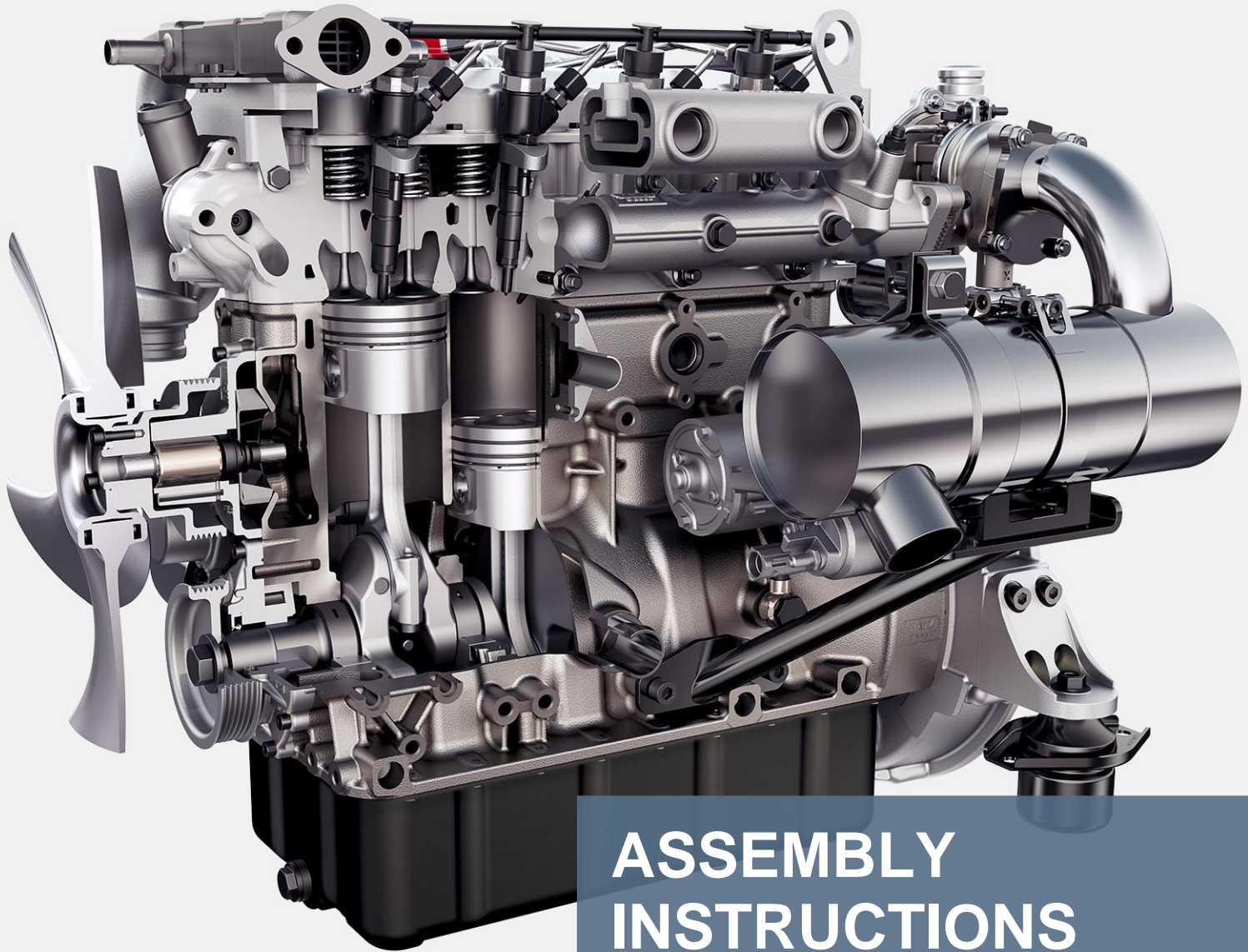


CREATING POWER SOLUTIONS.



ASSEMBLY INSTRUCTIONS H50

Hatz Diesel

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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 station** 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.

Modifications, which serve the technical improvements, are reserved.

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 that the manufacturer of the machine in which the engine is installed has specified and tested. Any other use is considered improper. Responsibility is not accepted by Motorenfabrik **HATZ** for any danger and 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 manual for diesel engine 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 manual for diesel engine 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 station**, please look at **www.hatz-diesel.com** on the Internet.

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 manual for diesel engine prior to commissioning in order to avoid danger to personnel and potential material damage.

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 manual for diesel engine. Damage resulting from non-observance of the assembly instructions or the manual for diesel engine 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 manual for diesel engine 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 from 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 difficult to read, it must be replaced promptly. For this purpose, contact your nearest **Hatz service station**.
- Any improper modification of the engine will result in a loss of liability coverage for resulting damage. Only regular maintenance, as specified in the manual for diesel engine, will maintain the operating readiness of the engine.

If you have any questions, please contact your nearest **Hatz service station** 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. Motorenfabrik HATZ does not accept any responsibility 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 the manual for diesel engine.

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 in this manual.
- 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 14 and in chapter *1.2.3 Machine-specific safety instructions for maintenance work*, page 15 as well as in other chapters of these instructions and in the manual for diesel engine 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 only operate the machine 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 manual for diesel engine.

Obligations of the operating and maintenance personnel

Personnel assigned with operating and maintaining the machine must have read and understood this manual for diesel engine 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 this manual for diesel engine.

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 this manual 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.
NOTICE	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 this manual for diesel engine or additional documentation from other manufacturers or the carrier.
	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, manual for diesel engine 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 this manual.
- Before working on the machine, read these manuals 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 8.




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: <ul style="list-style-type: none">• 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 18).

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 station**.

Maintenance work

Maintenance work that goes beyond the scope described in this manual for diesel engine must only be performed by qualified technicians (see chapter *General information*, page 6). Independent maintenance work and constructional changes to the machine, especially to the safety equipment, are not permitted.

Safety equipment

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

General safety instructions



DANGER

Danger to life and danger of injury due to failure to follow the warnings on the machine, in the assembly instructions and in this manual for diesel engine.

- Follow the warning instructions on the machine, in the assembly instructions and in the manual for diesel engine.
-



WARNING

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

- The personnel must have read and understood the assembly instructions and the manual for diesel engine or 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 29).
-

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 manual for diesel engine 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 6).
- When disposing of parts that can no longer be used, do so in accordance with local environmental regulations or send them to a recycling center.

Measures following maintenance and troubleshooting

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

Safety instructions for maintenance work



DANGER

Danger of explosion from flammable cleaning agents.

Cleaning with benzene is an explosion hazard. It is highly flammable, can become electrostatically charged, and can generate an explosive gas/air mixture.

- Use halogen-free, cold cleaners with a high 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 from ignoring the maintenance instructions.

- Only perform maintenance work when the engine is stopped.
 - Disconnect the negative battery terminal.
 - Protect the starting key from 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 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.
-

CAUTION

Danger of damage to the machine from incorrect engine cleaning.

- Let the engine fully cool down before cleaning.
 - Do not use gasoline or acid-based cleaning agents.
 - The components of the electrical equipment are protected against rain and spray water. Cleaning with a water jet is permitted. When cleaning with a high pressure cleaner, ensure a minimum distance of 100 cm between the high pressure nozzle and engine parts. Otherwise, engine parts can be damaged.
-




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.
- 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
	The engine may only be operated with fuel that is "EXTREMELY LOW IN SULFUR OR SULFUR FREE".



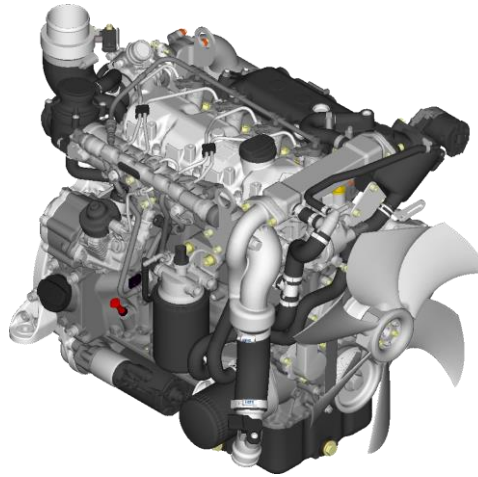
NOTE

The "fuel label" must be positioned close to the fuel cap.

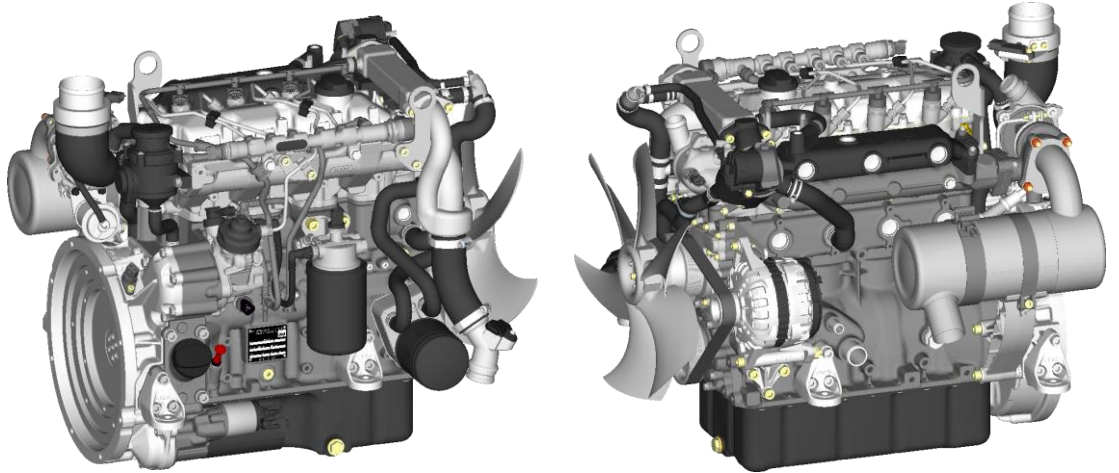
2. General information about the H50 engine

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, external exhaust gas recirculation (EGR) and diesel oxidation catalyst (DOC) or diesel particulate filter (DPF) with diesel oxidation catalyst.



Top view of the H50



Maintenance side (operating side) Exhaust gas side

Available exhaust gas relevant engine variations	Exhaust gas standard
With turbocharger and charge air cooler, without EGR, without DOC, without DPF	EPA TIER 2 EU IIIa (<37 kW) / EU II (>37 kW)
With turbocharger and charge air cooler, with EGR, with DOC, without DPF	EPA TIER 4 final / EU IIIb
With turbocharger and charge air cooler, with EGR and DOC/DPF combination filter	EU V/EPA TIER 4 final
EGR	Exhaust gas recirculation
DOC	Diesel oxidation catalytic converter
DPF	Diesel particulate filter

2.1 Technical data

2.1.1 Engine information and filling quantities

Type		3H50	4H50
Type		Liquid-cooled four stroke diesel engine	
Combustion system		Direct injection	
Injection system		Bosch common rail	
Number of cylinders		3	4
Bore/stroke	mm	84 / 88	84 / 88
Displacement	cm ³	1,464	1,952
Engine oil capacity	Approx . L.	5.0 ¹⁾	7.0 ¹⁾
Difference between the "max." and "min." mark	Approx . L.	1.0 ¹⁾	1.0 ¹⁾
Engine oil consumption (after the running-in period)	Max.	0.5% of fuel consumption (pertaining to full load)	
Engine oil pressure at oil temperature (100 ± 20 C)		2.5 bar to 4.5 bar	
Coolant quantity	Approx . L.	12.7 ²⁾ / 12.0 ³⁾	13.2 ²⁾ / 12.5 ³⁾
Sense of rotation		Left (view toward flywheel)	
Tappet clearance		Automatic hydraulic valve adjustment (maintenance-free)	
Max. permissible tilt position ⁴⁾		See chapter 4.9.5 <i>Continuous</i> skewed positions, page 75	
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⁾ HATZ radiator with integrated expansion tank.

³⁾ HATZ radiator with external expansion tank

⁴⁾ Exceeding these values causes engine damage.

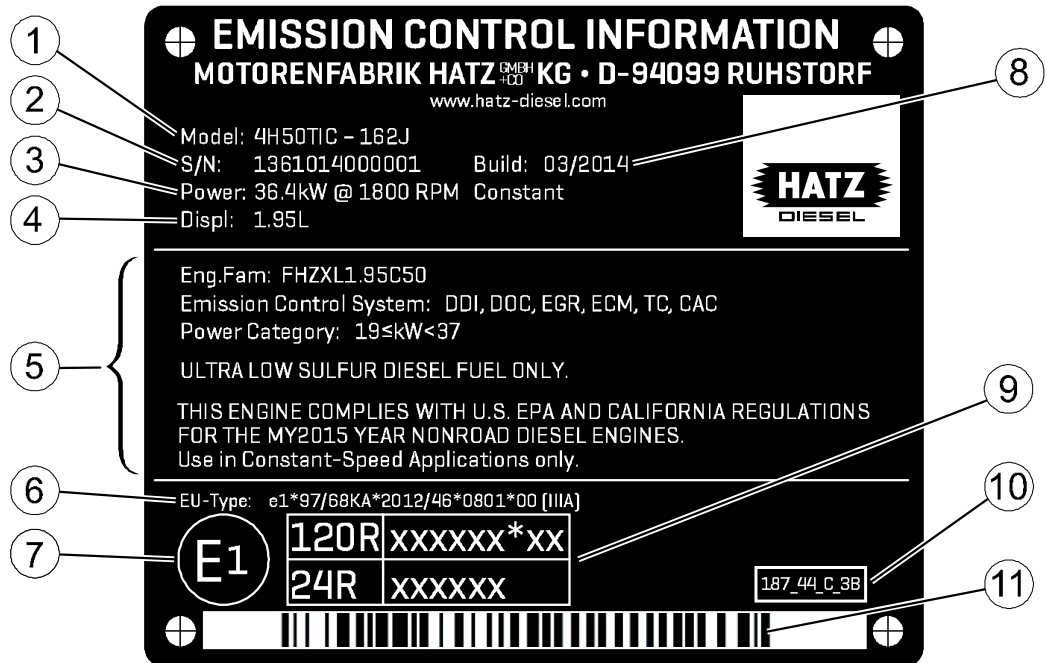
2.1.2 Engine specifications

Model	Description
TI	With turbocharger and charge air cooling
TIC	with turbocharger, charge air cooling, cooled exhaust gas recirculation (EGR) and diesel oxidation catalyst (DOC)
TICD	With turbocharger, charge air cooling, cooled exhaust gas recirculation (EGR), diesel oxidation catalyst (DOC) and diesel particulate filter (DPF)
OPU	Open Power Unit. Complete system with all components required for engine cooling.
Silent Pack	Open Power Unit with noise and weather protection capsule.

2.1.3 Weights (without operating fluids)

Type	Model		
	Fan2Flywheel (F2F)	OpenPowerUnit (OPU)	Silent Pack
3H50 TI	133	215	–
3H50 TIC	154	236	–
3H50 TICD	161	243	–
4H50 Ti	152	234	339
4H50 TIC	173	255	360
4H50 TICD	180	262	–

2.1.4 Engine type plate

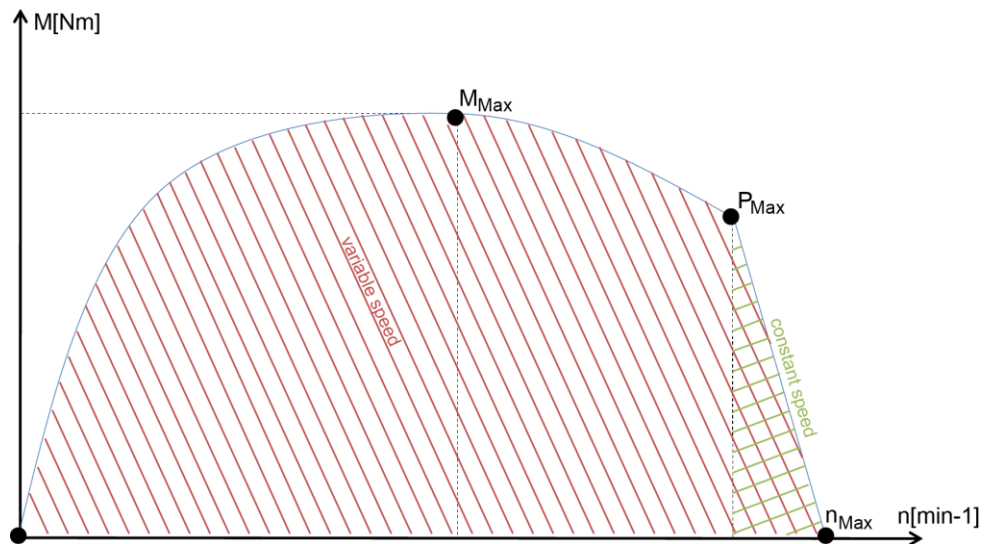


The engine type plate is affixed to the crankcase and includes the following engine information:	
1	Model designation of the engine
2	Engine serial number
3	Serial rating (kW) at nominal speed (rpm)
4	Displacement (liters)
5	Information for US emission certification (EPA/CARB)
6	EU type approval
7	EU 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)

2.2 Power data H50

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

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).

2.2.1 Power data H50

Overview of variable speed/constant speed 4H50				
UPM	Tier IV final	EU 3b	EU 3a	EU V
	3 / 4 H50 TIC	3 / 4 H50 TIC	4 H50 TI 3 / 4 H50 TIC	3 / 4 H50 TICD
3000	-	-	-	CS
2800	VS	VS	-	VS
2,700	VS	VS	-	VS
2600	VS	VS	VS*2	VS
2500	VS	VS	-	VS
2400	VS*1	VS*1	-	VS
2300	VS*1	VS*1	-	VS
2200	-	-	-	VS
2,100	-	-	-	-
2000	-	-	-	-
1,900	-	-	-	-
1,800	CS	-	CS	CS
1500	CS	-	CS	CS
VS = variable speed			CS = constant speed	

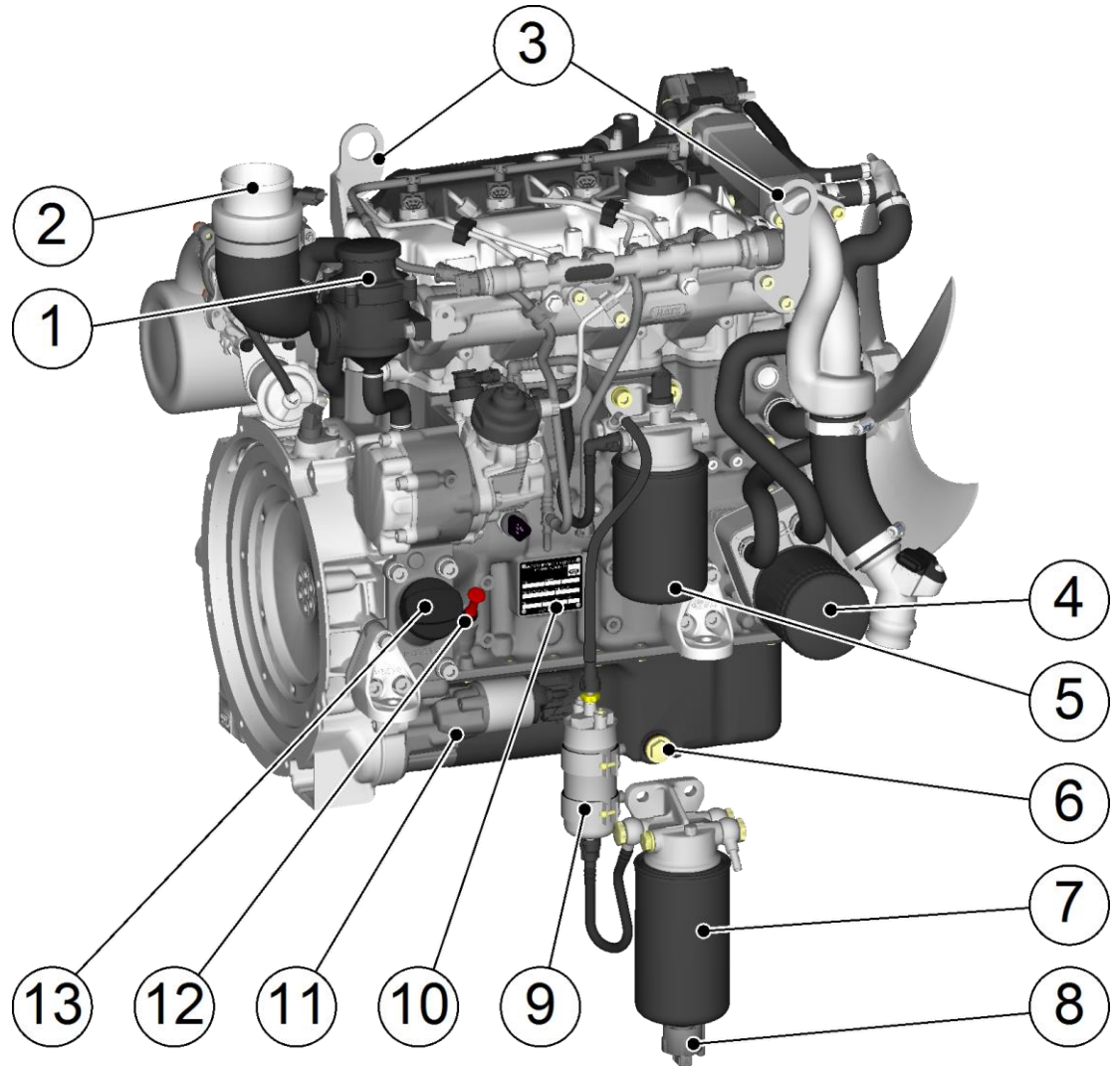
*1 = 4H50TIC only

*2 = 4H50TI only (<37kW)

2.3 Engine design

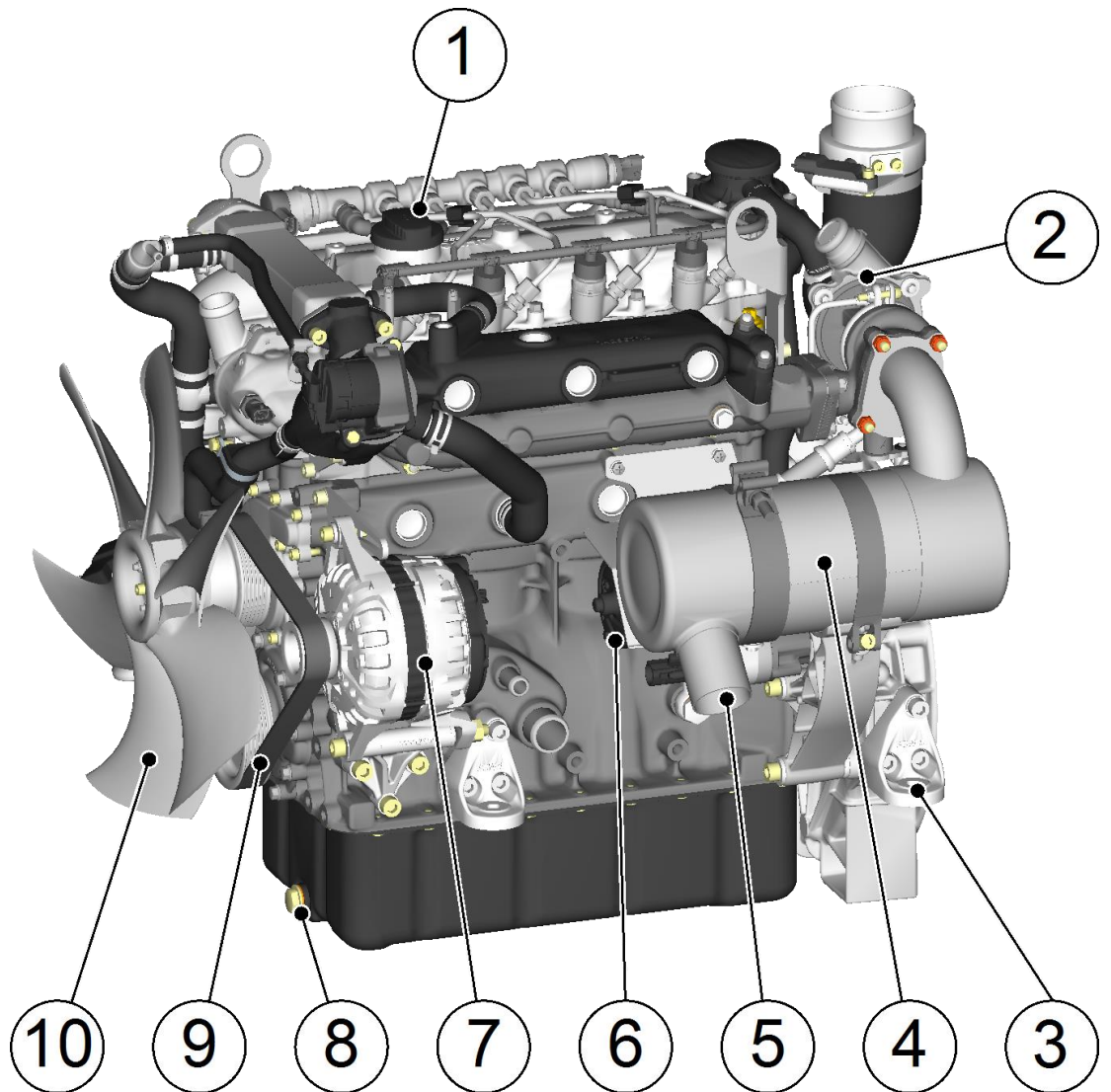
2.3.1 Fan2Flywheel (F2F) TIC

Intake side



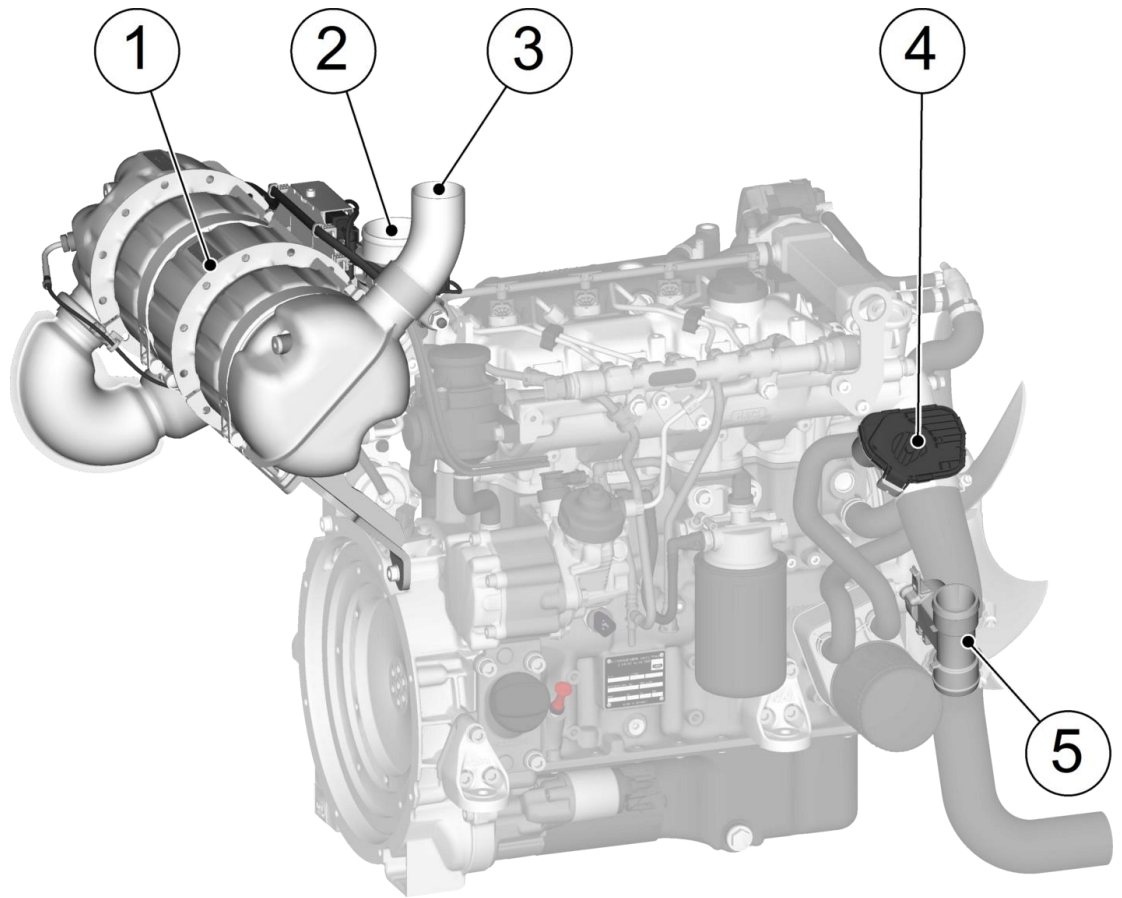
1	Crankcase ventilation	8	Drain plug with integrated water level sensor
2	Intake opening for combustion air	9	Electric fuel pump
3	Lifting eyes	10	Engine type plate
4	Oil filter	11	Starter (low mounting position)
5	Main fuel filter	12	Dipstick
6	Side oil drain screw	13	Oil filler plug, bottom
7	Fuel prefilter		

Exhaust side



1	Oil filler plug, top
2	Turbocharger
3	Engine foot
4	Diesel oxidation catalyst (DOC)
5	Exhaust outlet
6	Starter (high mounting position)
7	Three phase alternator
8	Oil drain screw, front
9	Poly-V belt
10	Fan

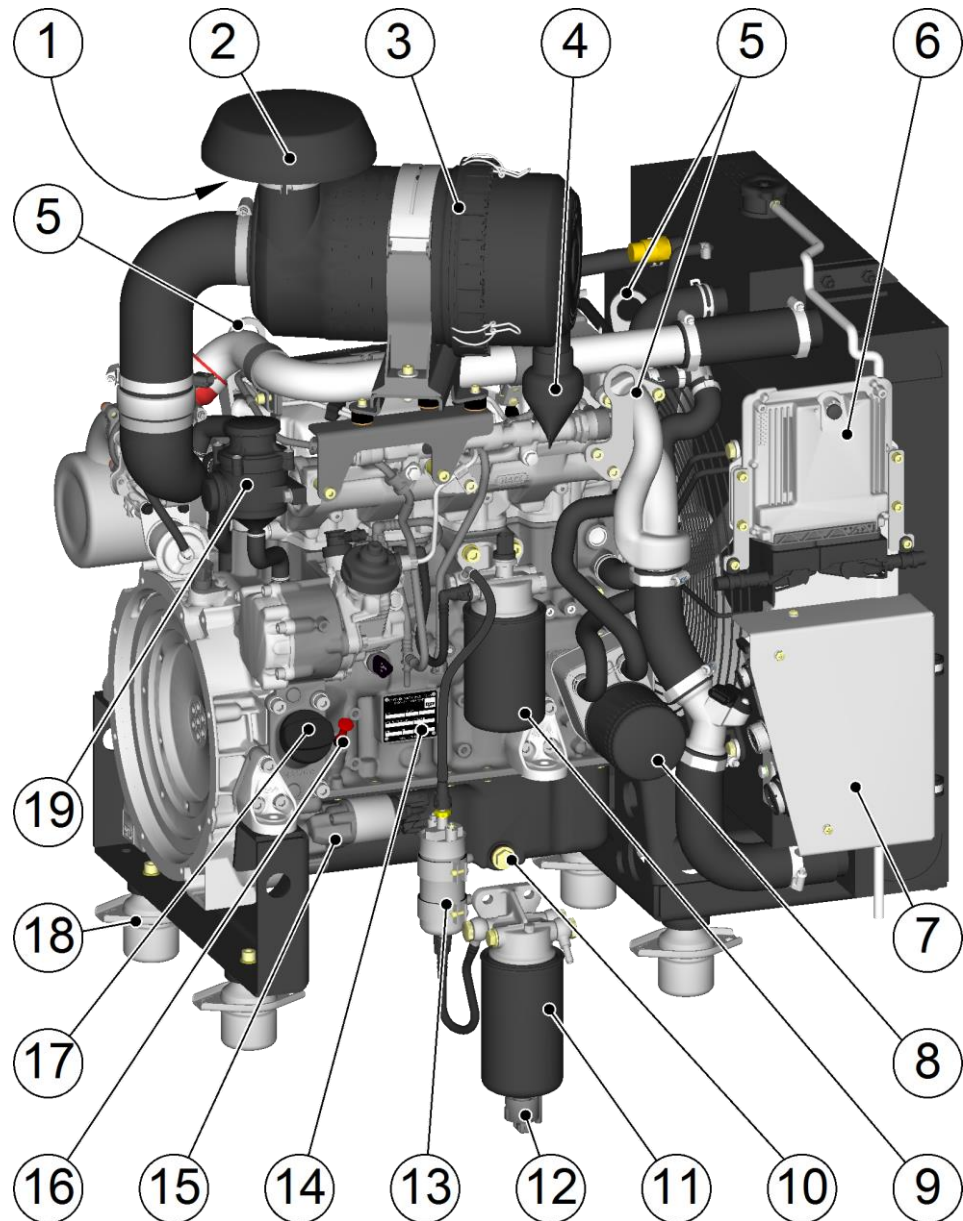
2.3.2 Fan2Flywheel TICD



1	Diesel particulate filter (DPF)
2	Intake opening for combustion air
3	Exhaust outlet
4	Throttle valve
5	Air mass gauge

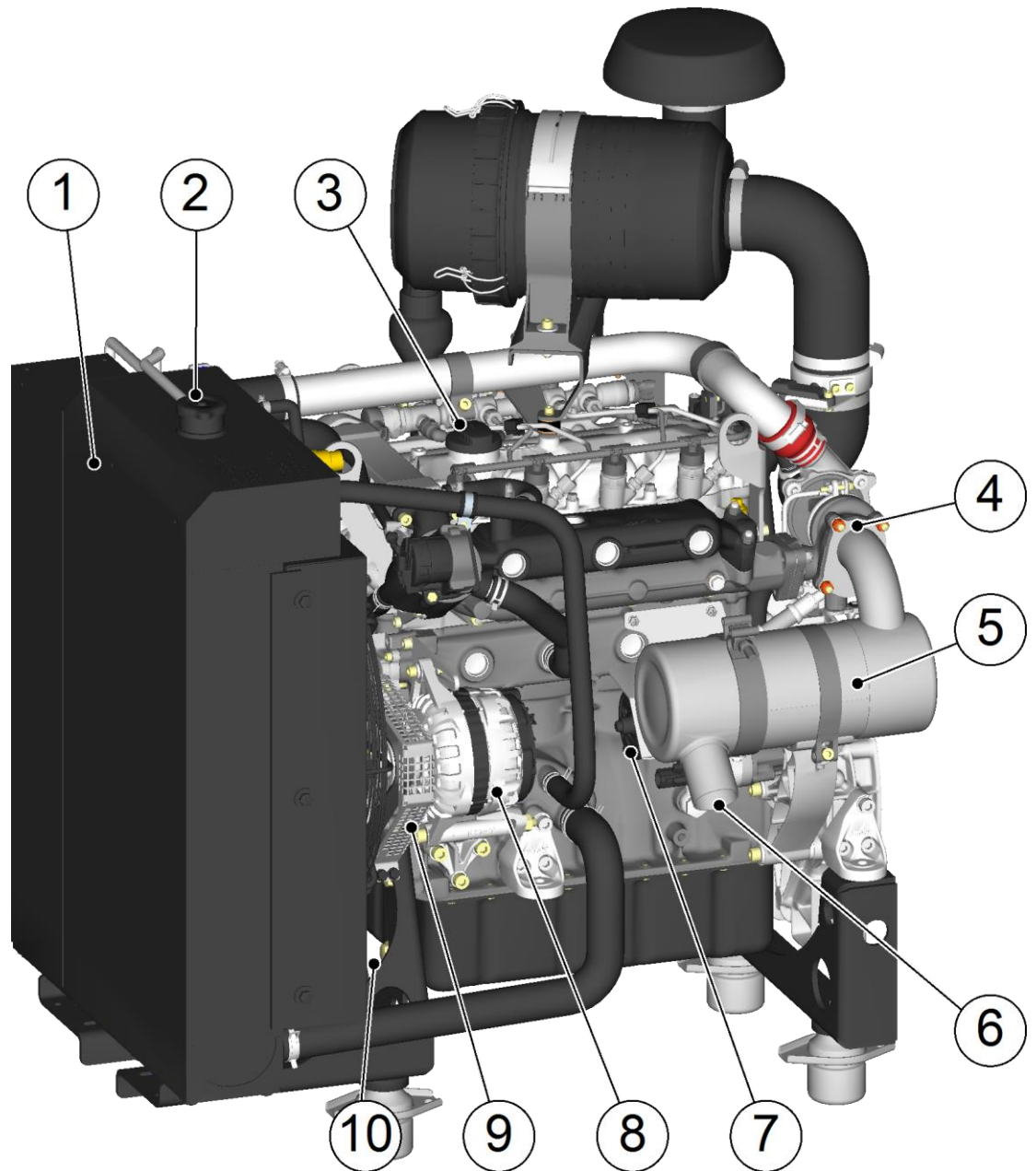
2.3.3 OpenPowerUnit (OPU) TIC

Intake side



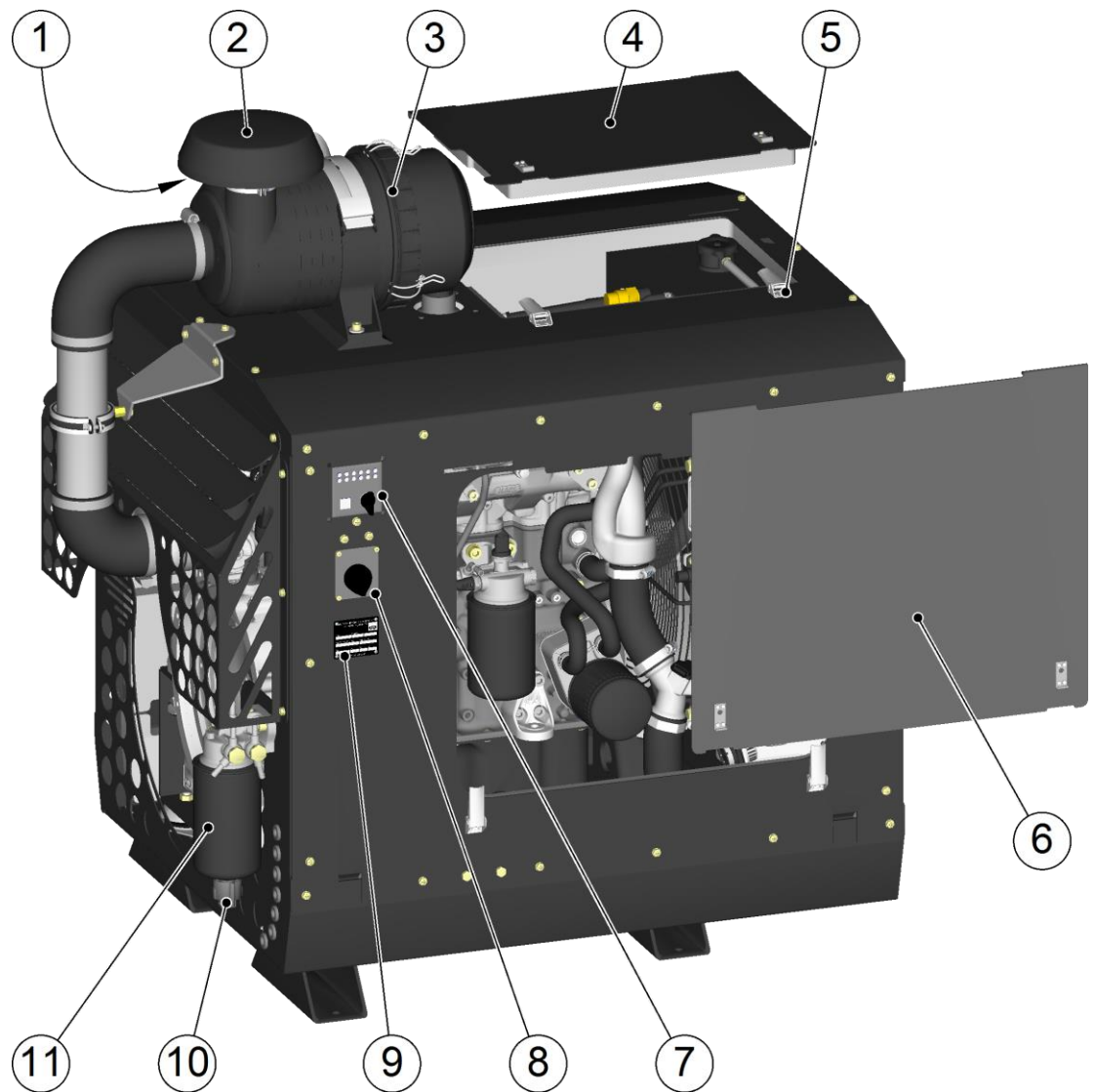
1	Intake opening for combustion air	11	Fuel prefilter
2	Rain cap	12	Drain plug with integrated water level sensor
3	Air filter (optional)	13	Electric fuel pump
4	Dust discharge valve	14	Engine type plate
5	Lifting eyes	15	Starter (low mounting position)
6	Engine control unit	16	Dipstick
7	Plug holder with integrated relay, glow control unit and fuse holder	17	Oil filler plug, bottom
8	Oil filter	18	Vibration damper
9	Main fuel filter	19	Crankcase ventilation
10	Side oil drain screw		

Exhaust side



1	Radiator with integrated expansion tank
2	Sealing cap for coolant
3	Oil filler plug, top
4	Turbocharger
5	Diesel oxidation catalyst (DOC)
6	Exhaust outlet
7	Starter (high mounting position)
8	Three phase alternator
9	Belt guard
10	Oil drain screw, front

2.3.4 SilentPack TI/TIC



1	Intake opening for combustion air
2	Rain cap
3	Air filter (optional)
4	Top maintenance cover
5	Clamp-type fastener
6	Side maintenance cover
7	HATZ instrument box
8	Speed adjustment
9	Engine type plate
10	Drain plug with integrated water level sensor
11	Fuel prefilter

3. Transport

WARNING

Danger of injury from improper lifting and transport.

