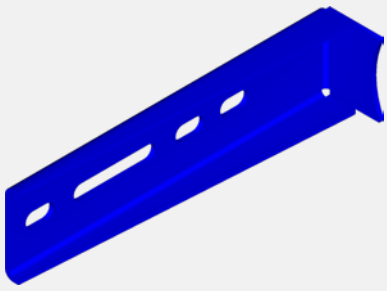
4.7.3.2 DOC separated

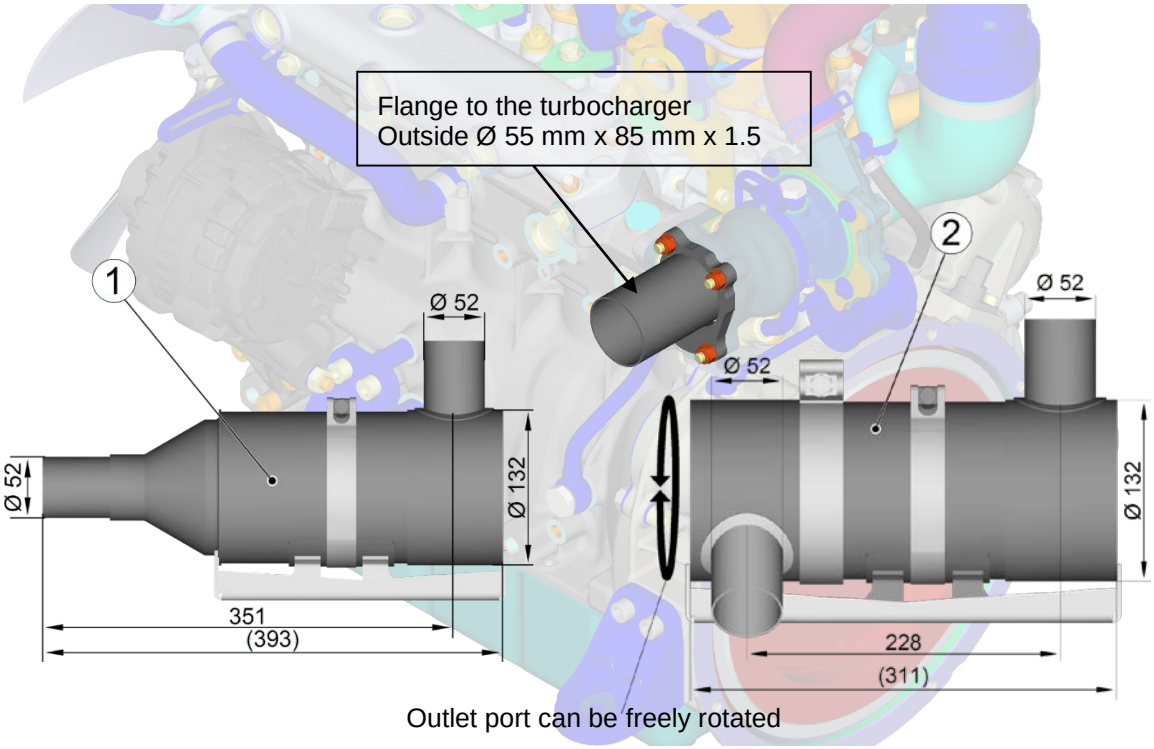
CAUTION

Danger of burns from hot exhaust gas system.

Hot surfaces on the entire exhaust system.

- Keep explosives and flammable materials away from the engine.
- Attach safety devices.
- Wear safety gloves.

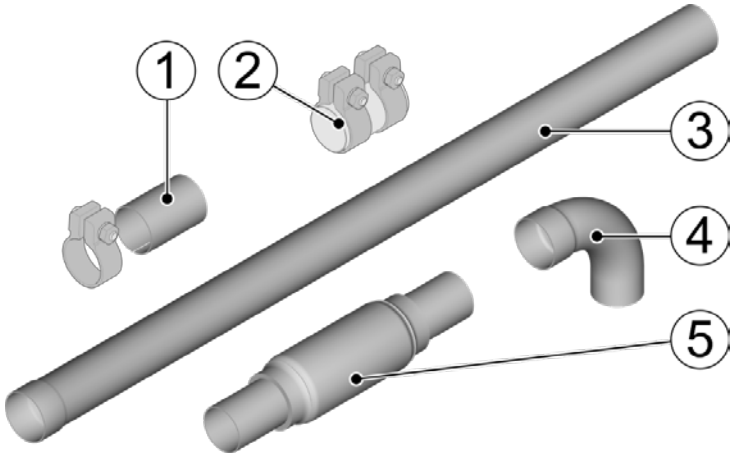
With separated DOCs, this retaining plate is available for mounting on the chassis side.	



Outlet port can be freely rotated

	Input	Dimensions	Output	Dimensions
1	radial	Outside Ø 52x1.5 mm	axial	Outside Ø 52x1.5 mm
2	radial	Outside Ø 52x1.5 mm	radial	Outside Ø 52x1.5 mm

Distance of turbocharger outlet flange – DOC ≤ 300 mm, with insulation ≤ 500 mm



These parts can be obtained from HATZ for the pipeline path.

1	Pipe adapter slit on one side with suitable frame clamp	Inside Ø 52 x 80 mm x 1.5 mm	
2	Pipe connector	Inside Ø variant 1: 55 x 90 mm Inside Ø variant 2: 58 x 90 mm	
3	Exhaust gas pipe, straight	Inside Ø52x980 mm x 1.5 mm	Inside Ø55.7 (expansion)
4	Exhaust gas pipe, bent	Inside Ø52x220 mm x 1.5 mm	Inside Ø55.7 (expansion)
5	Exhaust gas compensator	Inside Ø55x340 mm x 1.5 mm	

The main influencing factor is the cooling by cooling air flowing past.For this reason thermal insulation may be necessary for greater distances/stronger circulation.

There are two variants of the separated oxidation catalytic converter

- Radial inlet and radial outlet
- Radial inlet and axial outlet

IMPORTANT NOTE

If the outlet port of the DOC is rotated after commissioning, it must be resealed with a special thermal paste.

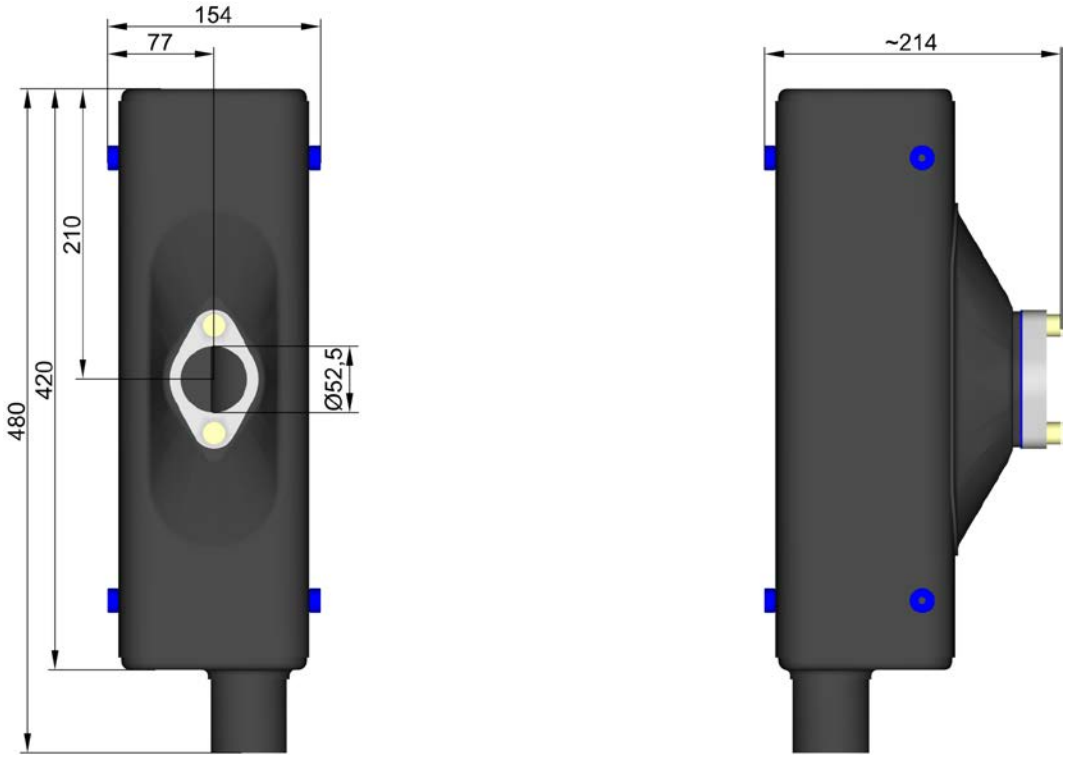
For details, please contact a **HATZ** service center.

4.7.4 Recommended dimensioning of the exhaust gas system

The design of the exhaust gas system is based on the exhaust gas back pressures specified in chapter *5.7.2 Permissible exhaust* gas back pressure, page *43*. The recommended pipe diameters for the continuation of the exhaust gas line corresponds to the outside diameter of the DOC (Ø 52 mm).
It should be noted that pipe bends from 45° significantly affect the exhaust gas back pressure.

4.7.5 Silencer (recommendations) and flexible connections

The HATZ rear silencer can also be mounted firmly to the chassis after the DOC.

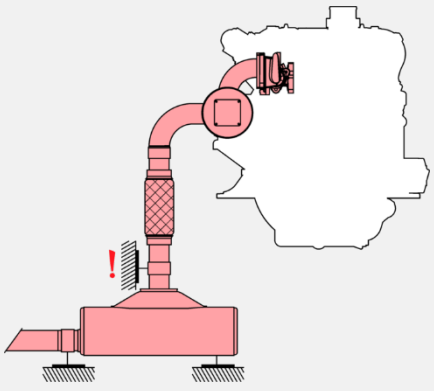
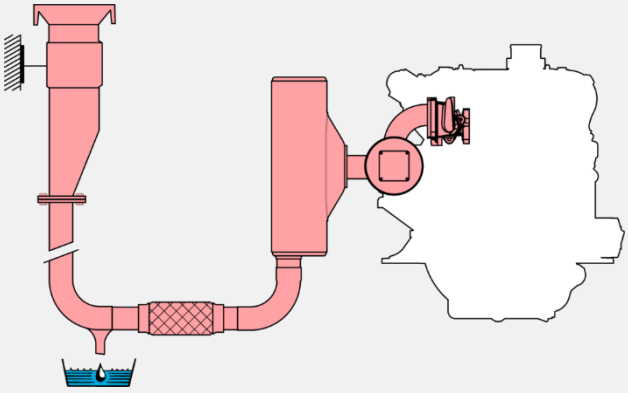


When laying the pipe, make sure that the pipe cross-sections after the DOC outlet cannot be narrowed under any circumstances. When configuring the entire system with regard to possible pipe lengths and number of pipe bends (elbows), make sure that the permissible exhaust gas back pressure is within the permissible tolerance window.

If exhaust gas pipes are installed on flexibly mounted engines, a flexible intermediate element (compensator) must be installed in the pipe to absorb the engine movements. Wherever possible, this flexible intermediate element must be installed close to the fulcrum of the flexible mounting because this is where there the amplitudes are the smallest.

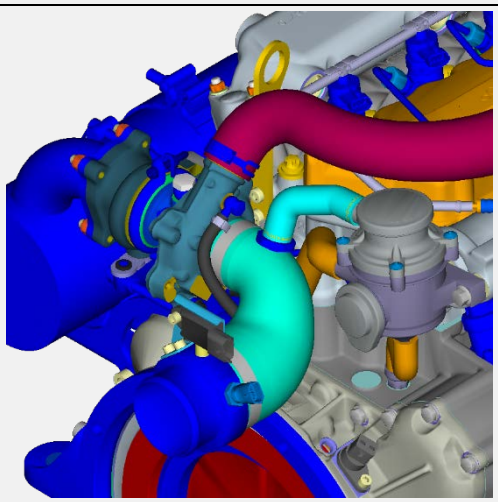
A fixed point is required after the flexible intermediate element. In long exhaust gas lines and in engines at low load, the exhaust gas condenses. Typical of this are welding units that have long idle times.

Such exhaust gas lines must have a condensate drain.

Attachment after the compensator	Condensate drain
	

4.7.6 Exhaust gas turbocharger (ETC)

Mounting the exhaust gas turbocharger:

Standard

45° position Optimized hose routing to the intercooler with standard cooler package (F2F or OPU)

4.7.7 Diesel particulate filter (DPF)

DANGER

Danger of fire from hot exhaust gas system.

The exhaust gas system and, in particular, the diesel particulate filter can become very hot. Combustible materials can ignite on the exhaust gas system, even when the engine has already been switched off.

- Keep combustible materials away from the exhaust gas system.
- Do not operate and place the engine in the direct vicinity of combustible materials.

DANGER

Danger of burns.

During the regeneration process, the diesel particulate filter and the exhaust system become very hot. There is a danger of burns when working on a hot exhaust system.

- Let the diesel particulate filter and exhaust system cool down.
- Wear safety gloves.

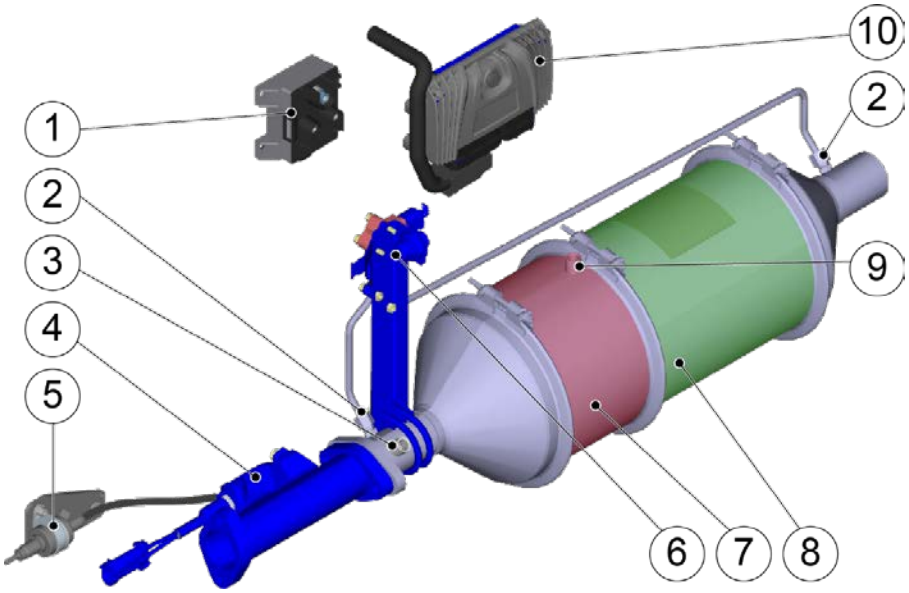
In some areas (Switzerland, Stockholm, ...) the use of a diesel particulate filter is already mandatory.

HATZ provides the diesel particulate filter (DPF) as an option, with certificate of conformity with the Air Pollution Control Ordinance (LRV) of the Federal Office for the Environment (BAFU) in Switzerland.

