

Water Heaters

Workshop Manual

DBW 2010
DBW 2016



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 serves to support instructed personnel, which repairs the water heater DBW 2010/2016.

The heater may only be operated with the predetermined fuel (diesel in accordance with DIN EN 590, EL fuel oil, F34, F35 kerosene, F54 diesel, F58 petroleum, F63 diesel) and only with the respectively specified electrical connection type.

1.2 Validity of manual

The manual is valid for the heaters listed on the cover page. The heaters mainly differ due to their different technical data (see Section 4) and due to the installation of different control units: Control unit 1553 or control unit 1563/1564 (see 2.6).

In conjunction with the control unit 1563/1564, a different flame monitor is installed (see 2.7).

1.3 Meaning of signal words

Throughout this manual, the signal words WARNING, IMPORTANT and NOTE have the following meanings:

WARNING

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

IMPORTANT

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

NOTE

This heading is used to direct your attention to a special feature deemed essential to highlight.

1.4 Additional documentation to be used

This workshop manual contains all information and instructions required for repairing the water heaters DBW 2010/2016.

The use of additional documentation is normally unnecessary. If necessary, the installation instructions and the operating instructions can also be used.

1.5 Safety precautions and regulations

In principle, the general accident prevention regulations and current works safety instructions are applicable.

"General safety precautions" which go beyond the scope of these regulations are listed in the following.

Any special safety regulations relevant to this instruction manual will be highlighted in the relevant sections or text passages of the procedures.

1.5.1 General safety precautions

There are type approvals for the DBW 2010 / 2016 water heaters according to the directives ECE-R 10 (EMC) and ECE-R 122 (heater).

Approval numbers see chapter 4, "Technical Data".

The provisions of the directive ECE-R 122 and the provisions of the installation instructions must primarily be observed for the installation.

IMPORTANT

Non-compliance with the installation instructions and the warnings contained therein will lead to the exclusion of all liability by Webasto. The same applies if repairs are carried out incorrectly or with the use of parts other than genuine spare parts. This will result in the invalidation of the General Type Approval for the heater and therefore of the General Homologation of the vehicle.

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

The heaters are approved for heating the motor vehicle engine and the vehicle cab. If the heater is used in vehicles not subject to the German Road Vehicle Licensing Act (StVZO) (e.g. ships), the regionally applicable regulations must be complied with.

The heater may only be installed in motor vehicles or in independent heating systems with a minimum coolant quantity of 10 litres.

The heater may not be installed in the cab or the passenger compartment of vehicles. If the heater is nevertheless installed in an area of this type, then the installation box must be sealed off tight to the vehicle interior. The installation box must be sufficiently ventilated from the outside so that a maximum temperature of 85 °C is not exceeded in the installation box. Malfunctions can occur if this temperature is exceeded.

WARNING

The heater must not be operated in enclosed areas such as garages and workshops without an emissions extraction system, even if you use the timer, because of the risk of asphyxiation and poisoning.

The heater must be switched off at filling stations and tank farms as a result of the risk of explosion.

IMPORTANT

Where flammable vapours or dust can form (e.g. near fuel, coal, wood-dust or grain warehouses, etc), the heater must be switched off due to the danger of explosion.

The heater may not be operated near flammable materials, e.g. dry grass, leaves, cardboard, paper, etc.

A temperature of 110 °C (storage temperature) must not be exceeded in the vicinity of the control unit (for example, during painting work on the vehicle).

Otherwise the electronics may suffer permanent damage. When checking the coolant level, the procedure described by the vehicle manufacturer must be followed. The water in the heating circuit of the heater must contain at least 10 % of a brand-name antifreeze according to manufacturer's instructions (corrosion protection).

Additives to the heating circuit must not attack metal, plastic or rubber and must not form deposits.

The opening pressure in the vehicle cooling system – generally specified on the radiator cap – must have an operating pressure between 0.4 and 2.0 bar (also applies to separate heating circuit).

1.6 Statutory regulations governing installation

NOTE:

The regulations of these guidelines are binding in the scope of the EU Directive 70/156/EEC and/or EC/2007/46 (for new vehicle models from 29/04/2009) and should also be observed in countries in which there are no special regulations!

Excerpt from directive ECE-R 122 point 5 (part I) and annex 7

Beginning of excerpt.

Part I

5.3 Vehicle Installation Requirements for Combustion Heaters

5.3.1 Scope

5.3.1.1 Subject to paragraph 5.3.1.2, heaters shall be installed according to the requirements of paragraph 5.3.

5.3.1.2 Vehicles of category O having liquid fuel heaters are deemed to comply with the requirements of paragraph 5.3.

5.3.2 Positioning of combustion heater

5.3.2.1 Body sections and any other components in the vicinity of the heater must be protected from excessive heat and the possibility of fuel or oil contamination.

5.3.2.2 The combustion heater shall not constitute a risk of fire, even in the case of overheating. This requirement shall be deemed to be met if the installation ensures an adequate distance to all parts and suitable ventilation, by the use of fire resistant materials or by the use of heat shields.

5.3.2.3 In the case of M2 and M3 vehicles, the combustion heater must not be positioned in the passenger compartment. However, an installation in an effectively sealed envelope which also complies with the conditions in paragraph 5.3.2.2 may be used.

5.3.2.4 The label referred to in Annex 7, paragraph 4, or a duplicate, must be positioned so that it can be easily read when the heater is installed in the vehicle.

5.3.2.5 Every reasonable precaution should be taken in positioning the heater to minimize the risk of injury and damage to personal property.

5.3.3 Fuel supply

5.3.3.1 The fuel filler must not be situated in the passenger compartment and must be provided with an effective cap to prevent fuel spillage.

5.3.3.2 In the case of liquid fuel heaters, where a supply separate from that of the vehicle is provided, the type of fuel and its filler point must be clearly labelled.

5.3.3.3 A notice, indicating that the heater must be shut down before refuelling, must be affixed to the fuelling point. In addition a suitable instruction must be included in the manufacturer's operating manual.

5.3.4 Exhaust system

5.3.4.1 The exhaust outlet must be located so as to prevent emissions from entering the vehicle through ventilators, heated air inlets or opening windows.

5.3.5 Combustion air inlet

5.3.5.1 The air for the combustion chamber of the heater must not be drawn from the passenger compartment of the vehicle.

5.3.5.2 The air inlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

5.3.6 Heating air inlet

5.3.6.1 The heating air supply may be fresh or re-circulated air and must be drawn from a clean area not likely to be contaminated by exhaust fumes emitted either by the propulsion engine, the combustion heater or any other vehicle source.

5.3.6.2 The inlet duct must be protected by mesh or other suitable means.

5.3.7 Heating air outlet

5.3.7.1 Any ducting used to route the hot air through the vehicle must be so positioned or protected that no injury or damage could be caused if it were to be touched.

5.3.7.2 The air outlet must be so positioned or guarded that blocking by rubbish or luggage is unlikely.

5.3.8 Automatic control of the heating system

5.3.8.1 The heating system must be switched off automatically and the supply of fuel must be stopped within five seconds when the vehicle's engine stops running. If a manual device is already activated, the heating system can stay in operation.

ANNEX 7**ADDITIONAL REQUIREMENTS FOR COMBUSTION HEATERS****7 Warning light**

7.1 A clearly visible tell-tale in the operator's field of view shall inform when the combustion heater is switched on or off.

End of excerpt.

NOTE

Additional information on and provisions for installation in vehicles are contained in the installation instructions.

Extraction of the combustion air from the vehicle passenger compartment is not permitted.

The mouth of the exhaust pipe should be installed upwards, to the side or, if the exhaust pipe passes under the floor of the vehicle, to the side or rear limit of the driver's cab or the vehicle. Exhaust pipes must be routed so that no penetration of the exhaust gases into the vehicle interior is to be expected. The function of important parts of the vehicle must not be adversely affected. Accumulated condensation in the exhaust line must be discharged immediately. A condensate drain hole may be drilled if necessary.

The openings of the combustion air inlet and exhaust air outlet must be designed so that a ball with a 16 mm diameter cannot be inserted.

The electric cables, controls and control units for the heater must be arranged in the vehicle so that their proper functioning cannot be adversely affected in normal operating conditions.

Compliance with §§ 45 and 46 of the German Road Vehicle Licensing Act (StVZO) must be ensured for the installation of fuel lines and the installation of additional fuel tanks. The main points from this law:

- Fuel pipes must be designed in such a way that torsion in the vehicle, movements by the engine and the like do not have a negative effect on their durability. They must be protected from mechanical damage. Parts that carry fuel must be protected from heat that will adversely affect their function and positioned so that dripping or evaporating fuel cannot collect or ignite on hot parts or on electrical equipment.
- With buses, fuel lines and fuel tanks must not be located in the passenger or driver's area. Fuel tanks must be positioned in these vehicles so that the exits are not immediately endangered in case of fire. The fuel must not be pumped into the fuel tank by gravity or gauge pressure.

Installation regulations for Webasto fuel tanks for supplying fuel to water heaters in vehicles:

- The tank must not be installed in the passenger or driver's cabin of buses.
- The fuel filler neck must not be inside the passenger or driver's cabin in any vehicle.
- The fuel tanks must either be provided with a vent cap or must be ventilated in another way (ventilation line).

Only caps may be used which comply with the standard DIN 73400.

All fuel tanks offered in the Webasto accessories catalogue are suitable for a maximum operating pressure of 0.15 bar.

All fuel tanks offered in the Webasto accessories catalogue are individually subjected to a pressure test of at least 0.3 bar gauge pressure at the factory.

- The respective operating mode of the heater, at least switched on or off, must be easily recognisable.

For heaters in vehicles not subject to the German Road Vehicle Licensing Act (StVZO), approval by the respective test facility is required – provided there are applicable regulations.

1.7 Suggestions for improvement and change

Complaints, improvements or suggestions for correction to this technical manual should be directed to Webasto.

2 General Description

The Webasto DBW 2010 and DBW 2016 water heaters are used in conjunction with the original vehicle heating system

- to heat the passenger compartment,
- to defrost the windows and
- for preheating water-cooled engines.

The water heater operates independently of the vehicle engine and is connected to the cooling system, the fuel system and the electrical system of the vehicle.

The heater is designed according to the heat transfer principle and its operation is controlled by the temperature sensor.

DBW 2016 Rail (24 V)

This is a special version of the heater with EBA (Germany's Federal Railway Office) approval. The main functions of the heater correspond to those of the standard variant.

The DBW 2010 and DBW 2016 water heaters mainly consist of:

- the combustion air fan
- the fuel pump
- The heat exchanger
- the combustion chamber and
- the ignition spark generator with ignition electrodes

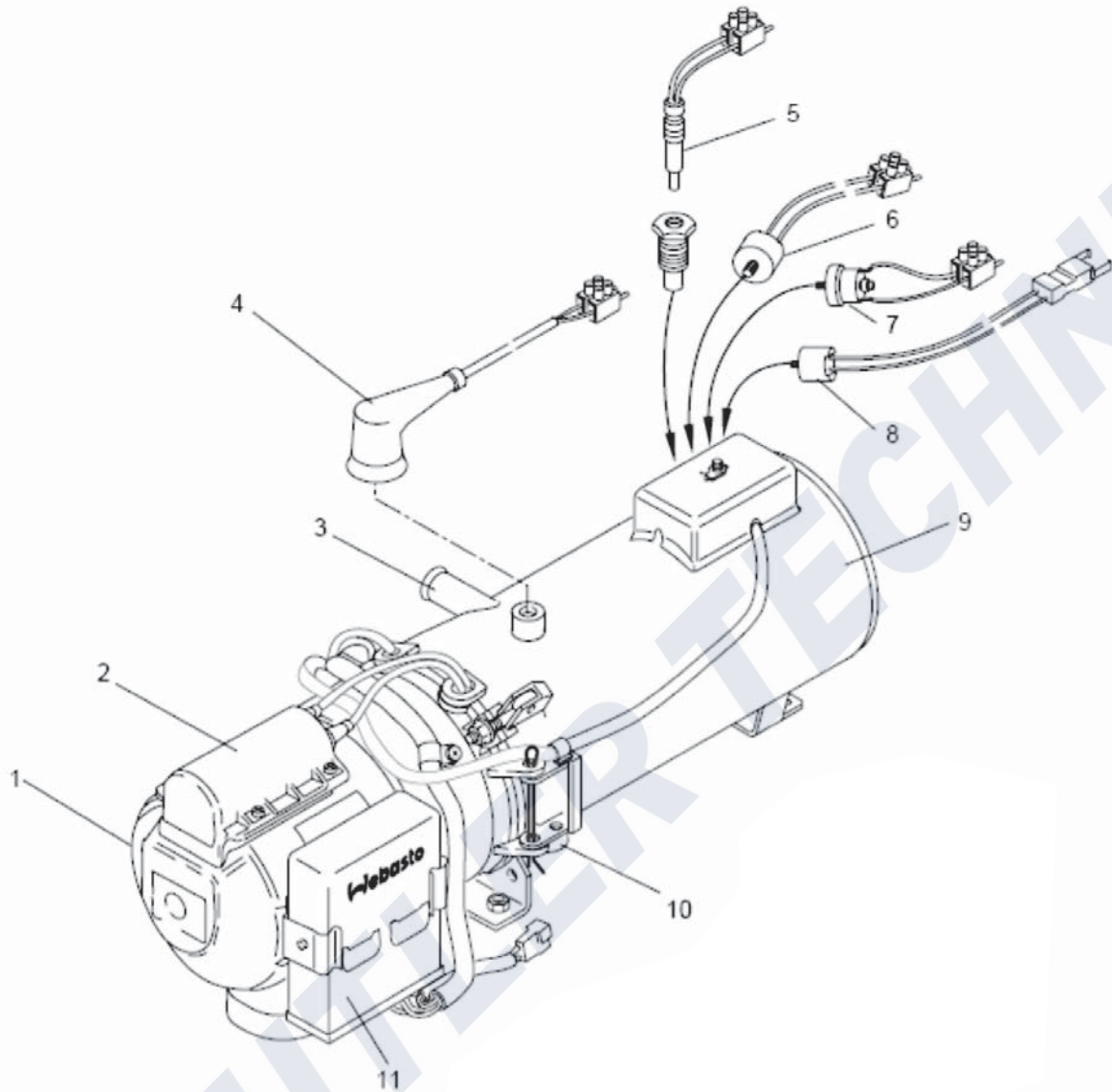
Depending on the heater variant, a nozzle holder pre-heating unit may be installed.

To control and monitor it, the heater has the following components inside it:

- A control unit
- A flame monitor

Depending on the heater variant, the following can be mounted on the heater:

- a temperature sensor
- a temperature limiter
- a thermal fuse
- a fan thermostat

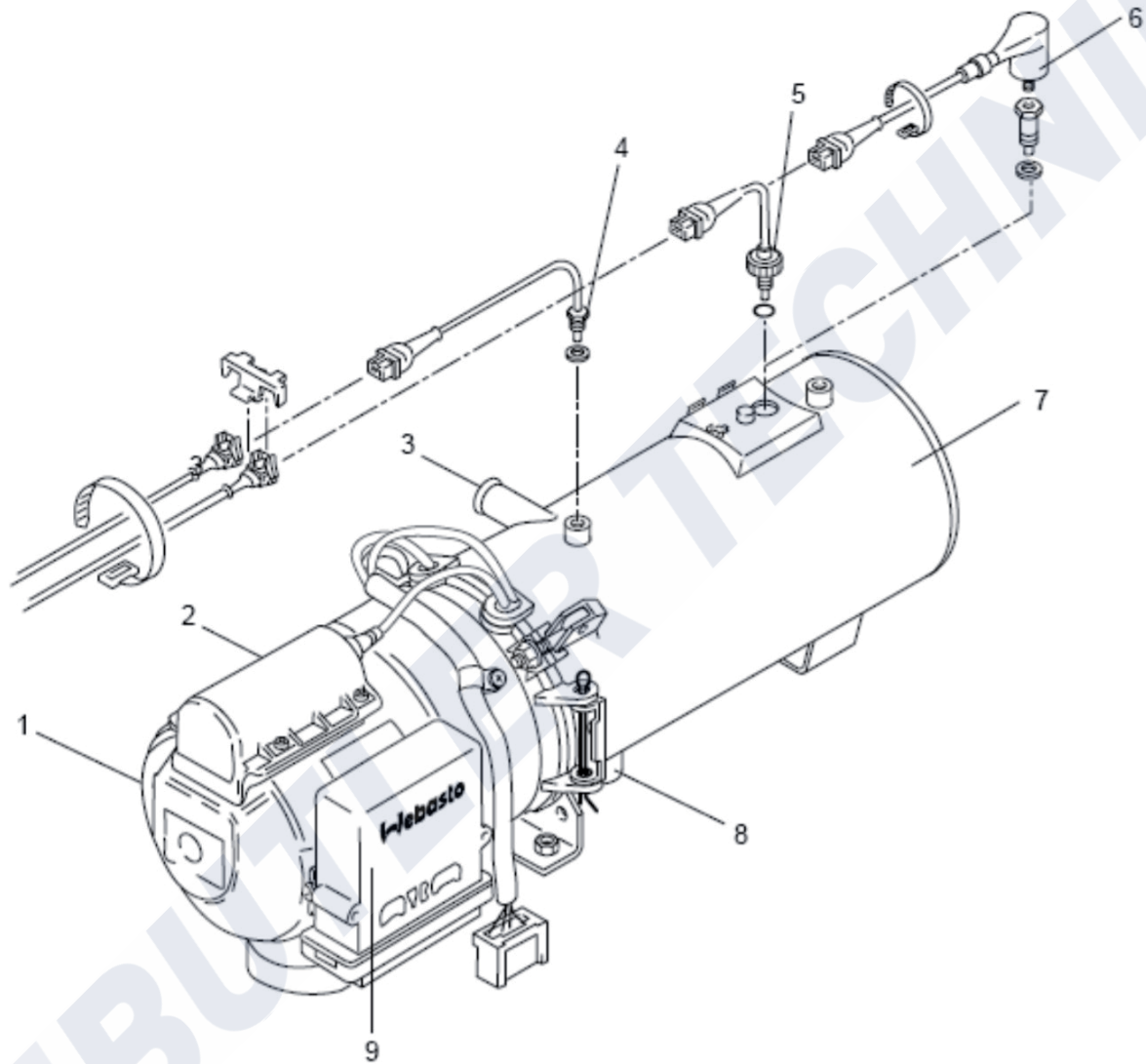


- 1 Burner head
- 2 Ignition spark generator
- 3 Coolant, outlet
- 4 Control thermostat *
- 5 Thermal fuse *
- 6 Control thermostat *
- 7 Temperature limiter *
- 8 Fan thermostat *

- 9 Heat exchanger
- 10 Exhaust outlet
- 11 Control unit

* for components installed in accordance with the heater variant

Fig. 201 DBW 2010 heaters

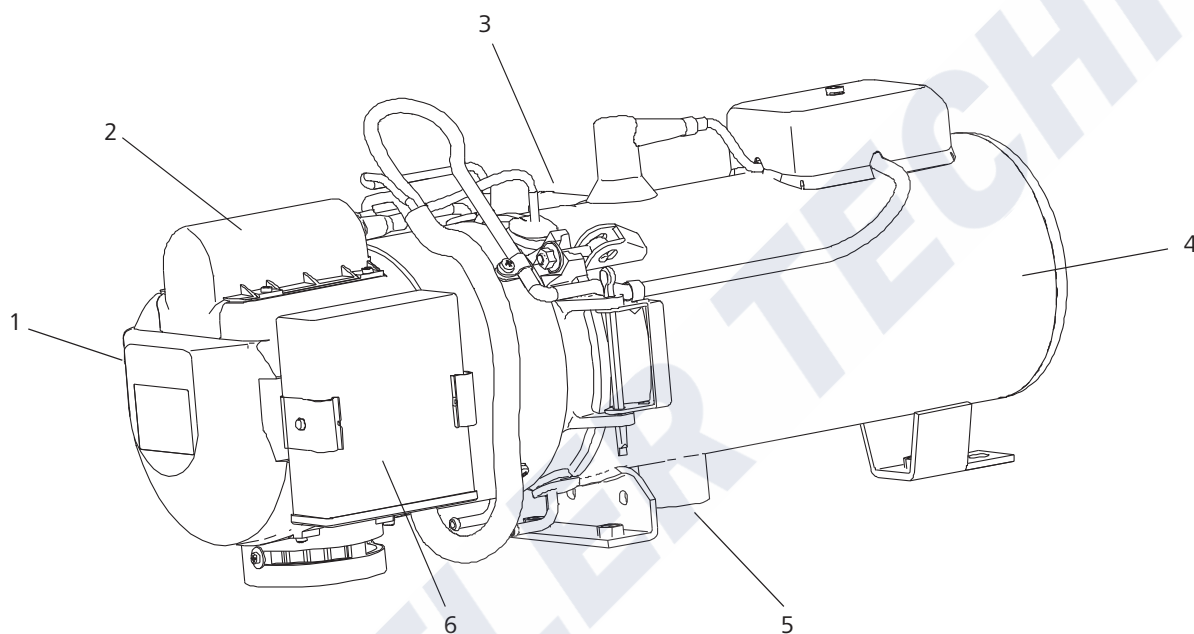


- 1 Burner head
- 2 Ignition spark generator
- 3 Coolant, outlet
- 4 Temperature sensor *
- 5 Thermal fuse *
- 6 Temperature limiter *
- 7 Heat exchanger

- 8 Exhaust outlet
- 9 Control unit

* for components installed in accordance with the heater variant

Fig. 202 DBW 2010 heaters with sensor technology



- 1 Burner head
- 2 Ignition spark generator
- 3 Coolant, outlet
- 4 Heat exchanger
- 5 Exhaust outlet
- 6 Control unit

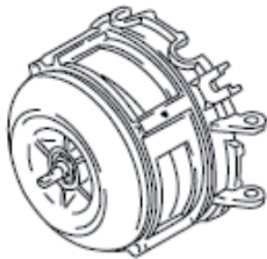
Fig. 203 DBW 2016 Standard / Rail heaters

2.1 Combustion air fan

The combustion air fan transports the air required for combustion out of the combustion air inlet into the combustion chamber.

The following fan models are installed in the heaters:

DBW 2010 / 2016 – radial fan.

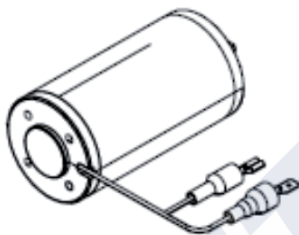


DBW 2010

Fig. 204 Combustion air fan

2.2 Motor

The motor drives the combustion air fan via a coupling and the fuel pump via a gearbox.



DBW 2010
DBW 2016
Standard / Rail

Fig. 205 Motor

2.3 Fuel pump

The fuel supply is provided with the fuel pump. The pump is driven by the motor of the combustion air fan via a coupling. The fuel is compressed in the fuel pump and is atomised via the high-pressure nozzle. A solenoid valve controls the fuel supply to the nozzle.

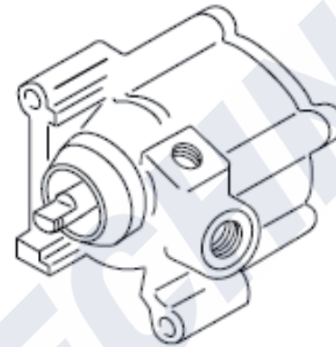


Fig. 206 Fuel pump

2.3.1 Nozzle holder pre-heating unit

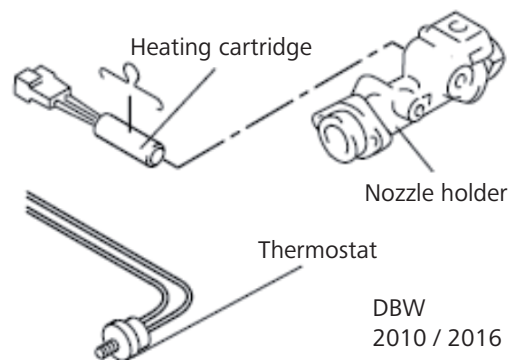
The fuel to the atomiser nozzle is heated with the nozzle holder pre-heating unit.

At extremely low temperatures, malfunctions can occur without nozzle holder pre-heating.

At a temperature of $< 0\text{ }^{\circ}\text{C}$, the heating cartridge in the nozzle holder is connected with a thermostat. The heating duration is dependent on the reflected heat in the combustion chamber and switches off at $+8\text{ }^{\circ}\text{C}$ at the thermostat.

If no nozzle holder pre-heating unit is installed in the heater, it can be retrofitted.

See the spare parts list for the required parts.

