

Workshop Manual

Thermo Top Pro 120 | 150

Water Heater



English

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1 About this document

1.1 Purpose of the document

This workshop manual is designed to assist trained personnel with maintenance of the Thermo Top Pro 120 | 150. The document is part of the product and contains all the information, settings and instructions necessary to maintain the product.

1.2 Using this document

- Read and understand this workshop manual before repairing the product.
- Read and observe important safety instructions.
- Read and observe Operating instructions.
- Read and observe Installation instructions.

1.3 Use of symbols and highlighting



DANGER

This signal word denotes a hazard with a high degree of risk which, if not avoided, may lead to death or serious injury.



WARNING

This signal word denotes a hazard with a moderate degree of risk which, if not avoided, may lead to minor or moderate injury.



CAUTION

This signal word denotes a hazard with a low degree of risk which, if not avoided, will lead to minor or moderate injury.



NOTE

This signal word denotes a Special Technical Feature or (if not observed) potential damage to the product.



Refers to separate documents which are enclosed or can be requested from Webasto.

- ✓ Requirements for the following necessary action

2 Safety

The general accident prevention regulations and valid operational safety instructions must be observed. "General safety requirements" that extend beyond the framework of these regulations are specified in the following. The special safety requirements that pertain to this workshop manual are highlighted in the individual chapters and procedural descriptions.

2.1 General safety information



DANGER

Danger of poisoning and suffocation

Do not operate the heater in closed rooms that do not have an exhaust extraction unit.

- ▶ Do not switch on or operate the heater.



DANGER

Danger of scalding from leaking hot coolant

Scalding on opening the coolant circuit. The vehicle coolant circuit is pressurised.

- ▶ Allow the engine to cool before working on the vehicle coolant system.



DANGER

Hazardous material vehicles (ADR) must not be switched on or off using a timer control or remote control.



CAUTION

Overheating possible

A battery disconnecter (emergency off switch) may only be actuated in the event of danger since the heater will be switched off without after-running period.

- ▶ Always switch the heater on and off via the control element.



CAUTION

Overheating

Insufficient bleeding can lead to a malfunction resulting from overheating in heating mode.

Take care when bleeding the coolant system.

Always bleed:

- Before first commissioning the heater
- After replacing the coolant



NOTE

Correct bleeding can be identified by the fact that the coolant pump is making very little noise.



NOTE

Incorrect handling

- ▶ Protect the heater against mechanical stress (e.g. dropping, impacts or knocks).
- ▶ Do not stand on the heater.
- ▶ Do not place any objects on top of the heater.
- ▶ Avoid shutting down the heater incorrectly during the after-running period. After switching off via the control element, the fan of the heater continues to run.
- ▶ Always switch off the heater via the control element.
- ▶ Do not disconnect from the power supply until the after-running period has elapsed.

2.2 Qualification of personnel

The personnel must have the following qualifications:

- Successful completion of Webasto training
- Corresponding qualification for working on technical systems
- Read and observe installation, operating and important safety instructions

2.3 Working on the heater



NOTE

Before dismantling the heater, disconnect the heater power supply from the vehicle battery or remove fuses **F1** and **F3**.



NOTE

Always carry out a visual inspection before starting repair work:

- Check the coolant system and fuel system for leaks.
- Check the combustion air and exhaust pipe for damage and ensure they are clear.



NOTE

- Collect the coolant running out of the system in a suitable container.
- Block or disconnect coolant hoses.
- Dispose of coolants in an environmentally friendly way.

The main battery power must not be disconnected as long as the heater is operating or after running due the risk of the heater overheating and consequently the overheating safeguard tripping.

Once the heater and all coolant-carrying components have been installed, fill the entire coolant system according to the vehicle manufacturer's specifications.

Bleed the system according to the vehicle manufacturer's specifications and check for leaks with the default system pressure of the vehicle.



NOTE

Replace component:

Within the warranty period, send in only the defective component (not the entire heater) to Webasto.



NOTE

When on-board power supply is applied, never disconnect the connector from the heater.

2.4 Working on the vehicle



NOTE

The heater temperature must not exceed 120 °C when switched off. See Technical data.

2.5 Heater test run



NOTE

Even if you use the timer, the heater must not be operated in enclosed spaces such as garages and workshops without an emissions extraction system.

2.6 Checks

Webasto recommends to carry out the following servicing jobs before and after each heating period:

1. Read out the fault code memory.
2. Clean heater exterior (make sure no water gets in).
3. Check the electrical connections for contact corrosion and firm seating.

4. Check exhaust gas and combustion air line for damage and ensure that they are clear.
5. Check the fuel line and filters for leaks.
6. Check the coolant circuit and coolant pump.
7. Check hoses for cracks.
8. If fitted and necessary, change the fuel filter.
9. Commission the heater.

3 Information regarding the heater

3.1 Basis

The Thermo Top Pro 120 | 150 heaters consist essentially of the following main components:

- Burner head (with fan, fuel pump, control unit)
- Combustion chamber
- Heat exchanger

A coolant pump (type U4850) is installed in the vehicle near the heater and guarantees the required heat transport via the coolant circuit.

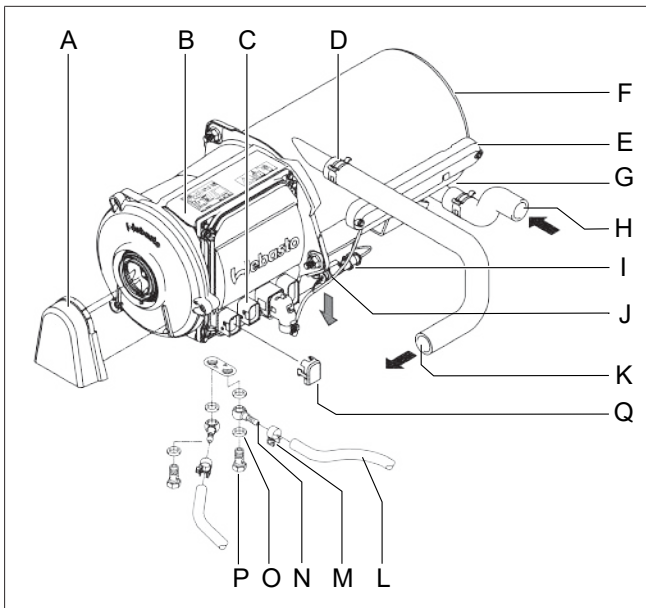


Fig. 1 Overview of heater and connections

A Spray guard (optional)	J Exhaust gas outlet
B Burner head	K Original vehicle coolant hose (inlet)
C Electrical Connections	L Fuel line
D Coolant outlet of heater	M Fuel hose clamp
E Coolant temperature sensors with cover	N Fuel connector
F Heat exchanger	O Seal
G Coolant inlet of heater	P Screw for fuel connector
H Coolant hose (inlet)	Q Dummy connector for coolant pump (for CPoff variant)
I Exhaust gas temperature sensor	

NOTE

This workshop manual describes the retrofit version of the heater. In the case of heaters installed directly by the vehicle manufacturer, different control units with different connectors and different software as well as different application parts may be used which are not described in this manual. For these heaters, information is only available in the documentation of the vehicle manufacturer.

3.2 Special variants (Rail, CPoff, Chiller, ADR)

3.2.1 Thermo Top Pro 150 Rail

This is a heater model for installation and operation in rail vehicles. The essential functions correspond to the standard version of the heater.

3.2.2 Thermo Top Pro 120 | 150 CPoff

In the case of the "CPoff" variant, controlling and monitoring the coolant pump is **deactivated** by the heater. Corresponding implementation of a coolant pump must be ensured in the vehicle by the customer. For information regarding pump selection and design, see chapter 4.16, "Coolant pump" on page 11. Connection X1 on the control unit, which is provided for the coolant pump, does not have a function in this variant and must be closed in this variant with a dummy connector for sealing purposes (see Fig. 1, position Q).



WARNING

Use of an unsuitable pump or malfunction thereof may result in the heater being damaged. Compared to the basic variant, there is **no** monitoring of the pump as well as a control unit via the heater is not possible in heating mode. This must be ensured by the customer as part of the vehicle application.

The additional functions correspond to the standard version of the heater.

3.2.3 Thermo Top Pro 120 Chiller

This variant is based on the previous "CPoff" and has the same requirements for use of the coolant pump. However, operation is only permitted in the "Motor on" configuration. As a result, the permissible coolant temperature is limited to 149° F (65° C). The heater must be connected according to the chiller-specific wiring diagram (see Fig. 56).

3.2.4 Thermo Top Pro 120 | 150 ADR

In this case it is the standard version of the heater with ADR-specific provision in the application. Special requirements for installing and operating the heater in accordance with the specifications of the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR), can be found in the general installation and operating instructions. Regarding ADR, see also: https://www.unece.org/trans/danger/publi/adr/adr_e.html

4 Description of the components

4.1 Overview of the subassemblies

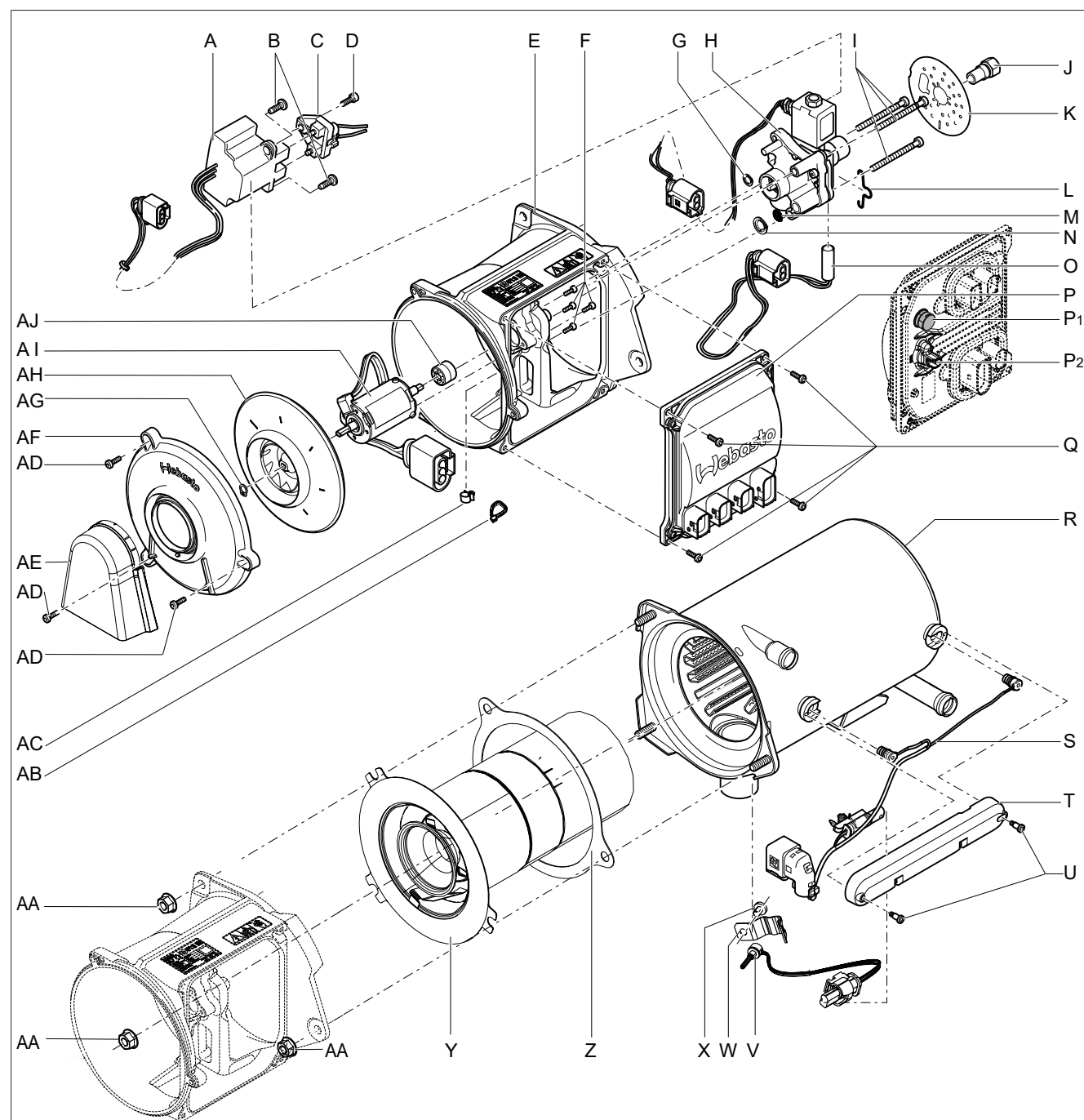


Fig. 2 Exploded view

The following legend extends over this and the next page.

A	Ignition spark generator	S	Coolant temperature sensors
B	Screw for ignition spark generator M5x14 PH2 (on fuel pump) (2 +/- 0.2 Nm)	T	Cover for sensors
C	Ignition electrodes	U	Collar screw on cover for sensors M4 T20 (2 +/- 0.2 Nm)
D	Cylinder bolt for ignition electrodes M4x12 SW3 (on ignition spark generator) (3 +/- 0.3 Nm)	V	Exhaust gas temperature sensor
E	Burner head	W	Spring clip

F	Screw for drive motor M3x10 T10 (on burner head) (2 +/- 0.2 Nm)	X	Screw for spring clip M4x5.5 T20 (2 +/- 0.2 Nm)
G	O-ring fuel pump (small)	Y	Burner
H	Fuel pump with solenoid valve	Z	Seal
I	Screw for fuel pump M5x45 T25 (on burner head) (3.5 +/- 0.35 Nm)	AA	Nut M8 SW13 (burner head on heat exchanger) (19 +/- 2 Nm)
J	Fuel nozzle SW16 (20 +/- 2 Nm)	AB	Cable tie for electrical cables (nozzle block preheater and ignition spark generator)
K	Baffle plate	AC	Clip for electrical cables (on burner head)
L	Clip for nozzle block preheater	AD	Screw for fan cover 40x14 T20 (3 +/- 0.3 Nm)
M	Screen (fuel pump)	AE	Combustion air spray guard (optional)
N	O-ring fuel pump (large)	AF	Fan cover
O	Heater cartridge, nozzle block preheater	AG	Circlip for blower fan wheel DIN471 6x0.7 (on drive motor axle)
P	Control unit (P1 pressure equalisation element, P2 optical sensor)	AH	Blower fan wheel
Q	Screw for control unit 4x14 T20 (on burner head) (3 +/- 0.3 Nm)	AI	Drive motor
R	Heat exchanger	AJ	Axle connection

4.2 Burner head

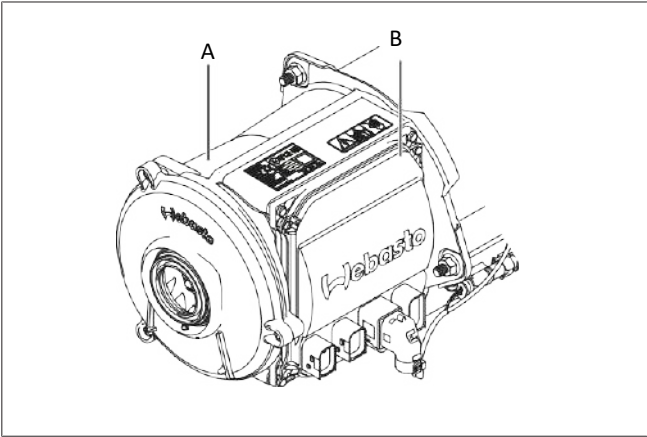


Fig. 3 Burner head

A	Burner head
B	Control unit

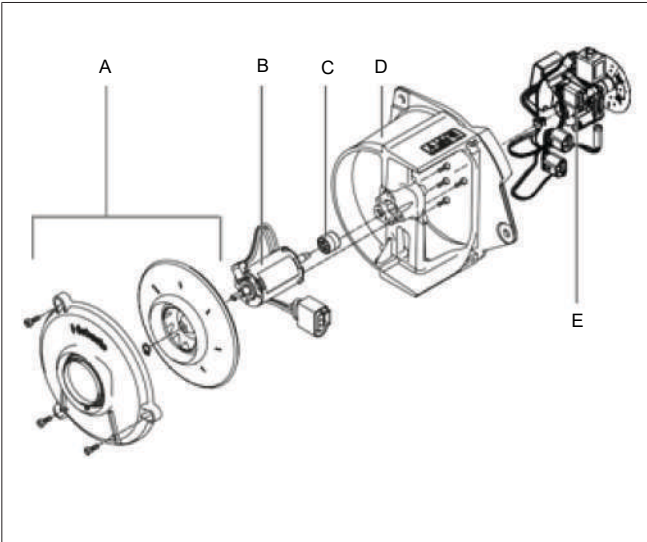


Fig. 4 Burner head details

A	Fan with cover	D	Housing
B	Drive motor	E	Fuel pump with solenoid valve, ignition spark generator, ignition electrodes, nozzle with pre-heating and baffle plate.
C	Axle connection		

The burner head can be removed for repair and maintenance purposes.

4.3 Combustion air fan

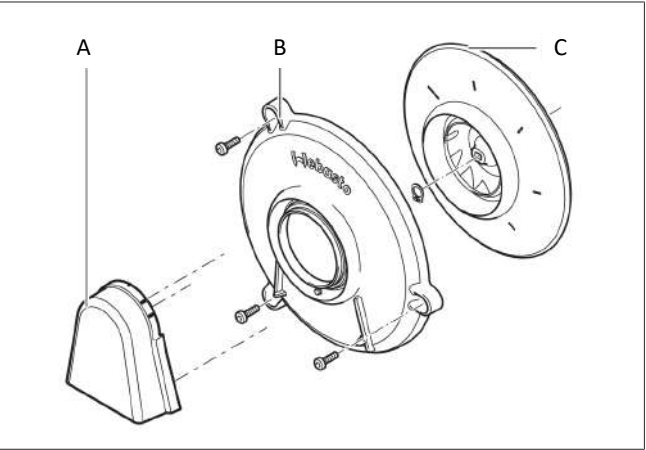


Fig. 5 Combustion air fan

A	Spray guard (optional)	C	Fan wheel
B	Fan cover		

The fan wheel delivers the air required for combustion in the combustion tube via the combustion air inlet. The air is sucked in through the air intake opening in the fan cover. Optionally, a spray guard or a combustion air intake line approved by Webasto can be attached to the fan cover.

4.4 Drive motor

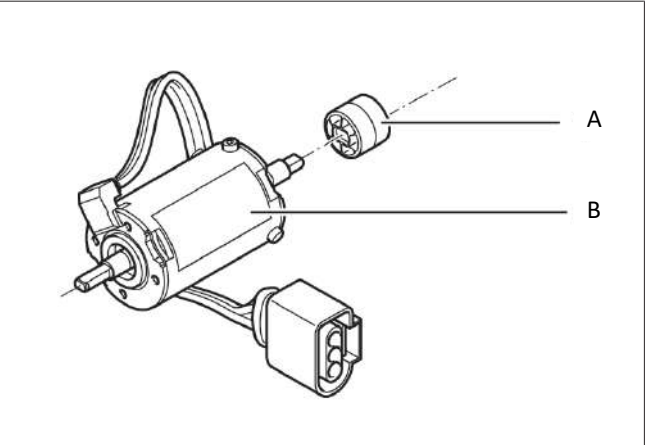


Fig. 6 Drive motor

A	Axle connection	B	Drive motor
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The drive motor drives the fan wheel and the fuel pump using a axle connection (shaft coupling).

4.5 Fuel pump with solenoid valve

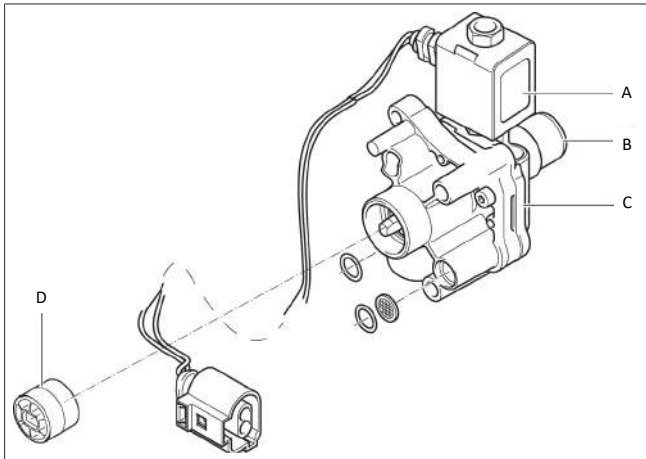


Fig. 7 Fuel pump with solenoid valve

A Solenoid valve	C Fuel pump
B Fuel nozzle	D Axle connection to the drive motor

The fuel for combustion is supplied by the fuel pump. The fuel pump is driven by the drive motor using an axle connection to the drive motor (shaft coupling).

