

Water heater

Service Instructions

Thermo Pro 90
Thermo Pro 90 HDD

Thermo Pro 90 12 V Diesel - ADR (Transport of dangerous goods)

Thermo Pro 90 24 V Diesel - ADR (Transport of dangerous goods)

Thermo Pro 90 HDD 24 V Diesel - ADR (Transport of dangerous goods)



Improper installation or repair of Webasto heating and cooling systems can cause fire or the leakage of deadly carbon monoxide leading to serious injury or death.

To install and repair Webasto heating and cooling systems you need to have completed a Webasto training course and have the appropriate technical documentation, special tools and special equipment.



Only genuine Webasto parts may be used. See also Webasto air and water heaters accessories catalogue.

NEVER try to install or repair Webasto heating or cooling systems if you have not completed a Webasto training course, you do not have the necessary technical skills and you do not have the technical documentation, tools and equipment available to ensure that you can complete the installation and repair work properly.

ALWAYS carefully follow Webasto installation and repair instructions and heed all WARNINGS.

Webasto rejects any liability for problems and damage caused by the system being installed by untrained personnel.

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1 Introduction

1.1 Contents and purpose

This workshop manual is designed to assist trained personnel in the repair of Thermo Pro 90 water heaters.

This workshop manual contains all the information and instructions necessary to repair Thermo Pro 90 water heaters.

1.2 Meaning of signal words

Throughout this manual, the signal words CAUTION, ATTENTION and NOTE have the following meanings:

CAUTION

This signal word is used to highlight operating instructions or procedures which, if not followed or not followed correctly, may result in personal injury or fatal accidents.

ATTENTION

This signal word is used to highlight operating instructions or procedures which, if not followed or not followed correctly, may result in damage to the equipment or its components.

NOTE

This signal word is used to draw your attention to a special feature.

1.3 Additional documentation to be used

Use the following documents:

- Installation Instructions
- Heater operating instructions
- Control element operating instructions
- Optional (if installed) vehicle-specific installation documentation

1.4 Legal requirements and safety information

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 sections and procedural descriptions.

1.4.1 Statutory regulations governing installation

The Thermo Pro 90 heater has been type-tested and approved in accordance with ECE-R 10 (EMC) and ECE-R 122 (heater).

Stipulations of Annex 7 to the Regulation ECE-R 122 and the requirements specified in the installation instructions must be observed for the installation.

NOTE:

The stipulations of these regulations are binding in the area covered by EU Directive 70/156/EEC and/or 2007/46/EC (for new vehicle models from 29/04/2009) and should also be observed in countries where there are no specific regulations.

The Thermo Pro 90 water heater has been designed for installation in commercial vehicles. If it is installed in special-purpose vehicles, the applicable regulations must be taken into account. Alternative applications must be agreed upon with Webasto in advance.

1.4.2 General safety information

Follow the Installation Instructions.

The year of initial commissioning must be permanently marked on the type label by removing the numbers of the inapplicable years.

The heaters are approved for heating the vehicle engine and the cab but they are not approved for heating cargo areas used to carry dangerous goods/hazardous substances.

The heater may only be installed in motor vehicles or in independent heating systems with a minimum coolant capacity of 6 litres.

The heater must not be installed in the driver's or passenger's compartment of vehicles. If the heater is nevertheless installed in such a place, the casing must be tightly sealed from the vehicle interior. If the heater is in an enclosure, outside air ventilation must be sufficient. Additionally, the ambient temperature regarding fuel pump and fuel line, combustion air intake and heater must be observed (see technical data). Faults may occur if the temperature exceeds this level.

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

Failure to follow the installation instructions and the notes contained therein will result in a disclaimer of liability by Webasto. The same shall apply if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will render the general type approval of the heater and therefore the vehicle type approval invalid.

CAUTION

Risk of burn injuries as the heater and its add-on parts can become very hot.

The heater must **NOT** be operated:

- at filling stations and tank facilities
- at locations where highly flammable gases or dust can form, or at locations where highly flammable liquids or solid materials are stored (e.g. near fuel, coal and wood dust, grain storage areas, dry grass and leaves, cardboard boxes, paper, etc.).
- in closed rooms (e.g. garages), nor with time pre-selection or the Telestart function.
- unless the water in the heating circuit contains at least 33% quality antifreeze.

The heater including the control unit:

- must **NOT** be exposed to storage temperatures in excess of +125 °C. The operating voltage may be applied. Exceeding the specified temperature can result in permanent damage to the electronics.
- may **ONLY** be operated with the fuel and the rated voltage specified on the type label.
- must be shut down by switching off immediately and removing the fuse in case of heavy smoking, unusual combustion noises or combustion odours. Restarting may not be carried out until after the unit has been checked only by Webasto-trained personnel.
- must be switched off when working in the engine compartment.
- may **NOT** be cleaned with high-pressure cleaners.
- may **NOT** be cleaned with compressed air.
- must be operated for 10 minutes with a cold engine on the lowest blower setting at least once a year.
- must be checked by a specialist every 2 years or at the start of the heating period at the latest.

CAUTION

Carefully read the operating instructions before operating the heater.

1.5 Spare parts

The identity numbers of the available spare parts can be found:

- in the Webasto spare parts catalogue
- online in the dealer portal (<http://dealers.webasto.com>)

2 General description

The water heater has been designed for installation in commercial vehicles. Depending on equipment, the ADR function is provided for the 12 V and 24 V variant.

Parking heating

In parking heating mode, the water heater works together with the vehicle's heating system for

- cab and engine preheating,
- use of residual heat from the vehicle engine.

The water heater works independently of the vehicle engine and is integrated in the cooling system, the fuel system and the electrical system of the vehicle.

Auxiliary heating

The water heater works during engine operation and provides thermal assistance to the cooling system. The water heater is integrated in the cooling system, the fuel system and the electrical system of the vehicle.

When the engine is switched off, the water heater is automatically switched off and fuel supply is interrupted within 5 seconds.

The heater operates fully automatically, controlled by the coolant temperature.

The burner output is controlled within the limits between 1.8 and 7.6 kW depending on the deviation of the current coolant temperature from the setpoint at the coolant temperature sensor.

The heater switches off burner operation automatically (pause) when the setpoint is exceeded and switches it back on automatically when the temperature drops below the setpoint.

Actuation of the water heater with an external regulator (e.g. room thermostat) is not permitted.

The Thermo Pro 90 heater mainly consists of the following components:

- Combustion air fan
- Heat exchanger
- Burner unit
- Coolant pump

The following control and monitoring components are integrated in the heater:

- Control unit
- Exhaust gas temperature sensor
- Glow plug
- Coolant temperature sensor
- Overheating protection

The burner motor speed is monitored by a Hall sensor integrated in the control unit. Operation with a remote control unit is therefore not possible.

The fuel is supplied externally by a fuel pump which is connected to the vehicle fuel system.

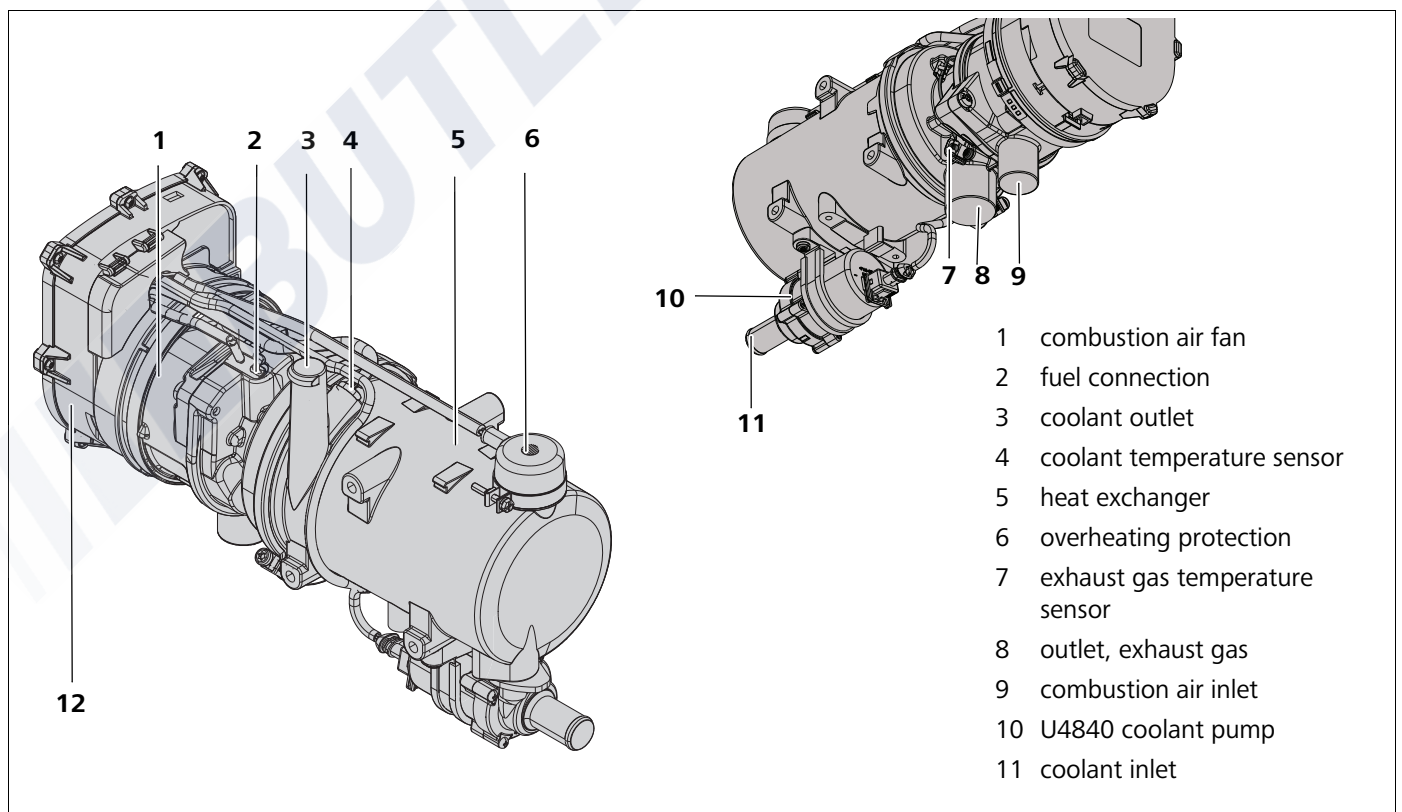


Fig. 201 Heater components

2 General description

Thermo Pro 90

2.1 Combustion air fan



Fig. 202 Combustion air fan

The combustion air fan supplies the air necessary for the combustion process to the burner unit.

2.2 Overheating protection, coolant temperature sensor and heat exchanger

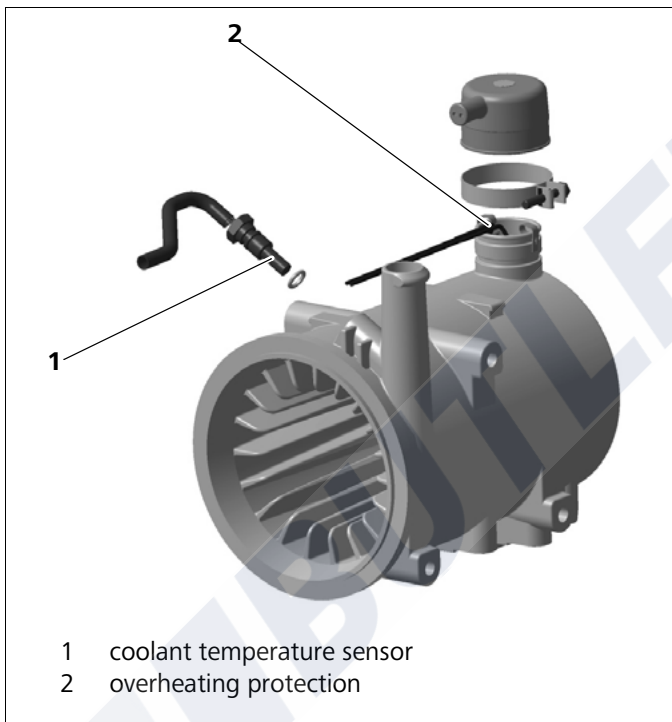


Fig. 203 Heat exchanger

The coolant temperature sensor registers the coolant temperature at the coolant outlet of the heater as an electrical resistance. This signal is sent to the control unit where it is processed.

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

The overheating protection (bimetal strip) protects the heater from impermissibly high operating temperatures. The overheating protection trips at a heat exchanger temperature in excess of $127 \pm 7 \text{ }^\circ\text{C}$ and switches off the heater.

The overheating protection is reset automatically at temperatures below $65 \pm 5 \text{ }^\circ\text{C}$.

2.3 Glow plug and burner unit

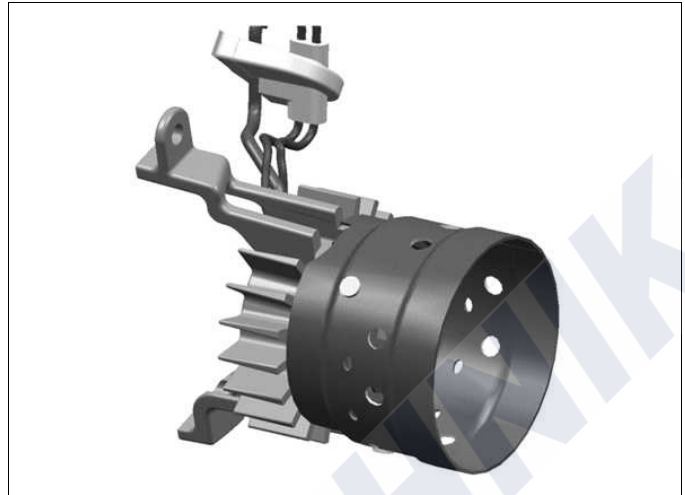


Fig. 204 Burner unit

The fuel is evaporated and precombusted in the burner unit.

The fuel/air mixture is ignited by the glow plug when the heater is started. The glow plug is axially arranged in the middle of the burner unit.

2.4 Combustion chamber

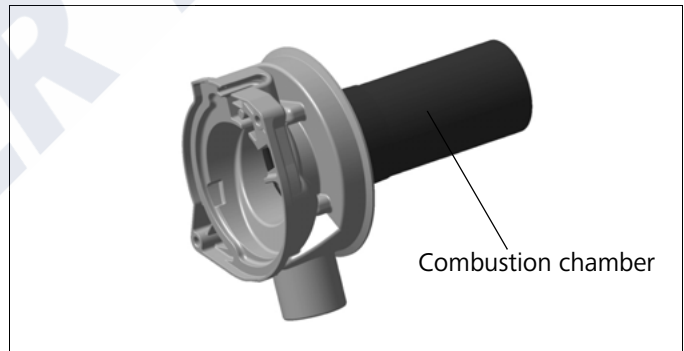


Fig. 205 Combustion chamber

The combustion chamber assists combustion of the fuel/air mixture thus heating the heat exchanger.

2.5 Exhaust gas temperature sensor

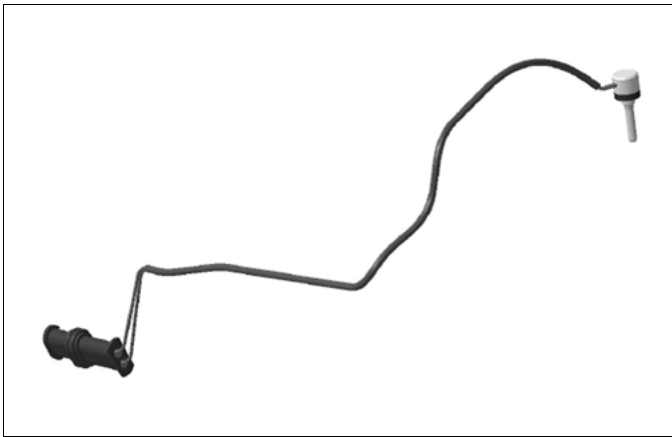


Fig. 206 Exhaust gas temperature sensor

The exhaust gas temperature sensor detects the flame as well as impermissible exhaust temperatures.

2.6 U4840 coolant pump

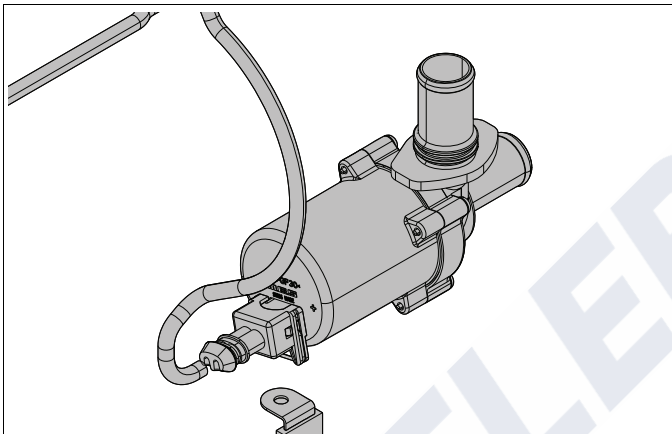


Fig. 207 U4840 coolant pump

The coolant pump pumps the coolant in the vehicle and heater circuits. The pump is switched on by the control unit and runs continuously during heater operation (also during the pause and afterrunning phases as well as during residual heat utilization).

2.7 Control unit

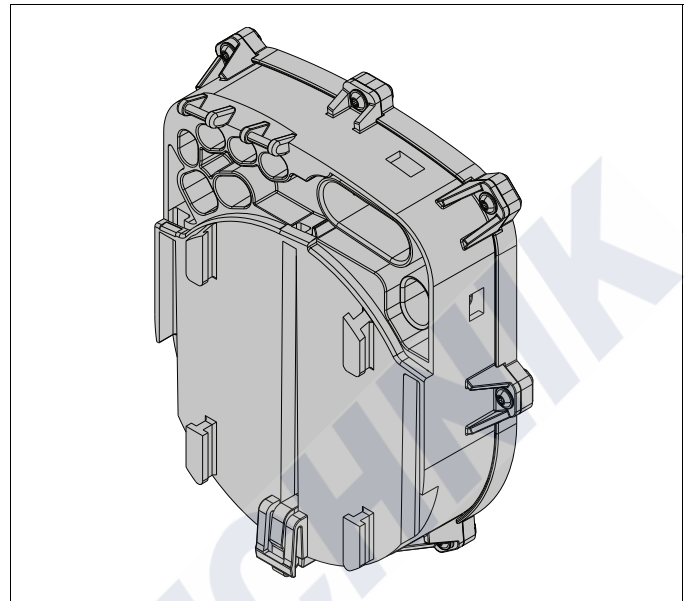


Fig. 208 Control unit

The control unit controls the functional sequence and monitoring of burner operation.