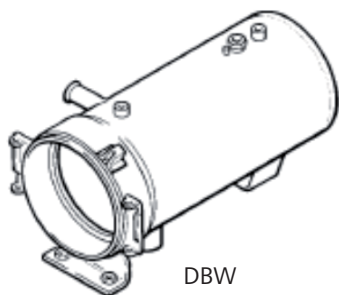


DBW
2010 / 2016

Fig. 207 Nozzle holder pre-heating unit

2.4 Heat exchanger

The heat generated in the heat exchanger by combustion is transferred to the coolant circuit.



DBW
2010 / 2016
(may differ, according to
variant)

Fig. 208 Heat exchanger

2.5 Combustion chamber

The fuel-air mixture is distributed in the combustion chamber and burned there. The heat exchanger is heated in the process.



DBW 2010 / 2016

Fig. 209 Combustion chamber

2.6 Control unit

The control unit is the central component and ensures the operating sequence and the monitoring of combustion operation.



Fig. 210 1553 control unit

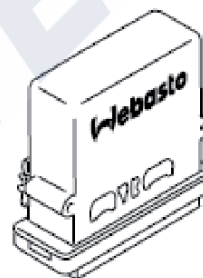


Fig. 211 1563/1564 control unit for heaters with sensor technology

2.7 Flame monitor

The flame state is monitored during the entire combustion operation with the flame monitor. The flame monitor is a photo resistor for standard device or a photo transistor for sensor technology variant, which reacts depending on the light spectrum of the flame.

The signals are sent to the control unit and processed there.

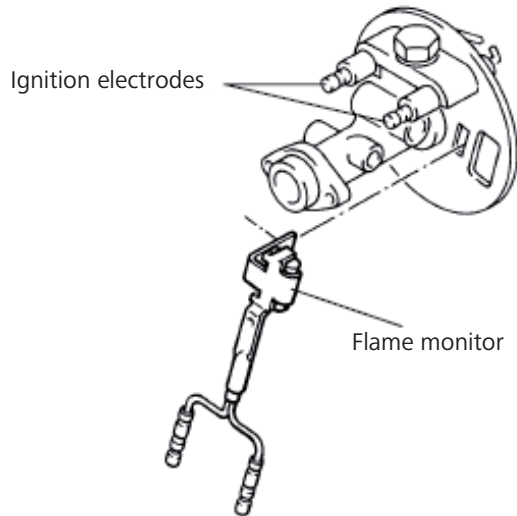


Fig. 212 Flame monitor standard device

2.8 Ignition spark generator with ignition electrodes

The high voltage for igniting the fuel-air mixture is generated in the ignition spark generator. Ignition is carried out with a high-voltage spark between the two ignition electrodes.

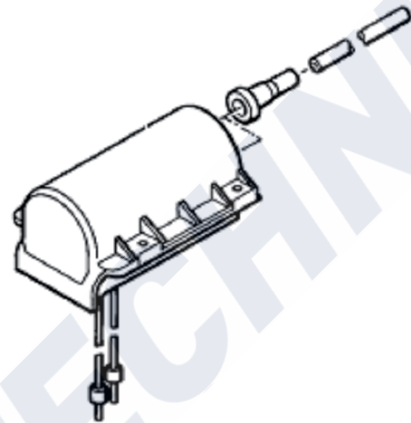


Fig. 214 Ignition spark generator with ignition electrodes

2.9 Temperature sensor (sensor technology variant)

The temperature sensor detects the coolant temperature at outlet of the heater exchanger as an electrical resistance. This signal is fed to the control unit, where it is processed.

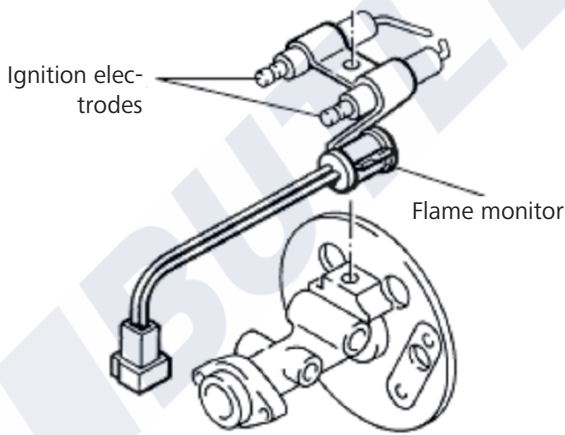


Fig. 213 Flame monitor heaters with sensor technology

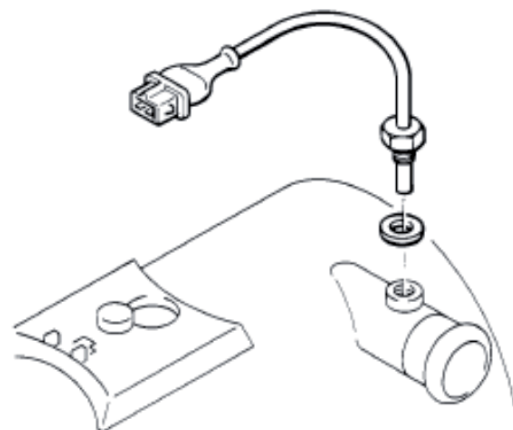


Fig. 215 Temperature sensor (sensor technology variant)

2.10 Temperature limiter/thermal fuse

Temperature limiter

The temperature limiter (bi-metal) protects the heater against impermissibly high operating temperatures. The temperature limiter reacts at a temperature above 107 °C or 117 °C and switches off the heater. The temperature limiter can be reset or is automatically reset.

Thermal fuse

The thermal fuse protects the heater against impermissibly high operating temperatures. The thermal fuse contains a fusible link which reacts when the permissible temperature is exceeded and switches off the heater.

The heater can be retrofitted with a temperature limiter in place of the thermal fuse.

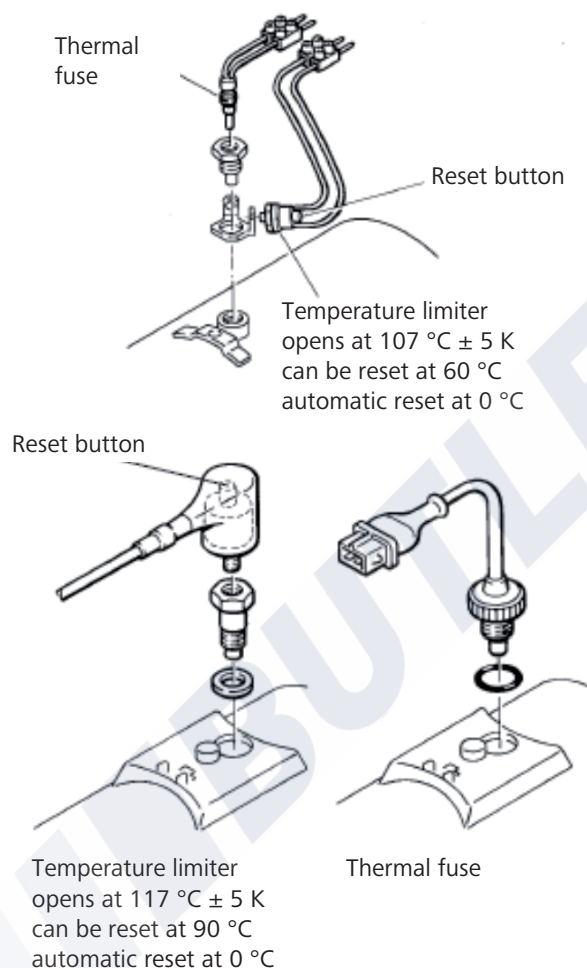


Fig. 216 Temperature limiter/thermal fuse only for heaters with 1563/1564 control unit

2.11 Control thermostat

Control thermostat on heater

The control thermostat assumes the control operation after the operating temperature is reached. Alternately switching the heater on and off maintains the coolant temperature at a constant level. The thermostat closes at 68 °C ± 5 K and opens at 75 °C ± 3 K.

Optional for DBW 2016 Rail version: The thermostat closes at 50 °C ± 5 K and opens at 65 °C ± 3 K.

External control thermostat

The control operation can also be controlled by an externally mounted control thermostat.

The control thermostat assumes the control operation after the operating temperature is reached. Alternately switching the heater on and off maintains the coolant temperature at a constant level. The thermostat closes at 71 °C ± 2 K and opens at 78 °C ± 2 K; alternatively at 62 °C ± 2 K and 70 °C ± 2 K.

For heaters with an economy mode (temperature holding mode), a thermostat can be installed which closes at 35 °C ± 2 K and opens at 42 °C ± 2 K.

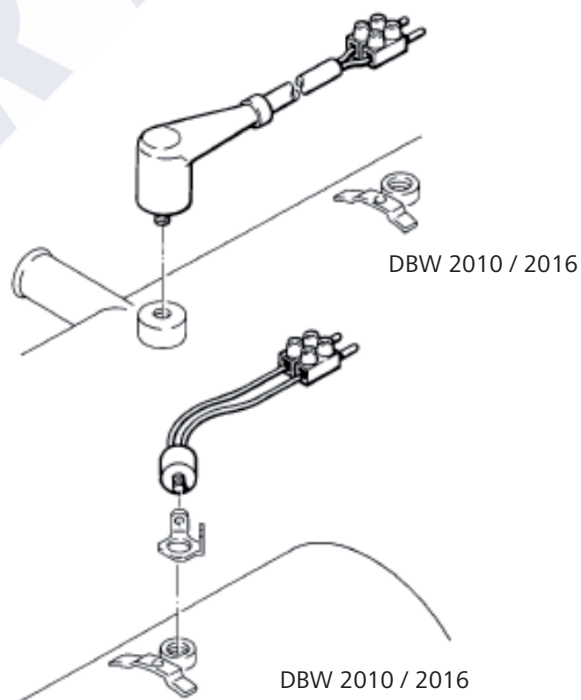


Fig. 217 Control thermostat on heater

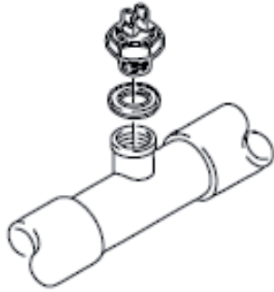


Fig. 218 External control thermostat

2.12 Fan thermostat

The fan thermostat switches the original vehicle heater fan off or on when the coolant temperature is between 30 °C and 40 °C. The thermostat closes at 40 °C \pm 3 K and opens at 30 °C \pm 5 K.

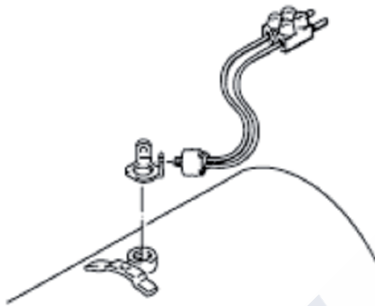


Fig. 219 Fan thermostat on heater



Fig. 220 Fan thermostat in coolant circuit

2.13 Circulation pump

The heater must be operated with a circulation pump. The externally positioned circulation pump ensures the pumping of the coolant in the vehicle and/or heater circuit. The pump is switched on with the control unit and runs during the entire operation of the heater.

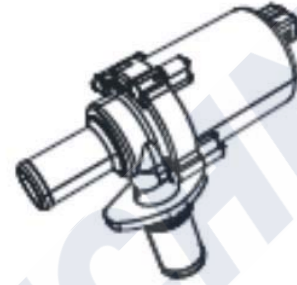


Fig. 221 U 4840, suitable for DBW 2010 and DBW 2016

3 Description of Operation

3.1 General information

The heaters equipped with a high-pressure atomizing burner operate in the intermittent mode.

Control is carried out either

- thermostatically (heaters with 1553 control unit) or
- with temperature sensor (DBW 2010 heaters with sensor technology with 1563/1564 control unit).

3.2 Operation

The heater is switched on and off with

- switch (On/Off) or
- digital timer.

To monitor the operating sequence, an operating indicator lamp is installed in the digital timer or separately.

On request, the heaters can be equipped with

- a nozzle holder pre-heating unit with a heating cartridge for extremely low temperatures,

There is a partially altered operating sequence for heaters with sensor technology (see Fig. 302).

3.2.1 Switching on

When the heater is switched on, the operating indicator lamp lights up. The combustion air fan, fuel pump and circulation pump start up. After approx. 15 seconds, the solenoid valve is opened, and fuel is sprayed into the combustion chamber via the atomiser nozzle and ignited by a simultaneously triggered high-voltage ignition spark. With a signal of the flame monitor, the control unit switches the ignition spark generator off again after a flame has been formed.

If no combustion is produced, see 3.2.4.

3.2.2 Heating mode

After the operating temperature is reached, the control mode is assumed by the control thermostat (or by the control unit with heaters with sensor technology).

Alternately switching on and off maintains the heat exchanger (coolant) temperature at a constant level. If the temperature exceeds the upper switch point, the solenoid valve shuts off the fuel supply, causing the flame to go out. The run-on begins, during which the combustion air fan continues to run and is switched off automatically after approx. 150 (or 90 for heaters with sensor technology) seconds. The circulation pump remains in operation in the control break and the operating indicator lamp lights up. If the temperature drops below the lower switch point, the new heater start-up process begins.

3.2.3 Switch off

Combustion ends when the heater is switched off. The operating indicator lamp goes out and the run-on begins. The combustion air fan and the circulation pump are switched off after approx. 150 (or 90 for heaters with sensor technology) seconds.

It is permissible to switch on the heater again during the run-on.

3.2.4 Fault switch-off

For heaters with 1553 and 1563/64 control unit

A fault switch-off is carried out

- if no combustion occurs within approx. 30 seconds after the heater is switched on,
- if the combustion-air supply during the heating mode is interrupted for longer than 10 seconds,
- by the thermal fuse or the overheating temperature limiter if the heater overheats. Then an identical thermal fuse must be used as a replacement (observe colour coding) or a reset must be carried out with the button of the temperature limiter (after cooling down to below 60 °C).

Fault switch-off for heaters with 1553 control unit

- in case of undervoltage approx. 10 to 25 seconds after the switching threshold is dropped below.

Fault switch-off only for heaters with sensor technology with 1563/64 control unit

- 12 seconds after start-up due to detection of extraneous light or in case of undervoltage
- during combustion operation as the result of undervoltage for at least 12 seconds. After a run-on of 90 seconds, the heater is in fault lock-out.

After the fault cause is eliminated, the fault release is carried out by switching the heater off and then on again.

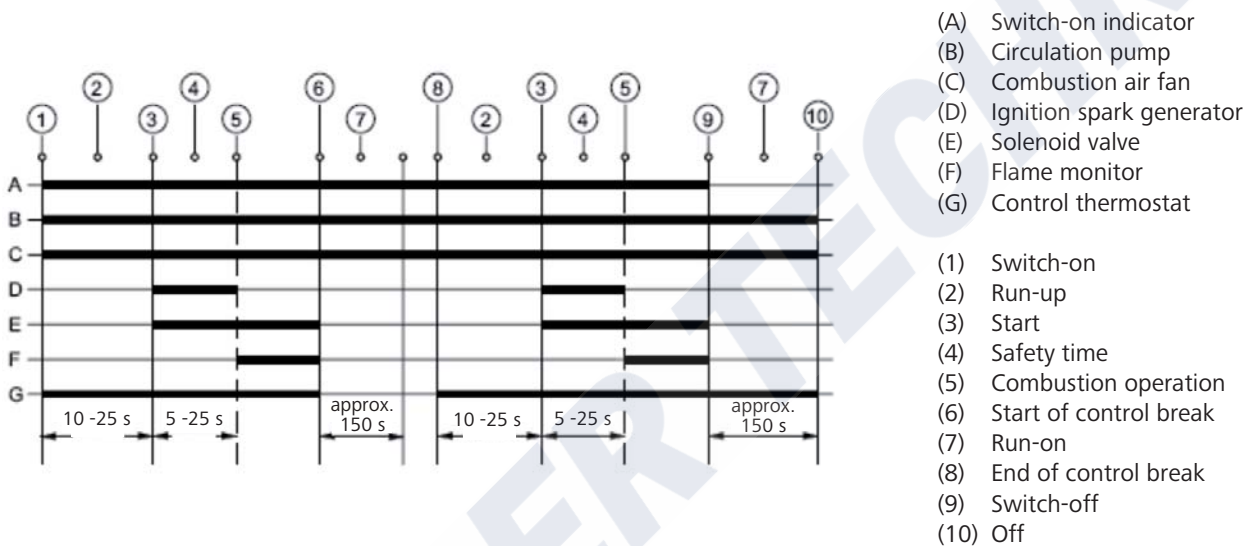


Fig. 301 Operating sequence (heaters with 1553 control unit)

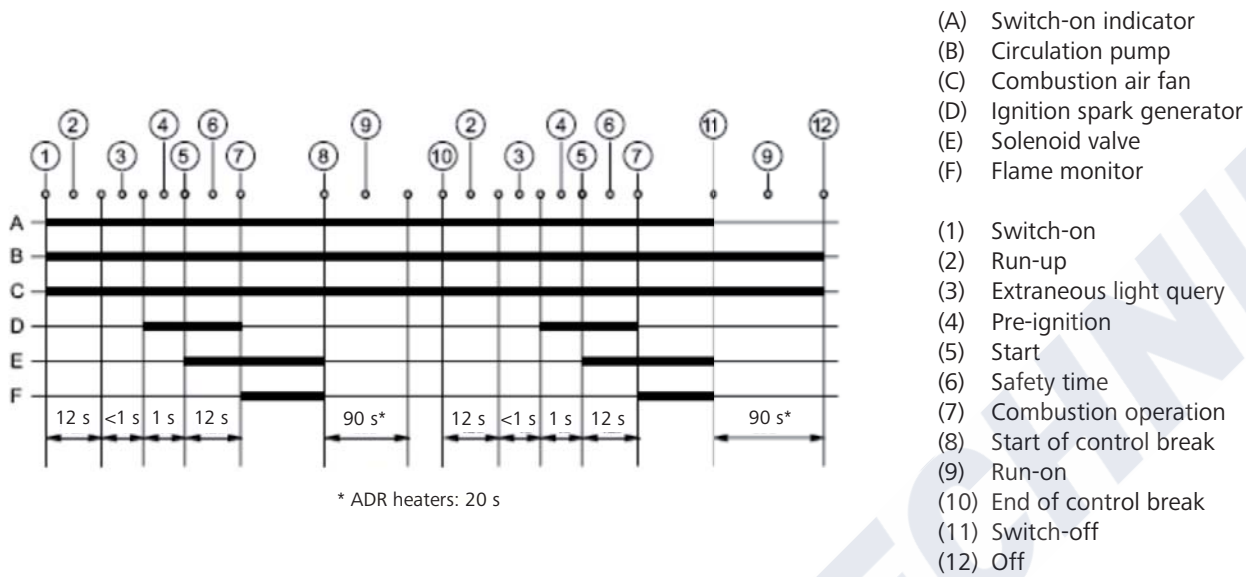


Fig. 302 Operating sequence (heaters with 1563/1564 control unit)

4 Technical Data

The technical data listed in the table refer to the usual heater tolerances of $\pm 10\%$ at an ambient temperature of $+20\text{ °C}$ and at nominal voltage.

4.1 Electrical components

Control unit, motors for combustion air fan and circulation pump, solenoid valve, ignition spark generator, heating cartridge, nozzle holder pre-heating unit and digital timer are designed for a 12 V (DBW 2010) or 24 V (DBW 2010 / DBW 2016) power supply. The components temperature limiter, flame monitor, temperature sensor and switch are independent of the voltage.

NOTE

The circulation pumps must be assigned to the heaters in accordance with the coolant-side resistances.

4.2 Fuel

The diesel fuel specified by the vehicle manufacturer is suitable as fuel. Only the fuel specified on the factory plate may be used (diesel in accordance with DIN EN 590, EL fuel oil, F34, F35 kerosene, F54 diesel, F58 petroleum, F63 diesel).

We know of no negative influences due to additives.

If fuel is extracted from the vehicle's tank, follow the additive instructions issued by the vehicle manufacturer.

If fuel is taken from a separate fuel tank, winter diesel fuel must be used at temperatures below 0 °C or petroleum or petrol fuel must be added to the diesel fuel in accordance with the proper mixing ratio. The use of flow improvers is permissible.

Mixing ratio for separate fuel tank

Temperature	Winter diesel fuel	Addition of petroleum or petrol fuel
0 °C to -20 °C	100 %	–
-20 °C to -30 °C	70 %	30 % or special low-temperature diesel fuel
-30 °C to -40 °C		special low-temperature diesel fuel or 100 % petroleum

Heater	DBW 2010	DBW 2016	DBW 2016 Rail	DBW 2016 High Altitude
Approval mark				
EMC:	E1 10R- 04 6955		E1 10R- 04 6955	
Heating:	E1 122R- 00 0006		E1 122R- 00 0001	
Model	High-pressure atomiser			
Heat output	[KW] ([kcal/h])	11.6/9.3 (10,000/8,000)		16.0 (13.800)
Fuel	Diesel according to DIN EN 590, EL fuel oil, F34, F35 kerosene, F54 diesel, F58 petroleum, F63 diesel			
Fuel consumption	[kg/h]	1.3/1.0		1,9
Rated voltage	[V]	12 or 24		24
Operating voltage range	[V]	10 to 14 or 20 to 28		20 to 28
Nominal power consumption (without circulation pump)	[W]	60		90
Perm. ambient temperature during operation (heater, control unit, circulation pump)	[°C]			-40 to +60
Perm. storage temperature (heater, control unit, circulation pump)	[°C]			-40 to +85
Perm. operating pressure	[bar]			0.4 to 2.0
Capacity of the heat exchanger	L:			1,1
Dimensions of heater incl. control unit (tolerance $\pm 3\text{ mm}$)				
- Length	[mm]			584
- Width	[mm]			205
- Height	[mm]			228
Weight	[kg]			15

Circulation pump		U 4840
Volume flow rate	[l/h]	1,600 (against 0.1 bar)
Rated voltage	[V]	12 or 24
Operating voltage range	[V]	9 to 15 or 16 to 30
Rated power consumption	[W]	30
Dimensions		
- Length	[mm]	135
- Width	[mm]	95
- Height	[mm]	48
Weight	[kg]	0,4

5 Troubleshooting

5.1 General information

This section describes troubleshooting on the DBW 2010/2016/2016 Rail heaters.

IMPORTANT

Troubleshooting work demands precise knowledge of the structure and theory of operation of the various components and must be carried out by trained personnel only.

If in doubt, refer to sections 2 or 3 for a description of how the functions interact.

IMPORTANT

Error detection is generally limited to the localisation of the defective components.

The following potential sources of malfunctions are not taken into account and should always be checked so that they can then be excluded as the cause of the particular fault:

Corrosion on connector
Loose contact on connector
Poor crimp contacts on plugs
Corrosion on lines and fuses
Corrosion on battery terminals

Conduct a function test in the vehicle after rectifying each fault.

5.2 General error symptoms

The following table (Fig. 501) lists the possible general error symptoms.

Error symptom	Possible cause
Malfunction in electrical system Switch-on indicator lamp does not light up and heater does not operate. Fuse F2 blows. Fuse F3 blows. Heater operation OK, however operating indicator lamp does not light up.	<ul style="list-style-type: none"> • No supply voltage, • Fuses, • Supply line to plug contacts of connector A of control unit. Short circuit in circulation pump or in supply line to heater. Short circuit in supply line to heater/engine/nozzle holder pre-heating unit (if installed). Operating indicator lamp defective or wiring to operating indicator lamp interrupted or short-circuited.

Fig. 501 General error symptoms (Section 1 of 2)

Error symptom	Possible cause
<p>Malfunction in water system</p> <p>Heater shuts off, as heat exchangers (heater and vehicle) do not give off sufficient heat.</p>	<p>Flow rate insufficient, as</p> <ul style="list-style-type: none"> • air or gas in heater, in heat exchangers or in system sections. • valves (flow controller) throttled, soiled or closed. • impurities in system, e.g. filter or with bottlenecks. • delivery capacity of circulation pump insufficient (air or gas in pump casing), rotating direction incorrect – check polarity. • insufficient frost protection. • system resistance too high (especially high at low temperatures). • circulation pump defective. <p><u>Vehicle's heat exchangers (water/air) give off insufficient heat, as</u></p> <ul style="list-style-type: none"> • air or gas in heat exchangers or in system sections. • soiled heat exchanger surfaces /(inside/outside). • insufficient air inlet or air outlet. • fan: delivery capacity insufficient/rotating direction incorrect/resistance too high. • percentage of antifreeze too high. • heat exchanger too small.
<p>Approximate determination of flow rate</p> <p>Flow rate in [l/h] = $\frac{\text{Heating capacity [kW] as per type label}}{\text{Temperature difference } \Delta T \text{ in [K] or } [^{\circ}\text{C}] \text{ measured between water inlet and outlet on heater (e.g. with contact thermometer)}} \times 860$</p>	
<p>Malfunction in fuel supply</p> <p>No fuel delivered to heater.</p>	<ul style="list-style-type: none"> • Fuel tank empty. • Kinked, sealed-off, clogged or leaky lines. • Paraffin precipitation or frozen water inclusions in fuel filter and/or lines. • Ventilation opening in tank closed. • Fuel line interchanged. • Fuel filter soiled.
<p>Malfunction in combustion</p> <p>CO₂ value cannot be set to nominal value. Combustion irregular.</p>	<ul style="list-style-type: none"> • Air bubbles in intake line (intake line leaky). • Fuel filter soiled or leaky. • Fuel connection leaky (suction height, vacuum in tank); see installation instructions. • Fuel pump defective (pump pressure). • Return line constricted. • Screen in pump soiled. • Atomiser nozzle defective. • Combustion-air and exhaust lines constricted or closed off. • Motor speed of combustion motor insufficient.