The fuel pressure is increased to approx. 11 bar in the fuel pump. The solenoid valve integrated into the fuel pump opens or closes the fuel supply to the fuel nozzle as a function of the heating mode.

4.6 Nozzle block preheater

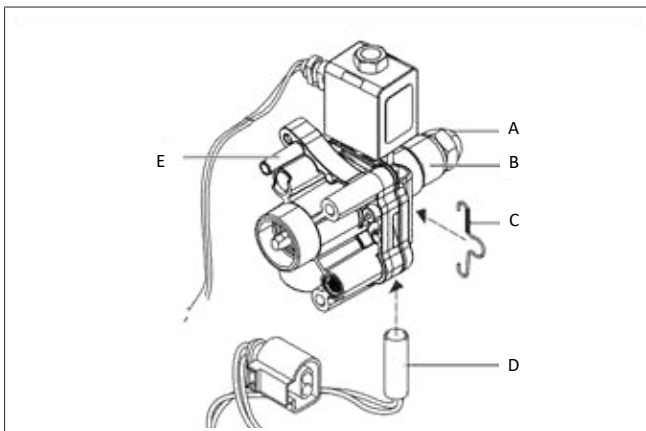


Fig. 8 Nozzle block preheater

A Fuel nozzle	D Heater cartridge
B Nozzle block	E Fuel pump
C Fastening clamp	

The nozzle block preheater consists of a heater cartridge (130 W) and is part of the standard equipment of the heater. At low temperatures (factory setting: $T < 41^{\circ}\text{F}$ (5°C), depending on the application of the heater), the heater cartridge warms the nozzle block and the fuel nozzle. This ensures an optimised atomisation of the fuel. The heater cartridge is activated automatically by the control unit.

4.7 Ignition spark generator with ignition electrodes

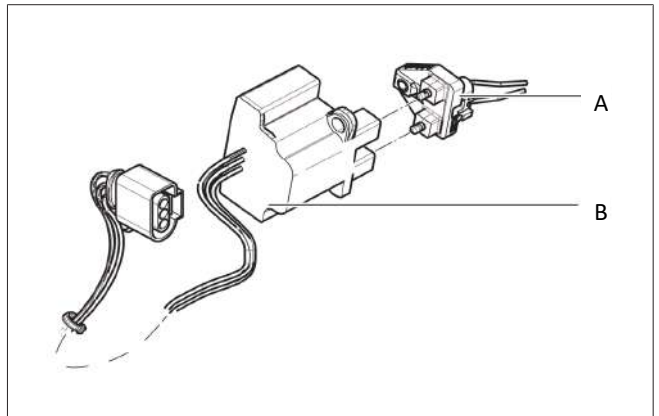


Fig. 9 Ignition spark generator

A Ignition electrodes	B Ignition spark generator
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The high voltage for igniting the air-fuel mixture is generated in the ignition spark generator. Ignition occurs by a high-voltage spark crossing between the two ignition electrodes.

4.8 Fuel nozzle and baffle plate

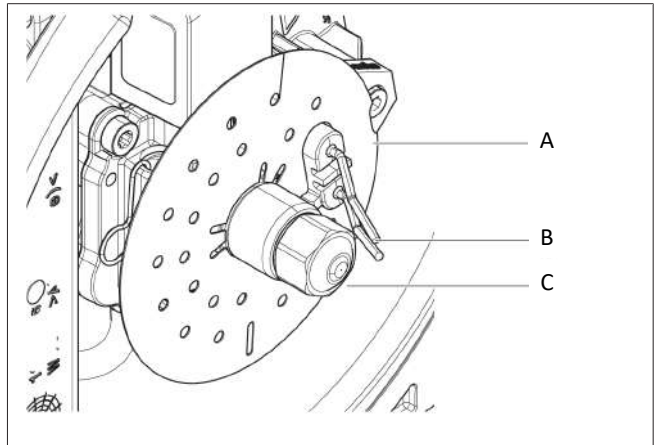


Fig. 10 Fuel nozzle and baffle plate

A Baffle plate	C Fuel nozzle
B Ignition electrodes	

The baffle plate guarantees the correct air distribution for the combustion process.

The baffle plate is permeable to flame light and makes visual flame monitoring possible with the control unit.

4.9 Control unit



NOTE

The control unit must not be disassembled.

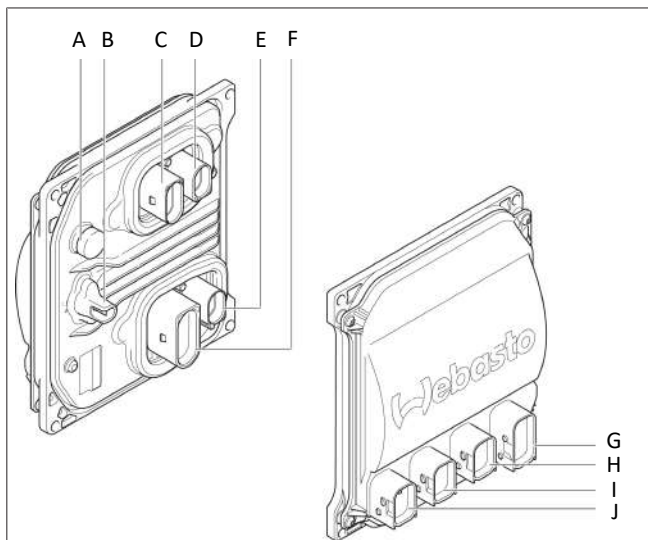


Fig. 11 Inside and outside of control unit

A	Pressure equalization element	F	Drive motor
B	Flame monitor	G	Control element(s), vehicle connection
C	Ignition spark generator	H	Temperature sensors
D	Nozzle block pre-heater	I	Heater power supply
E	Fuel pump	J	Connecting coolant pump

The control unit controls the functional sequence and monitors the heating mode. Sensors for continuously determining the temperature and pressure are integrated into the control unit.

4.10 Flame monitor

An optical flame monitor in the control unit detects the flame formation.

4.11 Pressure equalization element

A pressure equalisation element prevents the humidity from penetrating the inside of the control unit and establishes an equalisation of pressure with the surrounding area (altitude compensation).

4.12 Heat exchanger

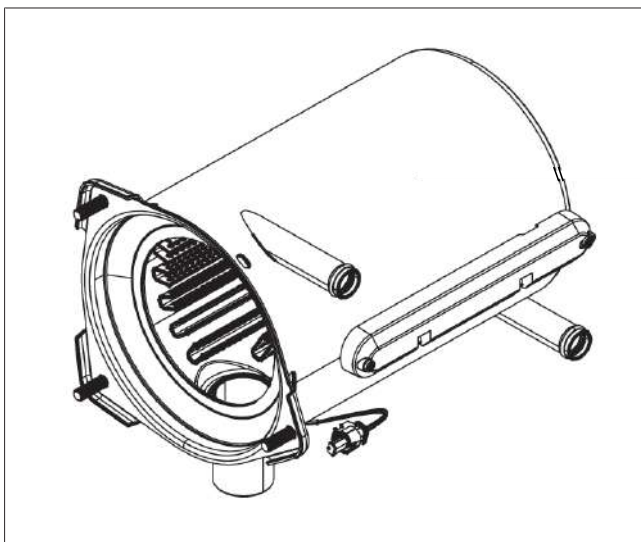


Fig. 12 Heat exchanger

The heat exchanger transfers the heat generated in the combustion process to the coolant circuit.

Components associated with the heat exchanger include:

- Seal
- Coolant temperature sensors with cover
- Exhaust gas temperature sensor

4.13 Combustion tube

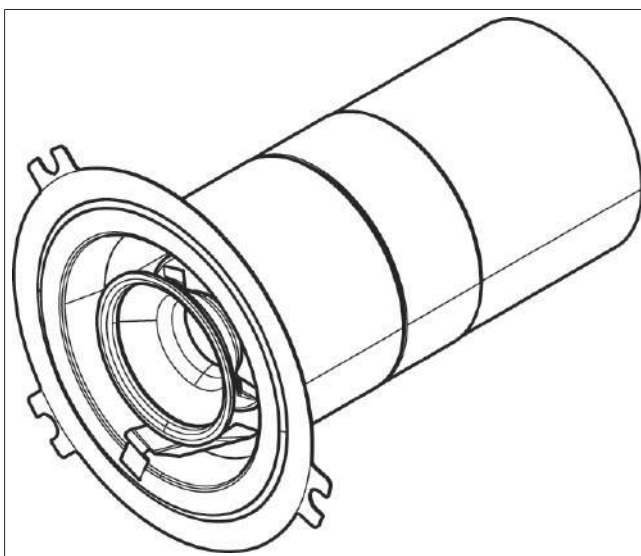


Fig. 13 Burner

The air-fuel mixture is burned in the combustion tube. The generated hot flue gases heat the coolant flowing through the heat exchanger.

4.14 Coolant temperature sensors

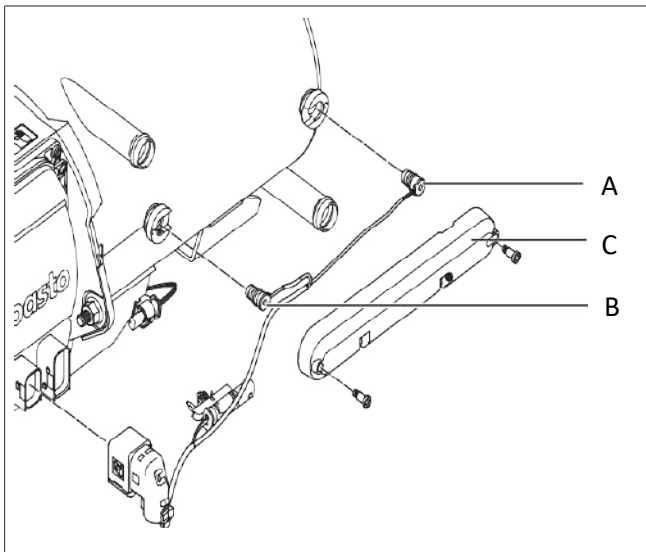


Fig. 14 Coolant temperature sensors

A Overheat sensor	C Cover for sensors
B Coolant temperature sensor	

The sensor values are used for the coolant temperature control and for protecting the heater against overheating. The sensors are connected to the control unit by the cabling.

4.15 Exhaust gas temperature sensor

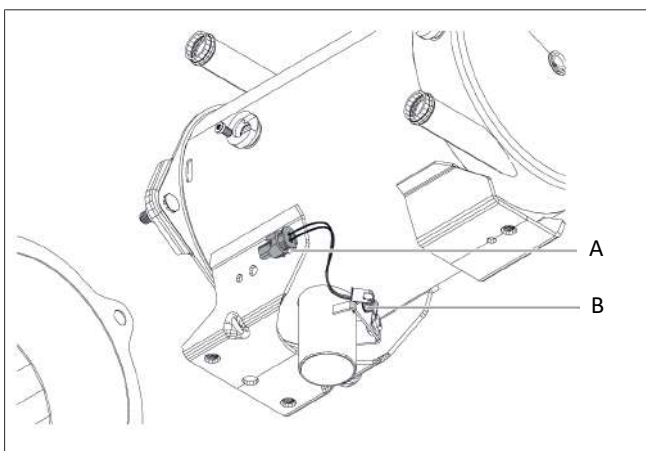


Fig. 15 Exhaust gas temperature sensor attachment and connector

A Exhaust gas temperature sensor connector	B Exhaust gas temperature sensor
--	----------------------------------

A sensor is installed on the exhaust gas stub of the heater to monitor the temperature in the exhaust gas. The sensor is connected to the control unit by the cabling.

4.16 Coolant pump

The standard variant of the Thermo Top Pro 120 | 150 are operated with the coolant pump U4850. The coolant pump is switched on by the heater control unit.

If using a CPoff heater variant (see chapter 3.2.2, "Thermo Top Pro 120 | 150 CPoff" on page 5), which can also be recognised via the "CP OFF" label, then a coolant pump is controlled externally. Exact specifications to this effect can be found at the end of this chapter in the section "Use of an external coolant pump".

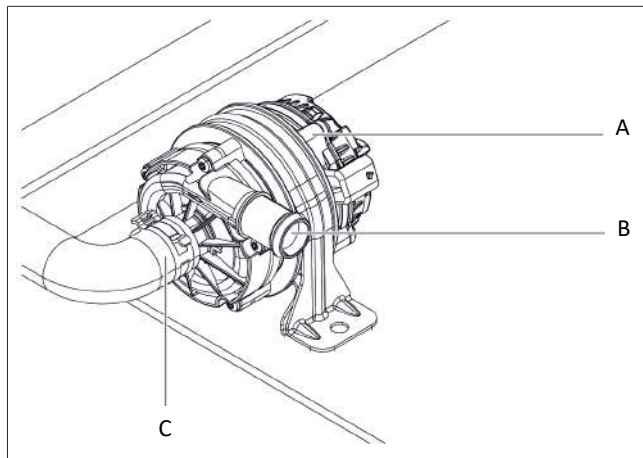


Fig. 16 Coolant pump U4850

A Coolant pump U4850	C Coolant inlet
B Coolant outlet	



NOTE

The use of the U4850 coolant pump in military vehicles or military applications is prohibited.



NOTE

The heater must be operated with a coolant pump. Pumps that have been dropped must not be re-used. Dropping may lead to external impact points and internal damage. Possible cracks in the plastic part of the pump may lead to a leakage in the pump compartment or the surrounding area. This may result in operational failures of the pump due to the ingress of coolant into the electronic area.

Characteristics of the coolant pump U4850



NOTE

Reactivation of the coolant pump motor:
The coolant pump motor can be reactivated from the dry-running protection or sleep mode. This is done by isolating the power supply for > for 2 min. After restoring the power supply, the coolant pump motor starts in soft-start again.

• Start-up

The coolant pump motor starts up within 2 seconds.

• Protection against blocking, running dry and overload

A continuous check of the coolant pump for blocking, running dry and overload is carried out during the start and regular operation.

If such an error case is detected, the coolant pump sends a corresponding diagnostic signal to the heater control unit and automatically deactivates itself temporarily. The coolant pump attempts to start again. After 20 unsuccessful start attempts, the coolant pump switches itself off. To carry out a renewed start attempt, the coolant pump must be turned off and switched back on again.

The coolant pump motor is not damaged by hydraulic overpressure of the coolant pump provided that the following limits are observed:

- Max. overflow forwards: 634 gal/h (2400 l/h)
- Max. overflow backwards: 132 gal/h (500 l/h)

• Overvoltage protection

In the event of overvoltage, the coolant pump automatically shuts down at a voltage supply above 36 V (24 V) and 16 V (12 V). If the voltage drops to 35 V or 15 V, the

pump automatically switches itself on again.
If overvoltage is diagnosed, the coolant pump sends a corresponding diagnostic signal to the heater control unit.

● Undervoltage protection

In the event of undervoltage, the coolant pump automatically shuts down at below 13.5 V (24 V) and 8 V (12 V) power supply. If the voltage rises to 14.5 V or 9 V, the pump automatically switches itself on again.

If undervoltage is diagnosed, the coolant pump sends a corresponding diagnostic signal to the heater control unit.

● Reverse-polarity protection

NOTE

The coolant pump motor is not equipped with internal reverse-polarity protection.

● Electrical protection

NOTE

The fuse for the coolant pump must never be pulled out during operation

The fuse for the coolant pump must never be replaced when switched on.

● Transport and storage

The pumps should only be transported and stored in the appropriate transport packaging. Unsorted transport (e.g. bulk product) is not permitted.

NOTE

The coolant pump shuts off for:

- Overvoltage
- Undervoltage
- An internal fault
- Dropping below the minimum speed
- Permissible operating temperature exceeded

Use of an external coolant pump

The externally controlled coolant pump in the CPoff variant must ensure that the coolant is delivered in the coolant circuit of the heater or vehicle. It must satisfy the following technical features:

	Thermo Top Pro 120	Thermo Top Pro 150
Nominal volume flow g/h (l/h) (against 0.56 bar)	396 (1500)	
Minimal volume flow g/h (l/h) (if lower than this then there is a risk of overheating. Heater may be damaged)	291 (1100)	370 (1400)
After-running period	Min. 60 s	
Connection piece diameter / Reduction of cross-section	System diameter TTP120 150 = .79" (20 mm). Reduction of cross-sections should be avoided.	

The coolant pump must be in operation during the entire heating mode and during the after-running period.

4.17 Coolant

Follow the instructions of the vehicle manufacturer when checking the coolant level.

NOTE

You will find further information in the installation instructions and at the vehicle manufacturer.

Coolant Mix ratio e.g. Glysantin®/water.

Permissible water/glycol (monoethylene glycol) mixes:

	Glycol [%]	Water [%]
Minimum	33	40
Maximum	60	67

4.18 Fuel filter

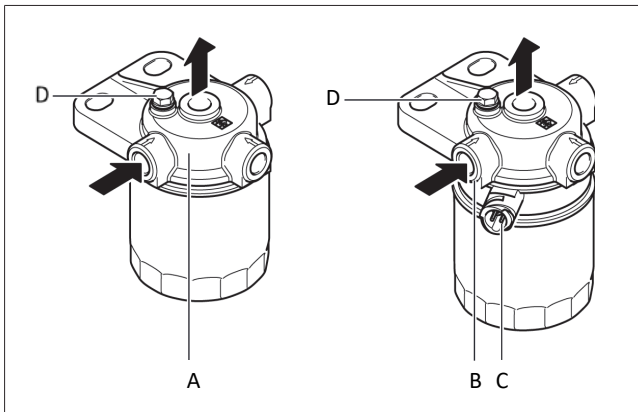


Fig. 17 Fuel filter

A Fuel filter without heating	C Electrical connection
B Fuel filter with heating	D Bleed screw

The externally located fuel filter is used for separating sediment from the fuel and therefore prevents blocking of the fuel nozzle. Filter heating is available as an option. It is recommended or necessary to install filter heating under certain use and operating conditions. See installation instructions.

The filter heating cut-in point is approx. 23° F (-5° C) and the cut-out point is approx. 41° F (+5 °C).

5 Functional description

5.1 Introduction

The Thermo Top Pro 120 | 150 is a water heater with coolant temperature control, monitored by its integrated control unit.

To regulate the coolant temperature, the heater works in cycle operation.

The necessary, continuous coolant flow is provided by a coolant pump.

After the heater is activated, heating mode and the residual heat utilisation/control pause are controlled automatically depending on the switching thresholds.

Standard temperature range (standard values)	Temperature °F (°C)
Motor OFF	149-176 (65-80)
Motor ON	122-149 (50-65)
Residual heat utilisation, motor OFF	131-149 (55-65)



NOTE

The switching thresholds are dependent on the heater variant and the type of heating mode.

To produce heat, the fuel is sprayed under pressure through a fuel nozzle, mixed with combustion air and burned.

The volume of combustion air is provided by the fan.

The fuel is supplied by a fuel pump with pressure limiting valve.

The fuel pump is driven directly by the speed-controlled drive motor and also has a temperature controlled nozzle block preheater for improving fuel atomisation at low temperatures.

The fuel system is opened and closed by a solenoid valve at the fuel pump.

The air-fuel mixture is ignited by a high voltage spark in the combustion chamber.

Flame monitoring is done with a flame monitor (optical sensor) in the control unit.

The coolant temperature and the exhaust gas temperature are monitored by the sensor system in order to protect the heater from overheating.

The correct volume of combustion air for combustion is maintained by the speed control of the drive motor. The speed control automatically compensates for the air pressure influence (altitude compensation) on combustion.

The speed is calibrated for correct combustion in the Device production department at Webasto. In case of service, calibration can be done in the workshop during CO₂ adjustment when carrying out the Webasto-Thermo test diagnosis (WTT diagnosis see chapter 7.2, "Check and set CO₂ in exhaust gas" on page 25).



NOTE

If combustion does not take place, see chapter 6, "Malfunctions and troubleshooting" on page 15.

The operating state is displayed by the control panel or an indicator lamp (LED).

5.2 Control elements

The Thermo Top Pro 120 | 150 heater can be controlled with various control units such as a rocker switch, SmartControl/Multi Control and ThermoCall TC4. A combination of control elements is also possible in certain cases.

Observe the operating instructions for the control element.