2.8 DP42 fuel pump

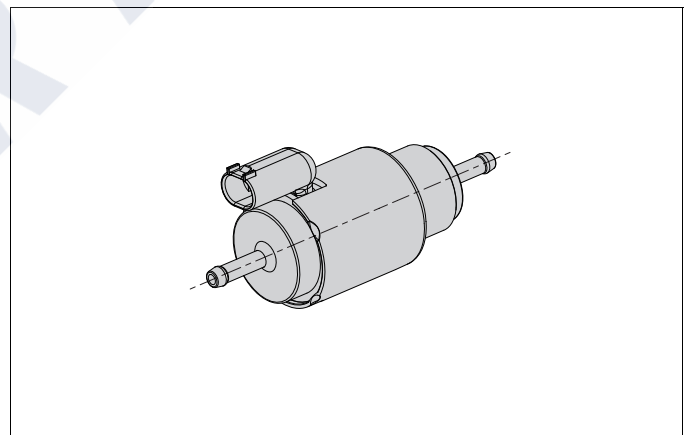


Fig. 209 DP42 fuel pump

The DP42 fuel pump supplies fuel to the heater.

ATTENTION

- The fuel pump must not be operated with the operating voltage (12 or 24).
- Power must not be supplied to the pump when a control unit is connected.

The fuel pump serves as a shut-off system when the heater is switched off.

3 Functional description

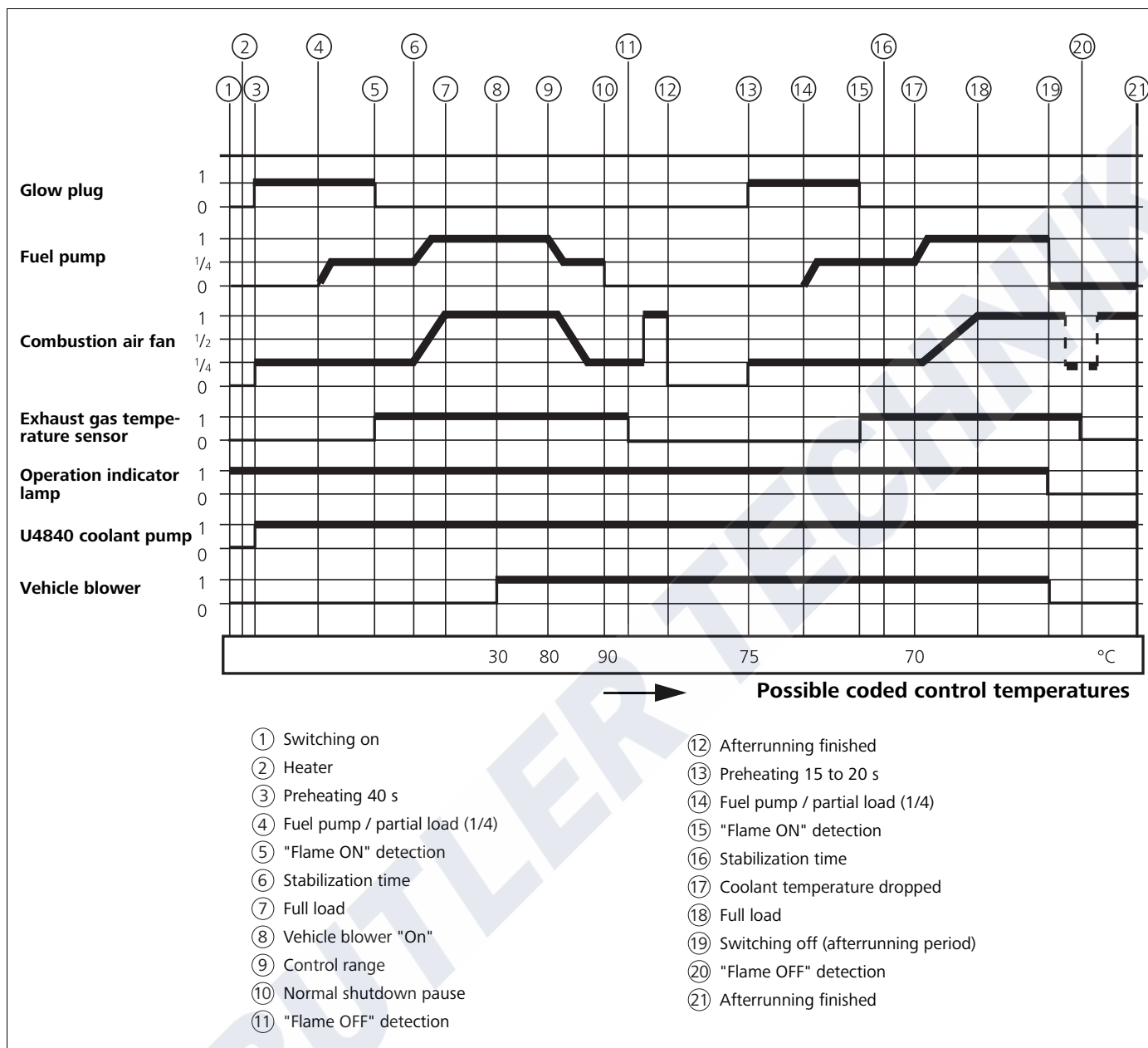


Fig. 301 Thermo Pro 90 functional sequence

3.1 Switching on and residual heat utilization

Switching on the heater

The heater is switched on with the control element.

Activation of residual heat utilization

Every time it is switched on, the heater checks the coolant temperature before the heating process. Residual heat utilization is activated automatically at coolant temperature above 60 °C. When residual heat utilization is activated, the coolant pump for the heater and the vehicle blower are automatically actuated.

Residual heat utilization can only be activated from the "OFF" state, i.e. the "residual heat utilization" state is not assumed from the "fault lock-out", "ADR lock-out" and "heater lock-out" states.

Deactivation of residual heat utilization

Conditions for deactivating residual heat utilization:

- When the lower operating voltage limit has been exceeded
- When the coolant outlet temperature is lower than 60 °C
- When the heater is switched off

OFF state will be assumed if the conditions a) or c) are met when activating residual heat utilization or during residual heat utilization.

The heater will be started automatically if the condition b) is met when activating residual heat utilization or during residual heat utilization.

The disconnecter (emergency off switch) may only be actuated in the event of danger since the heater will be switched off without any afterrunning period (possible overheating).

3.2 Start and control mode

Automatically controlled heater operation begins when combustion is initiated (start).

The boost heating capacity of 9.1 kW can be actuated for max. 2 hours at low coolant temperatures.

The heating capacity is modulated between 1.8 kW and 7.6 kW at higher coolant temperatures. The aim is to reach and maintain the control temperature.

The vehicle's heater fan cuts in when the coolant reaches a temperature of approx. 30 °C.

The heater is switched to control pause mode if the coolant temperature continues to increase beyond the control temperature setpoint up to the pause threshold. The coolant pump, the vehicle's heater fan and the operation indicator remain in operation during the control pause phase.

The heater starts up again automatically after the coolant has cooled down to the precoded cut-in temperature.

3.3 Switching off

The operation indicator lamp goes out when the heater is switched off. The fuel pump stops, combustion stops and afterrunning begins. The coolant pump, glow plug and the combustion air fan continue to run during the afterrunning phase in order to cool down the heater. It is possible to switch the heater back on during the afterrunning period. The heater restarts after the afterrunning period has elapsed.

3.4 Heater functions in ADR vehicles

The Thermo Pro 90 heater is switched on and off manually by means of a switch. Automatic controllers are prohibited. In vehicles of the type FL, the operation of these heaters is prohibited during loading and unloading and at the loading points. The generator signal and auxiliary drive signal are requested for this purpose.

In vehicles of type FL, the heaters are automatically switched off and the maximum ADR afterrunning time is 40 s in accordance with the legal specifications.

An ADR afterrunning period takes place if:

- the generator signal (D+) is discontinued or
 - the auxiliary drive signal (e.g. pumping device) is present.
- After the end of the ADR afterrunning period, the control unit is in ADR locking mode.

Before the restarting, the ON/OFF switch must be set to "OFF" and the auxiliary drive signal must no longer be applied.

4 Technical data

Thermo Pro 90

4 Technical data

Heater		Thermo Pro 90 Diesel	
		12 V	24 V
Approval mark	ECE R122 (heating) ECE R10 (EMC)	E1 00 0320 E1 04 6196	
Design		Water heater	
Heat flow	Max. Control range	9.1 kW 1.8 to 7.6 kW	
Fuel		Diesel DIN EN 590 PME DIN EN 14214	
Fuel consumption Fuel consumption over control range	Maximum (+/- 10%) Control range (+/- 10%)	1.1 l/h 0.2 to 0.9 l/h	
Rated voltage		12 Volt	24 Volt
Operating voltage range		10.5 to 15.5 Volt	20 to 31.5 Volt
Rated power consumption without coolant pump and vehicle blower over control range [W] (max.)		≤ 90 W 37 to 83 W	
Permissible ambient temperature: Heater (incl. control unit): - Operation - Storage Fuel pump: - Operation - Storage		-40 to +80 °C -40 to +125 °C (heater off, operating voltage may be applied) -40 to +30 °C -40 to +85 °C	
Permissible working pressure of coolant		2.0 bar	
Capacity of the heat exchanger		0.15 l	
Max. combustion air intake temperature		+40°C	
Minimum volume in coolant circuit		6.0 l	
Specific volumetric coolant flow	against 0.15 bar	1650 l/h	
DP42: fuel pump: specific volumetric fuel flow	Diesel:	115 ml/(stroke*Hz)	
DP42 fuel pump: rated voltage		7 - 10 V (PWM actuation)	
CO ₂ in exhaust gas (permitted function range)		9 to 12 Vol.-%	
CO ₂ setting (at 20 °C and 1010mbar)		10.1 Vol.-%	
Heater dimensions (tolerance ± 3 mm)	Length/length* (length of control unit as far as intake connection to coolant pump)	L = length: 355 (381*) mm W = width: 131 mm H = height: 232 mm	
Weight		4.9 kg	

5 Malfunctions and troubleshooting

General information

This chapter describes how to identify and remedy faults in the Thermo Pro 90 heater.

ATTENTION

Troubleshooting assumes detailed knowledge of the design and functional principle of the individual heater components and must only be carried out by specifically trained personnel.

If in doubt, refer to Section 2 and 3 for information on how the functions interact.

ATTENTION

Troubleshooting is generally restricted to locating faulty components. The following potential sources of malfunction are not taken into account as they should always be checked to rule them out as the cause of fault:

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

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

5.1 Procedure in the case of fault, malfunction and lock-out

ATTENTION

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

The control unit recognises faults in the heater as malfunctions. Afterrunning may be initiated depending on the type and severity of the fault. If afterrunning is initiated in the case of fault, the heater remains in the lock-out state. A fault code is also output after detecting a malfunction during the fault switch-off.

The fault code is shown on the control element either by the indicator lamp flashing of letter combination on the display (depending on the type of control element).

The fault code assists the workshop or Webasto Technical Service in determining the fault.

NOTE

Select W-Bus under "Diagnostics" => "Device Selection" in Webasto Thermo Test PC Diagnostics. It is recommended to print out the operating and fault data as well as the extended fault conditions.

5.1.1 Fault code output at the control element

• Control element (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.

• MultiControl / SmartControl element

In the case of control elements with a display (analogue or W-bus), the malfunction is shown on the display in the form of a fault code.

Error code output:

The fault code is indicated by a letter (F) followed by a 2-digit combination (FXX).

NOTE

- See Chapter "5.5 Fault code table (fault codes, flash codes)" on page 503.
- The fault code for the heater begins with F (FXX). Other fault codes do not stem from the heater (e.g. TXX for MultiControl/SmartControl, see MultiControl/SmartControl installation instructions).

5.2 Cause of malfunctions

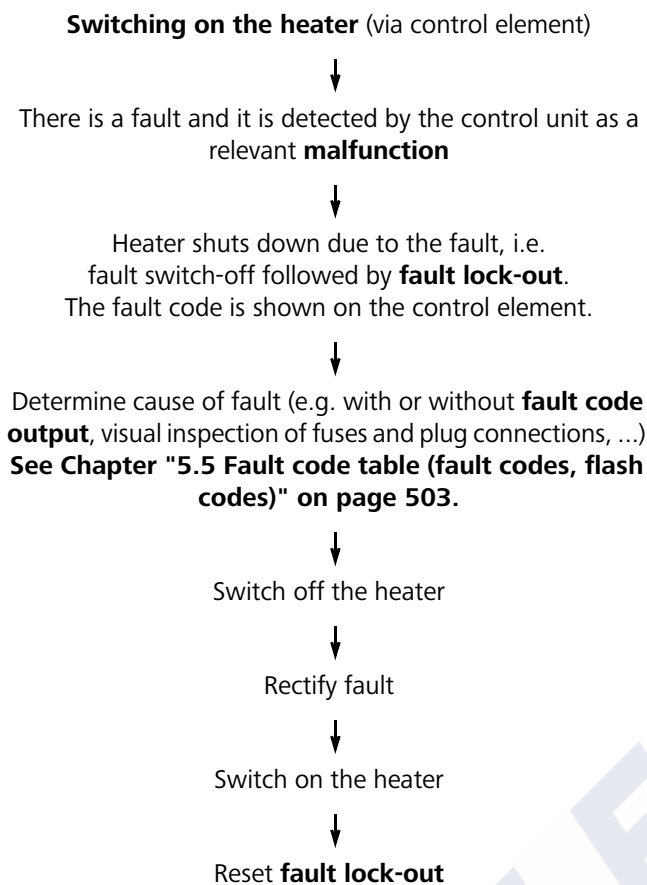
A malfunction is caused when there is one or more faults occur. Possible faults are:

Overvoltage / Undervoltage,

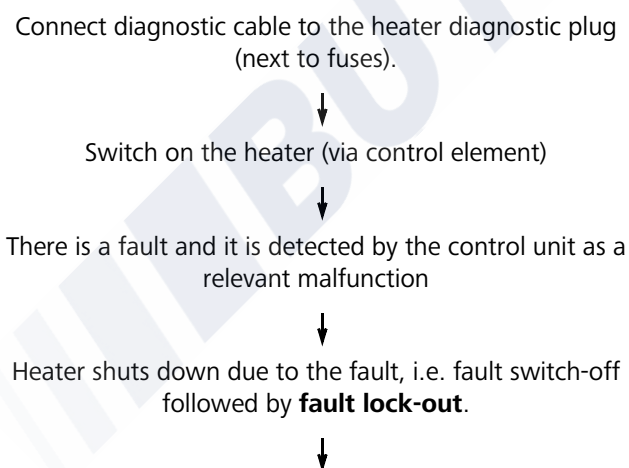
- malfunctions of all components, e.g. due to short-circuit or break,
- overheating of heater,
- impermissible exhaust temperature,
- unsuccessful starts,
- flame failure.

5.3 Deleting fault code

5.3.1 Without Webasto Thermo Test PC Diagnostics



5.3.2 with Webasto Thermo Test computer diagnostics



Determine cause of fault 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 down fault code memory

↓

Rectify fault

↓

Clear fault code memory with the command "Clear Fault Code Memory/Heater Lock-Out" in the "Fault Code Memory" menu.

↓

Switch on the heater

↓

Reset **fault lock-out**

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.

5.4 Heater lock-out

The heater can be unlocked:

Without Webasto Thermo Test computer diagnostics:

1. **Switching on the heater** (via control element)
2. Remove fuse **F3** for at least 10 s within 10 s after switching on.
3. Reinsert fuse **F3**
4. **Switching off the heater** (via control element)

With Webasto Thermo Test computer diagnostics:

See Chapter "5.3.1 Without Webasto Thermo Test PC Diagnostics" on page 502.