Fig. 501 General error symptoms (Section 2 of 2)

5.3 Troubleshooting – rapid diagnosis

Heater types:

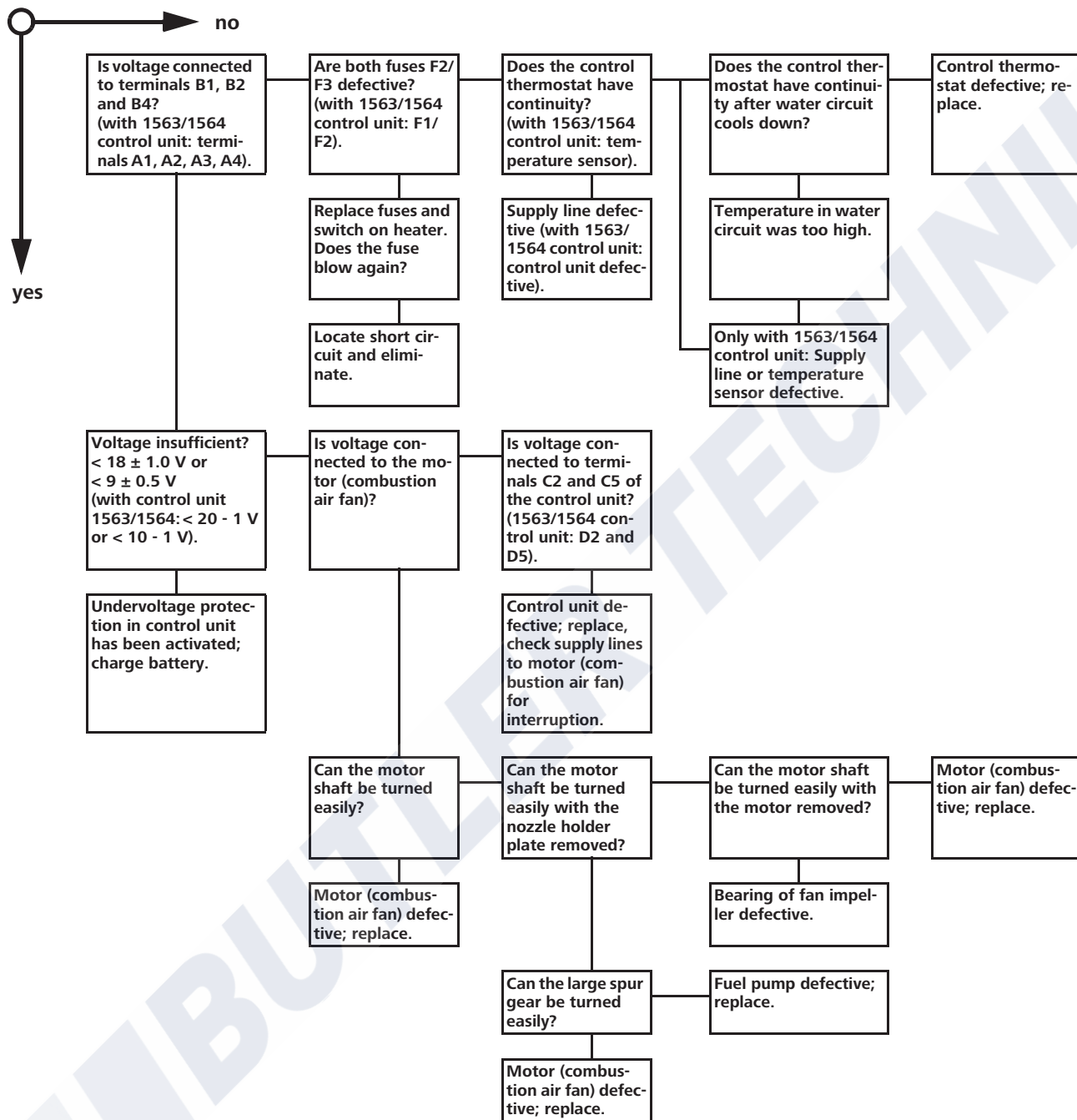
- All heaters
- Only heaters with sensor technology with 1563/1564 control unit

Description of malfunction	Check and repair or replace if necessary																			
	Power supply	Fuses	Electr. lines and connections	Switch	Thermal fuse or limiter	Control thermostat or temp. sensor	Flame monitor	Control unit	Ignition electrodes	Ignition spark generator, ignition cable	Drive (engine)	Fuel supply	Fuel pump	Solenoid fuel valve	Atomiser nozzle	Circulation pump	Combustion-air routing	Exhaust-gas routing	Heating system	
After switching on – no function	●	●	●	●				●												
Switch-on check – goes out after approx. 25 sec. (30 sec. ○)					●		●	●	●	●	●	●	●	●	●					
Combustion air fan – not running	●	●	●			●		●			●									
Combustion air fan – no run-up	●							●												
Combustion air fan – no run-on								●												
Circulation pump – not running	●	●	●					●			●									
Ignition spark – not present		●	●				●	●		●										
Combustion – does not begin (after 15 sec. ○)					●		○	●	●	●		●	●	●	●					
Combustion – stops after approx. 25 sec. (30 sec. ○)	●		●				●	●												
Combustion – cannot be shut off				●				●						●						
Combustion is carried out – with light-coloured smoke												●	●		●					
Combustion is carried out – with dark-coloured smoke	●		●								●	●						●	●	
Heater – overheated			●		●	●		●								●				●

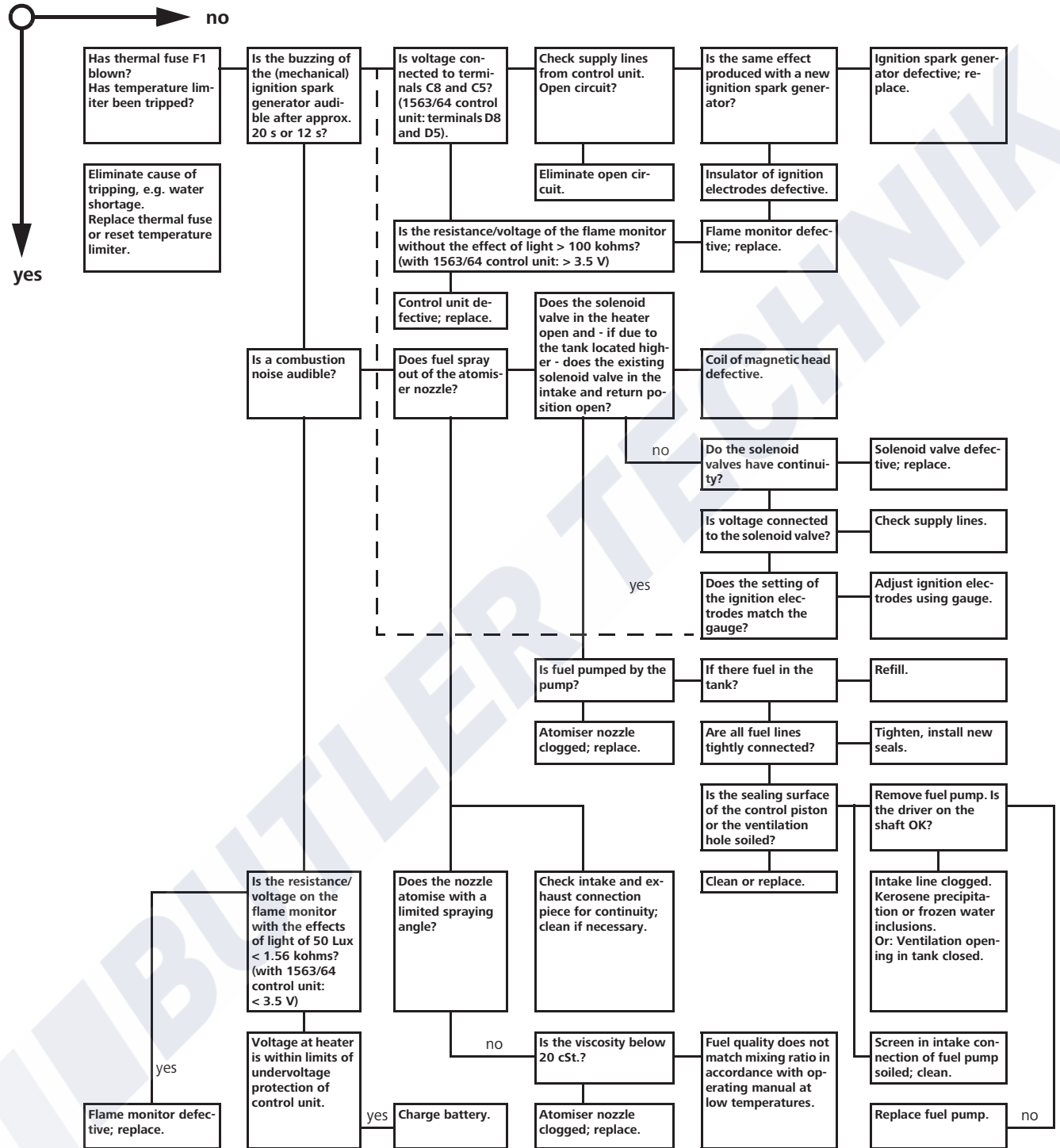
Fig. 502 Troubleshooting – rapid diagnosis

5.4 Malfunction symptoms

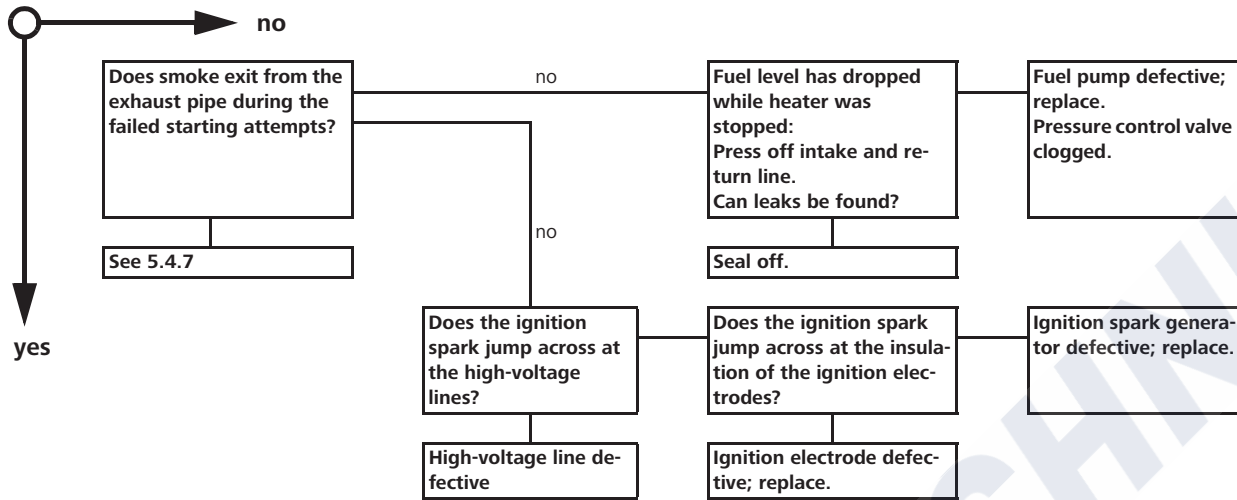
5.4.1 Heater does not start up when switched on



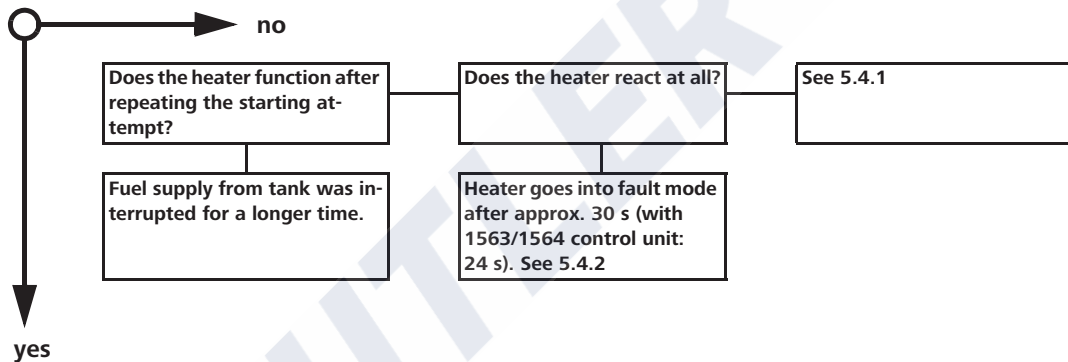
5.4.2 Heater switches into fault mode repeatedly after approx. 30 s (20 s with 1563/1564 control unit) when switched on



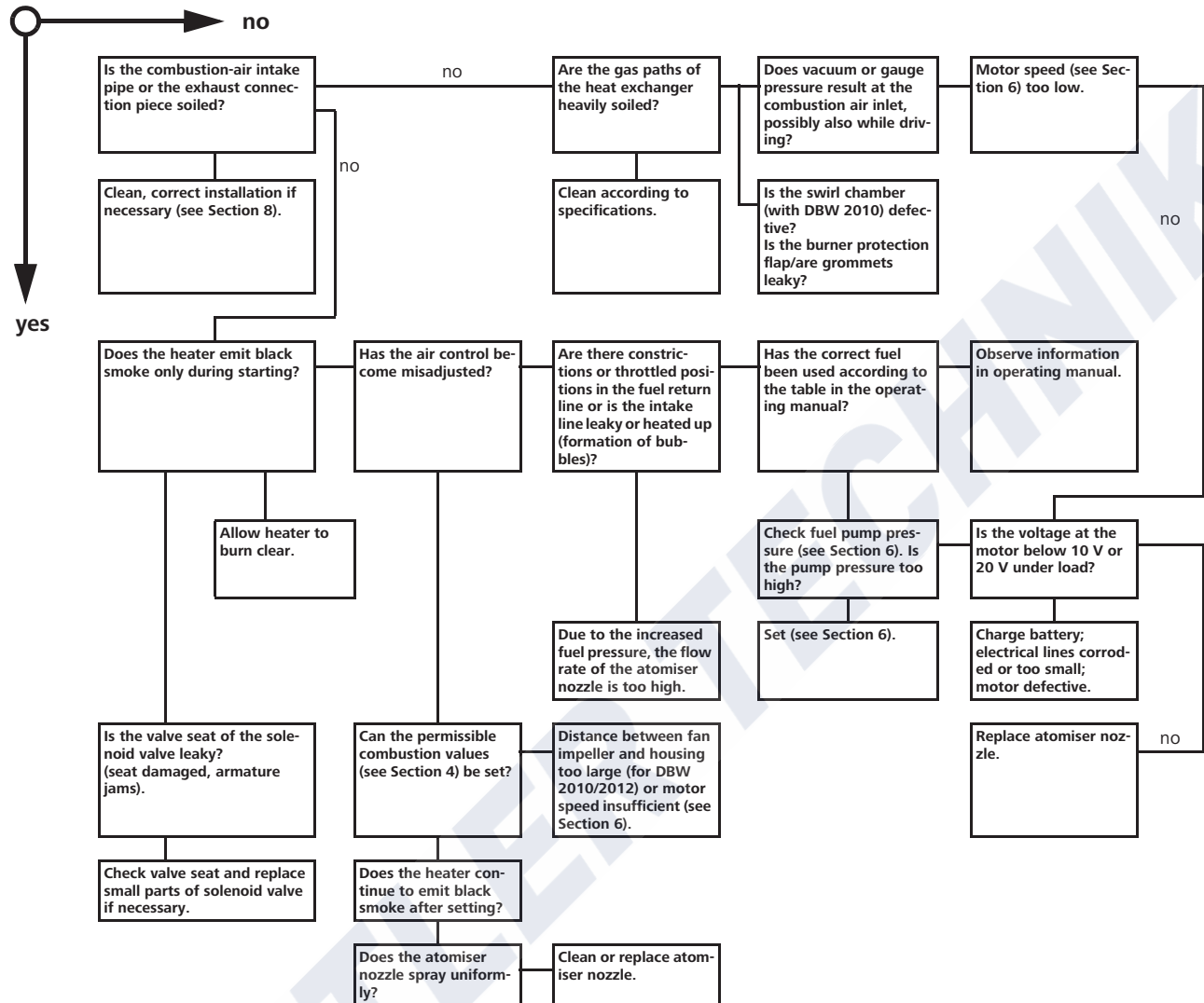
5.4.3 Heater does not start until after several starting attempts



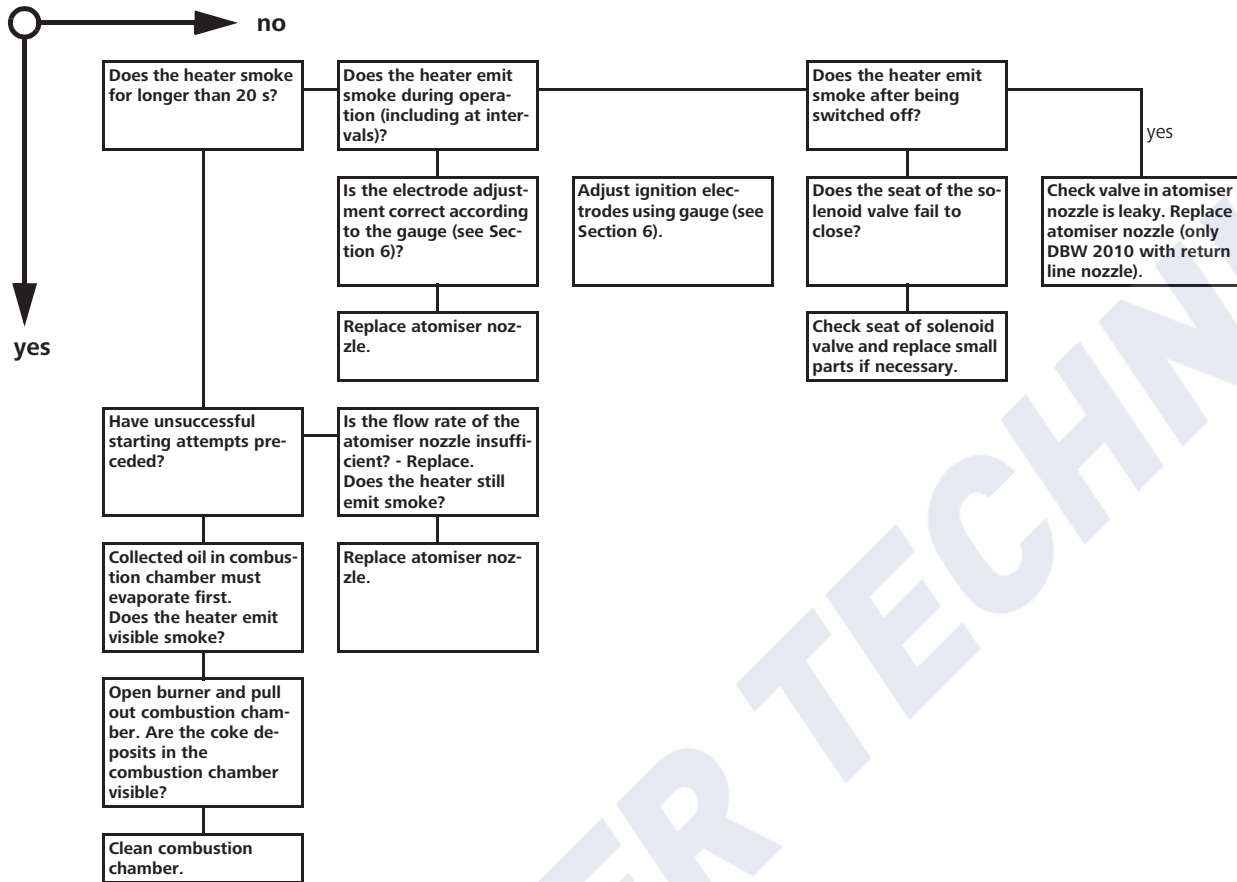
5.4.4 Heater goes out by itself during operation



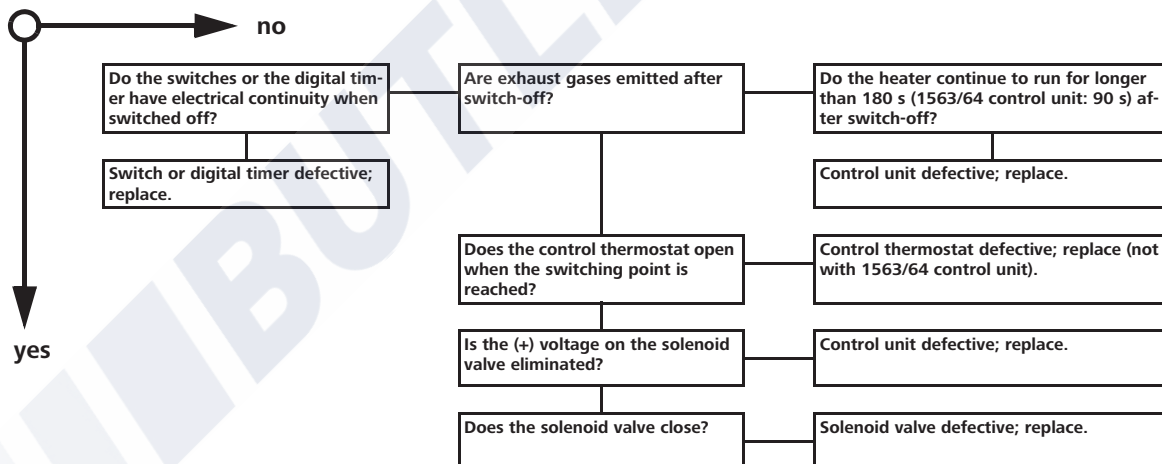
5.4.5 Heater emits black smoke



5.4.6 Heater emits white smoke



5.4.7 Heater cannot be switched off



6 Operating Tests

6.1 General information

This section describes the tests and settings carried out on the heater when it is installed and not installed to verify that it is in working order.

WARNING

The heater must not be operated in enclosed areas such as garages and workshops without an emissions extraction system.

Do not switch on the heater with the burner swung away due to the fire danger.

6.2 Settings

6.2.1 Adjusting CO₂ content

A change in the combustion air quantity set at the factory is permissible and can be achieved by turning the adjustment ring.

Measure the CO₂ value in the exhaust gas and set the combustion-air quantity if necessary:

- following repairs to the burner
- in case of combustion irregularities
- as part of a functional check
- following a nozzle replacement

Adjustment process

- Measure input voltage on heater
- Allow heater to run for approx. 5 min.
- Measure CO₂ value and amount of soot and compare to corresponding graph.

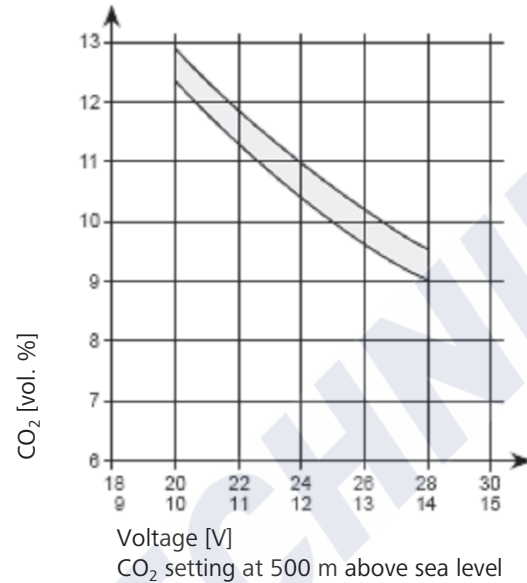


Fig. 601 CO₂ setting DBW 2010 (nozzle: 0.3 gph)

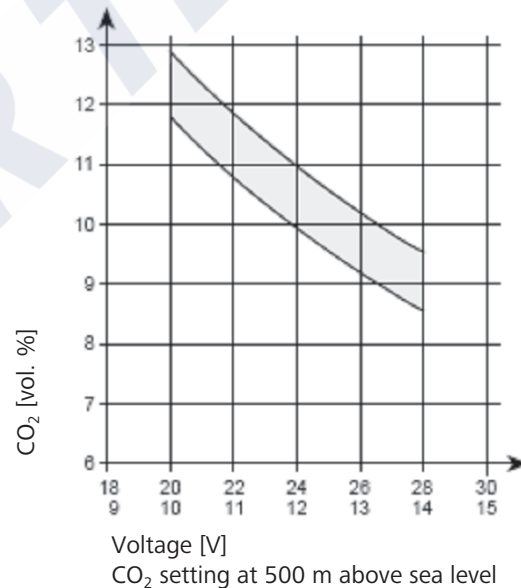


Fig. 602 CO₂ setting DBW 2010

NOTE

The CO₂ setting is dependent on the fuel (viscosity) and the geodetic altitude (0.1 % per 100 m).