5.3 Switch the heater on and off

The heater is switched on and off by different switch signals. Depending on the system equipment, the switch signals are produced by a switch, control element or a climate control system.



DANGER

Overheating possible

An emergency off switch may only be actuated in the event of danger since the heater will be switched off without after-running period.



See the operating and installation instructions for the control element.

If the documents are not available, these can be requested from Webasto.



NOTE

Always switch off the heater via the control element

After switching off via the control element, the heater switches to a short controlled run-on phase. Switching off incorrectly, without after-run, can cause damage to the heater.

5.4 Using the heater in hazardous material vehicles (ADR)

It is not possible to set a preselection time in hazardous material vehicles (ADR). The SmartControl (if present) shows how much heater operation time is left (remaining operation time).



NOTE

An ADR after-running period is applied in the following cases:

- the generator signal (D+, light machine) is discontinued.
- the pumping device (auxiliary drive) belonging to the vehicle is put into operation.

After the end of the ADR after-running period, the heater is in ADR locking mode.



NOTE

Release ADR lock:

- Put the pumping device belonging to the vehicle out of operation.
- Restart the heater by switching it off and on again using the control element.

5.5 Functional sequence

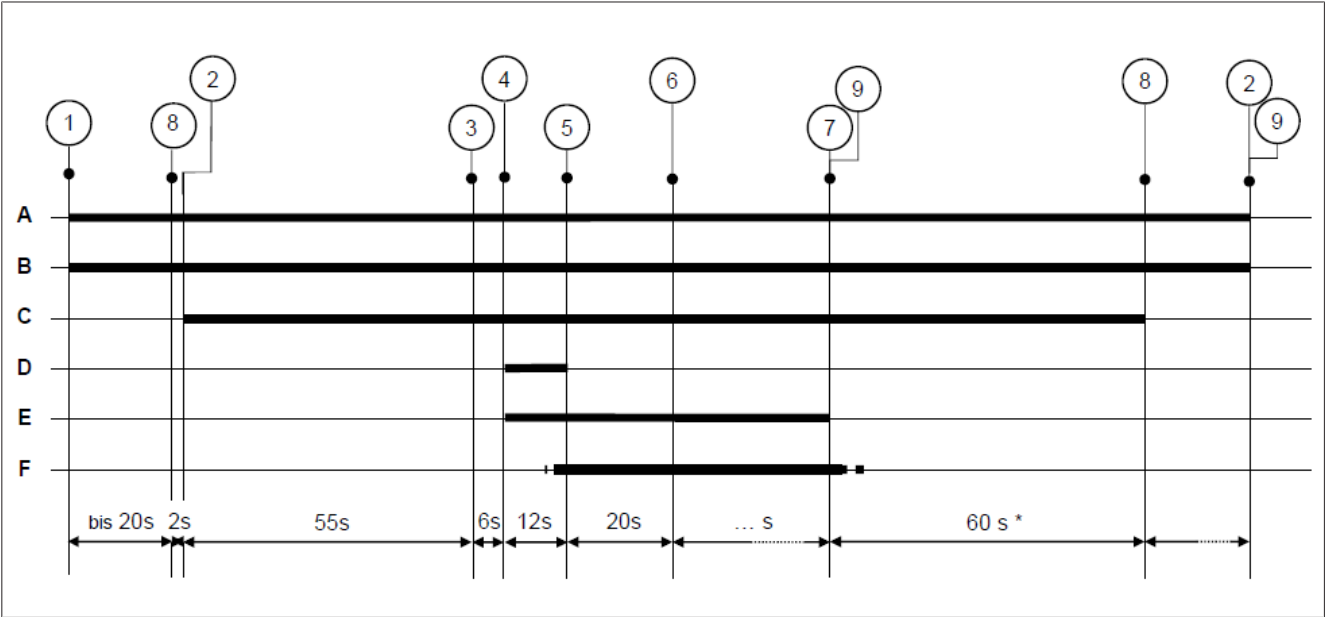


Fig. 18 Functional sequence

1	Switch on/ component test	A	Operating indicator
2	Supply	B	Coolant pump
3	External light request 1	C	Fan
4	Pre-ignition/flame ignition	D	Ignition spark generator
5	Flame stabilisation	E	Fuel cut-off valve
6	Control mode	F	Flame indicator
7	After-running period		
8	Control pause	*	ADR heaters < 40 s
9	Switching off		

5.6 Fault switch-off

If the heater detects a malfunction, the indicator lamp flashes.

The malfunction must be located and rectified. To assist with troubleshooting, see chapter 6, "Malfunctions and troubleshooting" on page 15.

6 Malfunctions and troubleshooting

6.1 Basics



NOTE

Troubleshooting is generally restricted to locating faulty heater components.

The following potential sources of malfunction are not taken into account and should always be checked to rule them out as the cause of fault:

- ▶ Corroded connector
- ▶ Loose plug connector
- ▶ Crimping defect at connector
- ▶ Completeness of the connector
- ▶ Corroded cables and fuses
- ▶ Corroded battery terminals
- ▶ Impermissibly high ambient temperature

Carry out a function check in the vehicle after rectifying each fault.

6.1.1 Diagnostics with Webasto Thermo Test

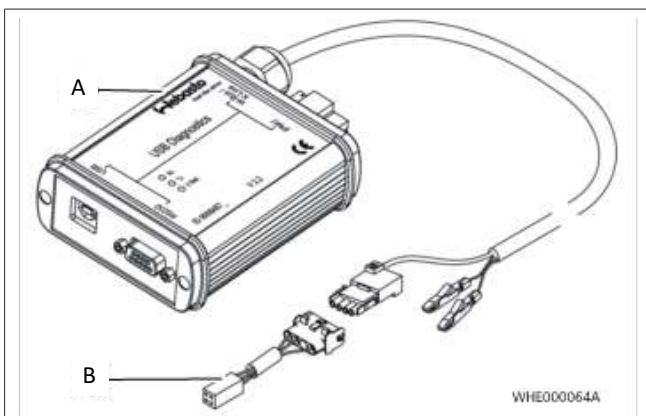


Fig. 19 Diagnostics with WTT

A WTT USB interface	Diagnostic adapter
	B



Connect and use the Webasto Thermo Test (WTT) USB interface, diagnostic adapter and adapter cable as described in the Operating Instructions.

The heater is diagnosable and can be tested with the WTT diagnostic adapter and the WTT diagnostic software installed on a PC/laptop when installed.

1. The diagnostic adapter is connected to the diagnostic connector provided in the heater wiring harness (see chapter 10.6, "Wiring diagrams" on page 41).
2. The diagnostic adapter is connected to the WTT USB interface.
3. The WTT USB interface is connected to the PC/laptop (at least, USB 2.0 port).
4. Then, the WTT diagnostic software is started and the connection is established to the heater.



For more information about the WTT and adapters, see <https://dealers.webasto.com>.



NOTE

When the control element is connected via W-bus, disconnect the connector and connect the adapter plug. After the diagnostics, reconnect the control element.

6.1.2 Fault lock-out and heater lock-out

Faults with the heater are detected by the control unit as a malfunction and a fault after-run. Afterwards, the heater remains in the fault lock-out. A fault code is output after detecting a malfunction during the fault switch-off.

Procedure for analogue signals

The fault code is shown on the control element either by flashing or by a letter combination on the display (depending on the type of control element). The fault code assists in determining the fault.



NOTE

If the **fault lock-out** is active, the heater can be restarted using the control element after rectifying the fault. See chapter 6.4, "Instructions for cancelling the fault lock-out" on page 16.

If the **heater lock-out** is active, switching on the heater again does not restart it. See chapter 6.5, "Heater unlocking instructions" on page 17.

Procedure for digital signals (with WTT)



NOTE

Select in Webasto Thermo Test PC Diagnostics: Diagnostics => Device Selection => W-bus.

Before removing the heater or add-on parts, always print out the logs with the following data:

- Operating and fault data.
- Extended fault conditions.

(select in Webasto Thermo Test PC Diagnostics: Logs.)



NOTE

Always determine the cause of the lock-out first before rectifying the lock-out.

6.2 Fault list on the control element

The fault codes of the heater are explained in chapter 6.6, "Overview of faults and fault codes" on page 18.

6.2.1 Switch (On/Off)

On control elements without a display (analogue), the fault code is indicated in the form of a flash pulse.

Error code output:

After **5** fast flash pulses, the fault code is output by a sequence of long flash pulses. The long flash pulses must be counted. This number (fault code) provides information for the workshop about the type of heater malfunction.

6.2.2 MultiControl / SmartControl / UniControl

Fault lock-out unlocked.

Malfunctions are shown with fault codes in the display.

Error code output:

The fault code is indicated by a combination of digits and letters (e.g. 'H02' or 'F05').



NOTE

Other fault codes (e.g. TXX) do not stem from the heater and describe control element, system, or communication faults.

6.3 Cause of malfunctions in the heater and systems

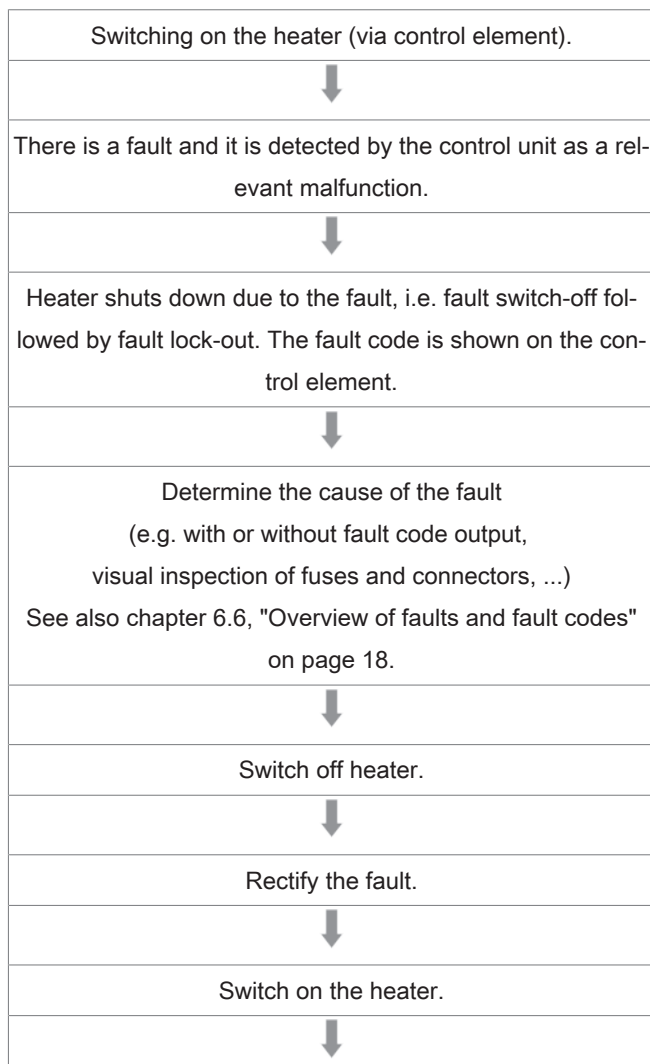
A malfunction is caused when one or more faults occur.

Possible faults are:

- Overvoltage / Undervoltage
- Malfunctions of components, e.g. due to short-circuit or break
- The overheating of heater
- Impermissible exhaust temperature
- unsuccessful starts,
- flame failure.

6.4 Instructions for cancelling the fault lock-out

6.4.1 Analogue cancelling the fault lock-out



6.4.2 Digital cancelling the fault lock-out (with WTT)

Connect diagnostic cable to the heater diagnostic plug (next to fuses).



Switch on the heater.



There is a fault and it is detected by the control unit as a relevant malfunction.



Heater shuts down due to the fault, i.e. fault switch-off followed by fault lock-out.



Determine error cause by reading out the fault code memory.

Click on the Fault list button to read out the fault code memory.



NOTE

Print out or note the fault code memory.



Rectify the fault.



Clear fault code memory with the command Clear fault code memory or Heater lock-out in the Fault code memory menu.



Switch on the heater.



Fault lock-out unlocked.



NOTE

Certain faults add to the fault count in the fault code memory. The heater assumes heater lock-out mode when the number of faults in the fault code memory exceeds a limit value. The maximum number of fault in the fault code memory and the limit value of the fault code memory is defined by the software.

6.5 Heater unlocking instructions

The heater can be unlocked with or without Webasto Thermo Test PC diagnostics.

6.5.1 Analogue heater unlocking



NOTE

When on-board power supply is applied, never disconnect the connector from the heater.

The fault must be rectified.

To do so, follow these steps:

- ▶ Switching on the heater (via control element).
- ▶ Remove fuse for at least 2 s within 2 s after switching on (e.g. F3 on-board power supply of the vehicle).
- ▶ Reinsert the fuse.
- ▶ Switching off the heater (via control element).

6.5.2 Heater unlocking, digital (with WTT)

See chapter 6.4.2, "Digital cancelling the fault lock-out (with WTT)" on page 17.

6.6 Overview of faults and fault codes

**NOTE**

The control element can be connected via W-bus or analogue (see wiring diagrams):

-W-bus connection: the HXX fault codes are shown in the display.

- Analogue connection with display: the FXX fault codes are shown in the display.

Analogue connection without display: the fault codes are shown by the number of long flash pulses after the 5 short flash pulses.

**NOTE****Hexadecimal fault codes**

The letter "H" is shown on the control element be-
fore the code, and in the WTT Diagnostics, the "h" is
shown at the end of the code. This means that, for
example, "H01" is equivalent to "01h".

**NOTE**

The heater can lock if several faults are registered.
To unlock the heater, see chapter 6.5, "Heater un-
locking instructions" on page 17.

All heater components are queried by the control
unit. The corresponding component must be
checked first when there is a defect. If it is OK, it
must be assumed that the control unit is defective.

**NOTE****Replace component:**

Within the warranty period, send in only the defect-
ive component (not the entire heater) to Webasto.

6.6.1 Troubleshooting with error code output

*: Indicator lamp of control element flashing: count the number of long flash pulses after 5 short flash pulses.				
Analogue fault code	Fault code (hexa-decimal)	Fault message / Symptom	Possible causes	Recommended action in workshop
F00 or 0*	H01	No component fault	Fuses	1. Check fuses: F1, F2 and F3
	H07		Electrical wiring	2. Check battery connections: At connector X2: - at pin 2 / + at pin 1 (heater voltage)
	H13			3. Check control element and test connector contacts: W-bus connection: contacts X4, pin 2 Analogue connection: connector X4: + at pin 1 / + at pin 7 (if present)
	H16			
	H18			
	H20			
	H26			
	H81			
	H91			
	H92			
	H2C		Electrical wiring vehicle blower	4. Check wiring of vehicle fan for damage, break and short-circuit, see wiring diagram
	H3F			
	HA0		Heater lock-out	5. Delete heater lock-out (Rectify cause)
	HA6			
	HAC		ADR function (if installed)	6. Check auxiliary drive input: S5, Y2, see wiring diagram with ADR
	HAD			7. Check Dynamo Plus input: X4, pin 3 and pin 4
	HAE		Battery disconnect (BTS) (if available)	8. Check connections BTS, replace BTS if necessary. See wiring diagram with BTS
				9. Replace control unit
			Control unit defective	
F01 or 1*	H02	No start	Fuel supply	1. Check fuel supply (tank empty, fuel lines clogged) 2. Check fuel filter 3. Check tank extracting device and fuel line for leaks 4. Bleed fuel system
	H82		Burner head	5. Check ignition electrode distance 6. Clean baffle plate, replace if necessary 7. Replace fuel nozzle 8. Fuel pump, check solenoid valve 9. Check fuel pump, replace if necessary
	H83			
F02 or 2*	H03	Flame failure	Fuel supply	1. Check fuel supply (tank empty, fuel lines clogged, fuel line only partially filled) 2. Check fuel filter 3. Check tank extracting device and fuel line for leaks 4. Bleed fuel system
			Flame monitor	5. Flame monitor
			Burner head	6. Clean baffle plate, replace if necessary 7. Replace fuel nozzle 8. Fuel pump, check solenoid valve
F03 or 3*	H04	Overvoltage or undervoltage	Power supply	1. Check battery 2. Check charging voltage 3. Check electrical connections
	H84			
F04 or 4*	H05	Flame was detected prior to combustion	Fuel pump solenoid valve defect	1. Visual check burner head, clean if necessary
				2. Check solenoid valve

*: Indicator lamp of control element flashing: count the number of long flash pulses after 5 short flash pulses.				
Analogue fault code	Fault code (hexa- decimal)	Fault message / Symptom	Possible causes	Recommended action in workshop
F05 or 5*	H1A H9A	Flame monitor	Flame monitor defect	Replace control unit
F06 or 6*	H14 H93 H94	Short circuit of coolant temperat- ure sensors	Coolant temperature sensors wiring de- fective	1. Check wiring for damage and short-circuit
			Coolant temperature sensors	2. Carry out function check of coolant tem- perature sensors, replace if necessary
F07 or 7*	H08 H88	Fuel pump solen- oid valve short-cir- cuit in electrical circuit	Fuel pump solenoid valve defect	1. Check wiring and connector for damage, break and short-circuit
				2. Check solenoid valve, replace fuel pump if necessary
F08 or 8*	H09 H15 H89 H95	Fan drive motor short-circuit or break	Fan lock-up protec- tion	1. Rectify cause of block and sluggishness
				2. Check wiring and connector for damage, break and short-circuit
				3. Check operation of drive motor, replace if necessary
F09 or 9*	H19 H99 H2E	Ignition spark cir- cuit is defective	Ignition spark gener- ator	1. Check wiring and connector for damage, break and short-circuit
				2. Check ignition spark generator, replace if necessary
F10 or 10*	H06	Heater overheats	Coolant temperature sensors defective	1. Check wiring for damage, break and short- circuit
				2. Measure resistance of coolant temperature sensors, replace coolant temperature sensors if necessary
			Coolant system	3. Check coolant level, bleed coolant circuit
				4. Carry out function check of coolant pump, replace if necessary
				5. Check wiring and connector for damage, break and short-circuit
F11 or 11*	H0B HC0 HC1 HC2 HC3 HC4	Coolant pump short-circuit or break	Coolant system	1. Check coolant level
				2. Check coolant flow
				3. Bleed coolant pump. Rectify possible cause
				4. Check anti-freeze in the coolant, change coolant if necessary
			Coolant pump de- fective	5. Check wiring for damage, break and short- circuit
				6. Carry out function check of the coolant pump, replace if necessary
F14 or 14*	H1B HAB	Coolant temperat- ure sensors breaks or short-circuits	Wiring defective	1. Check coolant temperature sensor wiring and connector for damage
			Coolant temperature sensors defective	2. Check coolant temperature sensors
F16 or 16*	H4F H5B	Exhaust gas tem- perature too high	Exhaust gas temper- ature sensor defect- ive	1. Check wiring and connector of exhaust gas temperature sensor for damage, replace if necessary
				2. Measure resistance of exhaust gas temper- ature sensor, replacing if necessary
			Heater fouled	3. Visual inspection with cleaning of inner sur- face of heat exchanger, replace if necessary

*: Indicator lamp of control element flashing: count the number of long flash pulses after 5 short flash pulses.				
Analogue fault code	Fault code (hexa-decimal)	Fault message / Symptom	Possible causes	Recommended action in workshop
F17 or 17*	H4D H31	Exhaust gas temperature sensor	Ambient temperature of heater too high	4. Allow the heater to cool down, check temperature and ventilation of installation space (see installation instructions)
			Control unit defective	5. Replace control unit
			Wiring defective	1. Check wiring and connector for damage, break and short-circuit
F20 or 20*	H25 HA5	No fuel preheating	Exhaust gas temperature sensor defective	2. Check exhaust gas temperature sensor, replace if necessary
			Heater fouled	3. Visual inspection with cleaning of inner surface of heat exchanger and combustion tube, replace if necessary
			Heater cartridge wiring defective	1. Check wiring and connector for damage, break and short-circuit
			Heater cartridge defective	2. Check operation of heater cartridge, replace if necessary

* The number of long pulses corresponds to the number of the fault code.

6.6.2 Troubleshooting without error code output



NOTE

We generally recommend the following procedure:

- ▶ Check fuses
- ▶ Check operating voltage
- ▶ Check for damage and ensure passages are clear:
 - combustion air intake
 - exhaust pipe
 - fuel line
- ▶ Also check condition of filter.