Danger of crushing from the engine falling or tipping.



- 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.
-

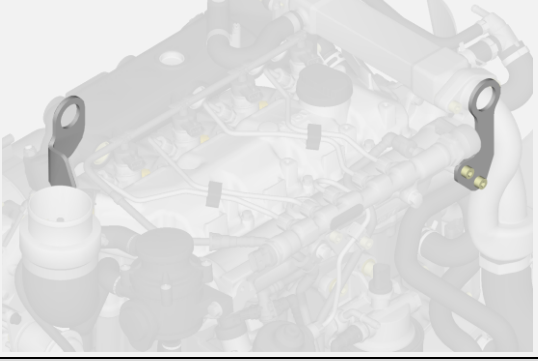
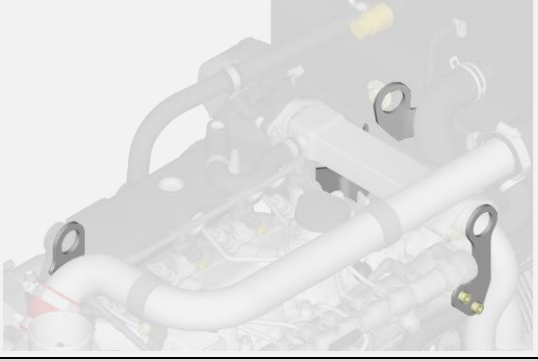
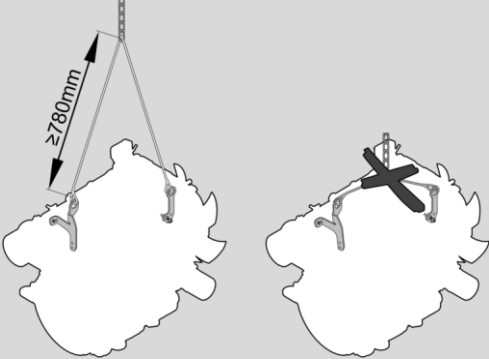

NOTE

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	Lifting eyes OPU
	
	
Maximum weight	
185kg	270kg

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 station**.

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 engine oil in accordance with the manual for diesel engine.
3	Change the pre- and main fuel filters in accordance with the manual for diesel engine.
4	Check the coolant level and concentration and top up if necessary or change in accordance with the manual for diesel engine.
5	Remove the battery in accordance with the Operator's Manual for the machine 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 in sea air.

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

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.

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, including functional safety, are fulfilled.

The operator must become familiar with the manual for diesel engine prior to commissioning in order to avoid danger to personnel and potential material damage.

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 manual for diesel engine. Damage resulting from non-observance of the assembly instructions or the manual for diesel engine will forfeit any warranty on the part of Motorenfabrik HATZ GmbH & Co. KG and 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 station**.
- Any improper modification of the engine will result 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 information on how to safely assemble the engine. They are available from any **Hatz service station**. If you have any questions, please contact your nearest **Hatz service station** before commissioning the engine.

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.

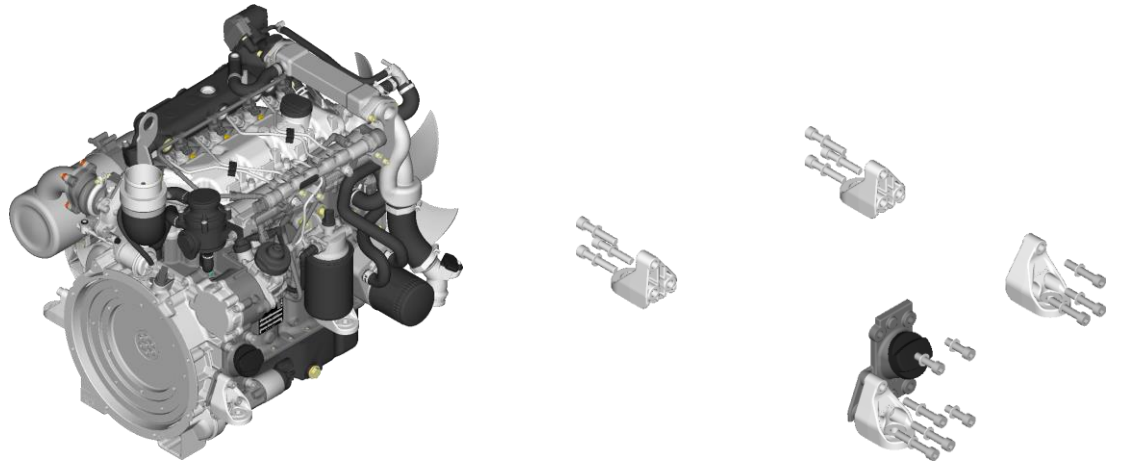
Generally, flexible mounting of the engine should be aimed at.

Uniform loading must also be ensured (see chap. 4.2.3.2 *uniform bearing load*, page 39).

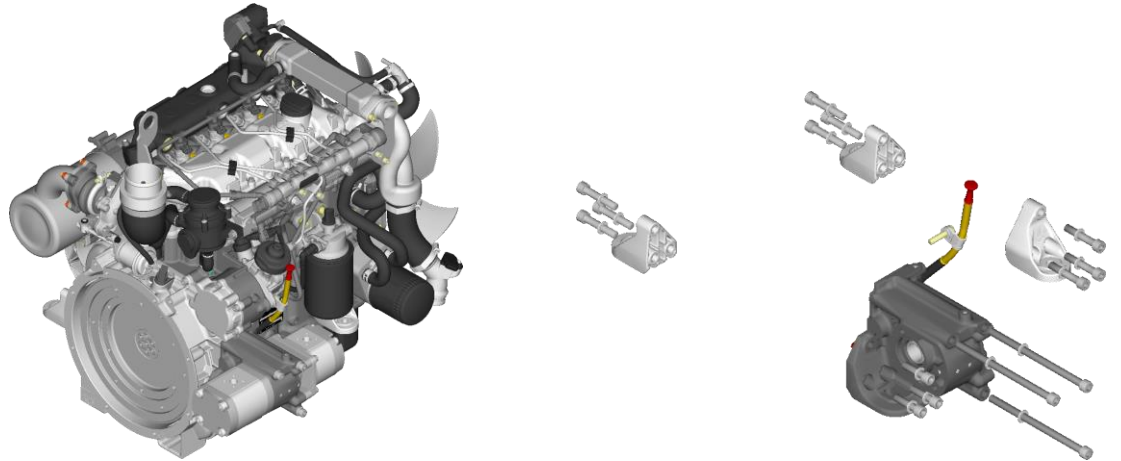
If there is any doubt, please contact your nearest **Hatz service station**.

4.2.1 Engine brackets

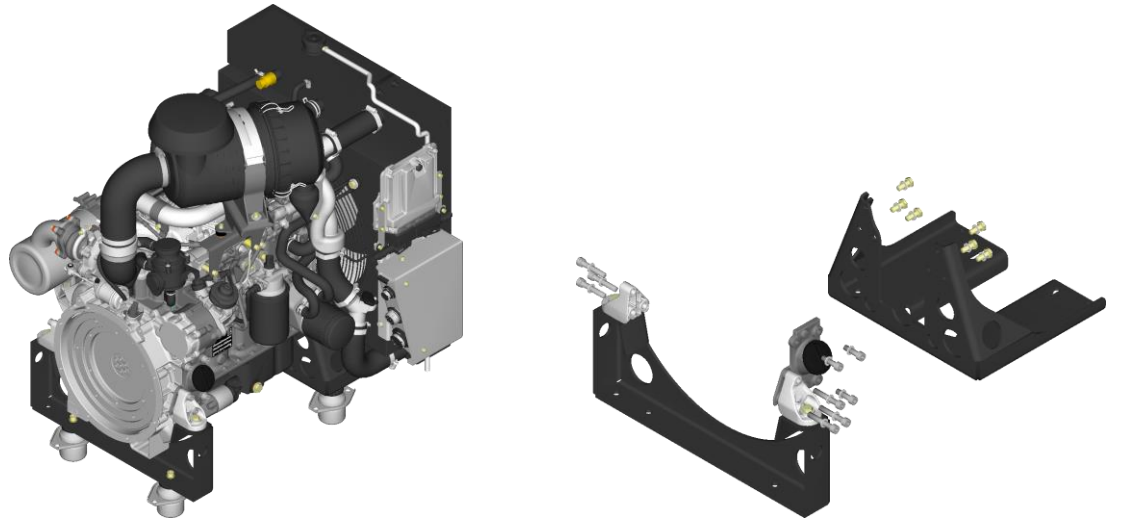
4.2.1.1 Standard



4.2.1.2 for hydraulic power take off



4.2.1.3 OpenPowerUnit (OPU)



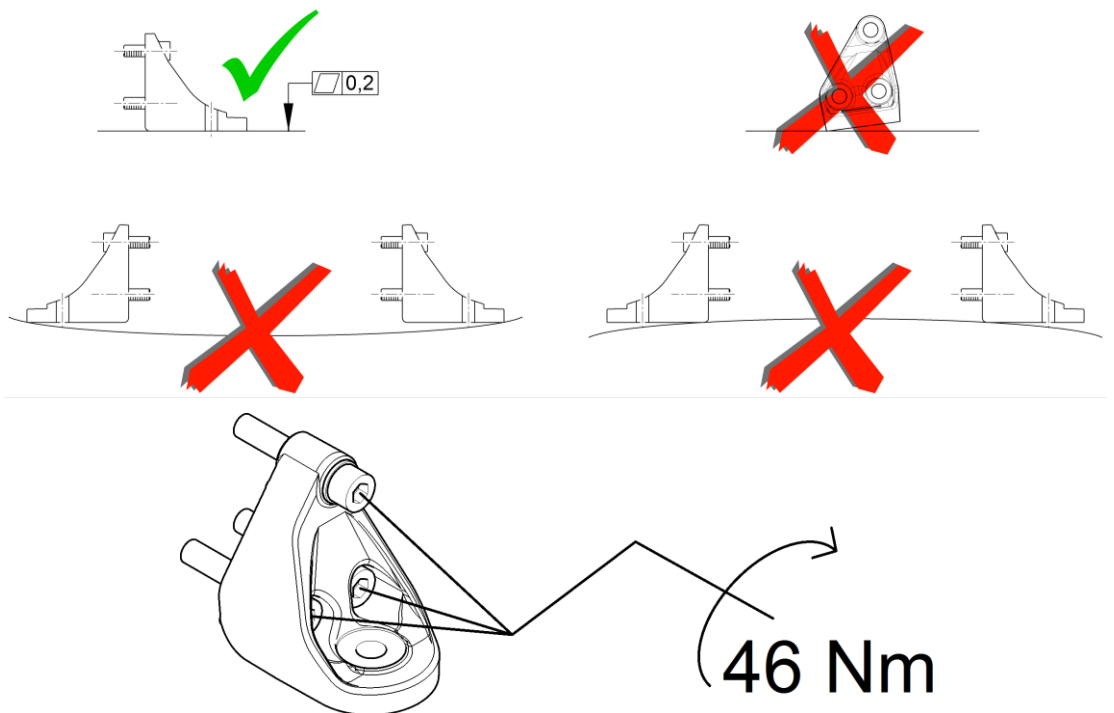
4.2.2 Rigid engine suspension

NOTICE

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).
- The engine is not permitted to be mounted on painted surfaces.
- 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

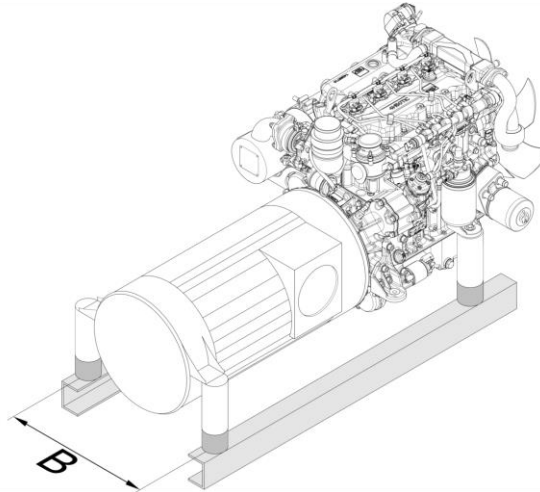
It is generally recommended to mount the engine in a flexible manner.

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.

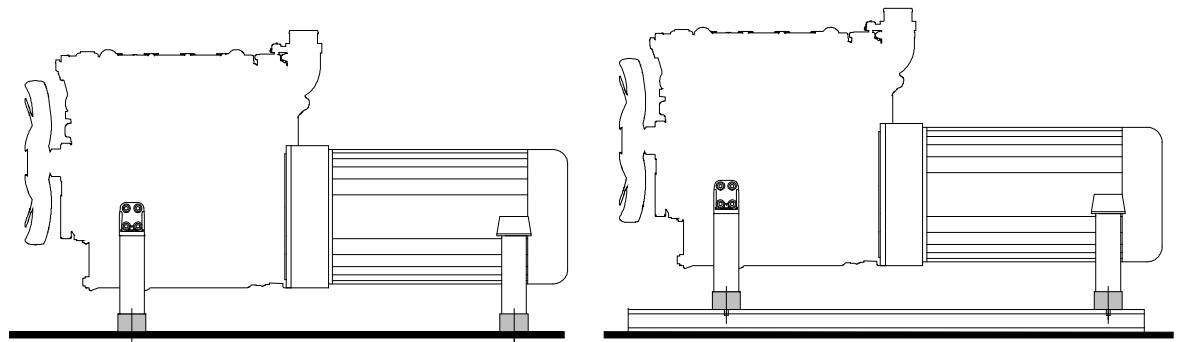


Depending on the type of machine, a decision must be made between

- 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

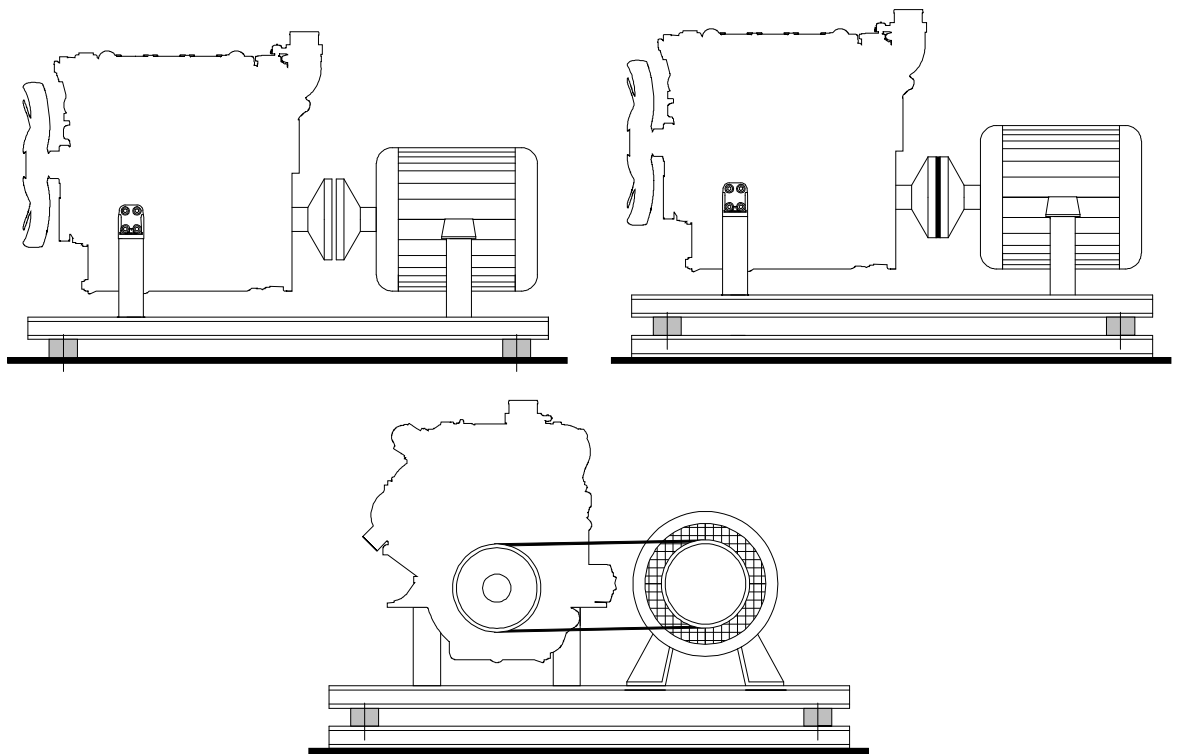
The engine is flange-mounted on the driven force sensors and constitutes a common vibration system. If a corresponding base is available, a frame can be dispensed with because the engine and force sensor already make up a rigid frame.



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

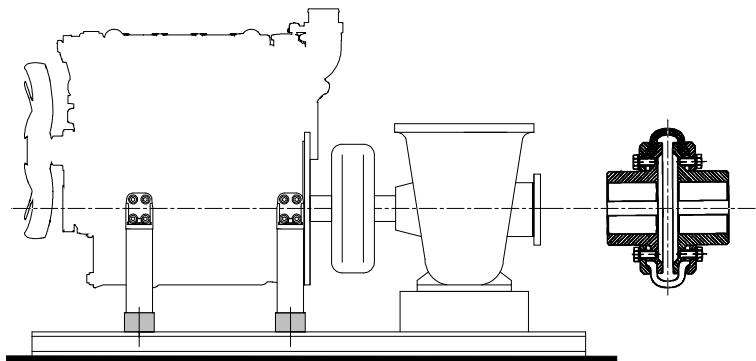
In place of the housing connection to flange-mounted force sensors, there is now a frame onto which the engine and the machine to be driven are rigidly screwed.

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.

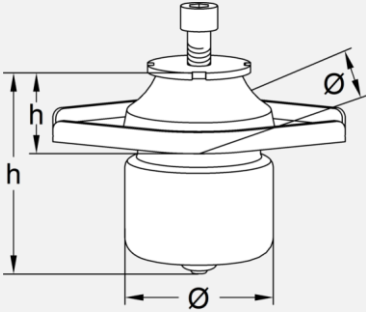
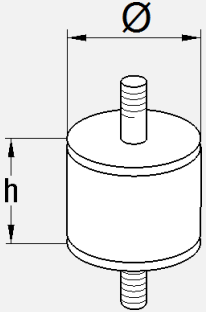
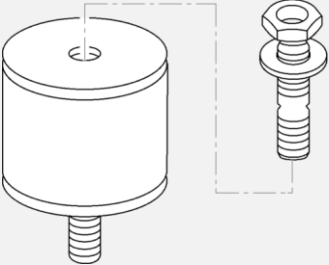
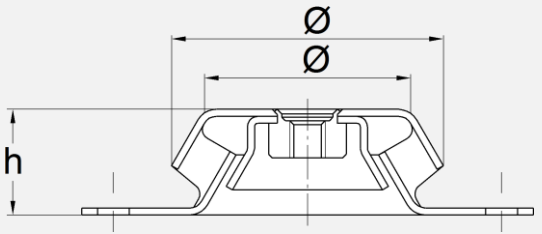


In contrast, the two variants in the picture below are not permitted because the engine and machine form separate vibration systems which work against each other and damage the flexible coupling or belt.



4.2.3.1 Vibration damper

The support surface for the fixing of the engine must comply with a flatness tolerance of max. 1 mm. The engine is not permitted to be mounted on painted surfaces.

Vibration damper	Ø (mm)	h (mm)	Hardness (Shore A)	Max. perm. skew to load direction
Hydro mount V600	64/89	32/91	45	20°
Hydro mount V1500	64/89	44/103	55	20°
Rubber buffer (8/10)	70	45	55	-
Rubber buffer (9/11)	70	45	65/70	-
Machine foot with breakaway	58.5/77	30	40 / 60	As for engine
Hydro mount (6)		Cylindrical rubber buffer (8/9)		
				
Cylindrical rubber buffer (10/11)		Machine foot with breakaway (12)		
				

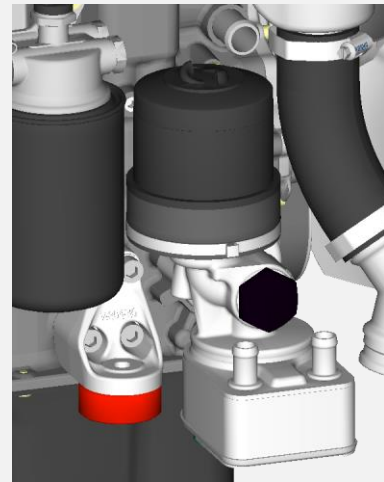
The vibration elements must be developed on the basis of the excitation frequency and mass through testing. On mobile machines, the rubber buffers must be secured against transverse forces. Manufacturers of rubber bumpers offer special constructions such as pot or taper elements. When using standard elements, a mechanical guard (breakaway) must be installed.





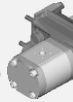
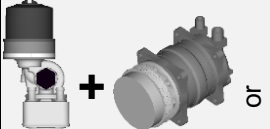




IMPORTANT NOTE

For engine installations on mobile machines (such as vehicles, trailers etc.), the engine must be secured against transverse forces. For this, either vibrators with breakaway or separate mechanical safety elements should be used (e.g. arrestor cables).

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.

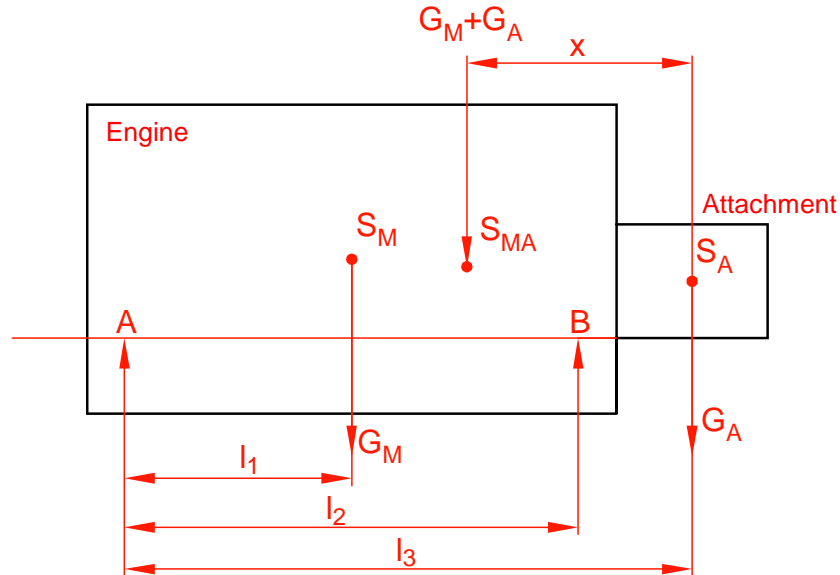


Vibration damper	Number of spacers			
			 +  or 	 +  or 
6	1	2	1	2
8/9	0	Not permitted		
10/11	0	0	0	0
12	0	2	0	2

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)



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

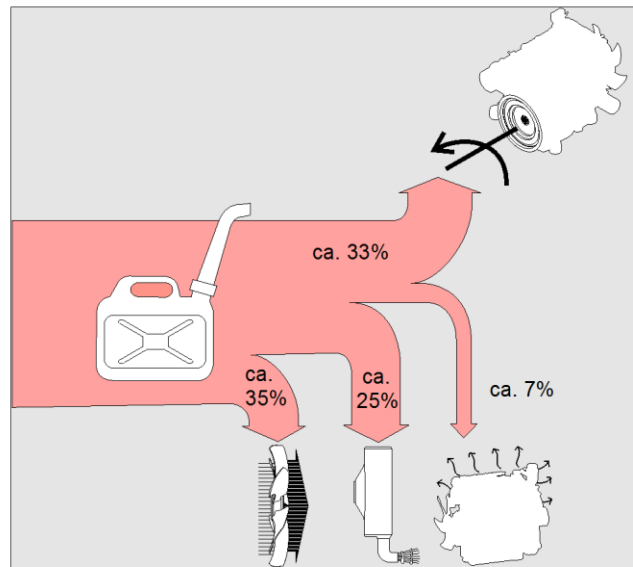
Abbreviation	Meaning
S _M	Center of gravity of engine
S _A	Center of gravity of attachment (e.g. hydraulic pump, alternator,...)
S _{MA}	Overall center of gravity (engine + attachment)
G _M	Weight force of engine [N]
G _A	Weight force of attachment [N] (e.g. hydraulic pump, alternator,...)
A	Bearing load A
B	Bearing load B
L _{1,2,3}	Distances [m]

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

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

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

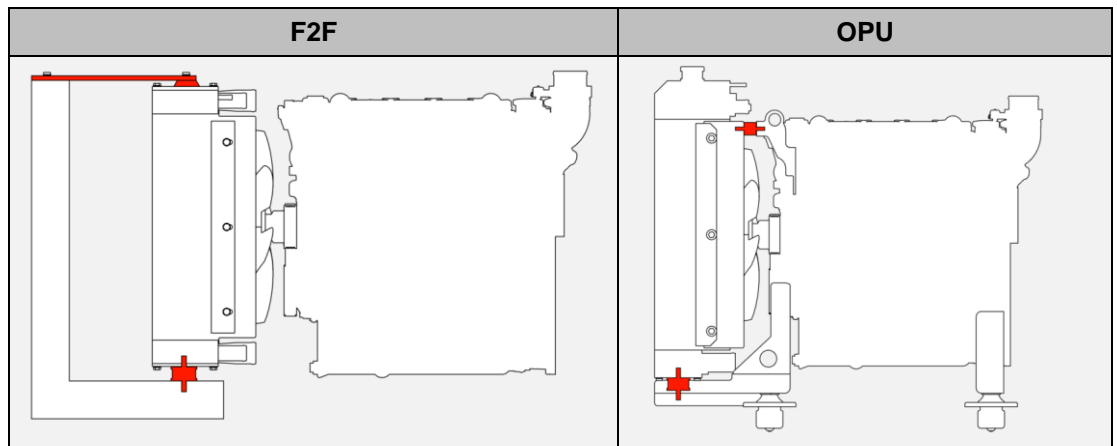
4.5.1 General: Attachment of the water cooler

The engine radiator must be decoupled from the engine vibrations.

The radiator (from HATZ) is permitted to be subjected to maximum vibration values of 5 g only.

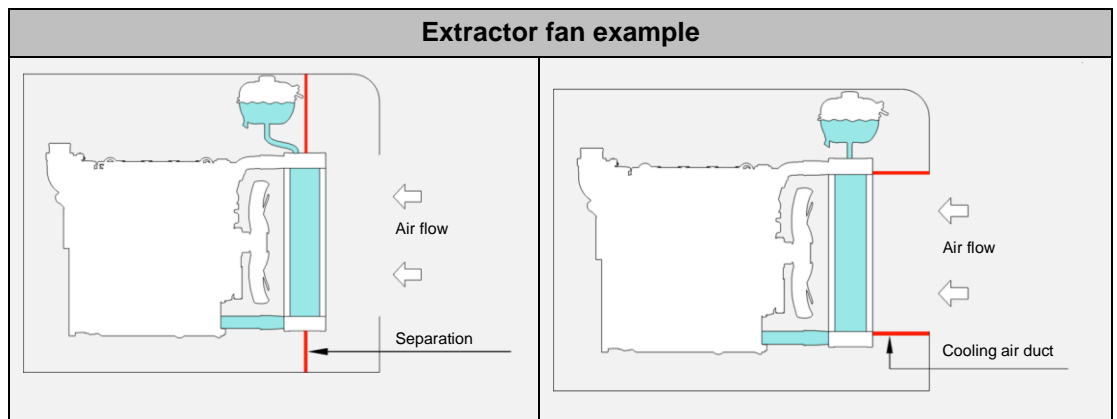
With the OpenPowerUnit (OPU), the radiator is vibration-decoupled with rubber buffers ex-works.

If using third party radiators, please consult and come to agreement with the radiator manufacturer.



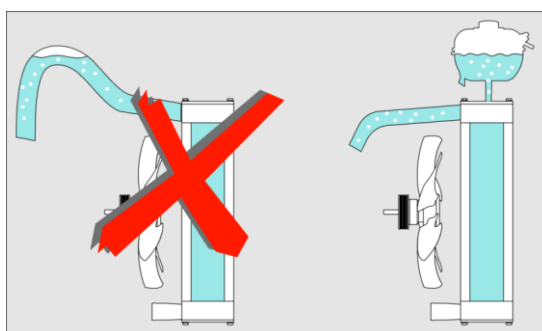
The engine radiator should be protected against external soiling. In addition, during installation ensure that accessibility for maintenance work is not restricted.

4.5.1.1 Installation under a cowling



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.

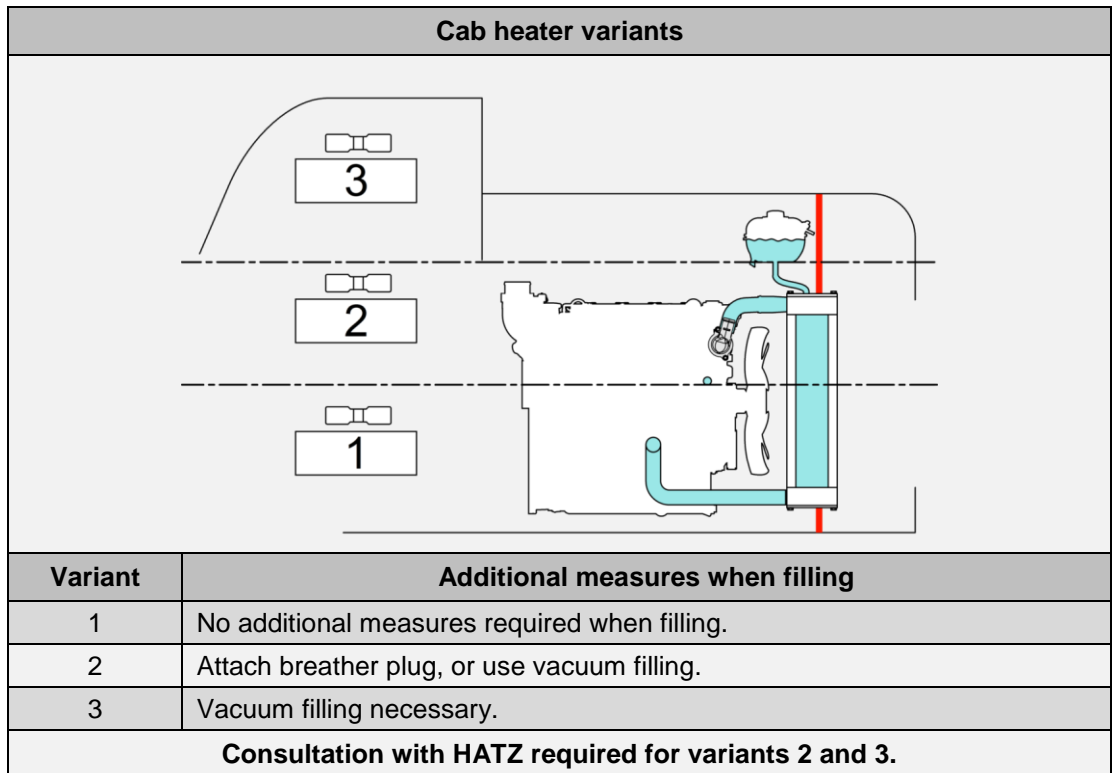
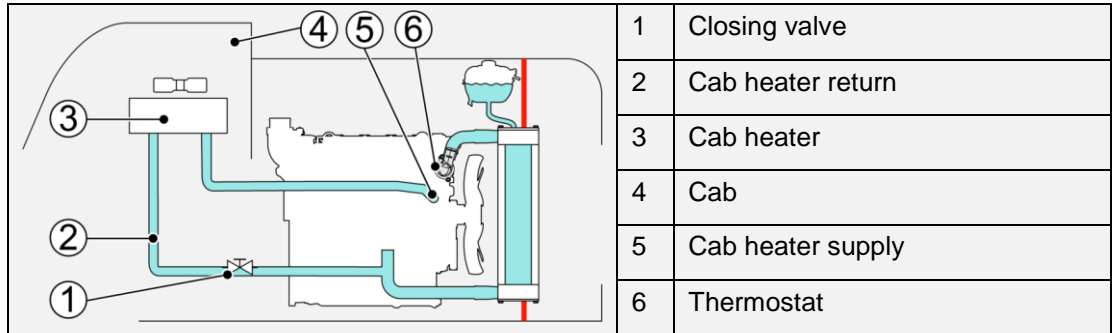
4.5.1.2 Cooling water hoses



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.

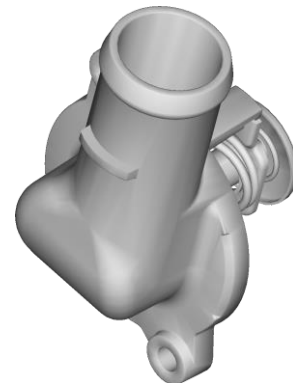
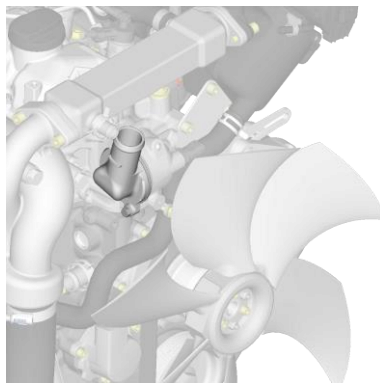
Avoid air pockets when laying the hoses.

4.5.1.3 Installation in combination with a cab heater



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 the "Coolant" chapter in the manual for diesel engine.

4.5.3 Engine radiator



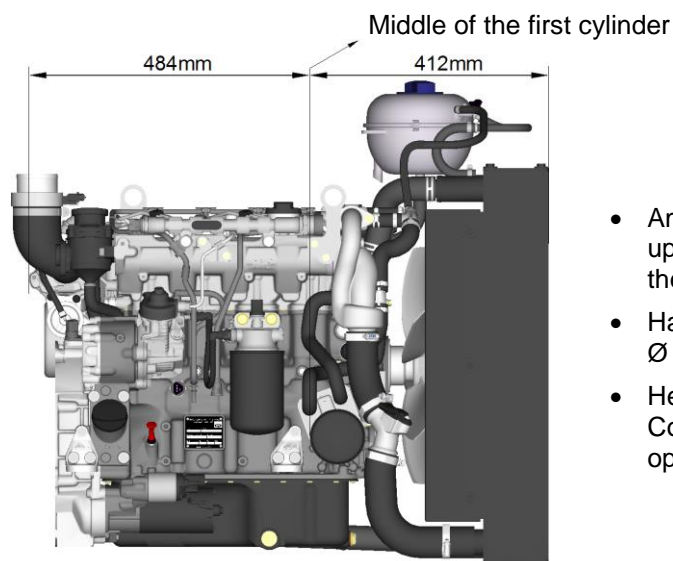
WARNING

Danger of injury from rotating parts

- A protective guard for the fan and the poly-V belt is mandatory for exposed structures.
- Attach Hatz protective devices.

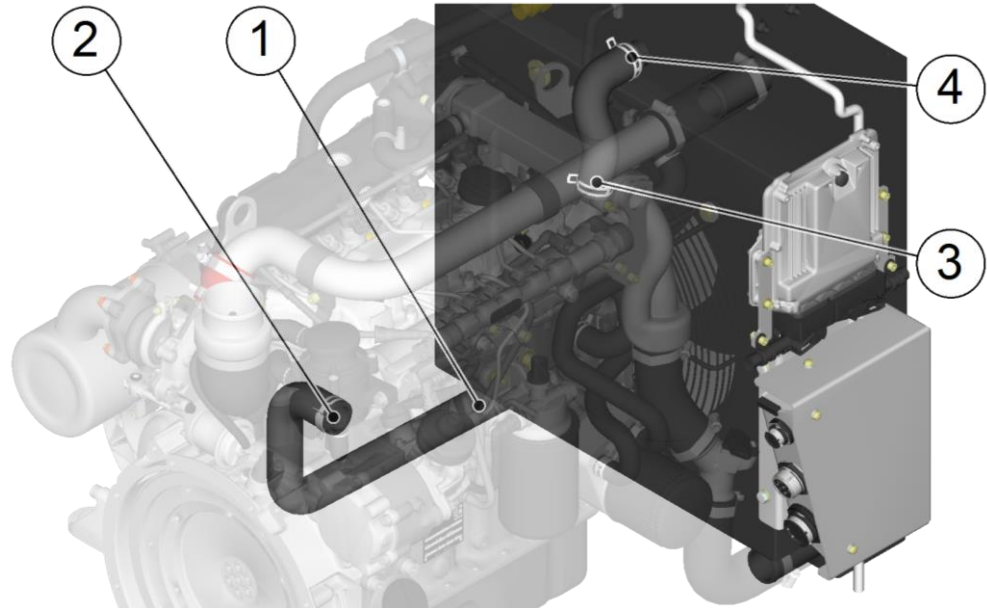
Maximum coolant temperature T_{\max} is 105 C.