If the CO₂ value cannot be properly set, proceed as follows:

- Check burner head for damage and replace if necessary
- Check pressure of fuel pump and replace pump if necessary
- Replace nozzle
- Measure speed of burner motor
- Check cable passage grommets for proper installation

Fig. 603 CO₂ setting DBW 2016 (values not available)

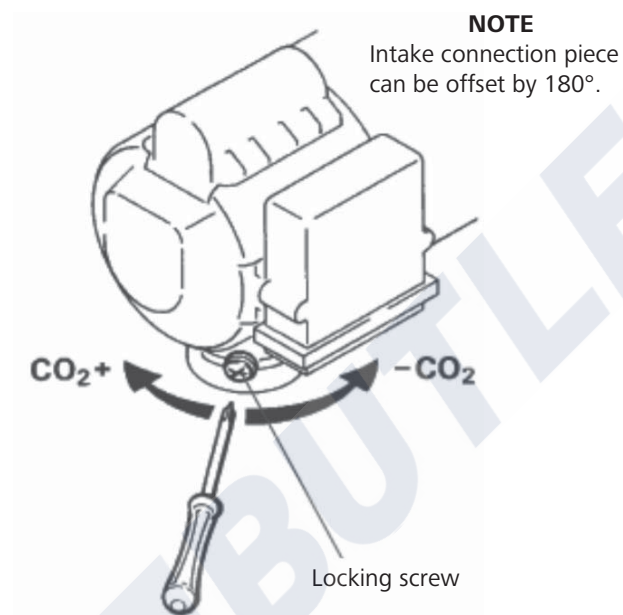


Fig. 604 CO₂ setting, locking screw

- Loosen locking screw (see Fig. 604) and move adjustment ring with locking screw until setpoint value is reached.
- Tighten locking screw to 1.0 + 0.5 Nm and lock with sealing paint.

6.3 Checking individual components

6.3.1 Resistance test of temperature sensor (only heaters with 1563/1564 control unit)

During an electrical test with a digital multimeter, the temperature sensor is to have the values in accordance with the following graph. The resistance measurement must preferably be carried out at 20 °C and approx. 100 °C (immerse sensor in water).

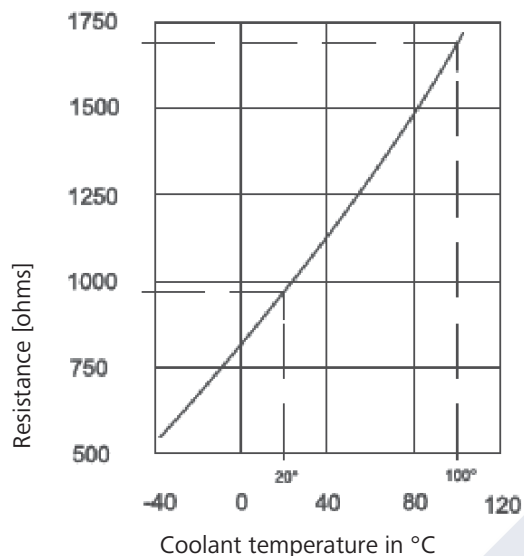


Fig. 605 Resistance test of temperature sensor

6.3.2 Resistance test of flame monitor

NOTE

The glass element of the flame monitor and the inspection window of the disc (see illustration) must be cleaned if soiled. The flame monitor must be replaced if it is damaged or the setpoint value is not reached.

6.3.2.1 Checking flame monitor with 1553 control unit

- Connect ohmmeter to flame monitor
- Darken flame monitor well. For this purpose, slide on a piece of black protective sleeving and pull together at the ends
- After approx. 20 second the resistance must increase to > 100 kohms
- Expose flame monitor to light of a match from a distance of approx. 1 cm. The resistance must drop to approx. 300 ohms in the process.

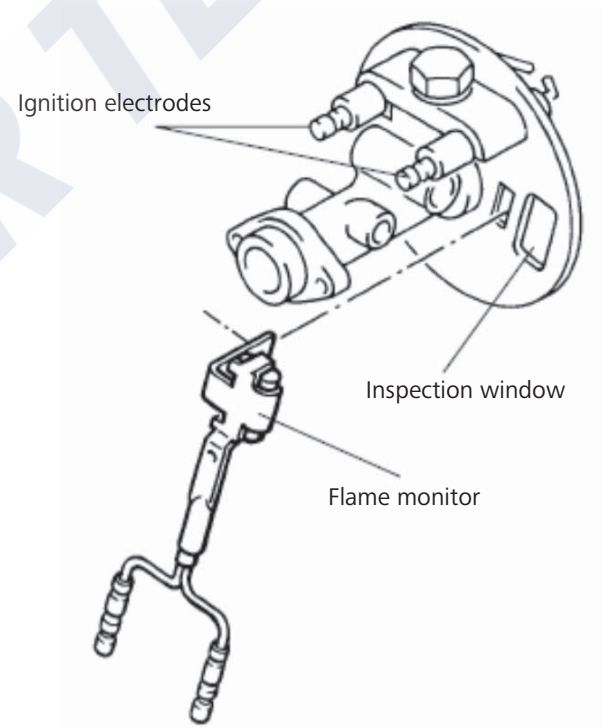


Fig. 606 Checking flame monitor with 1553 control unit

6.3.2.2 Checking flame monitor with 1563/1564 control unit

When installed

- Connect voltmeter to connections D6 (+) and D7 (-) of control unit
- Switch on heater
- The measured voltage must be 5 V.
- After approx. 15 s to 26 s, the voltage must drop to < 1 V.

When removed

- Connect flame monitor with a series resistor of 1 kohms to 5 V
- Connect voltmeter parallel to flame monitor
- The voltage must drop to > 1 V with the lens darkened and an open flame or light bulb (5 W).

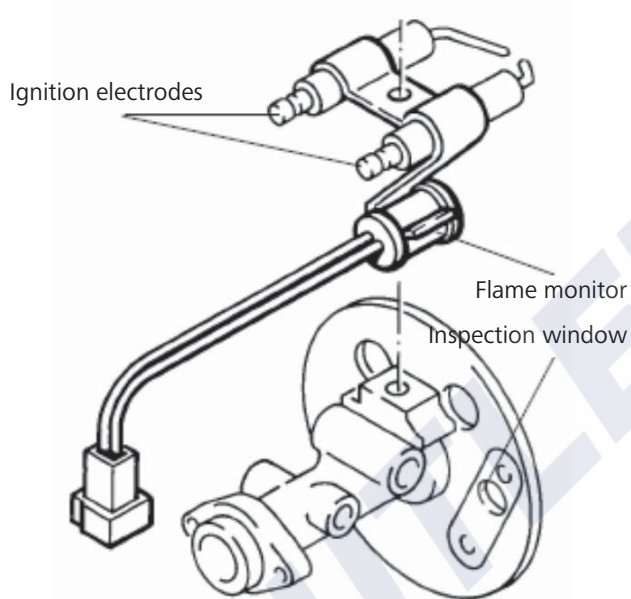


Fig. 607 Checking flame monitor with 1563/1564 control unit

6.3.3 Checking and setting ignition electrodes

NOTE

- The insulating elements of the ignition electrodes must not be damaged. Ignition electrodes with an electrode spacing outside the tolerance or ignition electrodes which do not operate properly must be adjusted or replaced.
- The ignition electrodes can be adjusted with the gauge. For this purpose, the front edge of the gauge must strike the atomising nozzle and the tip of the ignition electrodes must be in the two notches.

Test

- Examine insulating element of ignition electrodes for damage.

IMPORTANT

So that the fuel atomisation is not impaired, do not touch the nozzle hole when measuring the electrode spacing.

- Check electrode spacing in accordance with gauge as per Fig. 608 and state of ignition electrodes.

Adjusting

Readjust electrode spacing by bending and check with gauge in accordance with Fig. 608.

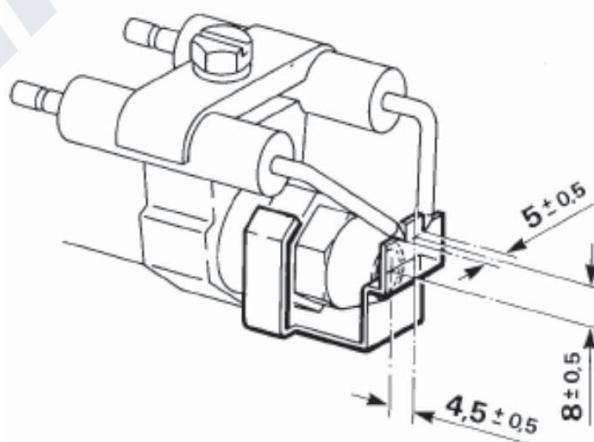


Fig. 608 Reassigning and checking electrode spacing

6.3.4 Checking ignition spark generator

WARNING

High voltage; a voltage of approx. 8,000 V jumps across at ignition electrodes.

IMPORTANT

Do not charge ignition spark generator without ignition electrodes with voltage.

Test

NOTE

Connect direct current supply with plus to black wire and negative to brown wire.

- Connect direct voltage of 12 V or 24 V
- Target state: Ignition sparks jump across to ignition electrodes.

6.3.5 Checking fuel pump

NOTE

The fuel pump is checked when installed. The pump pressure may be adjusted.

A tester is required for testing. A tester (display range 0 to 15 bar) can be purchased from your authorised Webasto dealer.

IMPORTANT

The ignition spark generator must be removed.

Test

- Remove ignition spark generator (see 9.2.7.1).
- Remove atomiser nozzle.
- Screw on tester.
- Cover flame monitor.
- Switch on heater.
- After approx. 15 sec. the pump pressure is displayed (see Fig. 609).
- DBW2010: 7 bar for nozzle 0.4 gph
10 bar for nozzle 0.3 - 0.35 gph
- DBW2016: 11.5 bar
- Switch off heater.
- Screw off tester.

IMPORTANT

Do not damage nozzle hole.

- Screw in atomiser nozzle and tighten to 20 Nm.
- Install ignition spark generator (see 9.2.7.2).

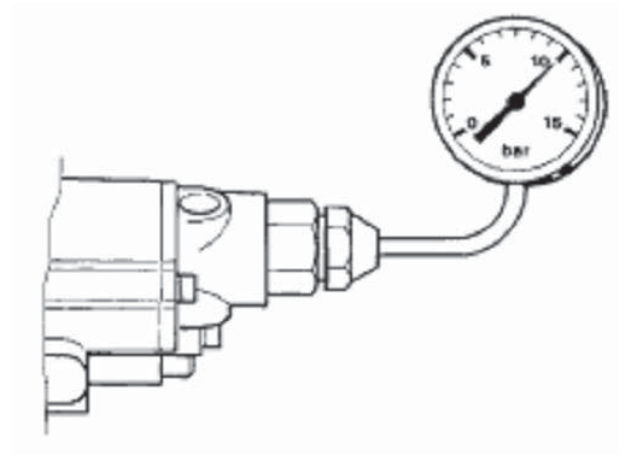


Fig. 609 Fuel pump pressure

6.3.6 Checking burner motor

NOTE

The combustion air fan is checked when installed. If the set-point states are not reached, then the fan motor must be replaced.

Test

- Examine bearing condition (stickiness) of burner motor.
- Measure input voltage on heater
- Switch on heater
- Measure speed (speeds must be within specified speed ranges at nominal voltage)

DBW 2010: 4,500 ± 100 / min.

DBW 2016: 5,000 ± 100 / min.

6.3.7 Checking solenoid valve

NOTE

A leaky valve seat of the solenoid valve is indicated by longer continued smoking of the heater in run-on. In this case, fuel continues dripping via the atomiser nozzle.

Brief continued smoking is normal. This is carried out by emptying the space between the solenoid valve and the nozzle hole.

Test**IMPORTANT**

Disconnect the connector of the solenoid valve at the control unit and connect to external power supply.

Failure to observe this can result in damage to the control unit.

- Check electrical operation with 12 V devices in accordance with data below:
 - Opening voltage 8.5 V
 - Operating voltage 9.6 to 14.4 V
 - Power consumption at nominal voltage and 20 °C 10 W
 - Nominal current 0.83 ampere
- Check electrical operation with 24 V devices in accordance with data below:
 - Opening voltage 17. V
 - Operating voltage 19: to 28.8 V
 - Power consumption at nominal voltage and 20 °C 10 W
 - Nominal current 0.42 ampere

6.3.8 Checking nozzle holder pre-heating unit (optional component)

NOTE

At a temperature of < 0 °C, the heating cartridge in the nozzle holder is connected with a thermostat. The heating duration is dependent on the reflected heat in the combustion chamber and switches off at +8 °C at the thermostat.





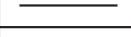
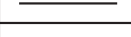

The power consumption is 130 ± 13 W with 12 V or 24 V.

Test

- Swing or remove burner head
- Disconnect connector from nozzle holder
- Connect ohmmeter to connector
- Cool thermostat with refrigerant spray or bypass
- Resistance value (max. 4.5 ohms).

7 Circuit Diagrams

The wiring diagrams or application examples (Fig. 701 to Fig. 706) show the possible circuits of the DBW 2010, DBW 2016 and DBW 2016 Railheaters.

Cable cross-sections		
	< 7.5 m	7.5 m–15 m
	0.75 mm ²	1.0 mm ²
	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
	Vehicle's own cable	

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

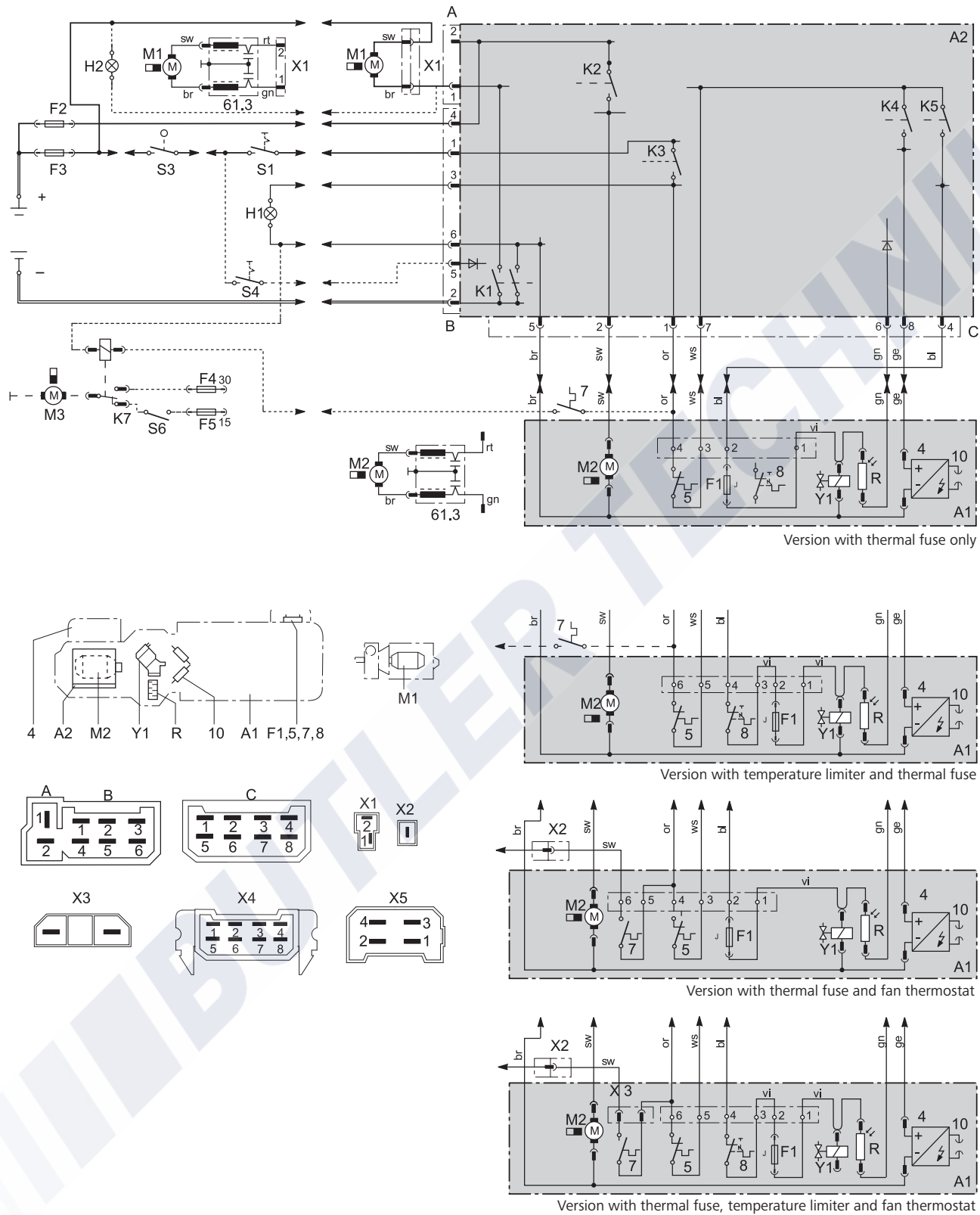


Fig. 701 System wiring diagram for DBW 2010 with 1553 control unit and switch, 12 and 24 V

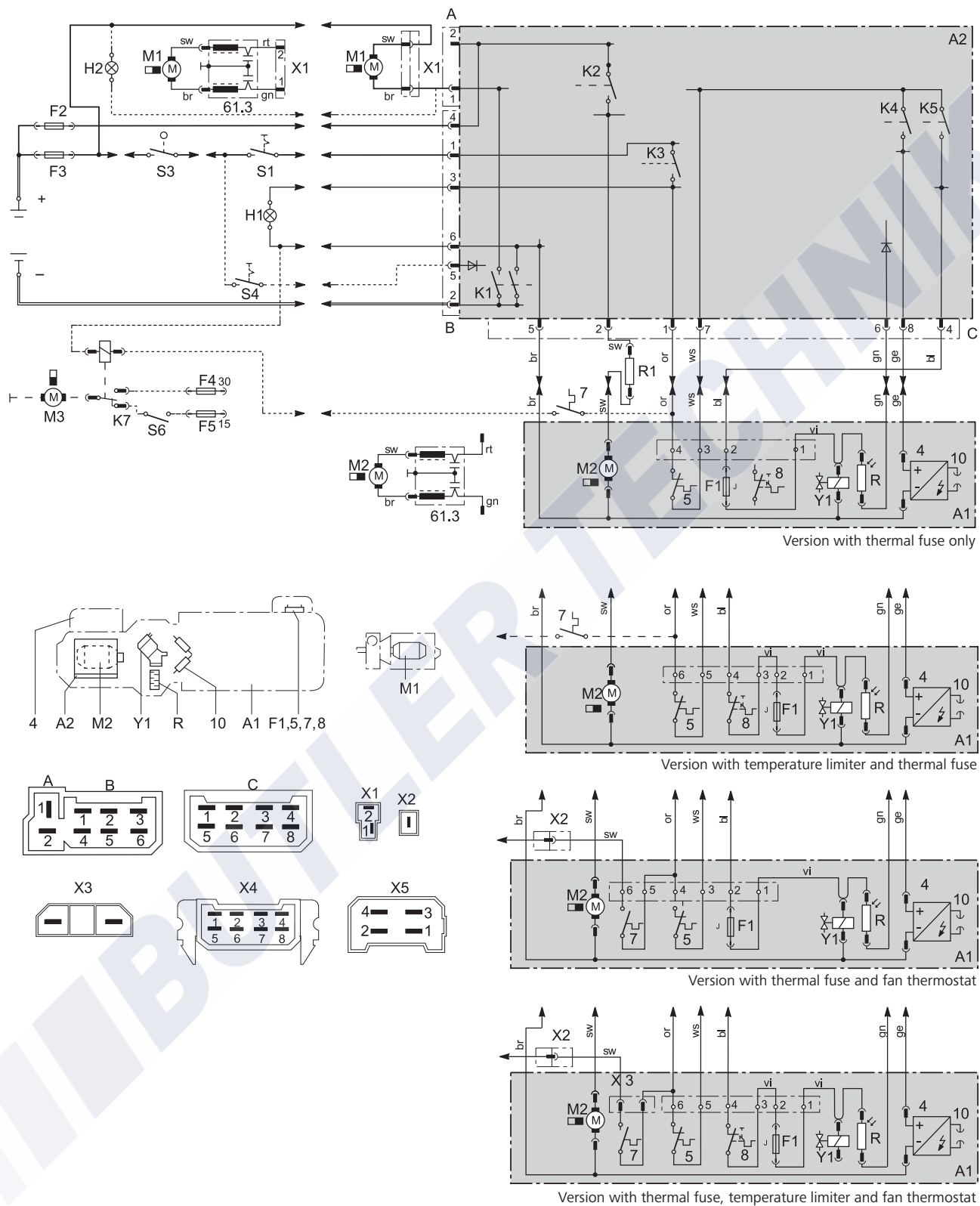


Fig. 702 System wiring diagram DBW 2016 with 1553 control unit and switch, 24 V

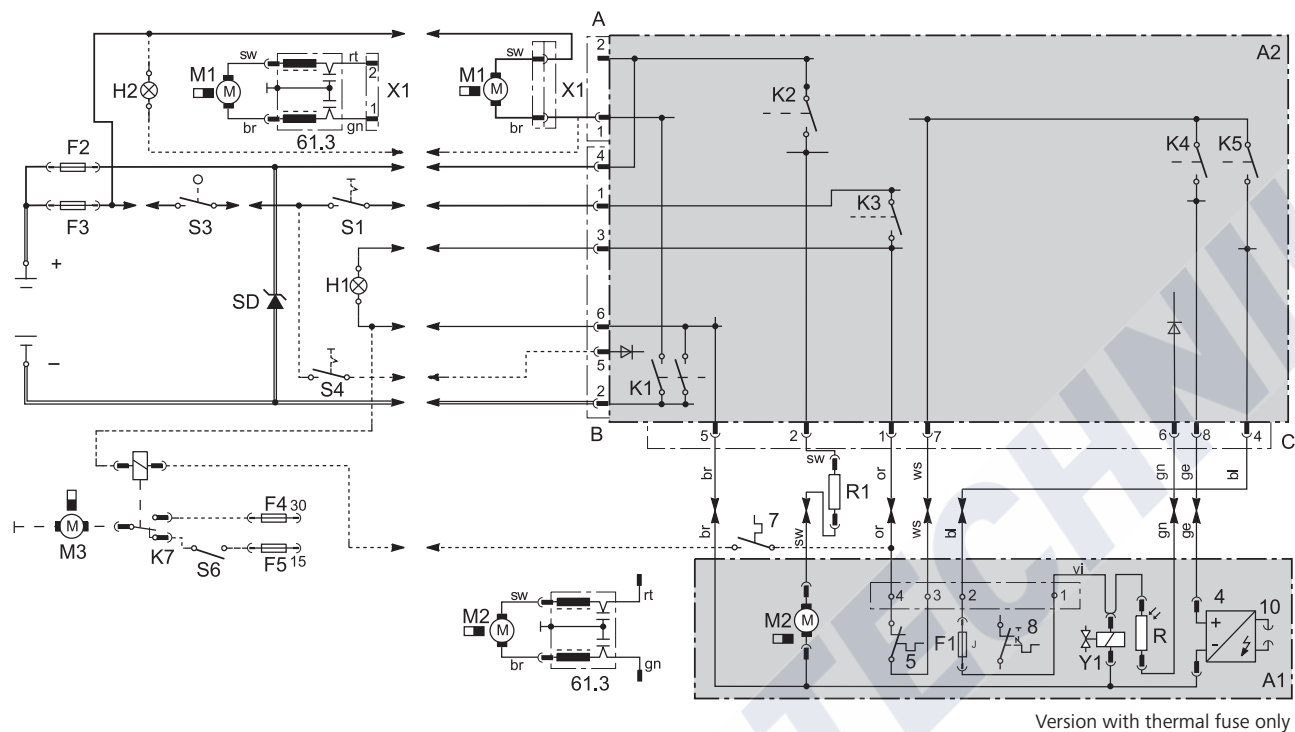


Fig. 703 System wiring diagram DBW 2016 Rail with 1553 control unit and switch, 24 V

NOTE

When using the digital timer 1531, the switch S1 in Fig. 703 is replaced by a relay, actuated by the load output of the digital timer 1531. The switching capacity of the relay must be at least 2 A. The control current may not exceed 0.4 A.