Symptom	Possible cause	Possible troubleshooting	Comments / Service
Heater does not respond, no component running. Indicator lamp not flashing.	Operating voltage	1. Fuse blown ▶ Rectify cause, change fuse 2. Unlock heater 3. Supply voltage to heater connector ▶ Measure voltage	The indicator lamp is provided by the heater (see wiring diagram). Check / replace control element.
	Indicator lamp (control element, Quick Heating button)	1. Control element fuse blown ▶ Rectify cause, change fuse 2. Supply voltage on control element (switch with function display) ▶ Measure voltage at pin	
		3. Continuity at control element (switch with function display) ▶ Check pin to ground	
		4. Control element indicator lamp defective ▶ Replace control element if necessary	

Symptom	Possible cause	Possible troubleshooting	Comments / Service
Heater will not start, coolant pump briefly starts up then switches immediately to after-running period, or the heater switches off. The indicator lamp flashes. (error code output, see chapter 6, "Malfunctions and troubleshooting" on page 15)	Component fault	See chapter 6.2, "Fault list on the control element" on page 15	
Heater will not start or coolant pump and drive motor may briefly start up, the heater switches off.	Low voltage cutoff: Brief drop or interruption in power supply	1. Check fuses ▶ Rectify cause, change fuse	Voltage drop (Example of cause: by start pulse of a starter: The maximum current load leads to the drop of the power supply and loss of the processor circuit functionalities (undervoltage can not be detected, the heater reinitialises itself and starts again).
		2. Supply voltage to heater connector ▶ Measure voltage	
		3. Battery defective ▶ Check battery	
		4. Electrical wiring break ▶ Check electrical wiring	
Excessive smoke from heater during start-up phase	Remaining fuel in combustion tube and in heat exchanger (uncombusted fuel in previous heating mode)	▶ Operate heater, the smoke reduces as the burning duration increases (self-cleaning)	● The heater can be extremely overfilled with fuel due to commissioning or improper use of fuel priming and must self-clean first. ● In the previous heating mode, fuel still has been supplied, after the flame was already out (e.g. the solenoid valve does not close or closes with a delay). ● Excessive smoke during after-running period after switched off (T > 10 s). Possibly also fault code for flame abort after combustion mode (F04 or H05) in fault memory.
Excessive smoke from heater during start-up phase. Unstable combustion can be heard	Fuel supply malfunction	1. Tank empty or leaking ▶ Refill tank, replace if necessary 2. Fuel lines blocked or leaking ▶ Unblock fuel lines, replace if necessary 3. Fuel filter clogged ▶ Replace fuel filter 4. Tank extracting device or fuel lines leaking ▶ Check tank extracting device and fuel lines for leaks. 5. Air in fuel system ▶ Bleed fuel system	● Leaks lead to air in the fuel system ● Vacuum and high fuel temperatures lead to outgassing of the fuel in the supply pipe. ● Several symptoms can occur at the same time. ● Low pressure in the fuel line > 0.4 bar fuel.
Excessive smoke from heater during start-up phase and during stationary operation. Unstable combustion can be heard Heater starts again	Fuel supply malfunction	1. Tank empty or leaking ▶ Refill tank, replace if necessary 2. Fuel lines blocked or leaking ▶ Unblock fuel lines, replace if necessary 3. Fuel filter clogged	● Leaks lead to air in the fuel system. ● Vacuum and high fuel temperatures lead to outgassing of the fuel in the supply pipe ● Several symptoms can occur at the same time.

Symptom	Possible cause	Possible troubleshooting	Comments / Service
		▶ Replace fuel filter 4. Tank extracting device or fuel lines leaking ▶ Check tank extracting device and fuel lines for leaks. 5. Air in fuel system ▶ Bleed fuel system	
	Combustion air line blocked	▶ Unblock combustion air inlet and combustion air line, replace if necessary	
	Exhaust pipe blocked	▶ Check exhaust line for foreign objects and clean if necessary ▶ Replace exhaust pipe if necessary	
	Fuel processing: nozzle clogged, baffle plate defective	▶ Replace baffle plate ▶ Replace fuel nozzle	● Fuel processing (spray pattern) by deposits in or on the nozzle not OK. ● Fuel nozzle must be replaced. Cleaning is not recommended
	Combustion tube damaged	▶ Visual inspection of combustion tube, clean or replace if necessary	● Combustion tube components cracked ● Welded seam cracked ● Burner components deformed ● Combustion tube head tilted ● Combustion tube to heat exchanger leaking
	Heat exchanger damaged	▶ Visual inspection of heat exchanger, clean or replace if necessary	Soot or coke deposits disturb combustion. Mainly result of other causes (e.g. fuel nozzle or combustion tube defective)
	Fuel pump disrupted	▶ Check fuel pump, replace if necessary	● Fuel pump not OK. ● Fuel pump leaks, draws air or loses pressure.
Excessive smoke from heater during after-running period (after switched off, T >10 s)	Fuel pump solenoid valve	▶ Check fuel pump, replace if necessary	● Solenoid valve does not close, closes with a delay or closes only partly due to fouling or defect. ● If as a result smoke is observed also being given off during the start-up phase. ● Another consequential fault would be flame after combustion mode (F04 or H05). ● It can give off smoke for up to 25 s and the fault flame after combustion mode is not triggered.
● Heater goes out prematurely ● Coolant does not heat up ● Heater switches on and off in cycle operation constantly	Coolant circuit	▶ Check connections in coolant circuit for leaks and kinks ▶ Bleed coolant circuit ▶ Check coolant flow	In principle, an error message is stored if combustion is stopped. Component faults, such as drive motor, fuel pump, solenoid valve, etc. are displayed).
	Fuel supply disrupted	▶ Check fuel supply (tank empty, lines clogged, fuel line only partially filled)	

Symptom	Possible cause	Possible troubleshooting	Comments / Service
		▶ Check fuel filter ▶ Check tank extracting device and fuel line for leaks ▶ Bleed fuel system	
● Coolant heats up ● Vehicle interior remains cold	Vehicle fan does not actuate	▶ Check fuse ▶ Check the relay for vehicle blower ▶ Check coolant temperature (switches On at approx. 86° F (30° C)) ▶ Check switch signal at the relay, ground and voltage (audible, see wiring diagram) ▶ Measure coolant temperature signal line (green/white, gr/ws), pin on relay	● If the coolant gets warm but the vehicle interior remains cold, heat removal out of the coolant circuit is disturbed. ● The switch signal of the vehicle fan is not OK. ● Vehicle fan not OK. ● Vehicle fan not activated, vehicle heat control flap position for warming the vehicle interior not OK
Smell of exhaust in vehicle interior	Exhaust system	▶ Check exhaust pipes (not clogged, rectify leaks) ▶ Check if exhaust pipe has been incorrectly installed (see installation instructions)	

7 Function checks

7.1 Basics



NOTE

Continue to follow the warnings and information provided in the operating- and Installation instructions.

7.1.1 Required test and measuring equipment

- Digital multimeter:
for measuring electrical resistance [ohms], electrical continuity 0.1 ohms test current < 5 mA
- Suitable voltage source
- Charged vehicle battery
- PC / Laptop
- Diagnostic adapter including Webasto Thermo Test software for displaying the fault code memory, operating data, control unit information. See chapter 6.1.1, "Diagnostics with Webasto Thermo Test" on page 15.
- Pressure measuring device with fuel nozzle adapter
- CO₂ measuring device:
Minimum specifications of CO₂-measuring device:

	Resolution	Precision	Division
CO	10 ppm	±5%	0-2000 ppm
CO ₂	0.1%	±5%	0-16%



NOTE

Technical data refer to an ambient temperature of 68° F (20° C), an air pressure of 1013 hPa.

7.1.2 Function check in the vehicle



NOTE

The heater switches first on the vehicle fan when the coolant reaches a temperature of 86°F(30°C).

Check the following points:

1. **Vehicle settings**
 - Set the fan and temperature such that maximum heat is provided in the vehicle (fan speed **high**, temperature **maximum**, flap position).
 - Check the coolant circuit and bleed it in accordance with the vehicle manufacturer's regulations
 - Test and bleed fuel system.
2. **Heater settings**
 - Switch on the heater at the control element.
 - Check heating action. Run the heater in combustion mode. Check heating effect on the outflow nozzles of the vehicle blower.
 - Check the heater for leaks between the burner head and the heat exchanger (visual inspection of the rough quantity of the leak).
 - Switch off the heater again at the control element.

7.2 Check and set CO₂ in exhaust gas



NOTE

After repairing the heater it will be necessary to check the CO₂ setting.

It is recommended to check or reset the CO₂ content after replacing the burner unit, the fan or the control unit.

CO₂ data: see chapter 11, "Technical data" on page 49.

It is permitted to change the factory-set level of combustion air by amending the CO₂ setting using the Webasto Thermo Test PC Diagnostics.

7.2.1 Check CO₂ in exhaust gas

The heater should be in combustion mode to test the fuel values.

Maximum heat dissipation must be ensured so that the coolant temperature remains as low as possible and several minutes in combustion mode (approx. 5-10 minutes) are possible for the test.

Procedure:

1. Switch on the heater
 2. Read CO₂ value after >5 minutes in combustion mode
- Check the following values (see instructions to that effect at chapter 11, "Technical data" on page 49):

CO₂ in exhaust gas, CO and soot number as per Bacharach

7.2.2 Set CO₂ in exhaust gas



NOTE

The heater features automatic altitude compensation.



NOTE

Increase the speed of drive motor => measured CO₂ level must drop

Decrease the speed of drive motor => measured CO₂ level must increase



NOTE

The CO₂ setting can only be carried out with Webasto Thermo Test (WTT).

1. Connect the WTT (see chapter 6.1.1, "Diagnostics with Webasto Thermo Test" on page 15).
2. Select the CO₂ setting.
The heater starts automatically. The heater is operated in CO₂ setting mode, which is exclusively used for the CO₂ setting.
3. Correction of the CO₂ setting is recommended in increments of 100 rev/min.
4. Position the CO₂ measuring device in the exhaust system branch of the heater according to the manufacturer's specifications. For measurement values, see CO₂ data in Chapter 11.

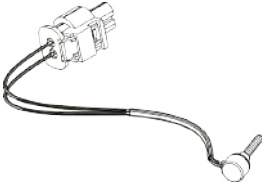


NOTE

Enabling the setting function accepts the CO₂ value.

7.3 Checking exhaust gas temperature sensor

When testing with a digital multimeter, the exhaust gas temperature sensor should show the following values:
Resistance at 68°F(20°C): 2130 - 2230 ohms.

Connectors and contacts OK? yes ↓	no →	Re-place component.	
Cables damaged or ceramic element broken? no ↓	yes →	Replace component.	
Resistance measurement with digital multimeter, is resistance outside the 2130-2230 Ohm range? No ↓	yes →	Replace component.	
Component is OK.			

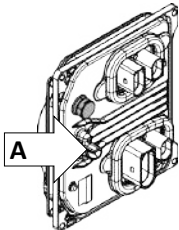
NOTE

Check the exhaust gas temperature cable for signs of mechanical damage from the outside.

NOTE

If the exhaust gas temperature sensor suffers external mechanical damage, this component can be replaced without the need for additional work.

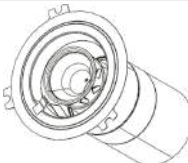
7.4 Checking control unit

PC and Webasto Thermo Test diagnosis adapter: Fault codes have been read out, fault code present? no ↓	yes →	For the fault code: See chapter 6.6, "Overview of faults and fault codes" on page 18. For changing components: See chapter 8.6, "Removing control unit" on page 32.	
Connectors and contacts OK? yes ↓	no →	Replace component.	
Externally damaged? Optical sensor defective? No ↓	yes →	Replace component.	 A = Optical sensor
Component is OK			

NOTE

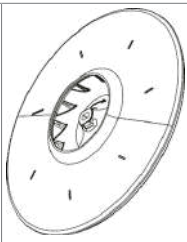
- The control unit has an optical sensor (flame monitor).
- Clean the sensor before installing the control unit, if necessary.
- Replace the whole control if it is defective.

7.5 Check combustion tube

Combustion tube mechanically damaged? no ↓	yes →	Replace component.	
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Combustion tube fouled?	yes →	Rectify cause. Replace component if necessary.
no ↓		
Component is OK.		

7.6 Check the blower fan wheel

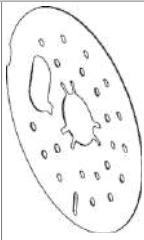
Blower fan mechanically damaged?	yes →	Replace component.	
Deformation?			
Locking lug broken?			
no ↓			
Component is OK.			



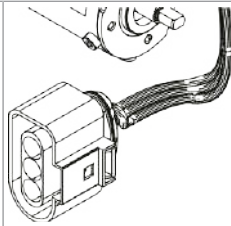
NOTE

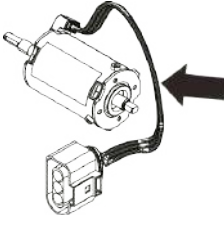
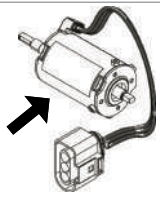
Electrical wiring must not lie against the blower fan wheel.

7.7 Checking baffle plate

Clean and visually check baffle plate: is it mechanically damaged?	yes →	Replace component.	
Deformation?			
Broken?			
no ↓			
Component is OK.			

7.8 Checking drive motor

Check connector. Damaged?	yes →	Replace component.	
no ↓			

Visually check cable of the drive motor. Damaged?	yes →	Replace component.	
no ↓			
Visually check drive motor. Drive motor damaged?	yes →	Replace component.	
no ↓			
Component is OK.			

7.9 Fuel pump and check solenoid valve

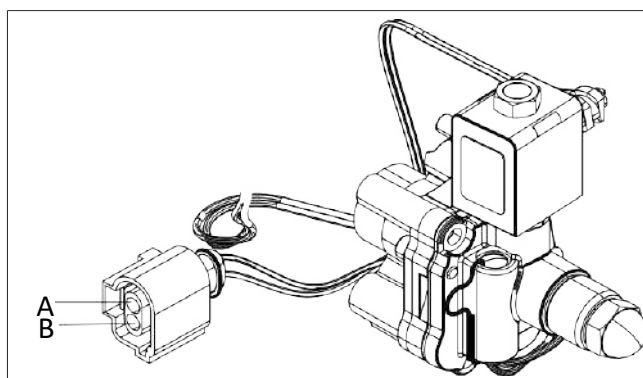


Fig. 20 Fuel pump

A	Pin 1	B	Pin 2
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NOTE

The pump pressure is non-adjustable ex-factory. Adjusting the pump pressure is not permitted.



NOTE

The fuel pump and the fuel lines must be replaced after 5 years.

7.9.1 Connect to Webasto Thermo Test PC Diagnostics

Test the fuel pump for abnormalities and activate the fuel supply.

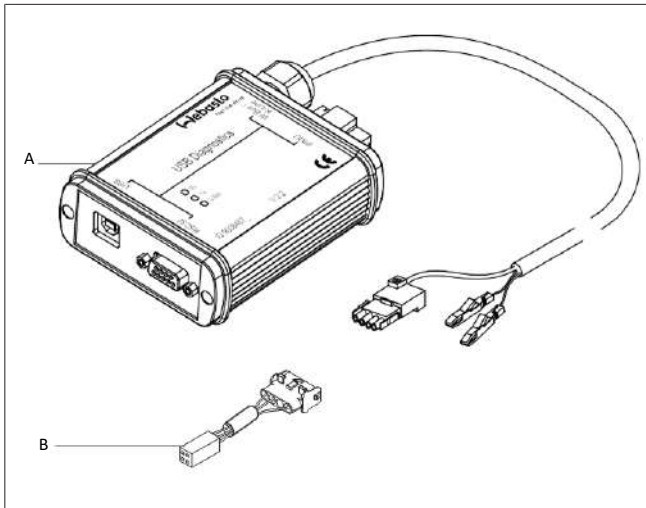


Fig. 21 Connect WTT PC diagnosis

A	USB interface 1	B	Diagnostic adapter 2
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Testing with Webasto Thermo Test Diagnostics:

1. Connect WTT
2. Start WTT
3. Start burner motor component test
4. Set speed of 5550 rpm
5. **Heater evaluation:**
 - Fan is running
 - Audible start-up noises (The fan starts up until the set speed is reached.)
 - No disturbing scraping noises must be audible, e.g., squeaking.
 - Fuel is sucked in, the supply pipe and the return line are OK.

7.9.2 Check fuel pump for leaks**DANGER****Risk of injury:**

Connector X3 must be disengaged, see chapter 10.5.2, "Overview of plug assignments at control unit" on page 41.

Follow these steps:

1. The burner head is disconnected from the heat exchanger.
See chapter 8.4, "Disconnect burner head" on page 31.
2. Connector **X2** and **X4** must be connected.
3. **Testing the fuel pump with Webasto Thermo Test Diagnostics:**
 - Disconnect connector **X3** from the control unit
 - Connect WTT
 - Start WTT
 - Start component test for burner motor speed
 - Input set speed of 5550 rpm for 5 min.
4. **Evaluation:**
 - Fan is running
 - Audible start-up noises (The fan starts up until the set speed is reached.)
 - No disturbing scraping noises must be audible, e.g., squeaking.
 - Monitor the fuel pump during operation (5 min).
 - No fuel may escape at the pump.

7.9.3 Check solenoid valve on fuel pump**DANGER****Risk of injury:**

Connector X3 must be disengaged, see chapter 10.5.2, "Overview of plug assignments at control unit" on page 41.

Follow these steps:

1. The burner head is disconnected from the heat exchanger. See chapter 8.4, "Disconnect burner head" on page 31.
2. Connector **X2** and **X4** must be connected.
3. **Testing the fuel pump with Webasto Thermo Test Diagnostics:**
 - Disconnect connector **X3** from the control unit
 - Connect WTT
 - Start WTT
 - Start component test for fuel cut-off valve of fuel pump
 - Activate / deactivate solenoid valve
4. **Evaluation:**
 - Audible opening sound of the solenoid valve
 - If faulty, the fuel pump should be replaced
5. Connect solenoid valve contacts on the connector X8 Pin 1 and 2. See chapter 11, "Technical data" on page 49.

Checking the cold resistance at 68°F (20°C):	
12 V valve	R = 20.8 Ω ±5%
24 V valve	R = 61.0 Ω ±5%
Checking the opening voltage:	
12 V valve	opens at 7 - 10 Volt
24 V valve	opens at 10 - 15 Volt
Checking the power consumption at 68°F (20°C):	
12 V valve	10 Watt
24 V valve	10 Watt

7.9.4 Check pressure on fuel pump

Follow these steps:

1. Burner head removed
2. Removing fuel nozzle
3. Install pressure measuring device (screw into the area of the fuel nozzle)
4. Connect WTT
5. Start WTT
6. Start fuel priming with WTT service.
7. The solenoid valve opens in this function automatically.

Alternative:

8. Start component test for burner motor speed.

Speed target:

- Thermo Top Pro 120: 5400 rpm
- Thermo Top Pro 150: 5550 rpm

9. The solenoid valve must be opened manually by applying the supply voltage to the fuel pump connector.
10. Read the pressure on the measurement device.

Fuel pressure at 68°F(20°C)	Value
Thermo Top Pro 120 psi(bar)	152 +/-3 (10.5 +/- 0.2)
Thermo Top Pro 150 psi(bar)	174 +/-3 (12.0 +/- 0.2)

7.10 Checking heater cartridge



DANGER

Heater cartridge becomes hot

Do not touch the heater cartridge.

Testing the heater cartridge when installed and using WTT Diagnostics

Follow these steps:

1. Connect Webasto Thermo Test (WTT).
2. Start WTT.
3. Start component test for nozzle block preheater.

Testing the heater cartridge when removed

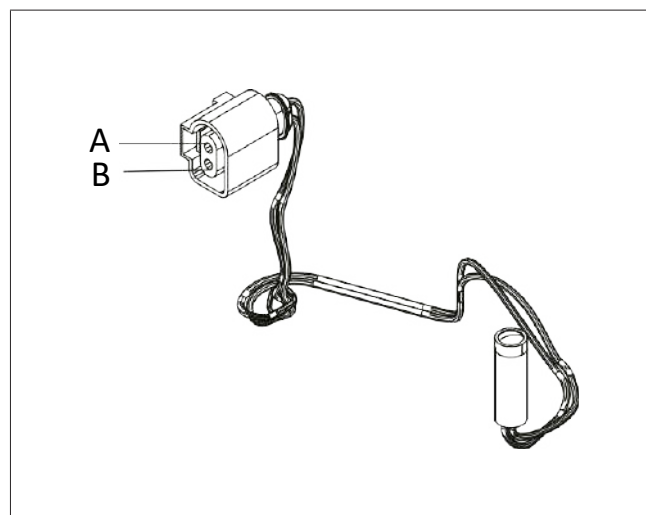


Fig. 22 Testing the heater cartridge

A	Pin 1	B	Pin 2
---	-------	---	-------

Follow these steps:

1. Connect supply voltage (12 V or 24 V) to PIN1 and PIN2 of connector.
2. Measure current
3. **Evaluation:**

10.8A	+/- 10 %	12 V
5.4A	+/- 10 %	24 V

7.11 Check coolant pump

Check control unit connector.	yes →	Replace component.	
Damaged?	no ↓		
Check connector / cable for coolant pump. Damaged?	yes →	Replace component.	
	no ↓		
Check direction of flow. Correct?	no →	X: Outlet Y: Inlet Correct if necessary, see illustration on right and the in-	
	yes →		

		stallation instruc- tions.	
Component is OK.			