The (standard) engine radiator from HATZ is a heavy-duty design and usually does not require a coarse dirt mesh. This is not to be confused with the contact guard for the fan. The contact guard can be provided by HATZ.



- Ambient temperature theoretically up to 50 °C at 56 kW, depending on the application
- Hatz expansion tank 2.4 L; Ø approx. 200 mm
- Heavy duty version
Contact guard for fan wheel optionally available

4.5.3.1 Water circuit piping



	Transfer point	Diameter
1	Cooler	Ø 32 ^{-1.5}
2	Crankcase	Ø 32 ^{-1.5}
3	Thermostat	Ø 32 ^{-1.5}
4	Cooler	Ø 32 ^{-1.5}

4.5.3.2 Expansion tank

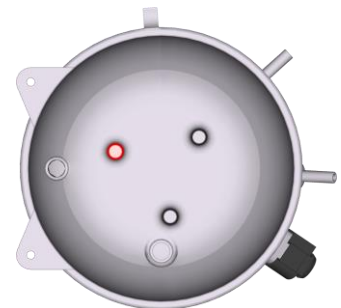
The size of the expansion tank should be 2.4 ± 0.2 liters at a cooling water amount of 13.2 liters and a coolant filling of 50 %. For the size of the expansion tank, it must be ensured that there is an overpressure of 0.3 bar before the water pump when the thermostat is open (85 C cooling water outlet temperature at the engine). When using third party tanks, a container tank with a minimum switch must be used.

The return line from the EGR radiator and the coolant radiator must be inserted separately into the expansion tank.

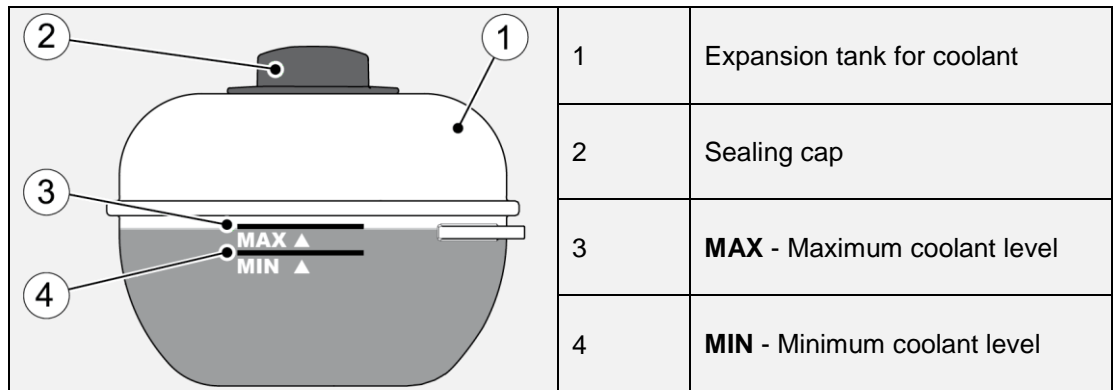
Good accessibility must be ensured for maintenance work such as inspection or filling.

4.5.3.2.1 Positioning of the expansion tank

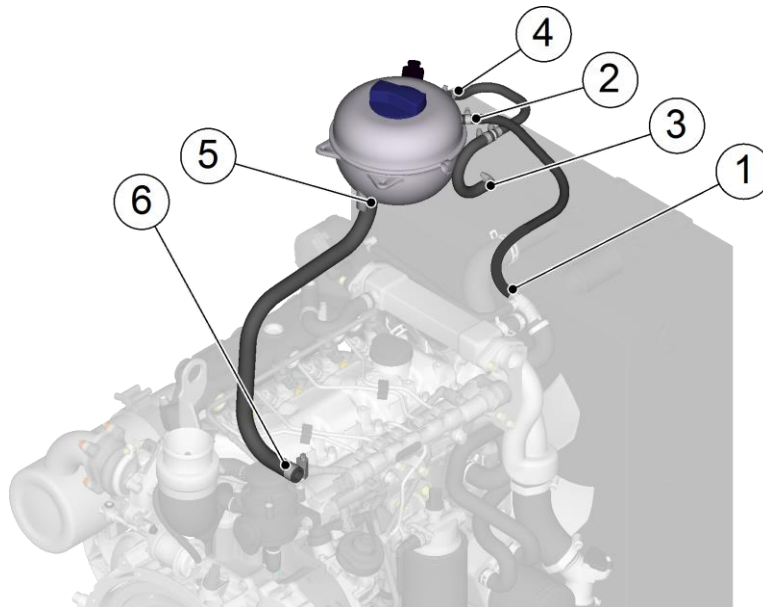
Theoretically, it is sufficient if the Min marking of the expansion tank is located above the highest component coming into contact with water (TIC or TICD: EGR radiator, TI: Cylinder head). In order to gain a little safety, however, the Min marking should be located "significantly" above this point. If the expansion tank is mounted above the radiator, this is quite sufficient. Higher installation situations of the expansion tanks are preferable. The expansion tank must be accessible at the overflow opening (external HATZ expansion tank marked in red underneath).



4.5.3.2.2 Overview of expansion tanks



4.5.3.2.3 Expansion tank tubing



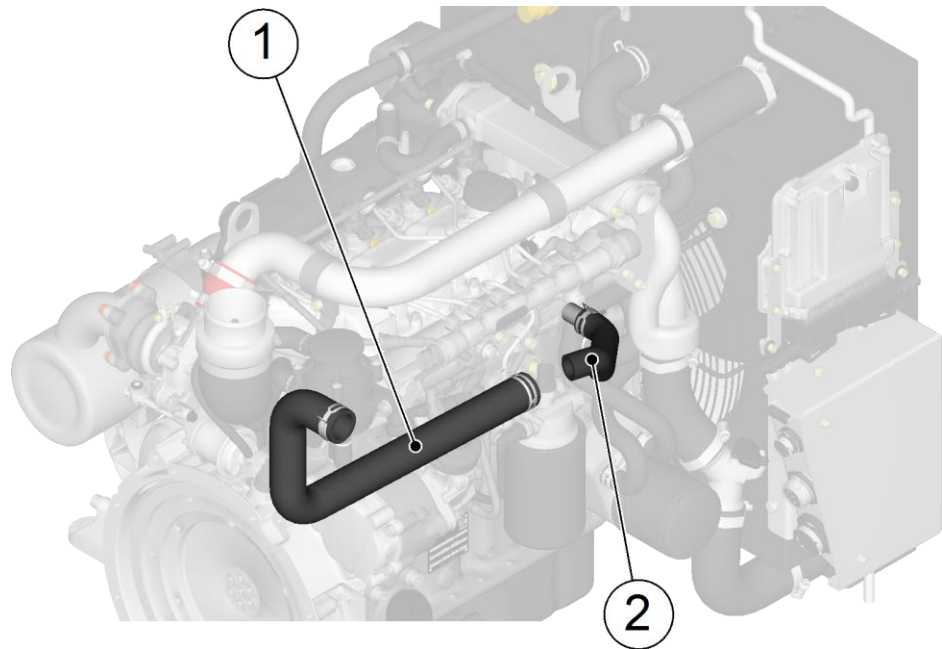
	Description	Transfer point	Diameter at transfer point
1	Radiator bleed pipe	EGR – radiator >	Ø 8 ^{-1.5}
2		Expansion tank	Ø 8 ^{-1.5}
3	EGR bleed pipe – valve	Radiator >	Ø 10 ^{-1.5}
4		Expansion tank	Ø 8 ^{-1.5}
5	Return	Expansion tank >	Ø 16 ^{-1.5}
6		Crankcase	Ø 16 ^{-1.5}

IMPORTANT NOTE



The piping to the expansion tank must be laid in a steadily rising manner. A drain (valve) must be provided for the coolant drain at the lowest point of the cooling system. If the piping to the expansion tank **CANNOT** be laid in a steadily rising manner, vacuum filling is required.

4.5.3.2.4 Piping of the cab heater



1	Cab heater return, insertion with T-piece	Ø 32 ^{-1.5}
2	Supply for cab heater	Ø 22 ^{-1.5}

Control of the cab heater using closing valves is preferable (here no bypass when not used), no restrictions on the temperature range.

If the cab heater is circulated constantly, a flow rate of maximum 10 l/min must not be exceeded or undercut at a pressure difference of at least 100 mbar. This also reduces the maximum permissible ambient temperature by about 3 C.

(exact values must be determined in the installation examinations)

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 label" must be positioned close to the fuel cap.

**ULTRA LOW SULFUR
FUEL ONLY**
0000 053 657 02

Even trace amounts of zinc, lead and copper can lead to deposits in the injection nozzles, which is why elements containing zinc, copper or lead are permitted to be used in the fuel system. Metal-sheathed fuel lines are not permitted either. 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 catalytic converter, 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 manual for diesel engine.

Special approval for fuels with different specifications

CAUTION

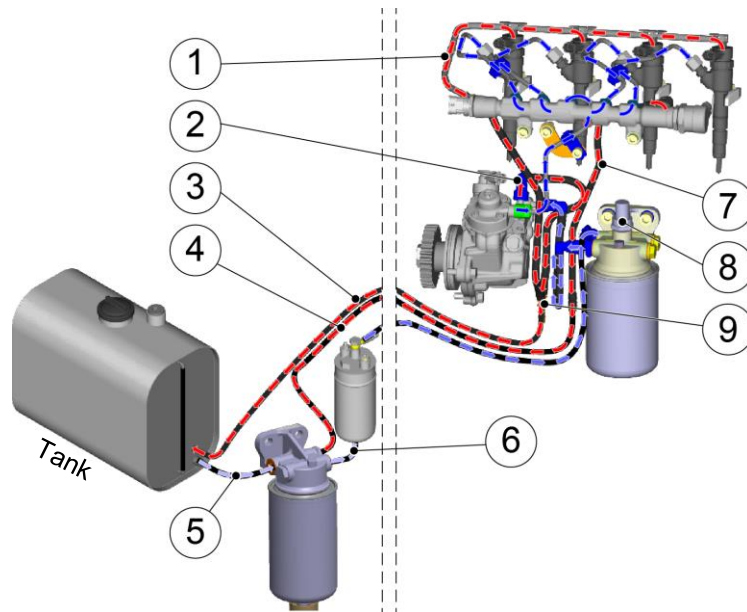
Danger of serious engine damage.

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:

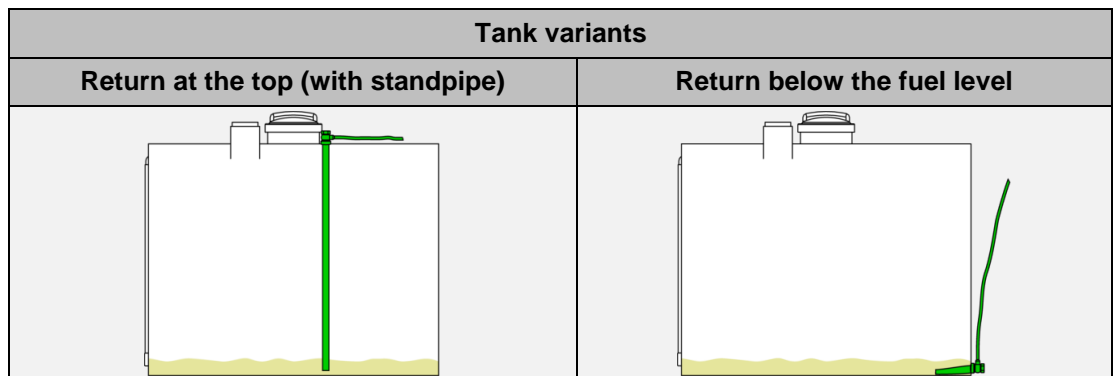
1. Any attached oxidation catalytic converter or particulate filter will be destroyed by operating with these fuels. An oxidation catalytic converter destroyed in this way does not impair the operation of the engine and can therefore remain on the engine, whereas a particulate filter will be clogged 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 prefilter
5	Supply from tank
6	Measurement point for negative intake pressure
7	Rail return
8	Measurement point for feed pressure
9	Measurement point for return pressure to tank
Fuel line specification	DIN 73379 - 8x3 – A6 or DIN 73379-8x3-B1 or of a higher order

Position the fuel prefilter 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 prefilter and heats it. Once the engine and fuel are heated sufficiently, the feed amount is regulated back to the actual required amount.



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

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 chapter "Starting the engine for the first time/after a filter change" in the manual for diesel engine.

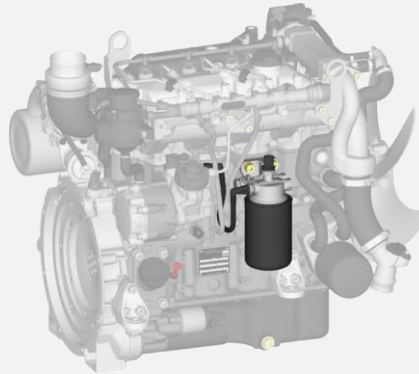
4.6.4.1 Main fuel filter



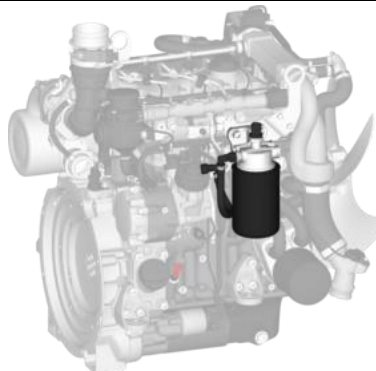
IMPORTANT NOTE

The fuel line between the high pressure pump and the main fuel filter must never be detached.

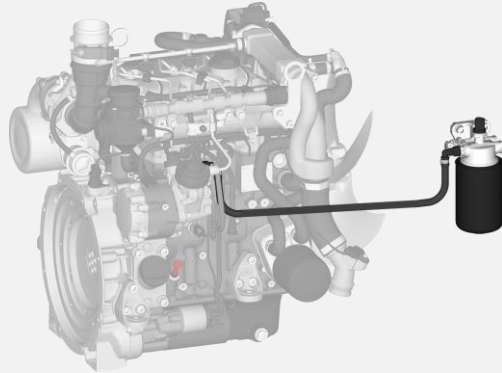
Position on engine 4H50



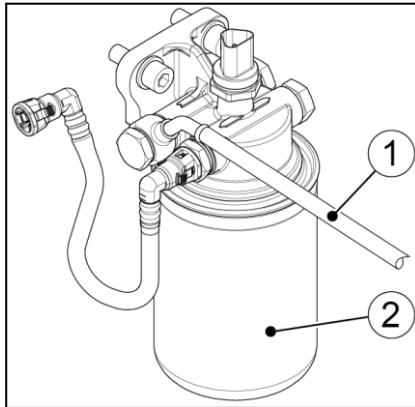
Position on engine 3H50



Position on chassis 3H50



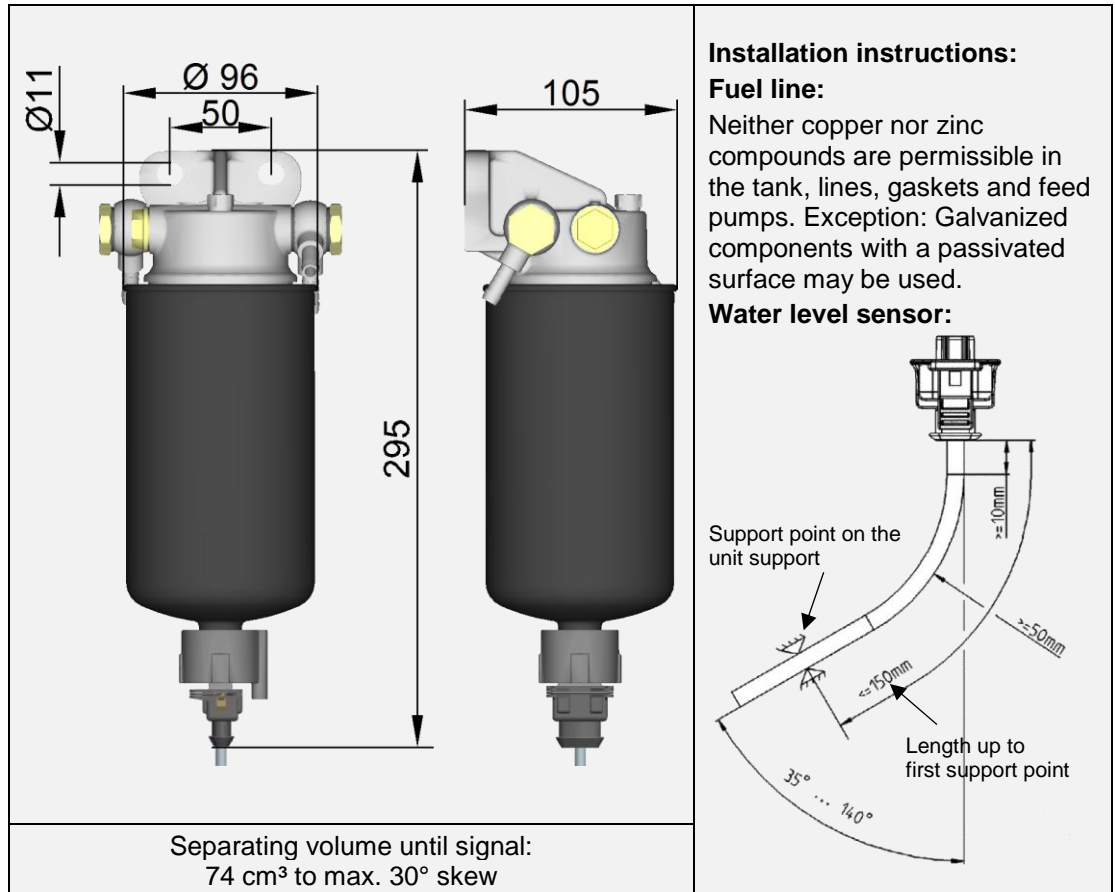
Line length 1.5 meters



1	Fuel feed line
2	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.



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.

A discharge port is provided at the lowest point 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 prefilter, for which (despite the water level sensor) the maintenance intervals must be carried out in accordance with the manual for diesel engine. especially before extended storage periods (e.g. winter breaks).

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. The distance of the return and supply line must be as large as possible. It absolutely must be avoided that the warm fuel of the return line can enter into the supply line (thermal short circuit).

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.



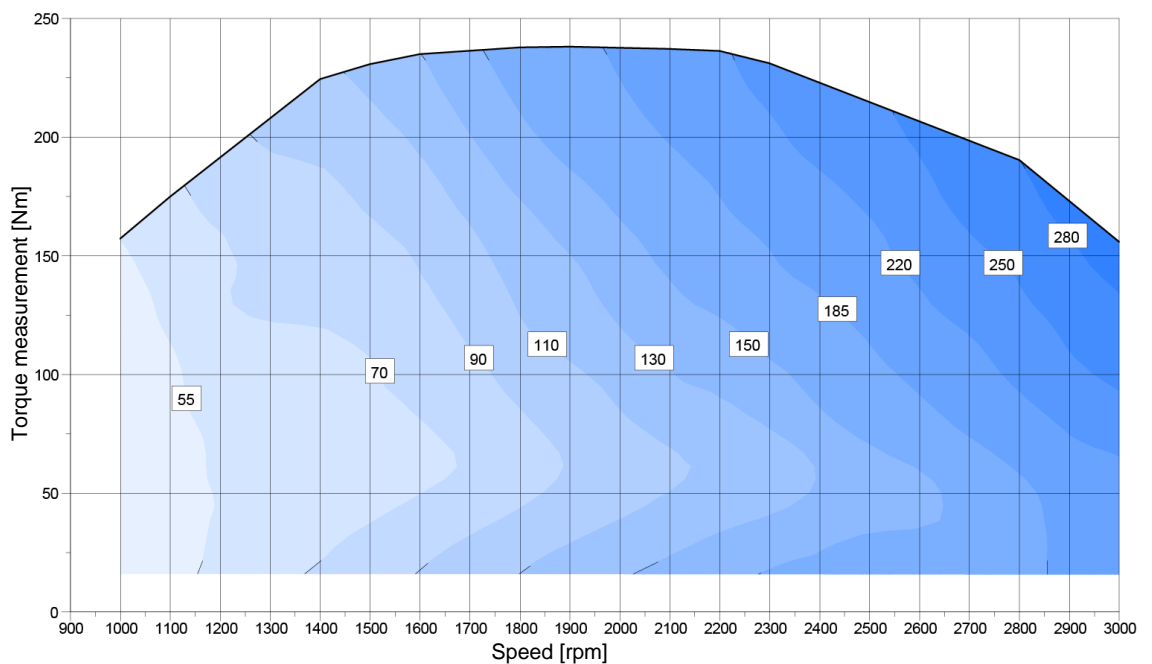
IMPORTANT NOTE

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

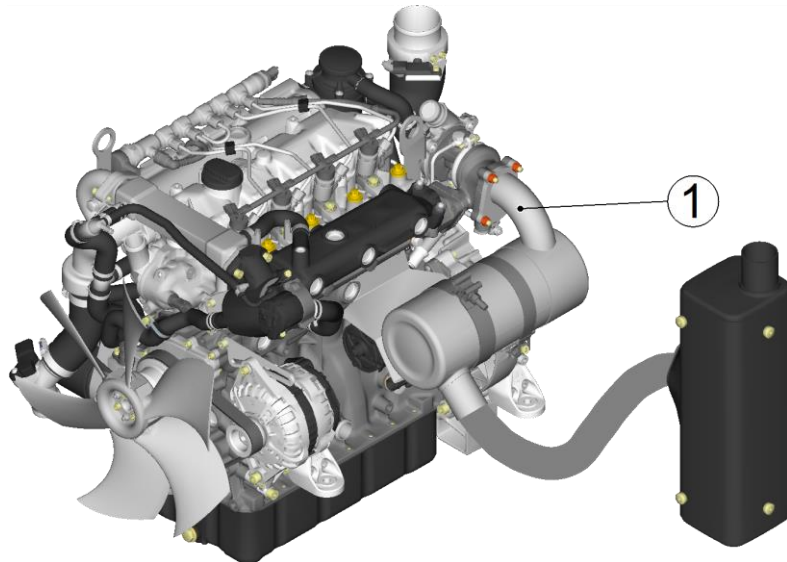
Contact protection for machine safety, page 121)

4.7.1 Mass flow rate H50TIC [m³/h]



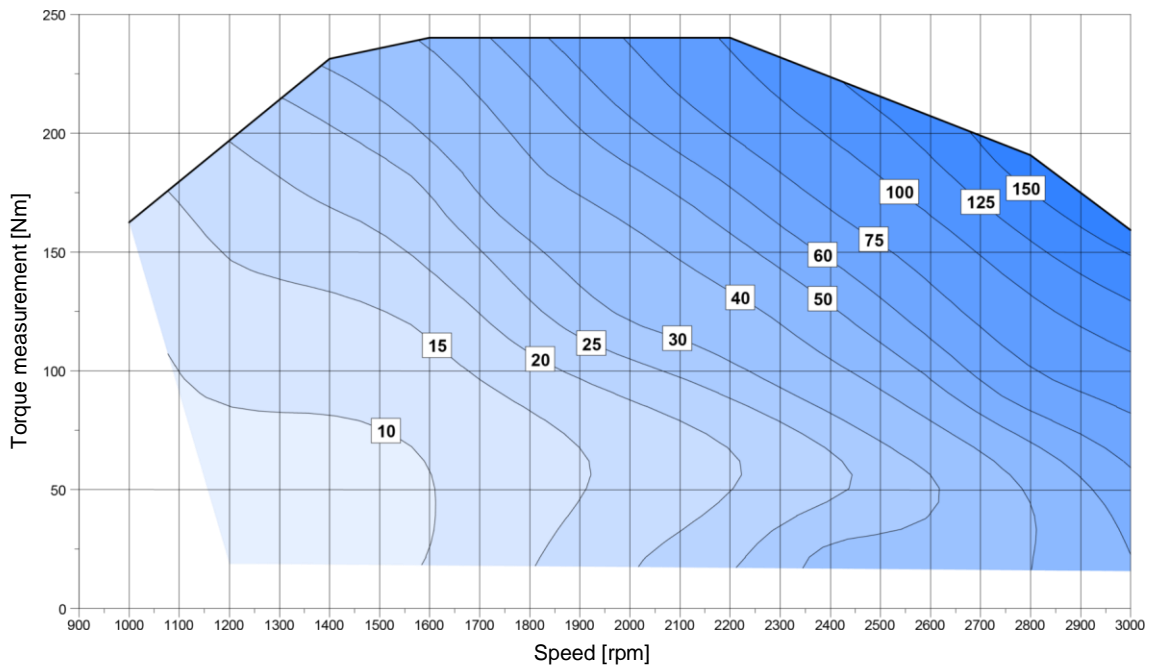
4.7.2 Permissible exhaust gas back pressure

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]	3000	1800	1500	2800	2700	2600	2500	2400	2300
* 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 H50TIC [mbar]



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

4.7.3 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 4.7.2 *Permissible exhaust gas back pressure*, page 55. The recommended pipe diameters for the continuation of the exhaust gas line corresponds to the outside diameter of the DOC (\varnothing 52 mm).

It should be noted that pipe bends from 45° significantly affect the exhaust gas back pressure.

4.7.4 Exhaust gas piping downstream of exhaust gas aftertreatment

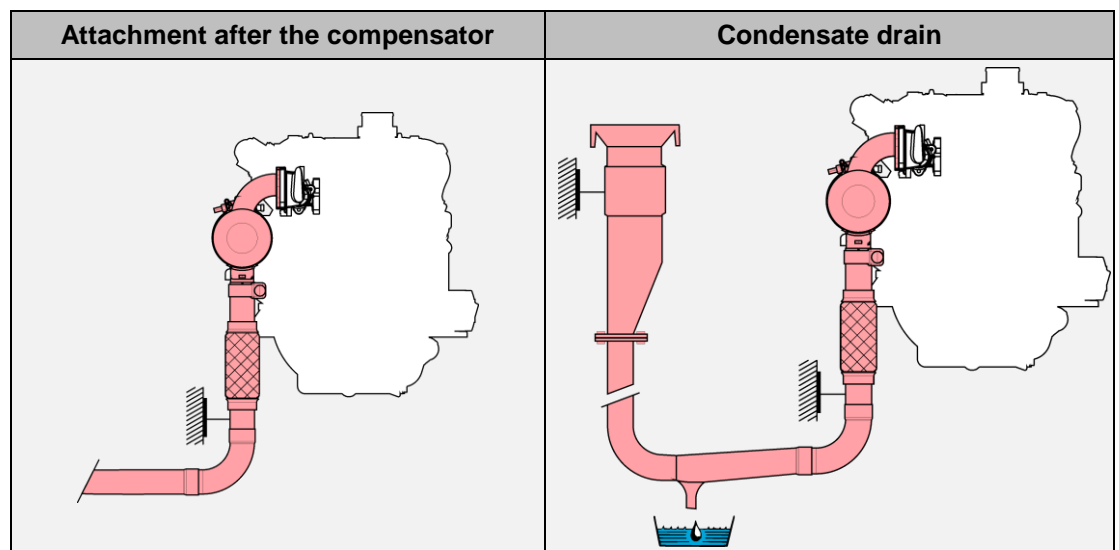
NOTICE

Property damage due to failure to comply with the assembly instructions

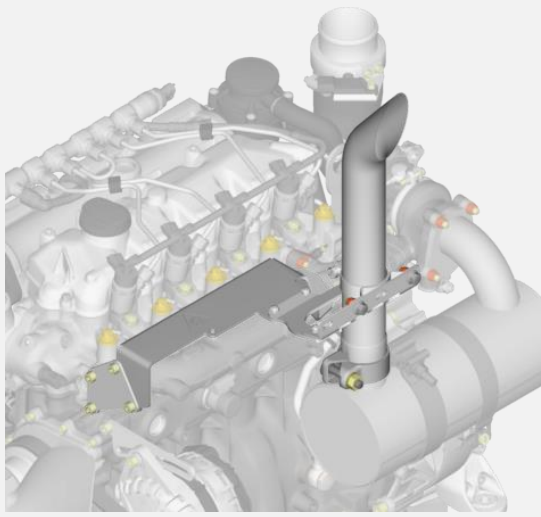
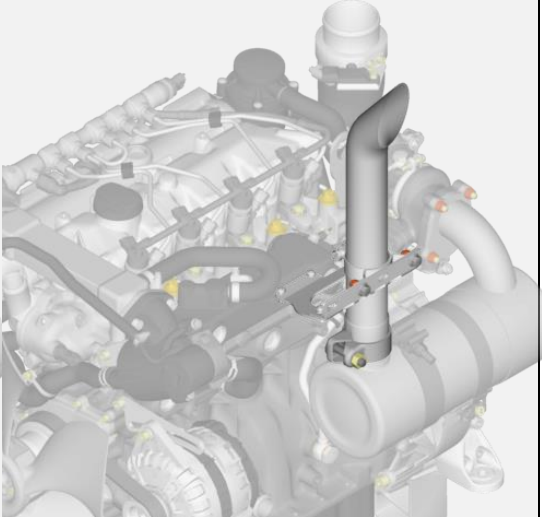
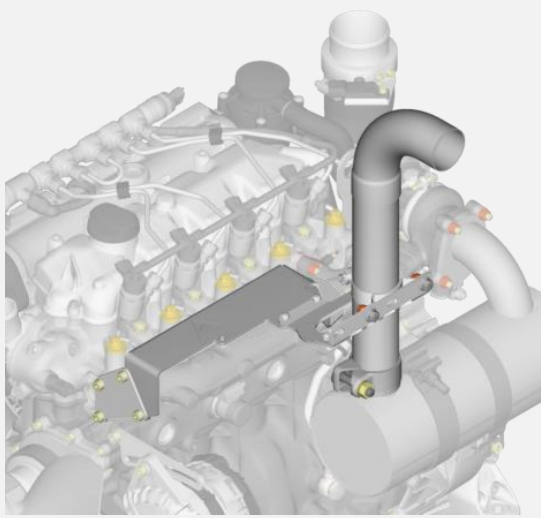
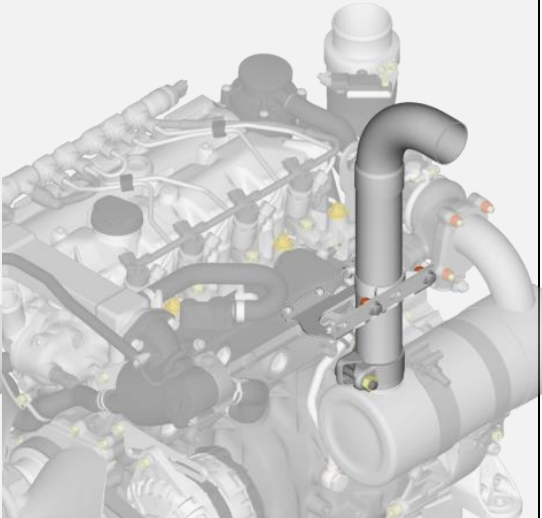
A compensator absolutely must be used directly after the exhaust gas aftertreatment as the components will otherwise be damaged. An exception is the use of our support at the EGR radiator.

The following points must be noted when laying the pipes:

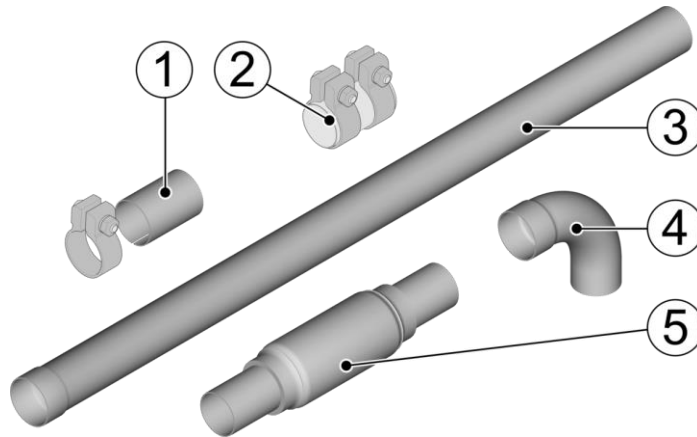
- Do not under any circumstances constrict the line cross-section after the exhaust gas aftertreatment exit.
- Prevent water from entering into the exhaust pipe (e.g. flaps or suitable pipe elbows at the end).
- Keep the exhaust gas backpressure within the permissible tolerance window in relation to the possible pipe lengths and number of pipe bends (angles).
- When installing an exhaust pipe, an elastic intermediate part must be installed along the exhaust pipe to absorb the engine movement. The compensator must be attached close to the pivot point of the elastic bearing. A fixed point is required after the compensator.
- A compensator is also required for a rigidly mounted engine.
- 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. The condensate drain must be located at the lowest point in the exhaust system. This enables the condensate to flow out by the force of gravity.



Exhaust piping without compensator, approved by Hatz

Exhaust pipe support on engine + Hatz exhaust pipe	
TI	TIC
	
Exhaust pipe support on engine + 300 mm pipe + pipe elbow	
TI	TIC
	

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	

4.7.5 Silencer TI



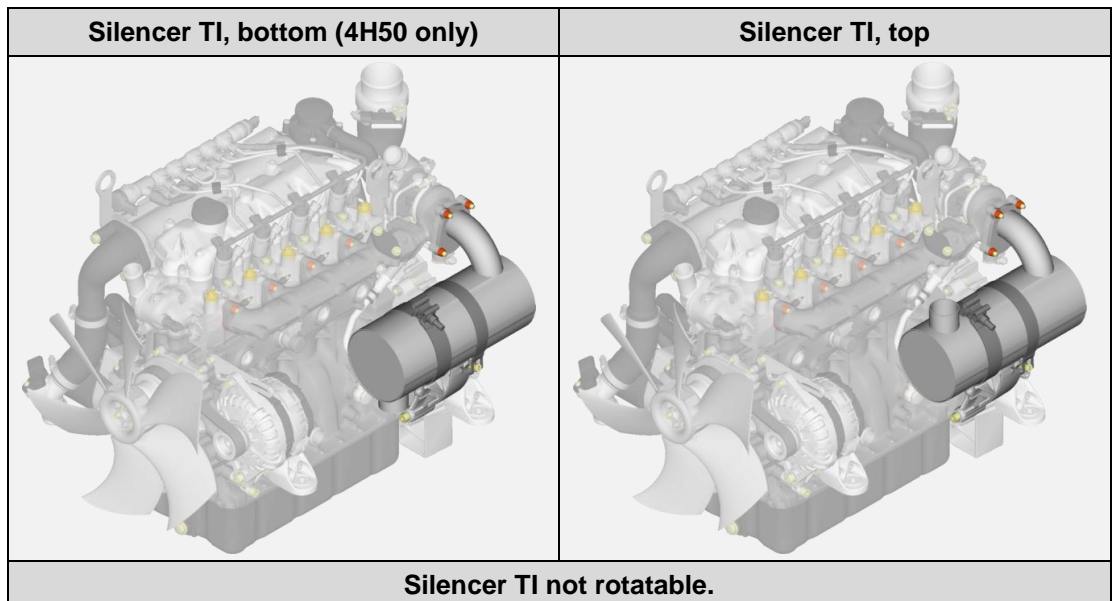
CAUTION

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.



4.7.6 DOC mounted on the engine side



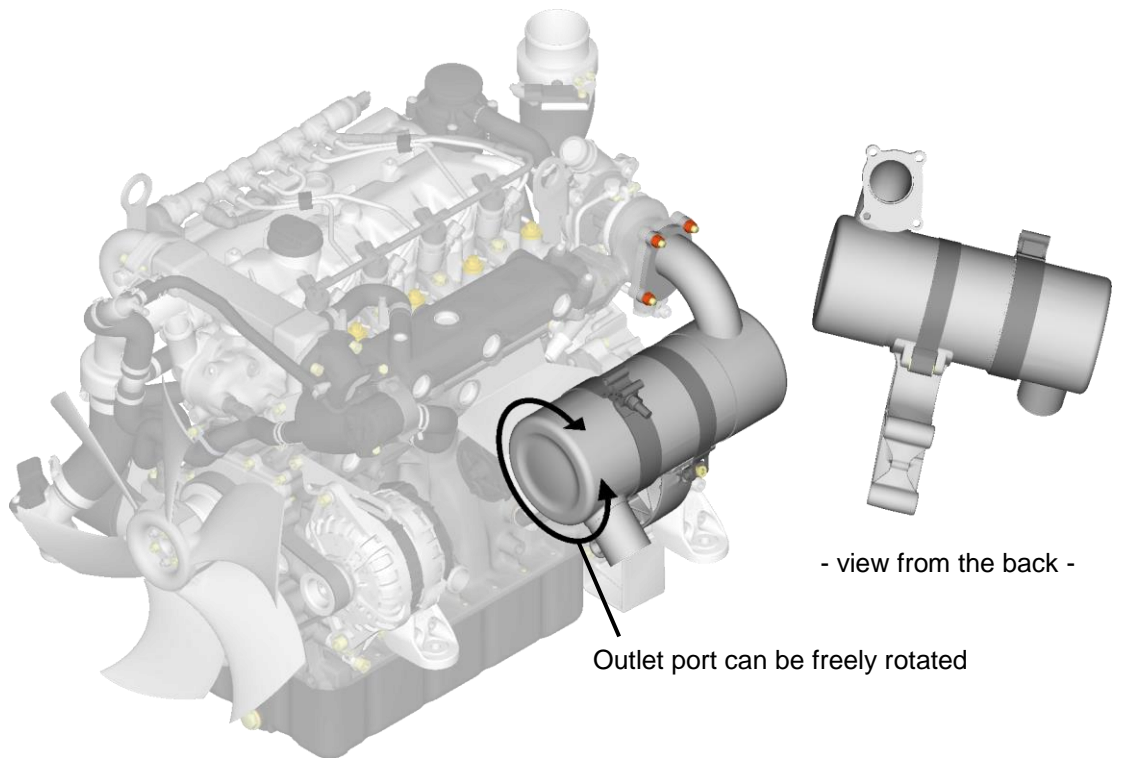
CAUTION

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.
-



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.