5.5 Fault code table (fault codes, flash codes)

*: Indicator lamp of control element flashing: Number of long flash pulses after 5 short flash pulses

Fault code (analogue)	Fault code (hexadecimal)	Error message	Possible causes	Recommended action in workshop			
F00 or 0*	F01 F81 F91 F92 F2C FA3 F07 FAC	No error	Fuses	Check fuses F1, F2 and F3			
			Electrical wiring	<ul style="list-style-type: none"> Check battery connections: + at 12 / - at 9 / + at 3 (switch-on signal), connector X8 Check control element Check contacts of W-bus cable (yellow cable) 			
			Heater lock-out	Delete heater lock-out			
			Control unit defective	Replace control unit			
F01 or 1*	F02 F82 F4E F32	No start	Fuel system	Check fuel level Check fuel filter Checking tank extracting device and fuel line for leaks Bleed fuel system			
			Combustion air / exhaust line	Check combustion air/exhaust line for foreign objects and clean if necessary			
			Burner unit	<ul style="list-style-type: none"> Clean burner unit or replace if necessary Check glow plug 			
			F02 or 2*	F03 F83	Flame abort	Fuel system	Check fuel level Check fuel filter Checking tank extracting device and fuel line for leaks Bleed fuel system
			Burner unit			Clean burner unit or replace if necessary	
F03 or 3*	F04 F84	Supply voltage too high	Power supply			Check battery Check electrical connections	
F04 or 4*			F05			Flame was detected prior to combustion	Exhaust gas temperature sensor defective
F06 or 6*	F14 F94	Temperature sensor short circuit	Wiring	<ul style="list-style-type: none"> Check wiring for damage Check resistance 			
			Coolant temperature sensor defective	Check operation of coolant temperature sensor, replacing if necessary			
F07 or 7*	F08 F88	Fuel pump short circuit	Wiring	Check wiring for damage, break and short-circuit			
			DP42 fuel pump defective	Check operation of fuel pump, replacing if necessary			
F08 or 8*	F09 F89 F2D	Combustion air fan short circuit	Wiring	Check wiring for damage, break and short-circuit			
			Combustion air fan blocked	Check operation of combustion air fan, replacing if necessary			
			Combustion air fan defective	Replace combustion air fan			

5 Malfunctions and troubleshooting

Thermo Pro 90

*: Indicator lamp of control element flashing: Number of long flash pulses after 5 short flash pulses

Fault code (analogue)	Fault code (hexadecimal)	Error message	Possible causes	Recommended action in workshop
F09 or 9*	F8A F19 F99	Glow plug / flame monitor short circuit	Wiring	Check wiring for damage, break and short-circuit
			Glow plug defective	Check operation of glow plug, replacing if necessary
F10 or 10*	F06 F07 F86	Heating unit overheated	Heating unit overheated	Check coolant level, bleed coolant circuit
				Check operation of coolant pump
			Overheating protection defective	Check wiring for damage, break and short-circuit
				Check operation of overheating protection, replacing if necessary
F11 or 11*	F0B F8B	Coolant pump short circuit	Wiring	Check wiring for damage, break and short-circuit
			U4840 coolant pump defective	Replace coolant pump
F12 or 12*	F16	Battery disconnecter or electronic battery switch short-circuit	Wiring	Check wiring for damage, break and short-circuit
			Electronic battery switch defective	Check power intake of battery disconnecter
F13 or 13*	F13 F30	Vehicle fan power circuit short circuit	Wiring	Check wiring for damage, break and short-circuit
			Vehicle fan relay	Check wiring for damage, break and short-circuit
				Check operation of vehicle fan relay (K5, see Section 11), replacing if necessary
F14 or 14*	F1B FAB	Overheat sensor short circuit	Wiring	Check wiring for damage, break and short-circuit
			Overheating protection sensor defective	Check operation of overheating protection sensor, replacing if necessary
F15 or 15*	F2E	The glow/ignition-element power circuit is defective	Wiring	Check glow plug wiring for damage, break and short-circuit
			Glow plug defective	Check operation of glow plug, replacing if necessary
F16 or 16*	F4F F3B	Exhaust gas temperature too high	Exhaust gas temperature sensor defective	Check wiring for damage, break and short-circuit
			Heater fouled	Check operation of exhaust gas temperature sensor, replacing if necessary
F17 or 17*	F31 F4D	Exhaust-gas temperature sensor: open or short circuit	Wiring	Check wiring for damage, break and short-circuit
			Exhaust gas temperature sensor defective	Check operation of exhaust gas temperature sensor, replacing if necessary

5.6 Troubleshooting (fault symptoms)

Symptom		Possible cause	Corrective measures
A	Heater does not respond, no component running, operation indicator remains off	Operating voltage	<ul style="list-style-type: none"> – Check fuses (F2, F3) – Check power supply: measure supply voltage at heater connector X8, Pin 12 (see Fig. 1112) (VG connector, See Chapter "9.8.1 Legend to connector VG95328R2016PN (if installed)" on page 904.
		Operation indicator (control element or ON/OFF switch)	<p>Operating indicator control element</p> <ul style="list-style-type: none"> – Measure supply voltage at connector X9, Pin 11 – Check continuity at connector X9, Pin 12 to ground <p>Operation indicator, switch:</p> <ul style="list-style-type: none"> – Measure supply voltage at switch S4, Pin A – Check continuity at switch S4, Pin F to ground
B	Heater will not start, briefly starts up then switches immediately to afterrunning, operating indicator flashing (fault code output, See Chapter "5.5 Fault code table (fault codes, flash codes)" on page 503.	DP42 fuel pump	<p style="text-align: center;">ATTENTION</p> <p>Always operate the fuel pump via the heater. Never connect directly to 12V or 24V supply.</p> <ul style="list-style-type: none"> – Check fuel line connection at fuel pump DP42 – Connect Webasto Thermo Test and evaluate. – Ensure clear passage and seating of the flat spring contacts of the fuel pump line. – Measure cold resistance of fuel pump DP42 at 25 °, see Section 6.4.5 Setpoints: 4.95 to 5.45 ohm, test current: < 1 mA
		Combustion air fan	<ul style="list-style-type: none"> – Check exhaust system and air intake system (see 'Excess smoke from heater during start-up phase') – Connect Webasto Thermo Test and evaluate. <ul style="list-style-type: none"> • Set speed of 5500 rpm • Listen for grinding noise and start-up noise. Start up to the specified speed must be heard. • The error message "Fan motor stiff" must not be activated – Short-circuit or break. Check fan wiring
		U4840 coolant pump	<ul style="list-style-type: none"> – Check coolant level – Connect Webasto Thermo Test and evaluate. Switch on component test via Webasto Thermo Test, touch pump with your hand, the pump is operating if slight vibration can be felt – Check wiring – Check self-bleeding position, see Section 7.5.2
		Coolant temperature sensor	<ul style="list-style-type: none"> – Check coolant level – Connect Webasto Thermo Test and evaluate. – Check cold resistance of coolant temperature sensor, see Section 6.4.1. Setpoints (at 25 °C): 990 to 1010 ohm, test current < 1 mA
		Glow plug	See symptom A, glow plug

5 Malfunctions and troubleshooting

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Symptom		Possible cause	Corrective measures
C	Excessive smoke from heater during start-up phase	Glow plug	<ul style="list-style-type: none"> – Connect Webasto Thermo Test and evaluate. – Measure glow plug resistance at glow plug connector X2, see Section 6.4.2. Measured values: (cold resistance at 25 °C): <ul style="list-style-type: none"> • 0.235 to 0.305 ohm, 12 V version • 0.670 to 0.870 ohm, 24 V version (green mark on glow plug)
		DP42 fuel pump	See symptom B, DP42 fuel pump
		Combustion air fan	See symptom B, combustion air fan
		Fuel integration	<ul style="list-style-type: none"> – Check fuel level and fuel take-off from fuel tank – Check integration in the vehicle's fuel system – Check fuel lines for leaks, kinks and clogging, especially in the area of line connectors on the intake side – Disconnect fuel line from heater, hold hose in a collection container and operate the fuel pump with Webasto Thermo Test PC Diagnostics. (Measured fuel delivery rate 115 ml/h*Hz) Fuel should be free of bubbles – The fuel pipe of the burner unit is clogged if fuel flows out of the line when it is disconnected from the heater, replace burner unit
		Exhaust system and air intake system	<ul style="list-style-type: none"> – Check that the lines are not clogged – Rectify any leaks in the intake line and exhaust pipe (no CO₂ in intake air) – Exhaust pipe outlet is not located under the intake line inlet. – Check that intake line and exhaust pipe are installed in accordance with installation instructions – Check that there is sufficient distance from the interior fresh air intake to the vehicle
		Burner unit	<ul style="list-style-type: none"> – Removal and visual inspection – Replace the burner unit if the fuel pipe is clogged
D	Heater goes out prematurely	Undervoltage detection	<ul style="list-style-type: none"> – Check fuses (F2, F3) – Webasto Thermo Test PC Diagnostics, check supply voltage – Without Webasto Thermo Test: measure supply voltage at heater connector X8, Pin 12 (see Fig. 1112). Setpoints: <ul style="list-style-type: none"> • 12 V version: The voltage must not drop below 10.5 V for more than 10 s • 24 V version: The voltage must not drop below 20.0 V for more than 10 s
		DP42 fuel pump	See symptom B, DP42 fuel pump
		Combustion air fan moves stiffly	See symptom B, combustion air fan
		Fuel integration	See symptom C, fuel integration
		Coolant circuit	<ul style="list-style-type: none"> – Check integration in vehicle's coolant circuit in accordance with general installation instructions. Remove kinks and chafing points. – Check heater, water connection, coolant pump and hoses for leaks, rectifying if necessary – Check that coolant circuit is bled correctly – Check circulation in coolant circuit
		Exhaust system and air intake system	See symptom C, exhaust system and air intake system
		Burner unit	See symptom C, burner unit
E	Irregular combustion noise	DP42 fuel pump	See symptom B, DP42 fuel pump
		Burner unit	See symptom C, burner unit

Symptom		Possible cause	Corrective measures
F	Excessive smoke from heater during heating phase	DP42 fuel pump	See symptom B, DP42 fuel pump
		Fuel integration	See symptom C, fuel integration
		Exhaust system and air intake system	See symptom C, exhaust system and air intake system
		Burner unit	See symptom C, burner unit
G	Heater running, vehicle interior cold	Vehicle blower	<ul style="list-style-type: none"> – Check fuse F1 – Check coolant temperature (K5 switches at approx. 30 °C) – Check switching signal at relay K5, ground at Pin 85 and positive at Pin 86, (audible, see wiring diagram in general installation instructions) – Check coolant temperature signal line (green/white, gr/ws), Pin 86 at K5
H	Excessive smoke from heater during afterrunning phase	Exhaust system and air intake system	See symptom C, exhaust system and air intake system
I	Fuel odour	Fuel integration	See symptom C, fuel integration
		DP42 fuel pump	See symptom B, DP42 fuel pump
		Glow plug	See symptom A, glow plug
J	Smell of exhaust in vehicle interior	Exhaust system and air intake system	See symptom C, exhaust system and air intake system
K	Coolant loss	U4840 coolant pump	See symptom B, coolant pump
		Coolant circuit	See symptom D, coolant circuit

BUTLER TECHNIK

6 Function checks

6.1 General information

This section describes the checks and settings carried out on the heater and its components in installed and uninstalled state.

CAUTION

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.

6.2 Function checks in the vehicle

1. Set vehicle fan to level 1 - 2 or to the level recommended in the vehicle Owner's Operating instructions.
2. Ensure that the fresh air inlet is free of foreign objects (snow, leaves, etc.) and the pollen and dust filters are clear.
3. Make sure that the coolant circuit and fuel system have been carefully bled according to the vehicle manufacturer's regulations.
4. Switch on heater at the control element.

The coolant pump and combustion air fan start up when the heater is switched on. Check that they can be heard. The heater switches on the vehicle fan when the coolant reaches a temperature of 30 °C. After max. 240 s the exhaust can be heard flowing out of the exhaust silencer or connection socket.

5. Run heater in heating mode. Check heating effect at the outlet nozzles of the vehicle fan.

NOTE

The heating function depends on several factors: The outside temperature, type of vehicle, engine temperature, type of integration in the vehicle's cooling system, quantity of coolant to be heated and the time since start-up must be taken into account for the assessment. The coolant temperature determined by the heater and the coolant or engine temperature displayed by the vehicle may differ significantly as the corresponding sensors are fitted in different positions and may evaluate different temperatures.

6. Switch off the heater again at the control element.

6.3 Setting CO₂ content

NOTE

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

ATTENTION

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

The Thermo Pro 90 features automatic altitude compensation. The permissible operating altitude of the heater is therefore between 0 and 3500 m above sea level.

It is possible to change the level of combustion air by changing the CO₂ setting with Webasto Thermo Test PC diagnostics.

Checking and setting the CO₂ content

- Using the Webasto Thermo Test PC diagnostics, set the heater to "CO₂ Setting" mode. The heater start up automatically and then switches to "burner operation". It runs at a heating output level of 7.6 kW which is used solely for the purpose of setting the CO₂ content, i.e. the heating capacity must remain at 7.6 kW for several minutes (approx. 10 minutes) as per Webasto Thermo Test PC diagnostics. The coolant temperature should be kept as low as possible. The greatest amount of heat is dissipated by the vehicle fan (fan and interior temperature set to maximum).
- Set the CO₂ value as shown in Fig. 601 on Page 602. When setting:
 - Increasing CO₂ content => combustion air fan delivers more air => measured CO₂ level should drop.
 - Decreasing CO₂ content => combustion air fan delivers less air => measured CO₂ level should rise.

ATTENTION

Due to the automatic altitude compensation by the heater, the CO₂ content should be set only with Webasto Thermo Test PC diagnostics in "CO₂ Setting" mode.

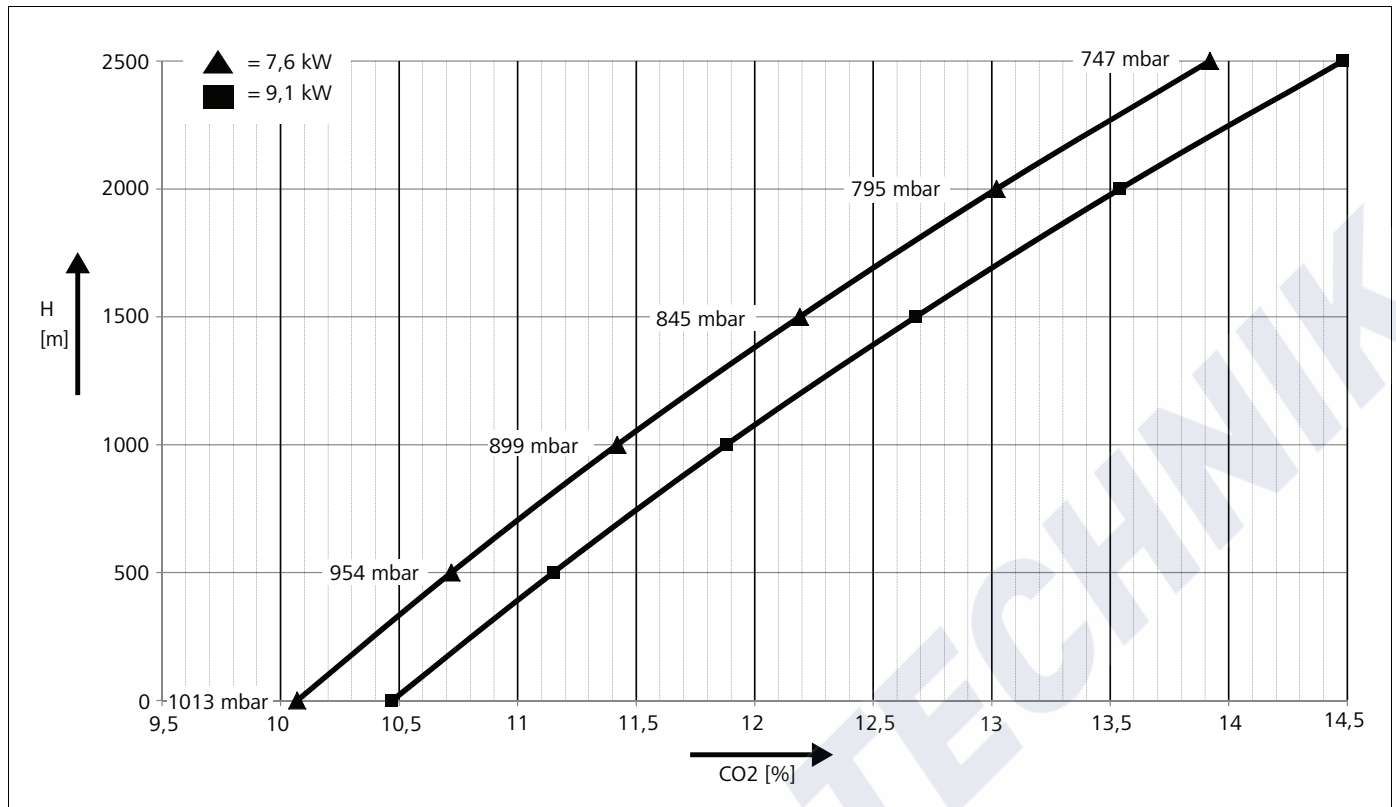


Fig. 601 CO₂ altitude correction

6.4 Testing individual components

6.4.1 Checking resistance of the coolant temperature sensor

When testing with a digital multimeter, the temperature sensor should show the following values:

Resistance at 25 °C: 990 to 1010 Ohm

Test current: < 1 mA

6.4.2 Checking resistance of the glow plug

When testing with a digital multimeter, the glow plug should show the following values:

Glow plug: 12 Volt (red) 24 Volt (green)

Resistance at 25 °C: 270 ± 35 mOhm 770 ± 100 mOhm

6.4.3 Checking resistance of the exhaust gas temperature sensor

When testing with a digital multimeter, the exhaust gas temperature sensor should show the following values:

Resistance at 25 °C: 2195 ± 4 Ohm

Test current: < 5 mA

6.4.4 Checking the combustion air fan

The combustion air fan speed must be checked in the permissible operating voltage range. Check for scraping noise.

NOTE

The combustion air fan is always checked in installed state, i.e. the control unit must be mounted on the fan housing. This is due to the sensors in the control unit that are required for speed control.

The test is performed with the Webasto Thermo Test PC diagnostics.

Specified speed 5500 rpm

Listen for grinding noise and start-up noise. Start up to the specified speed must be heard. The error message "Fan motor stiff" must not be activated.

6.4.5 Checking the DP42 fuel pump

ATTENTION

- The fuel pump must not be operated with the operating voltage (12 or 24).
- Power must not be supplied to the pump when a control unit is connected.

When testing with a digital multimeter, the DP42 should show the following values:

Resistance at 25 °C: 4.95 to 5.45 Ohm

Test current: < 1 mA

Diesel delivery rate:

See "Technische Daten" on Page 401.

6.4.6 Checking the overheating protection

NOTE

The overheating protection should only be removed when it is to be renewed. It must be checked in installed state.

Check continuity of overheating protection at room temperature, the electrical resistance must go towards 0 ohm.

6.4.7 Checking the U4840 coolant pump

The coolant pump should be checked with the component test function in Webasto Thermo Test PC diagnostics. The coolant pump can also be checked by touching it with your hand. Constant vibration of the coolant pump should be felt.

Technical data :
see Page 401

BUTLER TECHNIK

7 Servicing

This section describes the servicing jobs that can be carried out on the heater and its components when installed.

7.1 Working on the heater

Always disconnect the power supply at the vehicle battery and remove fuses F2 and F3 before carrying out any work on the heater. The main battery power must not be disconnected whilst the heater is operating or after running due to the risk of the heater overheating and consequently the overheating safeguard tripping. Completely remove the heater to carry out repairs.

Once the heater and all coolant-carrying components have been installed, the entire coolant system should be filled, bled and checked for leaks at the system pressure as specified by the vehicle manufacturer (see Technical Data).

Refer to the general installation instructions and the vehicle-specific installation instructions for repairs that require the heater to be installed in a different position.

NOTE

Coolant running out of the system should be collected in a suitable container.

7.2 Working on the vehicle

ATTENTION

With the operating voltage applied and the heater is switched off, on no account must a temperature of 125 °C be exceeded in the vicinity of the heater (e.g. vehicle paintwork) (see Technical Data).

7.3 Heater test run

CAUTION

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.

7.4 Checks

To maintain the functional reliability of the heater, the following servicing jobs should be carried out before and after each heating period:

- Read out fault code memory.
- Cleaning heater exterior (make sure no water gets in).
- Check the electrical connections for contact corrosion and firm seating.
- Checking exhaust gas and combustion air line for damage and ensuring they are clear.
- Checking fuel line and strainer for leaks.
- Check coolant circuit and coolant pump for leaks.
- Check hoses for cracks.
- Replacing fuel filter, if fitted.
- Check heater operation as described under section 6.2.

7.5 Removing and installing heater

CAUTION

Hot coolant leaking out can cause burn injuries.