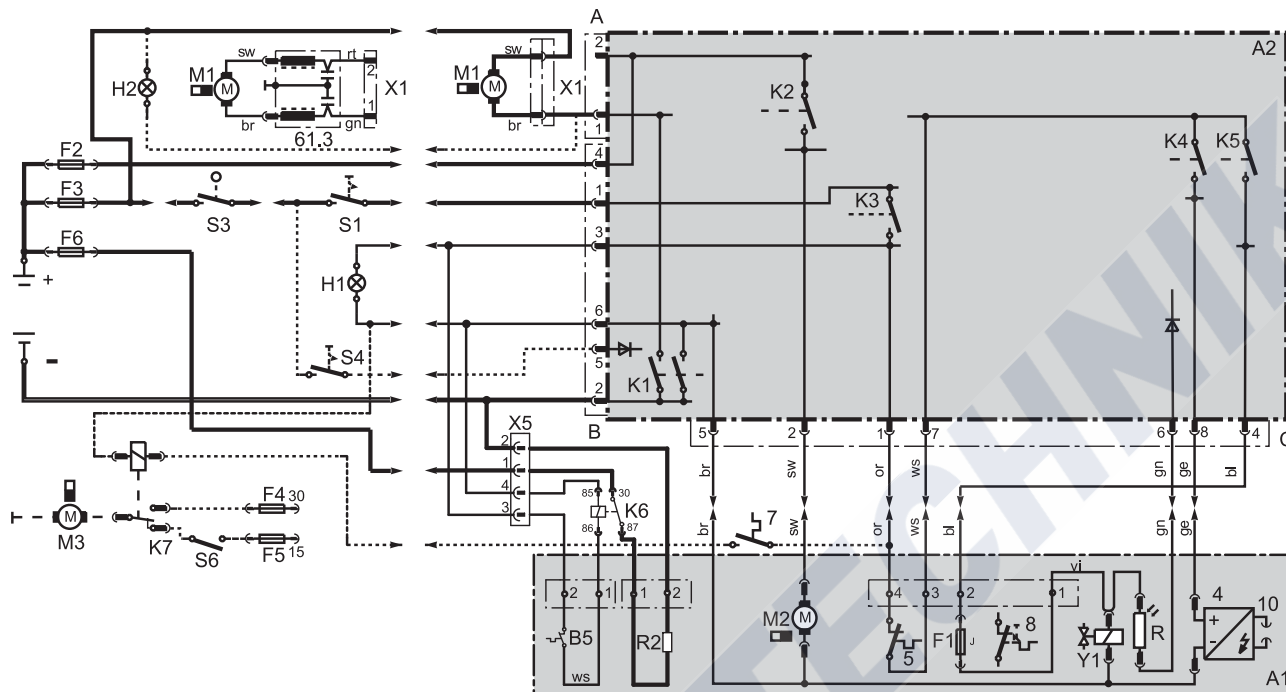


Fig. 704 System wiring diagram DBW 2010 with 1553 control unit, 12 and 24 V, switch, nozzle holder pre-heating unit and altitude control

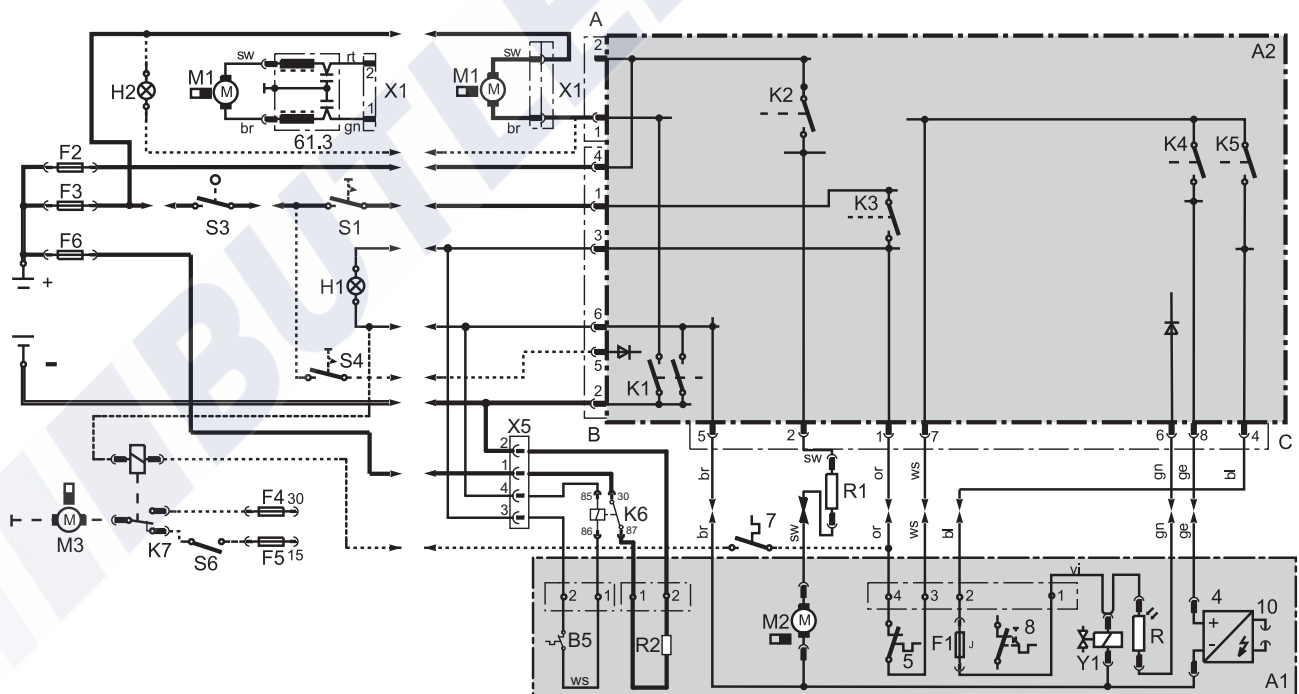


Fig. 705 System wiring diagram DBW 2016 with 1553 control unit, 24 V, switch, nozzle holder pre-heating unit and altitude control

Legend Fig. 701 to Fig. 705:

Item	Description	Comment	A	B	C	D
1	Heater	Not earthed		●		
2	Control unit	SG 1553	●			
4	Ignition spark generator		●			
5	Thermostat	Control thermostat (internal)	●			
7	Thermostat	Fan thermostat	○	○	○	
8	Thermostat	Temperature limiter thermostat	●			
10	Ignition electrodes		●			
61.3	Interference suppression set (2x)	Radio interference suppression			○	
F1	Thermal fuse	Independent of polarity	●			
F2	20 A fuse	Flat fuse SAE J 1284		○		
F3	10 A fuse	Flat fuse SAE J 1284		○		
F4	Fuse	Flat fuse SAE J 1284		○		
F5	Fuse	Flat fuse SAE J 1284				●
H1	Lamp, green	Operation indicator		●		
H2	Lamp, for circulation pump	If operated via S4			○	
K1	Relay	Circulation pump; minus for heater				
K2	Relay	Heater motor				
K3	Relay	Lamp; operation of control thermostat				
K4	Relay	Ignition spark generator				
K5	Relay	Solenoid valve; flame monitor				
K7	Relay	Fan of vehicle heater			○	
M1	Motor	Circulation pump		●		
M2	Motor	Heater motor	●			
M3	Motor	Vehicle fan				●
R	Flame monitor	Photo resistor, Independent of polarity	●			
S1	Switch	for heater ON - OFF (starting current max. 2 A)		●		
S3	Switch on water valve	Contact open when water valve closed			○	
S4	Switch	For ON - OFF; circulation pump separate			○	
S6	Switch	Vehicle fan				●
SD	Protective diode	Diode 5KP36A		○		
X1	Plug connector	2-pin		○		
X2	Plug connector	1-pin		○		
X3	Plug connector	2-pin		○		
Y1	Solenoid valve	Independent of polarity	●			
A	installed in heater		●	Fixed assignment		
B	loose delivered parts		○	Possible depending on delivery scope or design		
C	only if required					
D	present in vehicle					

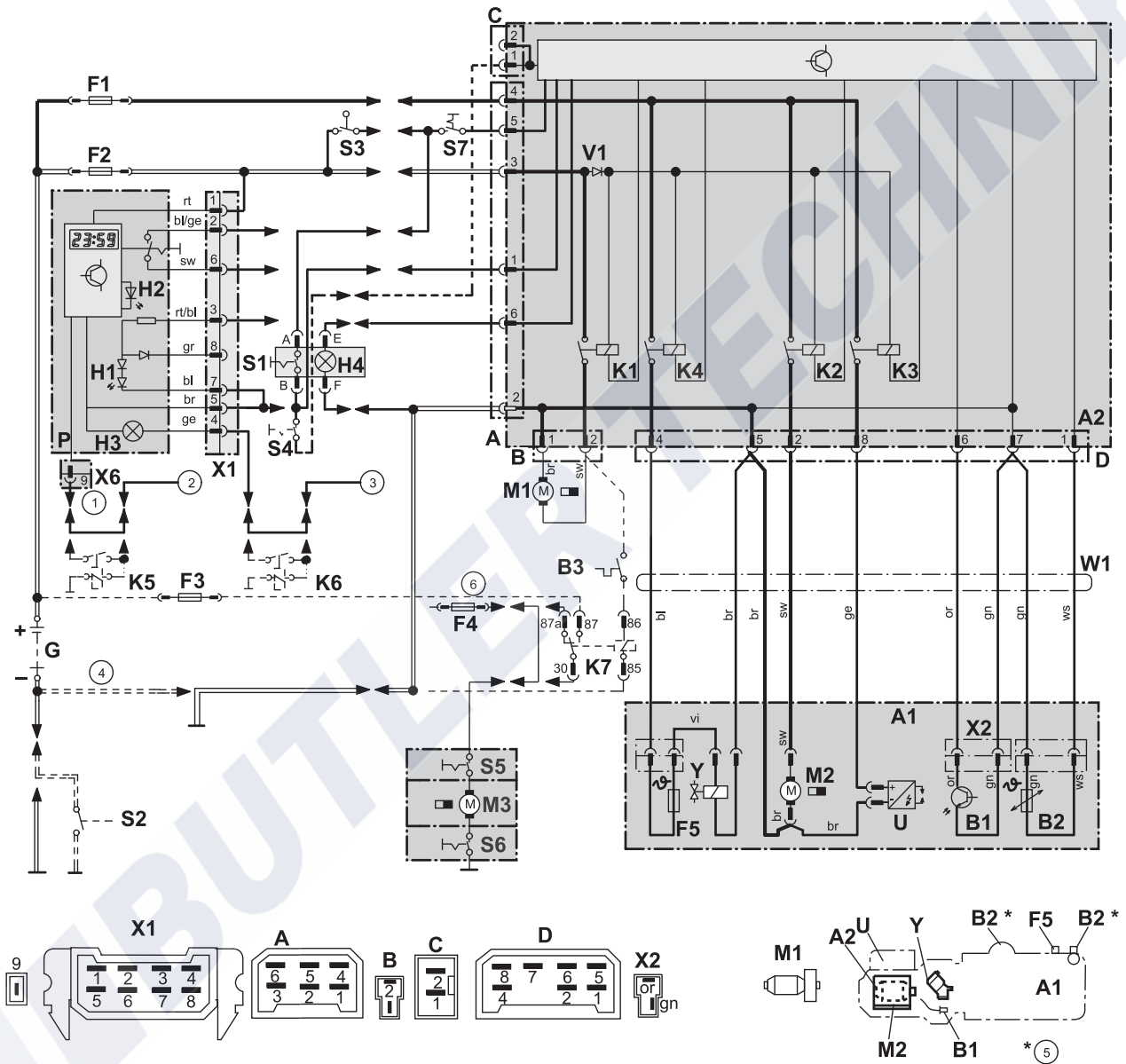


Fig. 706 Automatic switching, DBW 2010 with 1563 control unit, 12 and 24 V

Legend Fig. 706:

Item	Description	Comment
A1	Heater	Not earthed
A2	Control unit	SG 1563
B1	Flame monitor	Ensure proper polarity
B2	Temperature sensor	Polarity as desired
B3	Fan thermostat	In water circuit, for vehicle fan (ON - OFF)
F1	20 A fuse	Flat fuse SAE J 1284
F2	10 A fuse	Flat fuse SAE J 1284
F3	Fuse	Flat fuse SAE J 1284
F4	Fuse	Flat fuse SAE J 1284
F5	Thermal fuse	Polarity as desired
G	Battery	
H1	LED, green	Operation indicator (in Item P)
H2	LED, yellow	Operation indicator (in Item P)
H3	Lamps	Symbol lighting (in Item P)
H4	LED, green	Operation indicator (when using S1)
K1	Relay (in Item A2)	For circulation pump
K2	Relay (in Item A2)	For combustion air fan
K3	Relay (in Item A2)	For ignition spark generator
K4	Relay (in Item A2)	For solenoid valve
K5	Relay	
K6	Relay	Only necessary with battery switch in minus
K7	Relay for vehicle fan	Only necessary together with B3
M1	Motor	Circulation pump
M2	Motor	Combustion air fan
M3	Motor	Vehicle fan
P	Timer (digital)	for programmed operation, no longer available
S1	Switch (ON - OFF)	Alternative to Item P
S2	Switch	Battery switch
S3	Switch	On water valve
S4	Switch	Economy mode
S5	Switch (for vehicle fan)	Alternative to Item S6
S6	Switch (for vehicle fan)	Alternative to Item S5
S7	Switch	For circulation pump, separate ON - OFF
U	Ignition spark generator	With ignition electrodes
V1	Diode	In control unit Item A2
W	Wiring harness	Control unit - heater
X1	Plug connector, 8-pin	For Item P
X2	Plug connector, 2-pin	
Y	Solenoid valve	Polarity as desired
<p>① Digital timer P: With plus on Connection 9 = continuous operation with immediate heating, without plus on connection 9 = heating duration: 1 hour</p> <p>② To vehicle terminal 75, if present – otherwise terminal 15</p> <p>③ Motor vehicle lighting (terminal 58)</p> <p>④ Hashed lines and relay K5 and K6 only when using battery switch S</p> <p>⑤ Alternative</p> <p>⑥ Vehicle terminal 15</p>		

8 Servicing Work

8.1 General information

This section describes the servicing work that can be carried out on the heaters when they are installed.

8.2 Work on heater

The main battery power must not be disconnected whilst the heater is operating or slowing down as a result of the risk of the heater overheating and the overheating guard thus being tripped.

If you wish to carry out extensive repair work on the heater, it may be a good idea to remove it.

After work is performed on the heating circuit, a coolant mixture of water and antifreeze must be added in accordance with the vehicle manufacturer's specifications and the heating circuit must be bled.

8.3 Work on vehicle

IMPORTANT

A temperature of 85 °C must not be exceeded in the vicinity of the heater under any circumstances (e.g. during painting work on the vehicle).

8.4 Test run of heater

The heater may not be operated in closed rooms, such as garages or workshops, without exhaust extraction, not even with time preselection.

8.5 Maintenance work

The following maintenance work must be carried out to maintain the functional reliability of the heater:

- The openings of the combustion-air intake pipe and the exhaust-gas opening must be checked for soiling and cleaned.
- Outside the heating period, the heater is to be operated approximately every 4 weeks for 10 minutes with the vehicle heating set to "hot" and the vehicle engine cold. This prevents starting difficulties.
- When the coolant for the vehicle engine is replaced, careful bleeding of the heater and the circulation pump must be ensured after bleeding the vehicle cooling system. If the fill level of the coolant is low, it must be topped up according to the vehicle manufacturer's specifications.
- The fuel filter or the filter insert must be replaced at least once a year, and with heavily soiled fuel more often, to prevent malfunctions.
- If leaks occur, the fuel pump and the fuel lines must be replaced immediately, and otherwise every 5 years.
- The heater should be checked by an authorised Webasto dealer at regular intervals, however at the latest at the start of the heating period.

8.5.1 Swinging burner head away and in

WARNING

The ignition spark generator is operated with high voltage. Before being swung away, the connectors of the wiring harness in the vehicle must be disconnected, as otherwise there is a danger of incurring life-threatening injuries. When the burner head has been swung in again, the connectors in the vehicle are connected.

NOTE

The heater is maintenance-friendly. Swinging away the burner head enables access to the following components:

- Fuel pump and atomiser nozzle
- Solenoid valve
- Ignition spark generator
- Ignition electrodes
- Flame monitor
- Combustion chamber
- Nozzle holder pre-heating unit (if installed)
- With DBW 2010/2016, ensure proper seating of cable grommets.

To achieve a corresponding opening angle, it may be necessary to disconnect the electrical connections.

Swinging away

- 1 Disconnect electrical connections if necessary.
2. Loose nuts (3, Fig. 801) until screws (1) can be swung away.
3. Swing away screws (1).
4. Swing away burner head (4).

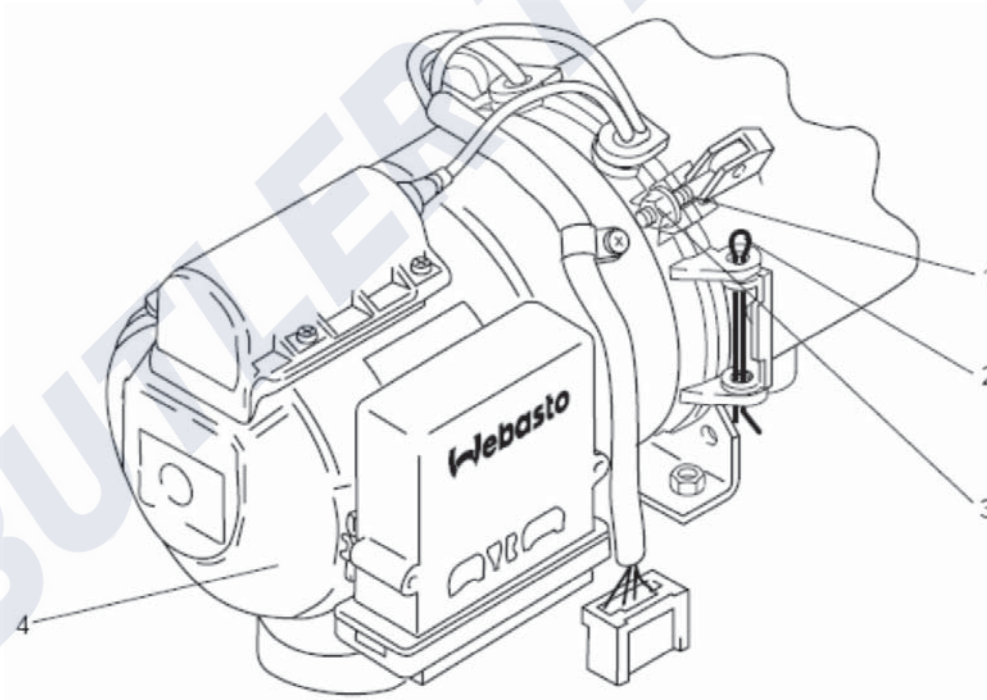
Swinging in

1. Swing in burner head (4, Fig. 801) and move into assembly position.
2. Swing in screws (1) and initially tighten hand-tight with nuts (3) to prevent one-sided twisting.
3. Tighten nuts (3) to 5,0 + 1 Nm.
4. Make electrical connections if necessary.

NOTE

Make sure that the electrical connections are properly connected in accordance with the colour coding.

- 1 Screw (2)
- 2 Cotter pin
- 3 Nut (2)
- 4 Burner head

**NOTE**

- The cotter pin can be positioned on the other side in accordance with the swinging direction of the burner head.
- The burner head of the DBW 2010 / DBW 2016 heaters is shown here.

Fig. 801 Swinging burner head away and in

8.6 Visual inspections and installation instructions

8.6.1 Connection to the vehicle cooling system

The heater should be installed as low as possible to permit automatic bleeding of the heater and circulation pump. This is particularly important as the circulation pump is not self-priming.

The heater must be connected to the vehicle cooling system as shown in Fig. 802. The system must contain at least 10 litres of coolant.

In the vehicle cooling system or with a separate heating circuit, only pressure relief valves with an opening pressure of at least 0.4 bar and a maximum of 2.0 bar may be used.

The coolant hoses supplied by Webasto must always be used. If other hoses are used, they must at least comply with DIN 73411. The hoses must be routed without kinking and, if possible, uphill to ensure proper bleeding. Hose connections must be supported by hose clips so they cannot slip off.

NOTE

The tightening torques of the hose clamps used must be observed.

Care must be taken to bleed the cooling system before the heater is taken into service for the first time or after refilling with fresh coolant. Heater and lines must be installed in such a way as to ensure static bleeding.

Malfunctions due to overheating may occur during heating operation if the heater and lines have not been bled correctly.

Proper bleeding can be recognised from the virtually silent operation of the circulation pump.

8.6.2 Connection to the vehicle fuel system

The fuel is taken from the vehicle fuel tank or from a separate fuel tank.

8.6.2.1 Fuel lines

Fuel lines must be installed with an upward inclined if possible to prevent air inclusions. Connections within the line must be secured with hose clamps if no mechanical screw fittings are used.

If fuel hoses are used, the hoses supplied or offered by Webasto must always be used. If other fuel hoses are used, they must at least comply with DIN 73379. Fuel hoses must not be kinked or twisted and must be secured with clamps at distances of approx. 25 cm.

The materials commonly used in vehicle construction, e.g. steel, copper and plastic lines of soft, light and temperature-stabilised PA11 or PA12 (e.g. Mecanyl RWTL) in accordance with DIN 73378, can be used as fuel lines while observing the respective connection technology.

The following must always be observed when installing fuel lines:

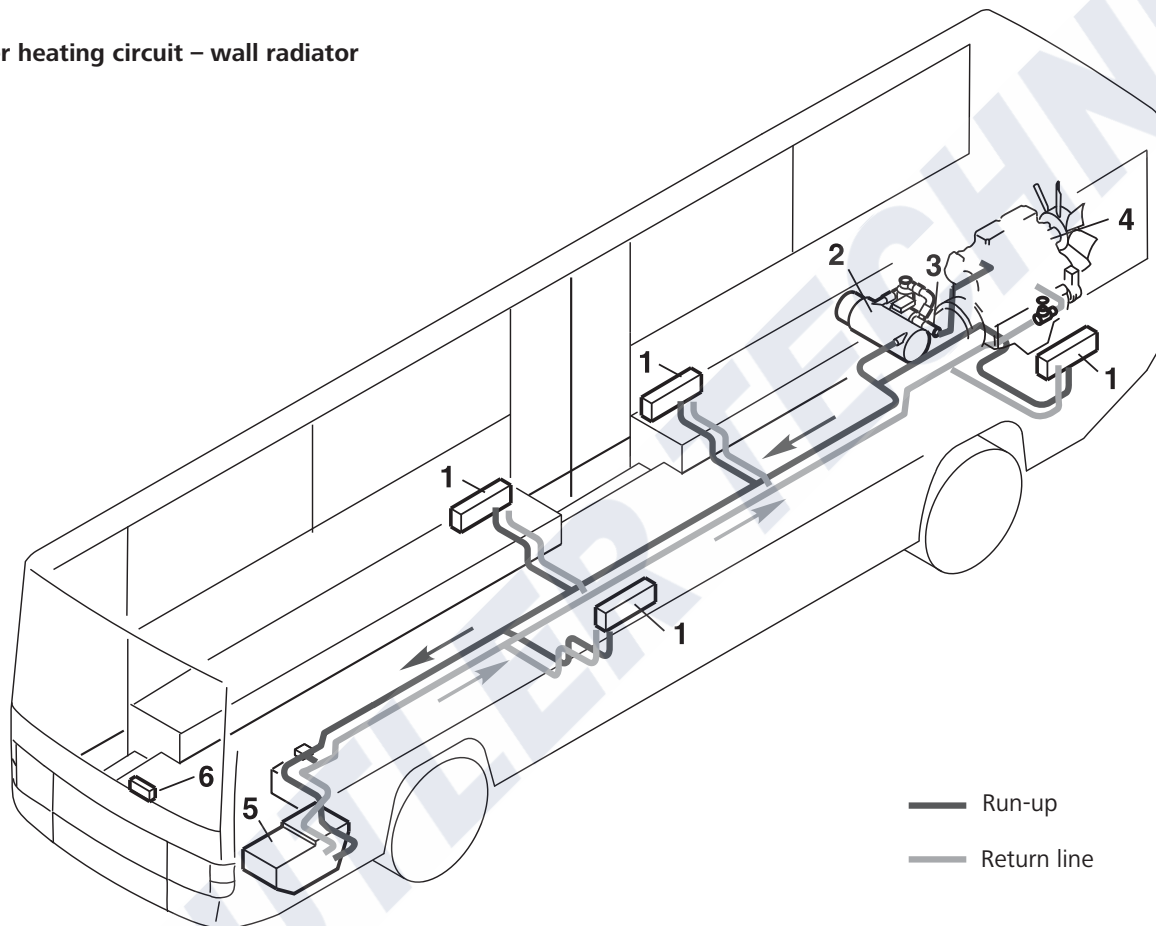
- Lines must be protected against the effects of temperature

WARNING

The outer jacket of the heater can reach the ignition temperature of diesel fuel in case of overheating!