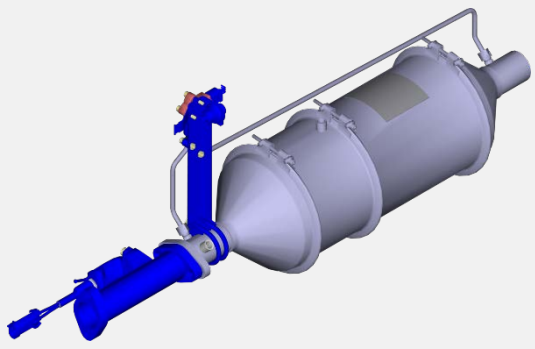
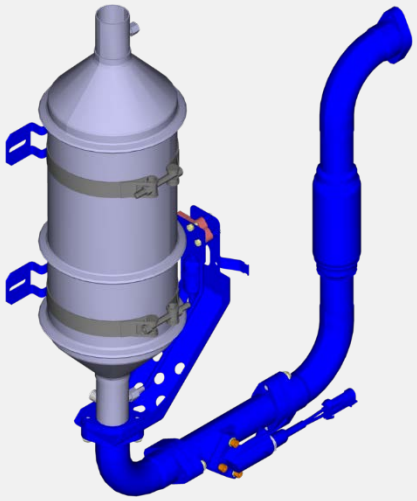
Due to the adaptation of the particle filter in conjunction with the certificate of the FOEN, the 4H50TIC can be used not only in Switzerland, but also in areas that place special demands on the post-treatment of exhaust gas

(e.g. use underground, in tunnel construction, in exhaust gas-intensive metropolitan areas based on local requirements, …).

When using the combination filter, the engine-side diesel oxidation catalytic converter (DOC) is omitted.



1	Load relay
2	Removal point for exhaust gas pressure
3	Temperature sensor
4	HC evaporator with glow plug
5	Feed pump for HC evaporator
6	Exhaust gas back pressure sensor
7	Oxidation catalytic converter
8	Particle filter
9	Temperature sensor
10	DPF control unit

Diesel particulate filter, horizontal	**Diesel particulate filter, vertical**
	

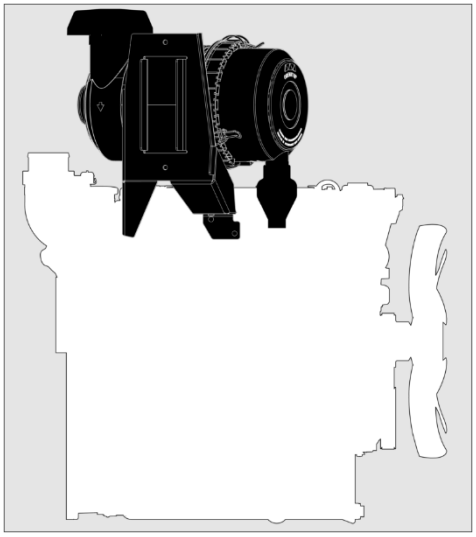
4.8 Intake and combustion air system

4.8.1 Air filter selection, dimensioning and intake section

The most important dimensions of the HATZ air filter system including fastening material and rain cap.

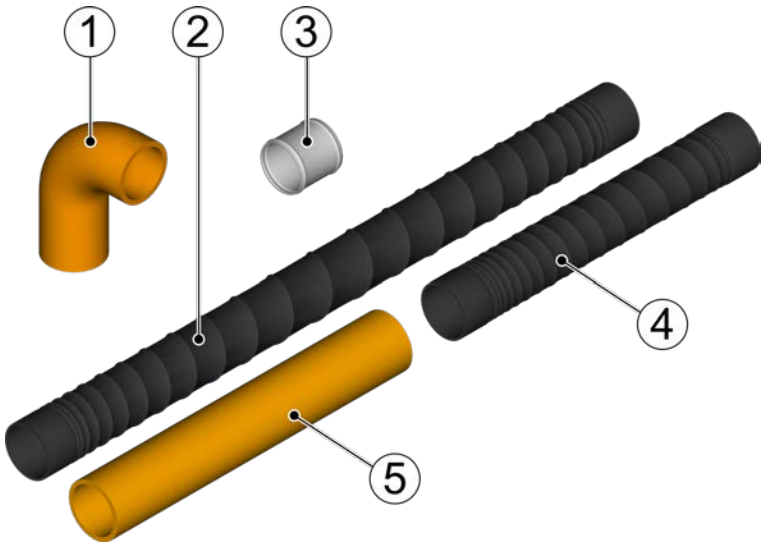
1	Secondary filter
2	Primary filter
3	Dust discharge valve

Approx. 82% of the dust is pre-separated through the tangential air inlet, the dust is ejected through the large dust discharge valve by pulsation.

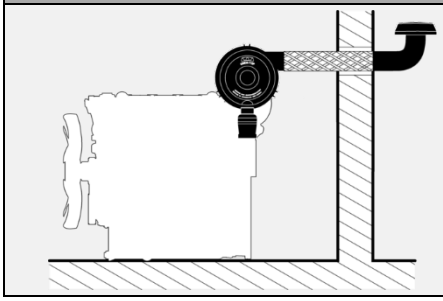
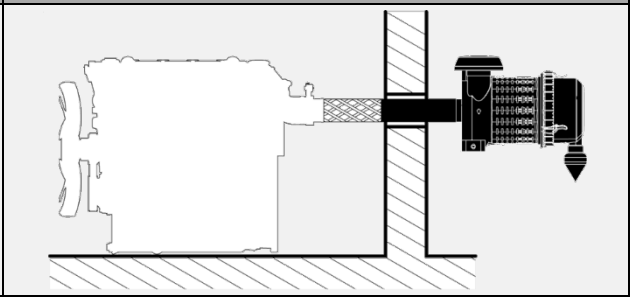


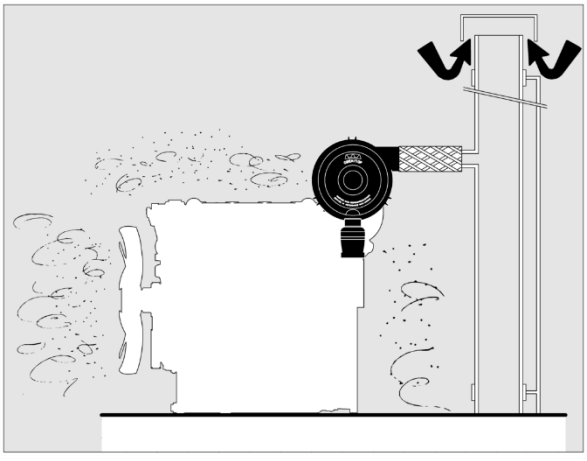
The air filters from our product range are matched to HATZ diesel engines. When using third party air filters, the HATZ specification must be adhered to.

Leaks on the clean air side must be avoided. The feed line must be resistant to the pulsation in the intake air and to the engine vibrations. For example, a hose with a spiral wire insert would therefore be suitable as the line material.



1	Hose elbow 90°	Ø70 mm
2	Flexible hose piece, cannot be shortened	Ø70 x 1000 mm
3	Sleeve	Ø70 mm
4	Flexible hose piece, cannot be shortened	Ø70 x 500 mm
5	Rigid hose piece, can be shortened	Ø70 x 500 mm
All hoses can be used before the air filter as well as between the air filter and turbocharger.		

Recommended variant	Possible alternative
	



In order to increase the filter life the inlet opening for the intake air must be located in the least dusty zone of the machine and must also be protected against splashing water and rain (e.g. by means of a rain cap).

4.8.2 Design of the combustion air line/intake negative pressure

	Constant speed			Variable speed					
Speed n [rpm]	3,000	1,800	1,500	2,800	2,700	2,600	2,500	2,400	2,300
Power (kW)	49.7	36.4	28.8	55.0	53.2	51.3	49.3	47.9	45.9
Perm. intake negative pressure with brand new filter element * [mbar]	50.0	15.0	10.0	45.0	40.0	35.0	30.0	28.0	25.0
* with loaded filter @ n=2800 rpm approx. 30 mbar more									

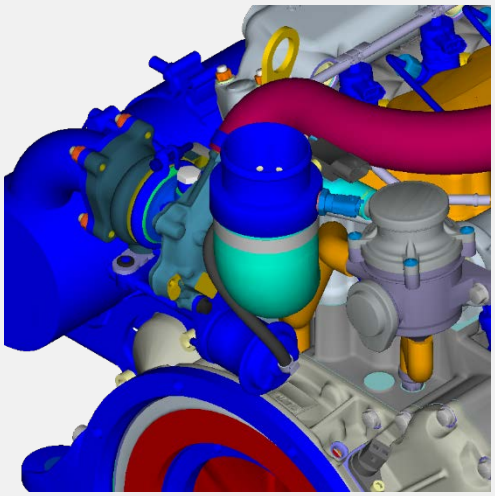
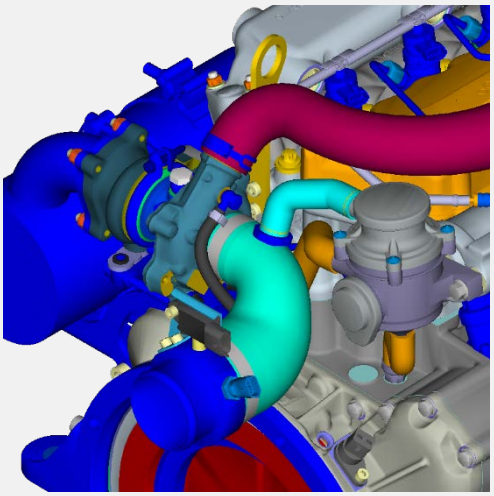
Here, the maximum permissible intake negative pressures are specified with full load and unloaded filter, the maximum loading of the filter is reached when the intake negative pressure at 2800 rpm and full load is 30 mbar above the value of the unloaded filter.

When designing the line for the intake system, a hose with a Ø 70 bore must be used between the air filter and exhaust gas turbocharger.

Quality → Flexafit HP/ NL21LIM

In the case of a 90° elbow, ensure that the elbow has a large radius as possible so that the bellows cannot be frayed by the pipe.
If a large radius cannot be realized, it is also possible to use an intermediate piece (90° pipe bend). Make sure that the pipes are completely sealed.
If necessary, the air supply line must be supported depending on the length in order to avoid damage to the intake system.

4.8.3 Possible connection options

Intake hose, vertical (standard)	Intake hose, horizontal
	

4.9 Lubricating oil

For operating the engine, it is important that the dipstick, oil filler, oil drain and oil filter are all easily accessible. If necessary, extensions are required for the oil filler and oil drain. Please request suggestions for this.

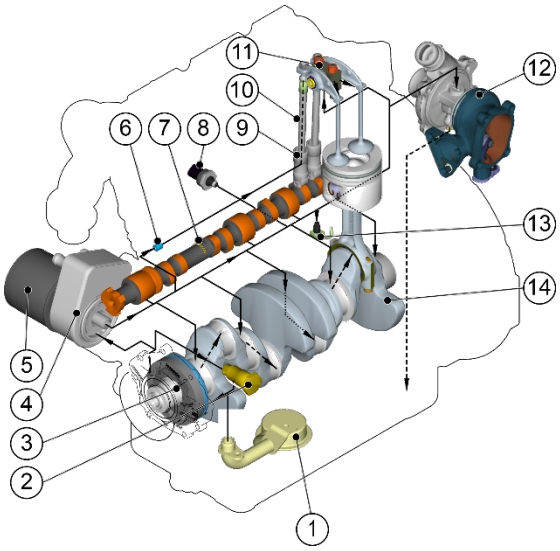
A tip:
Try to fill oil into the sample machine, drain the oil and change the oil filter. Only if you are convinced of the ease of carrying out this work after this test, the series machine will be maintained later in accordance with the Operator's Manual.

For the oil specification and oil viscosity, see Operator's Manual, chapter Engine oil.

4.9.1 Filling quantities

Filling quantity	7.0 l
Delta min/max	1.0 l

4.9.2 Lubricating oil system



1	Oil suction pipe
2	Oil overpressure valve
3	Oil pump
4	Oil cooler
5	Oil filter
6	Oil check valve
7	Camshaft
8	Oil pressure sensor
9	Roller tappet with hydraulic valve adjustment
10	Push rod
11	Bell crank support with spray nozzles
12	Exhaust gas turbocharger
13	Piston cooling
14	Crankshaft

4.9.3 Oil service points

CAUTION

Danger of burns

When working on the engine, there is a danger of burns from hot oil.

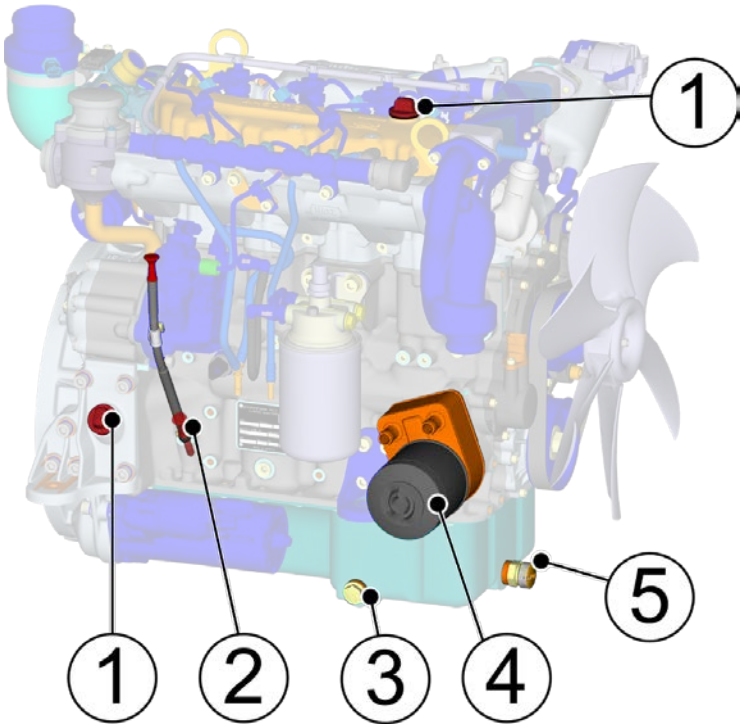
- Wear personal protective equipment (gloves).

CAUTION

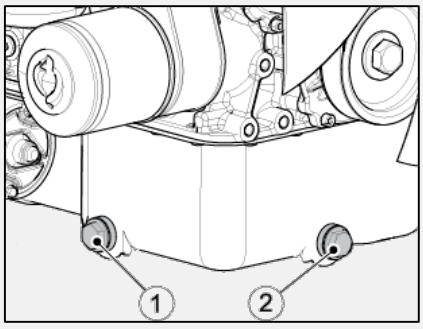
Danger of environmental damage from used oil

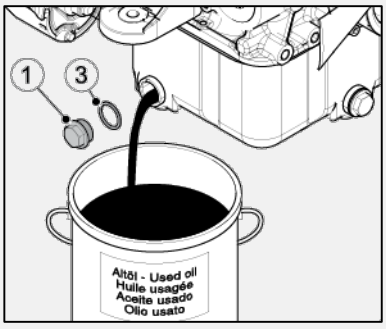
Used oil is water-polluting.

- 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.