7.5.1 Removal

1. Disconnect vehicle battery.
2. Remove heater fuses.
3. It is not necessary to release the control unit cover to remove the vehicle-specific wiring harness.
4. Unplug the wiring harness connector at the heater (do not pull the cables).
5. Depressurise coolant system.

NOTE

Protect all open plugs and connectors from moisture and dirt.

6. Release hose clips and detach the coolant hoses from the water connection pieces on the heater. Prevent coolant from dripping out of the coolant hoses.
7. Release and detach combustion air line and exhaust pipe at heater.
8. Release hose clips, detach fuel line. Close off fuel connection socket at heater and fuel line with suitable plugs or similar.
9. Remove the three screws and washers from the heater mounting bracket.
10. Remove the heater.

7.5.2 Installation

1. Place heater in installation position and secure with the 3 screws and washers.
2. Connect fuel line and secure with hose clip.
3. Connect coolant hoses and tighten hose clips to 8 Nm.
4. Reestablish all electrical connections.
The 12-pin vehicle-specific wiring harness connector and the 2-pin fuel pump connector must audibly snap in.
5. Connect combustion air line and exhaust pipe.
6. Connect vehicle battery.
7. Bleed coolant circuit.
8. Bleed the vehicle fuel system if necessary.

ATTENTION

Reversing the polarity of the power supply can damage the control unit. Ensure correct polarity of the connection cables. Direct connection to the power supply without an intermediate fuse is not permitted.

7.6 Visual inspection to assess the burner unit

Pay attention to the specific features of the burner unit when it needs to be replaced or is faulty.

The criteria for a thorough check are listed in the following. To remove and install the burner unit: See "Burner unit and glow plug" on Page 805.

First check that the burner unit is complete and not damaged.

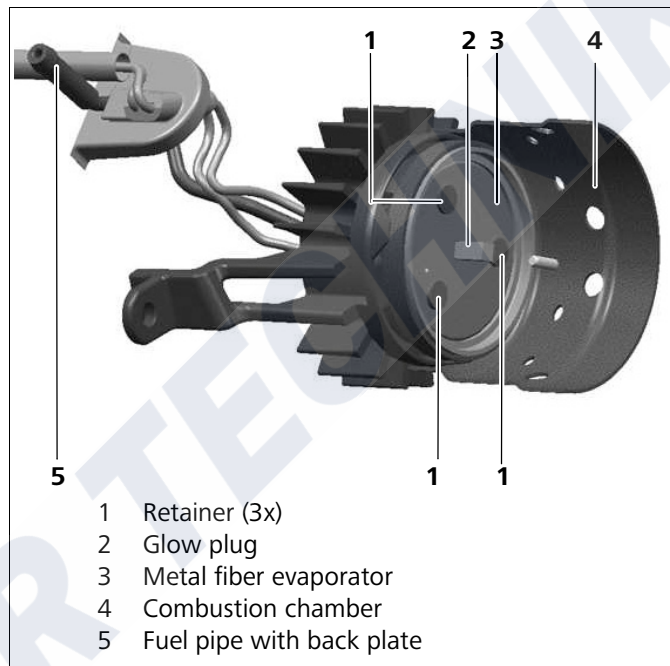


Fig. 701 Visual check, burner back plate

7.6.1 Metal fiber evaporator

- Cracks, flaking as well as black or other discoloration of the metal fiber evaporator (3, Fig. 701) will not cause the burner to fail and do not impair operation.
- Carbon deposits on the evaporator surface are normal; the burner unit normally cleans itself when changing from full load/partial load and partial load/full load.
- The burner unit must be replaced when the metal fiber evaporator is partially burnt through.
- The burner unit must be replaced when the retaining ring is deformed such that the metal fiber evaporator is not pressed down correctly.

7.6.2 Combustion chamber

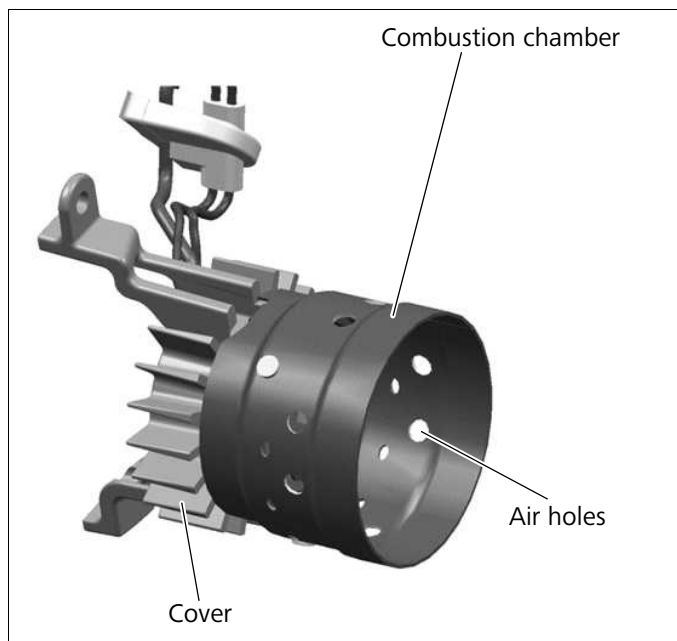


Fig. 702 Combustion chamber

- The cover and the combustion chamber (Fig. 702) must be firmly secured and have no play (check by lightly moving). The burner unit must otherwise be replaced.
- The burner unit must be replaced if there is a radial gap between the combustion chamber and cover.
- The fuel pipe must be firmly secured to the back plate and must have no play (check by lightly moving the fuel pipe).
Replace the burner unit if there is play between the fuel pipe and back plate.
The combustion chamber (Fig. 702) should not be damaged (e.g. dented). A dented combustion chamber can cause poor combustion or coking of the heater. The burner unit should be replaced in this case.
- The air holes (Fig. 702) in the burner unit should not be clogged. Clogged air holes can result in the burner not starting or poor combustion.
Carefully scrape the air holes clear.
- The metal fiber evaporator will not fit correctly if the retainers (3x) are deformed or missing.
The burner unit should be replaced in this case.

7.7 Restarting

Carefully bleed the coolant circuit and the fuel supply system after installing the heater. Follow the vehicle manufacturer's specifications. During the test run, check all coolant and fuel connections for leaks and that they are firmly fitted. If the heater encounters a fault during operation, perform the troubleshooting procedure to locate the malfunction (see Section 5).

To assist the coolant circuit bleeding procedure, operate the coolant pump with the "component test" function in Webasto Thermo Test PC diagnostics.

ATTENTION

The coolant temperature must be $< 60\text{ }^{\circ}\text{C}$ before the heater starts up otherwise burner operation may not take place. The heater is to be placed into operation with Webasto Thermo Test PC diagnostics. If completely empty, the fuel line should be filled by means of Webasto Thermo Test PC diagnostics: press the "Fill Line" button and pump fuel up to the heater. During the heater test run, check all coolant and fuel connections for leaks and that they are firmly fitted.

8 Repairing and replacing components

8.1 General information

This section describes the repair jobs that can be carried out on the heater after it has been removed from the vehicle. Any further dismantling will invalidate the warranty. For assembling the heater only use the spare parts from the corresponding spare parts kits.

8.2 Component layout

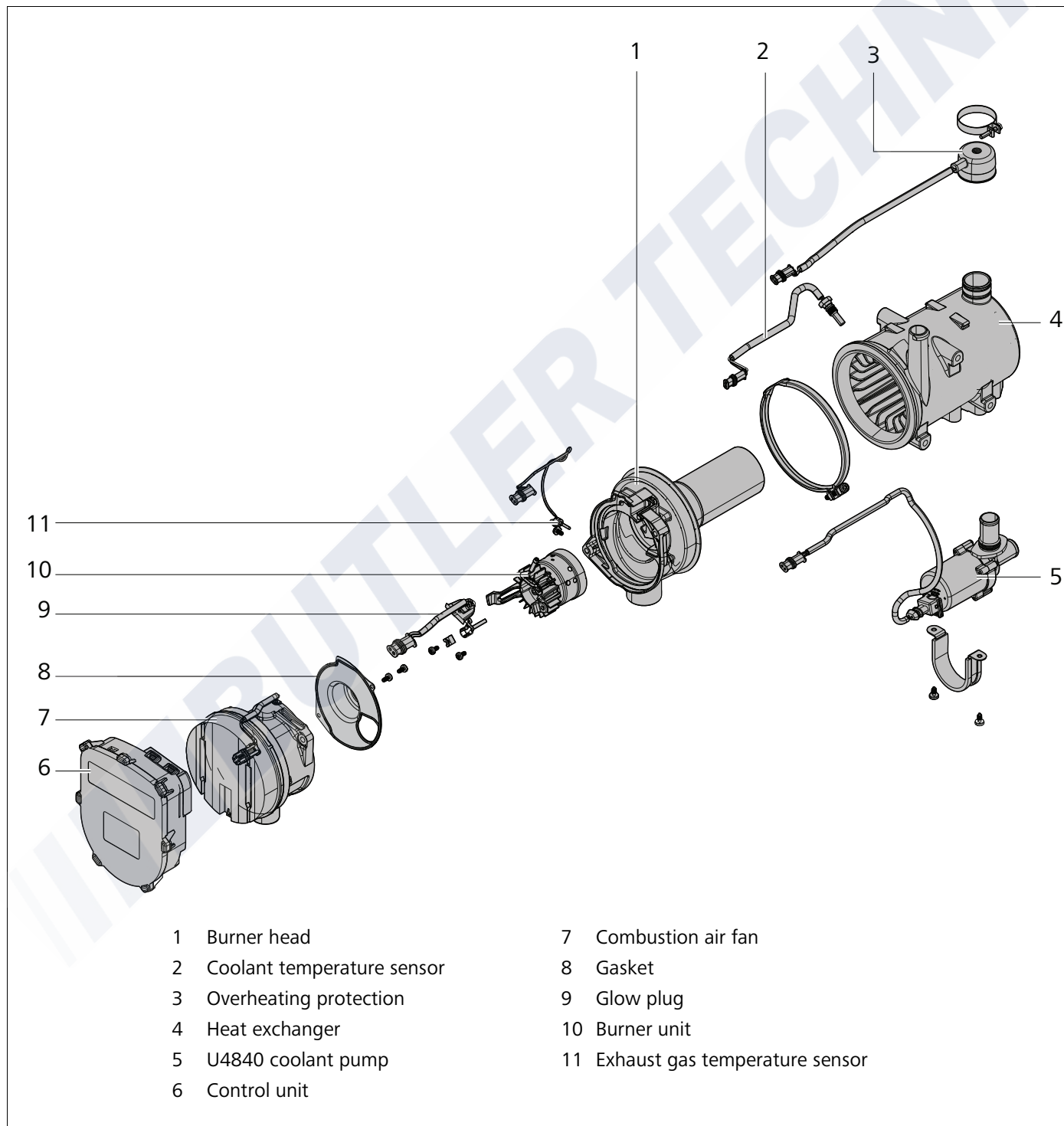


Fig. 801 Component layout

8.3 Work on stripped down components

NOTE

Seals should generally be renewed before reassembling the heater.

Cleaning

Clean all stripped down components.

Visual inspection

- Check all components for damage (cracks, deformation, wear, etc.) and replace as required.
- Inspect the connectors and cables for corrosion, loose contacts, crimping faults, etc. and repair as required.
- Check plug contacts for corrosion and contacts to ensure they are secure, repairing if necessary.

8.4 Electrical connections

All electrical connections are connected separately with individual connectors in the control unit. Before removing a component first unplug the corresponding electrical connection. See Chapter 11.15 "Plug assignments at control unit" on page 1111.

8.5 Control unit

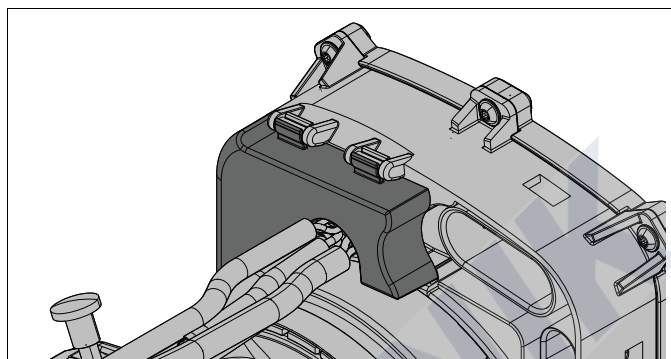


Fig. 802 Control unit cover

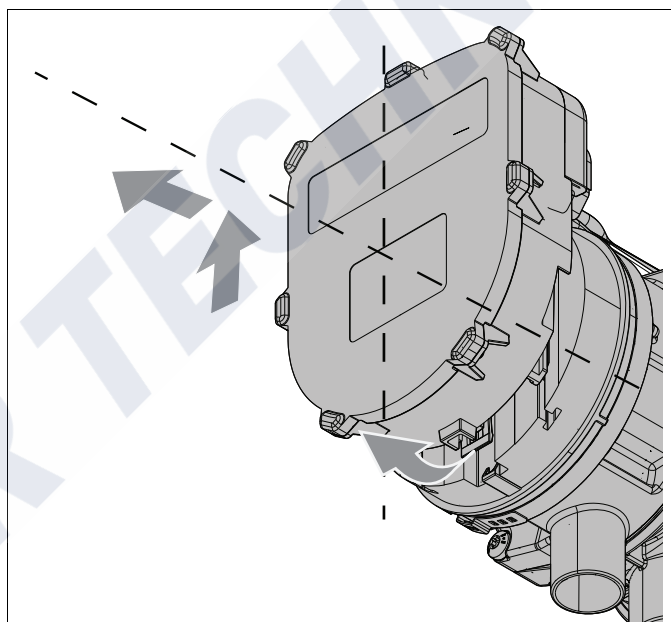


Fig. 803 Control unit

Removal

1. Remove control unit cover (see Fig. 802)
2. Unplug electrical connections (see section 8.4).
3. Release control unit and detach from the cap of the combustion air fan.

Installation

1. Slide control unit onto the cap of the combustion air fan until the clip snaps in.
2. Reestablish electrical connections (see section 8.4).
3. Close control unit cover so that it snaps in.

ATTENTION

It is important to follow the correct procedure when plugging in the individual connectors at the control unit. This means, all connectors are pushed by hand as far as they will go into the respective position in the control unit. The control unit cover is then locked. The control unit cover is not a plug insertion aid. It only prevents the connectors from falling out.

8.6 U4840 coolant pump

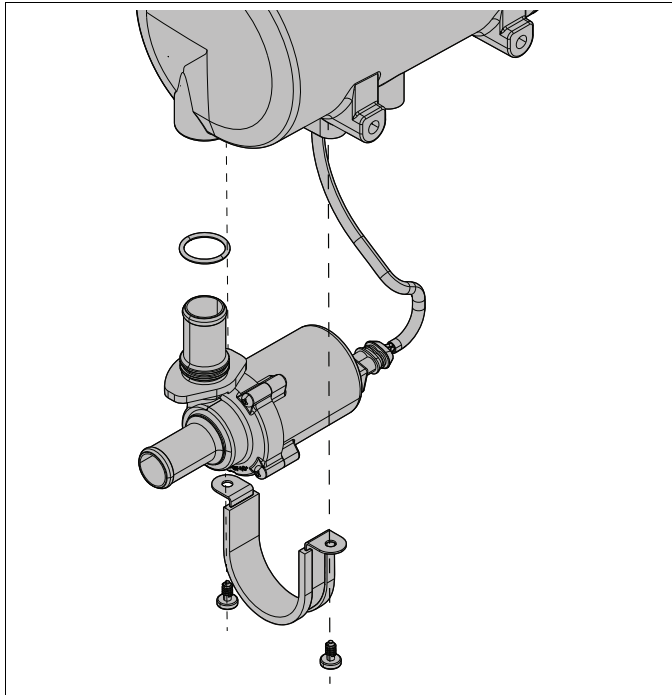


Fig. 804 Replacing the U4840 coolant pump

Removal

1. Remove heater (see section 7.5).
2. Disconnect plug connections (see section 8.4).
3. Undo screws (2x).
4. Remove clip and coolant pump.
5. Complete work on stripped down components (see section 8.3).

Installation

1. Lubricate seal (between coolant pump and heat exchanger) with acid-free grease (Vaseline).
2. Place coolant pump in assembly position and secure with clip and screws.
3. Tighten screws (2x) to **3 Nm** \pm 10%.
4. Plug in connector at control unit (see section 8.4).

8.7 Overheating protection

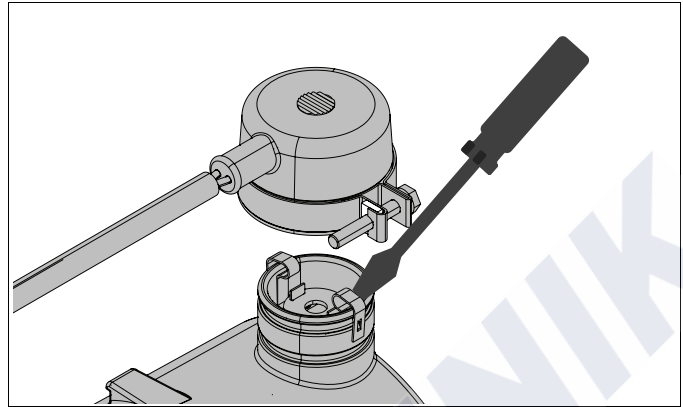


Fig. 805 Removing overheating protection sensor

Removal**NOTE**

- The overheating protection should only be removed when it is to be renewed.
- It must be checked in installed state.

1. Remove heater (see section 7.5) (depending on space requirements).
2. Unplug electrical connections (see section 8.4).
3. Remove clip and detach protective cap.
4. Lever off retaining spring with a screwdriver and remove overheating protection.
5. Complete work on stripped down components (see section 8.3).

Installation**ATTENTION**

Incorrect installation can cause the heat exchanger to burn through.

1. Fit new overheating protection in heat exchanger and press in retaining spring.

NOTE

The spring must be heard and felt to snap into the groove.

This ensures that the overheating protection is installed in the correct position.

If the spring cannot be heard and felt to snap in:

- Clean contact surface of overheating protection on the heat exchanger
- Clean the groove in the heat exchanger
- Make sure that there are locking lugs on both sides of the spring. Replace overheating protection if necessary.

2. Fit protective cap and secure with clip.
3. Tighten clip to **0.5 Nm** \pm 20%.
4. Plug in connector at control unit (see section 8.4).
5. If removed, install heater (see section 7.5).