4.7.7 DOC separated



CAUTION

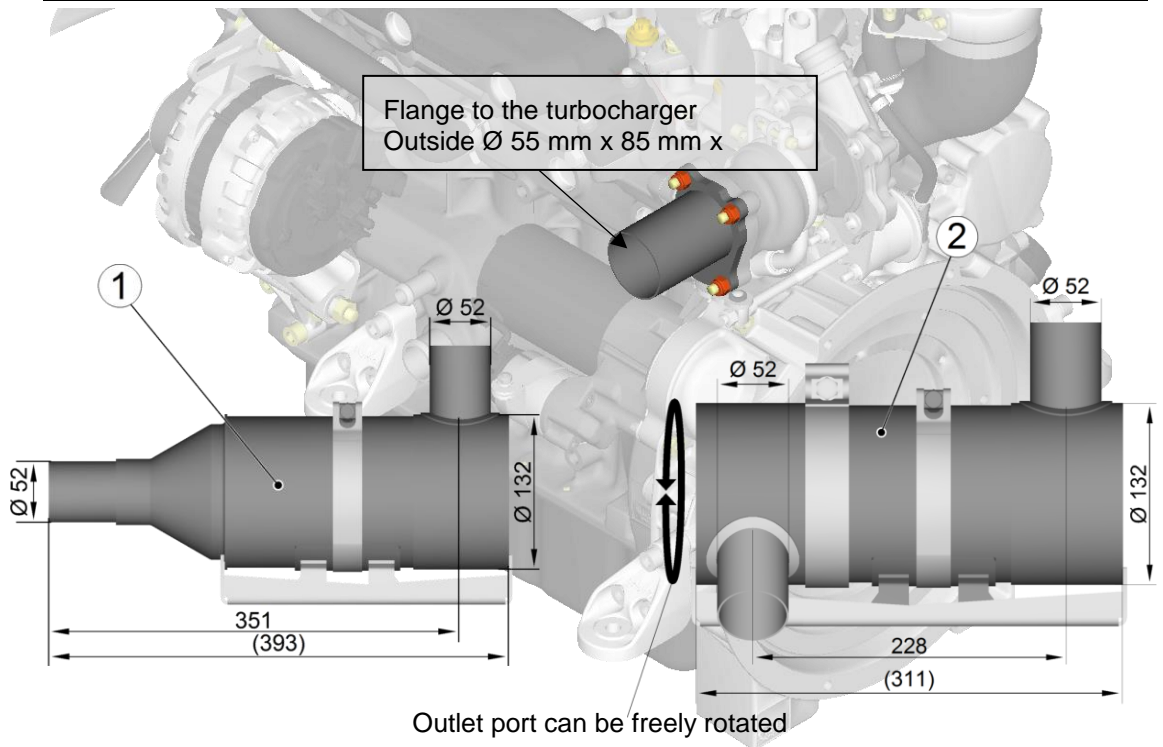
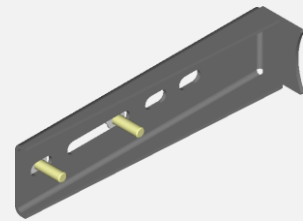
Danger of burns from hot exhaust gas system.

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.



	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

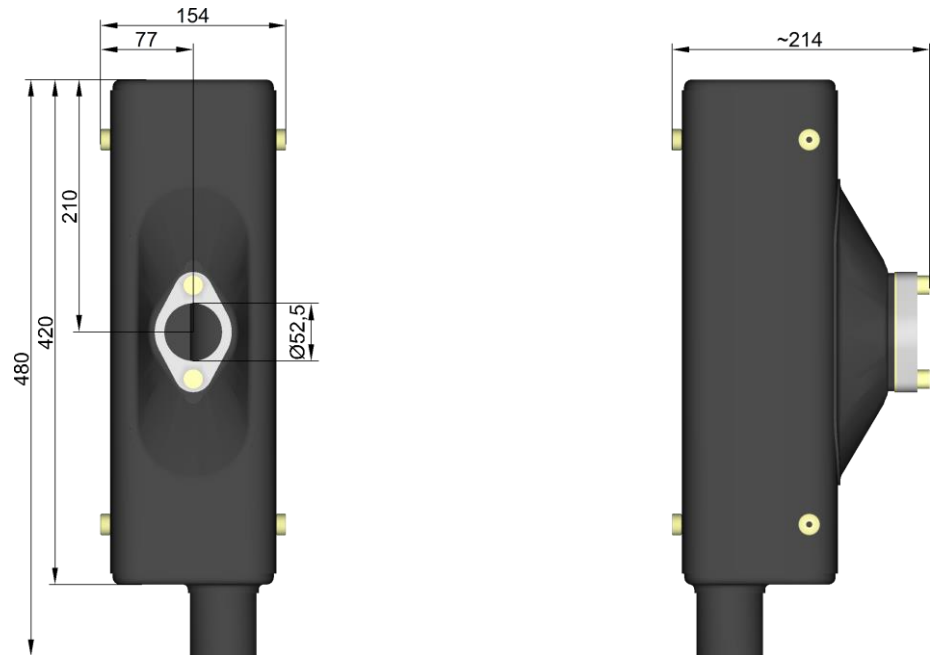
The main influencing factor is the cooling by cooling air flowing past. For this reason thermal insulation may be necessary for greater distances/stronger circulation.

There are two variants of the separated oxidation catalytic converter

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

4.7.8 Silencer TIC/TICD

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



4.7.9 Diesel particulate filter (DPF)



CAUTION

Cutting hazard!

Sharp edges on the diesel particulate filter.

- Wear cut-proof gloves.



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.



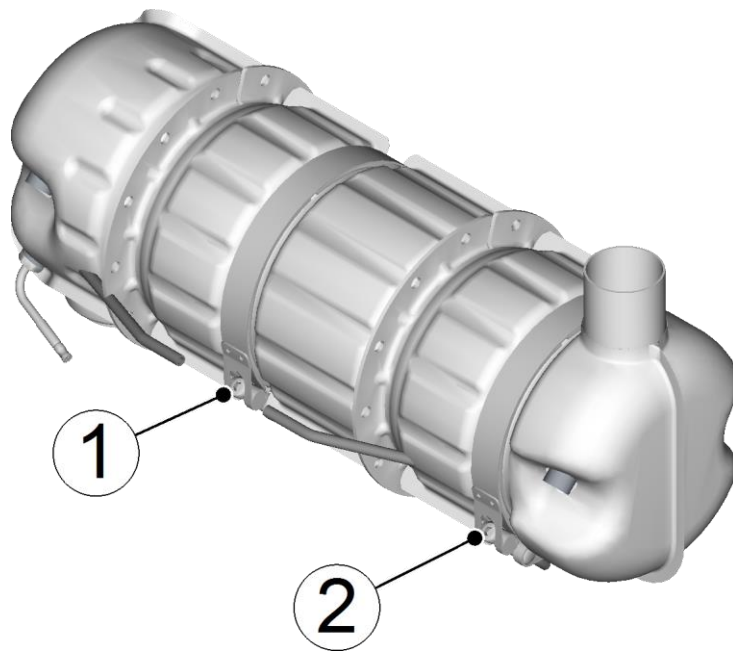
DANGER

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.

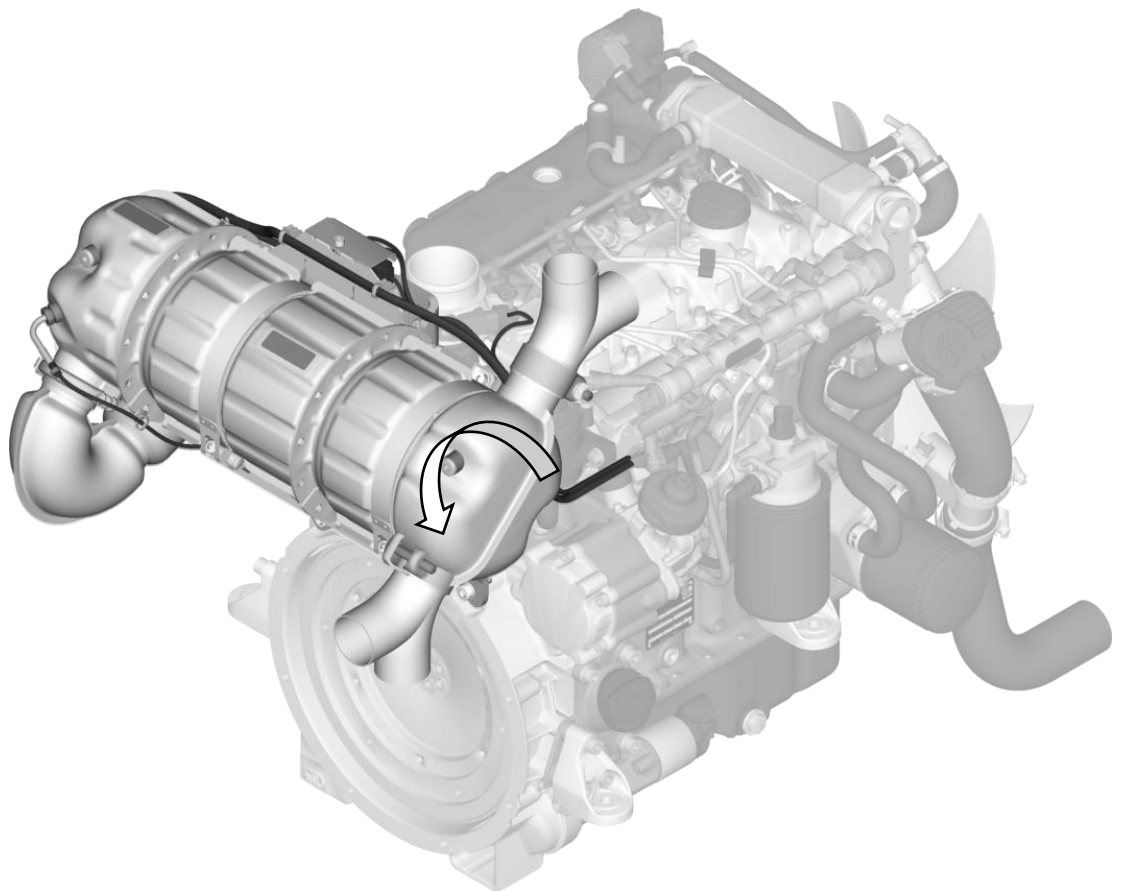
- Let the diesel particulate filter and exhaust system cool down.
- Wear safety gloves.





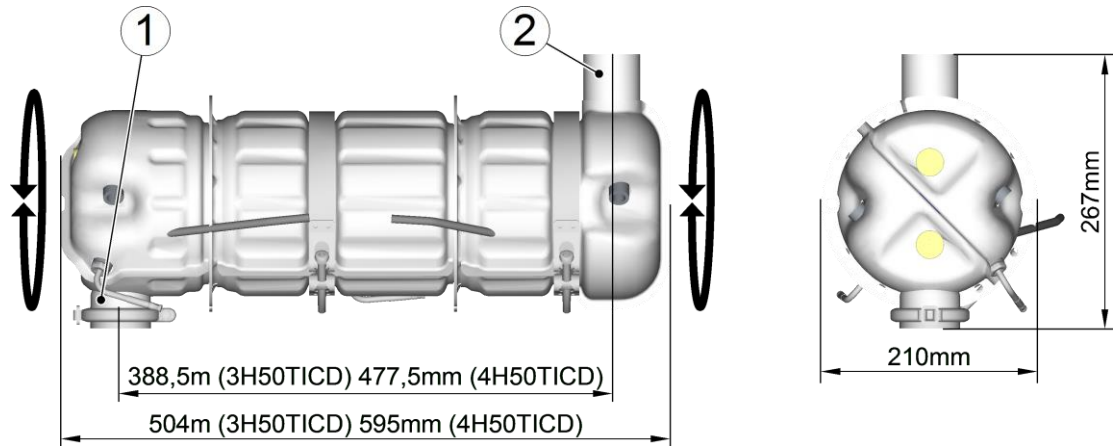
1	The V-Band clamp is NOT permitted to be opened to correct the position.
2	The V-Band clamp is permitted to be opened to correct the position.

Engine-mounted diesel particulate filter (with possible exhaust outlet positions)



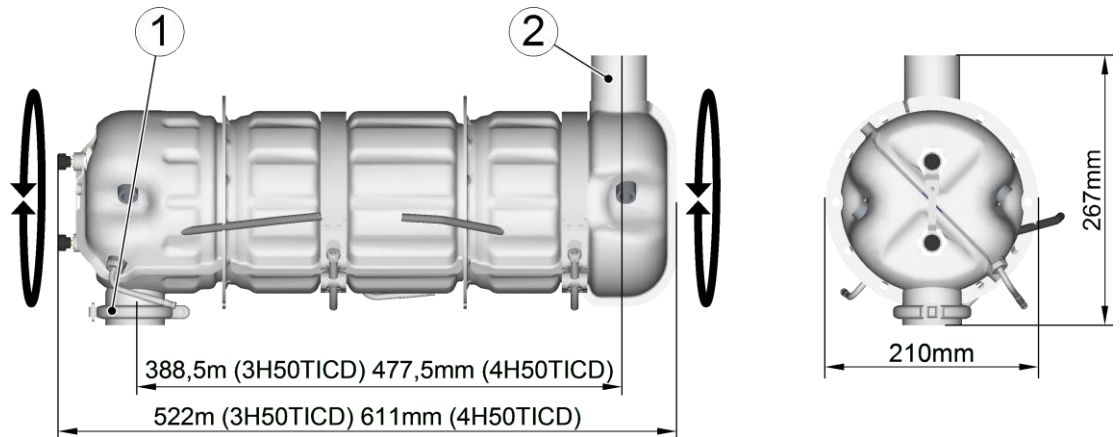
Exhaust outlet rotates by 180°

Removed diesel particulate filter (chassis) Active



		Dimensions
1	Exhaust inlet	Inside Ø 55.60 mm
2	Exhaust outlet	Outside Ø 55 mm
<ul style="list-style-type: none"> Exhaust inlet/exhaust outlet can be rotated in any direction. Mountable horizontally, vertically or in any direction. 		

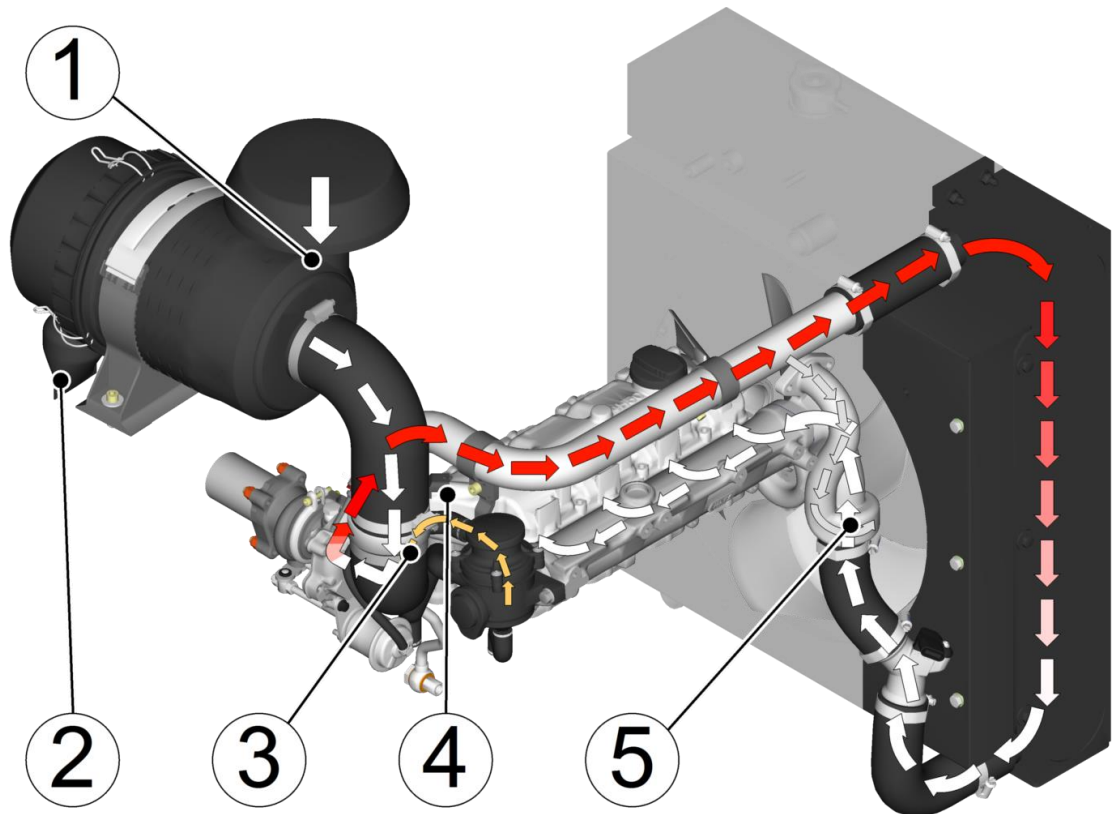
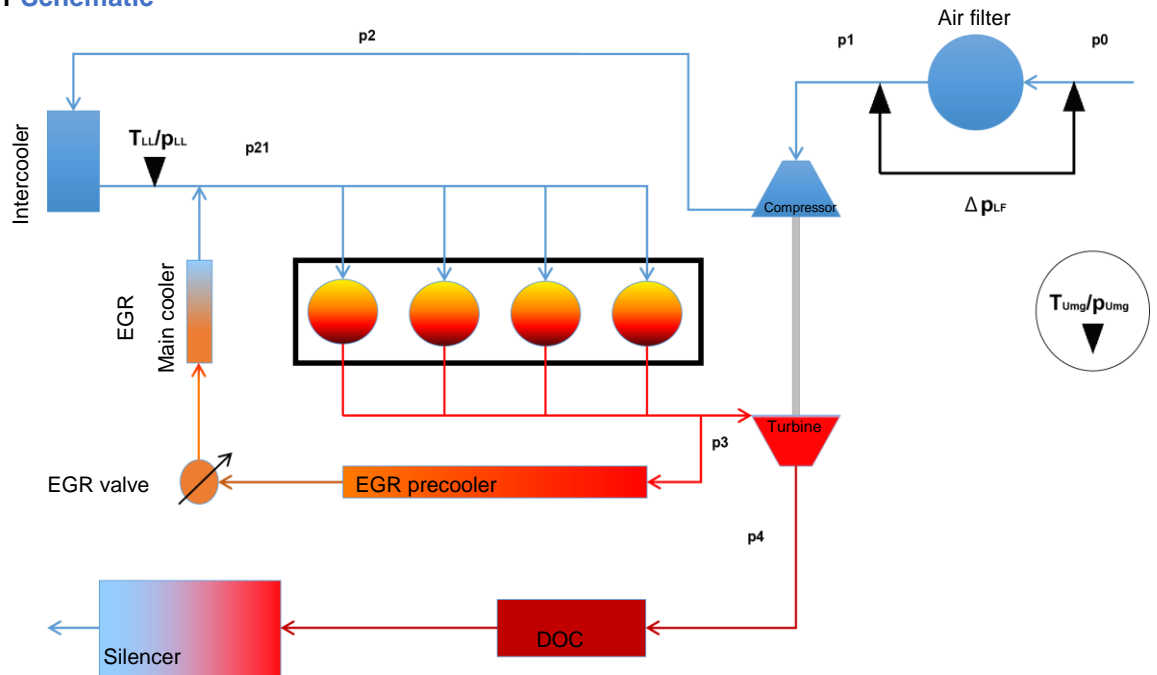
Removed diesel particulate filter (chassis) Active Premium



		Dimensions
1	Exhaust inlet	Inside Ø 55.60 mm
2	Exhaust outlet	Outside Ø 55 mm
<ul style="list-style-type: none"> Exhaust inlet/exhaust outlet can be rotated in any direction. Mountable horizontally, vertically or in any direction. 		

4.8 Intake and combustion air system

4.8.1 Schematic



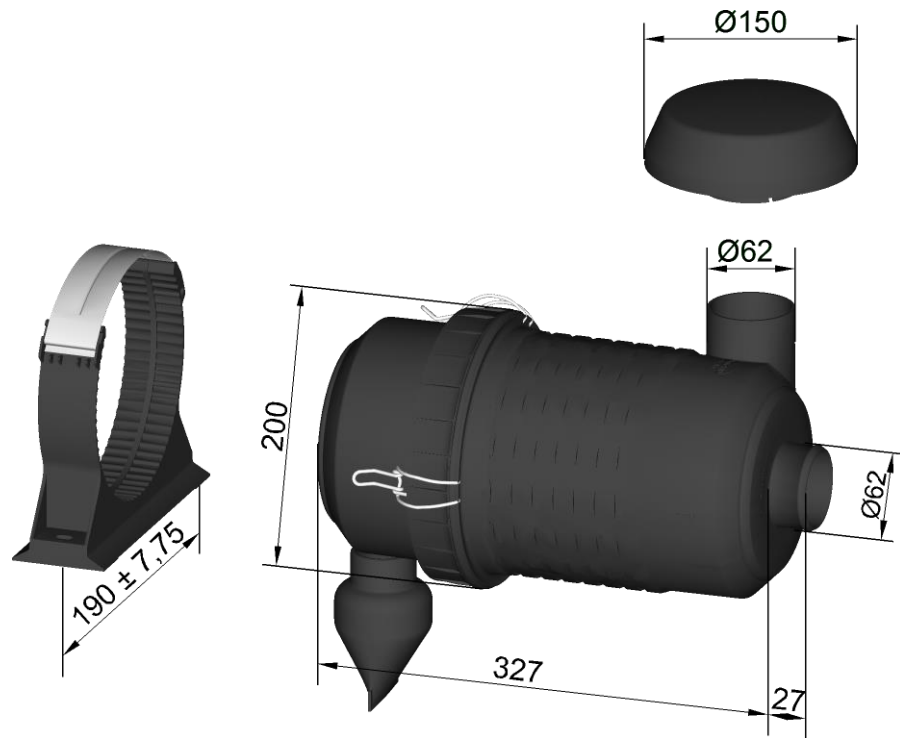
1	Pre-separation through tangential inlet
2	Dust discharge valve
3	Crankcase ventilation insertion
4	Measurement point for negative intake pressure
5	Exhaust gas recirculation insertion

4.8.2 Air filter selection, dimensioning and intake section

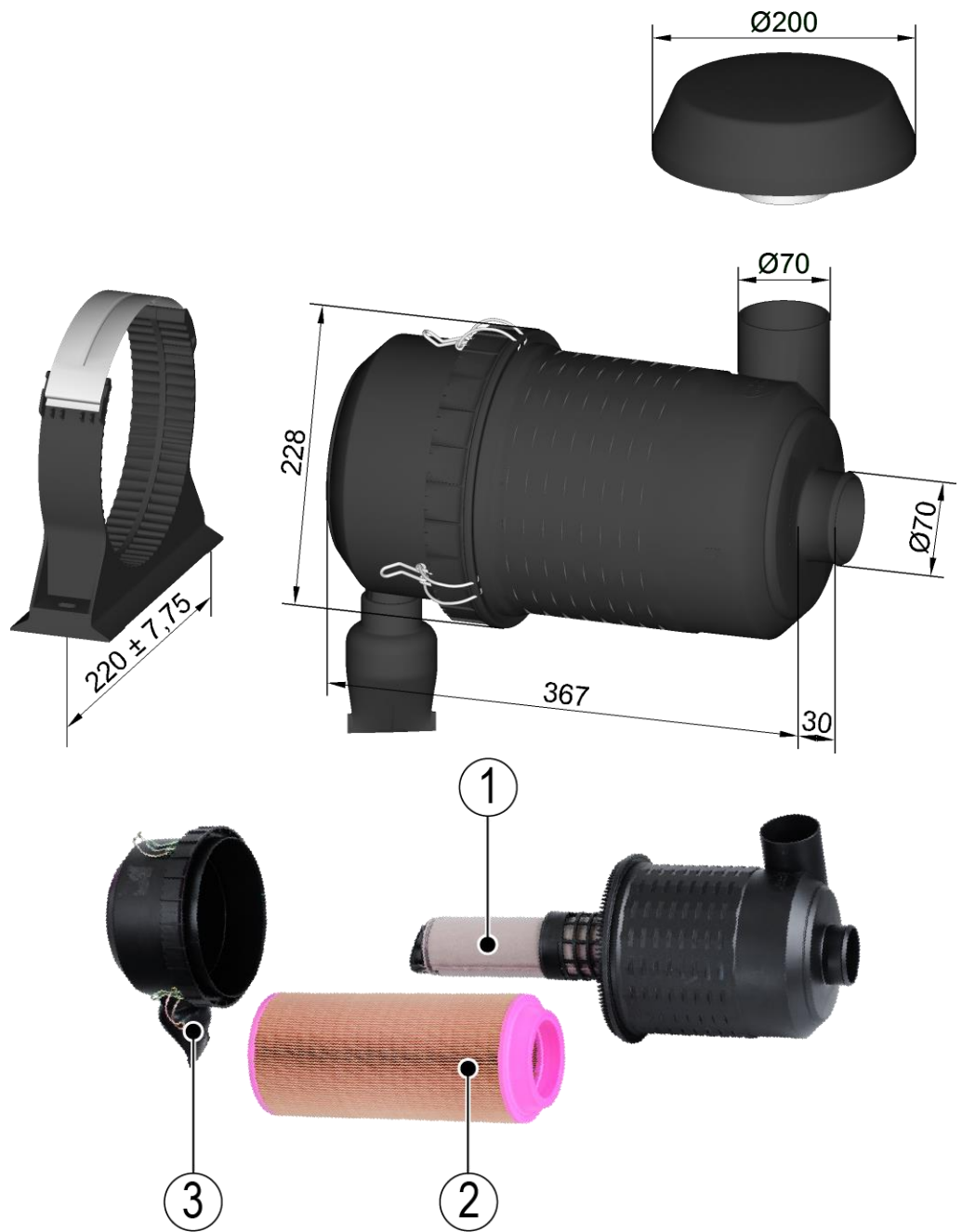
The most important dimensions of the HATZ air filter system including fastening material and rain cap.

Europiclon 200

The Europiclon 200 can be used for low-dust applications. However, it is not part of the Hatz sales program.

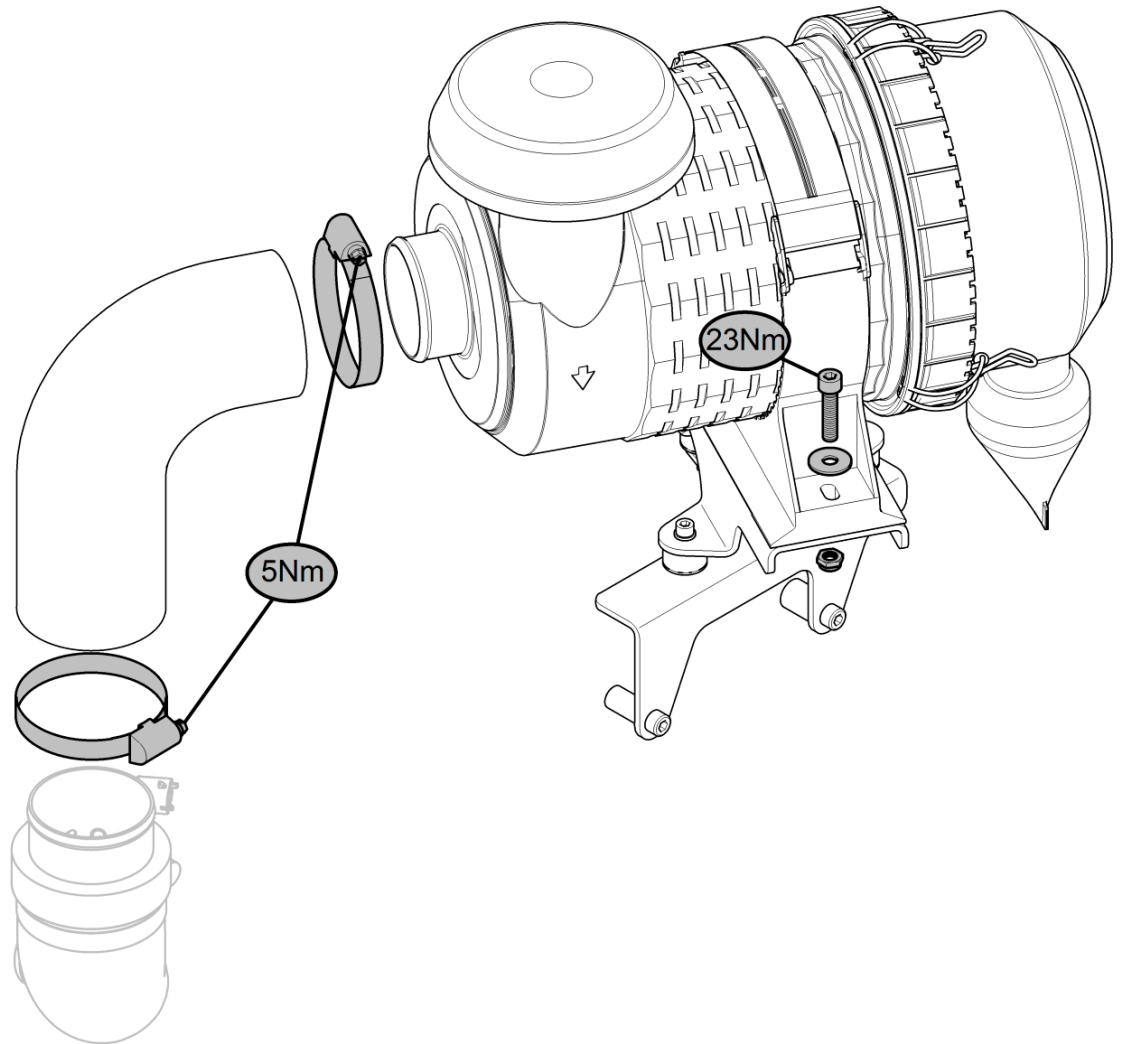


Europiclon 300

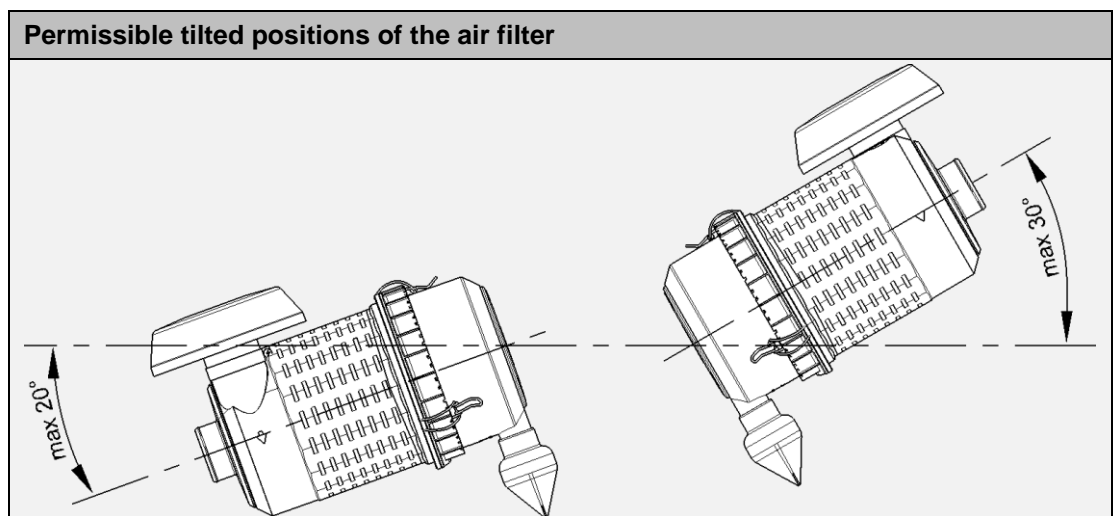


1	Secondary filter
2	Primary filter
3	Dust discharge valve

4.8.2.1 Air filter installation above the engine T1/TIC/TICD

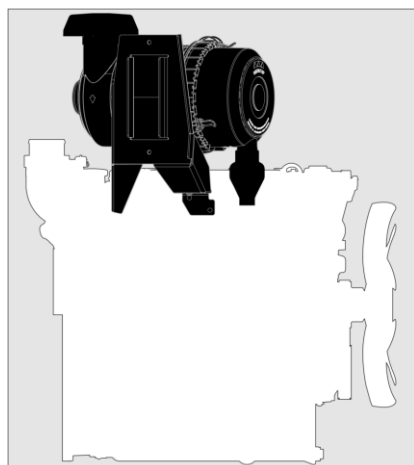
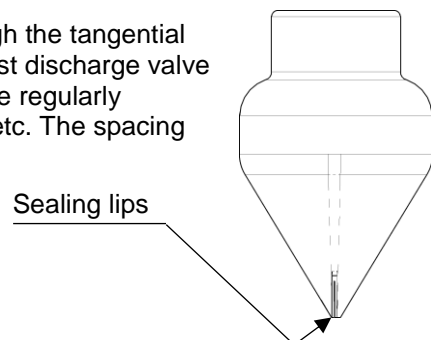


4.8.2.2 Tilted positions of the air filter



Permissible tilted positions of the air intake	
Without rain cap	With rain cap
Permissible tilted positions of 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 dust discharge valve should be regularly cleaned to remove adhesions due to dirt, dust, etc. The spacing between the sealing lips should be max. 2 mm.



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.

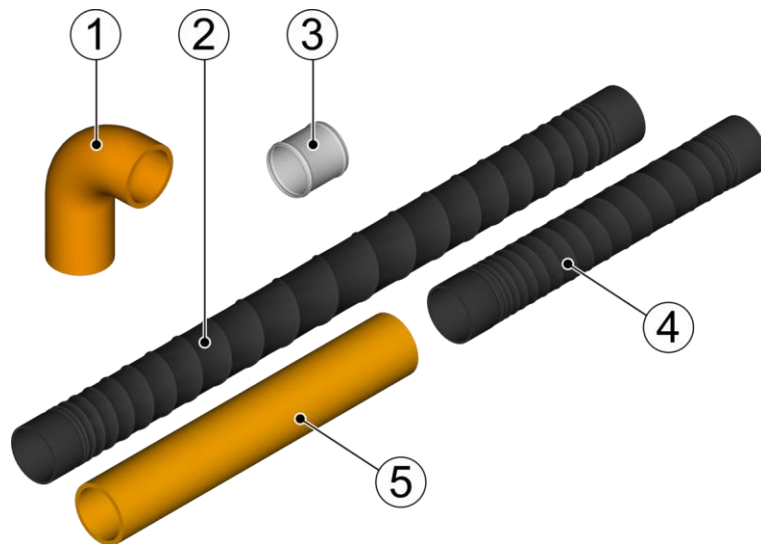
4.8.2.3 Intake section

NOTICE

Note the following regarding hoses with spiral wire inserts:

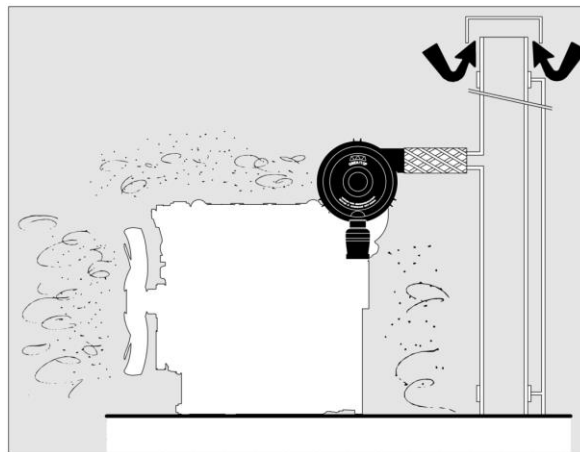
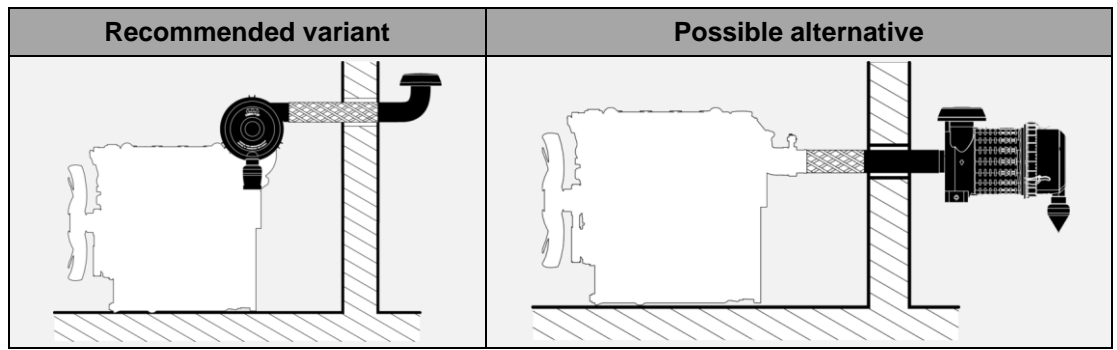
- In very dusty and dirty environments, the hose needs to be checked regularly for leaks.
- The hose is very thin between the spirals (1.5 – 2 mm). Do not touch with sharp or pointed objects.
- Because the hose has low strength, no pressure is permitted to be applied to the hose.
- Minimum bending radius = 105 mm
- The hose has good resistance to oil, but is not approved for permanent contact with oil.

Leaks on the clean air side must be avoided. The intake 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.



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).

4.8.3 Design of the combustion air line/intake negative pressure

4H50									
	Constant speed			Variable speed					
Speed n [rpm]	3000	1800	1500	2800	2700	2600	2500	2400	2300
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									

3H50							
	Constant speed		Variable speed				
Speed n [rpm]	1800	1500	2800	2700	2600	2500	2800
Power (kW)	28.5	22.3	43.6	42.0	40.3	36.4	36.4
Perm. intake negative pressure with brand new filter element * [mbar]	10.0	10.0	35.0	30.0	25.0	20.0	30.0
* with loaded filter @ n=2800 rpm approx. 25 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 \varnothing 70 bore must be used between the air filter and exhaust gas turbocharger.