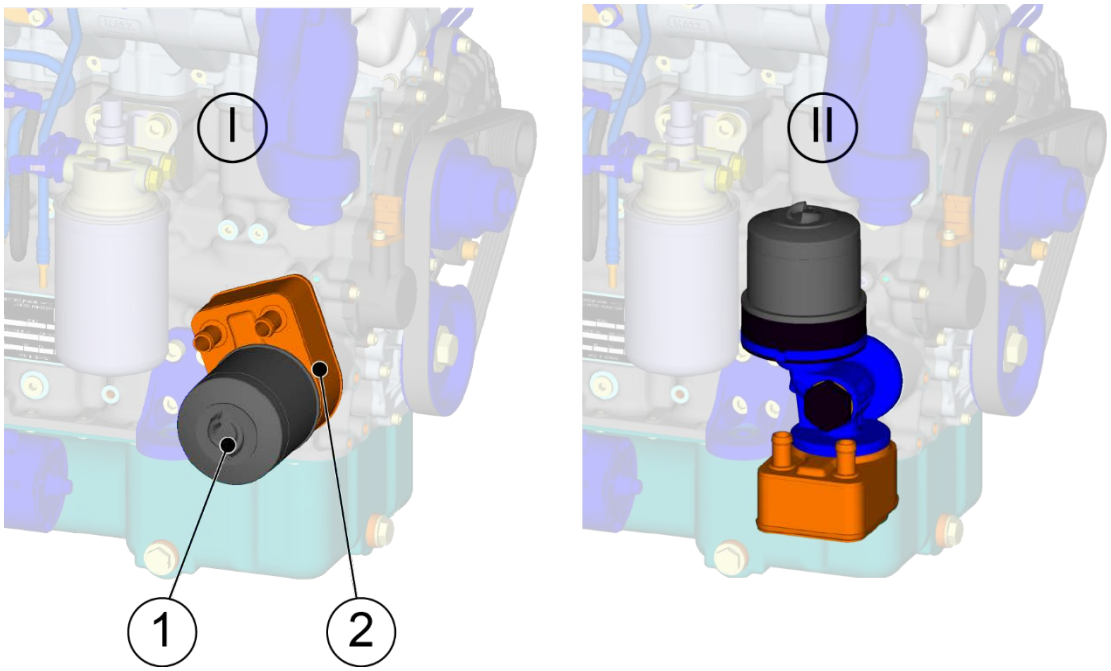
1	Oil filler
2	Dipstick (raised option)
3	Oil drain screw
4	Oil filter
5	Oil drain valve (option)





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

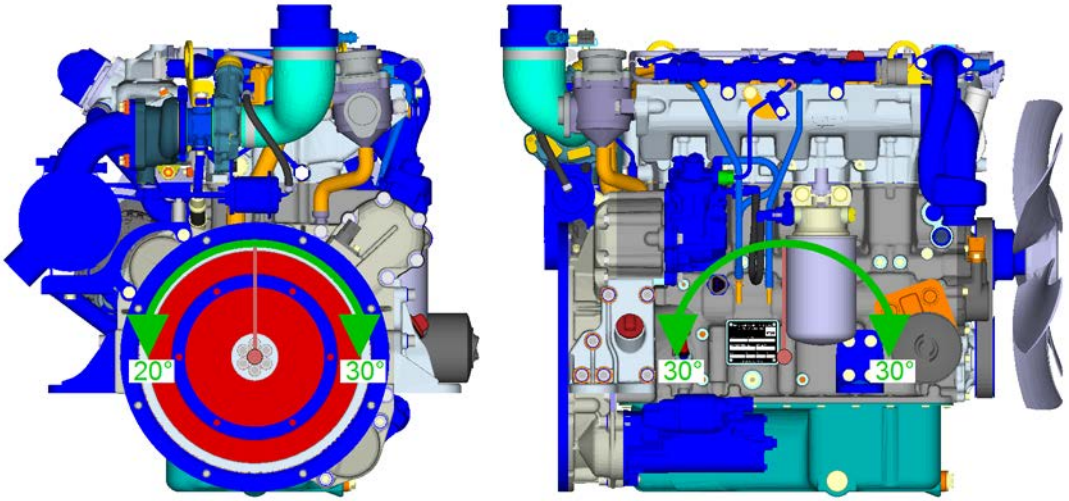
4.9.4 Oil filter mounting options



I	Horizontal mounting position (standard)
II	Vertical mounting position (with the vertical oil cooler, lowering of the mounting position is required, see chapter *4.2.3.1 spacer* discs to engine mounting, page *31*)
1	Oil filter cartridge
2	Oil cooler

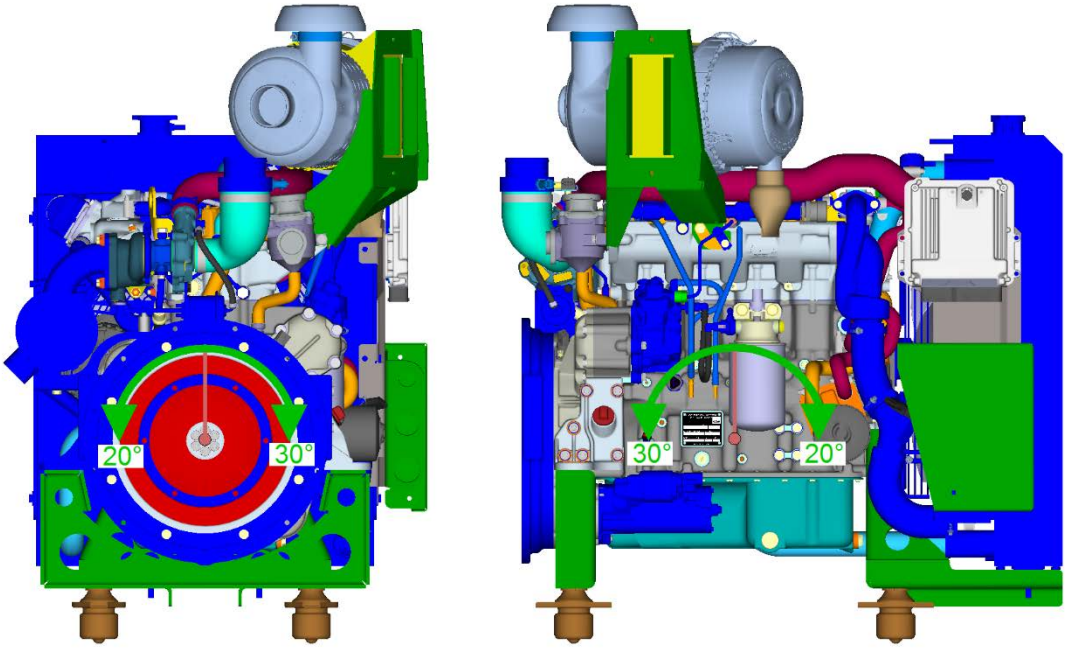
4.9.5 Permanent incline

4.9.5.1 Permanent incline F2F



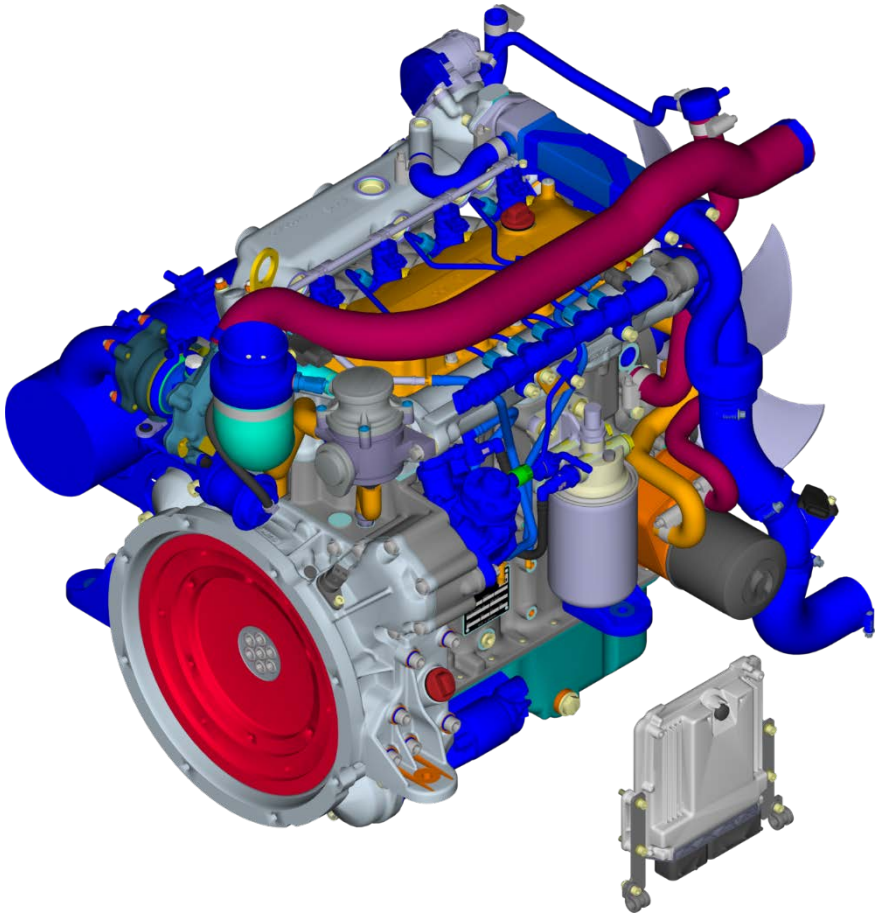
If the engine with a permanent incline is used in an application, the dipstick must be modified to the permanent skew (new Min / Max mark).
Please contact the HATZ main factory in this regard.

4.9.5.2 Permanent incline OPU



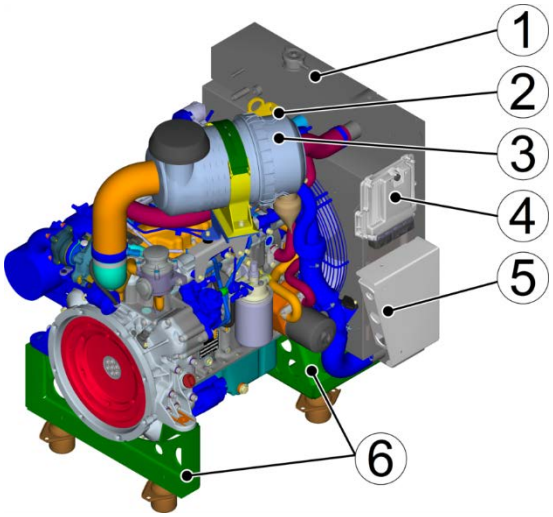
5. Engine specifications

5.1 Fan-To-Flywheel (F2F)



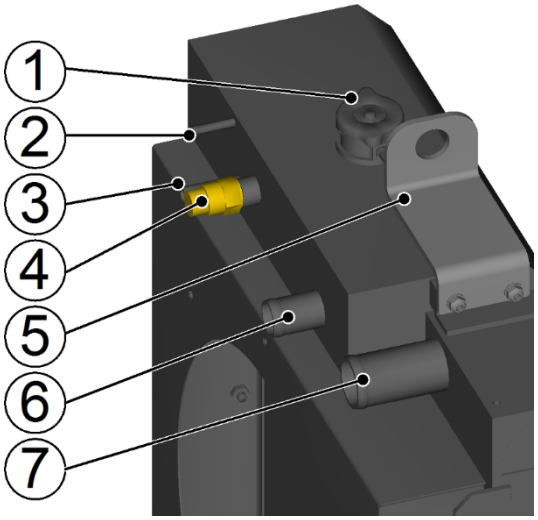
Scope of delivery of Fan-To-Flywheel (F2F)	
• Basic engine with EGR	• Pulley
• Main fuel filter	• Poly v belt
• Exhaust gas turbocharger	• Water pump
• Exhaust manifold	• EDC17CV54 control unit
• DOC mounted radially	• Oil filter horizontal with oil cooler
• Starter 12 V	• Flywheel 6.5" and 8"
• Alternator and governor 12 V	• Flywheel housing SAE 5
• Cable harness, engine side	• Extractor fan (central)
• Glow plug	• Dipstick
• Sprocket	• Sheet metal oil sump
• Engine brackets	• Thermostat
• Connection point for air filter	• Cable fixing EDC 17CV54

5.2 Open Power Unit (OPU)



1	Combination cooler (engine radiator/charge air cooler with integrated expansion tank)
2	3rd lifting eye
3	Air filter (mounting optional)
4	EDC 17CV54 control unit
5	Holder for plugs
6	Engine mounting on bracket

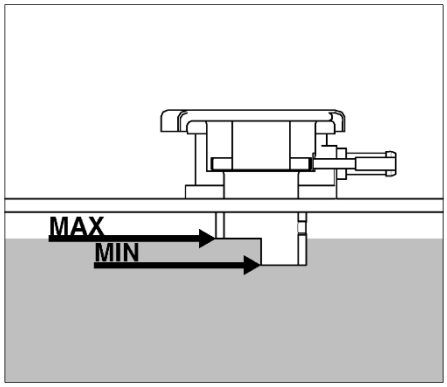
5.3 Combination cooler with integrated expansion tank



1	Opening for coolant
2	EGR radiator venting
3	From the integrated expansion tank to the water pump
4	Coolant level sensor
5	Holder for OPU radiator (mounting aid not intended for lifting complete machines)
6	Supply from thermostat
7	Charge air cooler inlet

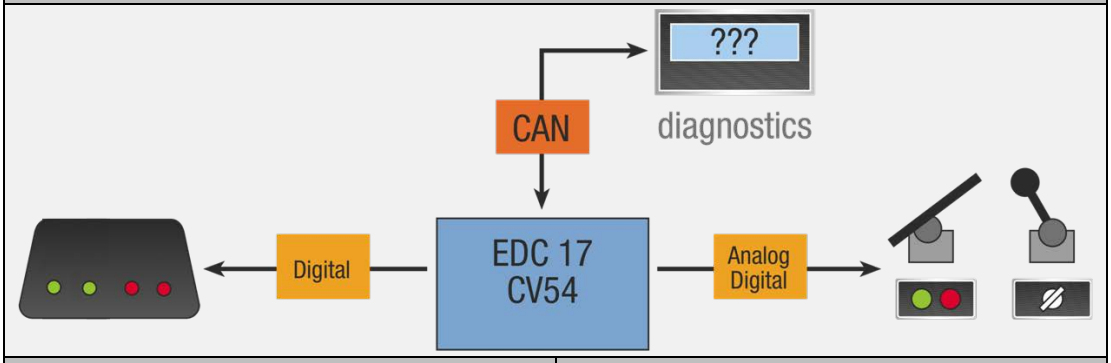
Filling quantity, max	13.2 l
Filling quantity, min	12.6 l
Difference, min/max	0.6 l