8.8 Coolant temperature sensor

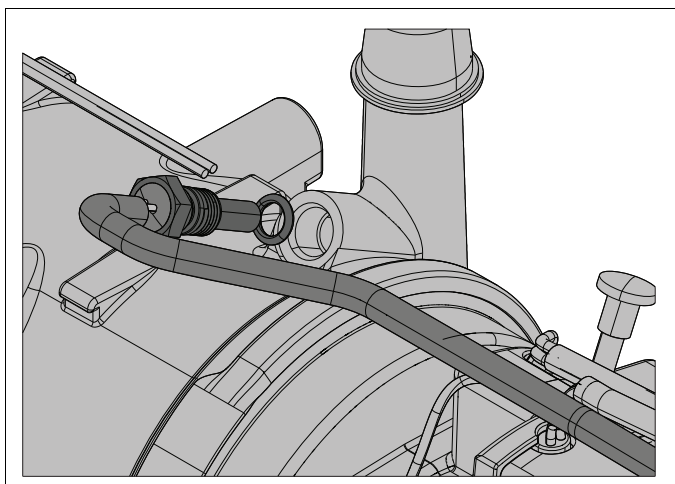


Fig. 806 Coolant temperature sensor removal

Removal

1. Remove heater (see section 7.5).
2. Unplug electrical connections (see section 8.4).
3. Unscrew coolant temperature sensor (Fig. 806) (13 mm hexagon) and remove together with O-ring.
4. Complete work on stripped down components (see section 8.3).

Installation

1. Lubricate O-ring (Fig. 904) with acid-free grease (Vaseline).
2. Screw coolant temperature sensor with O-ring into the heat exchanger and tighten to **1.5 Nm ±10%**.
3. Make electrical connections (see section 8.4).
4. If removed, install heater (see section 7.5).

8.9 Combustion air fan

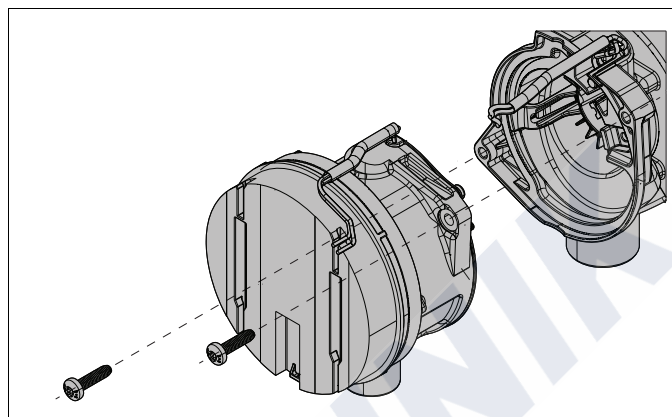


Fig. 807 Combustion air fan removal

Removal

1. Remove heater (see section 7.5), depending on space requirements.
2. Unplug electrical connections (see section 8.4).
3. Remove screws (2x). Detach control unit if necessary.
4. Pull the combustion air fan off the burner head and remove.
5. Complete work on stripped down components (see section 8.3).

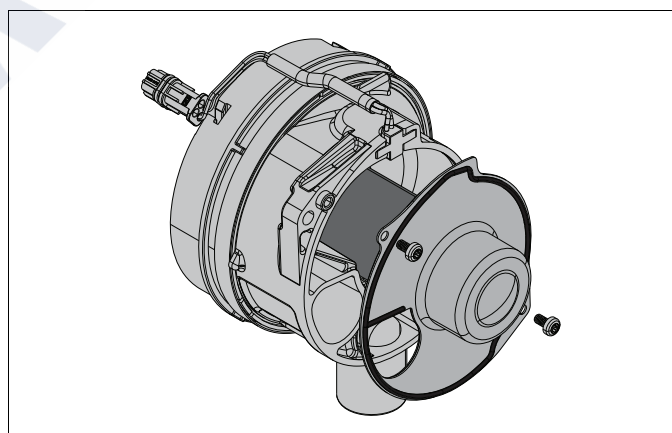


Fig. 808 Seal on combustion air fan

NOTE

Make sure that the seal on the combustion air fan is intact (both sides).

Installation

1. Place the combustion air fan in the assembly position and secure with screws.
2. Tighten screws (2x) to **3 Nm ± 10%**.
3. Fit control unit and reestablish electrical connections (see section 8.4).
4. If removed, install heater (see section 7.5).

8.10 Burner unit and glow plug

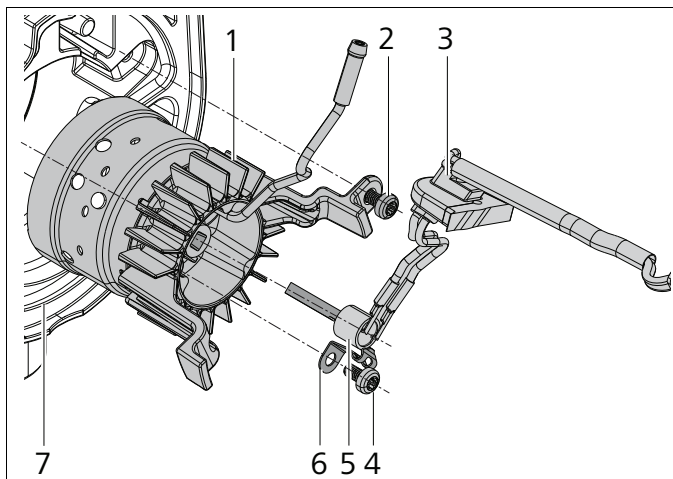


Fig. 809 Burner unit and glow plug

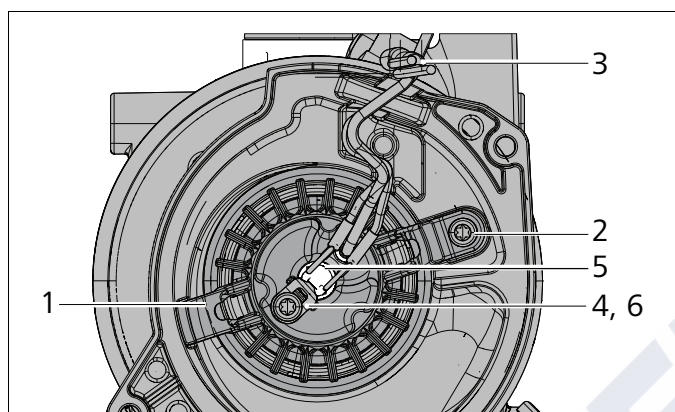


Fig. 810 Burner unit and glow plug, front

Removal

1. Remove heater (see section 7.5), depending on space requirements.
2. Remove combustion air fan (see section 8.9).
3. Remove screw (2, Fig. 809/Fig. 809).
4. Remove burner unit (1) with glow plug socket (3).
5. Remove glow plug:
Detach retaining tab (6) by removing screw (4), detach glow plug socket from fuel line.
6. Complete work on stripped down components (see section 8.3).

Installation

1. Carefully insert the glow plug as far as it will go into the burner unit.
2. Secure retaining tab for glow plug with screw (4) (tightening torque **2.5 Nm ±10%**).
3. Fit glow plug socket on fuel line.
4. Fit burner unit and glow plug socket in the burner head (7).
5. Secure burner unit with screw (2). Tighten screw to **3 Nm ±10%**.
6. Install combustion air fan (see section 8.9).
7. Make electrical connections (see section 8.4).
8. If removed, install heater (see section 7.5).

8.11 Burner head

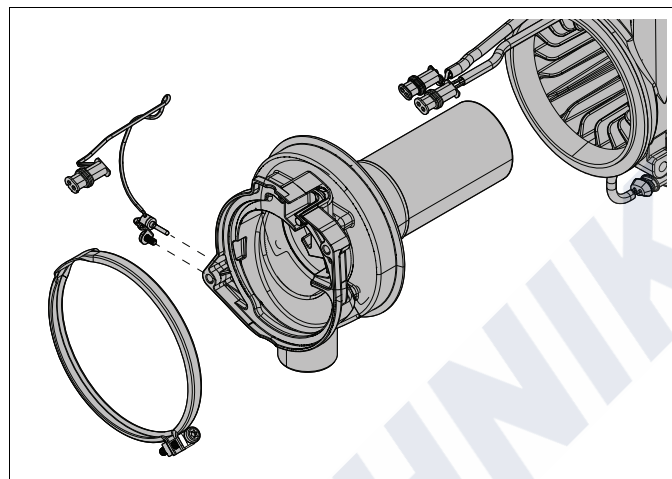


Fig. 811 Burner head

Removal

1. Remove heater (see section 7.5).
2. Remove combustion air fan (see section 8.9).
3. Remove burner unit with glow plug (see section 8.10).
4. Remove retaining screw of V-clip and detach V-clip.
5. Pull burner head out of heat exchanger and remove.
6. Complete work on stripped down components (see section 8.3).

NOTE

When replacing the burner head, the exhaust gas temperature sensor must be removed from the old burner head and fitted in the new burner head. See to section 8.13.

Installation

NOTE

The burner head and exhaust gas outlet socket can still be aligned after installation in the vehicle.

1. Fit burner head in heat exchanger, align if necessary and secure with V-clip.
2. Tighten retaining screw of V-clip to **3 Nm ±10%**.
3. Install burner unit with glow plug (see section 8.10).
4. Install combustion air fan (see section 8.9).
5. Install heater (see section 7.5).

8.12 Heat exchanger

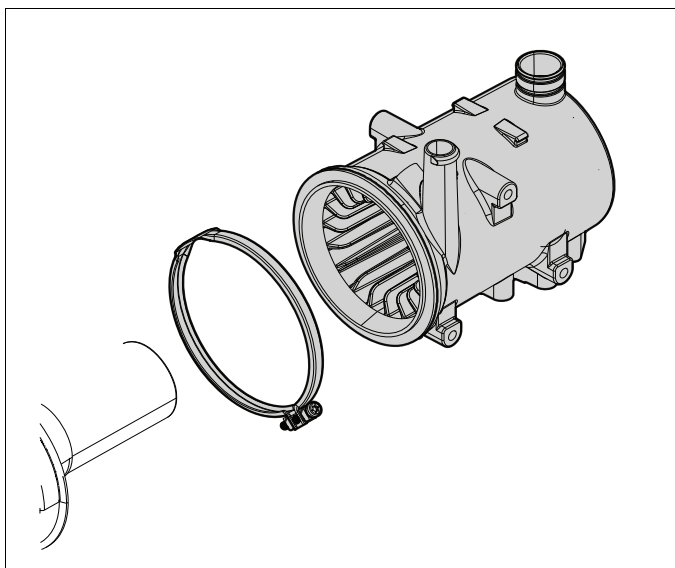


Fig. 812 Heat exchanger

Removal

1. Remove heater (see section 7.5).
2. Remove coolant pump (see section 8.6).
3. Remove overheating protection (see section 8.7).
4. Remove coolant temperature sensor (see section 8.8).
5. Remove burner head and combustion air fan (see section 8.11).
6. Complete work on stripped down components (see section 8.3), check for damage (cracks, deformation etc.) and replace if necessary.
Clean soot from inner jacket of heat exchanger.

Installation

1. Install burner head and combustion air fan (see section 8.11).
2. Install coolant temperature sensor (see section 8.8).
3. Install overheating protection (see section 8.7).
4. Install coolant pump (see section 8.6).
5. Install heater (see section 7.5).

8.13 Exhaust gas temperature sensor

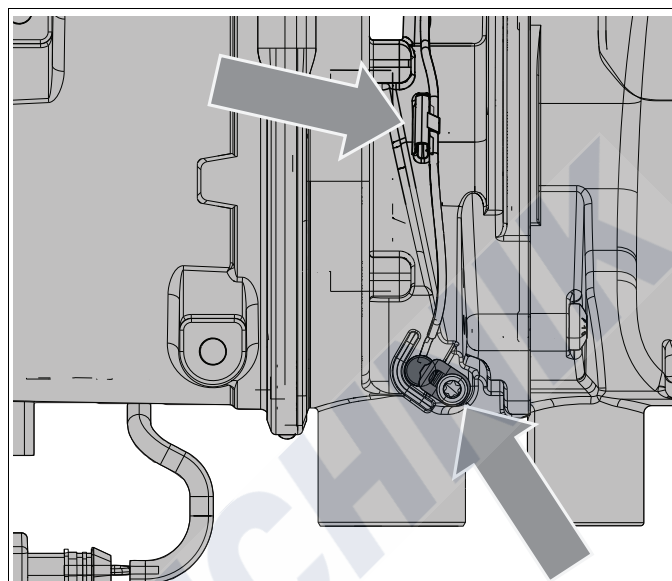


Fig. 813 Exhaust gas temperature sensor with clip

Removal

1. Unplug electrical connections (see section 8.4).
2. Lever cable clip from rib on burner head (make a sketch of the position of the clip if necessary).
3. Release screw connection of holder and pull out exhaust gas temperature sensor.

Installation

1. Fit exhaust gas temperature sensor in burner head.
2. Secure the exhaust gas temperature sensor to the burner head with the holder and screw. Tighten the holder screw to **2.5 Nm ±10%**.
3. Press down the clip to secure the exhaust gas temperature sensor cable to the rib on the burner head. Make sure that the cable is fitted free of stress between the exhaust gas temperature sensor and clip.

NOTE

If the exhaust gas temperature sensor suffers external mechanical damage, this component can be replaced without the need for additional work. Additional work will, however, be necessary if an obvious thermal defect is incurred or no mechanical defect is found despite an error message. This means it is necessary to visually inspect the burner unit, exhaust pipes, the combustion chamber as well as the heat exchanger fins (inner surface). Check for abnormal quantities of soot, fuel residue as well as coking. If this is the case, clean all affected parts. The burner unit should be additionally checked by a specialist technician for thermal damage and replaced if necessary.

ATTENTION

- 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 while the heater is in operation.

Avoid sharp kinks in the cable at the sensor head to prevent damage to the Teflon cable insulation.

Do not pull the cable after fitting the exhaust gas temperature sensor!

Replace the sensor if it is dropped while carrying out maintenance work.

When fitting the sensor, make sure the mica insulator on the sensor is okay, the cable clip of the exhaust gas temperature sensor is fitted without stress and the cable from the exhaust gas temperature sensor is installed loosely to the control unit.

- The cable of the exhaust gas temperature sensor is designed as a high temperature resistant cable with Teflon insulation.

The material can withstand permanent temperatures of up to 185 °C but is sensitive to external mechanical impact.

Before finally determining the installation location of the heater we recommend that you assess the possible risk of damage to the cable as the result of stone impact. If stone impact cannot be ruled out in the place the heater is installed, precautions should be taken to protect the cable of the exhaust gas temperature sensor, e.g. fitting suitable cover.

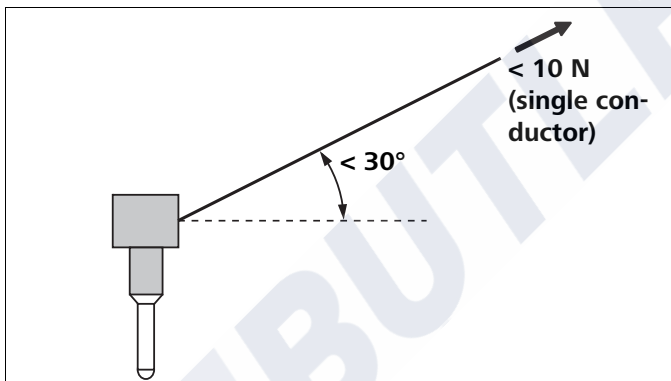


Fig. 814 Burner head and exhaust gas temperature sensor

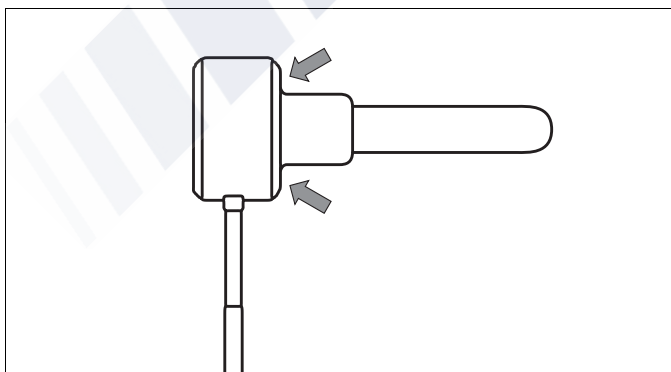


Fig. 815 Checking mica insulator on sensor

9 Thermo Pro 90 HDD

9.1 General information

This section describes the differences between the Thermo Pro 90 HDD and the Thermo Pro 90. Refer to the Thermo Pro 90 specifications in this document for specifications that are not referred to in this section.