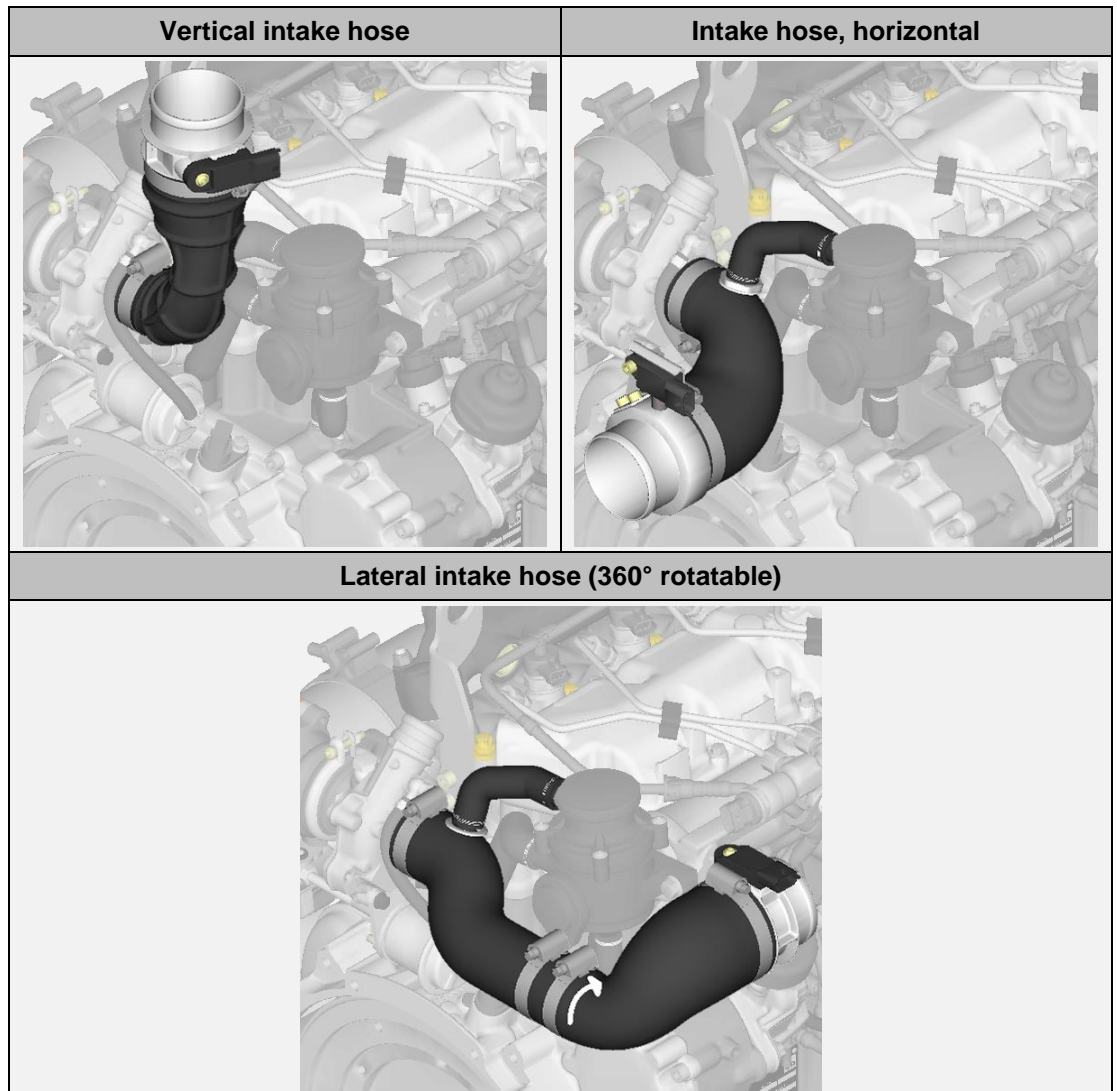
Quality → Flexafit HP/ NL21LIM

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.

4.8.4 Possible connection options



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, will the series machine be maintained later in accordance with the manual for diesel engine.

For the oil specification and oil viscosity, see the "Engine oil" chapter in the manual for diesel engine.

4.9.1 Filling quantities

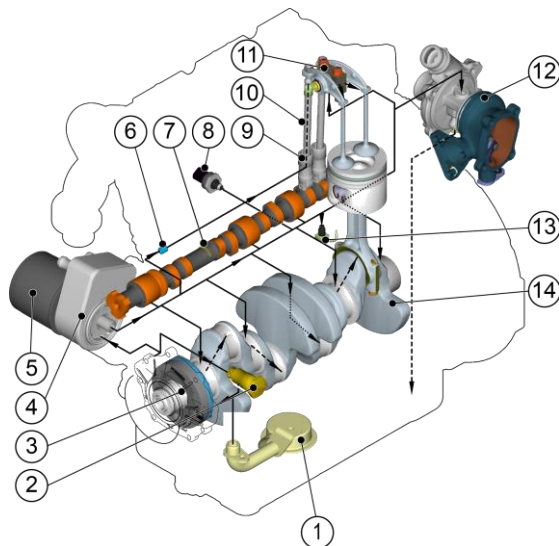
	Filling quantity	Delta min/max
3H50	5.0 l	Approx. 0.8 l
4H50	7.0 l	Approx. 1.0 l



IMPORTANT NOTE

The filling capacities only apply to the standard oil sumps.

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).

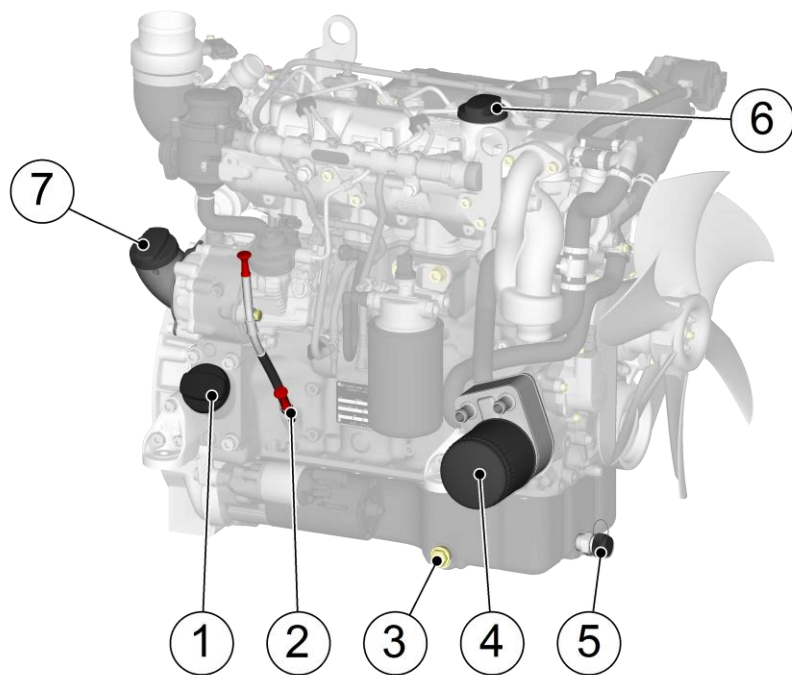


CAUTION

Danger of environmental damage from used oil

Used oil is water-polluting.

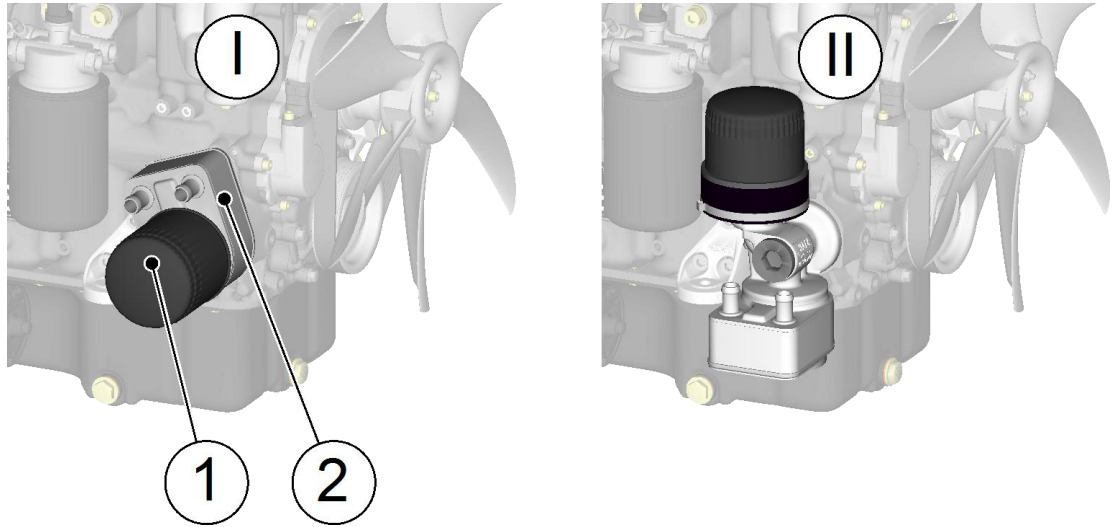
- Do not allow them to enter the ground water, water bodies, or sewage system.
- Collect the used oil and dispose of it according to local environmental regulations.



1	Oil filler, bottom
2	Dipstick (raised option)
3	Oil drain screw
4	Oil filter
5	Oil drain valve (option)
6	Oil filler, top (4H50 option, 3H50 standard)
7	Oil filler behind the high-pressure pump

1	Oil drain screw (side)
2	Oil drain screw (front)
3	Seal ring

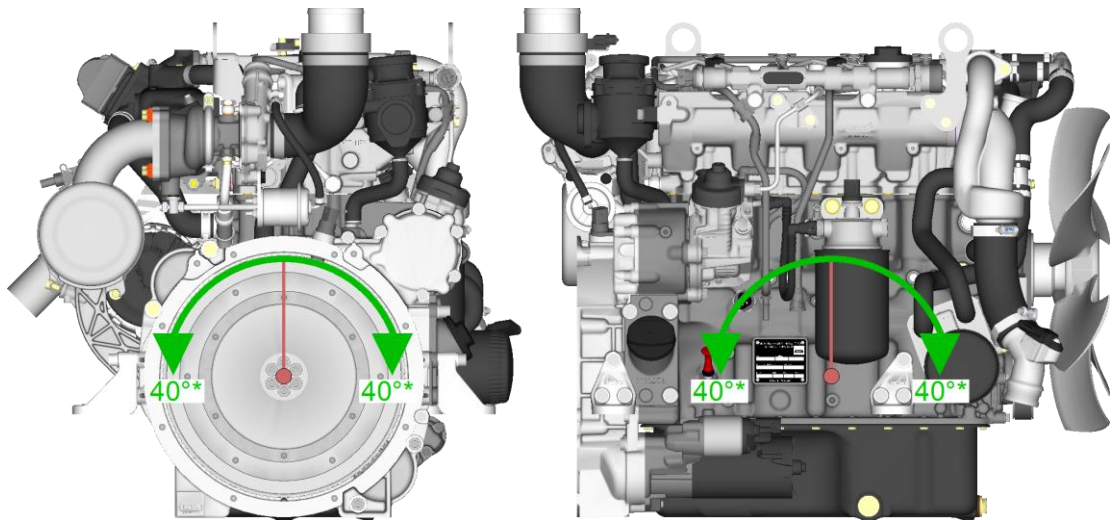
4.9.4 Oil filter mounting options



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 <i>Vibration damper</i> , page 37)
1	Oil filter cartridge
2	Oil cooler

4.9.5 Continuous skewed positions

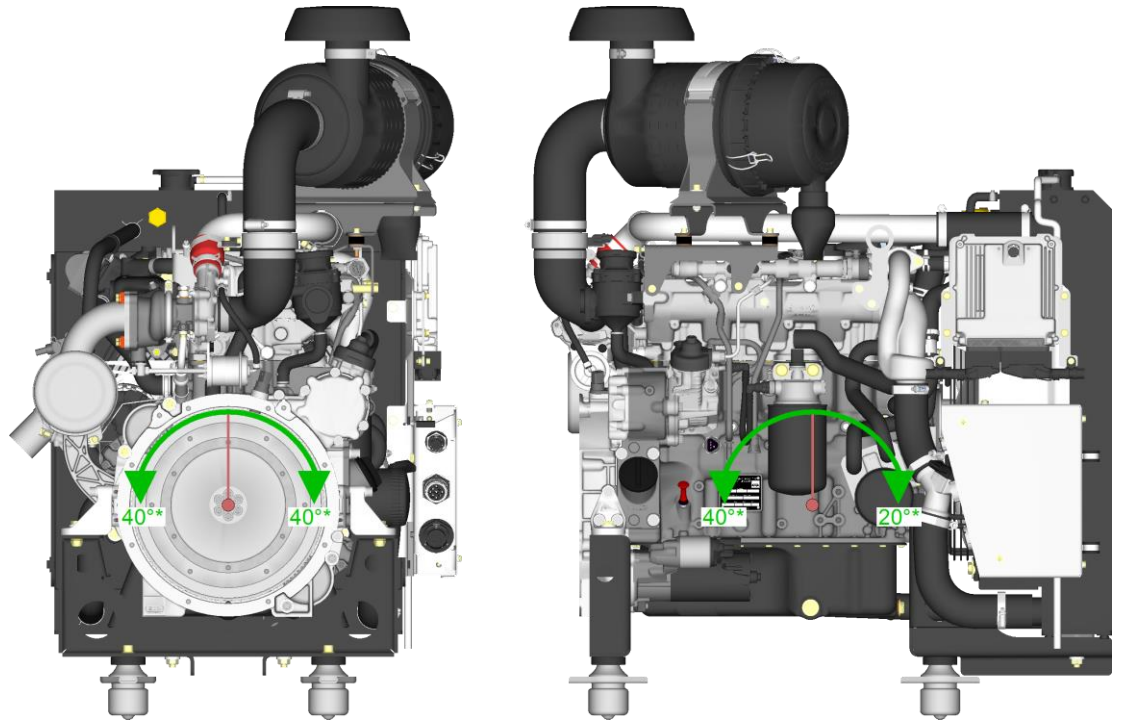
4.9.5.1 Continuous skewed positions F2F



*Maximum 7 hours, 30° without time-related restrictions

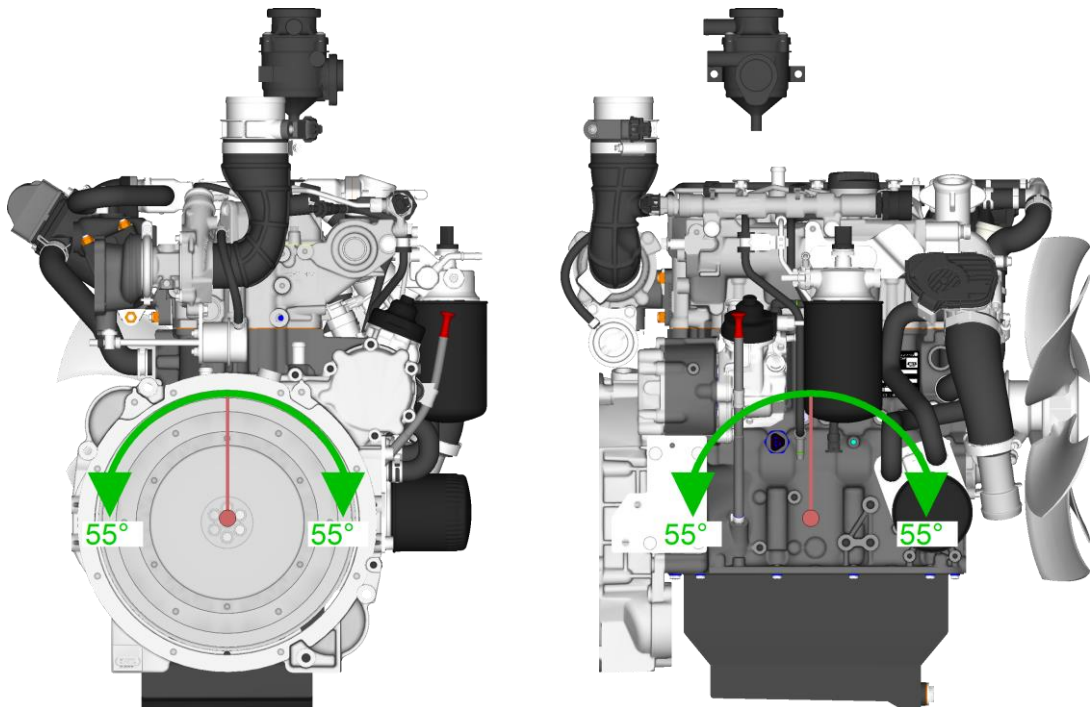
If the engine with a permanent skew is used in an application, the dipstick must be modified to the permanent skew (new Min / Max mark).
Please contact the HATZ main factory in this regard.

4.9.5.2 Continuous skewed positions OPU



*Maximum 7 hours, 30° without time-related restrictions

4.9.5.3 55° tilting positions, special package

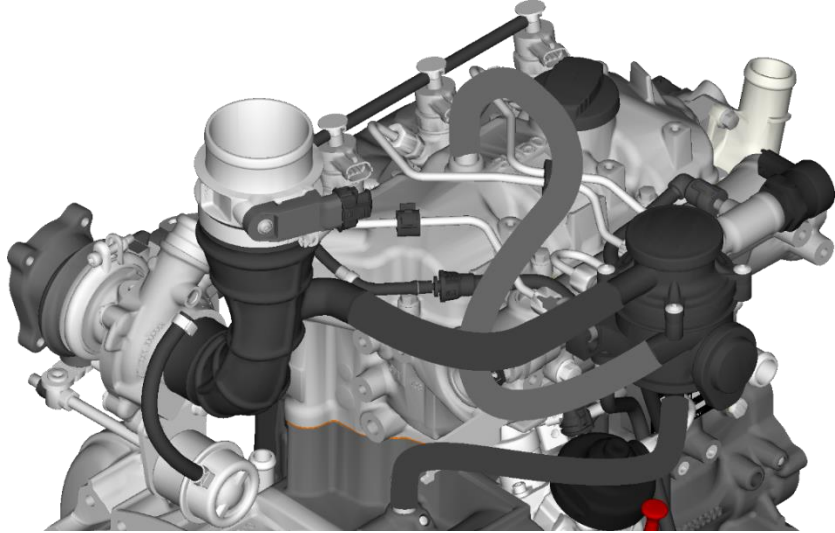


	Filling quantity	Delta min/max
3H50	5.85l	Approx. 1l

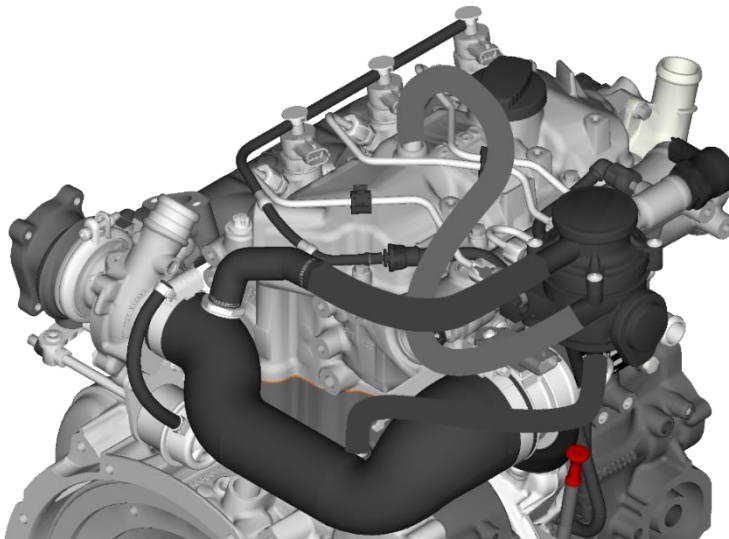
4.9.5.3.1 Installation of crankcase ventilation (ProVent) 55° tilt positions

Delivery status

Air intake, vertical



Air intake, lateral

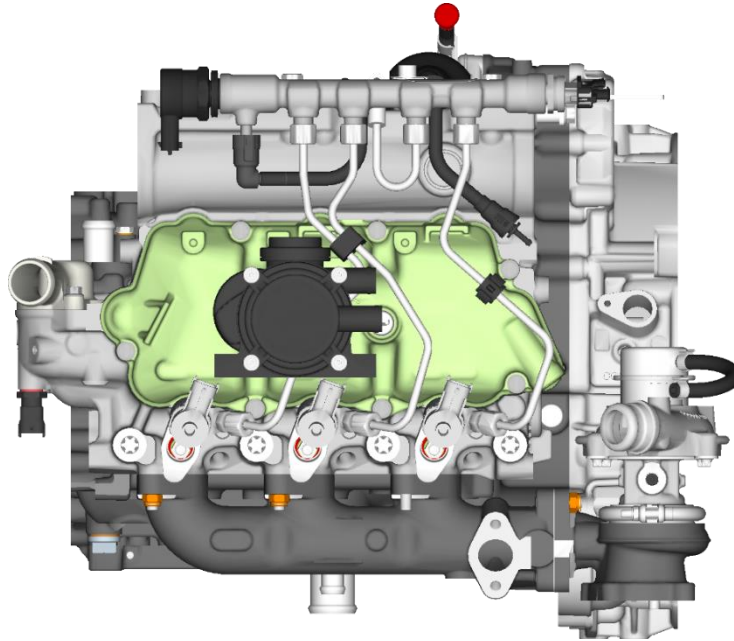


NOTE

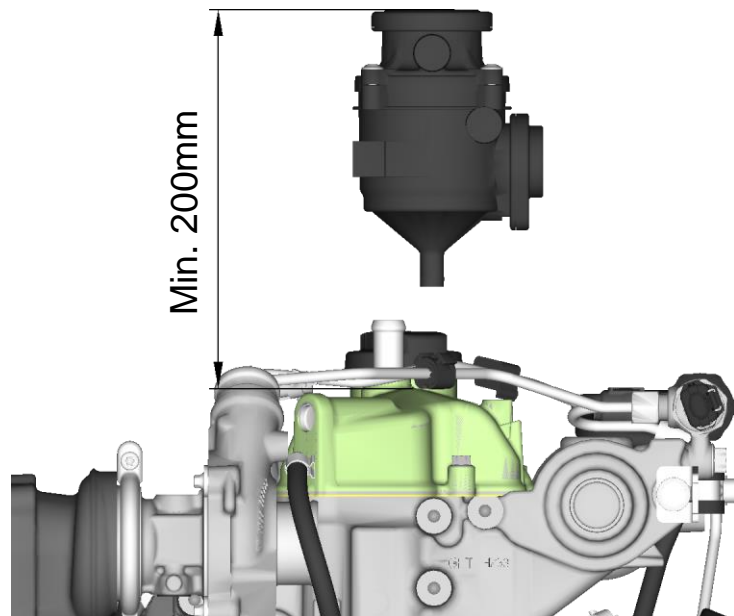
The crankcase tubing must always be routed in a descending direction.

**Minimum height of crankcase ventilation –
Position above cylinder head cover (green area)**

Top view:

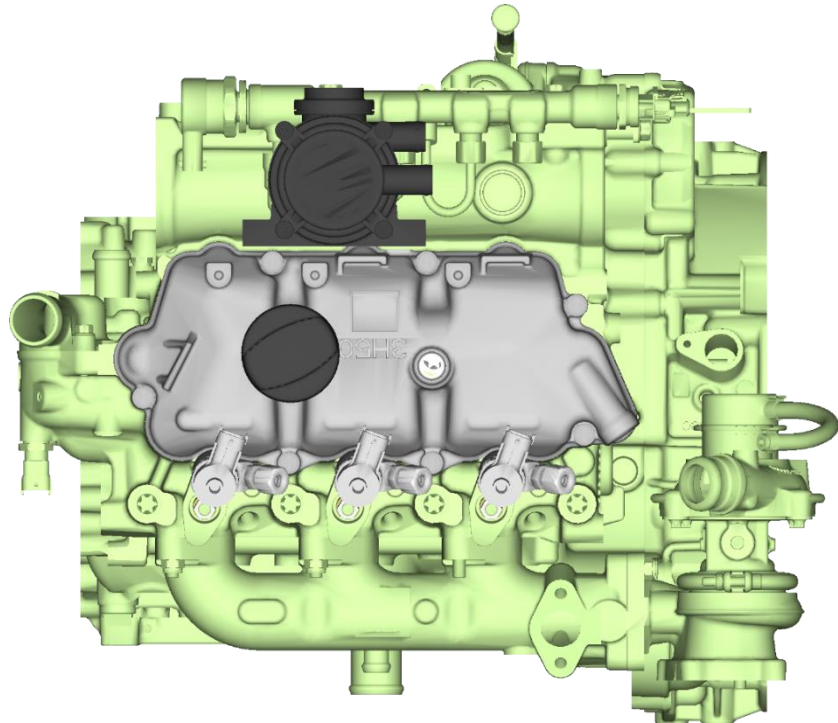


Front view:

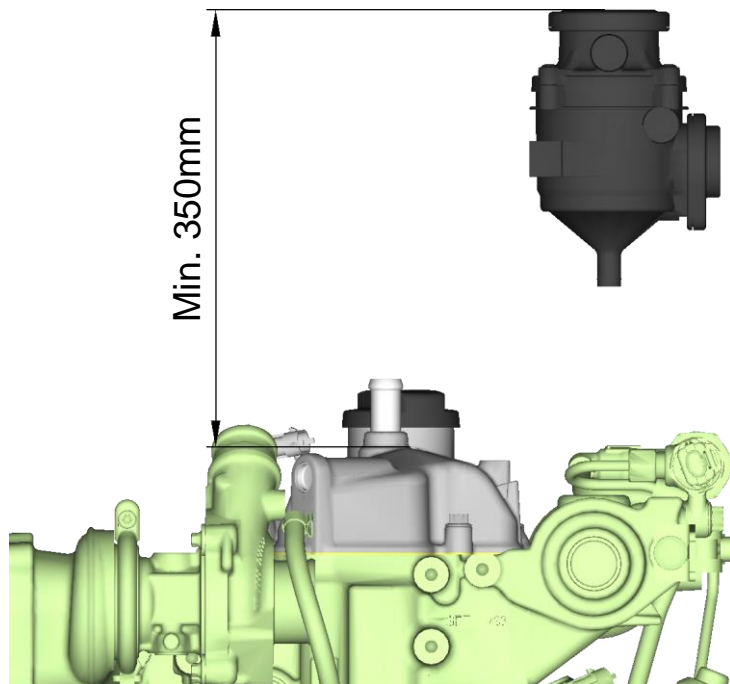


**Minimum height of crankcase ventilation –
Position outside of cylinder head cover, within crankcase (green area)**

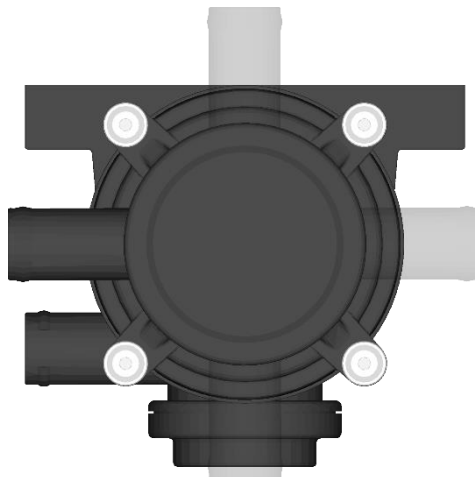
Top view:



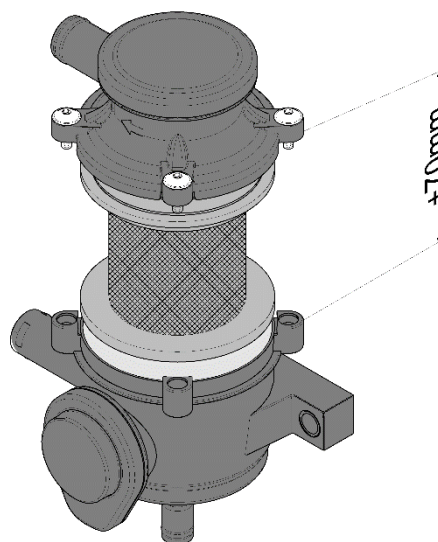
Front view:



The cover is permitted to be rotated relative to the crankcase ventilation by means of 4 hexagon socket screws in 90° steps.



The expansion dimension of 70 mm must also be taken into consideration when installing in the machine.

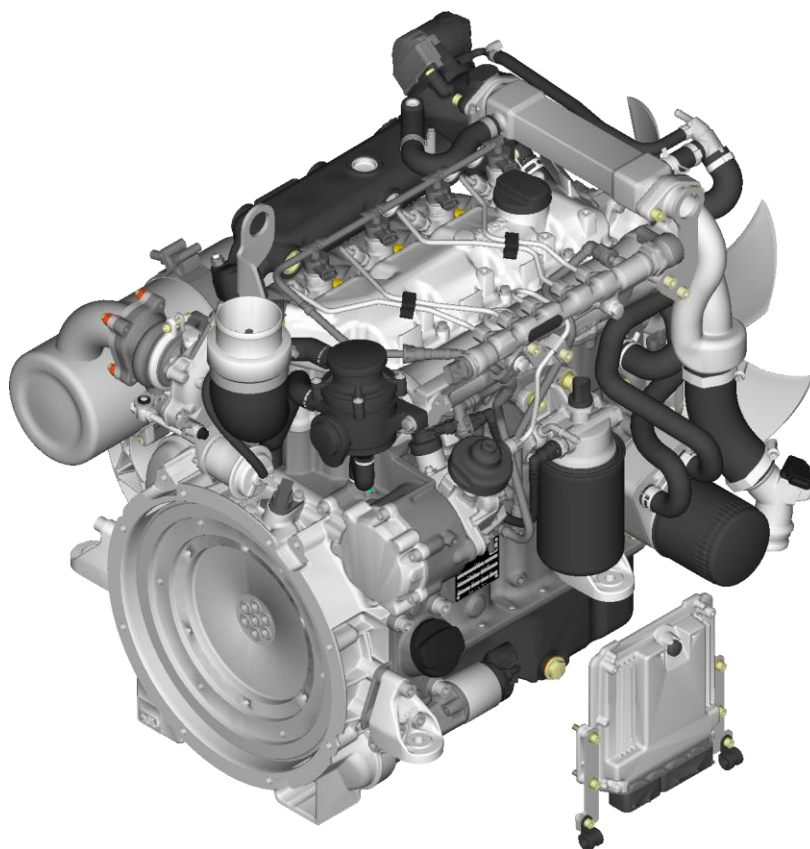


NOTE

After the crankcase ventilation is installed, the tubing must be checked for possible chafing and kinks and, if present, these must be eliminated.

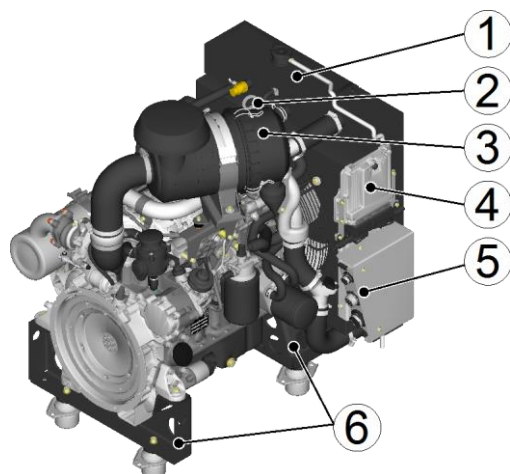
5. Engine specifications

5.1 Fan-To-Flywheel (F2F)



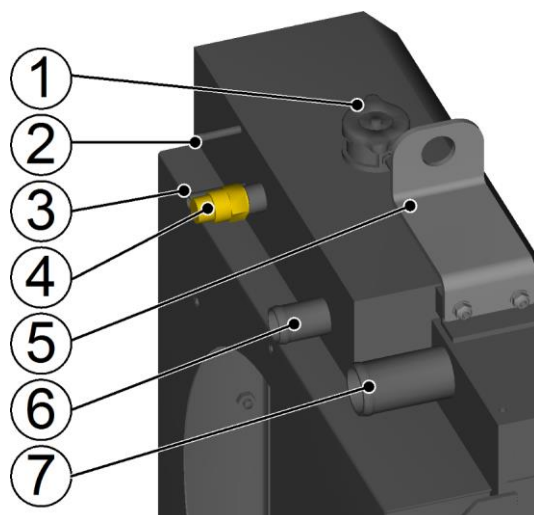
Scope of delivery of Fan-To-Flywheel (F2F)	
• Basic engine with EGR	• Pulley
• Main fuel filter	• Poly v belt
• Exhaust gas turbocharger	• Water pump
• Exhaust manifold	• EDC17CV54 control unit
• DOC mounted radially	• Oil filter horizontal with oil cooler
• Starter 12 V	• Flywheel 6.5"/8"
• Alternator 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 bracket

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

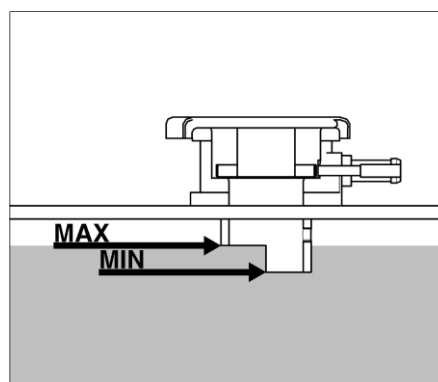
5.3 Combination cooler with integrated expansion tank



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

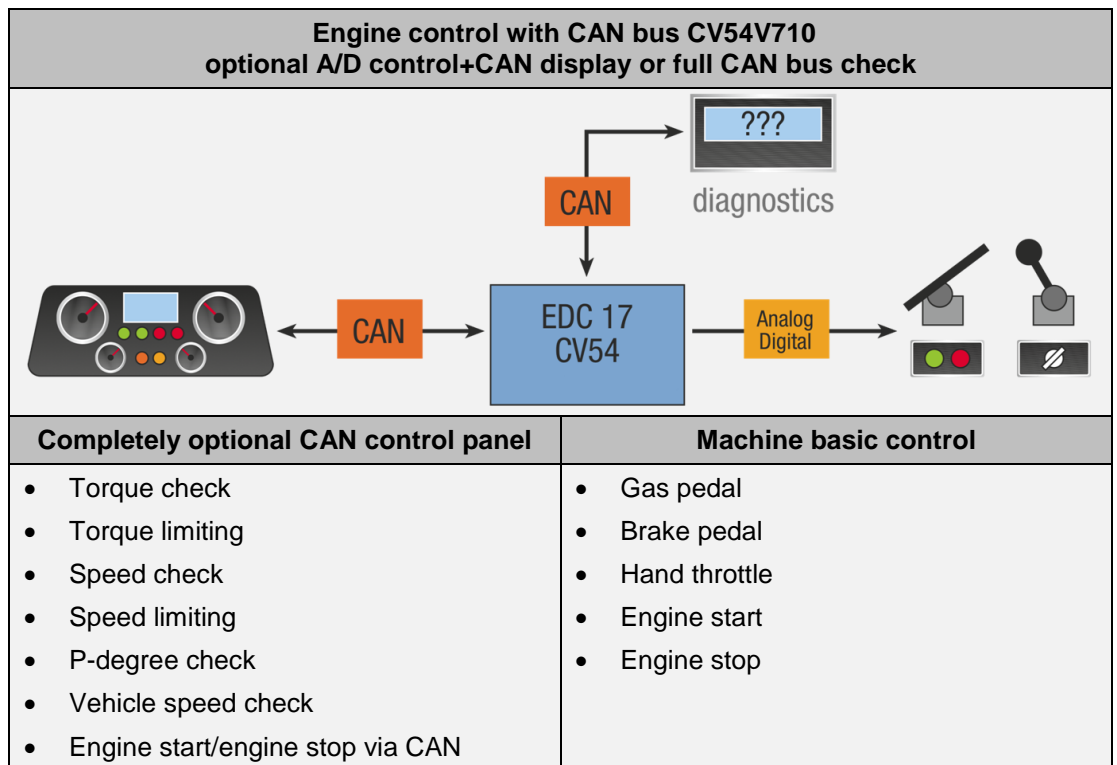
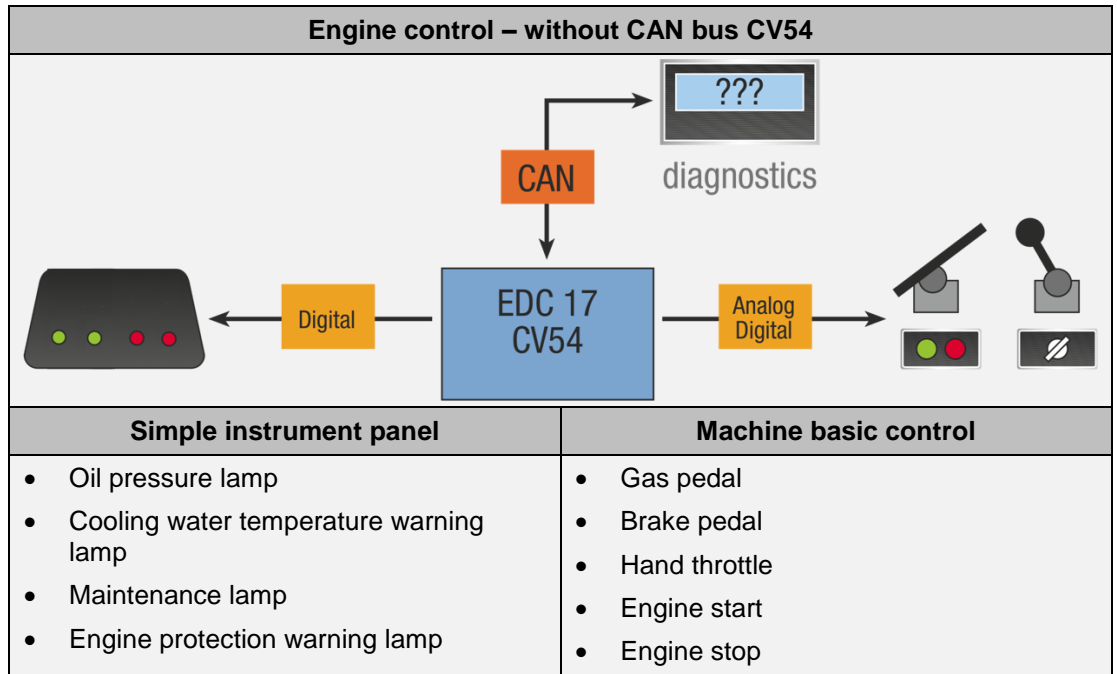
	Filling quantity	Delta min/max
3H50	12.7 l	Approx. 0.6 l
4H50	13.2 l	Approx. 0.6 l

5.3.1 Checking the coolant level

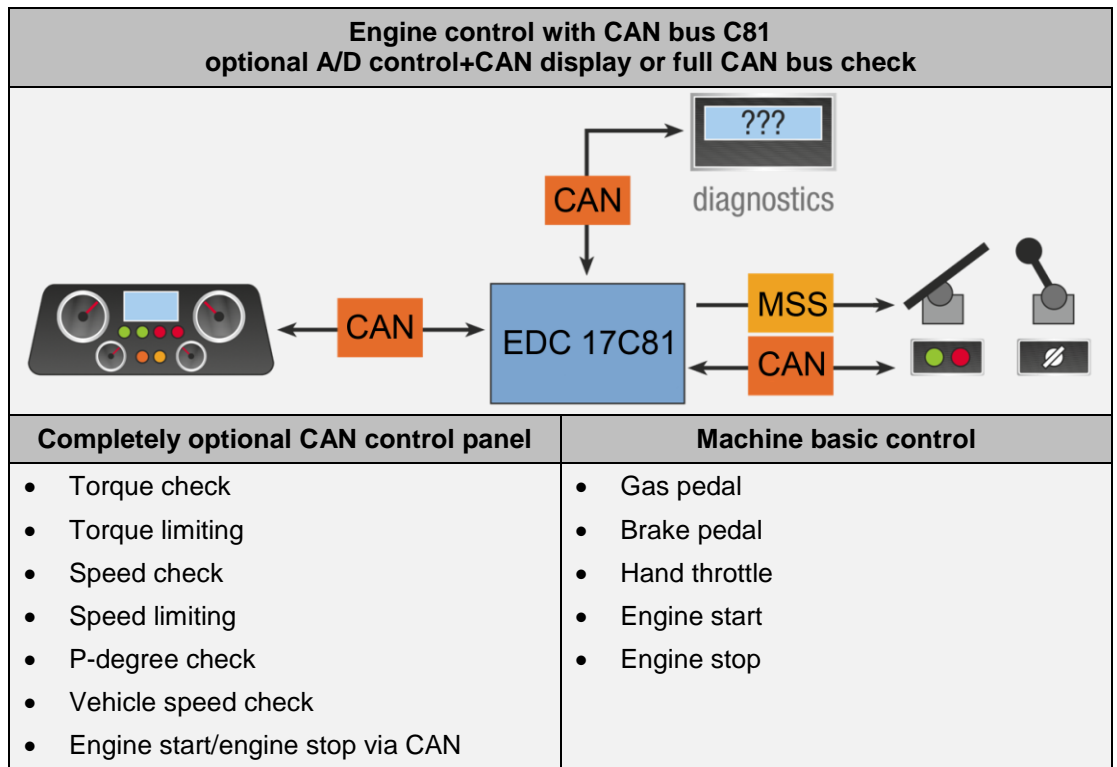


6. Electrical system

6.1 Engine control



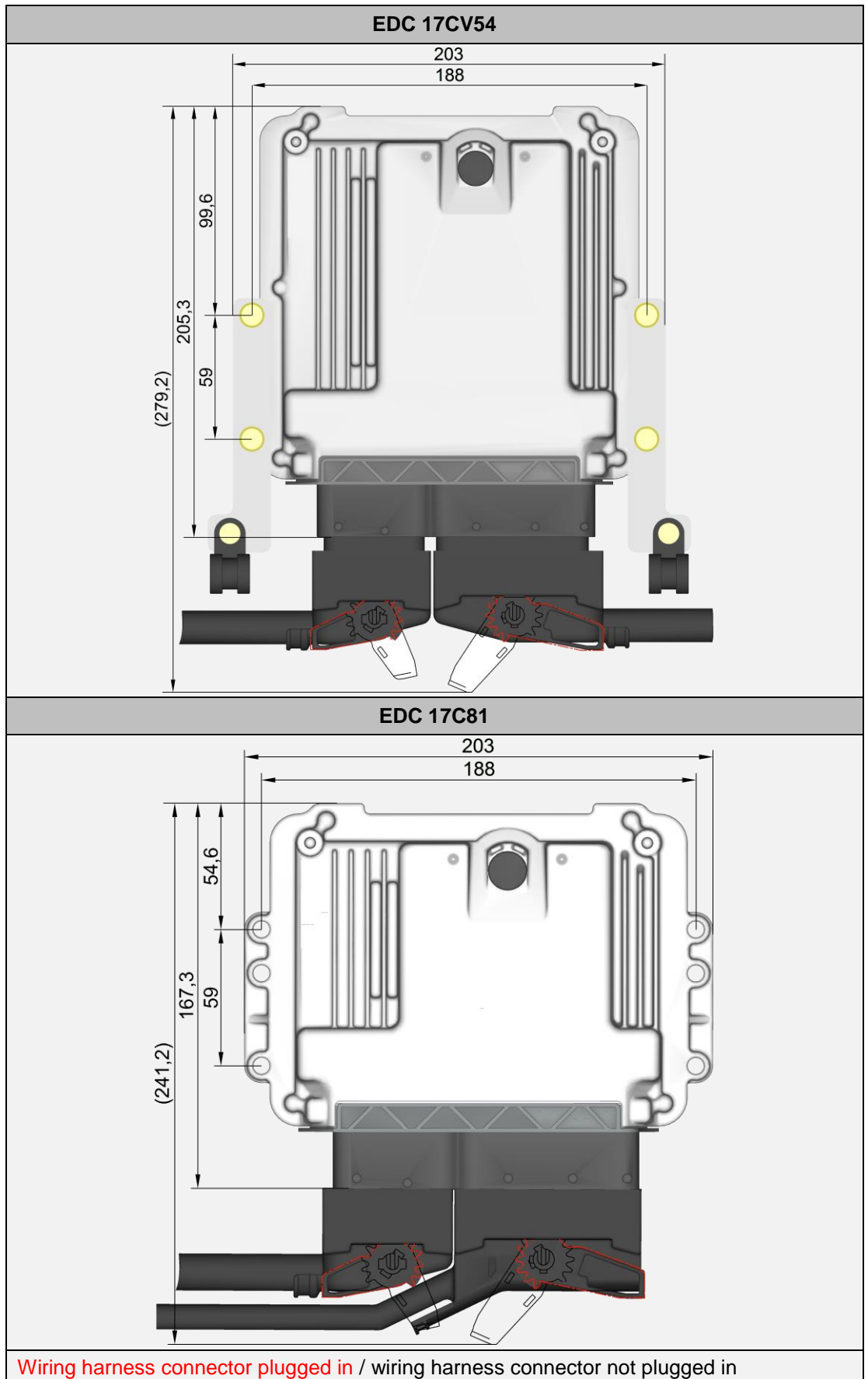
Possible engine control with CAN bus. Optional analog/digital control and information output only via CAN display, or also full CAN control including setpoint (e.g. engine speed).