7.12 Checking coolant temperature sensors

7.12.1 Testing the coolant temperature sensors via WTT Diagnostics

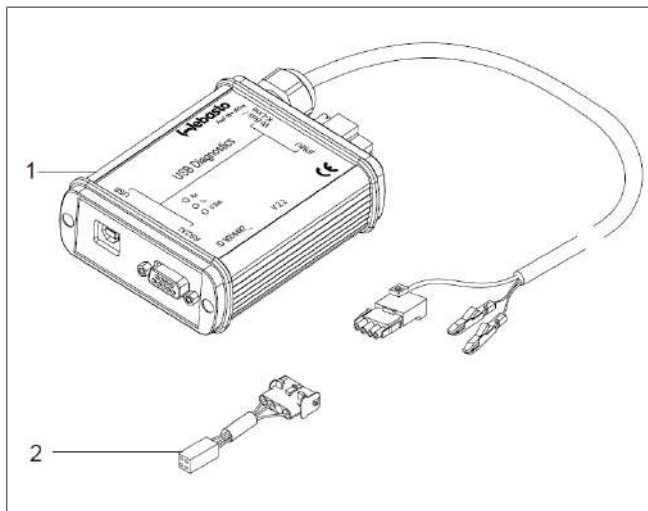


Fig. 23 Coolant temperature sensors testing via WTT

A	WTT USB interface	B	Diagnostic adapter
---	-------------------	---	--------------------

Follow these steps:

1. Connect WTT
2. Start WTT
3. **Evaluation:**
 - The temperature values displayed in the WTT must be plausible.

7.12.2 Testing resistance of coolant temperature sensors via WTT

Test of coolant temperature sensors when installed on the heater by testing the electrical resistance. See chapter 10.6, "Wiring diagrams" on page 41.

Evaluation:

- Coolant temperature sensor contacts on connector **X3** pin 1 and 2
- Overheating sensor contacts on connector **X3** pin 5 and 6
- Checking the cold resistance at 68°F (20°C): $R = 3.266 - 3.479$ ohms

7.13 Checking ignition electrode

7.13.1 Testing the ignition electrode via WTT Diagnostics

Follow these steps:

1. Connect WTT
2. Start WTT
3. Activate component test for ignition spark generator (maximum duration of 10 s, process can be repeated).

7.13.2 Testing ignition electrode when removed



DANGER

Potentially hazardous high voltage

This operating mode is not intended for the ignition spark generator and safety precautions must be taken to rule out a danger for the worker in the workshop.

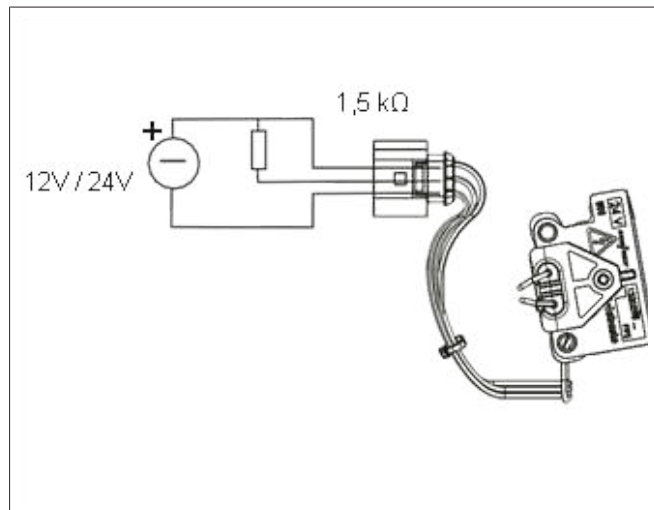


Fig. 24 Checking ignition electrode when removed

Follow these steps:

1. Removing ignition spark generator. See chapter 8.11, "Removing ignition spark generator" on page 34.

Evaluation:

2. After all safety precautions have been made:
 - Briefly connect the resistor and voltage as shown above. Maximum duration of 10 seconds.
 - Visual check of the flashover between the electrode tips.

7.13.3 Checking the ignition electrode distance

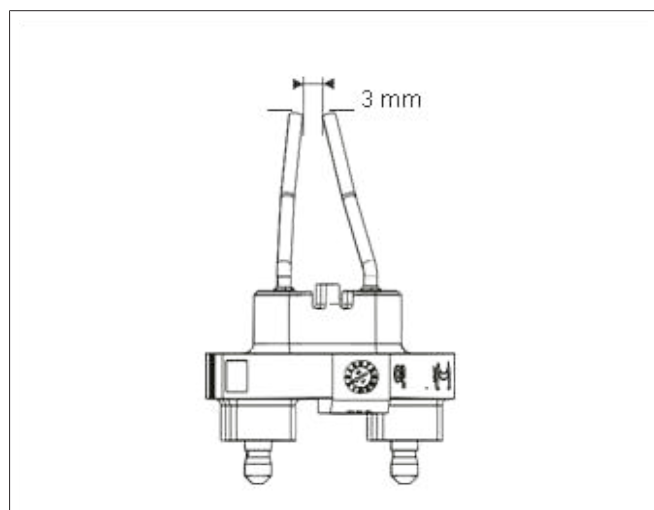


Fig. 25 Ignition electrode distance

Visual inspection

The electrodes are not:

- Bent
- Dirty

Follow these steps:

If the electrodes are dirty:

1. Rectify cause.
2. Remove spark corrosion from electrode tips with sandpaper.

7.13.4 Check the distance between ignition electrode and fuel nozzle tip

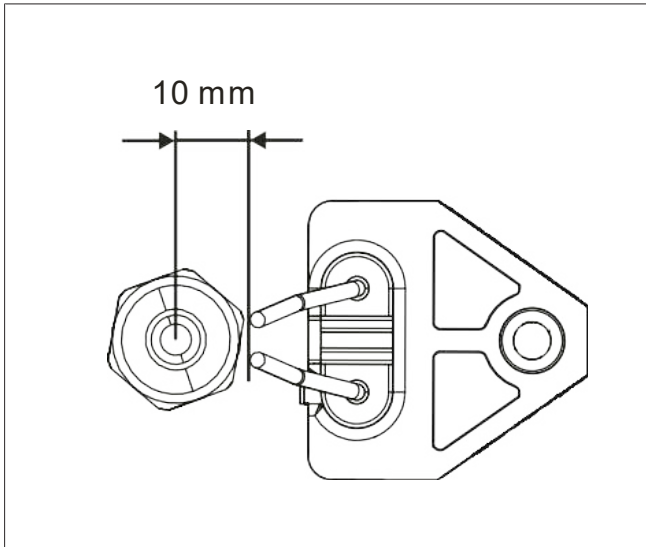


Fig. 26 Distance between ignition electrode and fuel nozzle tip

Follow these steps:

1. When installed on the open heater, burner head removed
2. Visual check for bending, dirt on the electrodes

8 Repairing and replacing components

8.1 Required tools

Phillips head screwdriver (PH2)

- Ring spanners SW13
- Ring spanners SW16
- Torque wrench SW16
- Circlip pliers
- Flat-blade screwdriver
- Socket spanners for screws with hex socket (SW3)
- Torx screwdriver T10
- Torx screwdriver T20
- Torx screwdriver T25

8.2 Installation notes

Installation is in the reverse order to removal as described. Specific installation instructions are provided.

8.3 Disconnecting control unit connections

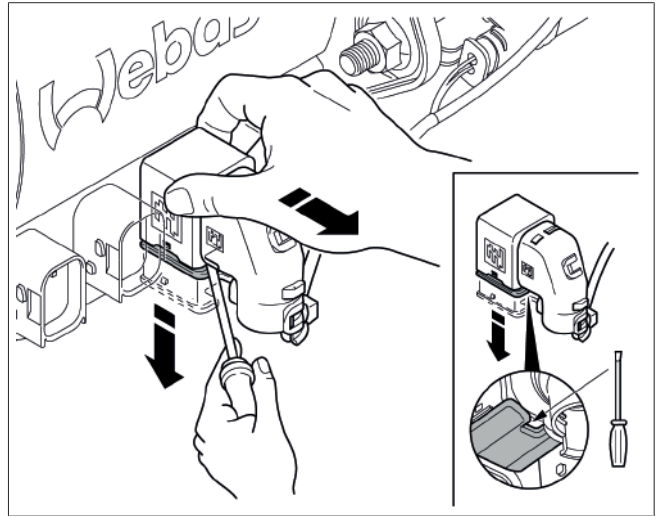


Fig. 27 Detaching the control unit connector

- Unlatch all connectors from the control unit and disconnect as shown above.



NOTE

Unclip the yellow clip in the connector:

While the yellow clip is carefully pressed down with the flat-blade screwdriver, remove the connectors.

8.4 Disconnect burner head

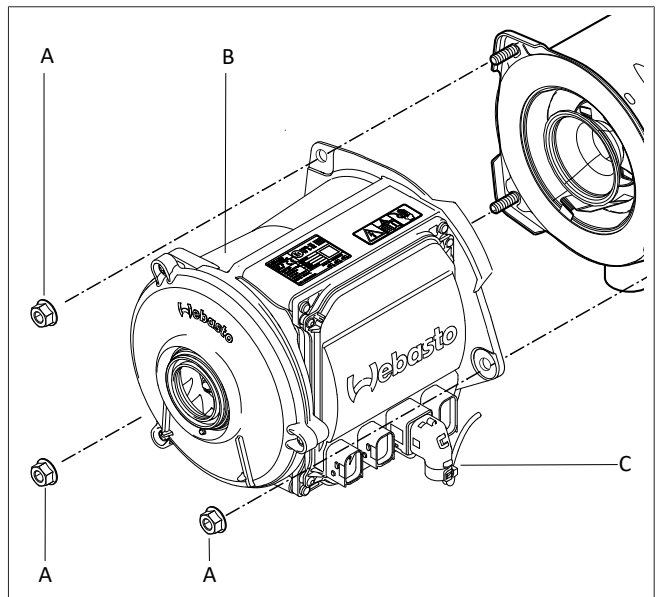


Fig. 28 Disconnect burner head

A	Nut	C	Connectors
B	Burner head		

Follow these steps:

1. Remove 3x nuts M8 SW13 (A).
2. Disconnect the fuel line if necessary.
3. Remove burner head (B).

8.5 Install burner head

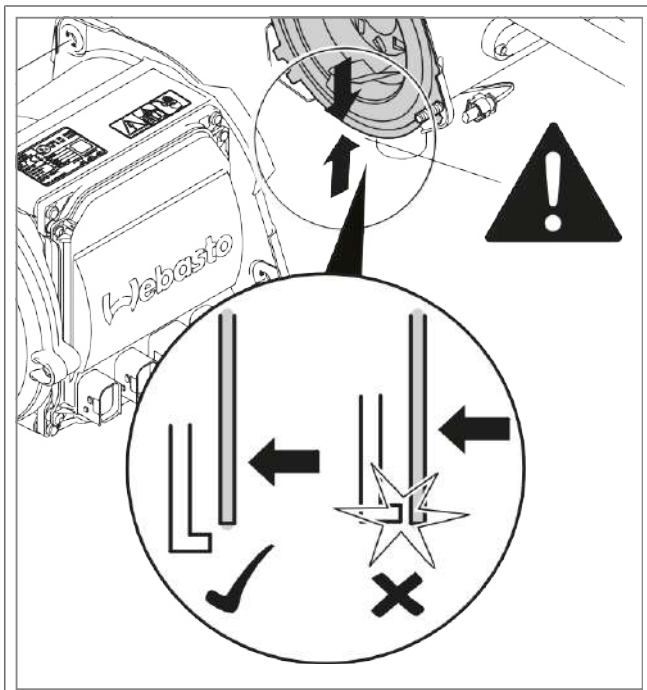


Fig. 29 Install burner head, check position of combustion tube.

- When attaching the burner head to the heat exchanger, combustion tube must not be damaged.
- Check the position of combustion tube.

8.6 Removing control unit

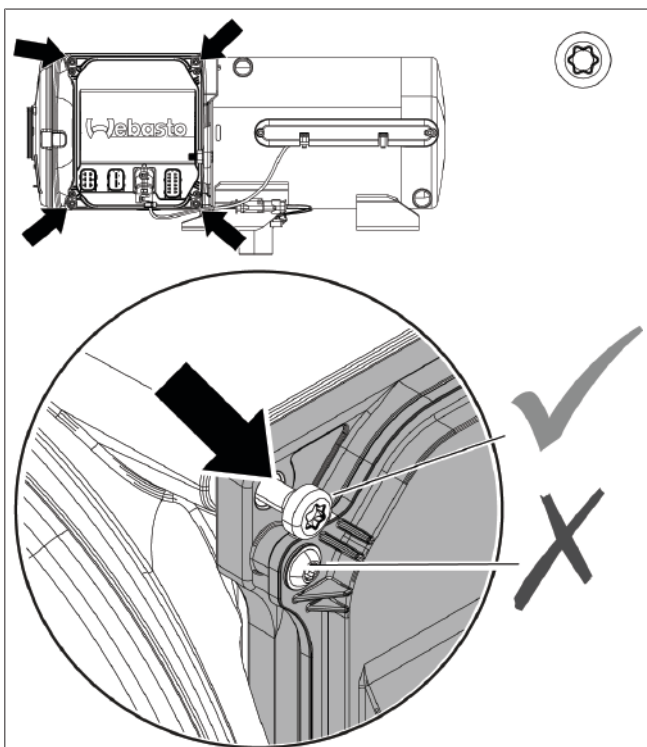


Fig. 30 Remove screws of control unit housing T20, do not remove T10.

NOTE

- Remove screws with a Torx screwdriver T20.
- ⇒ Do not remove screws of control unit housing T10. Warranty claims on the control unit are voided if the screws have been removed.

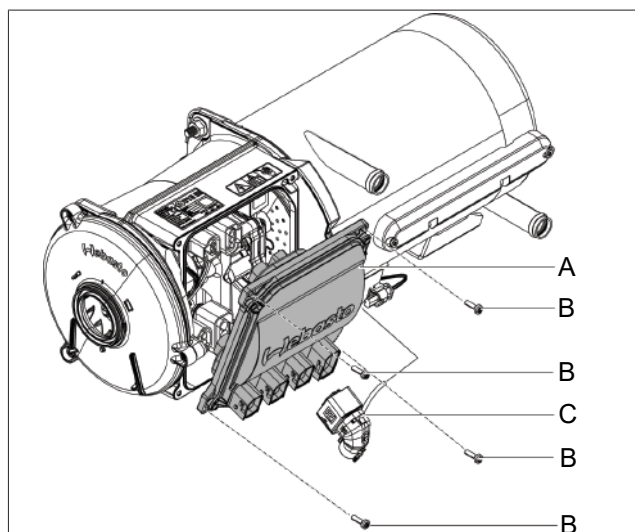


Fig. 31 Removing control unit

A	Control unit	C	Connectors
B	Bolt T20		

Follow these steps:

1. Pull connector (C) out of control unit (A).
2. Remove screws of control unit (B) 4x14 T20 (4x).
3. Turn control unit toward front.
4. Pull connector at back out of control unit.
5. Remove control unit.

8.7 Electrical wiring in the burner head



NOTE

Electrical wiring must not lie against the blower fan wheel.

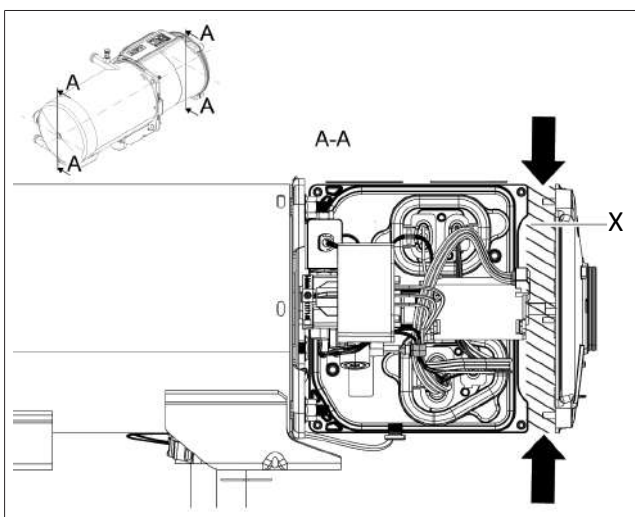


Fig. 32 Electrical wiring



NOTE

There must be no electrical wiring in the specified area (X).

After every removal of electrical wiring:
Carefully fit clip and cable tie, see the figures below.

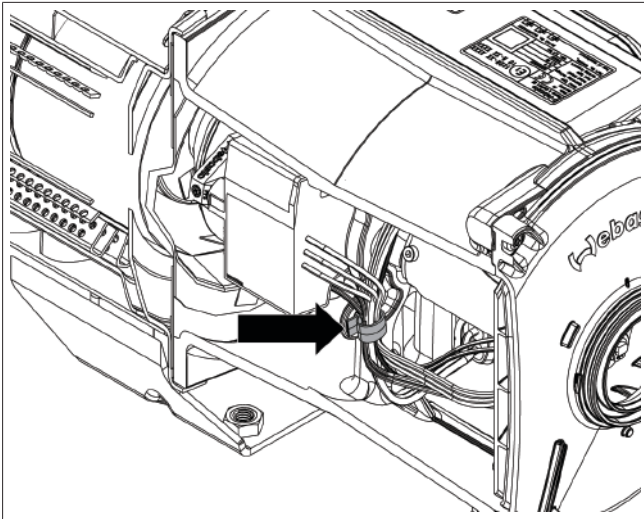


Fig. 33 Position of clip for electrical cables on housing

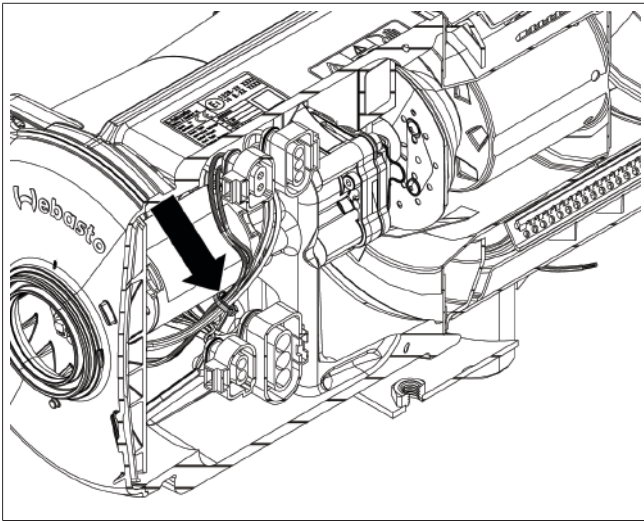


Fig. 34 Position of cable tie (on electrical wiring for ignition spark generator and nozzle block preheater)

8.8 Removing baffle plate

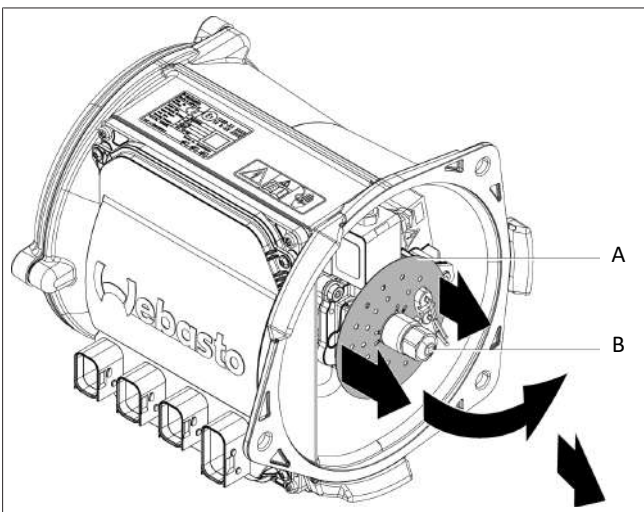


Fig. 35 Removing baffle plate

A	Baffle plate	B	Fuel nozzle
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NOTE

Carefully remove baffle plate over the collar. During removal, **do not bend ignition electrodes**.