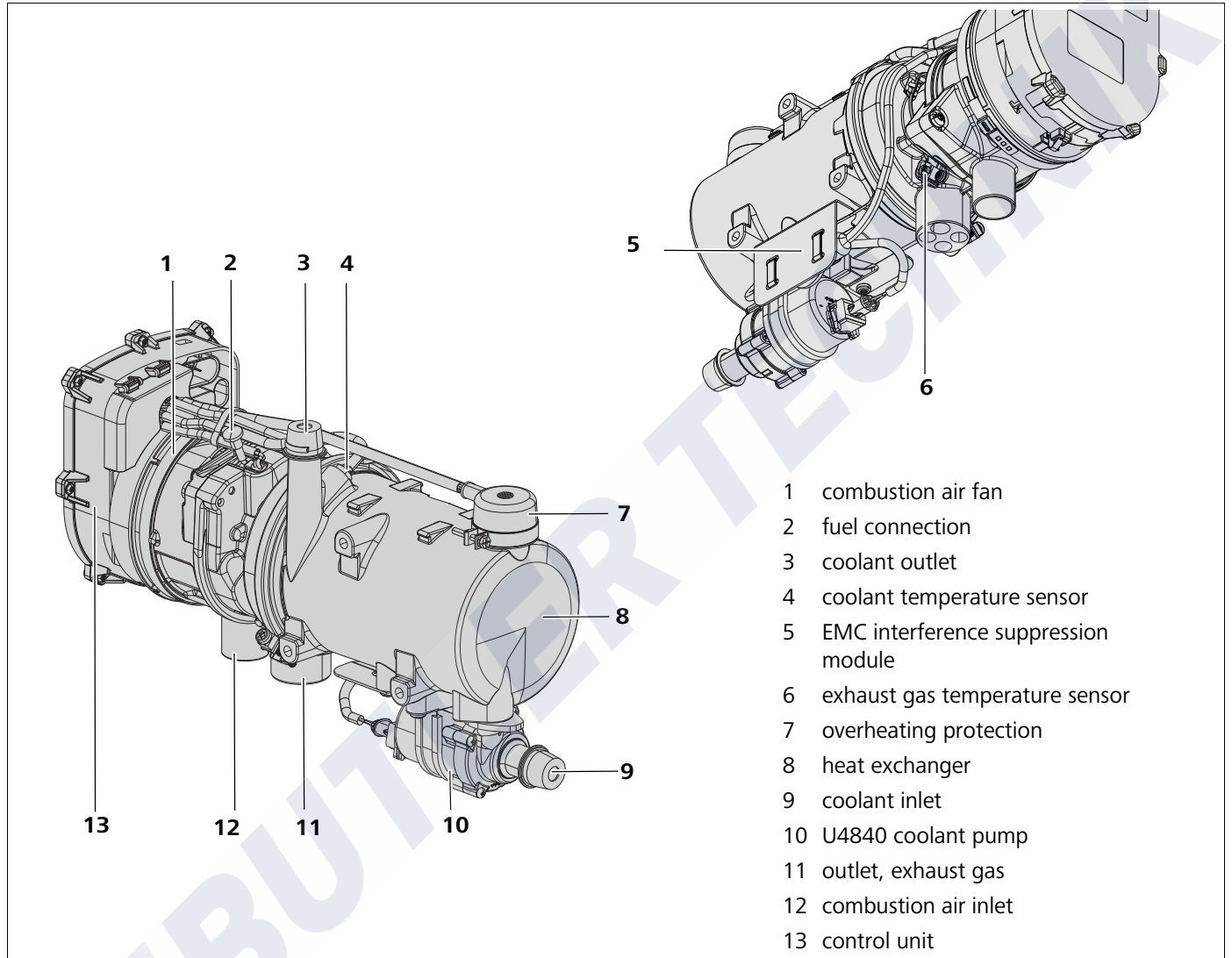


Fig. 901 Thermo Pro 90 HDD heater components

9.2 Technical data

Heater		Thermo Pro 90 HDD*1
		24 V
Approval mark	ECE R122 (heating) ECE R10 (EMC)	00 0443 04 7225
Design		Water heater
Heat flow	Max. Control range	9.1 kW 1.8 to 7.6 kW
Fuel		Diesel DIN EN 590 PME DIN EN 14214 NATO Codes: F34, F35, F63, F44 and F75
Fuel consumption Fuel consumption over control range	Maximum (+/- 10%) Control range (+/- 10%)	1.1 l/h 0.2 to 0.9 l/h
Rated voltage		24 Volt
Operating voltage range		19 to 33 Volt
Rated power consumption without coolant pump and vehicle blower over control range [W] (max.)		37 to 83 W
Permissible ambient temperature: Heater (incl. control unit): - Operation - Storage Fuel pump: - Operation - Storage		-40 to +80 °C -40 to +125 °C (heater off, operating voltage may be applied) -40 to +30 °C -40 to +85 °C
Permissible working pressure of coolant		2.0 bar
Capacity of the heat exchanger		0.15 l
Max. combustion air intake temperature		+40°C
Minimum volume in coolant circuit		6.0 l
Specific volumetric coolant flow	against 0.15 bar	1650 l/h
DP42: fuel pump: specific volumetric fuel flow		115 ml/(stroke*Hz)
DP42 fuel pump: rated voltage		7 - 10 V (PWM actuation)
CO ₂ in exhaust gas (permitted function range)		9 to 12 Vol.-%
CO ₂ setting (at 20 °C and 1010mbar)		10.1 Vol.-%
Heater dimensions (tolerance ± 3 mm)		L = length: 355 (381)*2 mm W = width: 131 mm H = height: 232 mm
Weight		5.0 kg

*1: The Thermo Pro 90 HDD water heater complies with the requirements of the United States Department of Defence concerning the electromagnetic compatibility of products in accordance with the standard MIL-STD-461F.

*2: Length (length of control unit as far as intake connection to coolant pump)

9.3 U4840 coolant pump with EMC suppressor module

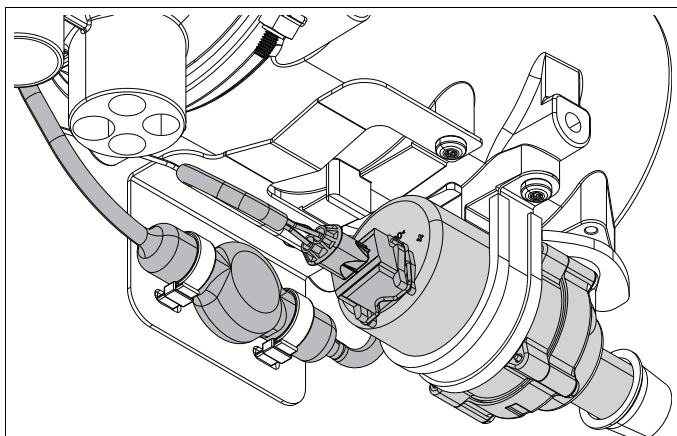


Fig. 902 U4840 coolant pump with EMC suppressor module

NOTE

- Ensure sufficient pull relief of the wiring harness when connecting to the coolant pump.
- After connecting to the control unit, bundle the coolant pump wiring harness together with the other component cables with a cable tie near the control unit.

9.3.1 Replacing the EMC suppressor module

Removal

1. Unplug electrical connections (see section 9.3).
2. Cut through cable tie.
3. Undo holder mountings screws, including ground connection of the EMC suppressor module.

Installation

1. Secure holder and cable lug for ground connection of EMC suppressor module with screws to the heat exchanger housing (tightening torque **6 Nm** +/-10%).

NOTE

Make sure the cable lug is seated correctly when tightening the screw connection. Avoid twisting the cable lug when screwing down.

2. Secure the EMC suppressor module to the inside of the holder with cable ties.

NOTE

The heads of the cable ties should face inwards to facilitate installation of the heater.

3. Establish electrical connections.

9.4 Combustion air fan



Fig. 903 Thermo Pro 90 HDD combustion air fan

NOTE

The Thermo Pro 90 HDD has a special combustion air fan (motor connected to ground).

9.5 Fuel

The diesel fuel in accordance with DIN EN 590 specified by the vehicle manufacturer must be used.

In terms of compatibility the fuels additionally comply with the corresponding NATO Codes F34, F35, F63, F44 and F75. The fuel properties according to the manufacturer's data-sheet must be taken into account.

9.6 Control unit

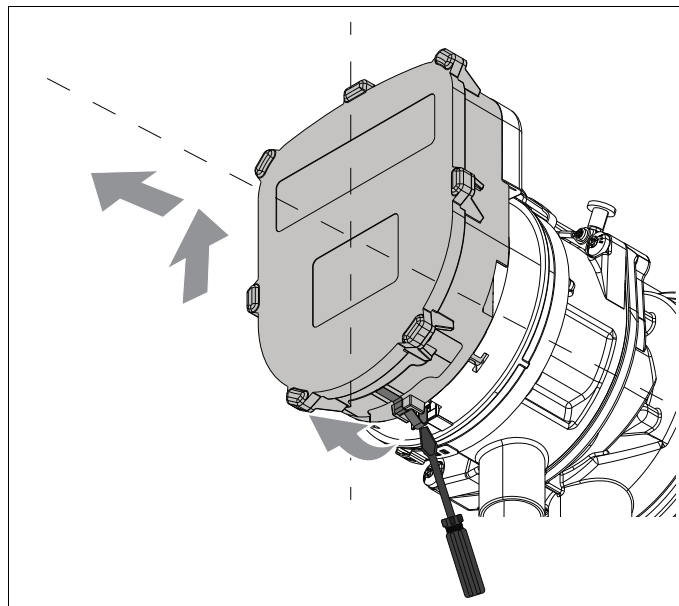


Fig. 904 Thermo Pro 90 HDD control unit

NOTE

For Thermo Pro 90 HDD control unit with retaining spring. The retaining spring must not be removed when replacing/installing the control unit and should be fitted as an assembly with the control unit on the heater.

9.8 Thermo Pro 90 HDD wiring diagrams

See "11 Wiring diagrams" on Page 1101.

9.8.1 Legend to connector VG95328R2016PN (if installed)

VG	Remarks
A	Output, vehicle fan relay
B	Operating indicator/error code output
C	W-bus
D	Power supply (terminal 30)
E	Power supply (terminal 30)
F	Power supply (terminal 31)
G	Power supply (terminal 31)
H	Terminal D+
J	Auxiliary drive
K	Input switch-on signal (ON/OFF)
L	Output, battery disconnecter afterrunning signal
M	CAN GND
N	CAN LOW
P	CAN HIGH
R	Not used
S	Not used

Fig. 905 Connector VG95328R2016PN (if installed)

CAN-Offboard diagnostics

Use similar to W-bus diagnostics with SAEJ1939-compliant diagnostic tools as per Webasto specification.

9.7 Electrical components

NOTE

A minimum bending radius of 110 mm must not be exceeded when using the WDT wiring harness (ID: 9029629_). Avoid mechanical stress at the connection areas.

ATTENTION

The heater must **not** be operated in systems with system voltages stipulated in the standard MIL-STD-1275D 5.3.2.4 (generator-supported systems with voltage peaks up to 100 V).

10 Packaging/storage and shipping

10.1 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.

The temperatures during transportation and storage must not drop below or exceed the ambient temperatures defined in the technical data in the installation instructions.

NOTE

When sending in a complete heater, the unit must be completely drained of fuel. Steps must be taken to ensure that residual fuel or coolant cannot leak out while packing the unit and during shipping.

The coolant connection sockets and fuel connection should be closed off with dummy plugs.

10.2 Storage and transportation

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

Heaters should always be stored in the original or similar packaging in closed rooms!

After removing the delivery packaging, the heaters should only make contact at the aluminium parts. The type label and the surface of the heaters should be protected from damage by placing suitable material under them (e.g. cardboard). The heater should be covered during storage and protected from dust, dirt and moisture.

The heater must not come in contact with chemicals or their vapours, e.g. fuels, battery fluids or brake fluids.

During storage, dirt, water or chemicals must not get into the heater through the openings, see above.

The fuel pipe must be protected from lateral impact that could cause deformation.

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

The electrical contacts and the fuel pipe must be protected from mechanical damage.

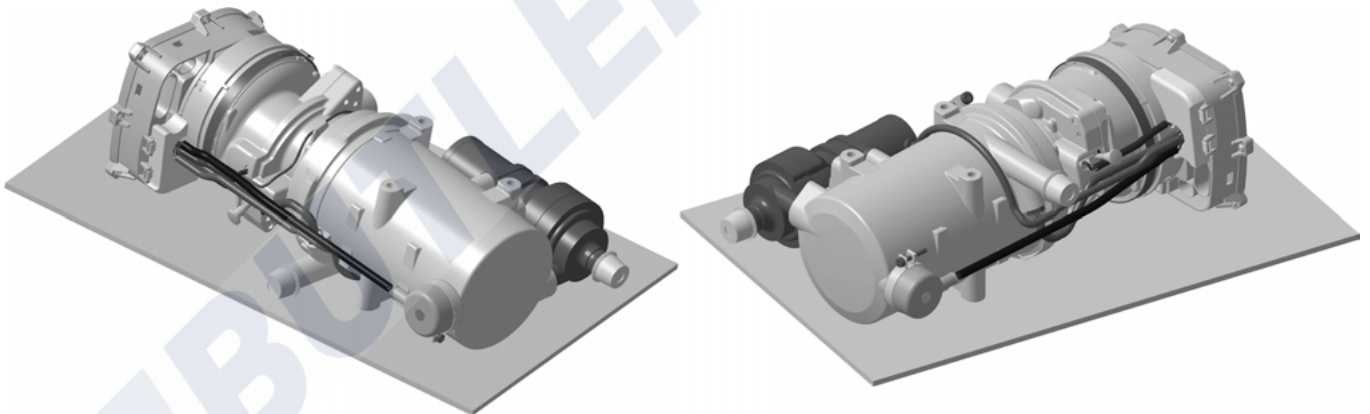


Fig. 1001 Preferred position of Thermo Pro 90 heater for storage and transportation

11 Wiring diagrams

The wiring diagrams show the possible connections for 12 or 24 volt heaters.

11.1 Thermo Pro 90

System wiring diagram for **Thermo Pro 90** and control element:

- MultiControl (battery disconnecter): see Fig. 1102
- SmartControl ADR: see Fig. 1103
- ADR on/off switch: see Fig. 1104
- ThermoCall TC4: see Fig. 1105
- UniBox: see Fig. 1106
- MultiControl (analogue connection): see Fig. 1107

Legend to wiring diagrams:

See:

- Section 11.12 "Cable cross-sections"
- Section 11.13 "Cable colours"
- Section 11.15 "Plug assignments at control unit"
- Section 11.16 "Legend to wiring diagrams"
- Section 11.17 "Legend for comments"
- Section 11.18 "Legend for plug X8, 12-pin"

11.2 Thermo Pro 90 HDD

System wiring diagram for **Thermo Pro 90 HDD** and control element:

- MultiControl: see Fig. 1108
- SmartControl ADR: see Fig. 1109
- with ADR on/off switch: see Fig. 1110

Thermo Pro 90 HDD VG connector pin assignments:

See Section 9.8 "Thermo Pro 90 HDD wiring diagrams"

11.3 System wiring diagram for Thermo Pro 90 with MultiControl control element with battery disconnecter

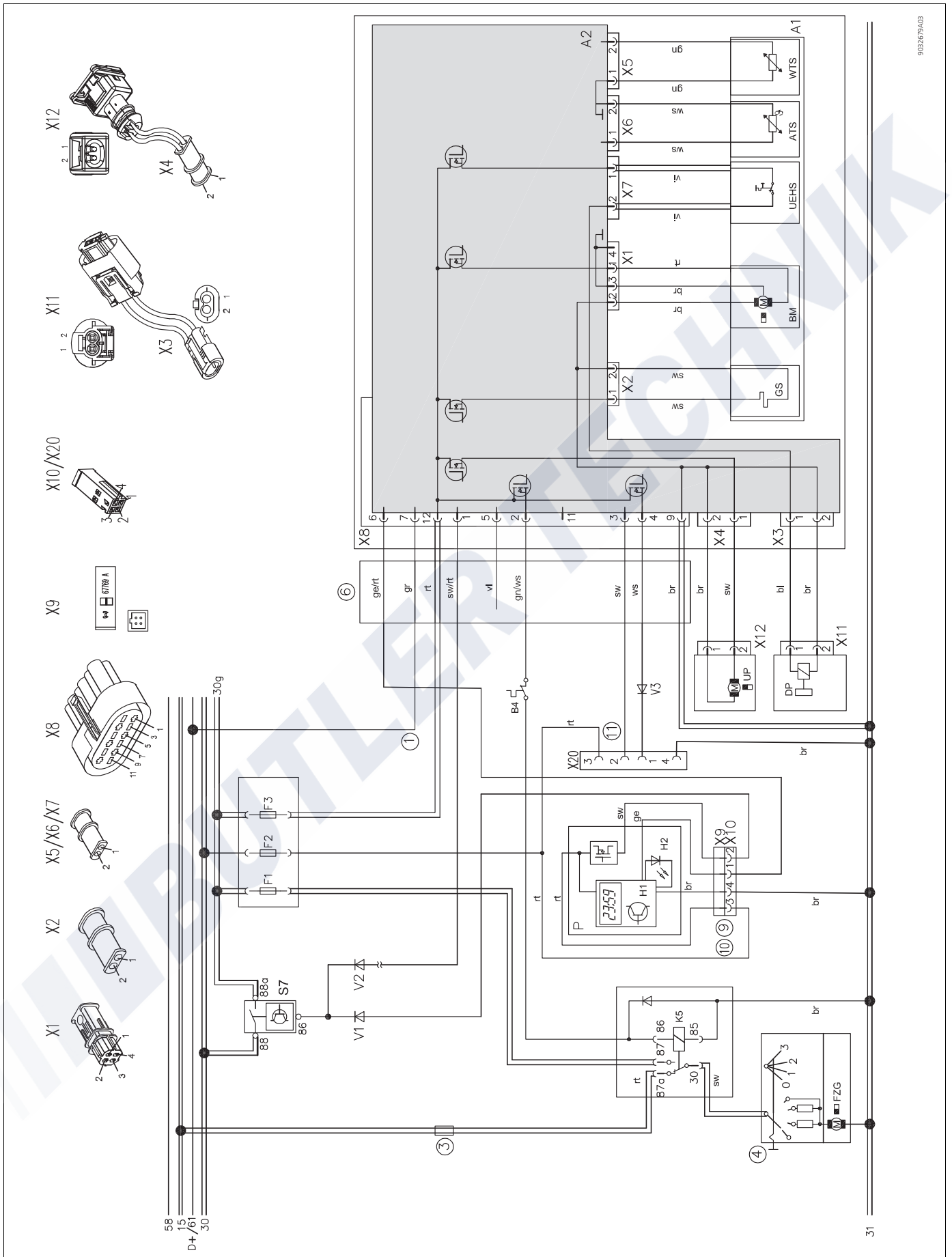


Fig. 1102 System wiring diagram Thermo Pro 90, MultiControl with battery disconnecter