- Lines must be protected against stone impact
- **Dripping or evaporating fuel must neither collect nor ignite on hot parts or electrical equipment.**

Water heating circuit – wall radiator



- 1 Wall radiator with fan
- 2 Heater
- 3 Circulation pump
- 4 Motor vehicle engine
- 5 Driver's seat heating
- 6 Control element

Fig. 802 Installation example for heater in bus

When installing a shut-off device in the return line, a notification sign must be mounted in a highly visible location.

IMPORTANT

Operation with a closed return line will result in damage to the fuel pump. Fuel can escape. Danger of fire!

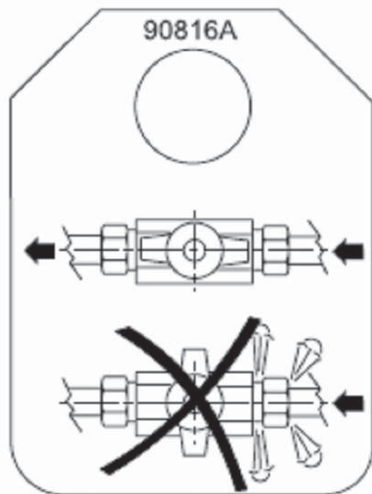


Fig. 803 Notification sign

Unsupported fuel lines must be secured to prevent them sagging.

The installation of an additional fuel pump is not permissible.

Permissible dimensions of fuel lines:

- Inside diameter for intake and return line: 6 mm (other diameters on request).
- Maximum permissible line length for each intake and return line: 10 m
- Maximum permissible suction height: 2 m (installation of a check valve is recommended with maximum suction height)
- Maximum permissible inlet pressure: 0.3 bar for intake and return line.

8.6.2.2 Fuel filter

A fuel filter supplied or approved by Webasto must be installed. Installation should be vertical if possible, while the direction of flow is horizontal.

To prevent malfunctions, the filter or filter insert must be replaced at least once a year, and with heavily soiled fuel more often, to prevent malfunctions.

8.6.3 Combustion air supply

IMPORTANT

The statutory regulations for the installation must be observed (see 1.6).

Under no circumstances may the combustion air be taken from areas occupied by people. The combustion air intake opening must not point in the direction of travel. It must be located so that it cannot become clogged with dirt or snow and intaking of splash water is not to be expected.

The combustion air inlet and exhaust-gas outlet location must be chosen so that no air pressure difference results in any vehicle operating mode.

Permissible dimensions of combustion-air intake line:

- Inside diameter: 55 mm
- Maximum permissible line length: 5 m
- Maximum permissible bends: 270 °C

The combustion air inlet must be positioned so that no exhaust gas can be sucked in.

NOTE

If the combustion-air intake pipe cannot be installed uphill, then a water drain hole with a diameter of 4 mm must be drilled at the lowest point.

If the heater is installed in a common installation space near the vehicle tank, the combustion air must be taken in from the outside and the exhaust gas discharged into the atmosphere. The openings must be splash-proof.

If the heater is installed in a closed installation box, a ventilation opening is required:

DBW 2010 / 2016 20 cm²

If the temperature in the installation box exceeds the permissible ambient temperature of the heater (see Section 4, "Technical Data"), then the ventilation opening must be enlarged after consulting Webasto.

8.6.4 Exhaust pipe

IMPORTANT

The statutory regulations for the installation must be observed (see 1.6).

The opening of the exhaust pipe must not point in the direction of travel.

The exhaust pipe opening for combustion air must be located so that it cannot become clogged with snow and mud.

The combustion air inlet and exhaust-gas outlet location must be chosen so that no air pressure difference results in any vehicle operating mode.

Rigid pipes of unalloyed or alloyed steel with a minimum wall thickness of 1.0 mm or flexible piping of alloyed steel only must be used as exhaust line.

The exhaust pipe is secured on the heater, e.g. with clamps.

Permissible dimensions of exhaust pipe:

- Inside diameter:
DBW 2010 / 2016 = 38 mm
- Maximum permissible line length: 5 m
- Maximum permissible bend: 270 °C

As an alternative, an exhaust-gas deflection approved by Webasto can be installed.

8.7 Removal and installation

IMPORTANT

When installed, only the following dismantling and removal procedures are approved, provided sufficient space is available for removal:

- Replacing temperature limiter
- Replacing temperature sensor
- Replacing fan or control thermostat
- Replacing thermal fuse
- Replacing thermal fusible link
- Replacing burner head
- Replacing ignition spark generator
- Replacing flame monitor
- Replacing combustion chamber

8.7.1 Heater, removal and installation

8.7.1.1 Removal

1. Disconnect the wiring harness plug from the control unit.
2. Disconnect the combustion-air inlet line from the heater.
3. Loosen the clamp on the exhaust-gas outlet.
4. Disconnect the fuel supply and return line and pull off the fuel lines and seal off with blind plugs.
Close water valves if present.
5. Loosen the hose clamps on the coolant hoses, pull off the hoses and seal off with blind plugs.
6. Remove the corresponding fastening elements (screws, nuts and washers) from the stand.
7. Remove heater.

8.7.1.2 Installation

1. Position heater in installation position and fasten with appropriate screws, washers and nuts.
2. Secure the line on the exhaust-gas outlet with a clamp.
3. Connect the coolant hoses and secure them with hose clamps. Open the water valves.
4. Connect the fuel supply and return line and secure.
5. Fasten the combustion-air inlet line on the heater.
6. Connect the wiring harness plug to the control unit.
7. Bleed the fuel supply system.
8. Bleed coolant circuit.

8.7.2 Replacing temperature limiter

NOTE

The procedure for replacing the temperature limiter with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.1.

WARNING

Before replacing the temperature limiter on heaters with the 1563/1564 control unit while installed, the pressure in the cooling system must be released by opening the radiator cap. Also allow the heater to cool and provide a catch container for the escaping coolant if necessary.

8.7.3 Replacing temperature sensor

NOTE

The procedure for replacing the temperature sensor with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.2.

WARNING

Before replacing the temperature sensor on heaters with the 1563/1564 control unit while installed, the pressure in the cooling system must be released by opening the radiator cap. Also allow the heater to cool and provide a catch container for the escaping coolant if necessary.

8.7.4 Replacing thermal fuse

NOTE

The procedure for replacing the thermal fuse with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.3.

WARNING

Before replacing the thermal fuse on heaters with the 1563/1564 control unit while installed, the pressure in the cooling system must be released by opening the radiator cap. Also allow the heater to cool and provide a catch container for the escaping coolant if necessary.

8.7.5 Replacing control thermostat

NOTE

The procedure for replacing the control thermostat with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.4.

8.7.6 Replacing fan thermostat

NOTE

The procedure for replacing the fan thermostat with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.5.

8.7.7 Replacing thermal fusible link

NOTE

The procedure for replacing the thermal fusible link with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.6.

8.7.8 Replacing burner head

NOTE

The procedure for replacing the burner head with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.8.

WARNING

The ignition spark generator is operated with high voltage. Before the burner head is replaced, the connectors of the wiring harness must be disconnected from the control unit, as otherwise there is a danger of incurring life-threatening injuries.

8.7.9 Replacing ignition spark generator

NOTE

The procedure for replacing the ignition spark generator with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.12.

WARNING

The ignition spark generator is operated with high voltage. Before the ignition spark generator is replaced, the connectors of the wiring harness must be disconnected from the control unit, as otherwise there is a danger of incurring life-threatening injuries.

8.7.10 Replacing flame monitor

NOTE

The procedure for replacing the flame monitor with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.13.

WARNING

The ignition spark generator is operated with high voltage. Before the flame monitor is replaced, the connectors of the wiring harness must be disconnected from the control unit, as otherwise there is a danger of incurring life-threatening injuries.

8.7.11 Replacing combustion chamber

NOTE

The procedure for replacing the combustion chamber with the heater installed or removed is identical.
Replacing must be carried out according to 9.2.17.

WARNING

The heater is operated with high voltage. Before the combustion chamber is replaced, the connectors of the wiring harness must be disconnected from the control unit, as otherwise there is a danger of incurring life-threatening injuries.

8.8 Start-up

After the heater has been installed, the coolant circuit and the fuel supply system must be carefully bled. The specifications of the vehicle manufacturer must be observed when doing so. All coolant and fuel connections must be checked for leaks and secure attachment during the test run. Should a fault occur in the heater during operation, then troubleshooting must be carried out (see Section 5).

8.8.1 Bleeding water circuit

NOTE

Bleeding must always be carried out according to the manufacturer's instructions. The circulation pump must not be switched on for bleeding.

Set the original vehicle heating system to "hot" and top up the coolant according to manufacturer's instructions. Operating the heater without antifreeze is not permitted.

Then allow the vehicle engine to run at increased idling speed until the radiator thermostat has opened. Switch off the vehicle engine and check the coolant level; top up the coolant if necessary.

Switch on the heater and the original vehicle heater fan with the vehicle engine switched off. After a certain cooling time, the heater must automatically switch on and deactivate. If the heater is then not switched on again, the temperature limiter on the heater has been tripped, as the heater has not been properly bled yet. Reset the temperature limiter (press the button on the temperature limiter) and repeat the entire bleeding process.

NOTE

The heater can be equipped with an automatically resettable temperature limiter. In this case, manual resetting is eliminated.

8.8.2 Bleeding fuel supply system

When the heater is switched on, the fuel pump primes the fuel and fills the entire fuel supply system.

Should combustion not yet begin with the first starting process, the heater must be switched off and then switched on again.

9 Repair

9.1 General information

This section describes the repair work that can be carried out on the heaters when they are installed. Any further dismantling will invalidate the warranty.

During assembly only the spare parts from the corresponding spare parts kit may be used.

WARNING

The ignition spark generator is operated with high voltage.

The following components may also be replaced with the heater installed, provided sufficient space is available:

- Temperature limiter
- Temperature sensor
- Fan or control thermostat
- Thermal fuse
- Thermal fusible link
- Burner head
- Ignition spark generator
- Flame monitor
- Combustion chamber

Before the replacement, the connectors of the wiring harness must be disconnected from the control unit, as otherwise there is a danger of incurring life-threatening injuries.

Before replacing the temperature sensor or the temperature limiter on heaters with the 1563/1564 control unit, the pressure in the cooling system must also be released by opening the radiator cap.

Also allow the heater to cool if necessary.

9.1.1 Works on components when dismantled

IMPORTANT

All sealing elements between the dismantled components must always be removed and replaced.

9.1.1.1 General visual inspection

- Check all components for damage (cracks, deformation, wear, etc.) and fit new ones if necessary.
- Inspect the plugs and cables for corrosion, loose contacts, crimping faults, etc. and repair them if necessary.
- Inspect connector contacts for corrosion and check contacts for firm seating; repair if necessary.

9.1.1.2 Visual inspection of combustion chamber

- Check swirl chamber for firm seating.
- Inspect the combustion chamber for scaling and remove coke deposits if necessary.
- Check welding seam for cracks.

NOTE

Cracks on the welding seam of up to approx. 80 mm in the longitudinal direction are permissible.

9.1.1.3 Visual inspection on heat exchanger

- Check exhaust-gas routing in heat exchanger for sooting, deposits, damage and corrosion.

NOTE

Remove deposits with a water jet and a brush.

- Examine heat exchanger for external damage, deformations, etc.

NOTE

Heavy deformations can impair the coolant flow.

9.1.1.4 Visual inspection on combustion-air rotor

- Inspect combustion-air rotor for soiling and cracks.
 - Check cover plate for firm seating.
 - Check gate valve for proper seating.
 - Adjust gap between fan impeller and fan housing (can be measured with a feeler gauge) at the narrowest point to 0.15 ± 0.05 mm.
- For tools, see spare parts lists and accessories catalogue.

DBW 2010 / 2016

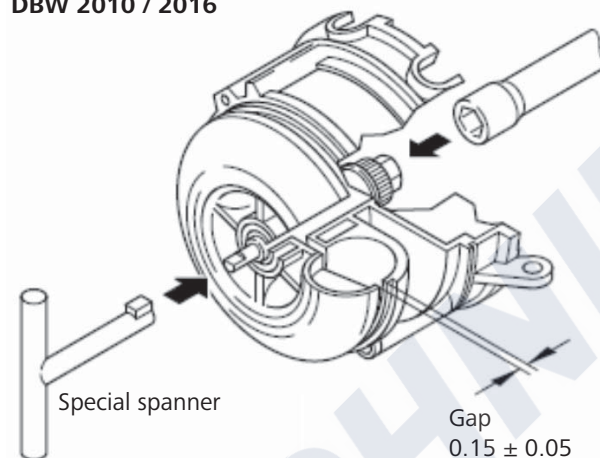


Fig. 901 Visual inspection on combustion-air rotor

9.1.2 Carrying out modifications

NOTE

The constant development of our heaters is aimed at optimizing them so as to prevent failures and malfunctions. Generally it is possible to modify heaters that are already in use. We can supply the appropriate modification kits for this purpose.

The modifications which can be carried out as part of the repair work are listed in the following:

- Installation of nozzle holder pre-heating unit for DBW 2010 / 2016 with 1553 control unit (see 9.1.2.1).
- Installation of nozzle holder pre-heating unit for DBW 2010 with 1563/1564 control unit (see 9.1.2.2).

9.1.2.1 Installation of nozzle holder pre-heating unit for DBW 2010 / DBW 2016 with 1553 control unit

General information

The fuel to the atomiser nozzle is heated with the nozzle holder pre-heating unit. At extremely low temperatures, malfunctions can occur without nozzle holder pre-heating for heaters specified above.

At a temperature of $< 0\text{ }^{\circ}\text{C}$, the heating cartridge in the nozzle holder is connected with a thermostat. The heating duration is dependent on the reflected heat in the combustion chamber and switches off at $+ 8\text{ }^{\circ}\text{C}$ at the thermostat.

If no nozzle holder pre-heating unit is installed in the heater, it can be retrofitted using the following procedure.

Following retrofitting, the following bags of spare parts are provided for the heaters specified above:

- 12 V heaters with 1553 control unit, Order No. 968 89A
- 24 V heaters with 1553 control unit, Order No. 989 71A

The bags of spare parts contain the following parts:

- 1 heating cartridge
- 1 clamping yoke
- 1 relay
- 1 thermostat
- 1 wiring harness
- 1 lug
- 1 disc
- 1 nut
- 1 serrated lock washer
- 1 socket housing, 4-pin
- 1 socket housing, 2-pin
- 4 tab receptacles

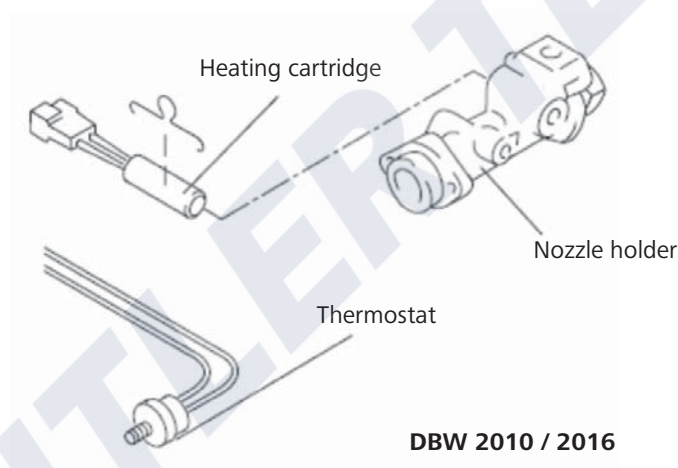


Fig. 902 Installing nozzle holder pre-heating unit with 1553 control unit

Retrofitting works DBW 2010 / DBW 2016

NOTE

On DBW 2010 / DBW 2016 heaters, the washer and the nut in the retrofit kit are not required.

1. Swing away burner head as described in 8.5.1.
2. Remove ignition electrodes as described in 9.2.14.1.
3. Remove snap ring and pull disc with flame monitor off nozzle holder.
4. Fasten thermostat (5) with lug (7) and screw (6) on nozzle holder plate.
5. Insert heating cartridge (3) in nozzle holder (4) and fasten with clamping yoke (2).
6. Fasten relay (11) with self-tapping screw (9) and serrated lock washer (10) on protective cap of burner head (12).

NOTE

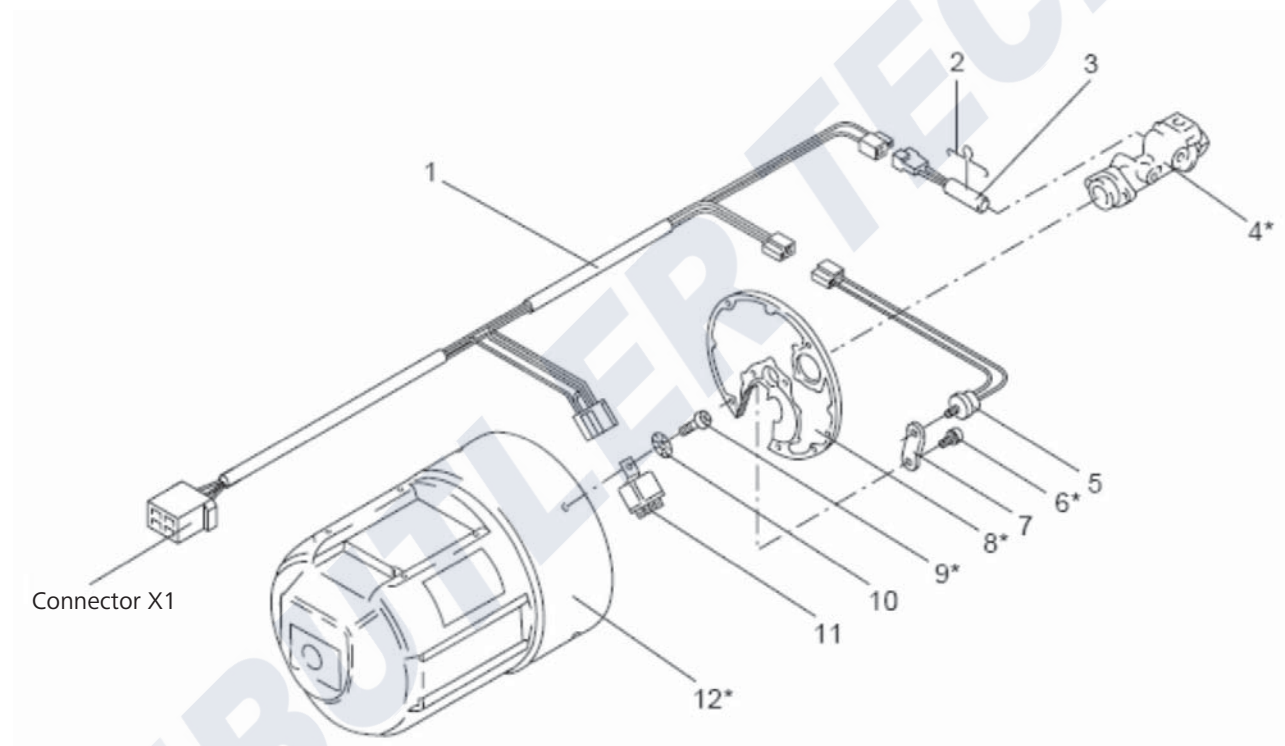
The polarity is irrelevant in the following work step.

7. Engage tab receptacle for heating cartridge connection in 2-pin socket housing accordingly.

NOTE

Route wiring harness (1) behind solenoid valve and guide to outside via a rubber grommet with 2-pin socket housing.

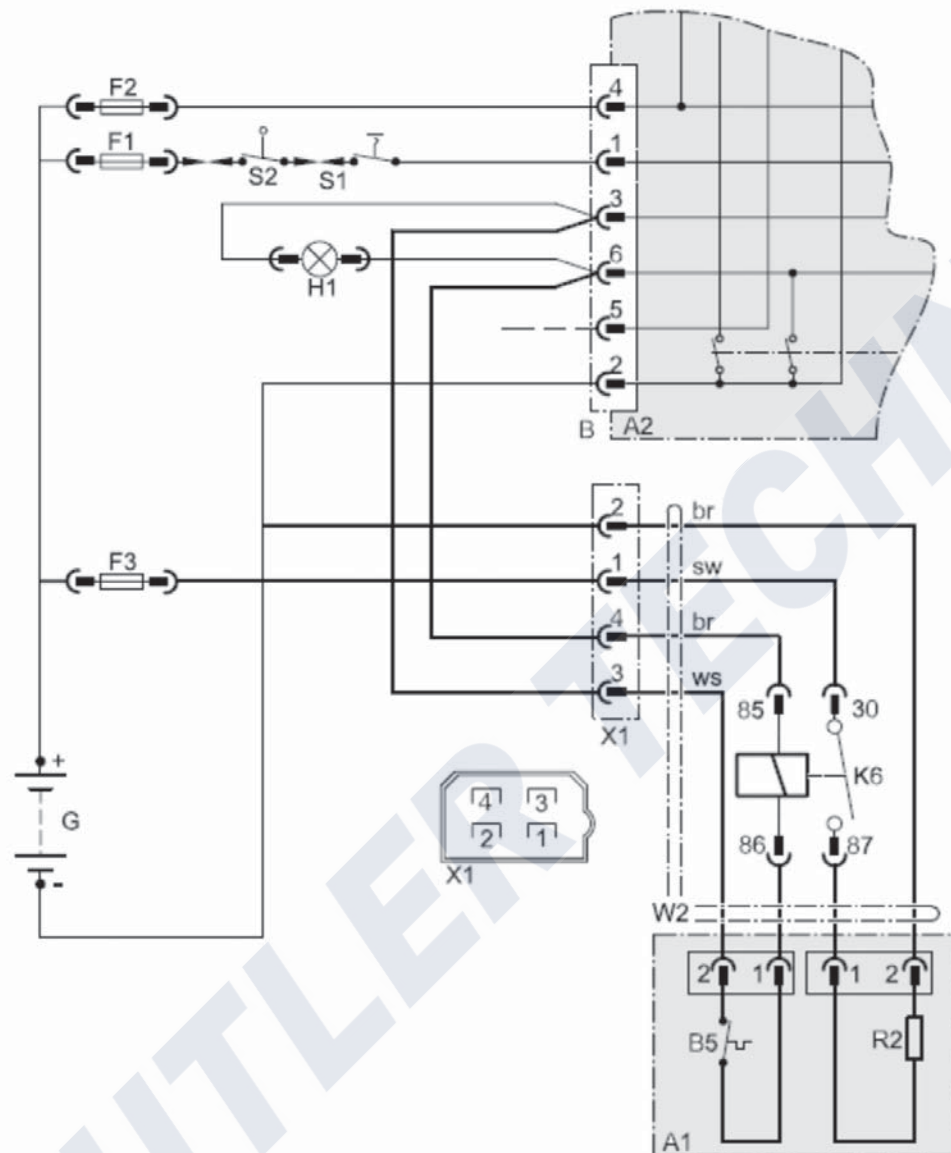
8. Make the electrical connections between wiring harness (1), heating cartridge (3), thermostat (5) and relay (11).
9. Fit disc with flame monitor on nozzle holder and secure with snap ring.
10. Install ignition electrode as described in 9.2.14.2.
11. Swing in burner head as described in 8.5.1.
12. Make the electrical connections as shown in Fig. 904.



- | | | | |
|---|-------------------|----|---------------------------------|
| 1 | Wiring harness | 7 | Lug |
| 2 | Clamping yoke | 8 | Nozzle holder plate * |
| 3 | Heating cartridge | 9 | Self-tapping screw * |
| 4 | Nozzle holder * | 10 | Serrated lock washer |
| 5 | Thermostat | 11 | Relay |
| 6 | Screw * | 12 | Protective cap of burner head * |

* Not included in bag of spare parts

Fig. 903 Retrofitting DBW 2010 / DBW 2016



Item	Description	Comment
A1	Heater	
A2	Control unit	SG 1553
B	Plug connector, 6-pin	
B5	Thermostat	for nozzle holder pre-heating unit
F1	10 A fuse	Flat fuse SAE J 1284
F2	20 A fuse	Flat fuse SAE J 1284
F3	16 A (12 V); 8 A (24 V) fuse	Flat fuse SAE J 1284
G	Battery	
H1	Lamp	Operation indicator
K6	Relay	for nozzle holder pre-heating unit
R2	Heating cartridge	for nozzle holder pre-heating unit
S1	Switch	ON/OFF
S2	Switch	On water valve
W2	Wiring harness	
X1	Plug connector, 4-pin	

Fig. 904 Electrical connection

9.1.2.2 Installation of nozzle holder pre-heating unit for DBW 2010 / DBW 2016 with 1563/1564 control unit

General information

The fuel to the atomiser nozzle is heated with the nozzle holder pre-heating unit. At extremely low temperatures, malfunctions can occur without nozzle holder pre-heating for heaters specified above.