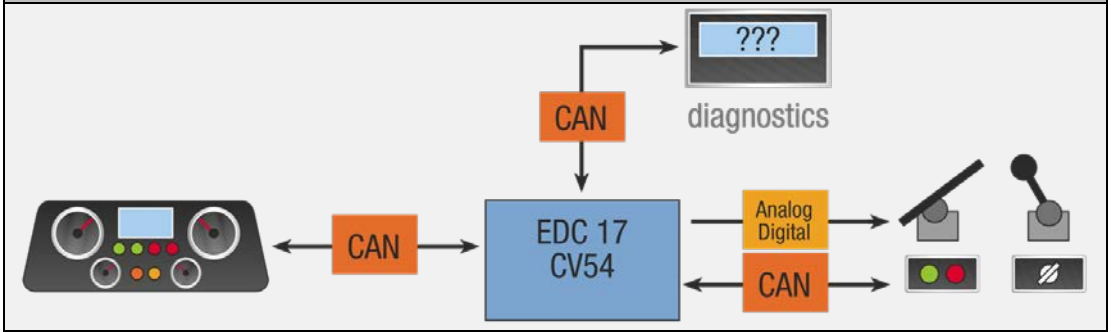
5.3.1 Checking the coolant level



6. Electrical system

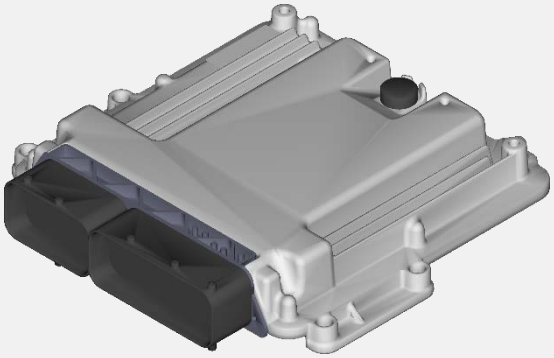
6.1 Engine control

Engine control – without CAN bus	
	
Simple instrument panel	**Machine basic control**
• Oil pressure lamp • Cooling water temperature warning lamp • Maintenance lamp • Engine protection warning lamp	• Gas pedal • Brake pedal • Hand throttle • Engine start • Engine stop

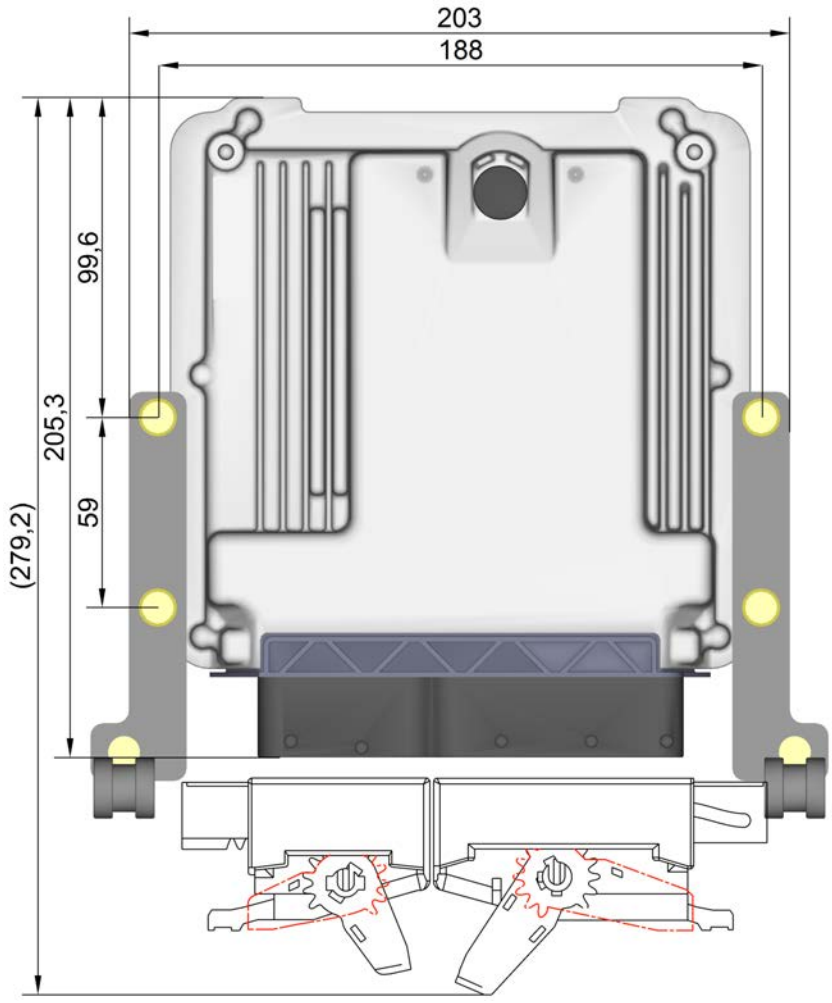
Engine control with CAN bus, optional A/D control+CAN displays or full CAN bus check	
	
Completely optional CAN control panel	**Machine basic control**
• Torque check • Torque limiting • Speed check • Speed limiting • P-degree check • Vehicle speed check	• Gas pedal • Brake pedal • Hand throttle • Engine start • Engine stop

Possible engine control with CAN bus. Optional control analog/digital and only information output via CAN display, or also full CAN control including setpoint (e.g. speed)

6.1.1 Control unit

Bosch control unit EDC 17	
Installation conditions: • Ambient temperature: -32 - +80 °C • Spray water protected • Dust tight • Tropicalized • Heavy duty • Vibration decoupled from engine separated	

6.1.2 Control unit setup



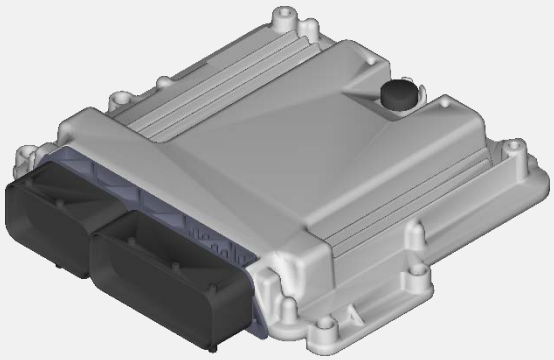
Cable harness plugged in

Cable harness unplugged

Weight: 850 g

6.1.3 Connections

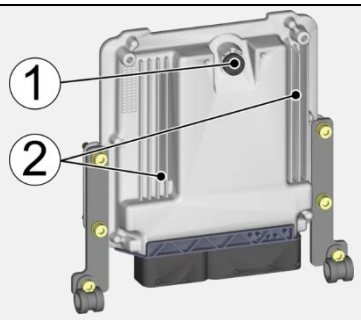
Analog/digital inputs/outputs	
Outputs:	
	**- Digital**
	• Diagnostics lamp (flashing code) • Maintenance indicator lamp • Overtemperature lamp • …
Inputs:	
	**- Analog**
	• Gas pedal (dual potentiometer)
	• Multistate switch
	**- Digital**
	• Remote start/stop
	• Diagnostics request
	• …
CAN bus SAE J1939	



6.1.4 Control unit installation

When installing the control unit, make sure that water does not penetrate the control unit via the wiring harness.
The control unit is mounted on the four locations (4 x M6, 8 Nm) available.
No standing or permanently running water permitted in the pressure compensation element (DAE) sealing area and the circumferential groove area (cover/base/measuring strip).
Both wiring harnesses must be fastened to the plug connectors with the supplied cable fixings to protect against thrust and traction forces (strain relief).

1	DAE sealing area (ambient pressure sensor)
2	Temperature measurement points (to max. + 105 °C)



NOTE

The control unit must be separated from the engine and vibration-decoupled. Mounting on the radiator permitted (see OpenPowerUnit).

6.1.5 Diagnostics tool

The HDS diagnostics tool (Hatz Diagnostic Software) is available for troubleshooting and analyzing the engine parameters. For details, contact your **HATZ subsidiary**.

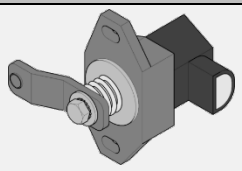
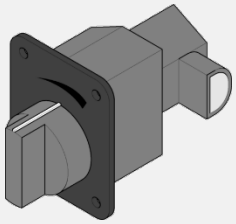
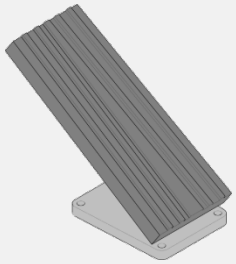
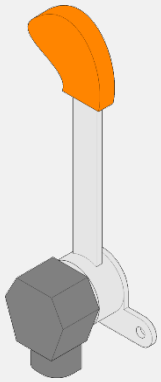
6.1.5.1 Flashing codes

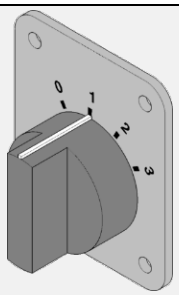
See Operator's Manual, chapter Faults/Flashing code table.

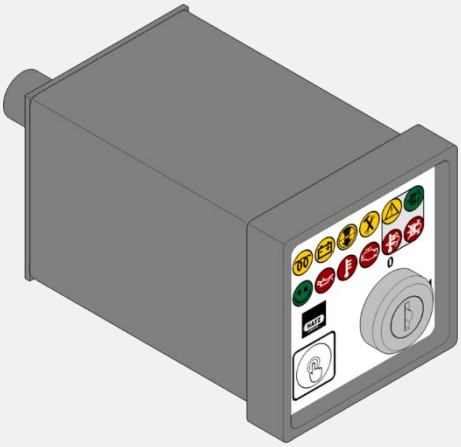
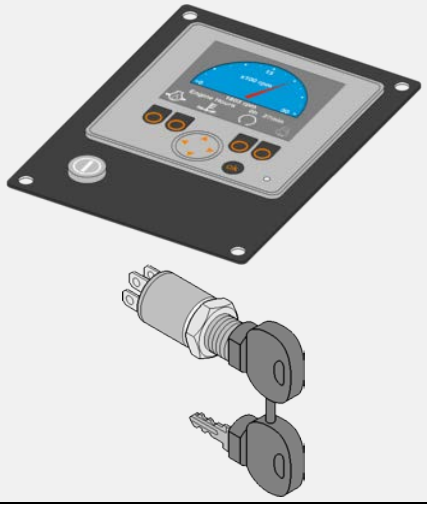
6.2 Engine monitoring

6.2.1 Actuators (speed adjustment), display instruments

Between the EDC 17CV54 control unit interface and the (instrument box, CAN multifunction touchscreen, CAN multifunction key display,…) control module, the maximum cable length must be 10 m with a cable cross section of 1 mm².

Speed adjustments	
Bowden cable (analog or CAN)	
Gas rotary knob (analog or CAN)	
Gas pedal (analog or CAN)	
Hand lever (analog or CAN)	

Stepped speed switch (optional 2, 3 or 4 steps)	
Speed limiting for CAN-enabled speed adjustments possible.	

Display instruments	
Hatz instrument box (TTCAN)	
CAN "IFM" display (a start device is required for this display instrument)	

6.3 Battery sizes

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 battery terminal.
- 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.
- Carry out the engine connection according to the enclosed wiring diagram.

DANGER

Danger of explosion from flammable substances

There is a danger of explosion from flammable gases.

- Keep the battery away from naked 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.

Battery capacity		
12 V	**Max.**	**110 Ah/450 A DIN**
24 V	**Max.**	**66 Ah/300 A DIN**

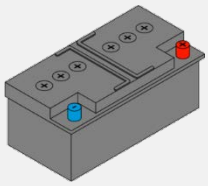
If a larger battery capacity is placed inside the machine than permitted by the general release, additional measures are essential.An example of this is the use of the starter batteries of a much larger main engine when the HATZ engine within the application is used as an auxiliary unit. Please consult the nearest **HATZ service center** in this regard.

Temperature limits of normal batteries:

- From approx. + 60 °C, the self-discharge increases significantly and the service life decreases significantly
- From approx. - 22 °C, half-charged batteries can freeze. A frozen battery must be thawed prior to charging
- Fully charged batteries have a freezing threshold of approx. - 60 °C

Conclusions concerning the charge state of a battery are possible from measuring the voltage when loaded. A discharged battery has the rated voltage at the terminals when unloaded!

6.3.1 Battery recommendations

Required capacity of a 12 V/24 V lead battery at an air temperature during the start of:			Power of the 12 V starter in kW	Max. permissible capacity of the 12 V lead battery	Power of the 24 V starter in kW	Max. permissible capacity of the 24 V lead battery (2x12 V)	
Engine type	Min. 0 °C req.	Min. -18 °C req.					
4H50	**60 Ah**	**100 Ah**	**2.2**	**110 Ah**	**3.0**	**2x66 Ah**	

Besides the battery capacity, the cold test current is decisive for the cold start behavior. If a battery is used with a larger cold test current than recommended, the starter can be mechanically and thermally overloaded and damaged. If a battery with a too low cold test current is used, the cold start behavior deteriorates.

6.3.2 Installation location

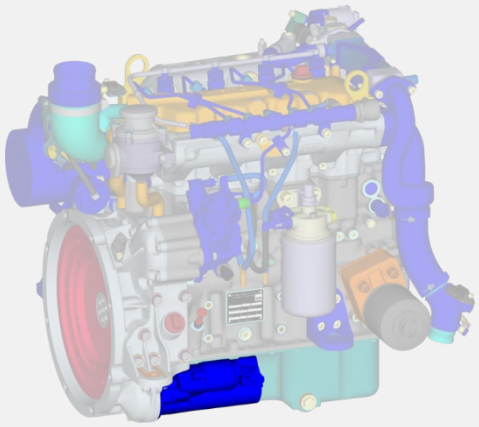
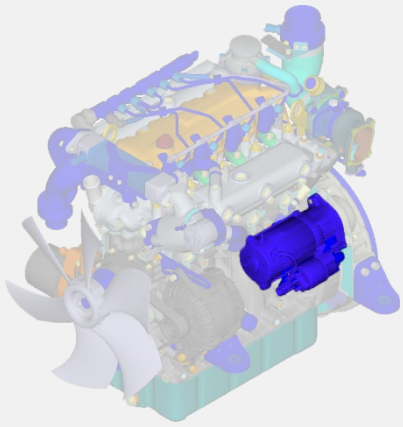
The positioning of the battery installation in the engine space must be verified by temperature measurements.

NOTE

- The max. ambient temperature of the batteries is +60 °C
- Installation of the battery easily accessible for maintenance work
- Secure the battery mount against inherent movement
- Ventilated battery installation location
- Mounting of electrical switches in the vicinity of the battery not permitted due to sparking and thus potential explosion hazard

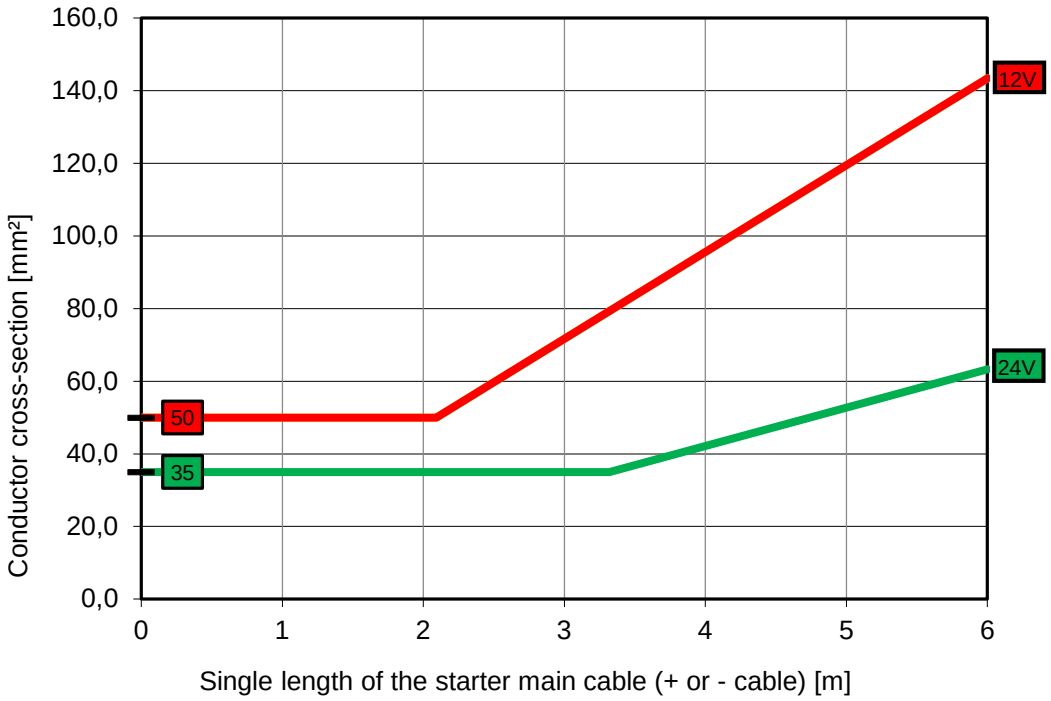
6.4 Starter

6.4.1 Possible starter mounting positions

Standard starter position	Alternative starter mounting position
	

The alternative starter mounting position on the exhaust side can, e.g. be required for marine applications. Here, the starter must be protected from the diesel oxidation catalytic converter by the heat shield (see chapter *9.2 Contact* protection, page *81*).