11.4 System wiring diagram for Thermo Pro 90 with SmartControl control element (ADR)

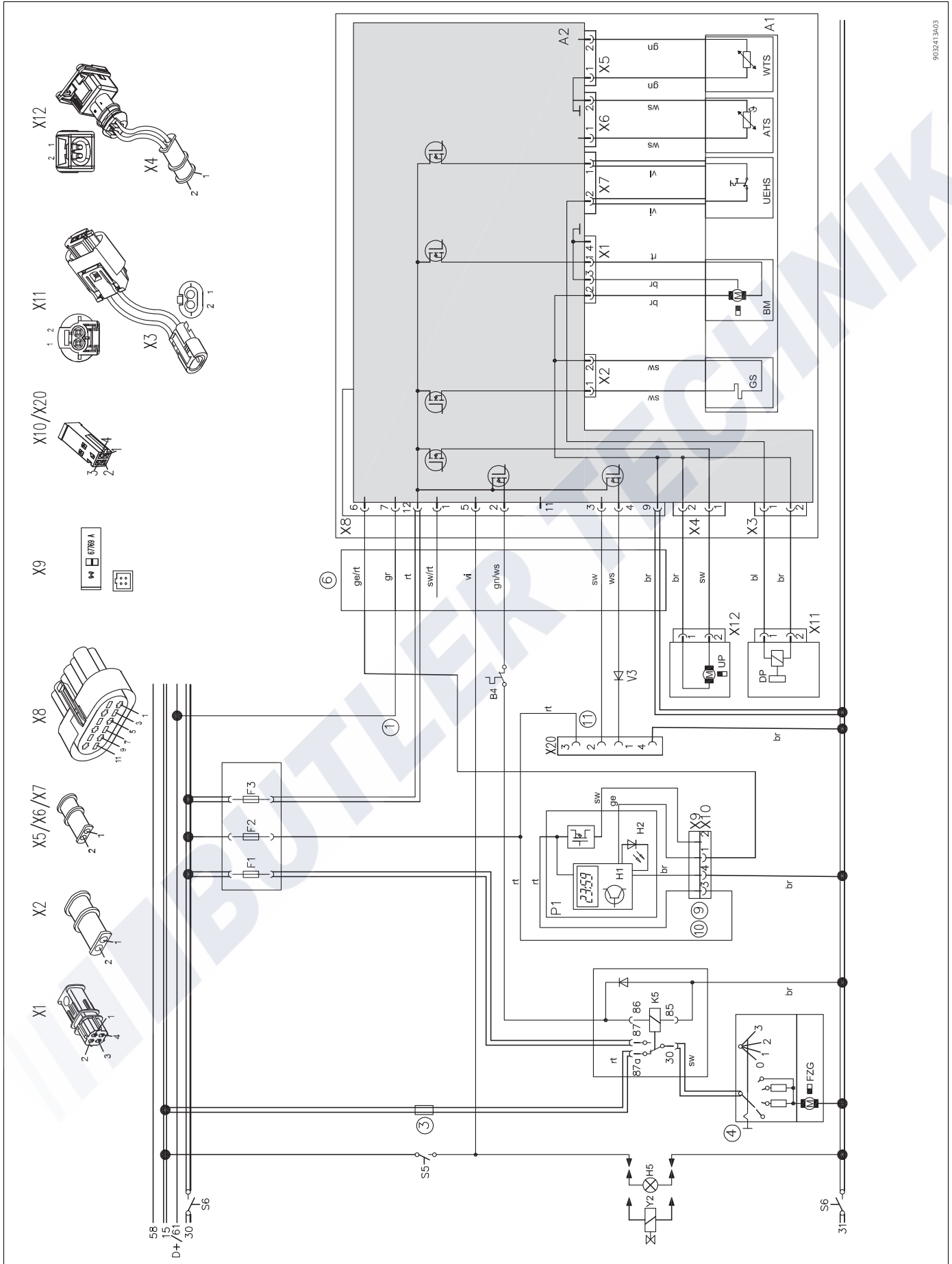


Fig. 1103 System wiring diagram Thermo Pro 90, SmartControl (ADR)

11.5 System wiring diagram for Thermo Pro 90 with on/off switch (ADR)

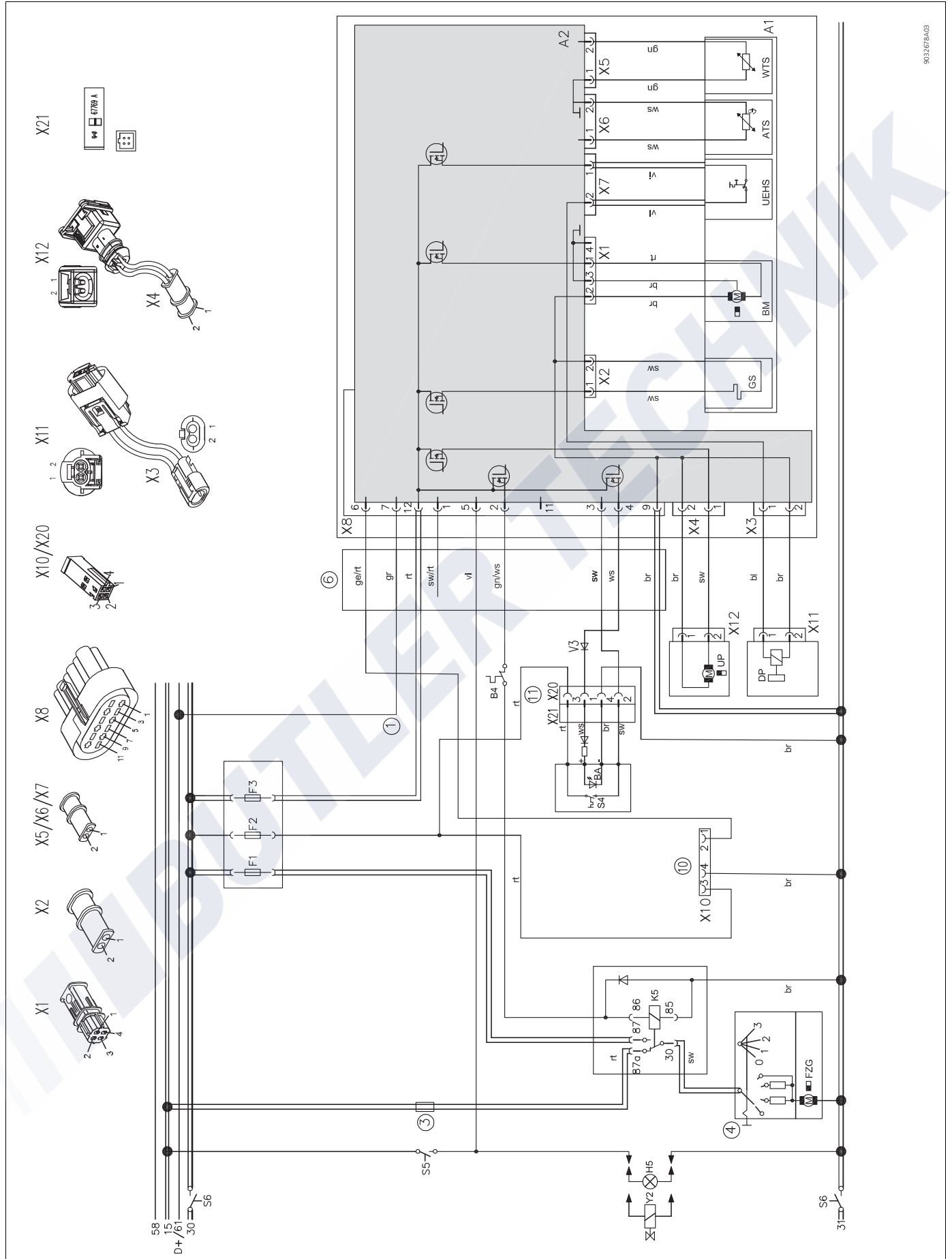
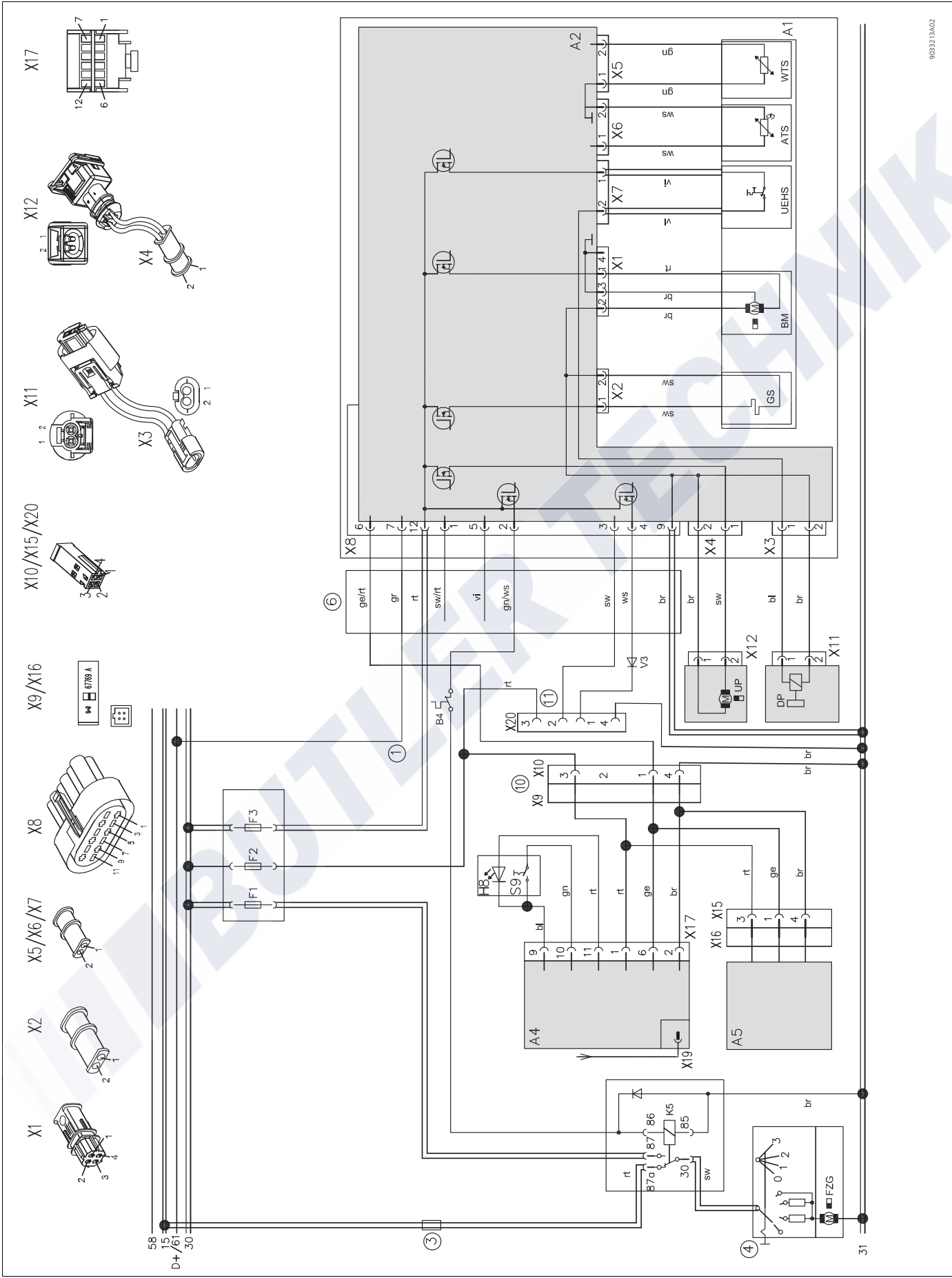


Fig. 1104 System wiring diagram Thermo Pro 90, on/off switch (ADR)

11.6 System wiring diagram for Thermo Pro 90 with ThermoCall TC4



9083213A02

Fig. 1105 System wiring diagram Thermo Pro 90, ThermoCall TC4

11.7 System wiring diagram for Thermo Pro 90 with UniBox

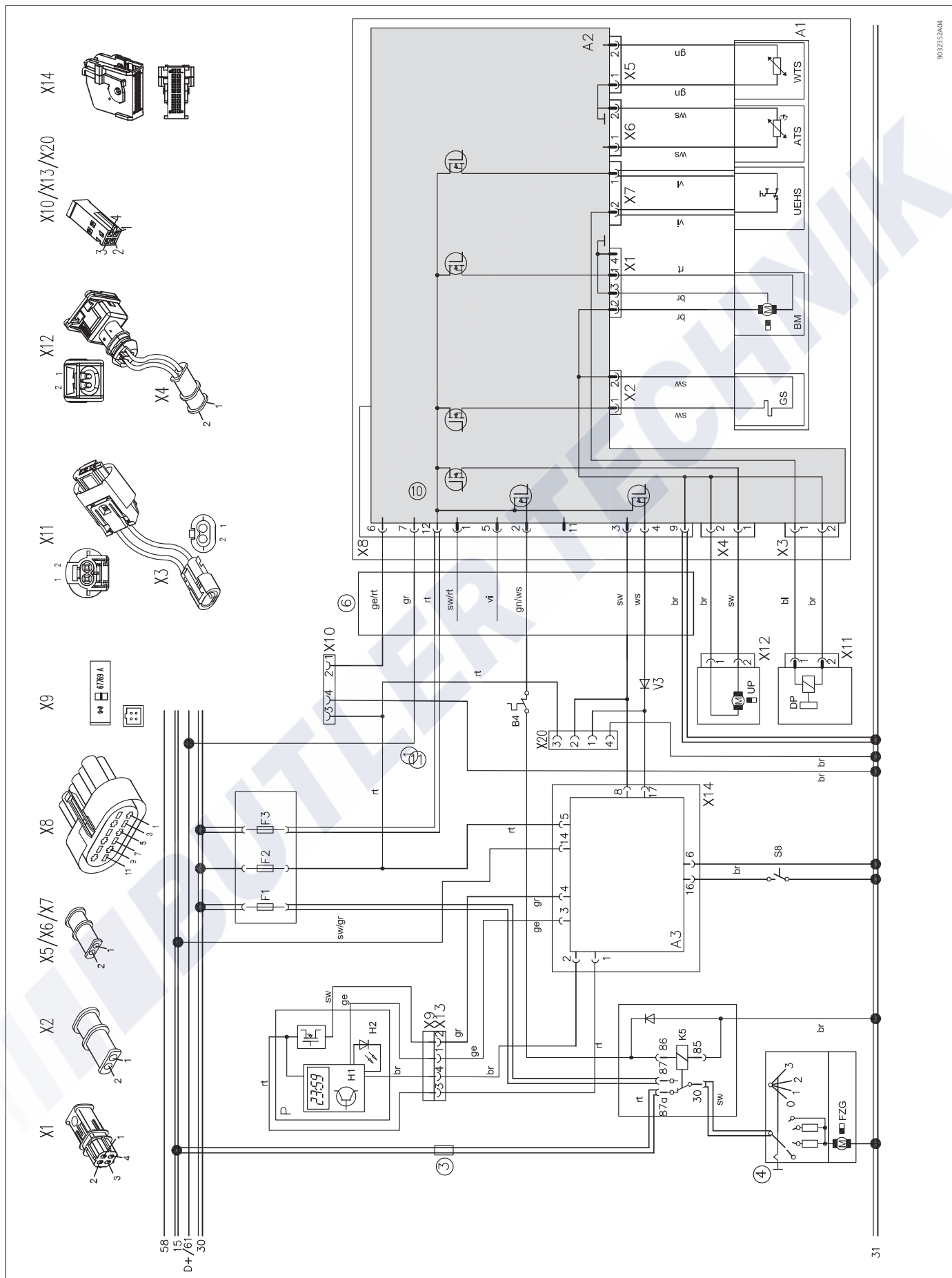


Fig. 1106 System wiring diagram Thermo Pro 90, UniBox

11.8 System wiring diagram for Thermo Pro 90 with MultiControl control element (analogue connection)

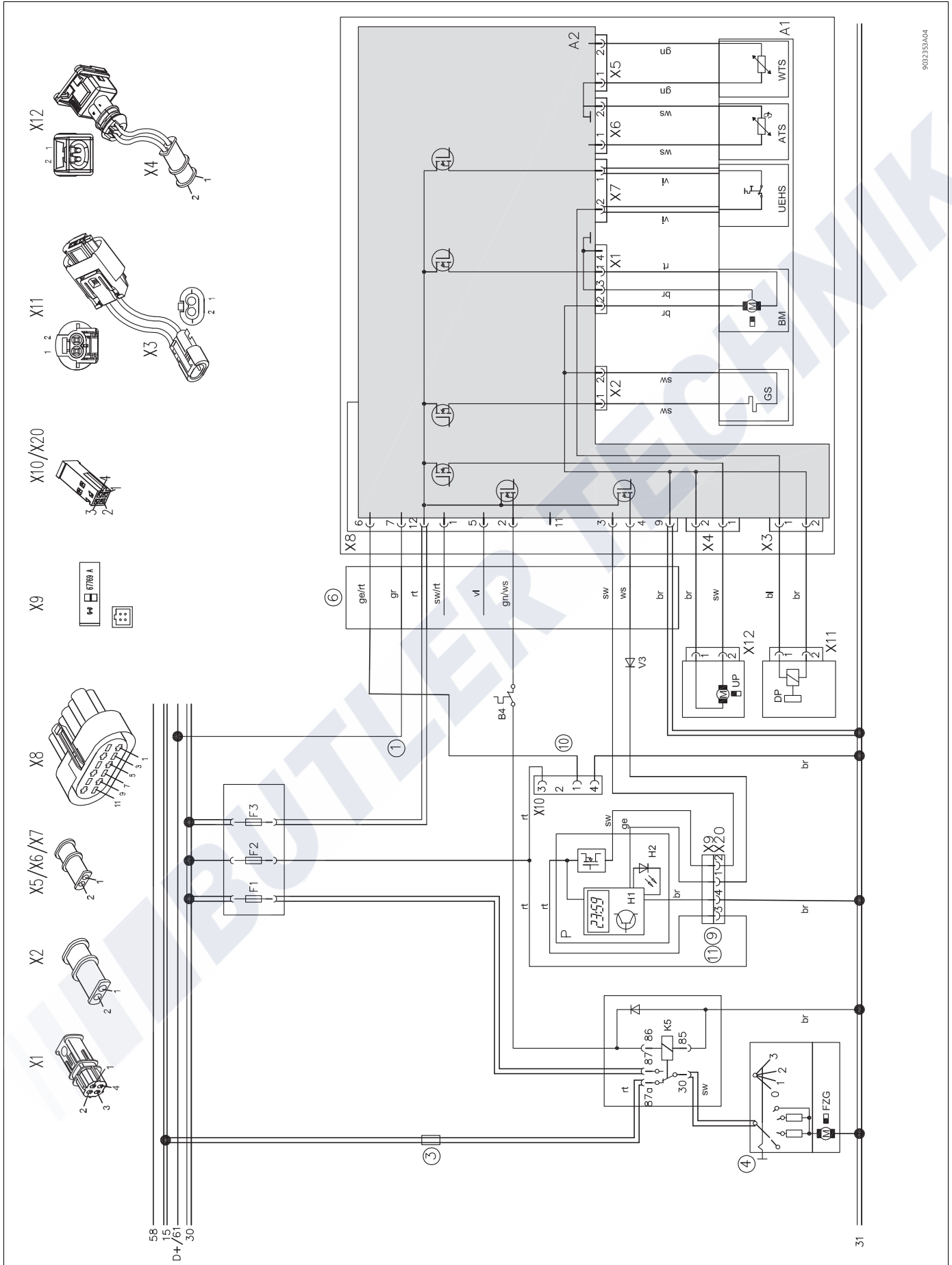
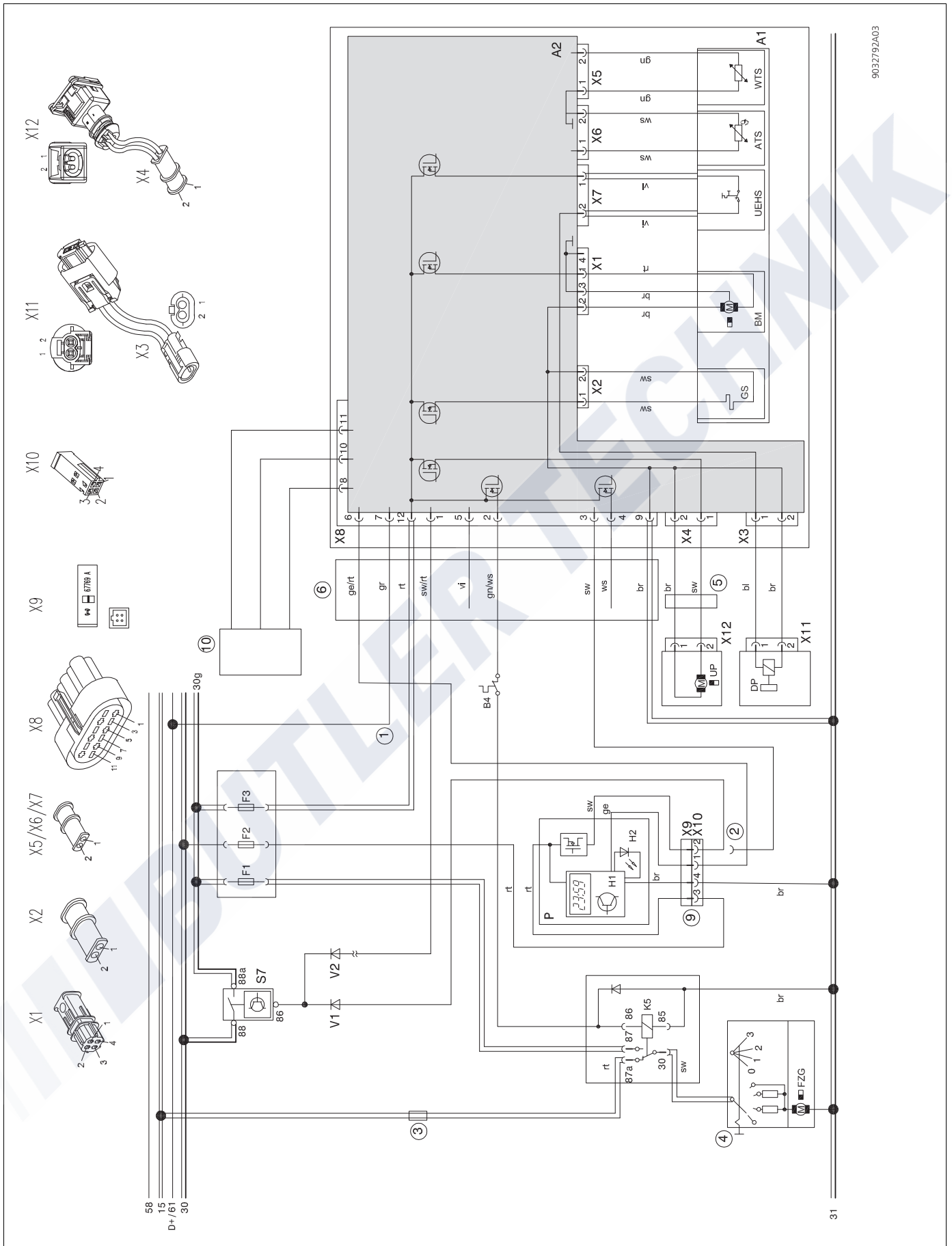