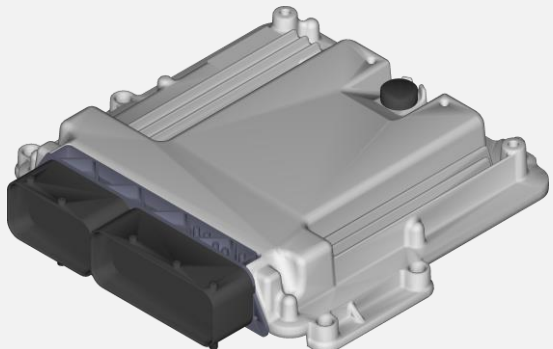
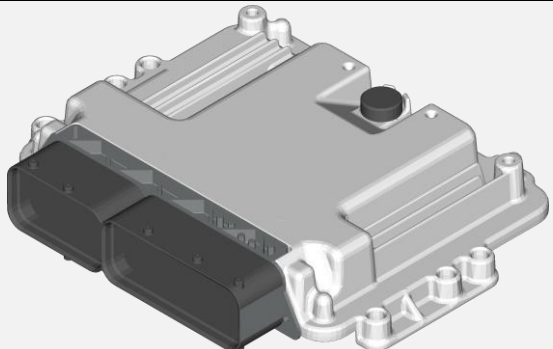
6.1.1 Control unit

Bosch control unit EDC 17CV54	
Installation conditions: <ul style="list-style-type: none"> • Ambient temperature: -32 - +80 C • Spray water protected • Dust tight • Tropicalized • Heavy duty • Vibration decoupled from engine separated • Permissible voltage range 9-32 V 	
Bosch control unit EDC 17C81	
Installation conditions: <ul style="list-style-type: none"> • Ambient temperature: -32 - +80 C • Spray water protected • Dust tight • Tropicalized • Heavy duty • Vibration decoupled from engine separated • Nominal voltage 12 V • Permissible voltage range 8-16 V 	

6.1.2 Control unit setup



6.1.3 Connections

EDC 17CV54	
Outputs:	
●	- Digital <ul style="list-style-type: none"> • Diagnostics lamp (flashing code) • Maintenance indicator lamp • Overtemperature lamp • ...
Inputs:	
	- Analog <ul style="list-style-type: none"> • Gas pedal (dual potentiometer) • Multistate switch
	- Digital <ul style="list-style-type: none"> • Remote start/stop • Diagnostics request • ...
CAN bus SAE J1939	
	
EDC 17C81	
Inputs/outputs:	
CAN bus SAE J1939	
- Digital	
<ul style="list-style-type: none"> • Remote starting/stopping • Diagnosis lamp 	
- Analog	
<ul style="list-style-type: none"> • Multistate switch 	
	

6.1.4 Control unit installation

It is recommended that you use the same installation position for the control unit as for the OPU.

When installing the control unit, it must be ensured that:

- No water can enter into the control unit along the wiring loom.
- No standing or permanently running water is permitted in the pressure compensation element (DAE – sealing area (1)) and the circumferential groove area (cover/base/measuring strip).
- Adequate ventilation is provided since the maximum ambient temperature of 80 C must not be exceeded.
- Both wiring harnesses are mechanically attached after a maximum distance of 100 mm to protect the plug connections against pull, push and vibration forces (tension relief) (see bracket for securing the cable (4)).

The control unit is mounted on the four locations (3) (4 x M6, 8 Nm) available. The installation in a vehicle must be executed in such a way that the control unit cannot collide with other vehicle parts or additional fasteners.

EDC 17CV54		
1	DAE sealing area (ambient pressure sensor)	
2	Temperature measurement points (to max. + 105 C)	
3	Mounting points	
4	Bracket for securing the cable	
EDC 17C81		
1	DAE sealing area (ambient pressure sensor)	
2	Temperature measurement points (to max. + 105 C)	
3	Mounting points	



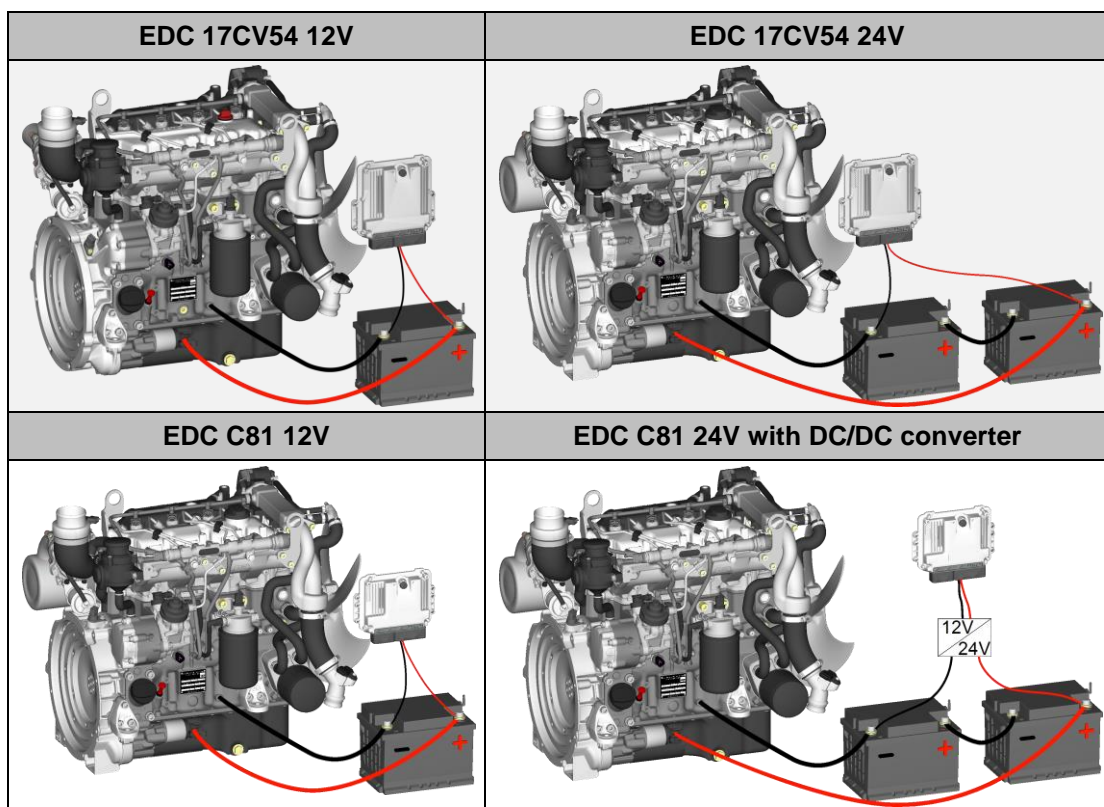
NOTE

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



IMPORTANT NOTE

Control unit voltage supply either via the fuse holder (standard for OpenPowerUnit) or directly from the battery (usually in Fan2Flywheel, see figure). If the voltage supply is implemented via the starter cable, a voltage undersupply or a fault in the control unit during the starting procedure is probable.



IMPORTANT NOTE



If using a battery master switch, the power supply of the control unit must be tapped downstream of the main switch. This ensures the full de-energization of all components. Before activating the main battery switch, it is necessary to wait for one minute after "Ignition off (ignition start switch)" to fully complete internal processes in the control unit.

6.1.5 Diagnostics tool

The HDS² diagnostics tool (Hatz Diagnostic Software) is available for troubleshooting and analyzing the engine parameters. For details, contact your **HATZ branch office**.

6.1.5.1 Flash codes EDC17 CV54

See the "Faults/flash code table" chapter in the manual for diesel engine.

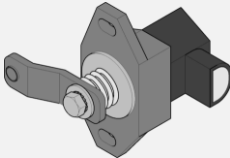
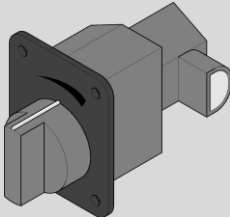
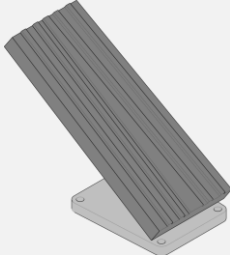


6.1.5.2 CAN message list

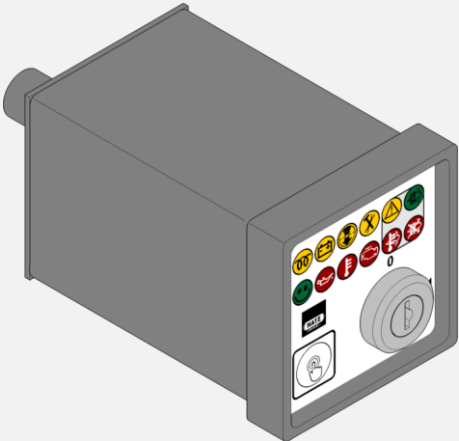
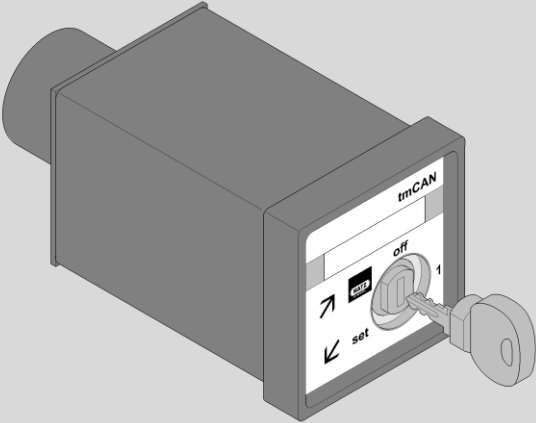
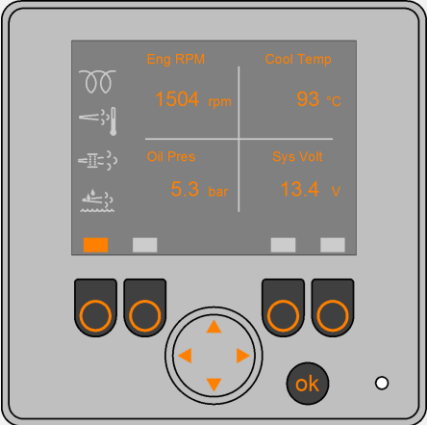
The CAN message list can be viewed under the following number 056 474 XX, which can be found under the following link <http://www.hatz.com/docu> using the engine serial number.

6.2 Engine monitoring (engine control and sensor system)

6.2.1 Actuators (speed adjustment), display instruments

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

Speed adjustments		IP degree of protection
Bowden cable (CAN)		IP66
Fuel rotary button (CAN)		IP66
Accelerator pedal (CAN)		IP69K
Hand lever (CAN)		IP66
Stepped speed switch (optional 2, 3 or 4 steps)		IP65
<p>Speed limiting for CAN-enabled speed adjustments possible. As a safety precaution against overspeed, the unprogrammed CAN rpm governors are set to 900 – 1500rpm.</p>		

Display instruments		IP degree of protection
Hatz instrument box (TTCAN)		IP65
Hatz instrument box (tmCAN)		IP65
CAN "IFM" display		IP65

6.2.2 Resetting the service interval

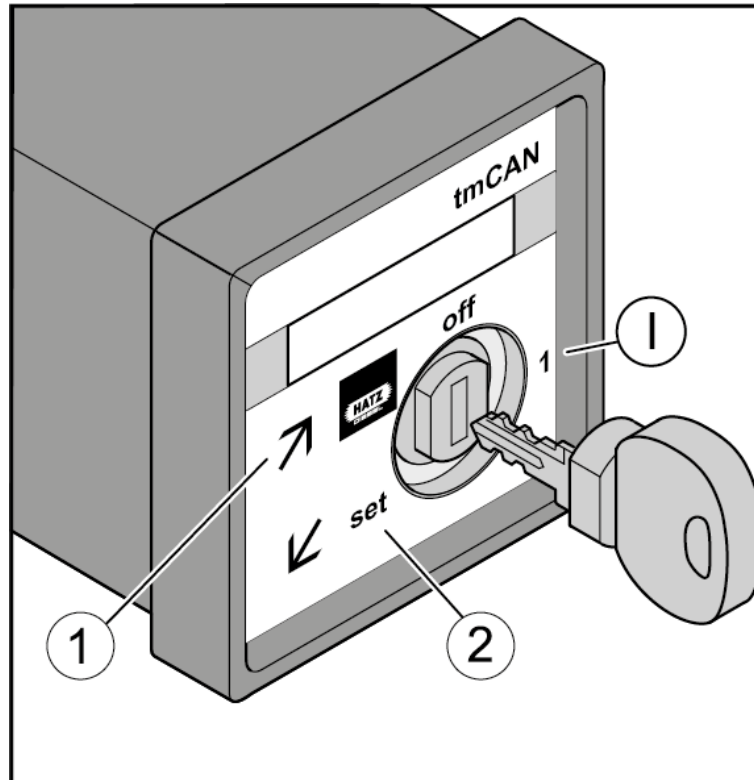
6.2.2.1 ttCAN



NOTE

See the manual for diesel engine.

6.2.2.2 tmCAN



NOTE

The service interval can only be reset as of control unit version V710 and instrument box tmCAN 02487901.

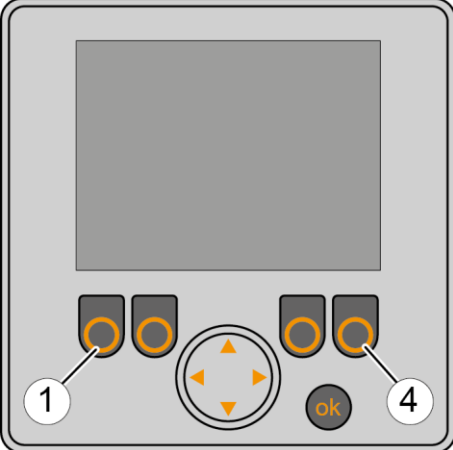
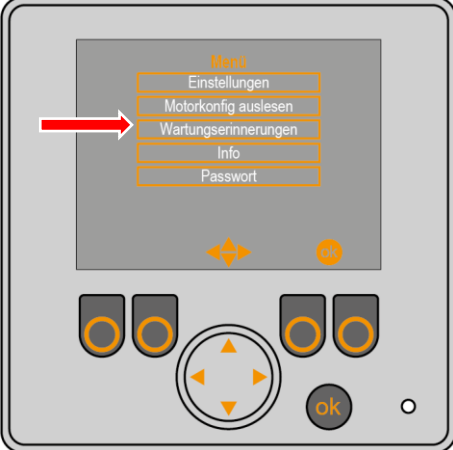
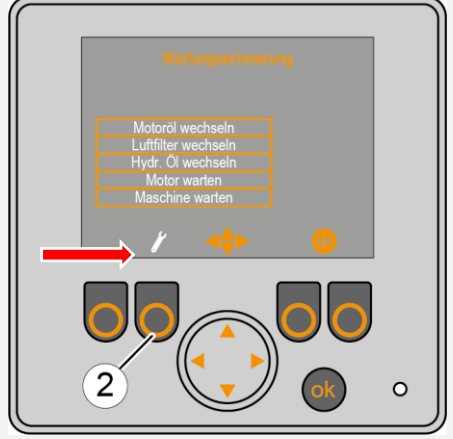
Step	Description
1	Turn the starting key to position 1 (I).
2	Press the "↗ button" (1) and "SET button" (2) at the same time.
3	Enter the password "1704" and confirm with the "SET button".
4	This acknowledges the flashing "service lamp".

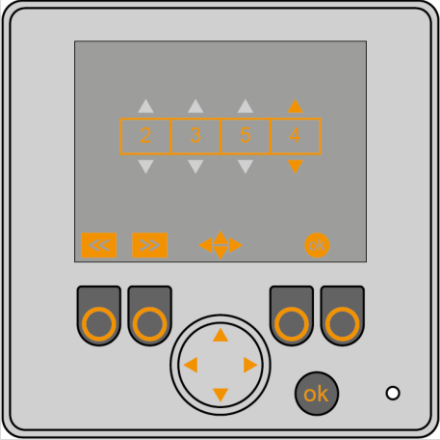
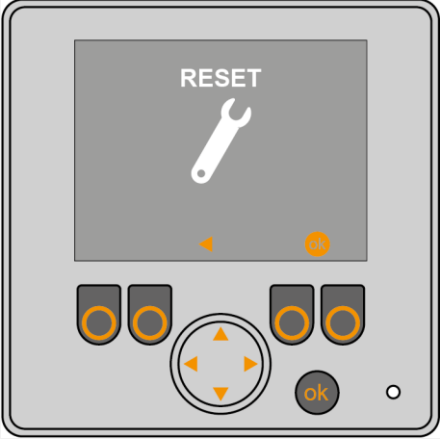
6.2.2.3 IFM panel



NOTE

The service interval can only be reset as of control unit version V710.

Step	Description
1	 <p>Press the two outer buttons (1) and (4) simultaneously for at least 2 seconds.</p>
2	 <p>Select "Service reminders" with the arrow buttons and open with "OK".</p>
3	 <p>Open "Reset service" with the second button from the left (2).</p>

4	 <p>Enter the password "2354" and confirm with "OK".</p>
5	 <p>Confirm resetting of service with "OK".</p>
6	Return to the main menu with the left arrow button.

6.2.2.4 CAN command



NOTE

All values are hexadecimal.

CAN ID	DLC	Data							
18FFCD6E	8	00	04	95	11	12	32	07	36

6.2.3 Start/stop control by means of ECU – danger avoidance

DANGER

Risk of death, risk of injury or danger of property damage due to unintended/unexpected starting up of the device.



- As the operator of the machine, you must ensure that all people working on/with the machine are familiar with the content of these manuals.
 - Before working on/with the machine, read these manuals carefully, paying special attention to the safety notes.
 - Maintenance tasks may only be performed by trained personnel.
 - Fulfill all required safety conditions before working on/with the machine.
 - The equipment manufacturer must indicate that the machine can start automatically.
-

6.2.3.1 Danger avoidance measures in moving applications (vehicles)

For engines in self-propelled applications (e.g. vehicles), a danger arises from the unintended movement of the vehicle, which is why a starter monitoring is needed.

The following measures must be taken to prevent an unintended movement of a vehicle:

- To release the starting procedure, a drive train interruption signal (e.g. clutch or neutral gear) in combination with a redundant brake signal (opener and closer) must exist. Signals must be directly connected to the control unit and are not permitted to be transferred as a CAN message.
- The start request can take place via a conventional start request (key switch), as a switch (see circuit diagram) or via a CAN message (see chapter 6.1.5.2 CAN message list, page 88).

6.2.3.2 Measures for danger avoidance in non-self-propelled applications

For engines in non-self-propelled applications (e.g. generator, water pump, etc.), there is no danger of unintended vehicle movement, yet there is a danger of the equipment being started up unexpectedly.

The following measures must be fulfilled:

- Warnings regarding unintended/unexpected startup must be installed.
 - Maintenance tasks may only be performed by trained personnel.
 - Closely adhere to the maintenance conditions prescribed in the manual for diesel engine.
 - Only perform maintenance work when the engine is stopped.
 - Disconnect the negative battery terminal before carrying out maintenance work.
-



NOTE/DANGER

To avoid danger, the above measures must be indicated in the operator's manual of the complete machine and on a label on the machine.

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 to 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.
-

IMPORTANT NOTE

To avoid a voltage drop at the control unit during the starting procedure, the control unit must be connected directly to the battery.



If using a battery master switch, the power supply of the control unit must be tapped downstream of the main switch. This ensures the full de-energization of all components. Before activating the main battery switch, it is necessary to wait for one minute after "Ignition off (ignition start switch)" to fully complete internal processes in the control unit.

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

12 V system	
Power of 12V starters	2.2kW
Recommended capacity of lead battery at an air temperature of 0°C	Min. 60Ah
Recommended capacity of lead battery at an air temperature of -18°C	110 Ah
24 V system	
Power of 24V starters	3.0kW
Recommended capacity of lead battery at an air temperature of 0°C	Min. 36Ah
Recommended capacity of lead battery at an air temperature of -18°C	66Ah



NOTE

The required capacity may deviate, depending on the installation case (e.g. resistances in the hydraulic system).

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.

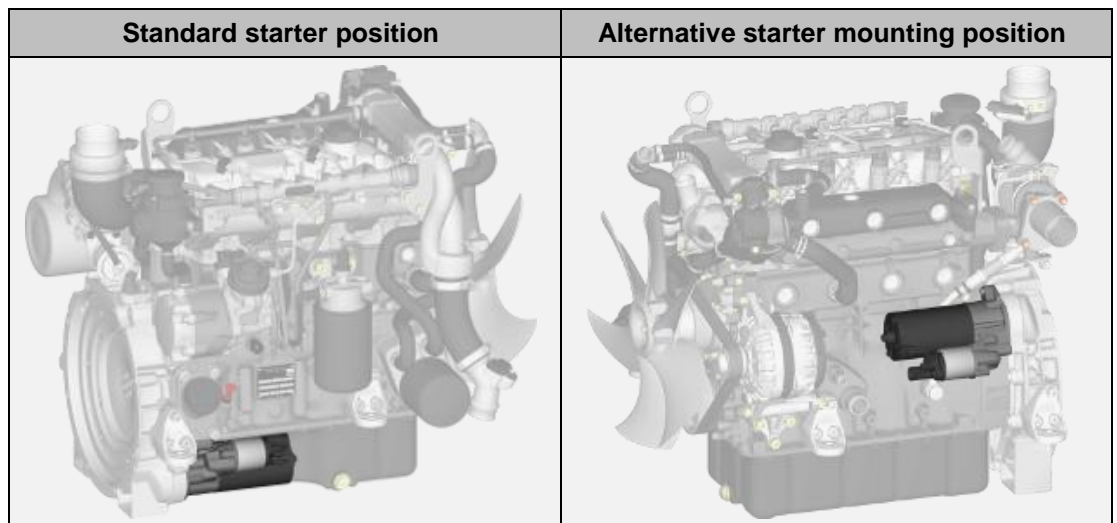


NOTE

- 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
-

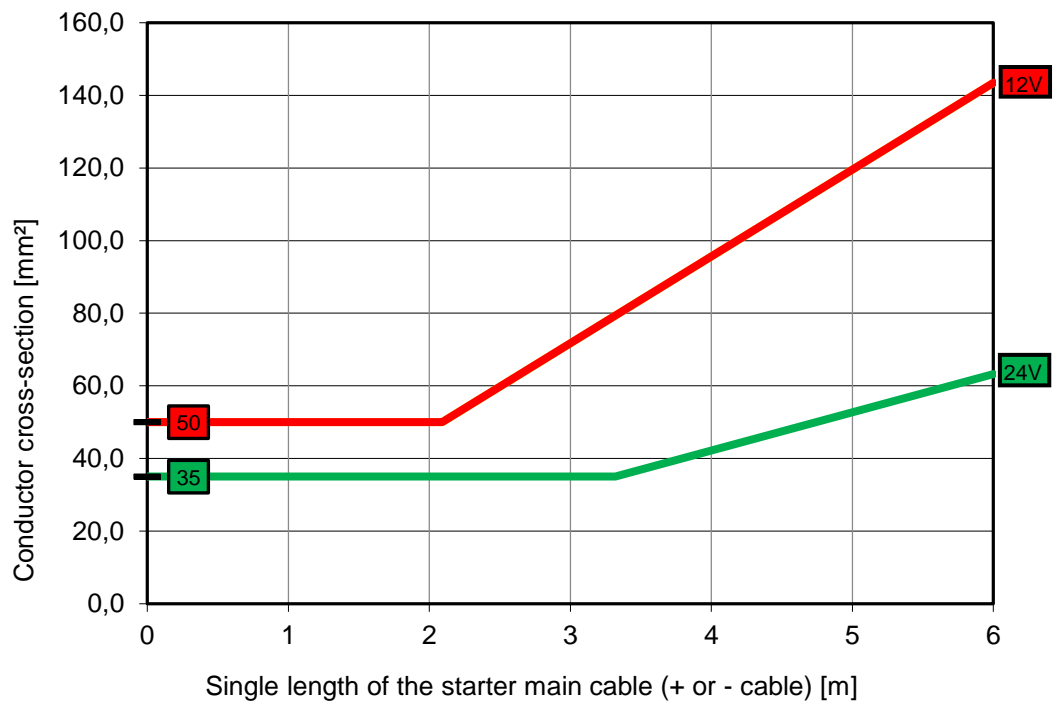
6.4 Starter

6.4.1 Possible starter mounting positions



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 124).

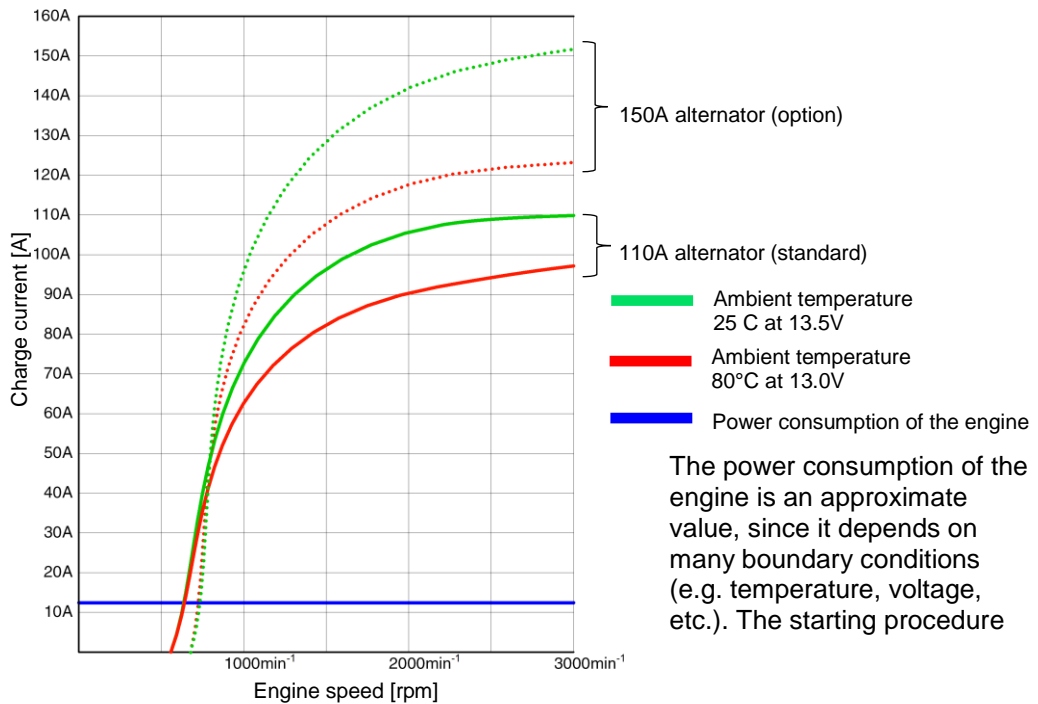
6.4.2 Dimensioning of the cables between the starter and battery



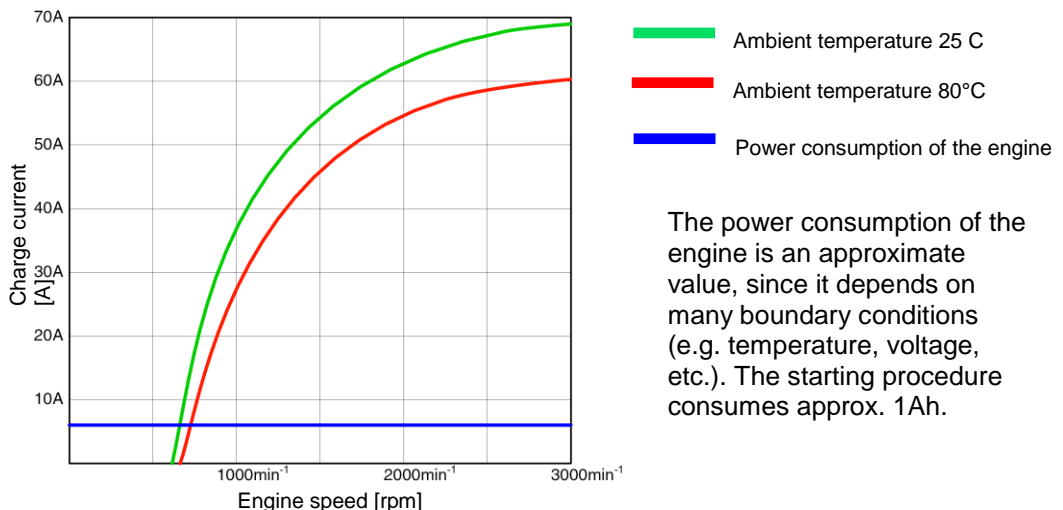
6.5 Alternator

Type	Air cooled compact alternator with internal fan		
Belt drive	V belt profile 6PK 768 (6 grooves, Ø 49 mm)		
Translation with crankshaft pulley Ø 103 mm	$n_{\text{alternator}} = 2.08 * n_{\text{engine}}$ [rpm]		
Type	12 V 110 A	12 V 150 A (option)	24 V
Max. current at engine speed 2880 rpm	110 A	150 A	60 A
Max. current at engine speed 860 rpm	55 A	Approx. 70 A	18 A
Control voltage at 20 C	14.25 - 14.75 V	14.25 - 14.75 V	28.10 - 28.70 V

6.5.1 Charge curve 12V

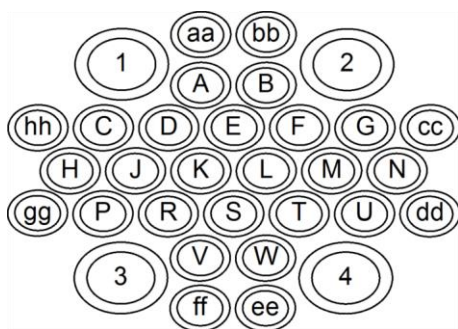


6.5.2 Charge curve 24V



6.6 Hatz terminal designation CV54

Customer plug connector assignment			
No	Designation	Bosch-Hatz ID	Label
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	1ST
B	Ignition on terminal 15	I_S_T15 - K88	15
C	Starter signal terminal 50	I_S_T50 - K35	50
H	Engine running lamp	O_S_ERL - K50 (low pressure side)	ML
K	Highside diagnostics lamp	O_V_DIA - K70	DIA+
M	Lowside diagnostic lamp	G_R_DIA - K65	DIA-
N	Engine start switch	I_S_ENGSA - K67	
T	Speed selector switch	I_A_MSSRPM - K33	14
U	Ground for digital inputs	G_R_DIG - K87	0
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		
12V	<	1.5V
24V	<	3V

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



IMPORTANT NOTE

All wiring harnesses and lines behind stationary plug connections must be feature a tension relief mechanism after a maximum distance of 100mm.

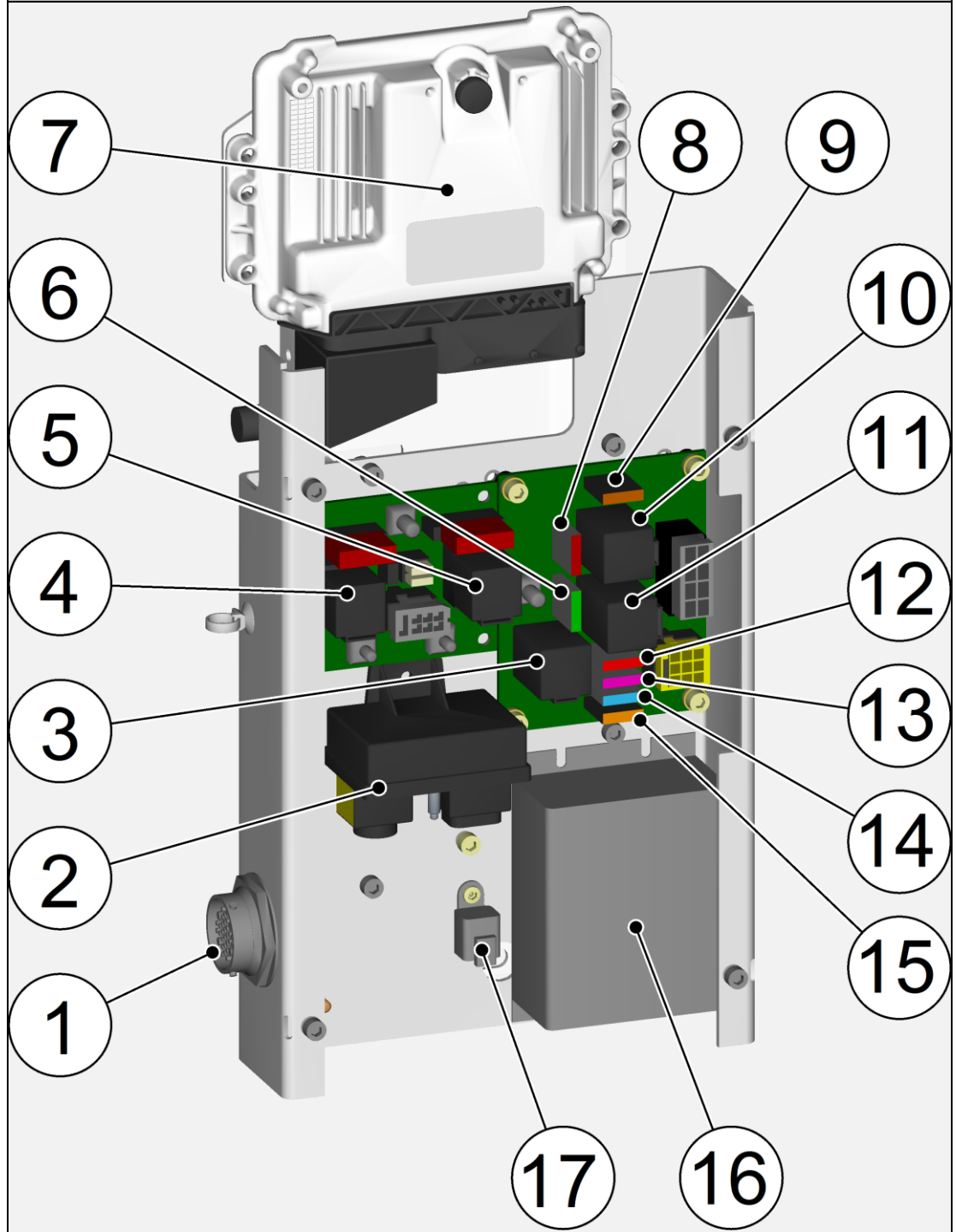


IMPORTANT NOTE

For leaktight plug connections, it must be ensured that the lines pass straight out of the plug for approx. 50mm and the single conductor seals have a suitable diameter, as the tightness of the plug connection otherwise cannot be ensured.