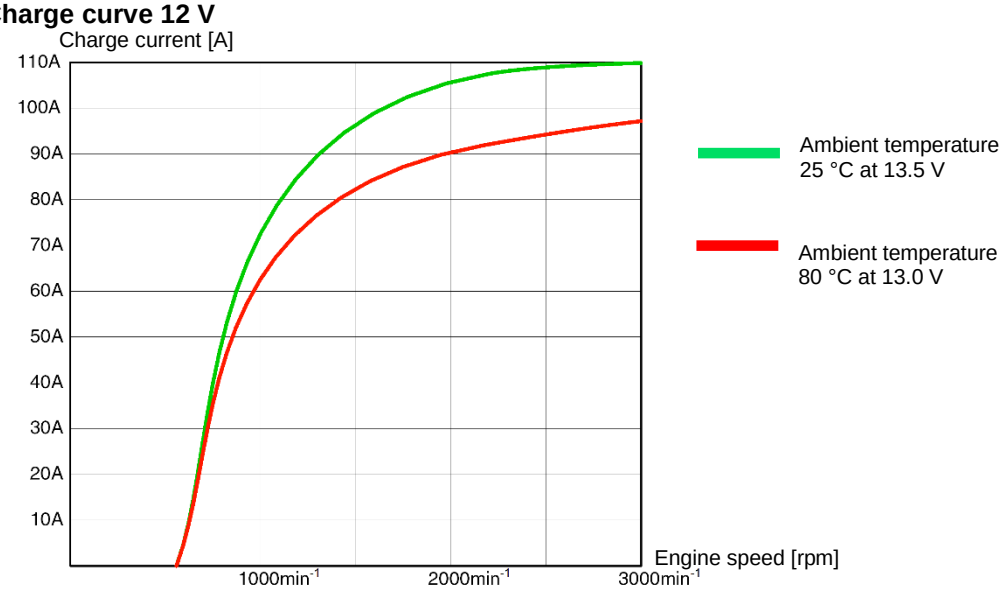
6.4.2 Dimensioning of the cables between the starter and battery



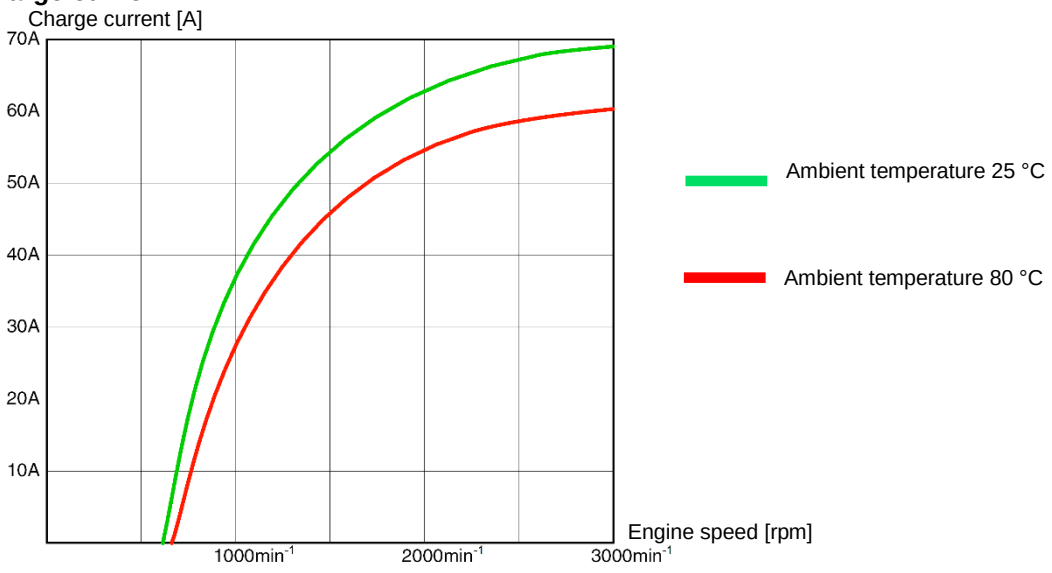
6.5 Alternator

Type	Air cooled compact alternator with internal fan	
Belt drive	V-ribbed belt profile PK 6 (6 grooves, Ø 49 mm)	
Translation with KW belt wheel Ø 104 mm	$n_{altenator}$ = 2.05 * n_{engine} [rpm]	
Type	**12 V**	**24 V**
Max. current at engine speed 2880 rpm	110 A	60 A
Max. current at engine speed 860 rpm	55 A	18 A
Control voltage at 20 °C	14.25 - 14.75 V	28.10 - 28.70 V

6.5.1 Charge curve 12 V

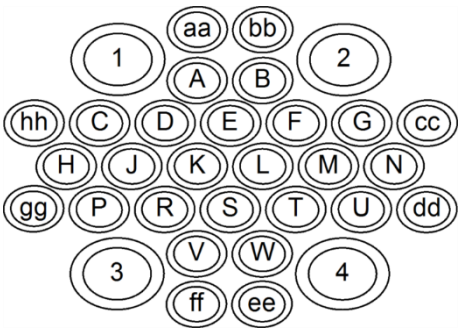


6.5.2 Charge curve 24 V



6.6 Hatz terminal designation

Customer plug connector assignment				
No.	**Designation**	**Bosch-Hatz ID**	**Cable code**	**Counterpiece**
1	B+15 A customer supply voltage	1 - from fuse block	1	
2	UB2 2 A switched B+	K29 V8	24	
3	B-	0 - from ground point	0	
4				
A	B+ 1 A voltage supply T15/50	from fuse block	1	
B	Ignition on terminal 15	I_S_T15 - K88	15	
C	Starter signal terminal 50	I_S_T50 - K35	50	
D	Charge control	No. 2	2	
E	Lack of oil pressure	O_S_OPLP - K27	4	
f	Engine overtemperature	O_S_OHTL - K94	5	
G	Air filter maintenance switch	O_S_AFLMP - K10 (Highsider)	17	
H	Engine running lamp	O_S_ERL - K50	ML	
J	Pre glow display	O_S_GLWLP - K92	13	
K	Highside diagnostics lamp	O_V_DIA – K70	DIA+	
L	Maintenance interval	O_S_MLP1 – K09	IV	
M	Lowside diagnostic lamp	G_R_DIA – K65	DIA-	
N	Engine start switch	I_S_ENGSA – K67	9	
P	Engine stop switch	I_S_STP – K31	11	
R	Diagnostics request switch	I_S_DIAREQ – K66	DR	
S	Speed signal	O_F_ENGN – K49	22	
T	Speed selector switch	I_A_MSSRPM – K33	14	
U	Ground for digital inputs	G_R_DIG - K87	0	
V				
W				
aa	CAN 0 High	B_D_CANH0 – K54	CAN+	
bb	CAN 0 LOW	B_D CANLO – K76	CAN -	
cc	B-	0 - from ground point	0	
dd	UB2 2 A switched B+	K29 –V8	24	

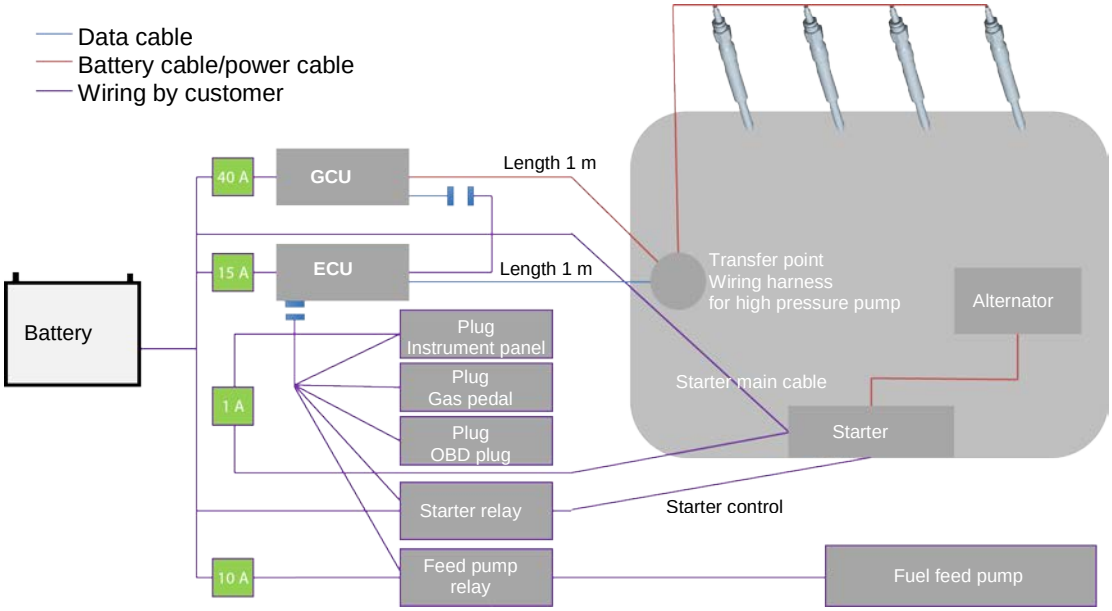


Max. permissible voltage drop on all control cables		
12 V	<	1.5 V
24 V	<	3 V

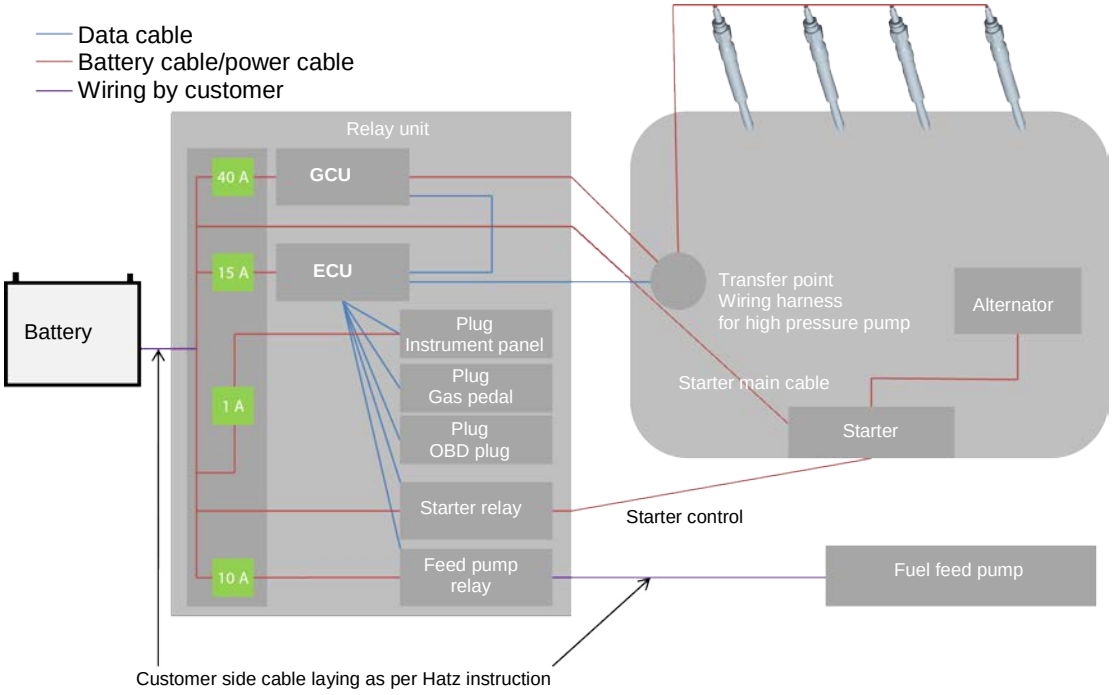
Ensure a good ground connection. Where possible, do not mount the switch box on the engine but attach it to vibration-free components. For special starting methods such as spring or pneumatic starter starters etc., please contact us.