Fig. 1107 System wiring diagram Thermo Pro 90, MultiControl (analogue connection)

11.9 System wiring diagram for Thermo Pro 90 HDD with MultiControl control element



9032792A03

Fig. 1108 System wiring diagram Thermo Pro 90 HDD, MultiControl

11.10 System wiring diagram for Thermo Pro 90 HDD with SmartControl control element (ADR)

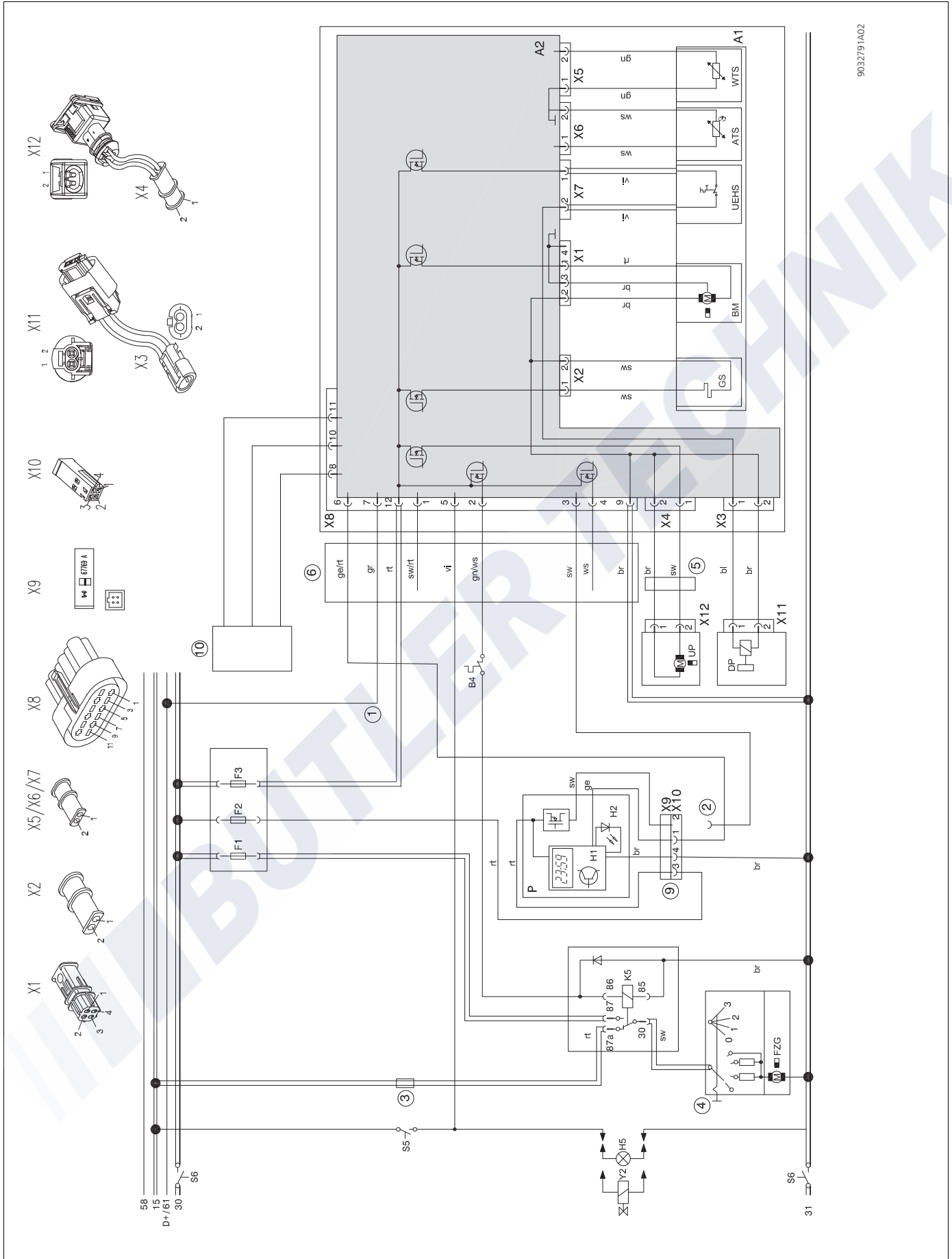
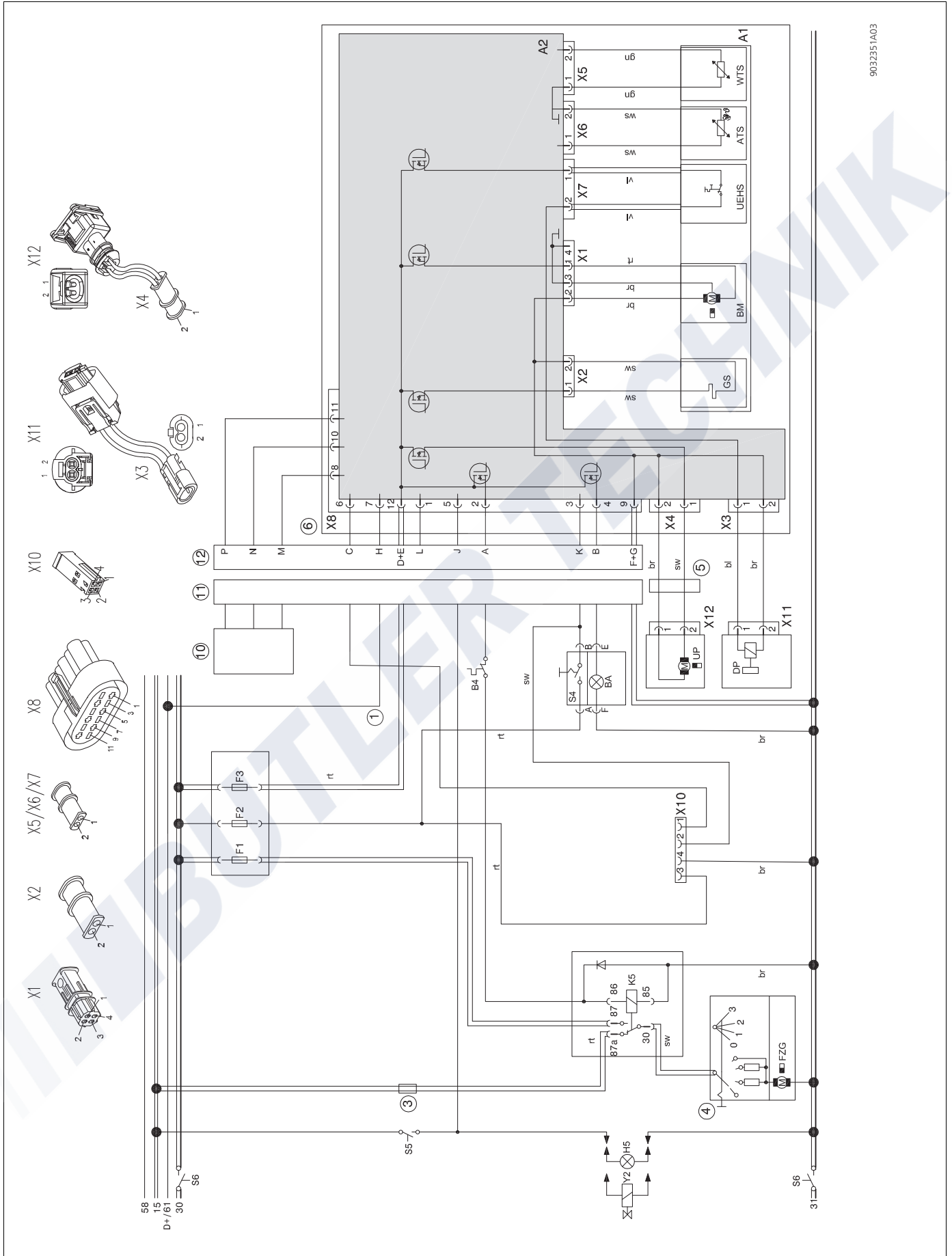


Fig. 1109 System wiring diagram Thermo Pro 90 HDD, SmartControl (ADR)

11.11 System wiring diagram for Thermo Pro 90 HDD with on/off switch (ADR)



9032351A03

Fig. 1110 System wiring diagram Thermo Pro 90 HDD, on/off switch (ADR)

11 Wiring diagrams

Thermo Pro 90

11.12 Cable cross-sections

Cable	< 7.5 m	7.5 - 15 m
	0.75 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

11.13 Cable colours

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

11.14 Heater connections

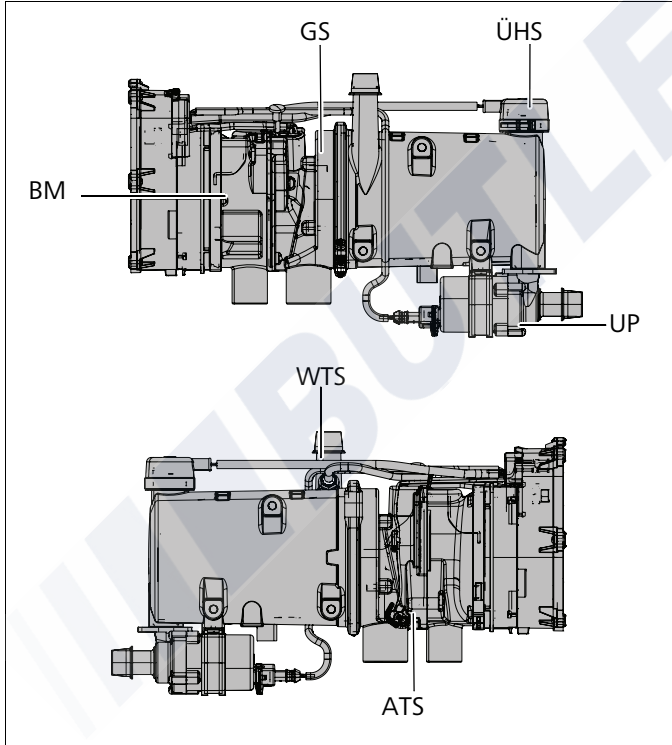


Fig. 1111 Heater connections

11.15 Plug assignments at control unit

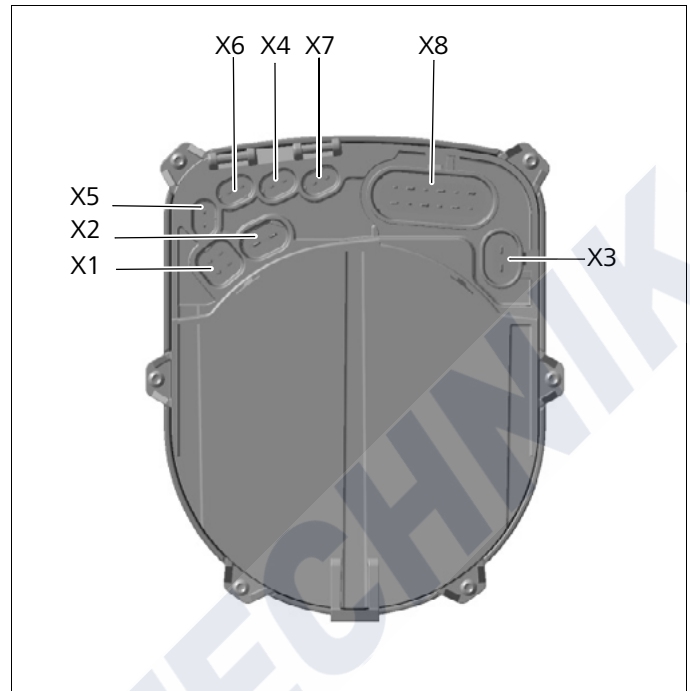


Fig. 1112 Plug assignments at control unit

11.16 Legend to wiring diagrams

Item	Description	Remarks
A1	Heater	Thermo Pro 90 / Thermo Pro 90 HDD
A2	Control unit	–
ATS	Exhaust gas temperature sensor	PT2000
B4	Room thermostat	Optional
BA	Operating indicator	Light 0.15 W to max 2 W
BM	Burner motor	Combustion air fan
DP	Fuel pump	Fuel pump for heater
F1	Fuse 20A	Blade fuse DIN 72581-3
F2	Fuse 1 A	
F3	Fuse 20 A	
FZG	Vehicle blower	–
GS	Glow plug	–
H1	Symbol on display	–
H2	LED	(green, blue, white, red) Operating indicator, ready indicator, ON indicator, fault list
H5	Bulb/LED	ON indicator, pumping device (max. 500 mA)
K5	Relay with free-wheeling diode	Vehicle blower
P	MultiControl / SmartControl	(W-bus)
P1	SmartControl	(W-bus)
S4	Switch	On/Off (min. 500 mA)
S5	Switch	Auxiliary drive / pumping device
S6	Switch, 1 or 2-pin	ADR
S7	Battery disconnecter	Electronically controlled disconnecter (max. 500 mA)
S10	Electronic battery disconnect switch	–
ÜHS	Overheating protection	Sensor on heat exchanger
UP	Coolant pump	U4840 coolant pump
V1 / V2	Diode	Min. 500 mA (optional, not included in wiring harness)
WTS	Coolant temperature sensor	Coolant temperature in coolant circuit
X1	4-pin plug connection	Item BM to item A2
X2	2-pin plug connection	Item GS to item A2
X3		Item DP to item A2
X4		Item UP to item A2
X5		Item WTS to item A2
X6		Item ATS to item A2
X7		Item ÜHS to item A2
X8		12-pin plug connection

11 Wiring diagrams

Thermo Pro 90

Item	Description	Remarks
X9	4-pin plug connection	To item P or P1
X10	4-pin plug connection	W-bus, MultiControl / SmartControl connection, Telestart (12 V only), ThermoCall or diagnosis
X11	2-pin plug connection	To item DP
X12	2-pin plug connection	To item UP
Y2	Solenoid valve / pump	Auxiliary drive / pumping device

11.17 Legend for comments

No.	Remarks
①	D+ signal (vehicle motor ON/OFF) for determining the control temperature
②	When connecting MultiControl/SmartControl (W-bus), the black wire must be removed from plug connection X10 (pin 2) and isolated (if not already done).
③	Fuse for vehicle blower (fuse present in vehicle)
④	Switch for vehicle blower
⑤	EMC interference suppression module (HDD version only)
⑥	Wiring harness
⑦	Fuse for vehicle blower (fuse present in vehicle)
⑧	-
⑨	Optional extension available (connection to plug connection X10)
⑩	CAN module; as per SAE J1939 for diagnostics function (optional, HDD version only)
⑪	Mating connector on vehicle conforms to VG95328R2016P (optional, HDD version only)
⑫	VG95328R2016PN connector (optional, HDD version only)

11.18 Legend for plug X8, 12-pin

No.	Remarks
1	Output, battery disconnecter afterrunning signal
2	Output, vehicle fan relay
3	Input switch-on signal (ON/OFF)
4	Operating indicator/error code output
5	Auxiliary drive
6	W-bus
7	Terminal D+
8	CAN GND as per SAE J1939 (HDD version only)
9	Power supply (terminal 31)
10	CAN LOW as per SAE J1939 (HDD version only)
11	CAN HIGH as per SAE J1939 (HDD version only)
12	Power supply (terminal 30)

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