Follow these steps:

1. Carefully pull baffle plate forward by approx. 5 mm.
2. Carefully pull baffle plate diagonally.
3. Remove the baffle plate completely.

8.9 Removing ignition electrodes



NOTE

Do not bend or damage ignition electrodes. Position and press on the ignition electrodes correctly when fitting them.

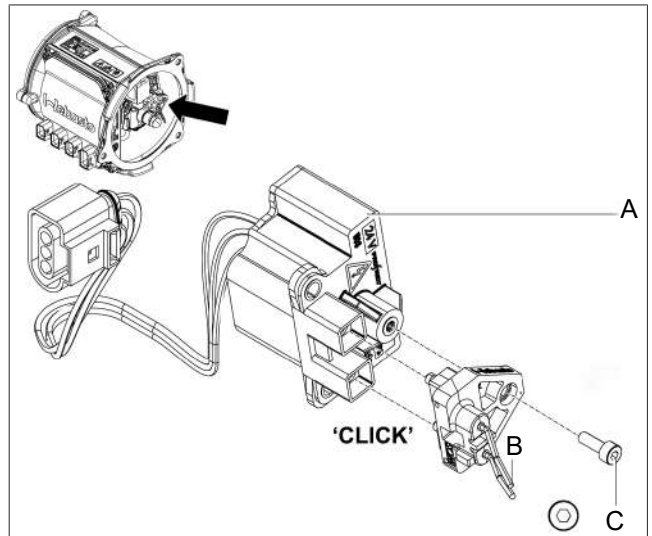


Fig. 36 Remove ignition electrodes

A	Ignition spark generator	C	Cylinder screw hex socket (SW3) M4
B	Ignition electrodes		

Follow these steps:

1. Remove baffle plate, see chapter 8.8, "Removing baffle plate" on page 33.
2. Unscrew cylinder screw (C) using hex socket (SW3) M4x12.
3. Carefully pull ignition electrodes (B) out of the ignition spark generator (A).

8.10 Removing fuel nozzle

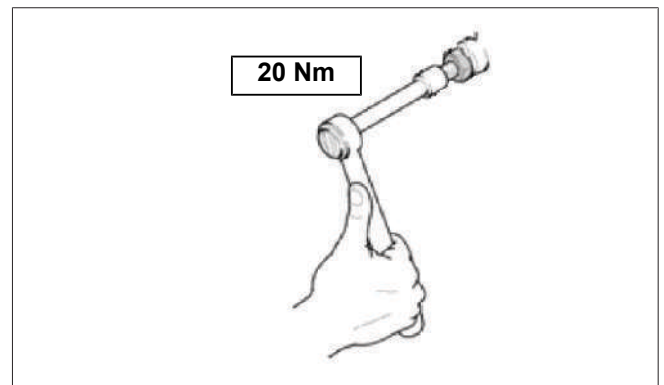


Fig. 37 Removing fuel nozzle

Follow these steps:

1. Remove ignition electrodes, see chapter 8.9, "Removing ignition electrodes" on page 33.
2. Carefully unscrew fuel nozzle (SW16).

**NOTE**

Please note:
When replacing the nozzle, not using the prescribed torque (20 Nm) may lead to a leak between the nozzle and the nozzle block. This can also result in problems such as leaking fuel, smoky combustion, and not achieving the stated emission values.

8.11 Removing ignition spark generator

**NOTE**

Do not bend or damage ignition electrodes.

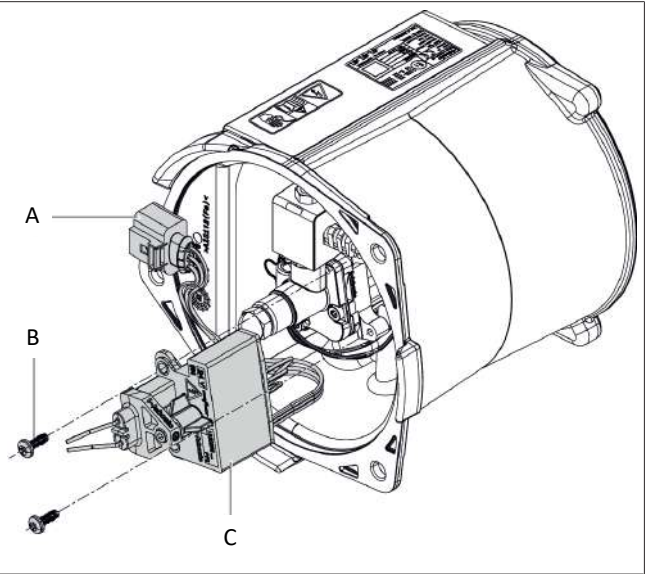


Fig. 38 Remove ignition spark generator (C) with ignition electrodes.

A	Clip	C	Ignition spark generator
B	Screws		

Follow these steps:

1. Remove control unit. See chapter 8.6, "Removing control unit" on page 32.
2. Remove clip (A) (electrical wiring).
3. Remove cable tie (electrical wiring).
4. Removing baffle plate. See chapter 8.8, "Removing baffle plate" on page 33.
5. Remove the 2 screws (B) of ignition spark generator (C) with screwdriver (PH2).
6. Remove ignition spark generator (with ignition electrodes, if necessary).

8.12 Removing fuel pump



NOTE

Pay attention to the axle connection (to drive motor). The axle connection may fall out of the drive motor.

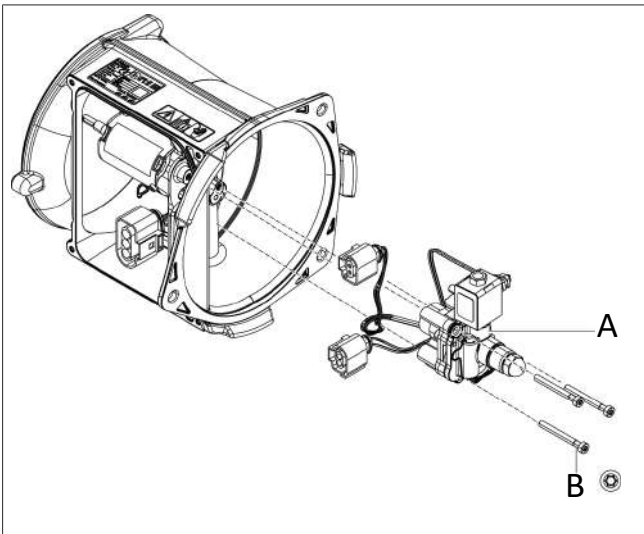


Fig. 39 Removing fuel pump

A	Fuel pump	B	Screws
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Follow these steps:

1. Remove control unit. See chapter 8.6, "Removing control unit" on page 32.
2. Remove ignition spark generator with ignition electrodes. See chapter 8.11, "Removing ignition spark generator" on page 34.
3. Remove 3x screws (B) M5x45, T25 (fuel pump on housing).
4. Removing fuel pump (A).

8.13 Installing fuel pump



NOTE

When installing the fuel pump, replace the old seals (A and C) and the screen (B). (Refer to the spare parts bag in the spare parts list).

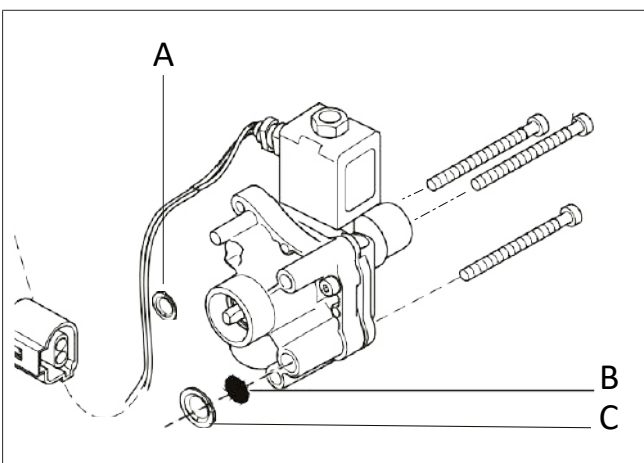


Fig. 40 Installing fuel pump

A	Seal	C	Seal
B	Screen		

8.14 Removing nozzle block preheater

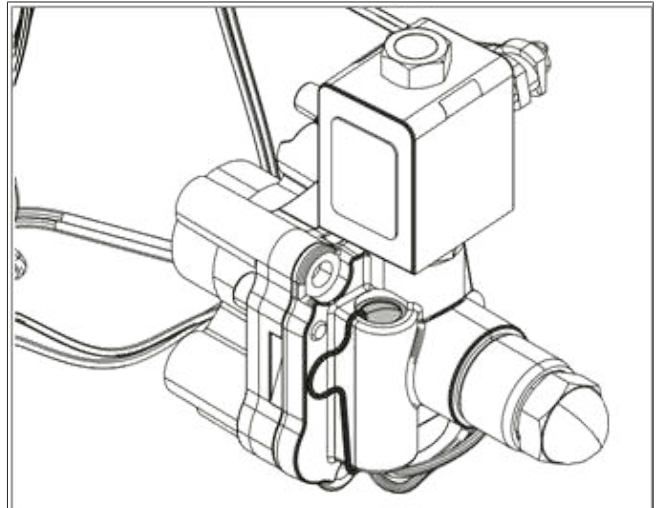


Fig. 41 Fuel pump with nozzle block preheater

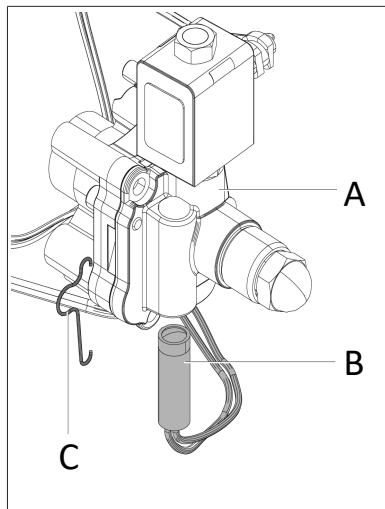


Fig. 42 Removing clip and heater cartridge

A	Fuel pump	C	Clip
B	Heater cartridge		

Follow these steps:

1. Remove control unit. See chapter 8.6, "Removing control unit" on page 32.
2. Remove ignition spark generator with ignition electrodes. See chapter 8.11, "Removing ignition spark generator" on page 34.
3. Unclip clip (C).
4. Pull heater cartridge (B) downwards out of fuel pump.

8.15 Removing blower fan wheel

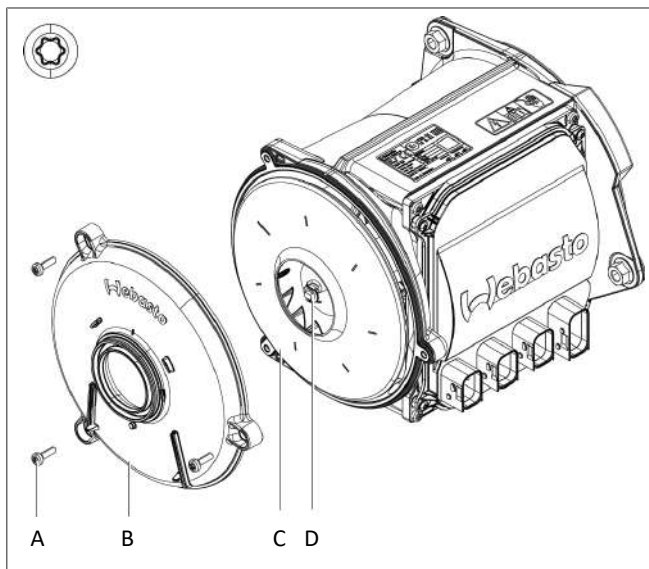


Fig. 43 Overview

A	Screws	C	Blower fan wheel
B	Cover for combustion air fan	D	Circlip

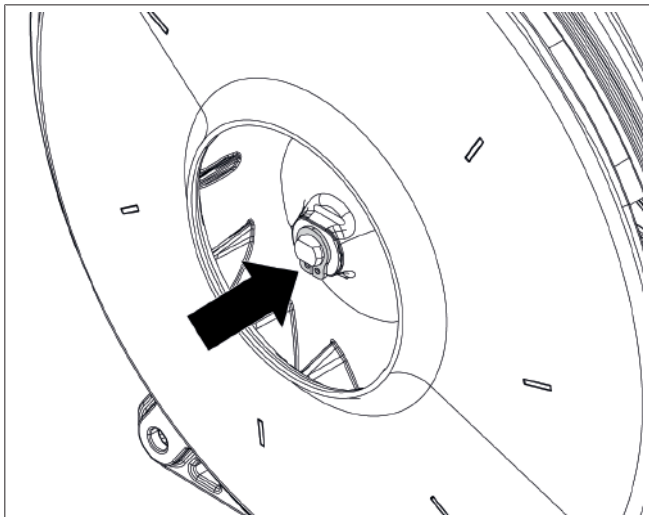


Fig. 44 Circlip

Follow these steps:

1. Remove 3x screws (A) Torx 40x14 T20.
2. Remove cover for combustion air fan (B).
3. Remove circlip (D) DIN471 6x0.7 from drive motor axle. See Note.
Use suitable circlip pliers.
4. Remove blower fan wheel.
5. Pull out blower fan wheel.



NOTE

Do not reuse the circlip.

8.16 Removing drive motor



NOTE

If the drive motor has to be removed, the ignition spark generator and the ignition electrodes can remain installed.

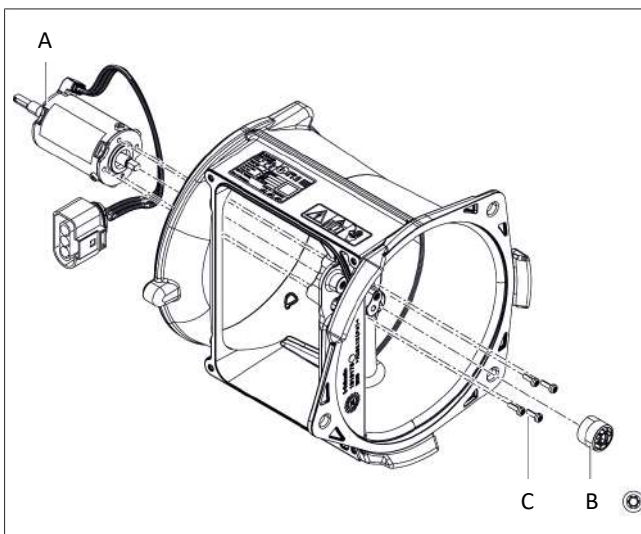


Fig. 45 Removing drive motor

A	Drive motor	C	Screws
B	Axle connection		

Follow these steps:

1. Remove control unit. See chapter 8.6, "Removing control unit" on page 32.
2. Remove fuel pump, see chapter 8.12, "Removing fuel pump" on page 35.
3. Remove 4x screws (C), M3x10 T10.
4. Remove drive motor (A).
5. Remove axle connection (B).

8.17 Remove heat exchanger



DANGER

Danger of burns

After briefly operating the heater, the heat exchanger may be hot. Allow the components to cool down if necessary.



NOTE

- Collect the coolant running out of the system in a suitable container.
- Block or disconnect coolant hoses.
- Dispose of coolants in an environmentally friendly way.

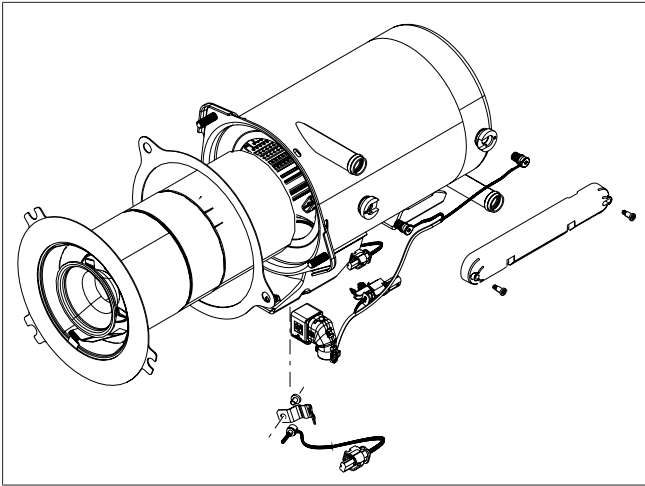


Fig. 46 Heat exchanger with burner and sensors

Follow these steps:

1. Remove burner head, see chapter 8.4, "Disconnect burner head" on page 31.
2. Remove screws that are fastening the heater (see also installation instructions).
3. Remove heat exchanger.

8.18 Remove combustion tube

Follow these steps:

1. Remove burner head, see chapter 8.4, "Disconnect burner head" on page 31.
2. Remove heat exchanger if necessary.

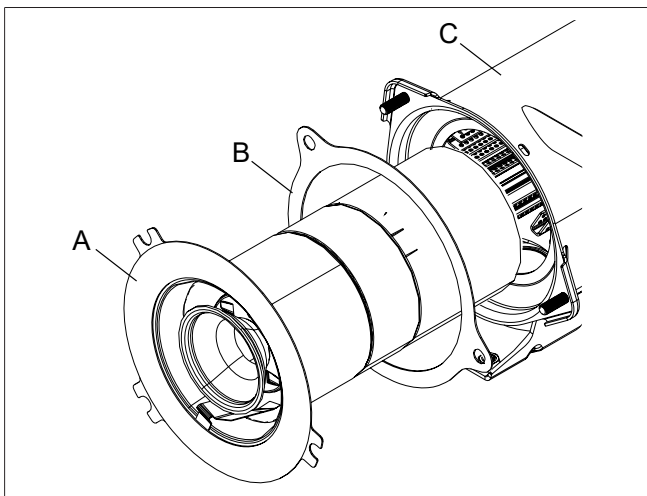


Fig. 47 Remove combustion tube

A	Combustion tube	C	Heat exchanger
B	Seal		

3. Remove combustion tube (A) from the heat exchanger (C).



NOTE

Damaged seals must be replaced.



NOTE

Ensure that the seal does not slip.



NOTE

Seals must be replaced every time it is dismantled.

8.19 Remove coolant temperature sensors



NOTE

Never remove the temperature sensors for testing, just for replacement.
Do not reinstall the removed sensors.

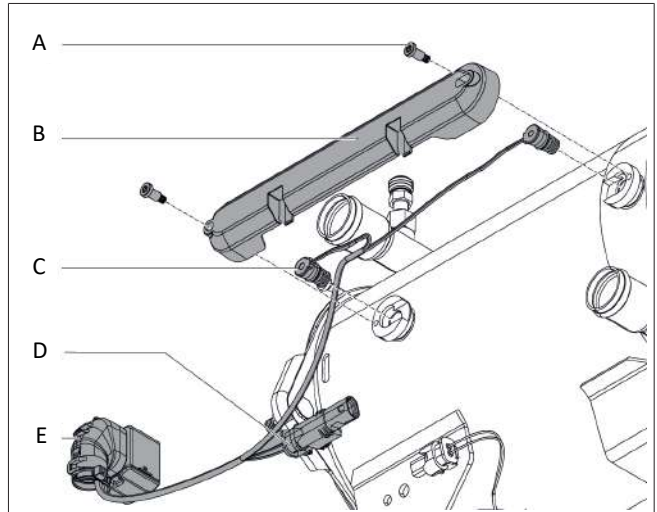


Fig. 48 Temperature sensors with sensor cover and screws

A	Collar screws	D	Exhaust gas sensor
B	Cover for sensors	E	Connector (control unit)
C	Temperature sensors		

Follow these steps:

1. Pull connector (E) out of control unit.
2. Disconnect connector for exhaust gas sensor (D).
3. Remove 2x collar screws for sensor cover (A) M4 T20.
4. Remove cover for sensors (B).
5. Pull temperature sensors (C) out of the heat exchanger.

8.20 Install coolant temperature sensors



NOTE

The seals of the sensors must be wetted with suitable lubricant before being inserted into the heat exchanger.

Note cable routing and position of sensors.

The cover protects the sensors

8.21 Removing exhaust gas temperature sensor



NOTE

Never remove the sensors for testing, just for replacement.