At a temperature of $< 0\text{ }^{\circ}\text{C}$, the heating cartridge in the nozzle holder is connected with a thermostat. The heating duration is dependent on the reflected heat in the combustion chamber and switches off at $+ 8\text{ }^{\circ}\text{C}$ at the thermostat.

If no nozzle holder pre-heating unit is installed in the heater, it can be retrofitted using the following procedure.

Following retrofitting, the following bags of spare parts are provided for the heaters specified above:

- 24 V heaters with 1563/1564 control unit, Order No. 968 90A

The bags of spare parts contain the following parts:

- 1 heating cartridge
- 1 clamping yoke
- 1 relay
- 1 relay with free-wheeling diode
- 1 thermostat
- 1 wiring harness
- 1 lug
- 1 disc
- 1 nut
- 1 serrated lock washer
- 1 socket housing, 3-pin
- 1 socket housing, 2-pin
- 7 tab receptacles
- 1 relay socket

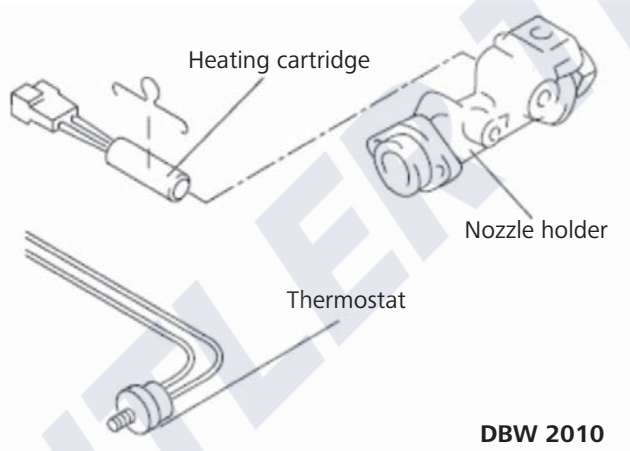


Fig. 905 Installing nozzle holder pre-heating unit with 1563/1564 control unit

Retrofitting works DBW 2010**NOTE**

On DBW 2010 heaters, the washer and the nut in the retrofit kit are not required.

1. Swing away burner head as described in 8.5.1.
2. Remove ignition electrodes as described in 9.2.14.1.
3. Remove snap ring and pull disc with flame monitor off nozzle holder.
4. Fasten thermostat (5) with lug (7) and screw (6) on nozzle holder plate.
5. Insert heating cartridge (3) in nozzle holder (4) and fasten with clamping yoke (2).
6. Fasten relay (11) with self-tapping screw (9) and serrated lock washer (10) on protective cap of burner head (12).

NOTE

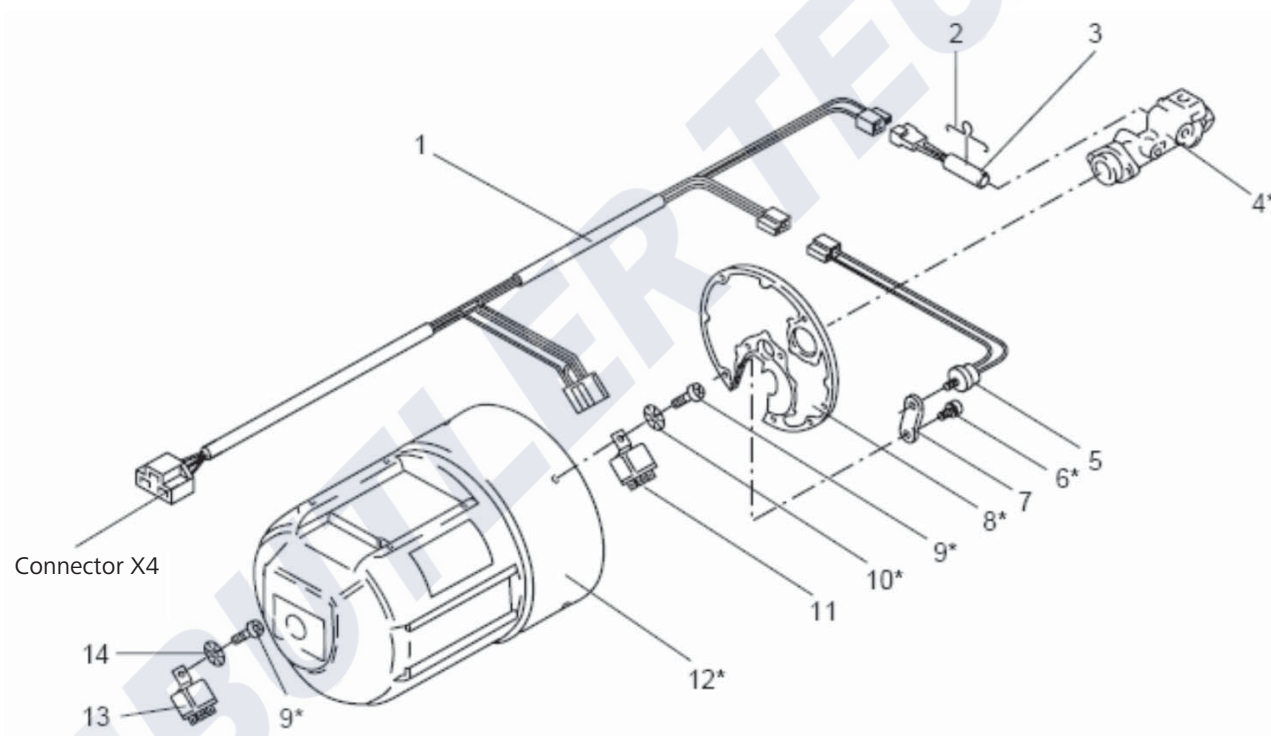
The polarity is irrelevant in the following work step.

7. Engage tab receptacle for heating cartridge connection in 2-pin socket housing accordingly.

NOTE

Route wiring harness (1) behind solenoid valve and guide to outside via a rubber grommet with 2-pin socket housing.

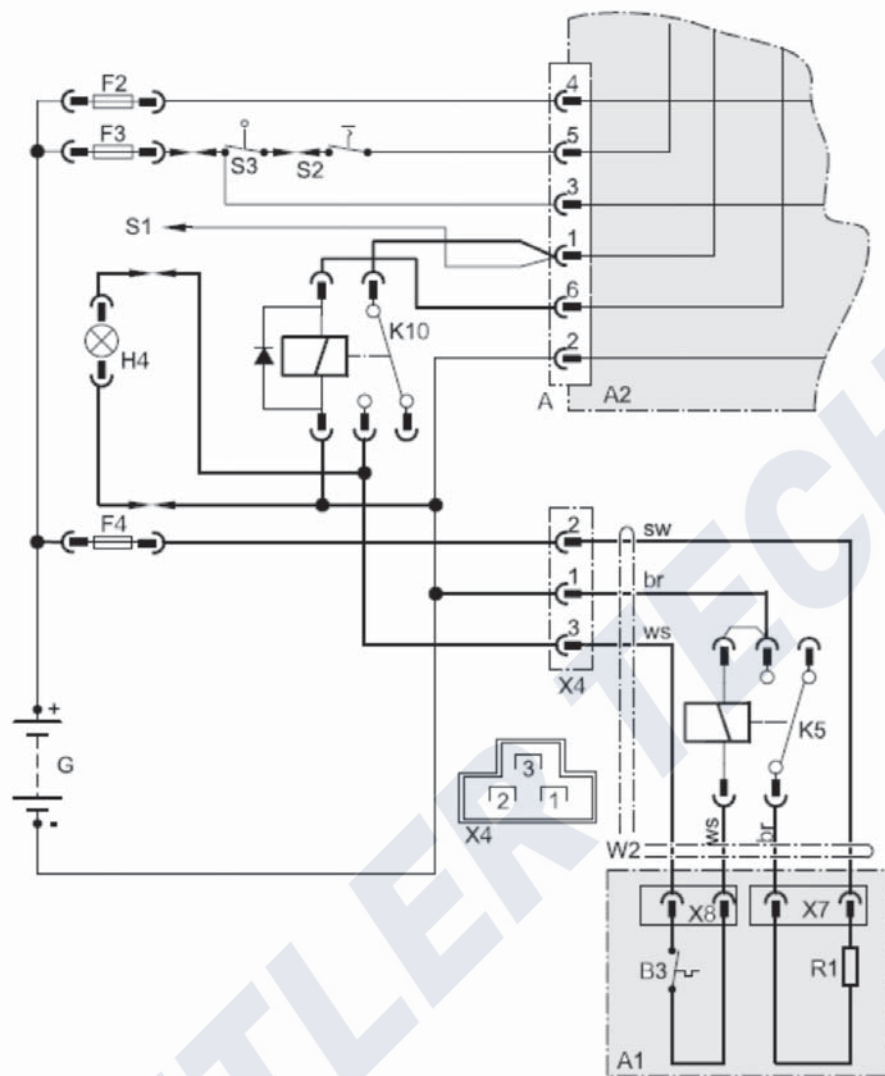
8. Make the electrical connections between wiring harness (1), heating cartridge (3), thermostat (5) and relay (11).
9. Fit disc with flame monitor on nozzle holder and secure with snap ring.
10. Install ignition electrode as described in 9.2.14.2.
11. Swing in burner head as described in 8.5.1.
12. Pull connector A off 1564 control unit.
13. Make the electrical connections between socket housing for connector X4, relay K10 (13) and connector A as shown in Fig. 907.
14. Fasten relay K10 on cover of burner head if necessary.



- | | | | |
|---|-------------------|----|---------------------------------|
| 1 | Wiring harness | 8 | Nozzle holder plate * |
| 2 | Clamping yoke | 9 | Self-tapping screw * |
| 3 | Heating cartridge | 10 | Serrated lock washer * |
| 4 | Nozzle holder * | 11 | Relay K5 |
| 5 | Thermostat | 12 | Protective cap of burner head * |
| 6 | Screw * | 13 | Relay K10 |
| 7 | Lug | 14 | Serrated lock washer |

* Not included in bag of spare parts

Fig. 906 Retrofitting DBW 2010



Item	Description	Comment
A1	Heater	
A2	Control unit	SG 1563/1564
A	Plug connector, 6-pin	
B3	Thermostat	for nozzle holder pre-heating unit
F2	Fuse	Flat fuse SAE J 1284
F3	Fuse	Flat fuse SAE J 1284
F4	16 A (12 V); 8 A (24 V) fuse	Flat fuse SAE J 1284
G	Battery	
H4	Lamp	Operation indicator
K5	Relay	for nozzle holder pre-heating unit
K10	Relay with free-wheeling diode	for nozzle holder pre-heating unit
R1	Heating cartridge	for nozzle holder pre-heating unit
S1	Switch	ON/OFF
S2	Switch	Separate switch-on/UPFA
S3	Switch	On water valve
W2	Wiring harness	
X4	Plug connector, 3-pin	

Fig. 907 Electrical connection

9.2 Dismantling and assembling

9.2.1 Replacing temperature limiter

NOTE

With the sensor technology device, release pressure from cooling system according to manufacturer's instructions before replacement.

IMPORTANT

Danger of injury from escaping hot coolant.

9.2.1.1 Removal

1. If necessary, remove nut (4, Fig. 908) and protective cap (3).
2. Disconnect electrical connection to temperature limiter (8).
3. Screw temperature limiter (8) out of angle bracket (5) or screw plug (6) and remove.
4. Carry out works on stripped down components (see 9.1.1).

9.2.1.2 Installation

1. Screw temperature limiter (8, Fig. 908) into angle bracket (5) or into screw plug (6) by hand.
2. Make the electrical connection.
3. Lay on the protective cap (3,) and secure with the nut (4) if necessary.

9.2.2 Replacing temperature sensor

NOTE

With the sensor technology device, release pressure from cooling system according to manufacturer's instructions before replacement.

IMPORTANT

Danger of injury from escaping hot coolant.

9.2.2.1 Removal

1. Disconnect electrical connection to temperature sensor (11, Fig. 908).
2. Screw temperature sensor (11) out of heat exchanger (10) or coolant outlet (16) and remove with sealing ring (15) or "o" ring (14).
3. Carry out works on stripped down components (see 9.1.1).

9.2.2.2 Installation

1. Screw temperature sensor (11, Fig. 908) with sealing ring (15) or "o" ring (14) into coolant outlet (16) or heat exchanger (10) by hand.

2. Tighten temperature sensor (11) to 20 + 5 Nm.
3. Make the electrical connection.

9.2.3 Replacing thermal fuse

NOTE

With the sensor technology device, release pressure from cooling system according to manufacturer's instructions before replacement.

IMPORTANT

Danger of injury from escaping hot coolant.

9.2.3.1 Removal

1. Disconnect electrical connection to thermal fuse (12, Fig. 908).
2. Screw thermal fuse (12) out of heat exchanger (10) and remove with sealing ring (15).
3. Carry out works on stripped down components (see 9.1.1).

9.2.3.2 Installation

1. Screw in thermal fuse (12, Fig. 908) with "o" ring (14) or sealing ring (15) by hand.
2. Tighten thermal fuse hand-tight.
3. Make the electrical connection.

9.2.4 Replacing control thermostat

9.2.4.1 Removal

1. Remove nut (4, Fig. 908) and protective cap (3).
2. Disconnect electrical connection to control thermostat (1) on terminal block (2).
3. Screw control thermostat (1) out of angle bracket (5) or heat exchanger (10) and remove.
4. Carry out works on stripped down components (see 9.1.1).

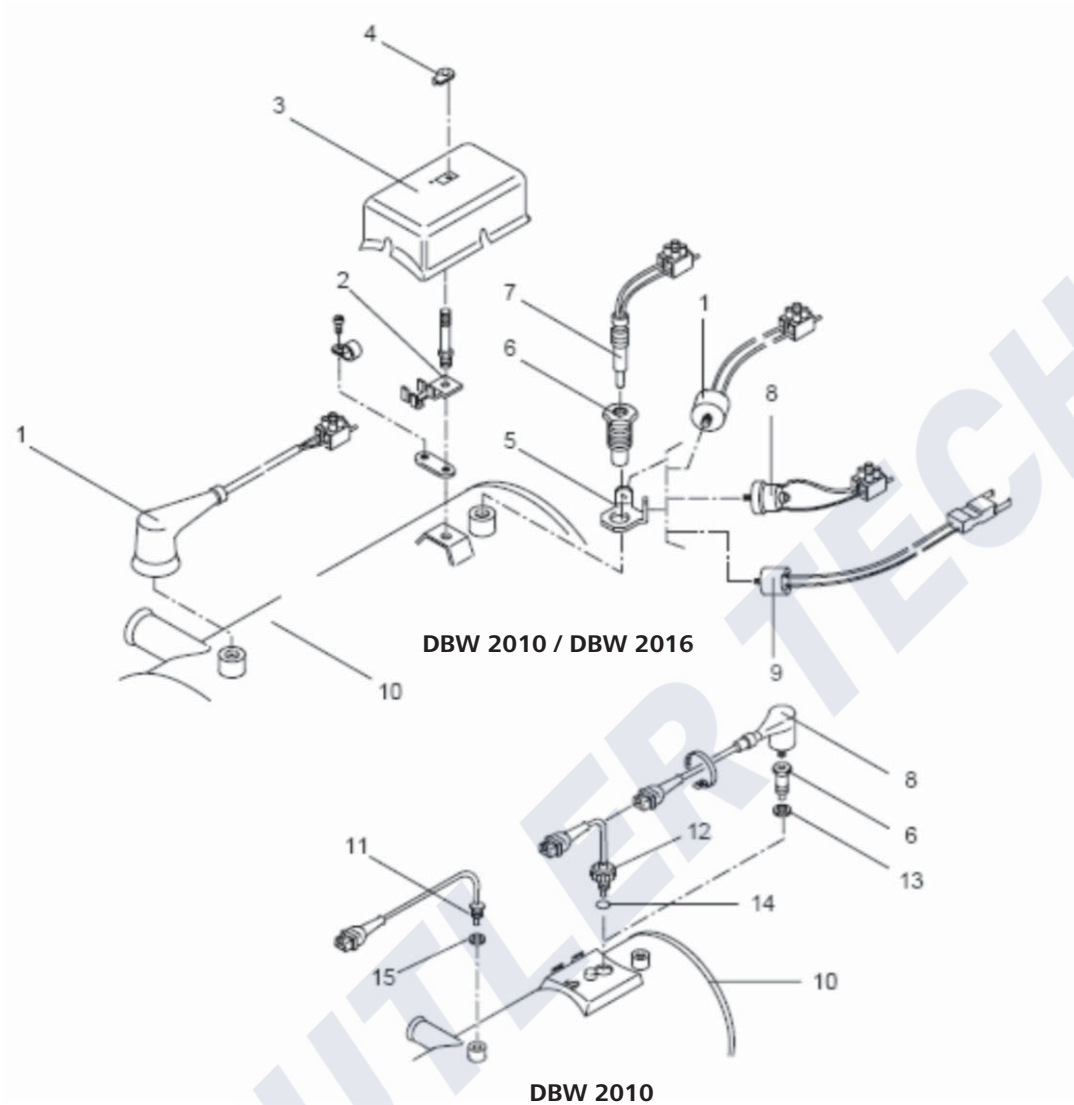
9.2.4.2 Installation

1. Screw control thermostat (1, Fig. 908) onto angle bracket (5) or heat exchanger (10) by hand.

NOTE

When installing in heat exchanger, tighten control thermostat hand-tight.

2. Make the electrical connection.
3. Lay on the protective cap (3,) and secure with the nut (4).



- 1 Control thermostat
- 2 Terminal block
- 3 Protective cap
- 4 Nut
- 5 Angle bracket
- 6 Screw plug
- 7 Thermal fusible link
- 8 Temperature limiter
- 9 Fan thermostat
- 10 Heat exchanger
- 11 Temperature sensor
- 12 Thermal fuse
- 13 Sealing ring
- 14 "O" ring
- 15 Sealing ring

Fig. 908 Replacing temperature limiter, temperature sensor, thermal fuse, fusible link and control thermostat

9.2.5 Replacing fan thermostat**9.2.5.1 Removal**

1. Remove nut (4, Fig. 908) and take off protective cap (3).
2. Disconnect electrical connection to fan thermostat (9).
3. Screw fan thermostat off angle bracket (5) and remove.
4. Carry out works on stripped down components (see 9.1.1).

9.2.5.2 Installation

1. Screw fan thermostat (9, Fig. 908) into angle bracket (5) by hand.
2. Make the electrical connection.
3. Lay on the protective cap (3) and secure with the nut (4).

9.2.6 Replacing thermal fusible link**9.2.6.1 Removal**

1. Remove nut (4, Fig. 908) and protective cap (3).
2. Disconnect electrical connection to thermal fusible link (7) on terminal block (2).
3. Screw thermal fusible link out of screw plug (6) by hand and remove.
4. Carry out works on stripped down components (see 9.1.1).

9.2.6.2 Installation

1. Screw thermal fusible link (7, Fig. 908) into screw plug (6) by hand.
2. Make the electrical connection.
3. Lay on the protective cap (3,) and secure with the nut (4).

9.2.7 Replacing control unit**9.2.7.1 Removal**

1. Disconnect connector on control unit (1 or 3, Fig. 909).
2. Using a suitable tool (e.g. flat-blade screwdriver), press lug between control unit (1 or 3) and protective cap (4) towards control unit and pull off control unit axially.
3. With 1553 control unit, spread open holding clamp (2) to side and pull off control unit towards front.
4. Carry out works on stripped down components (see 9.1.1).

9.2.7.2 Installation

1. Guide 1563/1564 control unit (3, Fig. 909) or 1553 control unit (1) with holding clamp (2) laterally into guide of protective cap (4) and push in up to stop.
2. Insert connector on control unit.

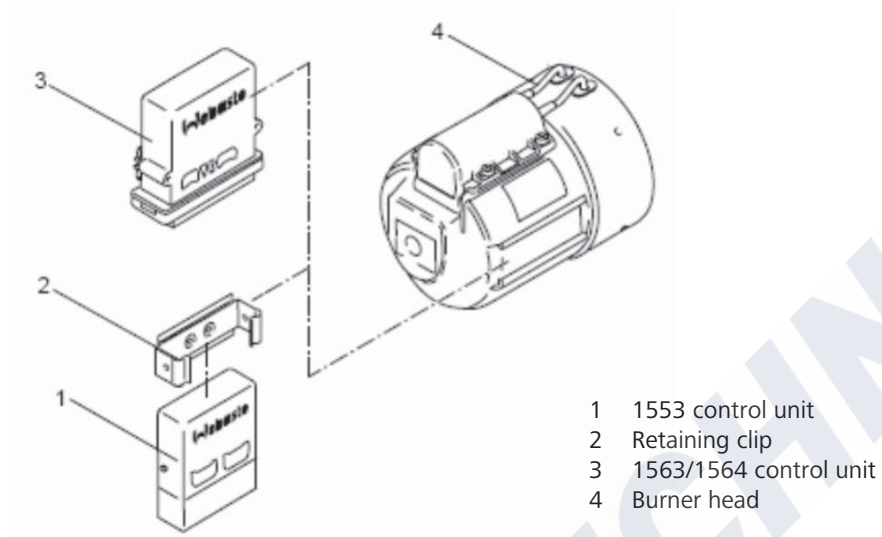
9.2.8 Replacing burner head**9.2.8.1 Removal****NOTE**

Before disconnecting the plug-in electrical connections or the connections between the wiring harness and the measuring and control sensors, the connector assignments should be marked or noted.

1. Disconnect plug-in connections to measuring and control sensors on heat exchanger and disconnect wiring harness.
2. Disconnect fuel lines if necessary.
3. Loosen nuts (3, Fig. 910) until bolts can be swung away.
4. Swing away screws (1), pull out cotter pin (2) and remove.
5. Remove burner head (4).
6. Carry out works on stripped down components (see 9.1.1).

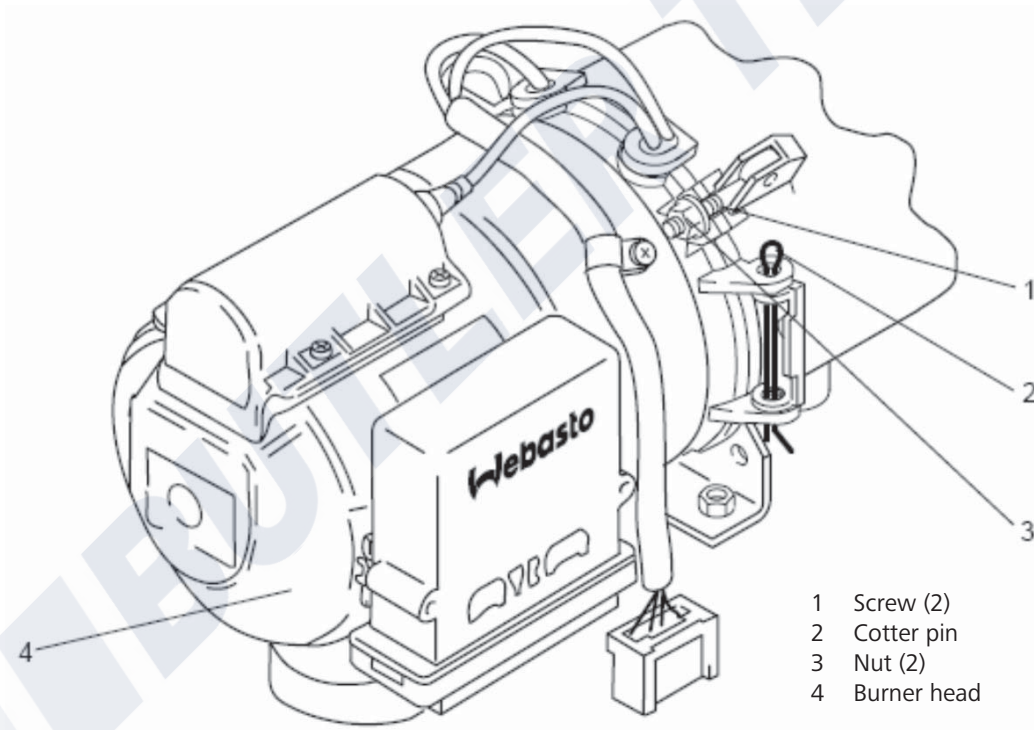
9.2.8.2 Installation

1. Move burner head (4, Fig. 910) into mounting position, swing in screws (1) and tighten nuts (3) by hand.
2. Mount cotter pin (2) in accordance with intended swinging direction and secure.
3. Swing in bolts (1) and initially tighten hand-tight with nuts (3) to prevent one-sided twisting.
4. Tighten nuts (3) to 5,0 + 1 Nm.
5. Connect fuel lines if necessary.
6. Make the electrical connections.