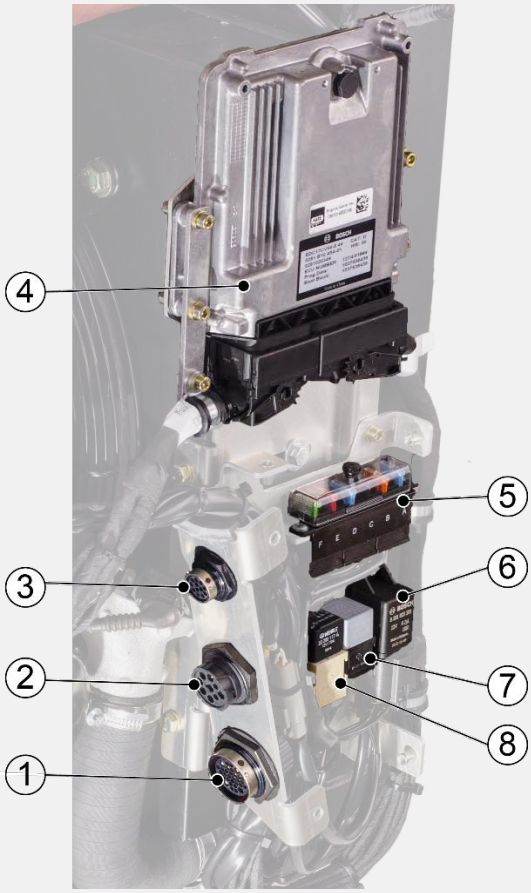
6.7 Cabling

6.7.1 Cabling of "Fan 2 Flywheel (F2F)"



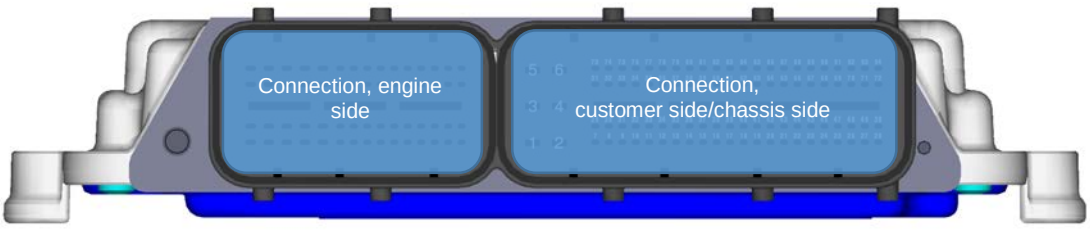
6.7.2 Cabling of "Open Power Unit (OPU)"



Cabling of OpenPowerUnit (OPU)		
	**1**	Instrument panel/Customer control unit: ITT Cannon TN7S14-0012S1L TN6S14-012P1L
	2	Diagnostics ISO 15765: BEMO HD10-9-1939-PE- B022 2411-002-1805
	3	Gas pedal (analog): ITT Cannon TN7S14-0012S1L TN6S14-012P1L
	4	EDC 17CV54 (ECU) engine control unit
	5	Fuseholder
	6	Glow control unit (GCU)
	7	Fuel feed pump relay
	8	Start relay

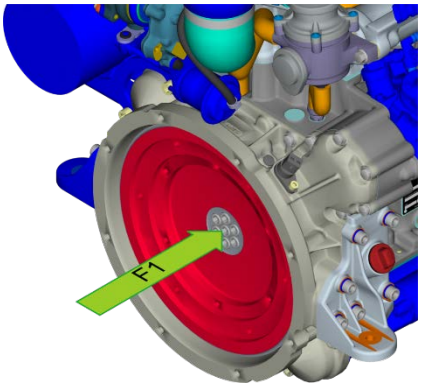
Use/Fusing		
A	Engine control unit B+	15 A
B	Glow control unit (GCU)	40 A
C	Control unit T15+T50	1 A
D	Customer control unit	15 A
E	Fuel feed pump relay	10 A
F	Start relay	30 A

6.7.3 Pin assignment/Cabling by customer



7. Power take off

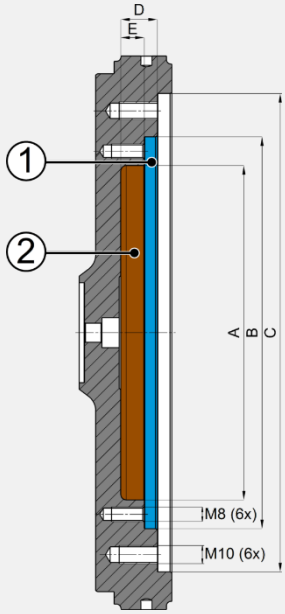
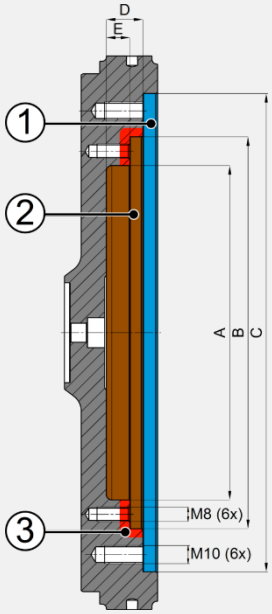
7.1 Main take off (flywheel side)



Axial (F1)	3000 N, direction dependent
Max. perm. mass moment of inertia	0.2 kgm²
$J_{flywheel+engine}$	0.234 kgm²

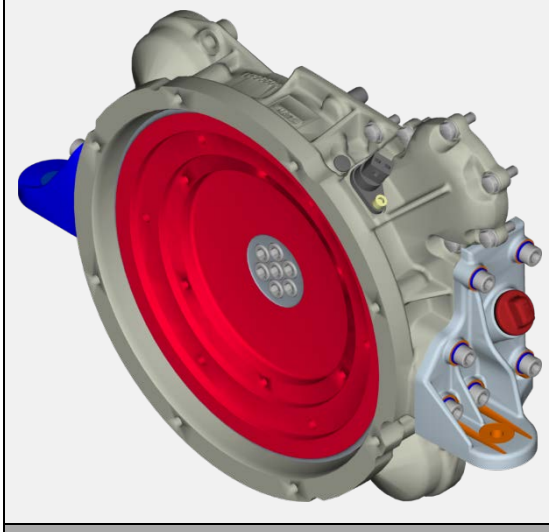
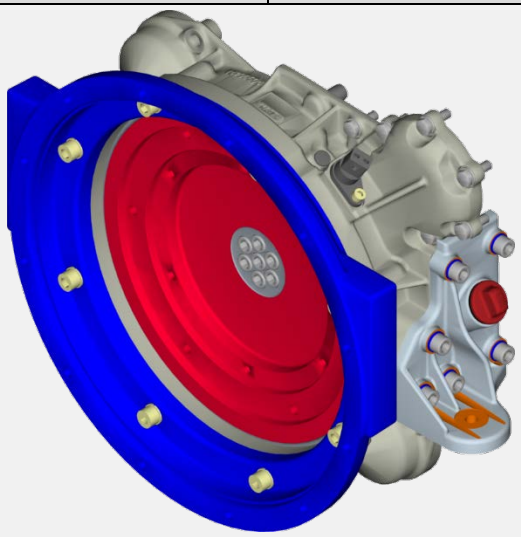
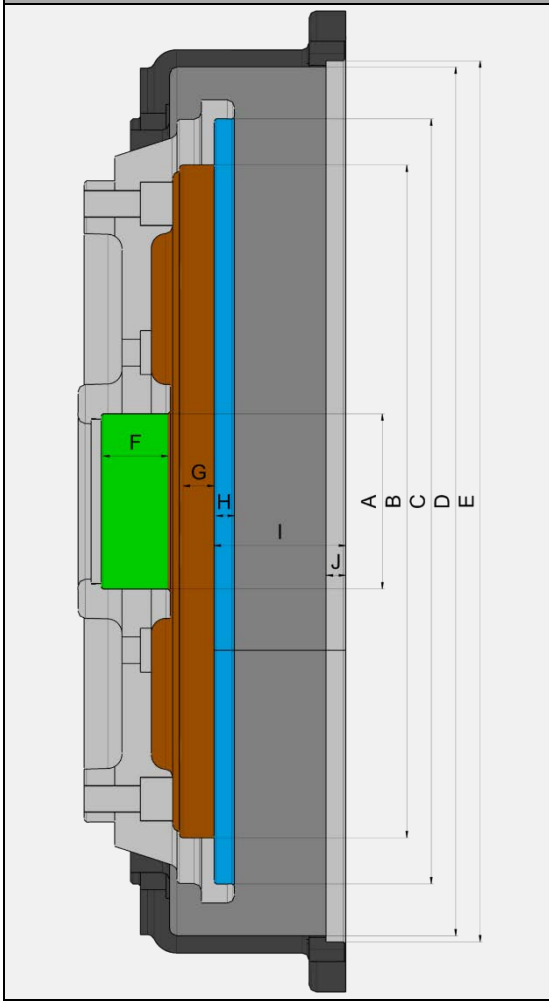
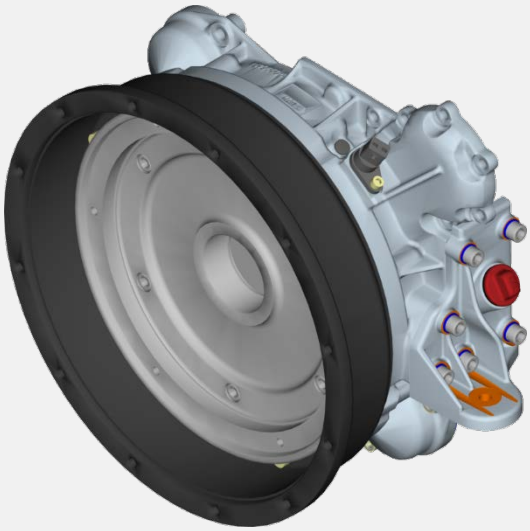
SAE 5 (6.5" flywheel) and optional SAE 4 (8" flywheel) connection housing will be available for the main take off.

7.1.1 Combined flywheel with connection housing/10 inch flywheel

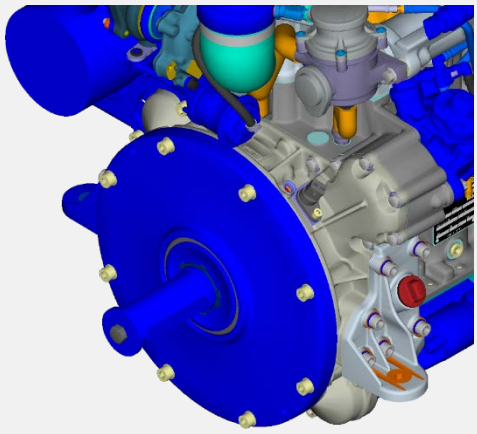
6.5 inch	8 inch
	

1	Coupling diameter
2	Indentation
3	For the manufacture of a combined flywheel required deviation from the SAE standard

A		B		C		D		E	
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch
184.2	7 ¼	215.90	8 ½	263.52	10 ⅜	12.9		20.1	

Connection housing	Flywheel	Connection housing	Flywheel
SAE 5	Combined flywheel 6.5" and 8"	SAE 4	Combined flywheel 6.5" and 8"
			
10 inch flywheel		SAE 4 connection housing	
			

7.1.2 Connection housing with outside bearing



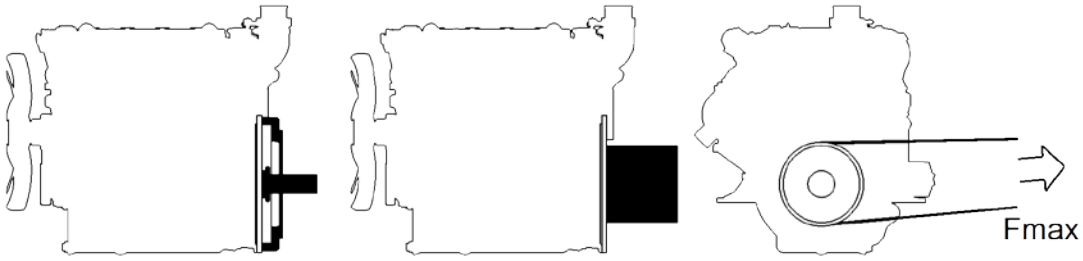
Permissible transverse forces on outside bearing	
Distance to flange level [mm]	**Permissible tensile force [N]**
0	9,000
45	9,000
90	4,500
135	3,000
180	2,250
225	1,800
270	1,500

Shaft end	Ø 48 h7 x 110 / Ø 50h7 x 110
Feather key	100 x 14 P9

7.1.3 Power take off

7.1.3.1 not separable

The drive elements offered may only be used in accordance with the instructions in the dimension sheets and these Assembly Instructions. The permissible axial offset of flexible couplings must not be exceeded.



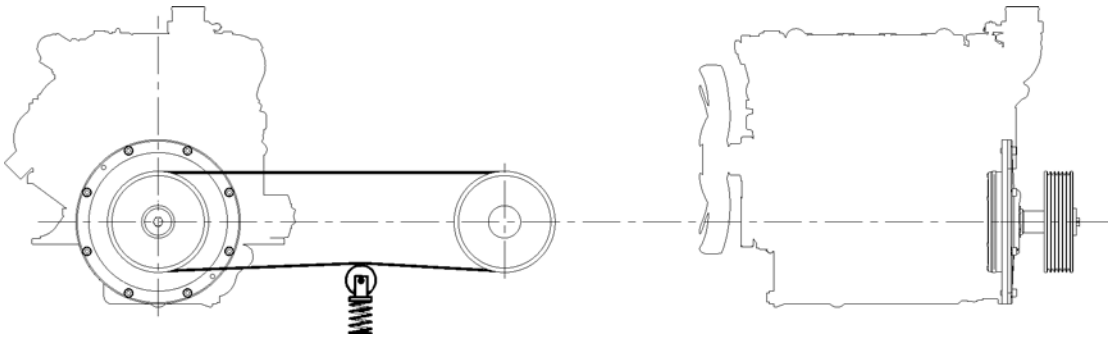
The capacity of the power take offs on the engine can be found in this chapter.
The overload of power take offs, particularly by uncontrollable belt tensioning devices, can cause damage to the bearings and shaft fractures.

If the permissible limits cannot be adhered to, please contact your responsible **HATZ subsidiary**. They will show you possible solutions.

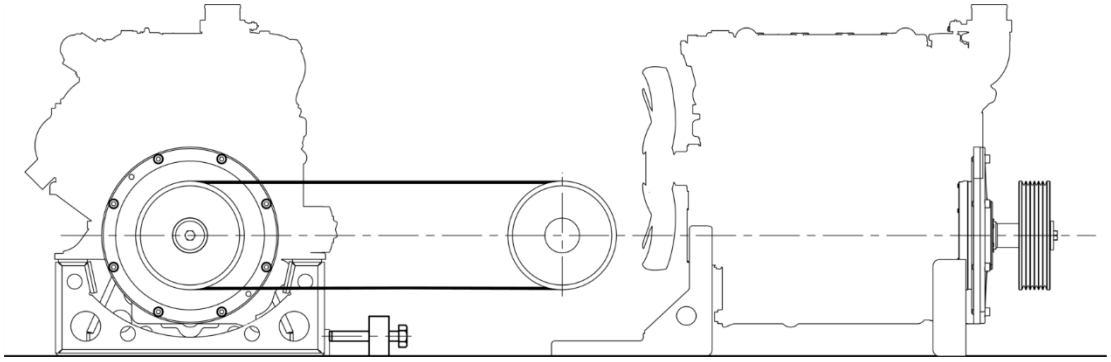
7.1.3.2 Belt drives

Since the type of belt tension can have a greater impact on the size of the bearing load than the size of the torque to be transmitted, the following applies:

a) **Controllable belt tensioners guarantee** that bearings and shafts are not overloaded and do not break. The belt tension is controllable by a spring-loaded idler pulley or hydraulic belt tensioner, for example.



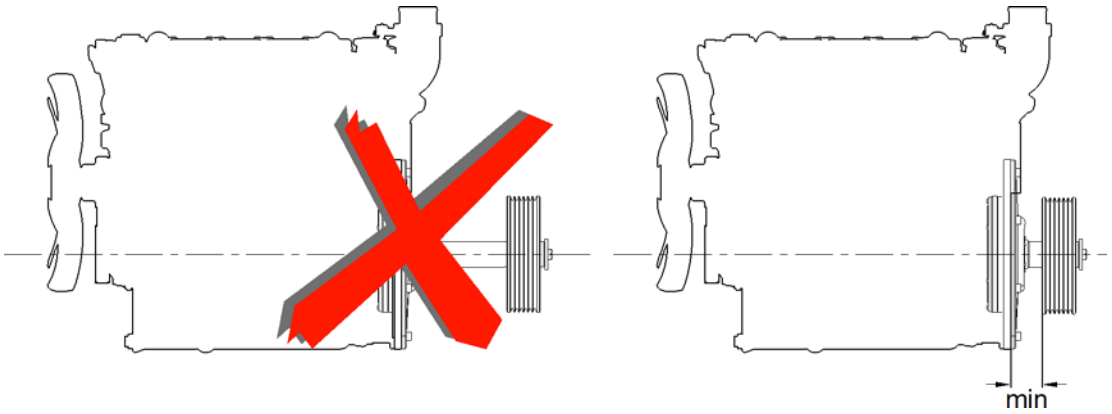
b) **Uncontrollable belt tensioners** have the risk of overloading the bearings due to excessive tension forces. These tensioners include tensioning screws, prestressing via flexible belts etc.