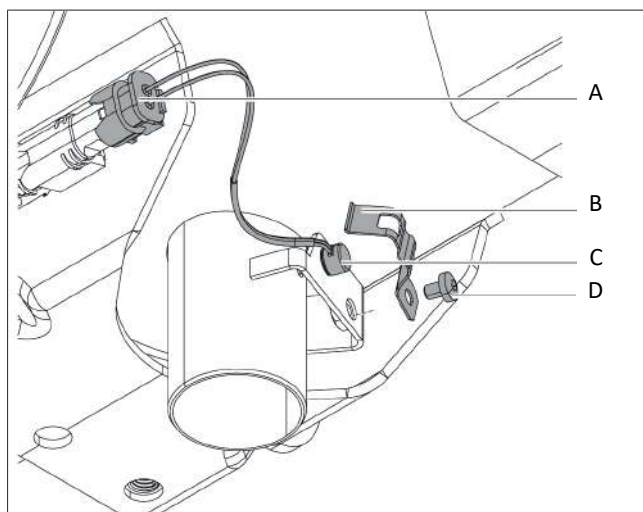


Fig. 49 Exhaust gas temperature sensor with connector, clip and screw

A	Exhaust gas sensor	C	Exhaust gas temperature sensor
B	Spring clip	D	Screw for spring clip

Follow these steps:

1. Disconnect exhaust gas sensor connector (A).
2. Remove 1x screw for spring clip (D) M4 T20.
3. Carefully remove spring clip (C).
4. Carefully pull out exhaust gas temperature sensor (C).

8.22 Installing exhaust gas temperature sensor



NOTE

Take particular care when handling the exhaust gas temperature sensor (as it is a sensitive electronic/ceramic component).

Avoid pulling the cable of the exhaust gas temperature sensor at the sensor head (during installation and in operation).

Prevent damage due to shock load.

The exhaust gas temperature cable must not be sharply kinked. The Teflon insulation must not be damaged.



NOTE

The exhaust gas temperature cable must not rest against the heater.

Route the cable between exhaust gas temperature sensor and spring clip without tension.

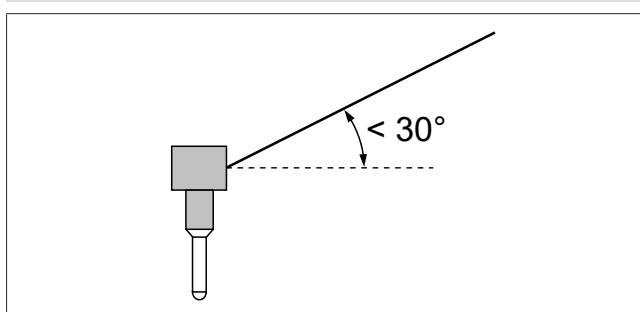


Fig. 50 Installing exhaust gas temperature sensor

Follow these steps:

1. Install exhaust gas temperature sensor.
2. Position spring clip of exhaust gas temperature sensor. See Fig. 49.

9 Packaging / storage / shipping

9.1 General information

The heater or its components to be sent to Webasto for testing or repair, must be cleaned and packed in such a way that they are protected from mechanical damage, soiling and environmental influences during handling, transportation and storage.



NOTE

The temperatures during transportation and storage must not drop below or exceed the ambient temperatures defined in the technical data. See chapter 11, "Technical data" on page 49.

9.2 Ideal position

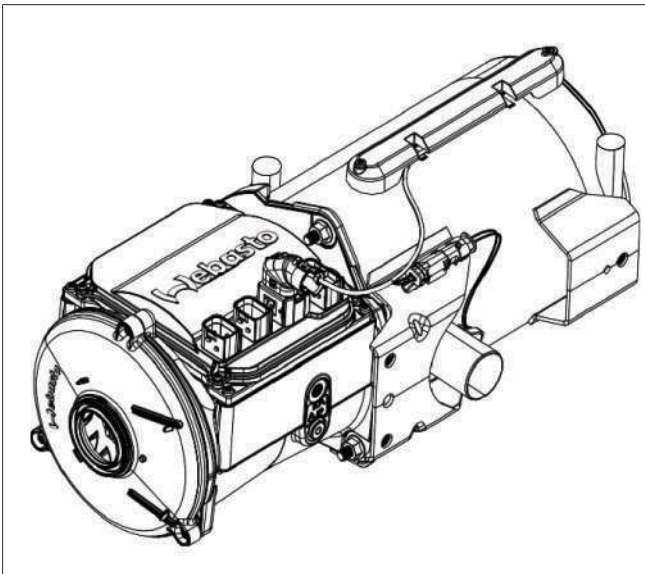


Fig. 51 Ideal position of Thermo Top Pro 120 / 150 heater for storage and transport

9.3 Storage and transportation

Sending in the complete heater

- The heater must be completely drained of fuel.

For packaging and shipping

- Make sure that the remaining fuel or coolant cannot leak out.
- Seal the coolant connection pieces and the fuel connection with dummy plugs.

Storage

- The heater can be stored in any position. There are no restrictions.

Packaging

- Always store heaters in the original or similar packaging in a closed room.

Transport

- The heater can be transported in any position in suitable packaging.

After removing the delivery packaging

- Grasp the heater at a suitable spot and remove it from the burner head and heat exchanger components (aluminium and steel parts).
- The type label and the surface of the heaters should be protected from damage by placing suitable material under them (e.g. cardboard).

10 Electrical incorporation

10.1 Information on the electrical connection



NOTE

- ▶ If the signal is not applied to terminal D+ on the control unit (connector X4, pin 3), the temperatures under "Engine OFF" are used as control thresholds.
- ▶ If the signal is applied to terminal D+, the control thresholds change to the temperatures under "Engine ON".

10.2 The heater in hazardous material vehicles (ADR)



NOTE

The ADR function is typically parameterised according to the specific application. In case of queries, contact a Webasto service workshop.

If the heater is parameterised for automatic ADR recognition and the ADR switch-off is set to the 'high' level, please note:

- ▶ In order to activate the ADR functions, an earth contact must be present at the control unit input X4 pin 4 via Y2 or H5 (see wiring diagram) when the heater is switched on.
- ▶ After connecting the positive potential to the control unit input X4, pin 4 (for "Auxiliary drive on) or after the signal at terminal D+ on control unit input X4, pin 3 stops (if the engine is switched off), there is a brief run-on for 40 seconds. The control unit is then in "ADR lock" mode.

10.3 Legend and remarks regarding wiring diagrams

10.3.1 Legend

No.	Remarks
-----	---------

A1	Heater components
A2	Control unit
A4	ThermoCall TC4 Entry or Advanced. Optional.
A5	W-bus temperature sensor, optional, for TC4 Advanced only
B3	Thermostat for internal fuel preheating
B4	Room temperature sensor
BA	Operating indicator
CAF	Fan motor
CP	Coolant pump
CTS	Coolant sensor
ETS	Exhaust gas temperature sensor
F1	Fuse 20 A, blade fuse DIN 72581-3
F2	Fuse 1 A, blade fuse DIN 72581-3
F3	Fuse 20 A, blade fuse DIN 72581-3
F4	Fuse 1A
F5	Fuse 1A
FH	Fuel preheating
FV	Fuel valve
FZG	Vehicle blower
H1	Symbol on display
H2	LED (green, blue, white, red) indicator lamp, ready indicator, ON indicator, fault list
H5	Light bulb or LED lamp, ON indicator, pumping device (max. 500 mA)
H8	ThermoCall TC4 LED green (in item S9) ON indicator, indicator lamp
ISG	Ignition spark generator
K5	Vehicle fan control, relay with free-wheeling diode or IPCU
OTS	Temperature sensor
P	SmartControl / MultiControl or (UniControl with adapter cable), Optional.
P1	UniControl
S12	Button, External Quick Heating button (optional)
S2	Switch for residual heat utilisation
S4	On/Off switch (min. 500 mA)
S5	Switch for auxiliary drive / pumping device
S6	Switch (1 or 2-pin) disconnecter
S7	Battery disconnecter, electronically controlled disconnecter (max. 500 mA)
S9	ThermoCall TC4 button
V1	Diode, min. 500 mA (not included in wiring harness)
V2	Diode, min. 500 mA (not included in wiring harness)
V4	Diode, for analogue ThermoCall TC4 connection to other control units
V5	Diode, for On/Off S4 switch connection to other control units
V6	Diode, for analogue SmartControl/MultiControl connection to other control units
X1	6-pin plug connection. Item CP to item A2

X2	2-pin plug connection. Vehicle-specific wiring harness
X3	8-pin plug connection. Item sensors to item A2
X4	12-pin plug connection. Vehicle-specific wiring harness
X5	3-pin plug connection. Item ISG to item A2
X6	3-pin plug connection. Item CAF to item A2
X7	2-pin plug connection. Item FH to item A2
X8	2-pin plug connection. Item FV to item A2
X9	4-pin plug connection. To item P or S4 or to A4 or to P or to S4
X10	W-bus connection control element / diagnosis (do not connect for analogue connection)
X12	4-pin plug connection W-bus, connection SmartControl / MultiControl, UniControl, ThermoCall or diagnosis
X15	4-pin plug connection. W-bus temperature sensor connection
X16	4-pin plug connection. To item A5 (optional)
X17	12-pin plug connection. To item A4 (see ThermoCall documentation)
X19	HF plug connection FAKRA (for TC4 Advanced only)
X20	To item S4 or analogue SmartControl / MultiControl connection or analogue ThermoCall (do not connect for W-bus connection)
X21	4-pin plug connection. To Item S4
X22	6-pin plug connection. Telestart connection (optional, see Telestart documentation)
X26	4-pin plug connection. To Item P
X27	4-pin plug connection. To Item P
X28	4-pin plug connection -
X29	4-pin plug connection -
X31	10-pin plug connection. To Item P1
Y2	Solenoid valve / pump, auxiliary drive / pumping device

10.3.2 Comments

No.	Remarks
1	D+ signal (vehicle motor ON/OFF) for determining the control temperature
3	Fuse for vehicle blower (fuse present in vehicle)
4	Switch for vehicle blower
6	Wiring harness
10	SmartControl/MultiControl connection, Telestart (12 V only), ThermoCall or diagnostics via W-bus
11	SmartControl / MultiControl connection or switch (analogue)
17	Positive from terminal 15/75 to connection 10: Continuous heating mode is possible in connection with quick heating function provided the ignition is switched on.
18	Connection to terminal 30: Continuous heating mode is possible with ignition switched off.

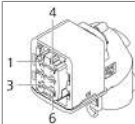
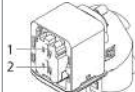
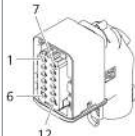
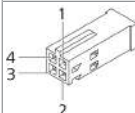
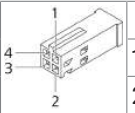
10.4 Cable colours / cable cross-sections

Line length	< 7.5 m	7.5 – 15 m
Cable cross-sections (Wiring diagram based on < 7.5 m)	0.5 mm ²	1.0 mm ²
	1.0 mm ²	1.5 mm ²
	1.5 mm ²	2.5 mm ²
	2.5 mm ²	4.0 mm ²
	4.0 mm ²	6.0 mm ²

Cable colours			
bl	blue	or	orange
br	brown	rt	red
ge	yellow	sw	black
gn	green	vi	violet
gr	grey	ws	white

10.5 Connector and pins

10.5.1 Overview of pin assignment on the connectors

	X1: Coolant pump connection		
1	Earth-		
2	PWM control input		
3	Plus+		
6	-		
	X2: Heater power supply		
1	Battery +		
2	Battery -		
	X3: Connection for temperature sensors and exhaust gas sensor		
1 + 2	Coolant sensor		
3 + 4	Exhaust gas temperature sensor		
5 + 6	Overheat sensor		
	X4: Control element(s), vehicle connection		
1	Input, switch-on signal (ON/OFF)		
2	W-bus		
3	Terminal D+		
4	Auxiliary drive		
5	Output, vehicle fan relay		
6	Output, battery disconnecter after-running signal		
7	Operating indicator/error code output		
8	Use of residual heat input (on/off)		
9	CAN Low (diagnosis)		
10	CAN High (diagnosis)		
11	CAN Shield (diagnosis)		
12	External activation of coolant pumps		
	X10		X20
1	W-bus	1	Status (LED)
2	Not used	2	Switch input
3	Battery +	3	Battery +

4	Battery -	4	Battery -
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Table 1: Connector X1 – X4, X10, X20

10.5.2 Overview of plug assignments at control unit

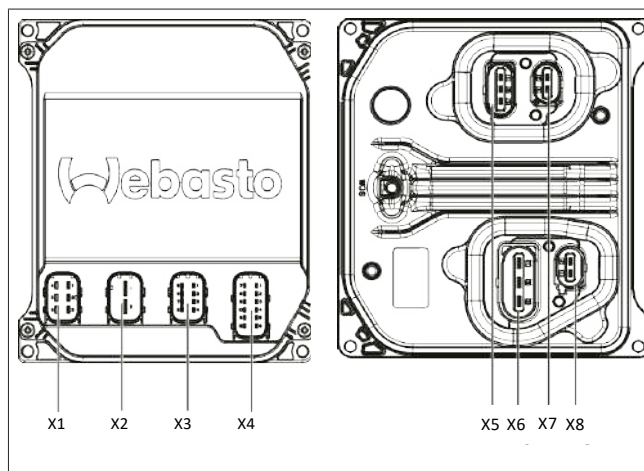


Fig. 52 Plug assignments at control unit: exterior (left): X1 – X4, interior (right): X5 – X8

10.6 Wiring diagrams

Please read the following pages.



Wires or components shown with dashed lines are optional and not included in the scope of delivery or in the wiring harness.

10.6.1 Heater

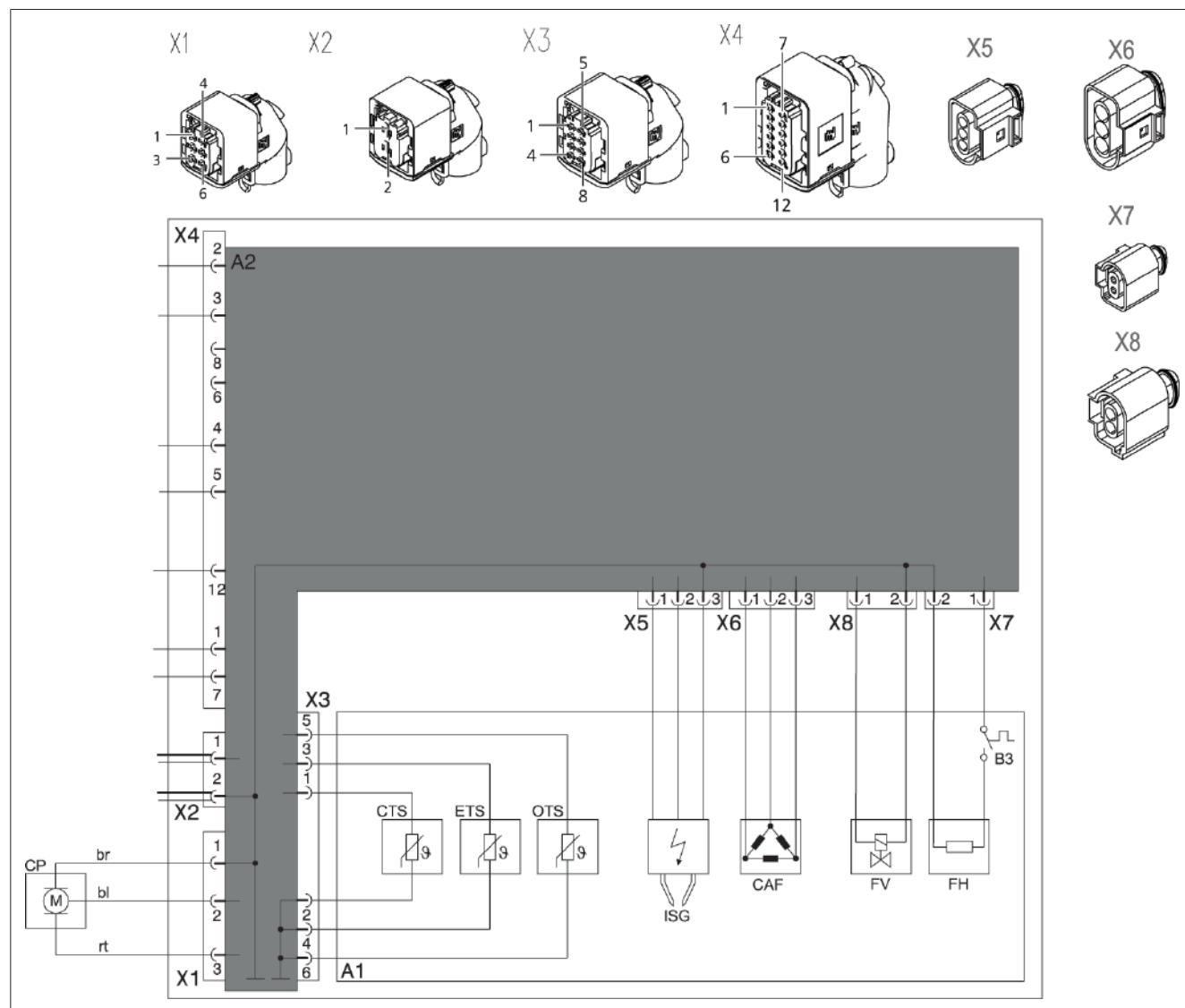


Fig. 53 Wiring diagram for heater Thermo Top Pro 120 / Thermo Top Pro 150

10.6.2 W-bus

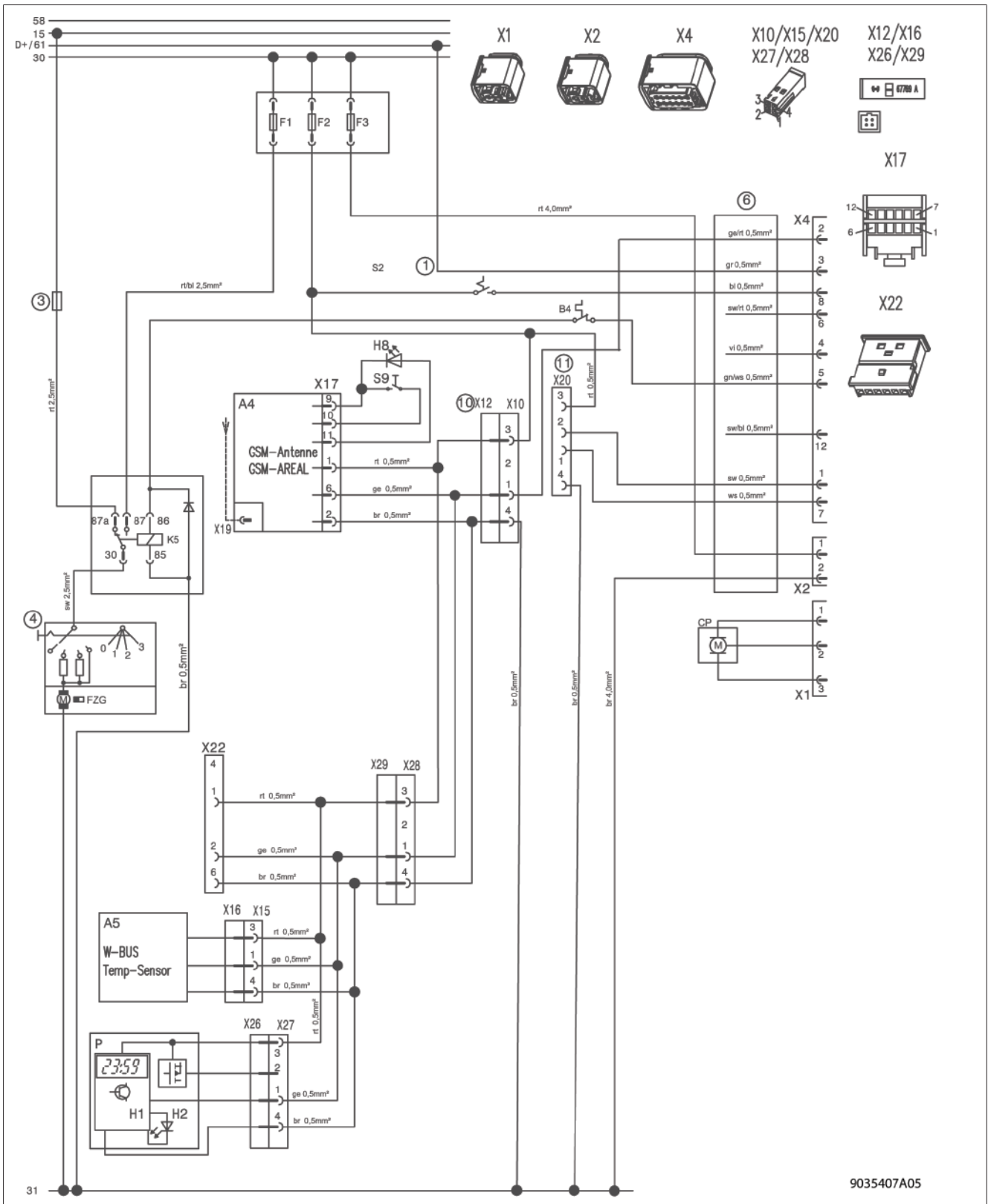


Fig. 54 Wiring diagram for power supply, fan control and control element(s) connection via W-bus (Cable cross-sections suitable for cable lengths <7.5 m)