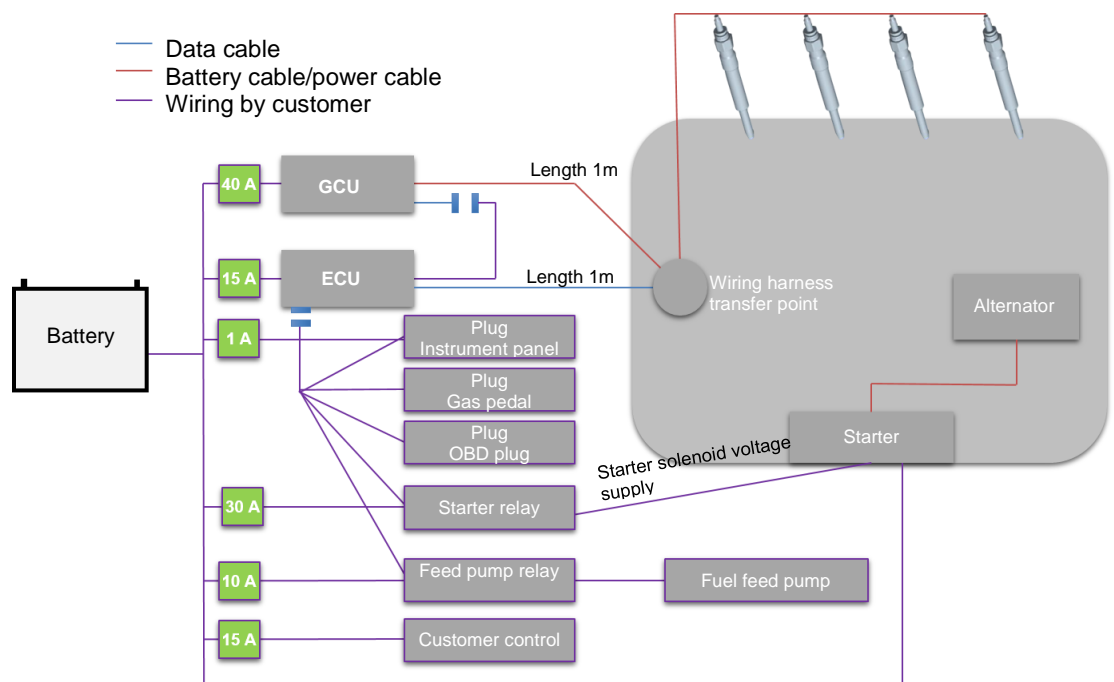
OpenPowerUnit (OPU) CV54 V710		
	1	Instrument panel/Customer control unit: ITT Cannon Plug 28+4 192900-0549 Receptacle 28+4 192900-0035
	2	Diagnostics ISO 15765: BEMO HD10-9-1939-PE- B022 2411-002-1805
	3	Gas pedal (analog): ITT Cannon TN7S14-0012S1L TN6S14-012P1L
	4	EDC 17CV54 (ECU) engine control unit
	5	Fuseholder
	6	Preheating control unit 12V (GCU) or GPCU (24V)
	7	Fuel feed pump relay
	8	Start relay
Use/Fusing		
A	Control unit supply voltage	15A
B	T15/T50 control unit input	1A
C	Glow plugs	40A
D	Customer voltage supply	15A
E	Fuel pump	10A
F	Starter	30A

OpenPowerUnit (OPU) C81

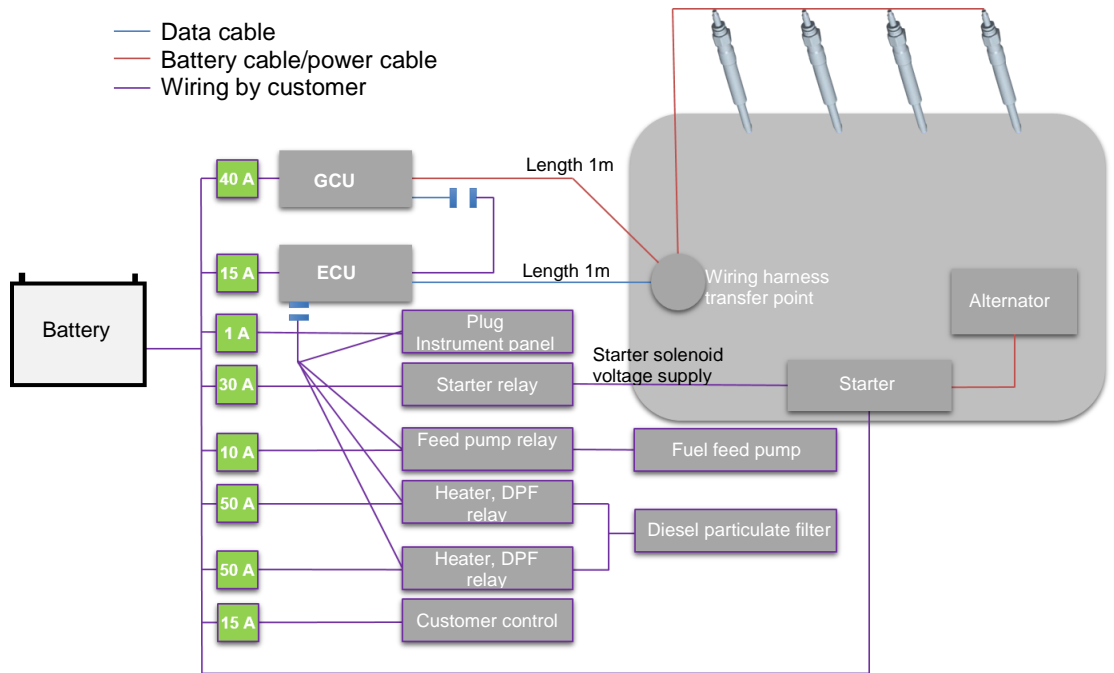


	Use	Circuit diagram designation	Fuse
1	Dashboard/customer control: ITT Cannon Plug 28+4 192900-0549 Receptacle 28+4 192900-0035		
2	Glow control unit (GCU)	GCU	
3	Main relay, control unit on	K6	
4	Relay exhaust heater 1 + fuse (TICD Active Premium)	2K7 / 2F7	50A
5	Relay exhaust heater 2 + fuse (TICD Active Premium)	2K8 / 2F8	50A
6	Fuse, starter 50	F6	30A
7	Engine control unit EDC 17C81 (ECU)		
8	Fuel pump fuse	1F2	10A
9	Glow plug fuse	1F3	40A
10	Fuel feed pump relay	1K5	
11	Start relay	1K4	
12	Terminal 15 ignition on fuse	1F5	10A
13	Terminal 15 ignition on fuse, customer	1F7	4A
14	Control unit B+ fuse	1F4	15A
15	T15/T50 fuse	1F1	5A
16	DC/DC converter (on with 24 V)		
17	Diagnosis plug		

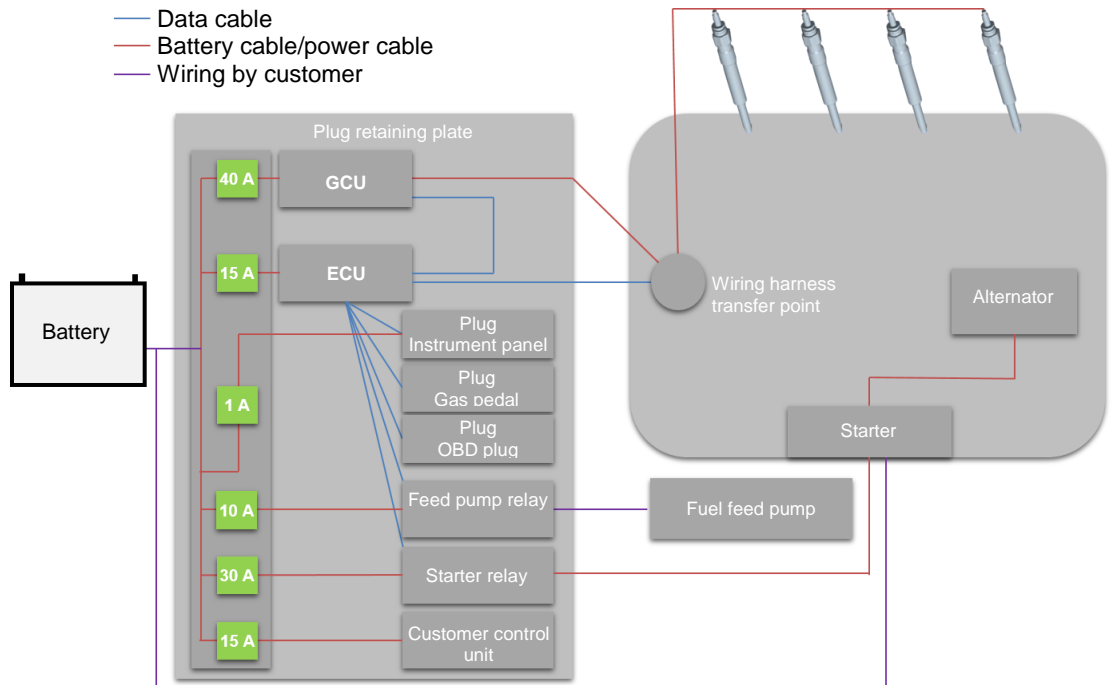
6.7.1 Cabling of "Fan 2 Flywheel (F2F)" CV54



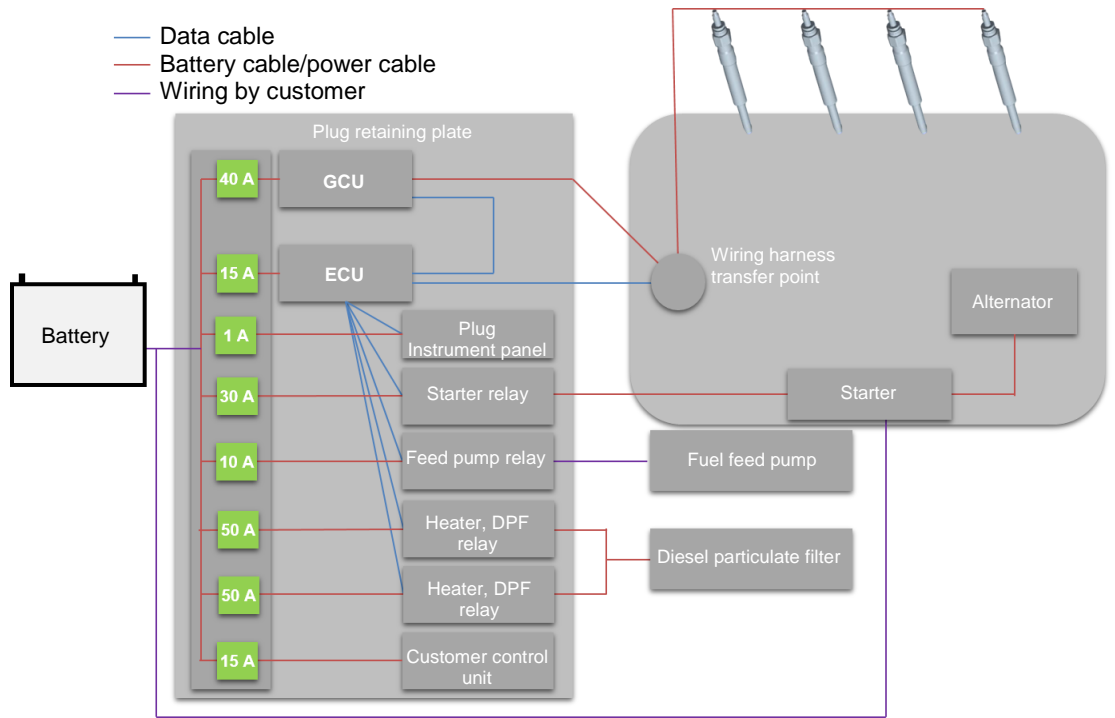
6.7.2 Cabling of "Fan 2 Flywheel (F2F)" C81



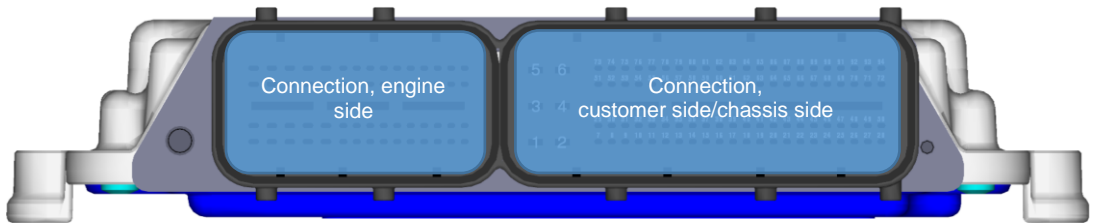
6.7.3 Cabling of "Open Power Unit (OPU)" CV54



6.7.4 Cabling of "Open Power Unit (OPU)" C81



6.7.5 Pin assignment/Cabling by customer



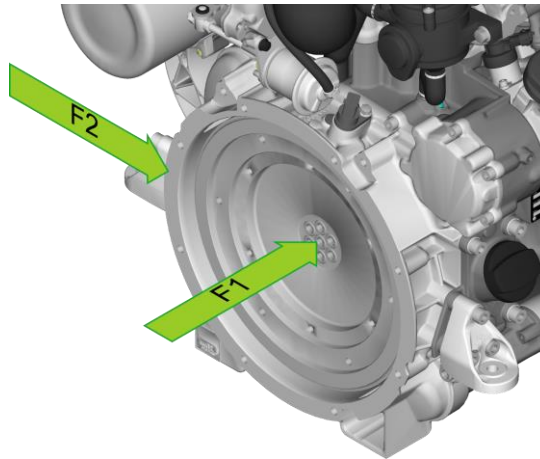
7. Power take off

7.1 Main take off (flywheel side)



NOTE

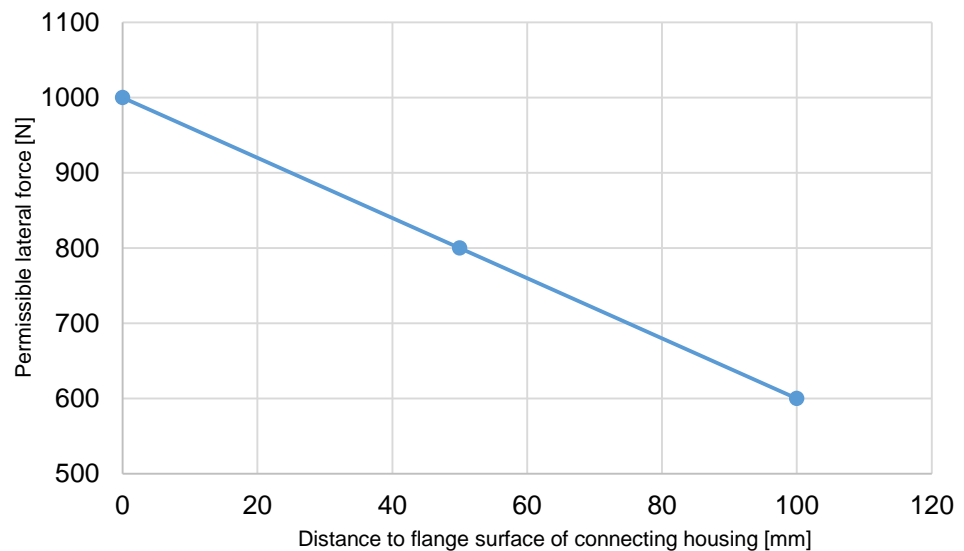
Before installing further add-on parts, the preservation wax must be removed from the screw-on surfaces and the surfaces must be cleaned.



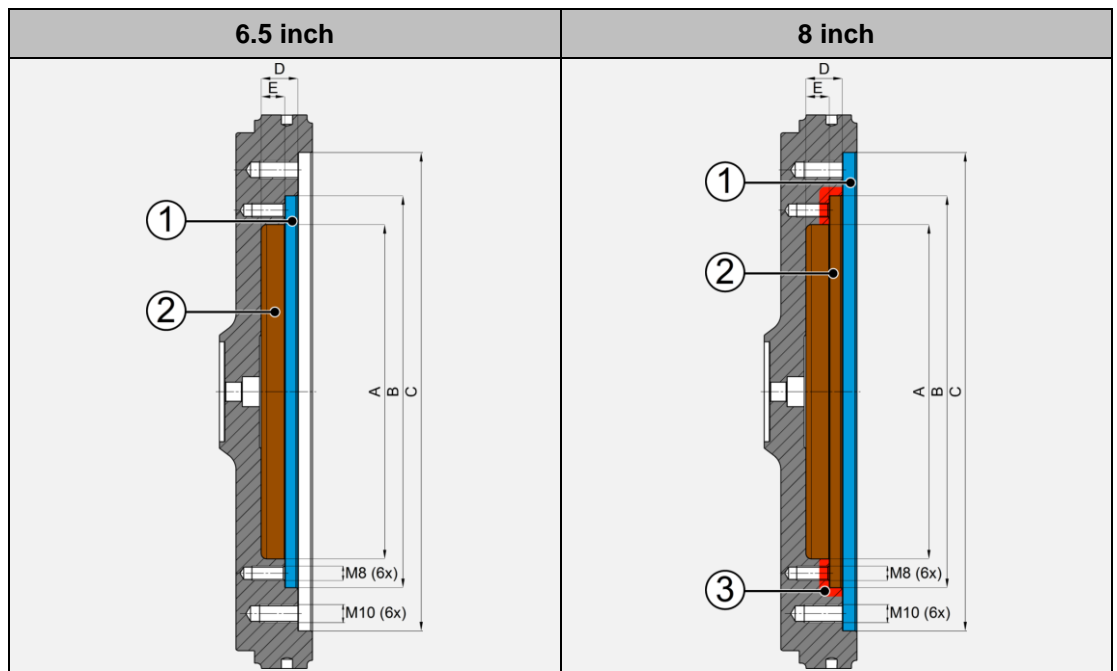
Axial (F1)	3000 N, direction dependent
radial (F2)	See diagram
Max. perm. mass moment of inertia	0.2kgm ²
$J_{\text{flywheel+engine 4H50}}$	0.234kgm ²
$J_{\text{flywheel+engine 3H50}}$	0.217kgm ²
Fixed mass on flywheel	Up to 10kg at 80mm centroidal distance to flywheel flange

SAE 5 (standard), SAE 4 or SAE 3 connecting housing and the 6.5"/8" or 10" flywheels will be available for the main take-off.

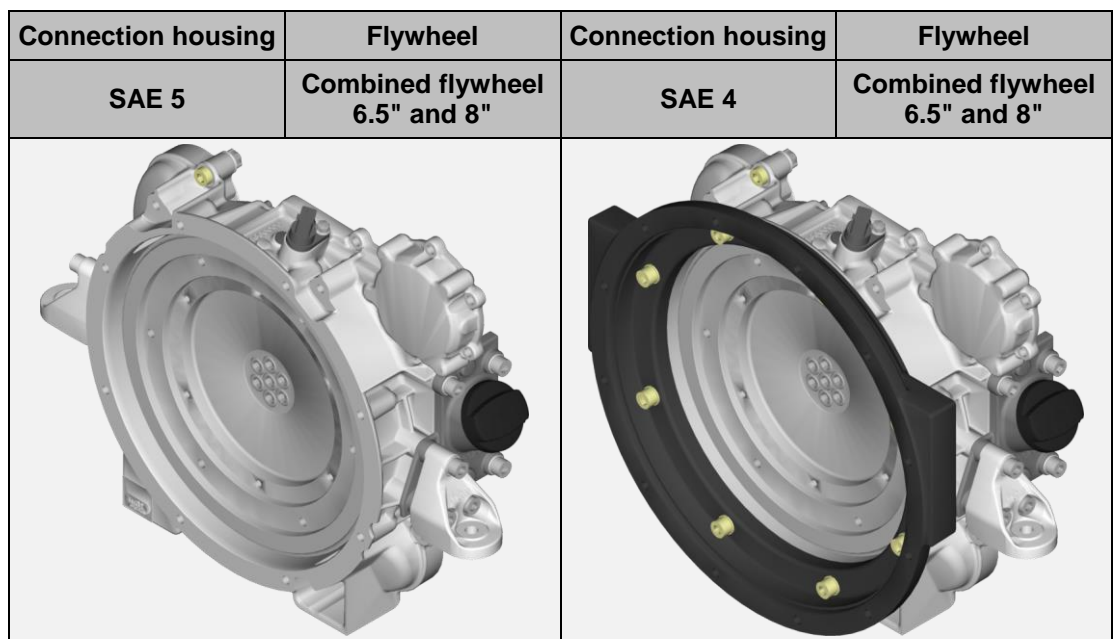
Lateral force on flywheel without additional mount



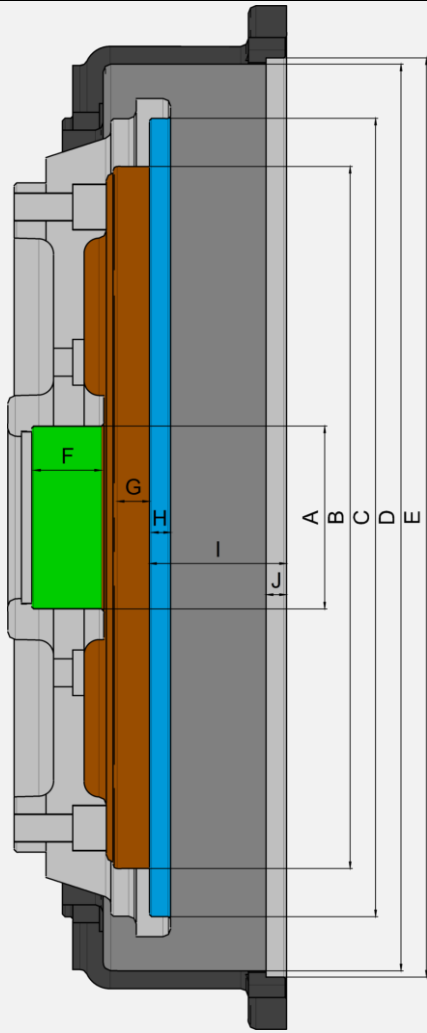
7.1.1 Combined flywheel 6.5"/8" with connecting housing/10 inch flywheel



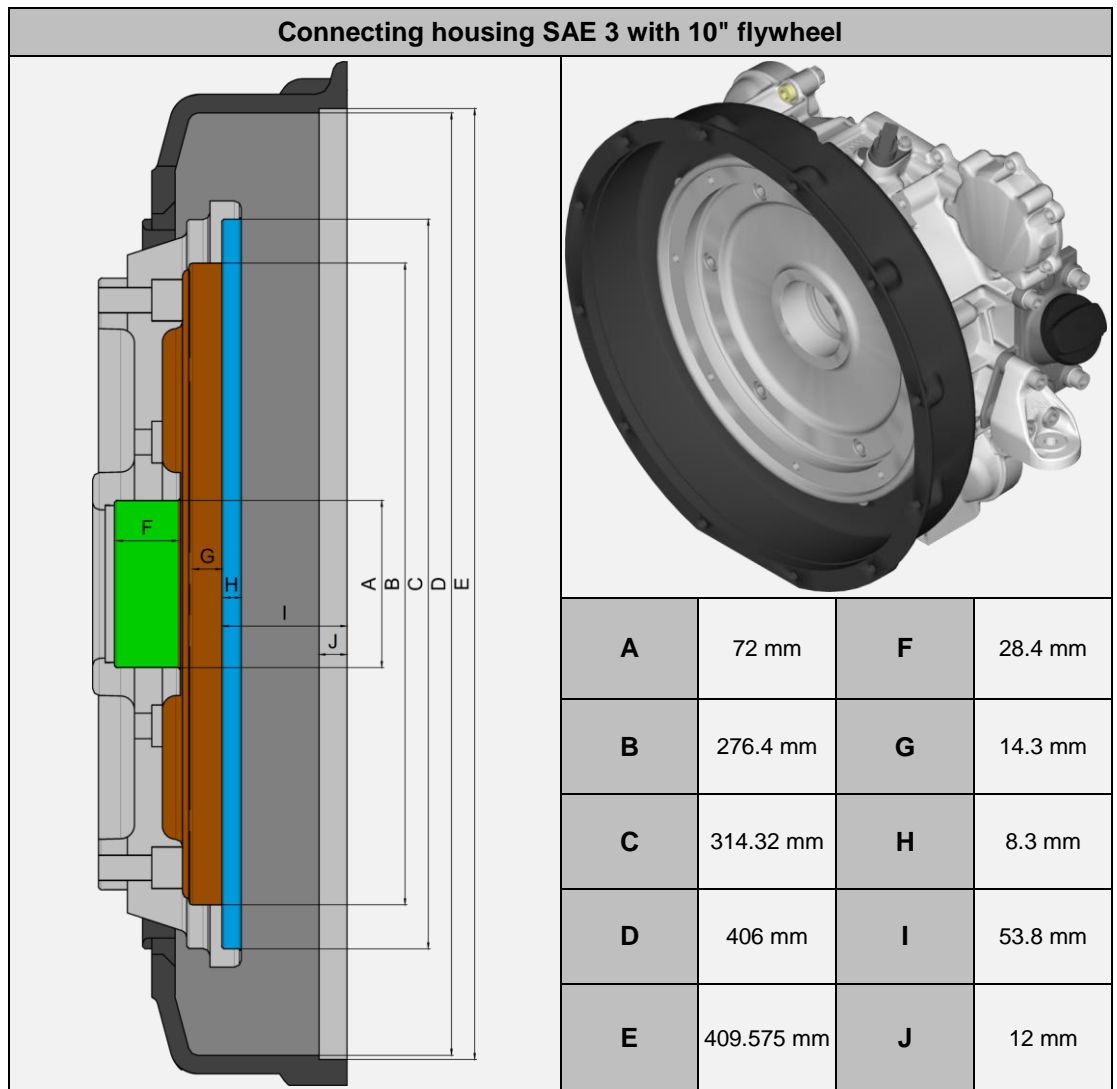
1	Coupling diameter									
2	Indentation									
3	For the manufacture of a combined flywheel required deviation from the SAE standard									
A		B		C		D		E		
mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	
184.2	7 ¼	215.90	8 ½	263.52	10 ⅜	12.9		20.1		



Connecting housing SAE 4 with 10" flywheel



A	72 mm	F	28.4 mm
B	276.4 mm	G	14.3 mm
C	314.32 mm	H	8.3 mm
D	357 mm	I	53.8 mm
E	361.95 mm	J	8 mm



7.1.2 Connecting 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	3000
	180	2,250
	225	1,800
270	1500	
Shaft end	Ø48 h7 x 110 / Ø50h7 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.



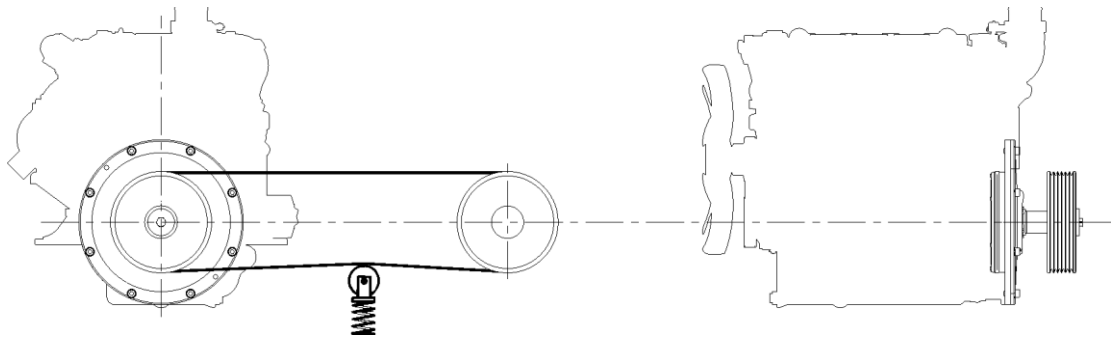
The capacity of the power take offs on the engine can be found in this chapter. The overload of power take offs, particularly by uncontrollable belt tensioning devices, can cause damage to the bearings and shaft fractures.

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

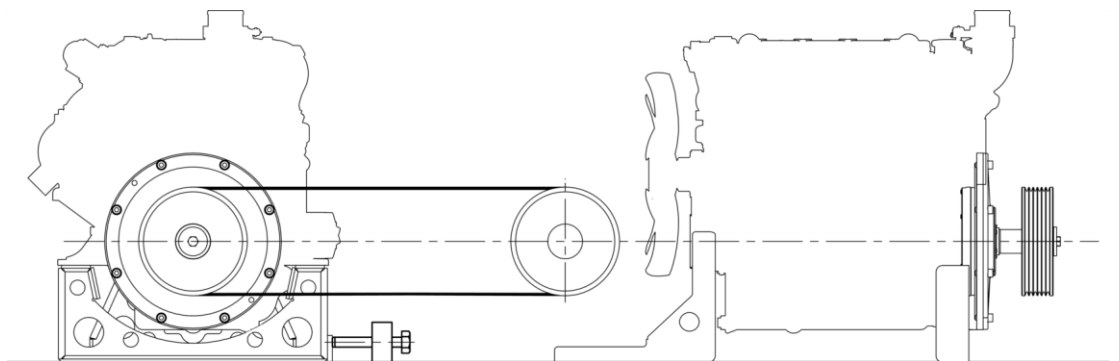
7.1.3.2 Belt drives

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.



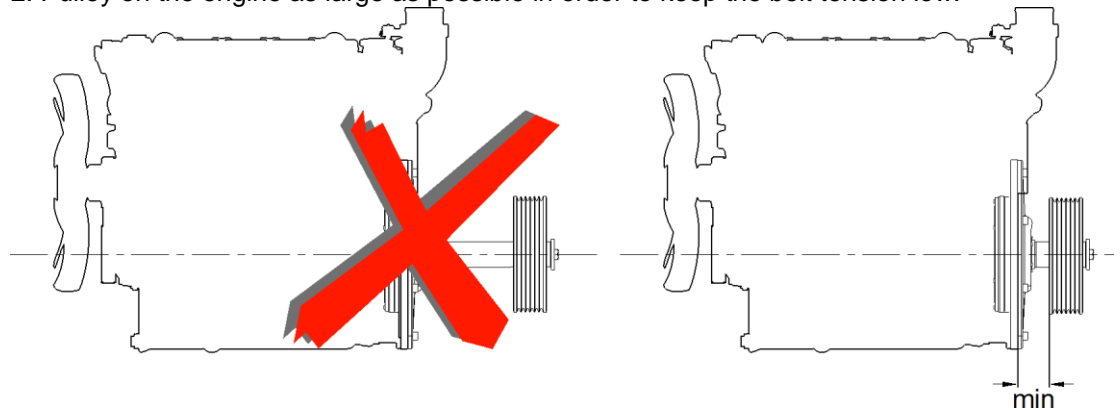
b) **Uncontrollable belt tensioners** have the risk of overloading the bearings due to excessive tension forces. These tensioners include tensioning screws, prestressing via flexible belts etc.



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 *Connecting housing with outside bearing*, page 109).
- 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 manuals.
- Before working on the machine, read this manual carefully, paying special attention to the safety notes.
- Fulfill all required safety conditions before working on the machine.

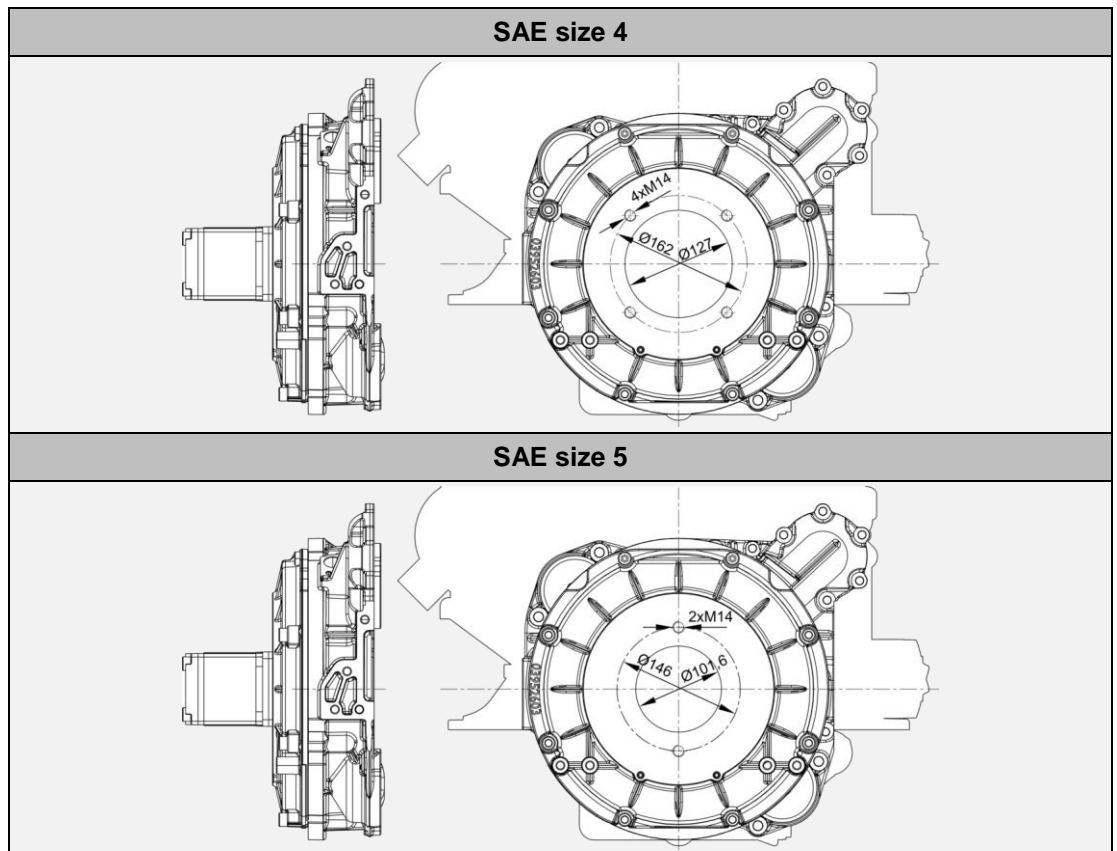
$$F_{perm} = \frac{1.7 * 10^6 [Nmm]}{(l + 53.1)[mm]}$$

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.

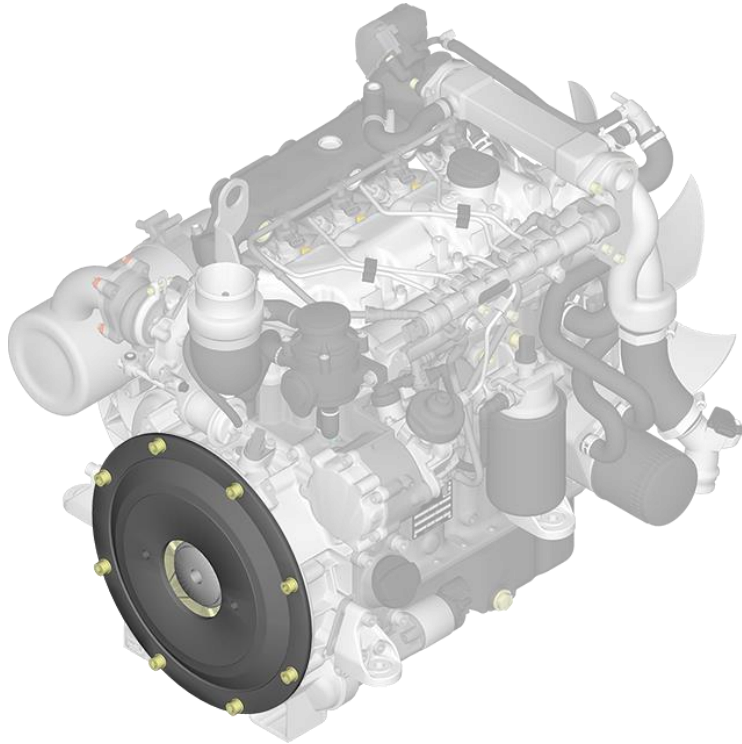
Your hydraulic pump manufacturer will be pleased to assist.



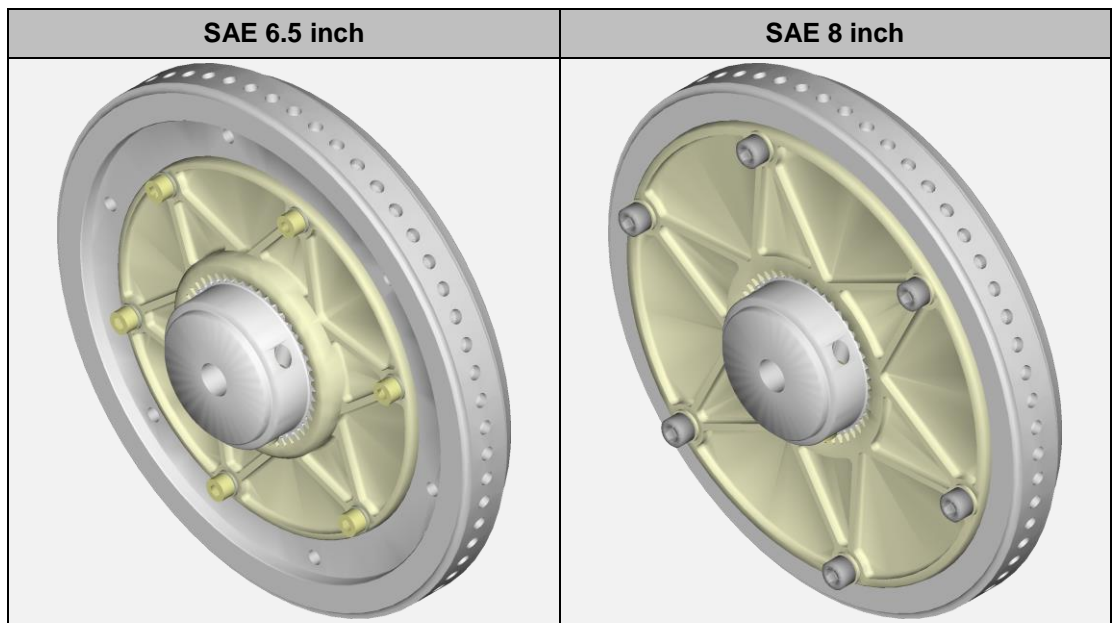
Other attachments for hydraulic pumps are available on demand.

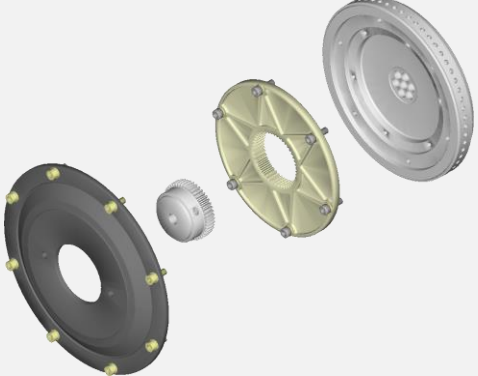
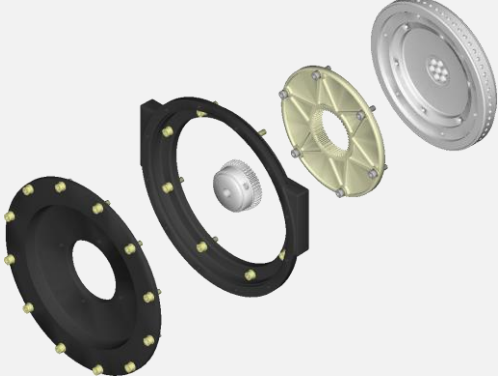
We are at your disposal for details on flange and shaft dimensions of the planned hydraulic pump. Hatz offers hydraulic pumps in different sizes. Please contact your **Hatz branch office**.