Conclusion: HATZ recommends the use of controllable belt tensioners to limit the bearing forces and avoid premature wear.

Two further recommendations for belt drives:

- 1. Mount the pulley as close as possible to the bearing mount to keep the bearing load low (see chapter *7.1.2 Connection housing with outside bearing*, page *73*.
- 2. Pulley on the engine as large as possible in order to keep the belt tension low.



7.1.3.3 Hydraulic pumps on the main take off

CAUTION

Risk of injury or danger of engine or hydraulic pump damage caused by failure to comply with the installation instructions/Operator's Manual of your hydraulic pump.

- As the operator of the machine, you must ensure that all people working on the machine are familiar with the content of these instructions.
- Before working on the machine, read these instructions carefully, paying special attention to the safety notes.
- Fulfill all required safety conditions before working on the machine.

$$F_{perm} = \frac{1.7 * 10^6 [Nmm]}{(l + 53.1)[mm]}$$

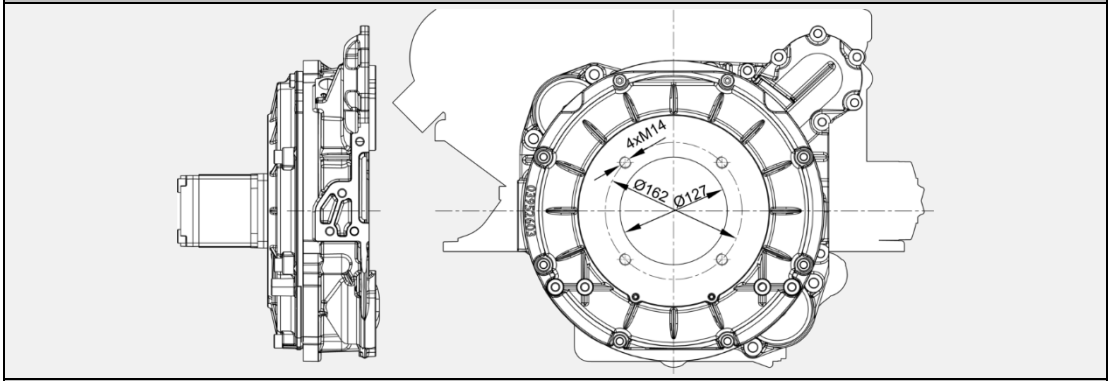
$$F_{perm} = maximum\ permissible\ alternating\ load$$

$$l = distance\ of\ attack\ point\ to\ the\ flange\ connection\ on\ the\ connection\ housing$$

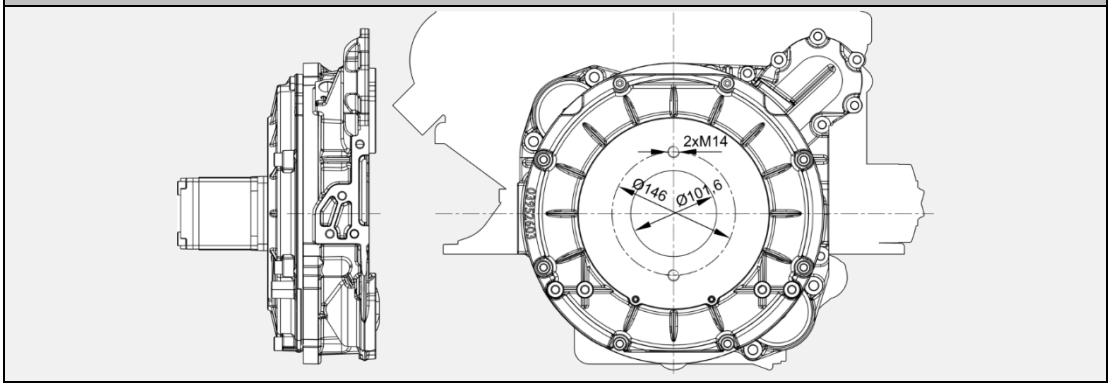
To install your hydraulic pump, only use the screw dimensions and qualities recommended by the hydraulic pump manufacturer. For mounting on the engine, heed the most recent installation instructions for your hydraulic pump.

Your hydraulic pump manufacturer will be pleased to assist.

SAE size 4



SAE size 5



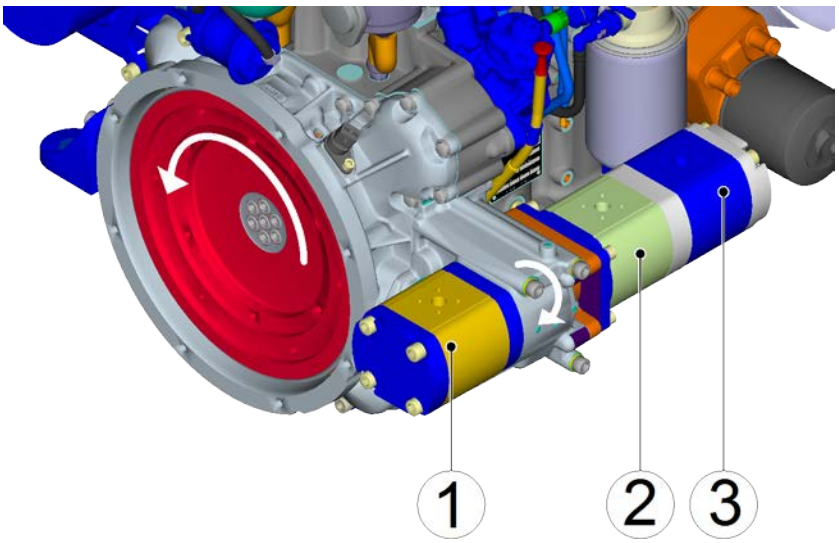
Other attachments for hydraulic pumps are available on demand.
We are at your disposal for details on flange and shaft dimensions of the planned hydraulic pump. Hatz offers hydraulic pumps in different sizes. Please contact your **Hatz subsidiary**.

7.2 Power take off

7.2.1 Hydraulic power take off

7.2.1.1 Hydraulic pump mounted by HATZ

A maximum of three hydraulic pumps can be flanged onto the power take off.



M_{max} = 100 Nm
$n_{hydr.}$ = 1.1 x n_{engine} rpm

Standard available hydraulic pumps:			
	Hydraulic pump	**Description**	**Sense of rotation**
1	2-bore HP Ø50 (12 ccm) (22 ccm) (30 ccm)	Without flange, 4.6 to 31 cm³/rev. splined shaft DIN5482 B17x14 - 9 teeth	Counterclockwise hydraulic pump
2	4-bore HP Ø80 (12 ccm)	4-bore flange, 4.6 to 31 cm³/rev. splined shaft DIN5482 B17x14 - 9 teeth	Clockwise hydraulic pump
3	SAE-A HP Ø82.55 (22.5 ccm)	2-bore flange, 4.6 to 31 cm³/rev. splined shaft SAE J744 16-4 9T 9 teeth	Clockwise hydraulic pump

Other hydraulic pumps can be provided on demand.

8. General limits of use

There is no power reduction up to 1460 m above sea level. Only above 1460 m is the engine power correspondingly reduced by the ambient air pressure. The engine has an ambient pressure sensor in the control unit (ECU).

8.1 Cold start capability

Cold start with 12 V equipment	-25 °C
Cold start with 24 V equipment	-32 °C -40 °C (possible with special release)

These specifications apply up to a height of 1460 m above sea level.
At higher altitudes, the cold-start capability deteriorates compared to these values.

With an additional load on the engine, e.g. due to a hydraulic pump, the start speed of the engine drops. With an increasing additional load, the battery capacity (for maximum permitted battery capacity, see chapter *6.3 Battery* sizes, page *64*) and engine oil (oil viscosity) parameters must be modified in such a way that the minimum start speed of the cold engine is > 100 rpm.

The driven machines should be uncoupled during the starting process. If this cannot be guaranteed, e.g. in hydraulic systems, an increase in the minimum starting temperature can be expected. This cold start limit temperature is then determined experimentally depending on the application.

8.2 Extreme conditions

The engine is mostly not used at the standard reference point of Performance Standard ISO 3046-1 (+ 25 °C, 100 m above sea level, 30% rel. humidity), but in locations with higher altitude and higher/lower temperature, usually also at higher relative humidity. Temperature rises caused by sunlight under a cowling must be considered.

Due to climatic conditions that differ from the standard reference location (altitude, temperature, humidity, pollution), the capacity of the engine leads to power reductions or system adjustments for extreme operating conditions.

It is necessary therefore to consult HATZ in order to best match the system to the application.

9. Contact protection for machine safety

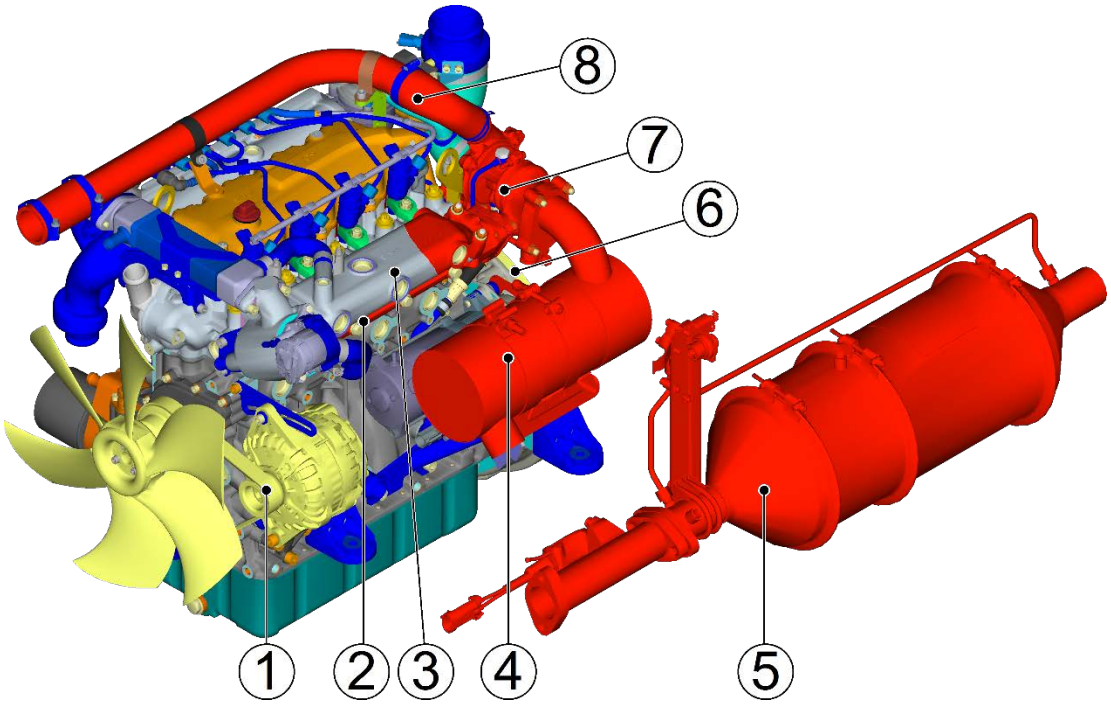
It is the responsibility of the manufacturer to heed and comply with the safety rules that apply to an engine in a finished machine.
The following chapter shows which contact protective devices are available from HATZ.

An overview that shows the hot surfaces (diesel oxidation catalytic converter, exhaust gas turbocharger (ETC), ...) and rotating parts (flywheel, fan, poly v belt, ...) appears below. There is an increased risk of injury here.

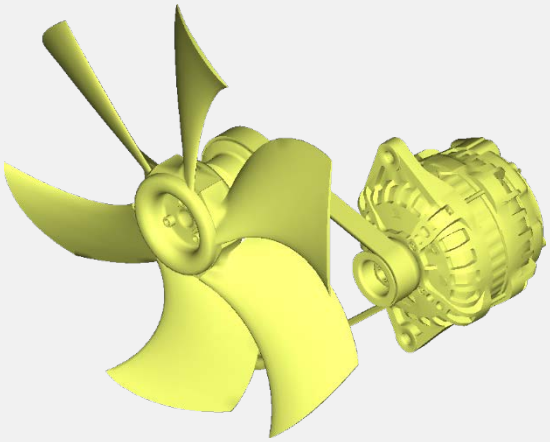
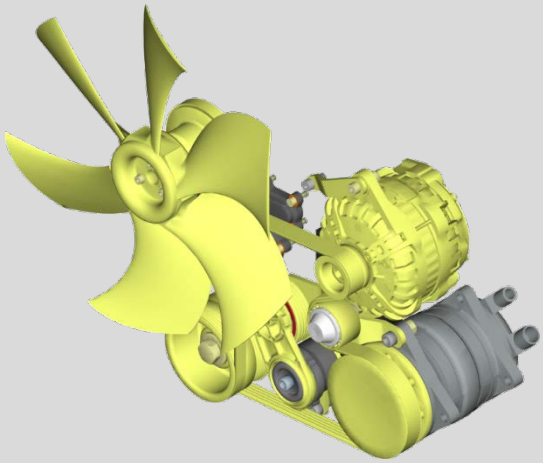
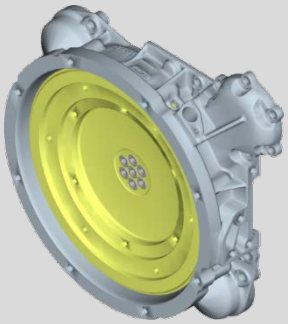
It is the duty of machine manufacturer to ensure that all safety precautions (e.g. contact protection for the diesel oxidation catalytic converter) are taken for the whole machine so that any injury from hot surfaces and rotating parts is excluded.

The protective devices are available from HATZ.