10.6.3 Analogue

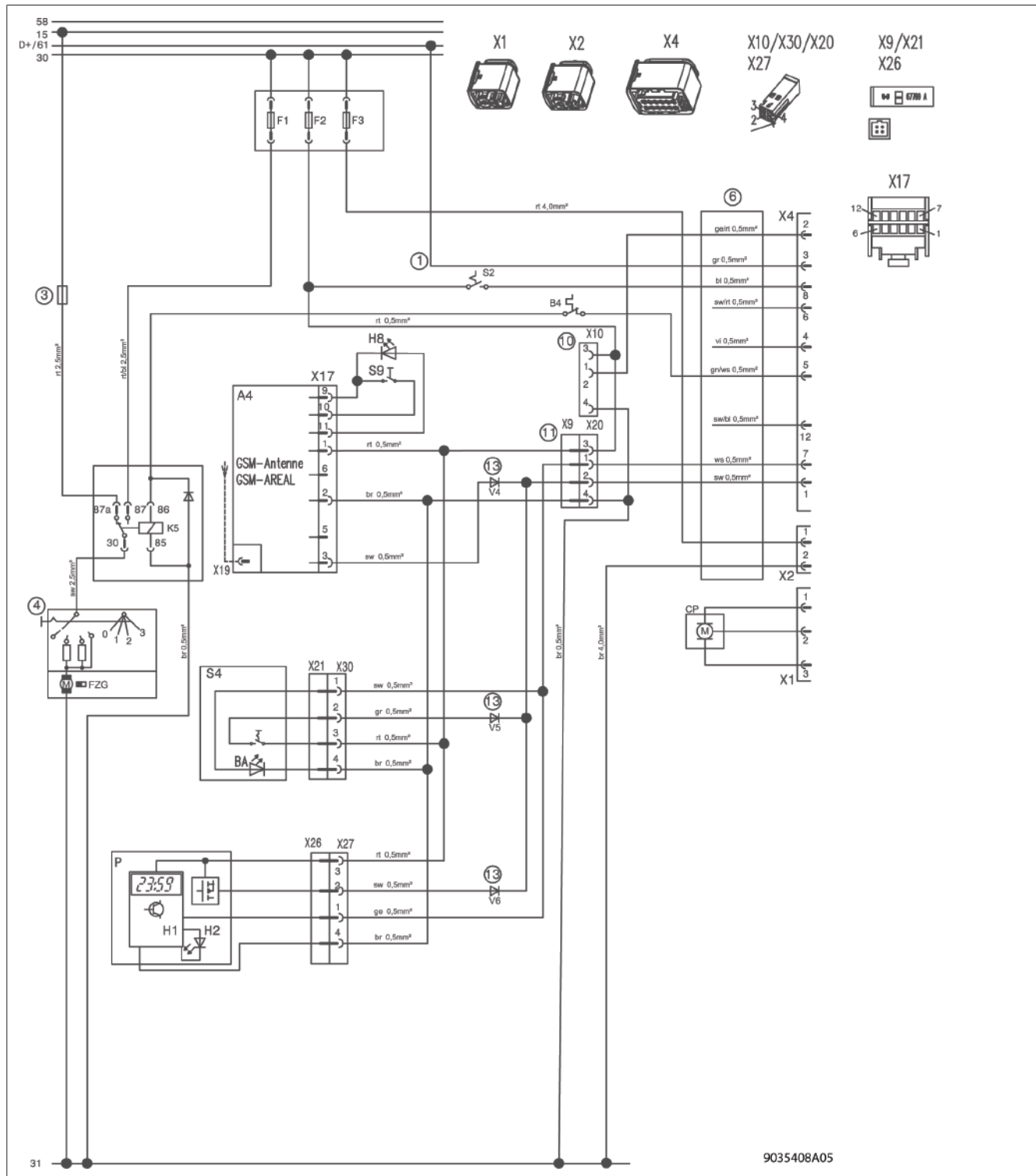


Fig. 55 Wiring diagram for power supply, fan control and control element(s) connection via analogue (optional) (Cable cross-sections suitable for cable lengths <7.5 m)

10.6.5 W-bus with ADR inclusion

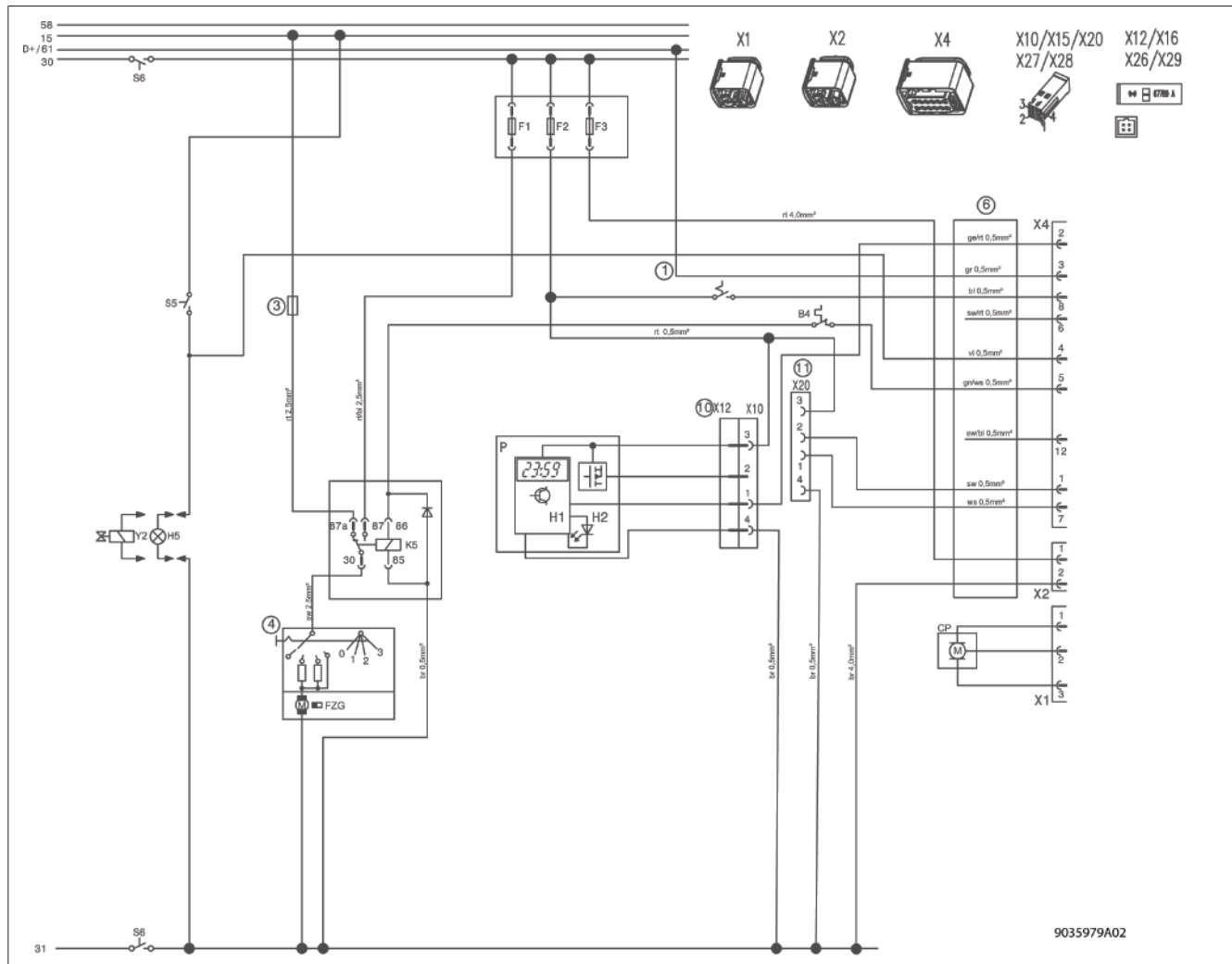


Fig. 57 Wiring diagram for power supply, fan control and control element(s) connection via ADR W-bus (Cable cross-sections suitable for cable lengths <7.5 m)

10.6.6 Analogue with ADR inclusion

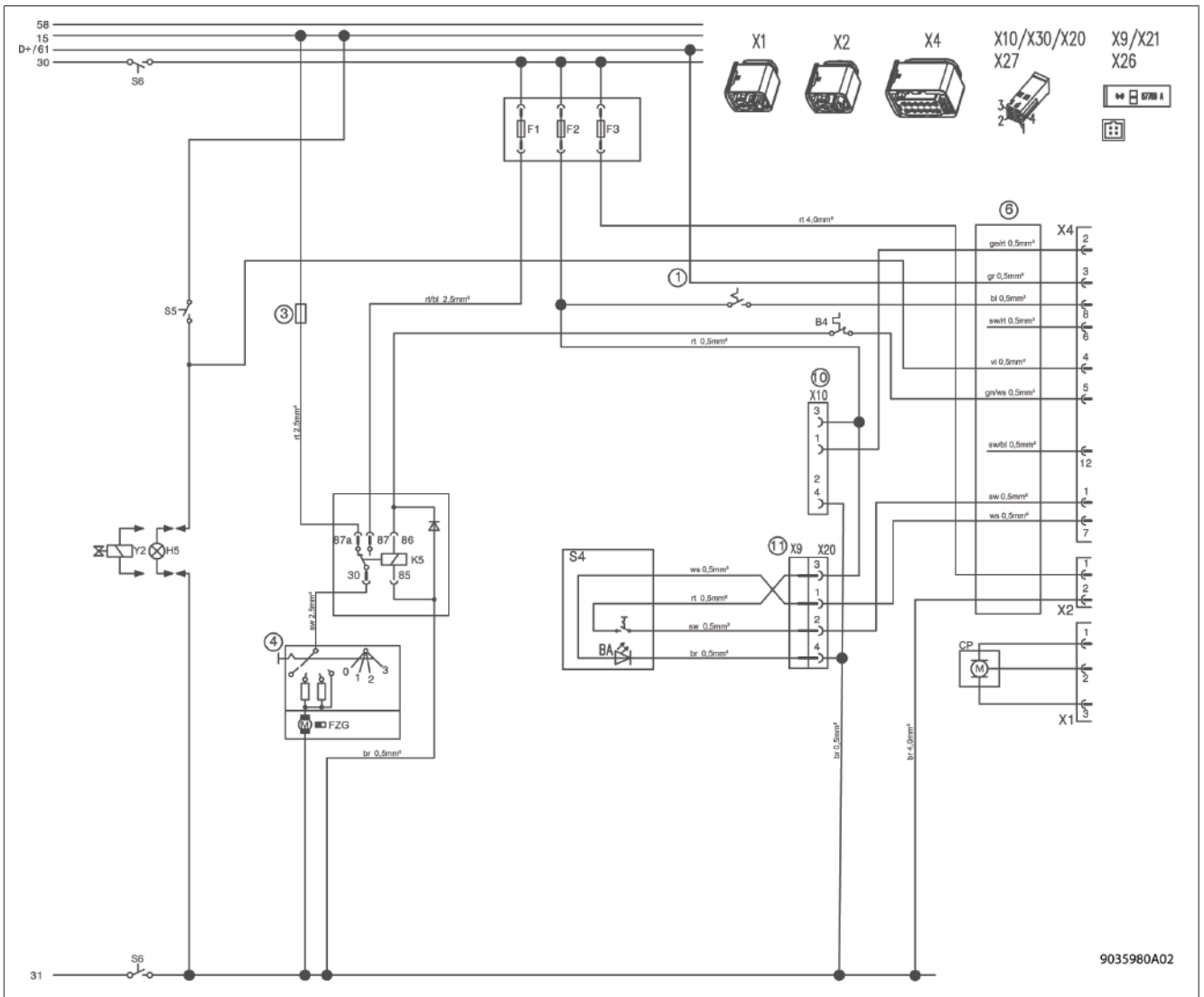


Fig. 58 Wiring diagram for power supply, fan control and control element(s) connection via ADR analogue (Cable cross-sections suitable for cable lengths <7.5 m)

10.6.7 UniControl with battery disconnecter (BTS)

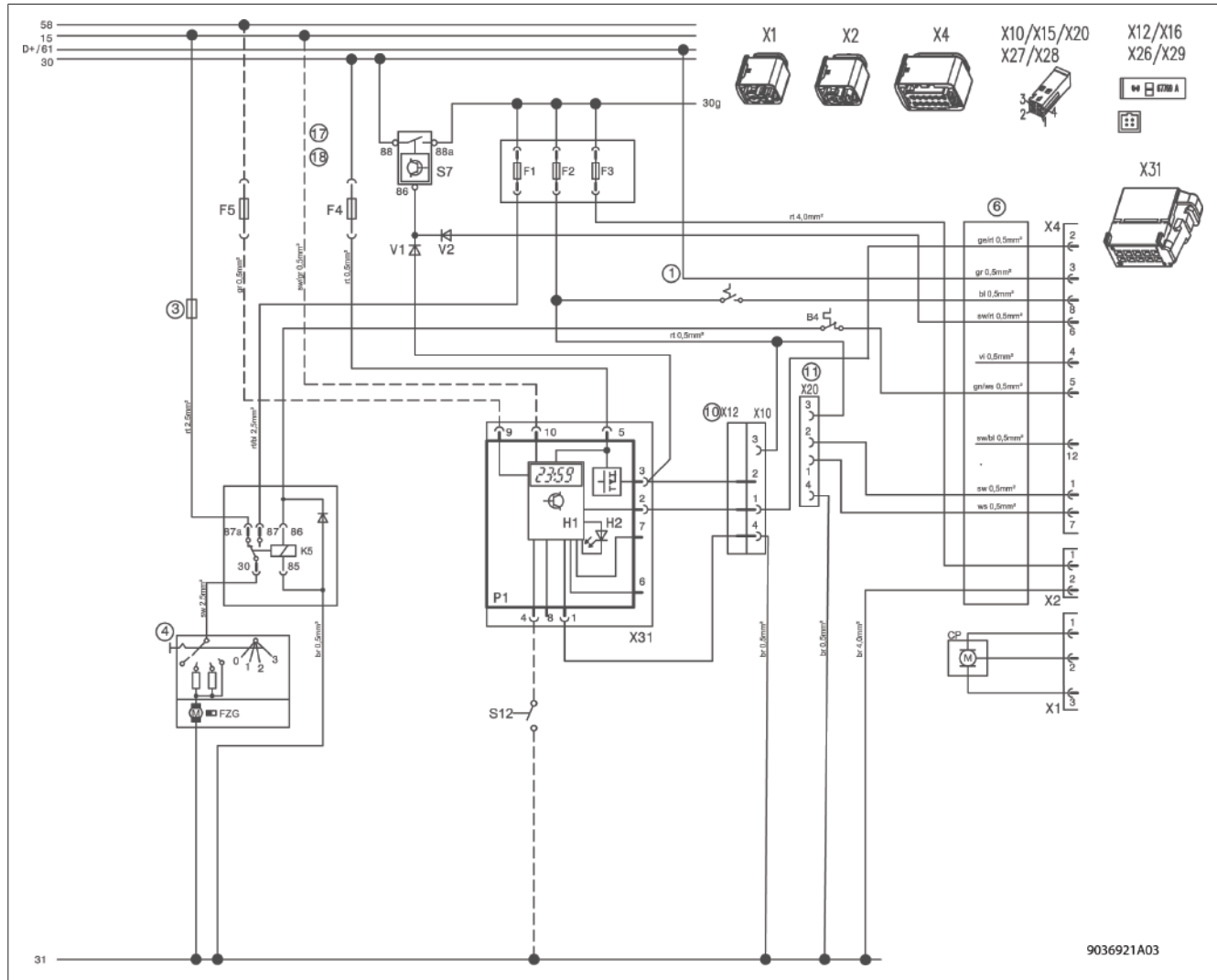


Fig. 59 Wiring diagram for power supply, fan control and control element(s) connection via UniControl with battery disconnecter (BTS)

(cable cross-sections suitable for cable lengths <7.5 m)

11 Technical data

Technical data (except for limit values where stated) refers to an ambient temperature of 20 °C, a rated voltage of 12V or 24V, air pressure of 1013 hPa, a relative humidity of 50% and a normal tolerance of $\pm 10\%$ provided no limit values are stated. Geodetic height is 0 m above sea level and the stated nominal value are determined for diesel in line with DIN EN 590. See: <https://webstore.ansi.org/standards/din/dinen5902017>.



You will find further information in the operating and installation instructions for the heater.

Heater TTP (Thermo Top Pro)	TTP 120 Diesel		TTP 150 Diesel	
	12 V	24 V	12 V	24 V
Type approval: Heating	E1 R122 00 0481		E1 R122 00 0480	
Type approval: EMC	E1 R10 05 7735		E1 R10 05 7735	
Design	Water heater (atomising burner)			
Fuel	Diesel: DIN EN 590, B20/ B30 DIN EN 16709 HVO: DIN EN 15940			
Heater output Btu(kW)	40,000 (12)		51,000 (15)	
Fuel consumption [kg/h]	1.37		1.45	
Rated voltage [V]	12	24	12	24
Operating voltage range [V]	10.5 - 15.5	20.0 - 31.0	10.5 - 15.5	20.0 - 31.0
Rated power consumption over control range [W]	80		100	
Permissible ambient temperature (operation) °F(°C)	-40 to 176 (-40 to +80)			
Permissible ambient temperature (storage) °F(°C)	-40 to 248 (-40 to +120)			
Permissible working pressure psi (bar)	< 36.2 (< 2.5)			
Automatic altitude compensation/max. permissible operating altitude ft(m)	11,482 (3,500)			
Capacity of the heat exchanger g(l)	.3 (1.2)			
Minimum volume flow for heater g/h(l/h) (with water/glycol mix ratio of 50% / 50%)	254 (960)		317 (1200)	
Minimum fill volume of the coolant circuit g(l)	2.6 (10)			
Check CO ₂ in exhaust gas [vol.%]	9.0 – 11.0			
Set CO ₂ in exhaust gas [vol.%]	9.7 (± 0.2)		10.0 (± 0.2)	
CO in exhaust gas [ppm]	< 1000			
Soot number (Bacharach method)	< 4			
Heater length inch(mm)	18.5 (470)			
Heater width inch(mm)	7.9 (200)			

Heater TTP (Thermo Top Pro)	TTP 120 Diesel		TTP 150 Diesel	
	12 V	24 V	12 V	24 V
Heater height inch(mm)	7.9(200)			
Heater weight, empty lb(kg)	24.3(11)			
Heater weight, with coolant lb(kg)	26.9(12.2)			
IP class Heater	IP 5KX, IP X4K			
IP class, control unit (installed)	IP 6KX, IP X6K, IP X9K			

Coolant pump	U4850	
	12 V	24 V
Volume flow g/h(l/h) (against 0.56 bar)	396(1500)	
Rated voltage [V]	12	24
Operating voltage range [V]	8 ... 16	16 ... 32
Rated power consumption [W]	70	
Length inch(mm)	4.6(118)	
Diameter Ø [mm]	3.15(80)	
Weight lb(kg)	1.5(0.7)	

12 List of abbreviations

Abbreviation	Meaning
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road. (Accord européen relatif au transport international des marchandises Dangereuses par Route.)
HVO	Hydrotreated Vegetable Oil (bio-diesel)
IP	Ingress Protection
PPM	Parts per million (millionth)
TTP	Thermo Top Pro
WTT	Webasto Thermo Test (PC diagnosis)

To request this documentation in another language, please locate and contact your local Webasto dealer. You can find your nearest dealer at: <https://dealerlocator.webasto.com/en-int>.

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Europe, Asia Pacific:

Webasto
Kraillinger Str. 5
82131 Stockdorf
Germany

UK only:

Webasto Thermo & Comfort UK Ltd
Webasto House
White Rose Way
Doncaster Carr
South Yorkshire
DN4 5JH
United Kingdom