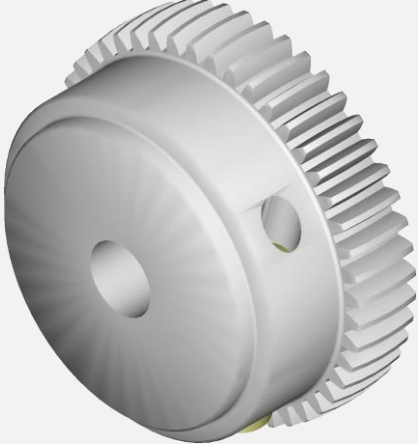
7.1.4 Couplings



Couplings are available in 6.5 inch and 8 inch, both can be combined with SAE5 and SAE4 connections

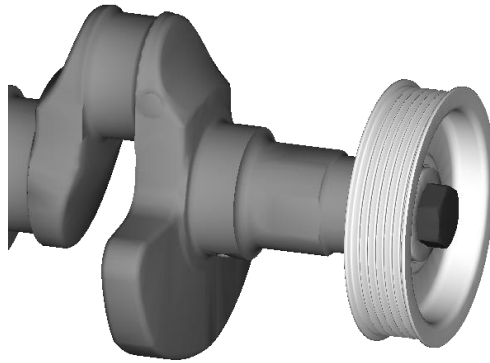


SAE 5 inch connection	SAE 4 inch connection
	
Bore Ø101.6	Bore Ø101.6
M14 – 2-hole flange	M14 - 4-hole flange
Bolt circle Ø146	Bolt circle Ø162

Coupling hubs	
<p>Hubs are available in the following sizes:</p> <ul style="list-style-type: none"> • Prebored Ø18.9mm • 7/8 inch, 13 teeth as per ANSI B92.1a/1976 • 1 inch, 15 teeth as per ANSI B92.1 <p>Further hubs on demand</p>	

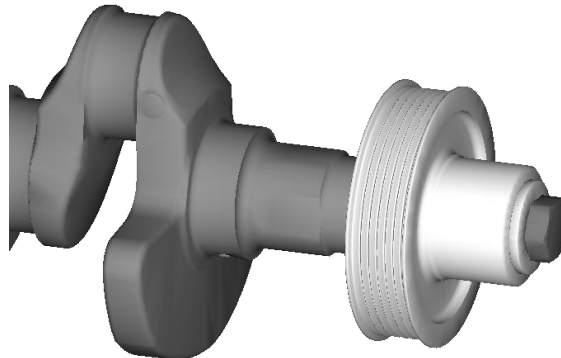
7.2 Governor side main take-off (crankshaft/fan)

7.2.1 Standard crankshaft

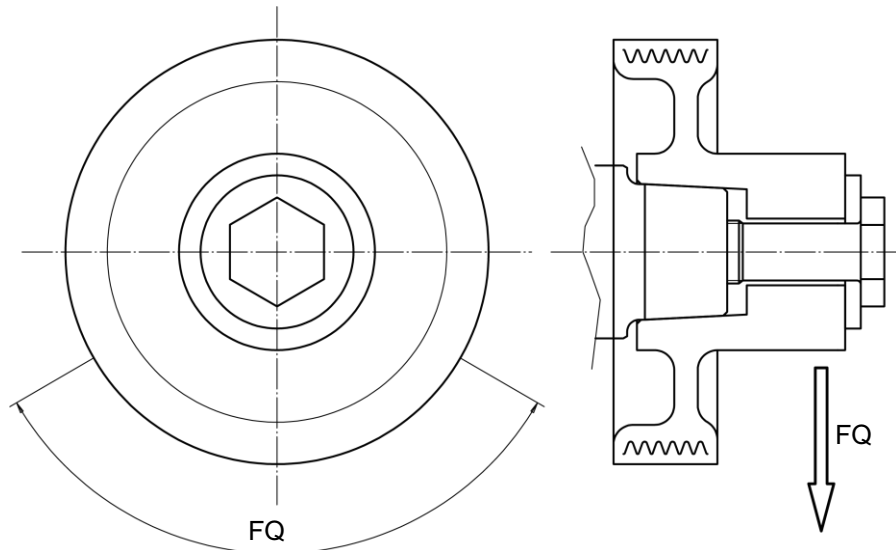


Without lateral force	42 Nm
With air conditioning compressor	12.5 Nm

7.2.2 Tapered crankshaft



Without lateral force	200 Nm
With lateral force (see figure below) (maximum lateral force FQ 2 kN may be tapped from 4 – 8 o'clock)	50 Nm



7.3 Power take off

7.3.1 Hydraulic power take off

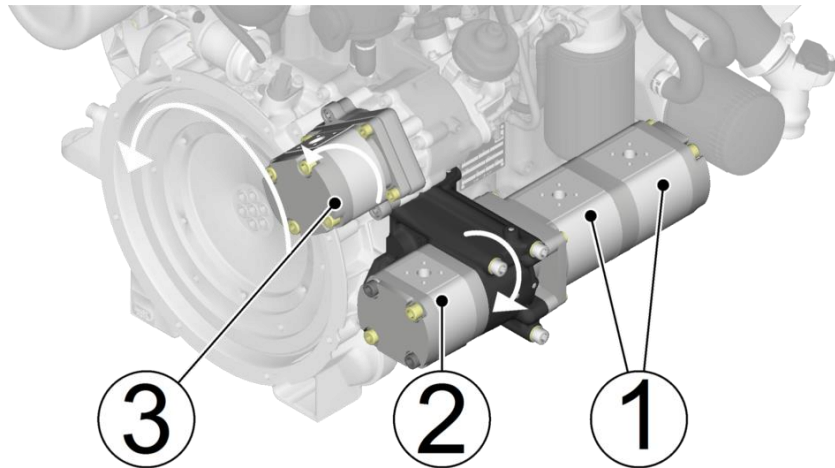


NOTE

The sum of the torques of all power take-offs must not exceed 100 Nm.

7.3.1.1 Hydraulic pump power take-off

A maximum of four hydraulic pumps must be flangeable on the two power take-offs.



1	$M_{\max} = 100 \text{ Nm}$
2	$n_{\text{hydr.}} = 1.1 \times n_{\text{engine}} \text{ rpm}$
3	$M_{\max} = 80 \text{ Nm}$
	$n_{\text{hydr.}} = 1.0 \times n_{\text{engine}} \text{ rpm}$

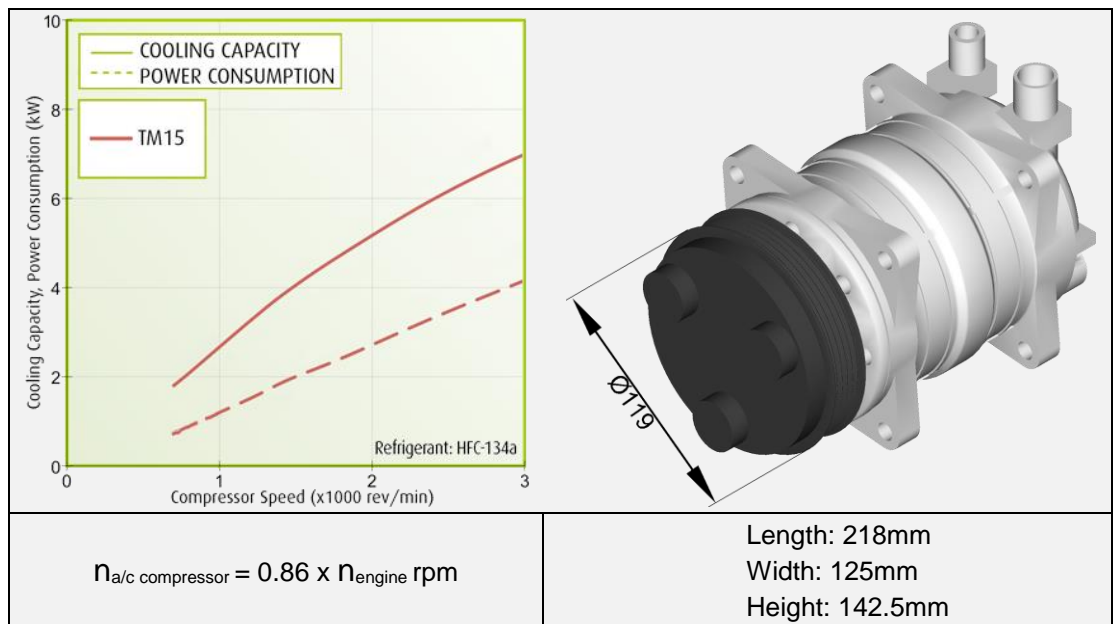
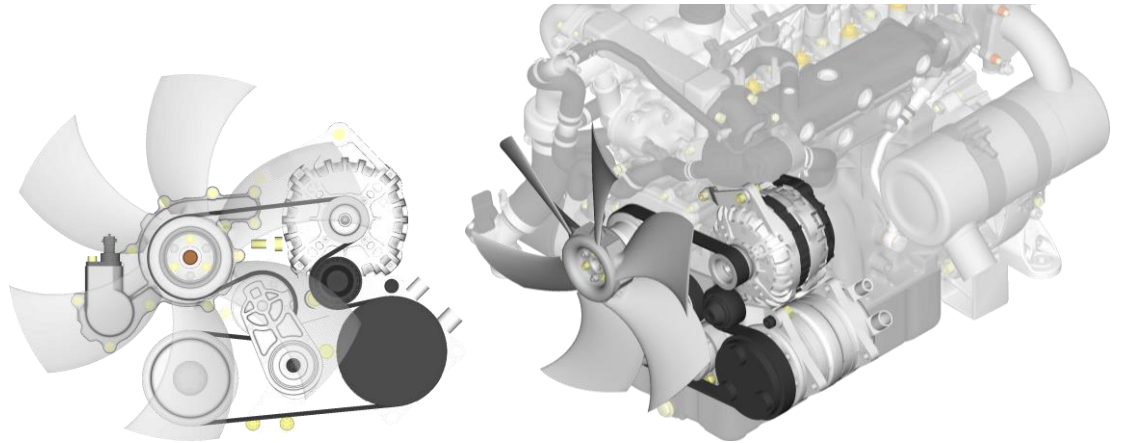
Standard available hydraulic pumps:				
	Hydraulic pump	Description	Sense of rotation	Available
1	4-hole HP Ø 80	4-bore flange, 4.6 to 31 cm ³ /rev. splined shaft DIN5482 B17x14 - 9 teeth	Clockwise hydraulic pump	4.65 cm ³ , 6.45 cm ³ , 8.25 cm ³ , 12 cm ³ , 13.8 cm ³ , 15.52 cm ³
1	SAE-A HP Ø 82.55	2-bore flange, 4.6 to 31 cm ³ /rev. splined shaft SAE J744 16-4 9T 9 teeth	Clockwise hydraulic pump	None
2	2-hole HP Ø 50	Without flange, 4.6 to 31 cm ³ /rev. splined shaft DIN5482 B17x14 - 9 teeth	Counterclockwise hydraulic pump	12 cm ³ 22.87 cm ³ 31.2 cm ³
3	4-hole HP Ø 80	4-bore flange, 4.6 to 31 cm ³ /rev. splined shaft DIN5482 B17x14 - 9 teeth	Clockwise hydraulic pump	4.65 cm ³ , 6.45 cm ³ , 8.25 cm ³ , 12 cm ³ , 13.8 cm ³ , 15.52 cm ³

7.3.2 A/C compressor



NOTE

Air conditioning compressor add-on only possible with 12V and 1.116 ratio.



8. General limits of use

There is no power reduction up to 1460m 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 1460m above sea level.

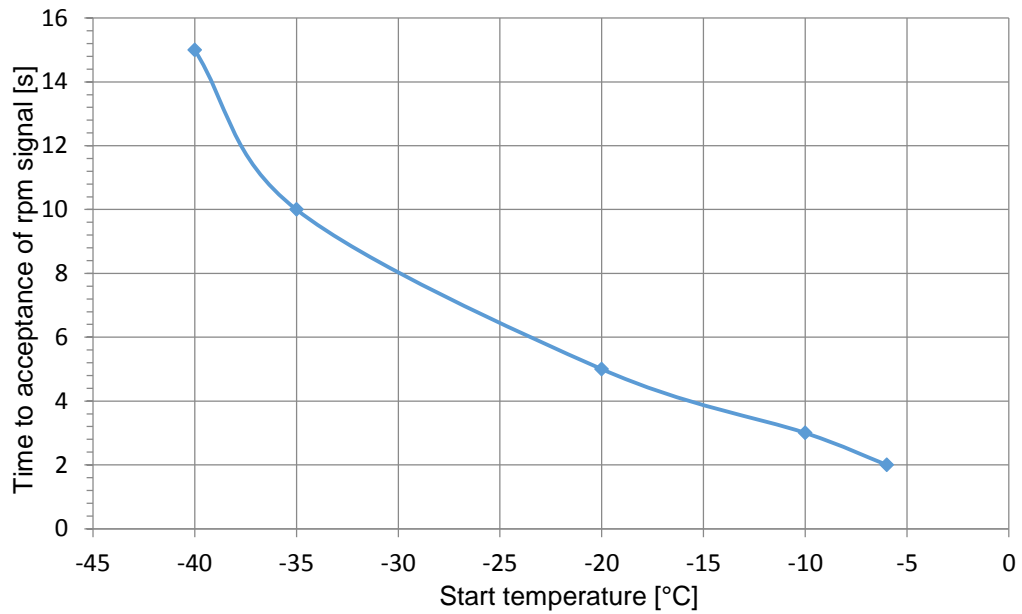
At higher altitudes, the cold-start capability deteriorates compared to these values.

With an additional load on the engine, e.g. due to a hydraulic pump, the start speed of the engine drops. With increasing additional load, the battery capacity (for maximum permissible battery capacity, see chapter 6.3 *Battery sizes*, page 95) and engine oil (oil viscosity) parameters must be modified in such a way that the minimum start speed of the cold engine is >100rpm.

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.

Engine protection function: delayed speed acceptance after cold start

Because the establishment of the oil pressure is delayed at cold temperatures due to the high oil viscosity, the engine does not accept the engine speed until after the time indicated in the diagram.



8.2 Maximum permissible speed in coasting overrun



NOTE

Maximum speed in coasting overrun → 3300rpm.

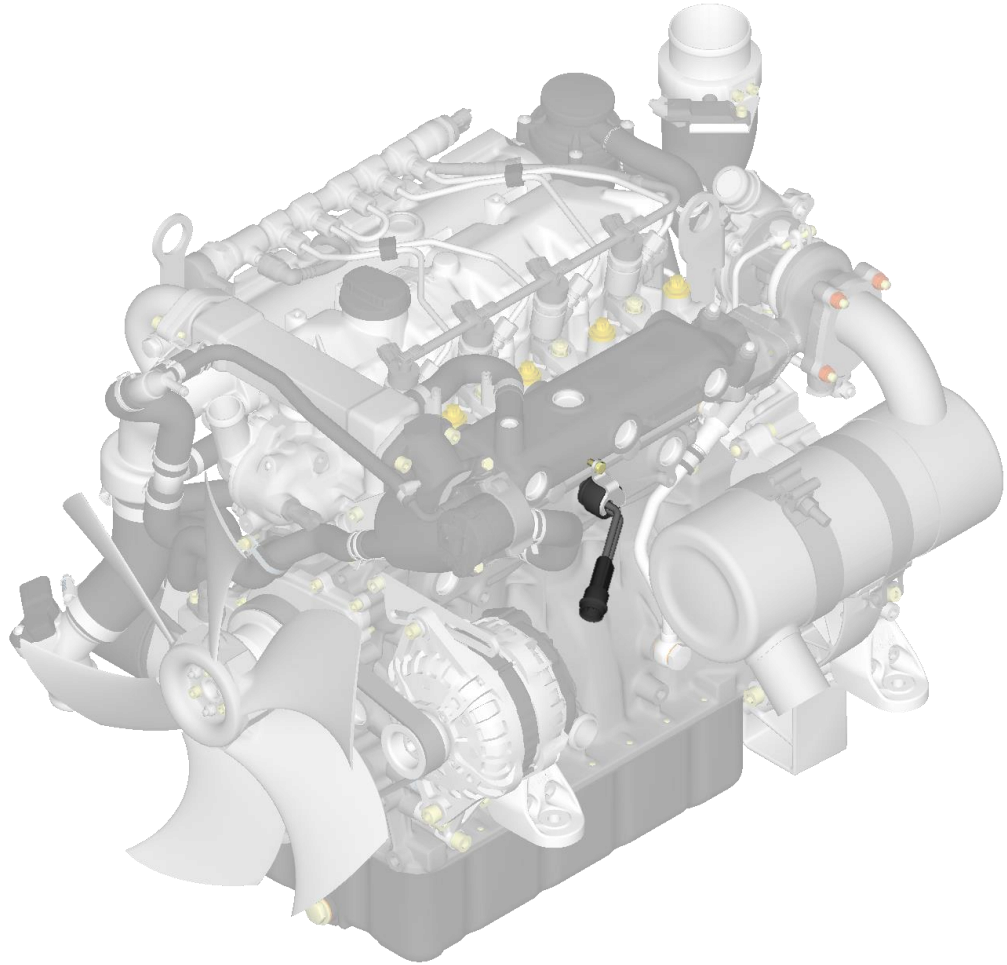
8.3 Block heater



DANGER

Danger of serious engine damage and fire

The heating element may burn off if the cooling water circuit is insufficiently filled or not filled at all.



V = 230V
P = 400W

Recommended switched-on period					
°C	-20°C	-10°C	-5°C	0 C	+10°C
Hours	3	2	1.5	1	1

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.

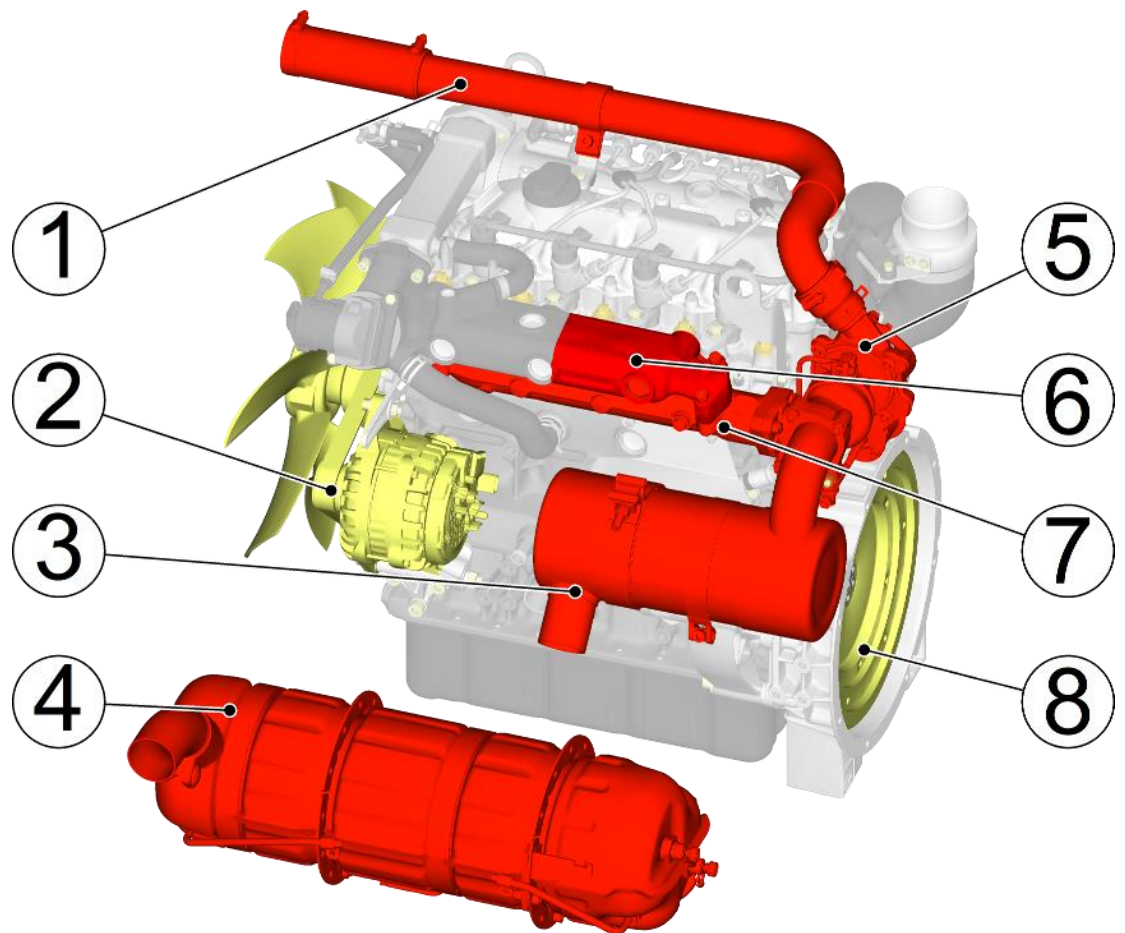
The following chapter shows which contact protective devices are available from HATZ.

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.

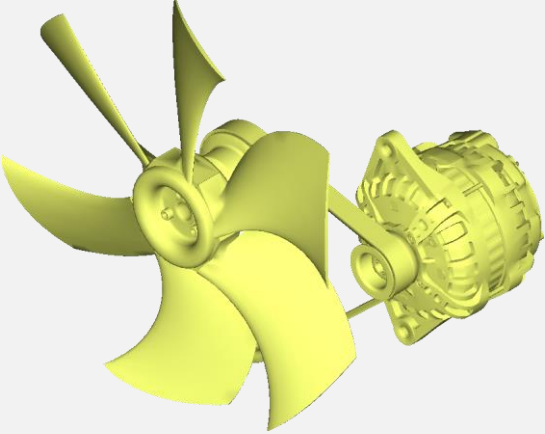
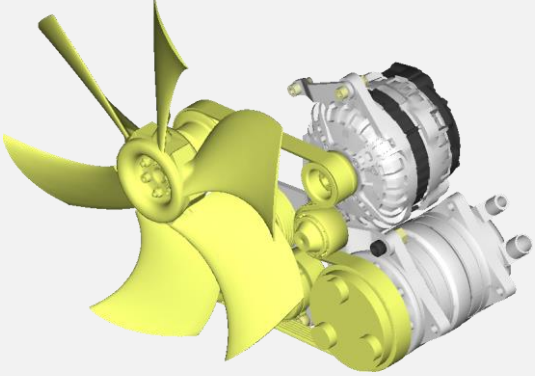
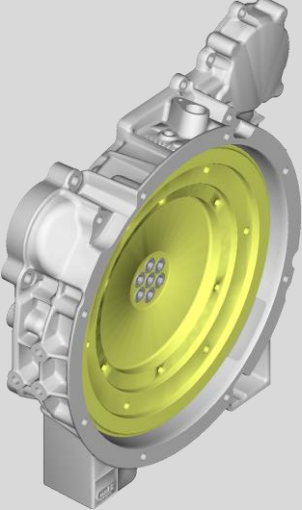
It is the duty of machine manufacturer to ensure that all safety precautions (e.g. contact protection for the diesel oxidation catalytic converter) are taken for the whole machine so that any injury from hot surfaces and rotating parts is excluded.

The protective devices are available from HATZ.

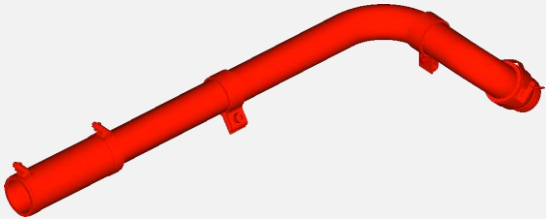
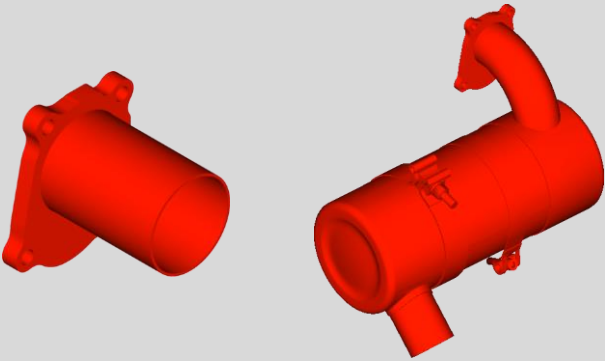
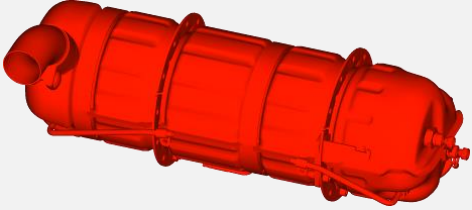
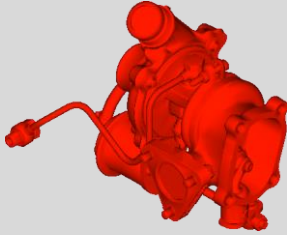
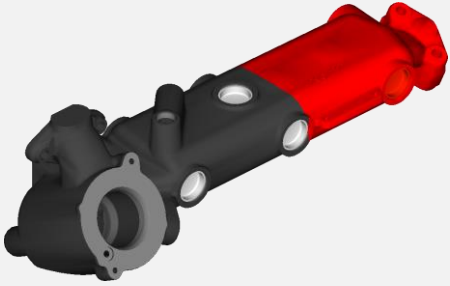
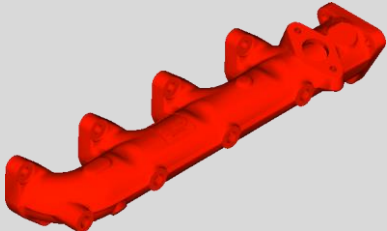
9.1 Hot surfaces and rotating parts



Rotating parts:

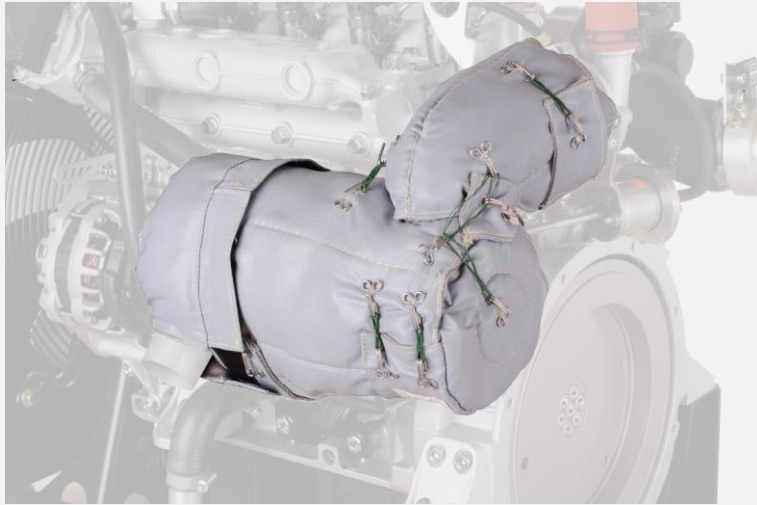
Pos.	Designation	Function
2	V-belt drive (fan, V-ribbed belt for alternator)	
	A/C compressor	
8	Flywheel	

Hot surfaces:

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

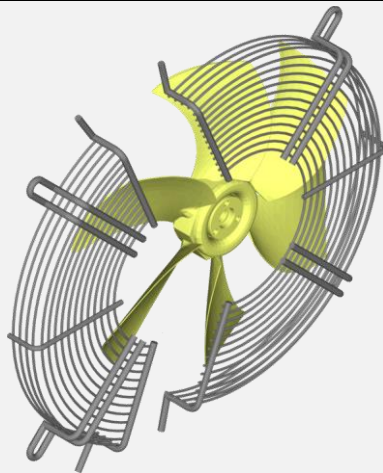
9.2 Contact protection

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)



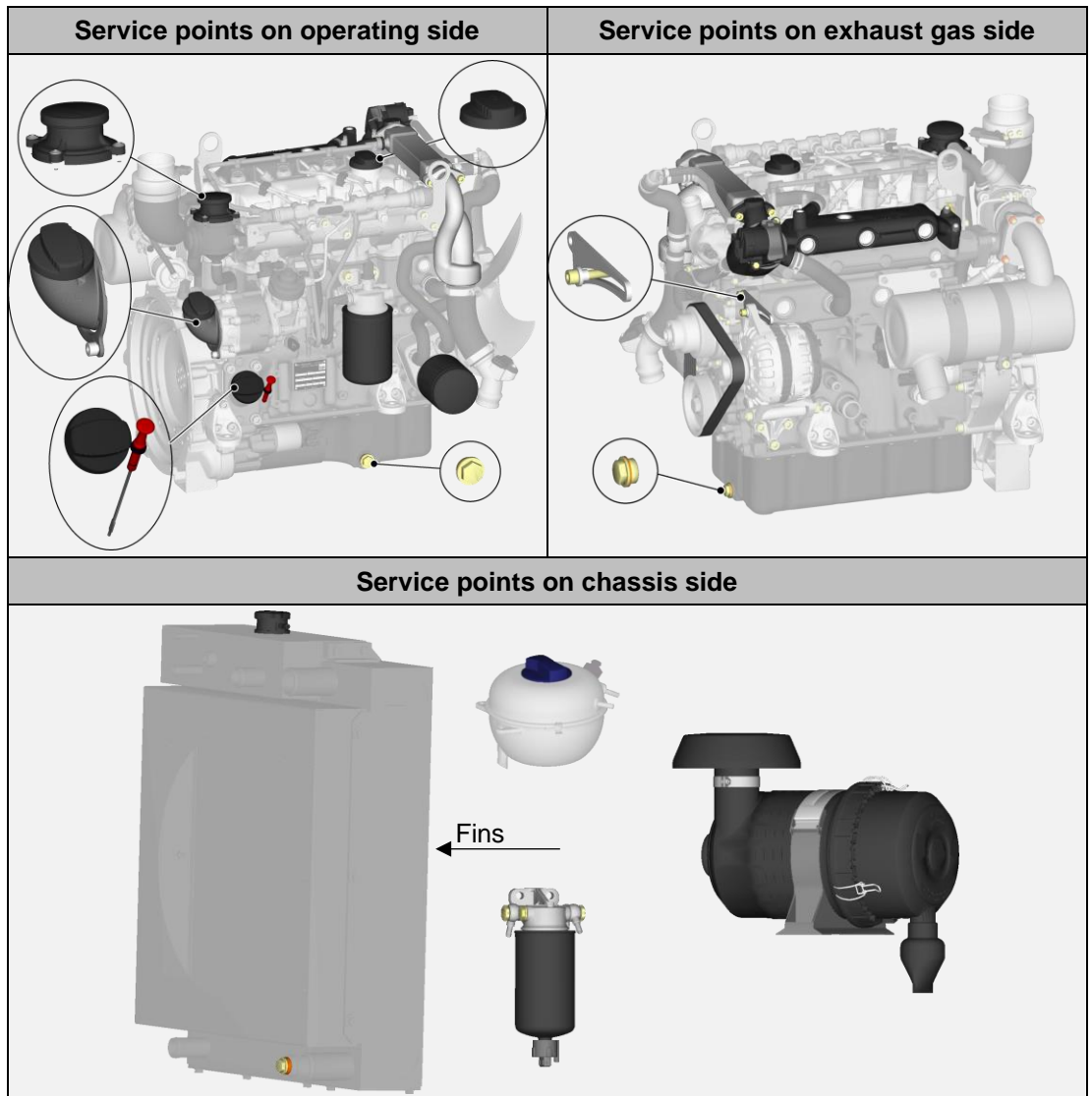
Contact guard for poly-V belt (optional)



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.



10.2 Maintenance intervals

Detailed information on carrying out maintenance intervals can be found in the manual for diesel engine.

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
Annually
Check the coolant concentration
Every 500 operating hours or every 2years
Change the engine oil and oil filter ¹⁾
Change the fuel prefilter ¹⁾
Change the main fuel filter ¹⁾
Check the poly-V belt ¹⁾
Change the oil separator of the crankcase ventilation ¹⁾
Check the screw fitting ¹⁾
Clean the engine ¹⁾
Change the air filter cartridge (or according to indicator)
When indicated, at least every 2years
Drain the water separator ¹⁾
If necessary, but every 3,000 operating hours at the latest
Replace the poly-V belts
Every 4,000 operating hours
Clean the entire exhaust-gas recirculation section (EGR precooler, EGR valve, EGR main cooler as well as EGR mixing nozzle) (to be carried out by a trained specialist)
Every 4years
Change the coolant

Maintenance according to maintenance interval or after 2years, depending on which criteria is first.



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. Engine preservation

For engine preservation >12 months, please follow the preservation guideline 043 450 XX.

12. 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:

12.1 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 station.
- Any improper modification of the engine will result in a loss of liability coverage for resulting damage.

Only regular maintenance, as specified in manual for diesel engine, 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.

12.2 Initial startup

- 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.
-

CAUTION

Health hazard due to inhalation of flue gas.



To protect exposed metal parts against corrosion, the parts concerned are coated with a protective wax. When the engine is started for the first time, this protective wax evaporates on hot components. This can lead to the generation of smoke for a brief period.

- Do not inhale flue gas.
 - Ensure sufficient ventilation.
-

CAUTION

Danger of engine damage from the use of starting fluid.



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



NOTE

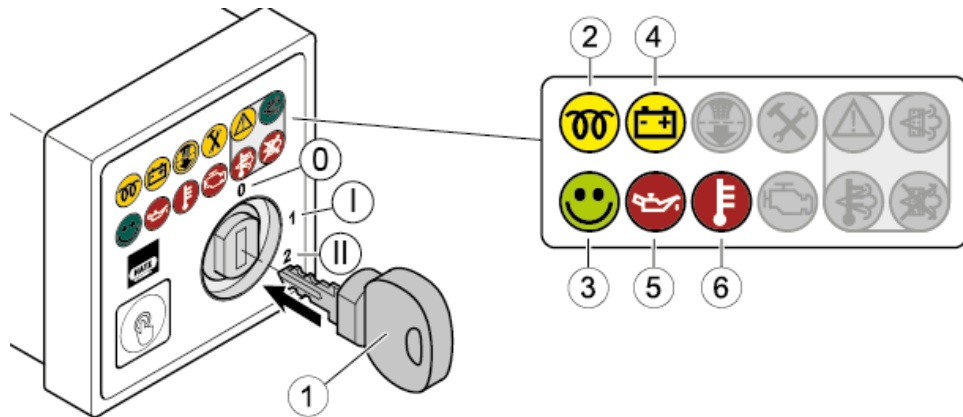
Before installing further add-on parts, the preservation wax must be removed from the screw-on surfaces and the surfaces must be cleaned.

Before starting

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

Step	Test
1	The machine is standing securely and on a level surface.
2	The installation location is adequately ventilated.
3	There is a sufficient amount of fuel in the fuel tank (see manual for diesel engine).
4	There is a sufficient amount of engine oil in the engine housing (see manual for diesel engine).
5	There is a sufficient amount of coolant in the expansion tank (see manual for diesel engine).
6	Radiator and radiator hoses are free from leaks (see the manual for diesel engine).
7	No persons are located in the danger zone of the engine or machine.
8	All safety equipment is in place.

Overview – HATZ instrument boxes



1	Starting key
2	Pre-glow display
3	Operating indicator
4	Charge control
5	Oil pressure display
Ignition lock	
0	Off
I	Operation
II	Start



NOTE

Further details on the instrument boxes can be found in the "HATZ – instrument boxes" chapter in the manual for diesel engine.

Procedure



NOTE

- Start for max. 20 seconds. If the engine is still not running after that, turn the starting key back to position "0" and eliminate the cause (see "Troubleshooting and elimination" chapter in the manual for diesel engine).
- Turn the starting key to position "0" every time you want to start the engine. The starter protection module prevents the starter from engaging while the engine is running and becoming damaged.

Step	Activity
Venting the fuel system	
1	Insert the starting key all the way and turn to position "I". Depending on the model, the following indicators light up: <ul style="list-style-type: none"> • Pre-glow display (2) • Charge control (4) • Oil pressure display (5)

2	Leave the starting key at position "I" until you hear the electrical fuel feed pump switch off (approx. 30 seconds).
3	Turn the starting key back to position "0". Note: Carry out steps 2 and 3 several times to press the air out of the fuel system.
Starting the engine	
4	Turn the starting key to position "I" again.
5	If the pre-glow display goes out, turn the starting key to position "II".
6	As soon as the engine is running, release the starting key. <ul style="list-style-type: none"> • The starting key springs back to position "I" and remains in this position during operation. • The charge control (4) and oil pressure display (5) go out. • The operating indicator (3) lights up and signals there is no engine fault.

NOTE



- In case of irregularities, switch off the engine immediately.
- Identify the fault and eliminate it.
- For details on the troubleshooting measures, see the "Troubleshooting and elimination" chapter in the manual for diesel engine.

12.3 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 cowl 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?

12.4 Testing of engine equipment

- Is the engine cooling system designed correctly?
- Was the engine mount 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?
 - Were the lines laid without chafing and are they free of collision?
 - 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 \leq 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 ...)?

12.5 Testing of accessibility to operating and service points

- Only perform maintenance work when the engine is stopped.
- 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 manual for diesel engine):

Service points:

(See installation drawings, manual for diesel engine and chapter *10.1 Accessibility of service points*, page 125)

- 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

12.6 The installation approval

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

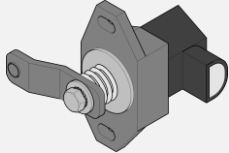
12.6.1 Prerequisite for carrying out the installation inspection

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

13. Functional safety

13.1 Speed adjustment

	<p>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)</p>
	<p>If the speed is specified via a speed selection switch (multi-state switch) or a control facility with a simple potentiometer, no redundant setpoint is required.</p>
	<p>Even with the speed setting via CAN bus, no redundant setpoint is given.</p>

13.2 Fault compensation reactions

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

1) Emergency running (standard with variable speed)

WARNING

Danger of injury during emergency operation due to engine damage and faults.



The engine fault indicator lights up or flashes.

- To avoid secondary damage, the engine may only be operated in emergency mode for a very short period, e.g. to move the equipment away from a critical location.
- Avoid staying in the vicinity of the running engine if possible.
- Switch off the engine and correct the fault promptly or contact a HATZ service center.

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

Failure	Fault replacement reaction
Engine speed setting, analog	If possible, emergency operation, otherwise lower neutral gear
Speed setting CAN or multistage switch	Lower idling speed
With master data set Rev11 (V710)/Rev6 (V620), the engine switches off when oil pressure is inadequate.	

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. Speed setting failure, analog: error message, no fault compensation response:
Speed setting failure, CAN or multistage switch: engine running with last known speed setting.