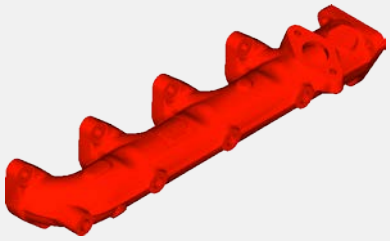
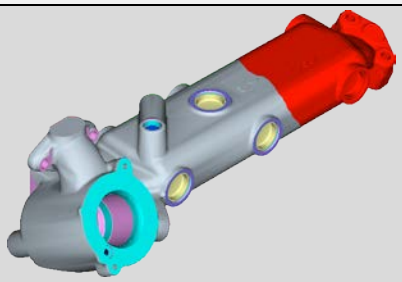
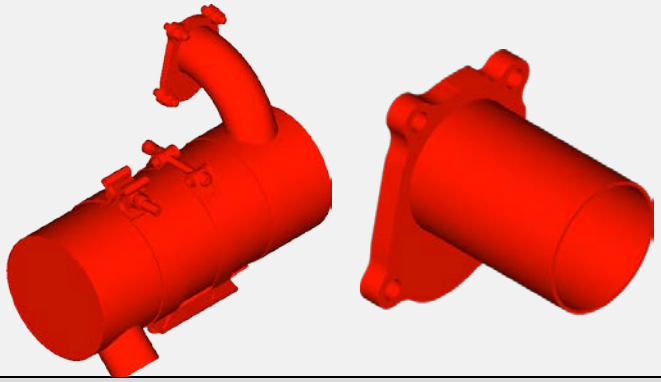
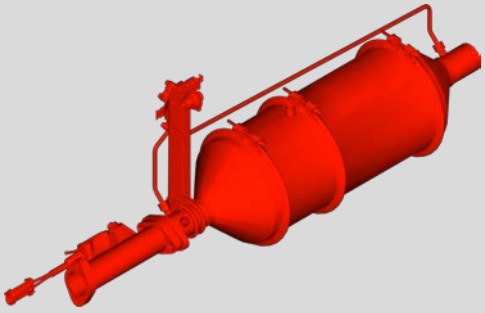
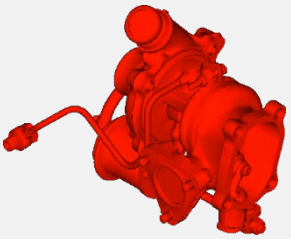
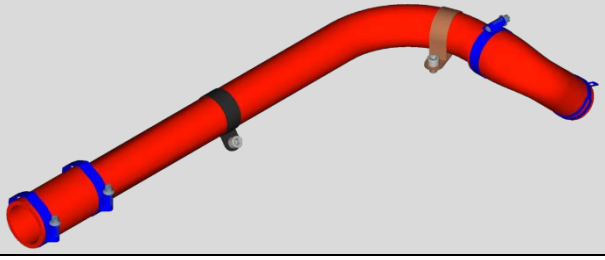
9.1 Hot surfaces and rotating parts



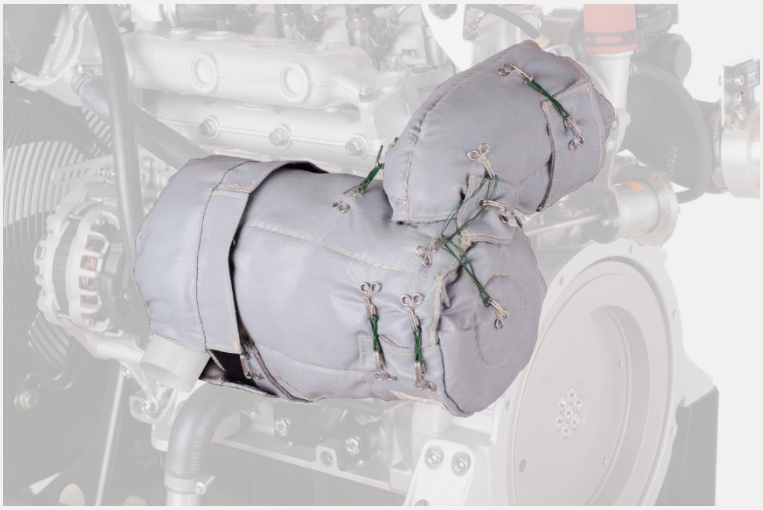
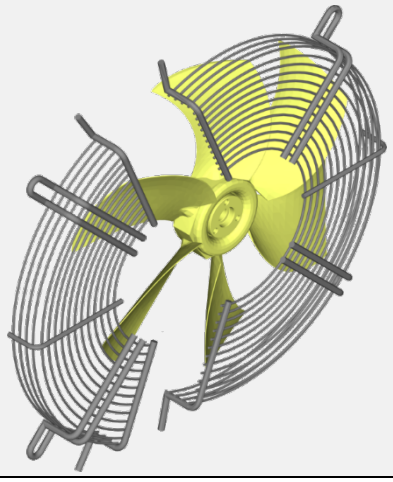
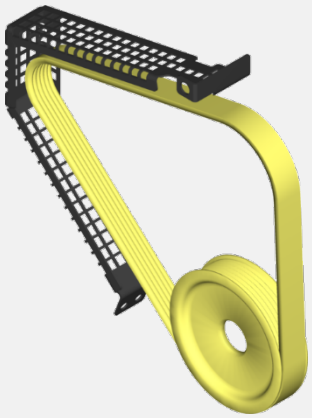
Rotating parts:

Pos.	Designation	Function
1	V-belt drive (fan, V-ribbed belt for alternator)	
	Raised fan, A/C compressor	
6	Flywheel	

Hot surfaces:

Pos.	Designation	
2	Exhaust manifold	
3	EGR precooler	
4	Diesel oxidation catalytic converter (DOC)/flange for turbocharger	
5	Diesel particulate filter (DPF)	
7	Exhaust gas turbocharger (ETC)	
8	Power pipe	

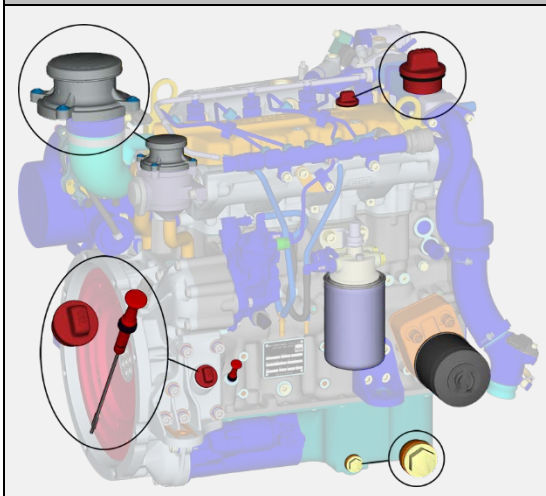
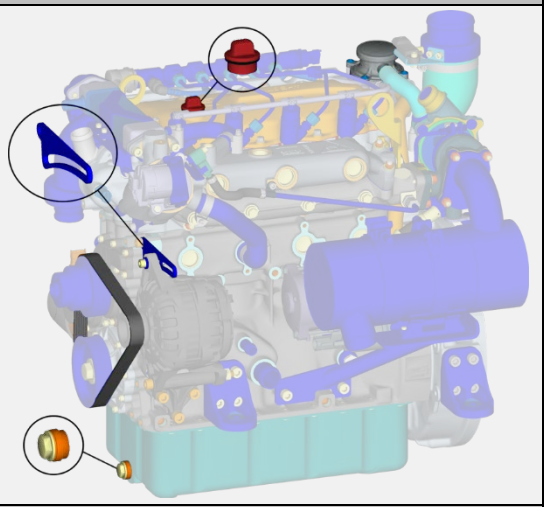
9.2 Contact protection

Diesel oxidation catalytic converter/exhaust gas turbocharger	
 The outlet from the DOC can also be rotated with the contact protection in all directions.	
Contact guard for fan (optional)	**Contact guard for poly V belt (optional)**
	

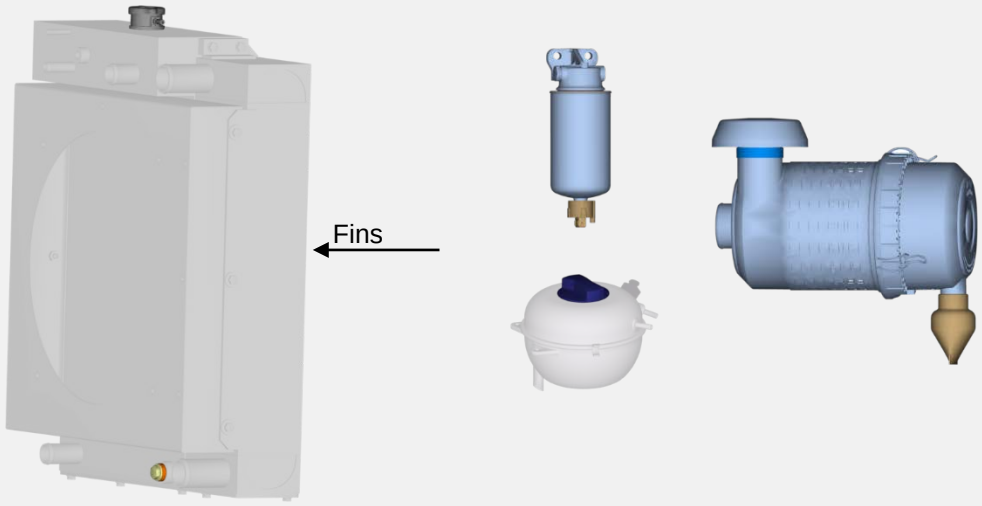
10. Maintenance

10.1 Accessibility of service points

When installing the engine, make sure that all service points are easily accessible and the service label on the engine and/or machine is legible.
If there is no easy access, there is a risk that the necessary maintenance work is not carried out at all or not carried out at the right time.
This can lead to increased wear and premature failure of the engine.

Service points on operating side	Service points on exhaust gas side
	

Service points on chassis side



10.2 Maintenance intervals

Detailed information for carrying out maintenance intervals can be found in the Operator's Manual.

Every 8–15 operating hours or every day before starting
Check the oil level
Check the intake area of the combustion air
Check the radiator fins for dirt accumulation
Check the cooling system
Every 500 operating hours or every 2 years
Change the engine oil and oil filter
Change the fuel prefilter
Change the main fuel filter
Check the poly v belt
Check the coolant concentration
Change the oil separator of the crankcase ventilation
Check the screw fitting
Clean the radiator fins
Change the air filter cartridge (or according to indicator)
When indicated
Drain the water separator
If necessary, every 3,000 operating hours at the latest
Replace the poly v belts
Every 4,000 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)
Every 4 years
Change coolant

NOTE

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

- Change the engine oil and oil filter
- Check the screw connections (do not retighten the screws for attaching the cylinder head)

11. Test of the engine installation (checklist)

The engine can only function so well as its installation situation dictates. Engine damage caused by an unfavorable engine installation, a neglected power calculation or a non-matching speed selection cannot be considered as warranty cases.

Please use the previous guidelines as a checklist during the final test on the engine installation.

We recommend proceeding as follows:

11.1 Assembly note

HATZ diesel engines are efficient, robust, and have a long service life. 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 may 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 notices and warning labels on the engine and keep them in a legible condition. If a label should become detached or difficult to read, it must be replaced promptly.
  For this purpose, contact your nearest HATZ service center.
- Any improper modification of the engine will result 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 prior to commissioning the engine.

11.2 Preparations for commissioning

- Check the delivered parts for completeness, damage, and other noticeable issues

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 machines in closed-off or poorly ventilated rooms.
- Do not breathe in the exhaust gases.

11.3 Testing of engine choice and engine environment

- Is the speed correctly chosen, properly adjusted and matches the operating hours per year?
- Is the load on the engine in order?
- Has the climate at the place of use been taken into account?
- When installing the engine under a cowling or in a room, has the climate change been taken into account in the power calculation?
- As small a temperature difference as possible between the ambient temperature and the temperature immediately in front of the turbocharger is decisive for as long a service life as possible.
- Is the machine **vibration free/oscillation decoupled** as far as possible?

Have our recommendations for **engine attachment** been taken into account?

11.4 Testing of engine equipment

- Is the engine cooling system designed correctly?
- Are the fuel lines laid in a flexible and ventable manner?
- Is the (fuel) tank content large enough for the intended operating time?
- Is the engine adequately protected against environmental influences?
    - Dust formation
    - Driving rain
    - Corrosive substances in the air
    - Rock fall
- Where present, are the supply and return air lines flexible, laid with the correct dimension, and in the right place?
- Was the correct fault compensation response option chosen?
- Has the exhaust pipe (if present) been selected so the exhaust gas back pressure is within the tolerance band and was the exhaust pipe laid in a flexible manner?
- Are the load limits adhered to at the power take off points?
- Do the following parameters of the engine installation correspond to the requirements of the machine?
    - Vibrations
    - Speed stability
    - Start-up time
- Is the max. possible machine skew ≤ the max. engine skew?
- Does the machine correspond to
    - the **noise regulations** in the specified fields of use?
    - the **exhaust gas regulations**?
    - the **safety regulations**?
    - all relevant **statutory regulations** (e.g. noise emission, exhaust gas emission, low voltage, electromagnetic compatibility, functional safety …)?

11.5 Testing of accessibility to operating and service points

- 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 from 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.

It must be possible to carry out operating and maintenance work easily.
The more accessible the service points, the more reliable the engine is maintained and the better it will work. Poorly accessible service points are not recognized by service personnel as service points, which affects the service life of the engine.

Please ensure that there is good accessibility to the operating and service points by carrying out the necessary manual actions personally.

Operating points:

(see also type sheet and Operator's Manual):

Service points:

(See Operator's Manual and chapter *10.1 Accessibility of service* points, page *82*)

- Dipstick
- Oil filler
- Oil drain
- Oil filter
- Cooling water filling
- Coolant drain
- Radiator (fins)
- Air filter
- Crankcase housing venting filter (ProVent)
- Belts (fan, alternator)
- Cooling air passages
- Battery
- Main fuel filter
- Fuel prefilter with water separator.
- Is the engine easy to remove for repair work?
- Diagnostics interface
- Fuseholder

11.6 The installation approval

HATZ - Ruhstorf reserves the right to installation inspection and installation approval in series engines. For this, please contact the respective subsidiary. The installation inspection is carried out by **HATZ Ruhstorf** or the relevant
HATZ representative/subsidiary. The warranty commitment for the engine in series machines is linked to the installation approval.

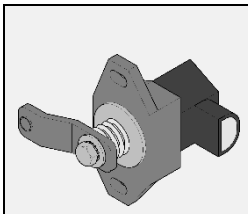
11.6.1 Prerequisite for carrying out the installation inspection

Before an installation inspection is performed with cooling capacity measurement, the following preparatory work must be carried out by the machine manufacturer and the following prerequisites fulfilled:

- The application should correspond as close as possible to the series condition
- The application must be operational for the measurements
- Any coverings (e.g. for sound optimization) on the machine must be fitted for measurements and correspond to the series status
- Cables, hoses etc. must be laid and connected
- The complete machine electronic system must be installed and fully operational
- Display and warning elements must function properly
- All power take offs (main take off, auxiliary take off(s)) must be operational and sealed
- The duration and carrying out of the installation inspection can vary due to the complexity of the application

12. Functional safety

12.1 Speed adjustment



All variable analog speed setpoint transducers supplied by Hatz (gas pedal, hand lever etc.) have a redundant speed setting (control loop 1: 0.5-4.5, control loop 2: 0.25-2.25 V)
If the speed is specified via a speed selection switch (multi-state switch), no redundant setpoint is given.
Even with the speed setting via CAN bus, no redundant setpoint is given.

All variable speed setpoint transducers are also available in CAN variants.

12.2 Fault compensation reactions

There are 3 different engine settings for the fault compensation responses:

1) Emergency running (standard with variable speed)

Engine emergency running program: 1900 rpm maximum speed, maximum 50% torque

Failure speed setting, analog	Emergency running
Failure speed setting CAN or multistage switch	Lower idling speed

2) Stop engine (standard with constant speed)

The "Stop engine" option has the same fault compensation responses as emergency running, except for stopping the engine in the event of the following faults:

- Oil pressure min./max. or sensor failure
- Coolant level below min.
- Water in fuel or sensor failure
- Max. coolant temperature
- Max. oil temperature
- Max. intake negative pressure reached (air filter clogged) or sensor failure
- Max. charge air temperature or sensor failure
- Min. fuel low pressure or sensor failure

Failure speed setting, analog	Emergency running
Failure speed setting CAN or multistage switch	Lower idling speed

3) No fault compensation response

For all faults without any fault compensation response only a warning is issued.

Failure speed setting, analog: Fault message, no fault compensation response

Failure speed setting, CAN or multistage switch: Engine running with last known speed setting