- 1 1553 control unit
- 2 Retaining clip
- 3 1563/1564 control unit
- 4 Burner head

Fig. 909 Replacing control unit



- 1 Screw (2)
- 2 Cotter pin
- 3 Nut (2)
- 4 Burner head

NOTE

- The cotter pin can be positioned on the other side in accordance with the swinging direction of the burner head.
- The burner head of the DBW 2010 heaters is shown here.

Fig. 910 Replacing burner head

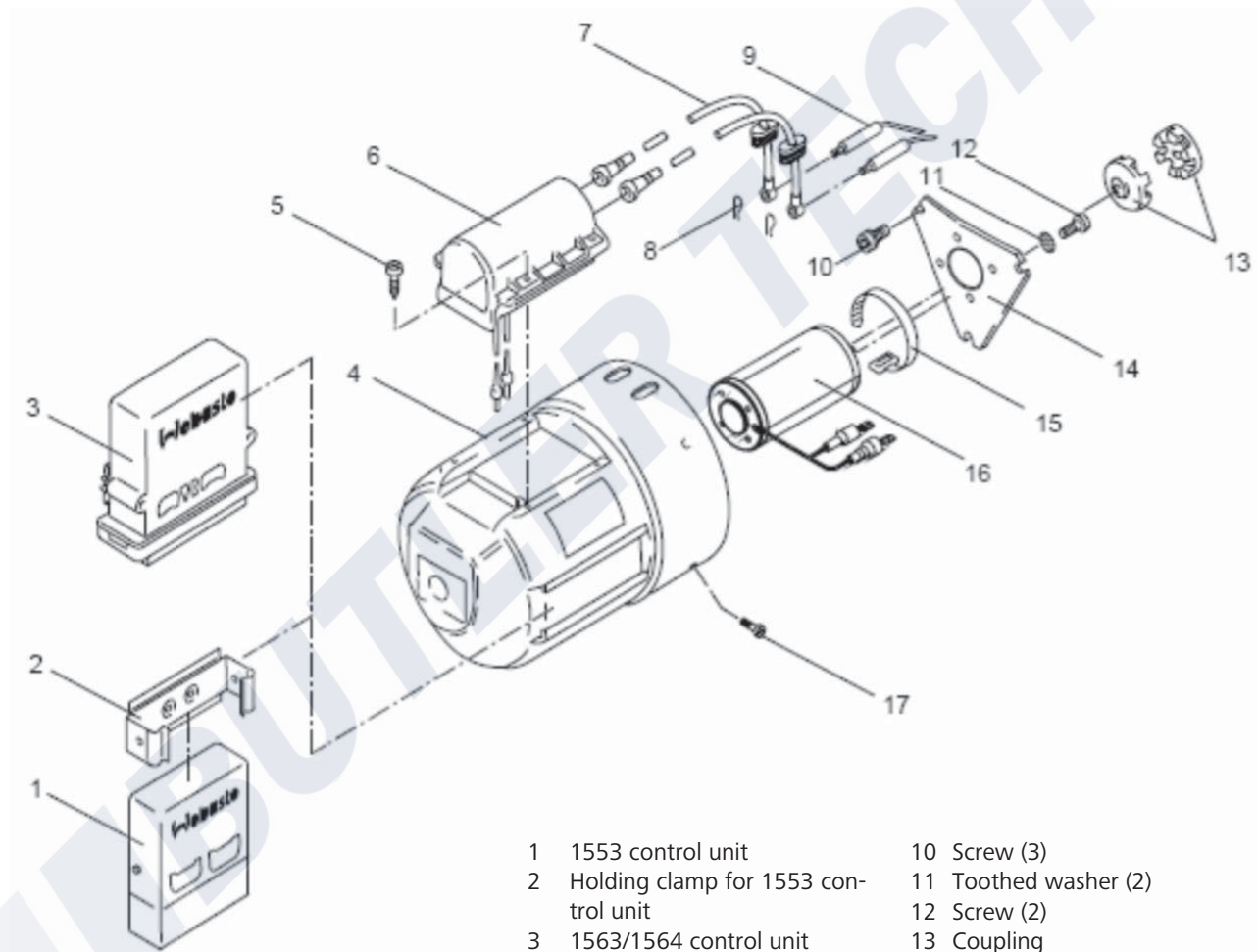
9.2.9 Replacing motor

9.2.9.1 Removal

1. Remove ignition spark generator (see 9.2.12.1).
2. Remove screws (17, Fig. 911) from protective cap (4) and pull off protective cap towards front.
3. Disconnect electrical connection to motor (16).
4. Remove screws (10) and take off motor (16) with flange (14).
5. Pull coupling (13) off motor shaft and remove.
6. Remove screws (12) with toothed washers (11), take off motor (16) and remove.
7. Carry out works on stripped down components (see 9.1.1).

9.2.9.2 Installation

1. Move motor (16, Fig. 911) into installation position and fasten with toothed washers (11) and screws (12) on flange (14).
2. Tighten screws to 5 + 1 Nm.
3. Mount coupling (13) on motor shaft.
4. Fasten flange (14) with screws (10).
5. Tighten screws to 5 + 1 Nm.
6. Make the electrical connections to motor in accordance with colour coding.
7. Slide on protective cap (4) and fasten with screws (17).
8. Install ignition spark generator (see 9.2.12.2).



- | | | | |
|---|-------------------------------------|----|--------------------|
| 1 | 1553 control unit | 10 | Screw (3) |
| 2 | Holding clamp for 1553 control unit | 11 | Toothed washer (2) |
| 3 | 1563/1564 control unit | 12 | Screw (2) |
| 4 | Protective cap | 13 | Coupling |
| 5 | Screw (4) | 14 | Flange |
| 6 | Ignition spark generator | 15 | Cable tie |
| 7 | Ignition cable (2) | 16 | Motor |
| 8 | Retaining clip (2) | 17 | Screw (4) |
| 9 | Ignition electrode (2) | | |

NOTE

The motor of the DBW 2010 / DBW 2016 heaters is shown here.

Fig. 911 Replacing motor

9.2.10 Replacing high-pressure nozzle**9.2.10.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Screw off high-pressure nozzle (11, Fig. 912) and remove.
3. Carry out works on stripped down components (see 9.1.1).

9.2.10.2 Installation

1. Screw in high-pressure nozzle (11, Fig. 912) and tighten to 20 Nm.
2. Swing in burner head (see 8.5.1).

9.2.11 Replacing nozzle holder pre-heating unit**9.2.11.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Pull off clamping yoke (3, Fig. 912) and remove.
3. Disconnect electrical connection.
4. Pull heating cartridge (2) out of nozzle holder (15) laterally and remove.
5. Carry out works on stripped down components (see 9.1.1).

9.2.11.2 Installation

1. Make the electrical connection.
2. Slide heating cartridge (2, Fig. 912) into nozzle holder (15) and secure with clamping yoke (3).
3. Swing in burner head (see 8.5.1).

9.2.12 Replacing ignition spark generator**9.2.12.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Lever connector off electrodes.
3. Remove screws (5) from ignition spark generator (6) and take off ignition spark generator.
4. Disconnect electrical connections.
5. Carry out works on stripped down components (see 9.1.1).

9.2.12.2 Installation

1. Make the electrical connections.
2. Move ignition spark generator (6, Fig. 911) into installation position and secure with screws (5).
3. Tighten screws to 0.8 Nm.
4. Guide ignition cable (7) through grommets into ignition spark generator (6).

5. Slide ignition cable onto ignition electrode (9) and secure with retaining clips (8).
6. Swing in burner head (see 8.5.1).

9.2.13 Replacing flame monitor**9.2.13.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Disconnect electrical connection from flame monitor (10/10a, Fig. 912).
3. Remove screw (14) and flame monitor (10) or clip out flame monitor (10a).
4. Carry out works on stripped down components (see 9.1.1).

9.2.13.2 Installation

1. Move flame monitor (10, Fig. 912) into installation position and fasten with screw (14) or clip in flame monitor (10a).
2. Tighten screws to 1.3 Nm.
3. Make the electrical connection.
4. Swing in burner head (see 8.5.1).

9.2.14 Replacing ignition electrodes**9.2.14.1 Removal**

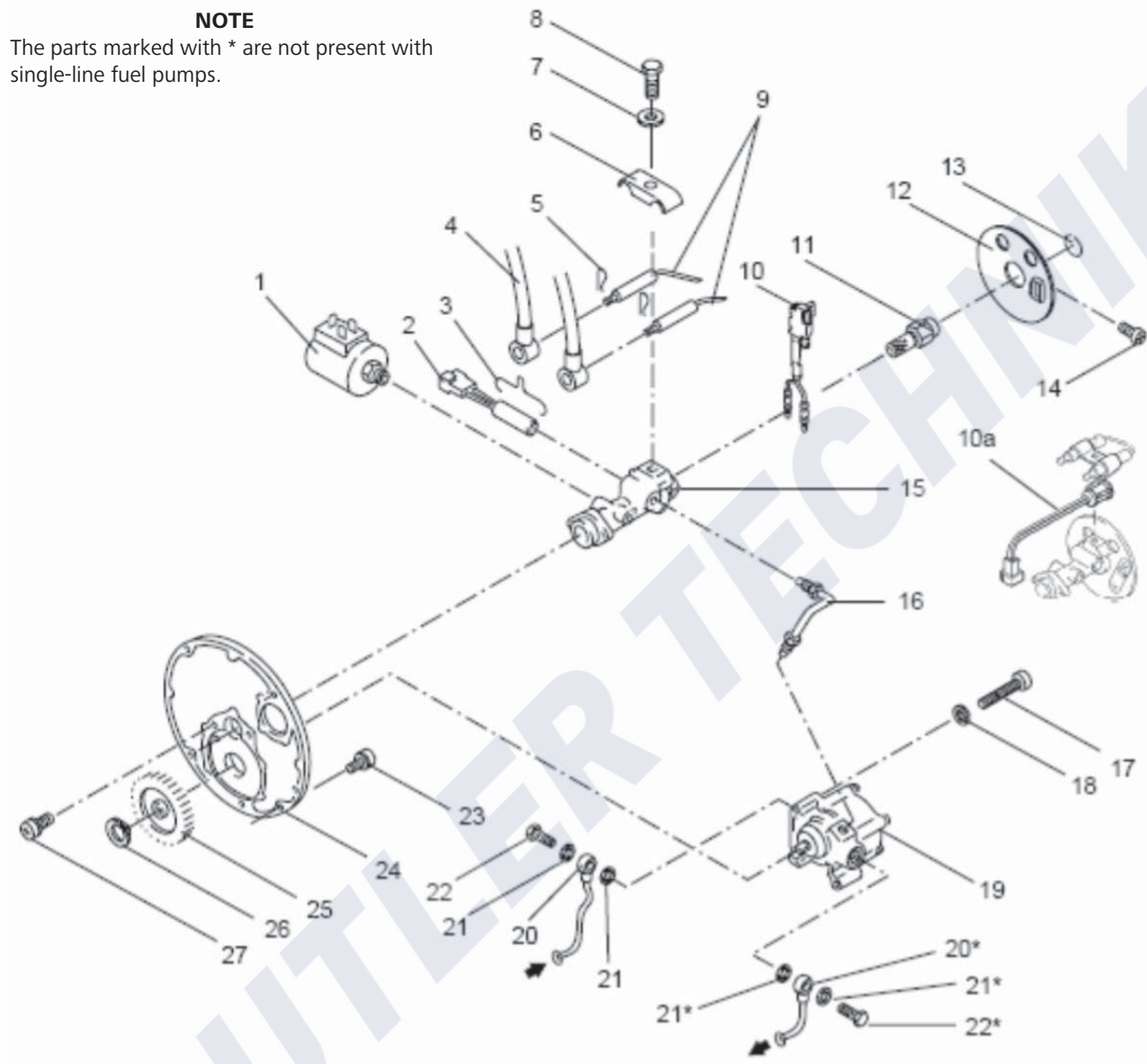
1. Swing away burner head (see 8.5.1).
2. Remove screw (8, Fig. 912).
3. Take off washer (7) and clamp (6) and remove.
4. Remove snap ring (13) and take off disc (12) and remove.
5. Push back insulating grommets onto ignition cable if necessary.
6. Lever retaining clips (8) off of ignition electrodes (9) and remove.
7. Take off ignition electrodes (9) and remove.
8. Carry out works on stripped down components (see 9.1.1).

9.2.14.2 Installation

1. Lay on disc (12, Fig. 912) and secure with snap ring (13) if necessary.
2. Guide in ignition electrodes (9) through disc (12), align and fasten with clamp (6), washer (7) and screw (8).
3. Tighten screw (8) to 1.7 Nm.
4. Fit ignition cable (4) and secure with retaining clips (8).
5. Slide insulating grommets onto ignition electrodes if necessary.
6. Swing in burner head (see 8.5.1).

NOTE

The parts marked with * are not present with single-line fuel pumps.



- | | | |
|--------------------------|-------------------------|------------------------|
| 1 Solenoid valve | 11 High-pressure nozzle | 21 Washer (4) |
| 2 Heating cartridge | 12 Disc | 22 Banjo bolt (2) |
| 3 Clamping yoke | 13 Snap ring | 23 Screw (4) |
| 4 Ignition cable (2) | 14 Screw | 24 Nozzle holder plate |
| 5 Retaining clip (2) | 15 Nozzle holder | 25 Spur gear |
| 6 Clip | 16 Pressure line | 26 Circlip |
| 7 Washer | 17 Screw (2) | 27 Screw (2) |
| 8 Screw | 18 Washer (2) | |
| 9 Ignition electrode (2) | 19 Fuel pump | |
| 10 Flame monitor | 20 Fuel line (2) | |
| | 20* | |
| | 21* | |
| | 22* | |

Fig. 912 Replacing nozzle holder, nozzle holder pre-heating unit, high-pressure nozzle and flame monitor

9.2.15 Replacing fuel pump**9.2.15.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Remove ignition electrodes (see 9.2.14.1).
3. Remove banjo bolts (22, Fig. 912) and washers (21), take off fuel lines (20) and remove.
4. Loosen screw fittings on pressure line (16), take off pressure line and remove.
5. Remove screws (23) and take off nozzle holder plate (24).
6. Remove circlip (26), take off spur gear (25) and remove.
7. Remove screws (17) and washers (18), take off fuel pump (19) and remove.
8. Carry out works on stripped down components (see 9.1.1).

9.2.15.2 Installation

1. Move fuel pump (19, Fig. 912) into installation position and fasten with screws (17) and washers (18).
2. Tighten screws to 3.0 Nm.
3. Lay on spur gear (25) and secure with circlip (26).
4. Fit nozzle holder plate (24) and fasten with screws (23).
5. Tighten screws to 5.5 Nm.
6. Move pressure line (16) into installation position and tighten screw fittings to 6 ± 0.6 Nm.
7. Move fuel lines (20) into installation position and fasten with banjo bolts (22) and washers (21).
8. Tighten banjo bolts to 15 ± 1.5 Nm.
9. Install ignition electrodes (see 9.2.14.2).
10. Swing in burner head (see 8.5.1).

9.2.16 Replacing solenoid valve**9.2.16.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Remove ignition electrodes (see 9.2.14.1).
3. Remove nozzle holder pre-heating unit (see 9.2.11.1).
4. Remove screws (23, Fig. 912) and take off nozzle holder plate (24).
5. Disconnect electrical connections on solenoid valve.
6. Remove nut (1, Fig. 914), take off solenoid valve head (3) and washer (2) and remove.
7. If necessary, screw off solenoid valve body (4) "o" ring (5), pin (6), spring (7) and bolt (8).
8. Carry out works on stripped down components (see 9.1.1).

9.2.16.2 Installation

1. Place "o" ring (5, Fig. 914) on solenoid valve body (4).
2. Fit spring (7) and pin (6) in bolt (8).
3. Guide bolt with spring and pin into solenoid valve body (4).
4. Screw solenoid valve body (4) into nozzle holder (9).
5. Tighten screws to 11.5 Nm.
6. Place solenoid valve head (3) on solenoid valve body and fasten with washer (2) and nut (1).
7. Tighten nuts to 2 Nm.
8. Fasten nozzle holder plate (24, Fig. 912) with screws (23).
9. Tighten screws to 5.5 Nm.
10. Install nozzle holder pre-heating unit (see 9.2.9.2).
11. Install ignition electrodes (see 9.2.12.2).
12. Make the electrical connections to solenoid valve.
13. Swing in burner head (see 8.5.1).

9.2.17 Replacing combustion chamber**9.2.17.1 Removal**

1. Swing away burner head (see 8.5.1).
2. Pull combustion chamber (1, Fig. 915) out of the heat exchanger (2) and remove it.
3. Carry out works on stripped down components (see 9.1.1).

9.2.17.2 Installation

1. Slide combustion chamber (1, Fig. 915) into heat exchanger (2) up to stop.
2. Swing in burner head (see 8.5.1).

9.2.18 Thermostat of nozzle holder pre-heating unit**9.2.18.1 Removal**

1. Swing away burner (see 8.5.1).
2. Disconnect electrical connection.
3. Screw thermostat (4, Fig. 913) off nozzle holder plate (7) or disc (1) and remove with screw (5), lug (6) or nut (3) and serrated lock washer (2).
4. Carry out works on stripped down components (see 9.1.1).

9.2.18.2 Installation

1. Move thermostat (4, Fig. 913) into installation position and fasten with lug (6) and screw (5) on nozzle holder plate (7) or with nut (3) and serrated lock washer (2) on disc (1).
2. Make the electrical connection.
3. Swing in burner (see 8.5.1).

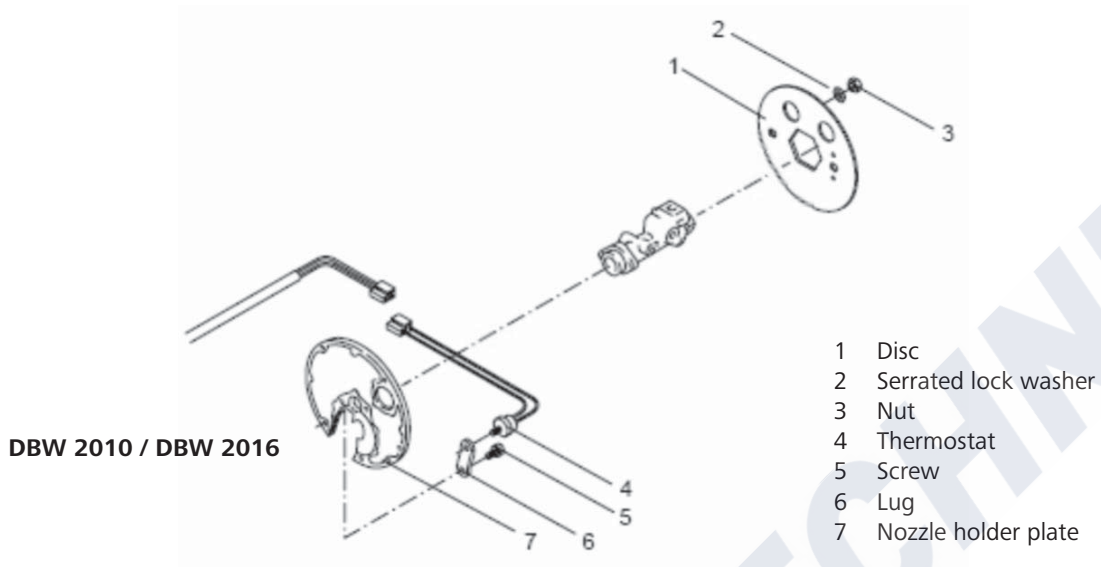


Fig. 913 Replacing thermostat of nozzle holder pre-heating unit

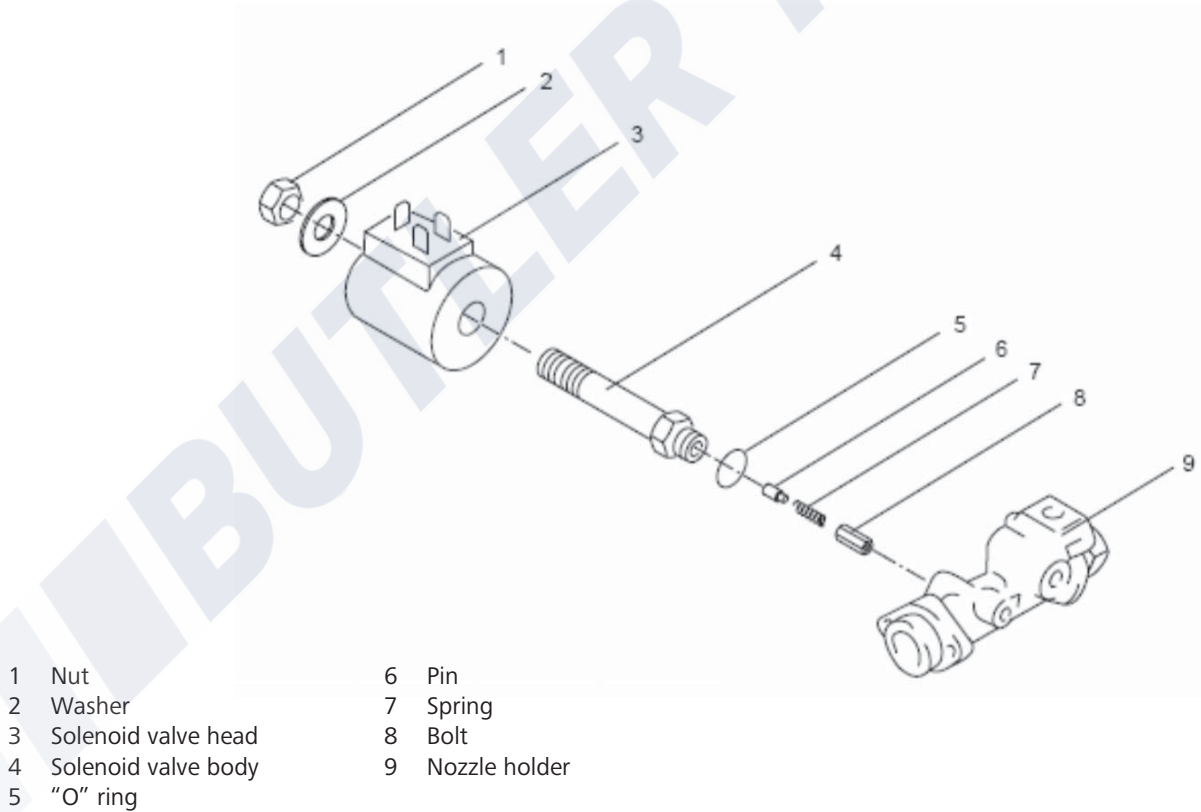


Fig. 914 Replacing solenoid valve

9.2.19 Replacing heat exchanger

9.2.19.1 Removal

1. If necessary, remove nut (6, Fig. 915) from cover (5) and take off cover and remove.
2. Remove temperature limiter or thermal fuse (see 9.2.1.1 or 9.2.3.1).
3. Remove temperature sensor (see 9.2.2.1).
4. Remove thermal fusible link if necessary (see 9.2.6.1).
5. Remove control thermostat if necessary (see 9.2.4.1).
6. Remove fan thermostat if necessary (see 9.2.5.1).

NOTE

Work steps 7 to 8 only apply to the devices DBW 2010 / DBW 2016 without sensor technology.

7. Remove screw (4) and take off bracket (3) with electrical connections and remove.
8. Remove screw plug (7) and take off with angle bracket (8) and remove.
9. Remove burner head (see 9.2.8.1).
10. Pull combustion chamber (1) out of the heat exchanger (2) and remove.
11. Remove heat exchanger (2).
12. Carry out works on stripped down components (see 9.1.1).

9.2.19.2 Installation

1. Slide combustion chamber (1, Fig. 915) into heat exchanger (2) up to stop.
2. Fit burner head (see 9.2.8.2).

NOTE

Work steps 3 to 6 only apply to the devices DBW 2010 / DBW 2016 without sensor technology.

3. Move angle bracket (8) into installation position and screw in screw plug (7).
4. Tighten screw hand-tight.
5. Move bracket (3) with electrical connections into installation position and fasten with screw (4).
6. Tighten screw hand-tight.
7. Install temperature sensor (see 9.2.2.2).
8. Install temperature limiter or thermal fuse (see 9.2.1.2 or 9.2.3.2).
9. Install thermal fusible link if necessary (see 9.2.6.2).
10. Install control thermostat if necessary (see 9.2.4.2).
11. Install fan thermostat if necessary (see 9.2.5.2).
12. Lay on cover (5) and fasten with nut (6) if necessary.

NOTE

The combustion chamber and the heat exchanger of the DBW 2010 / DBW 2016 heaters are shown here.

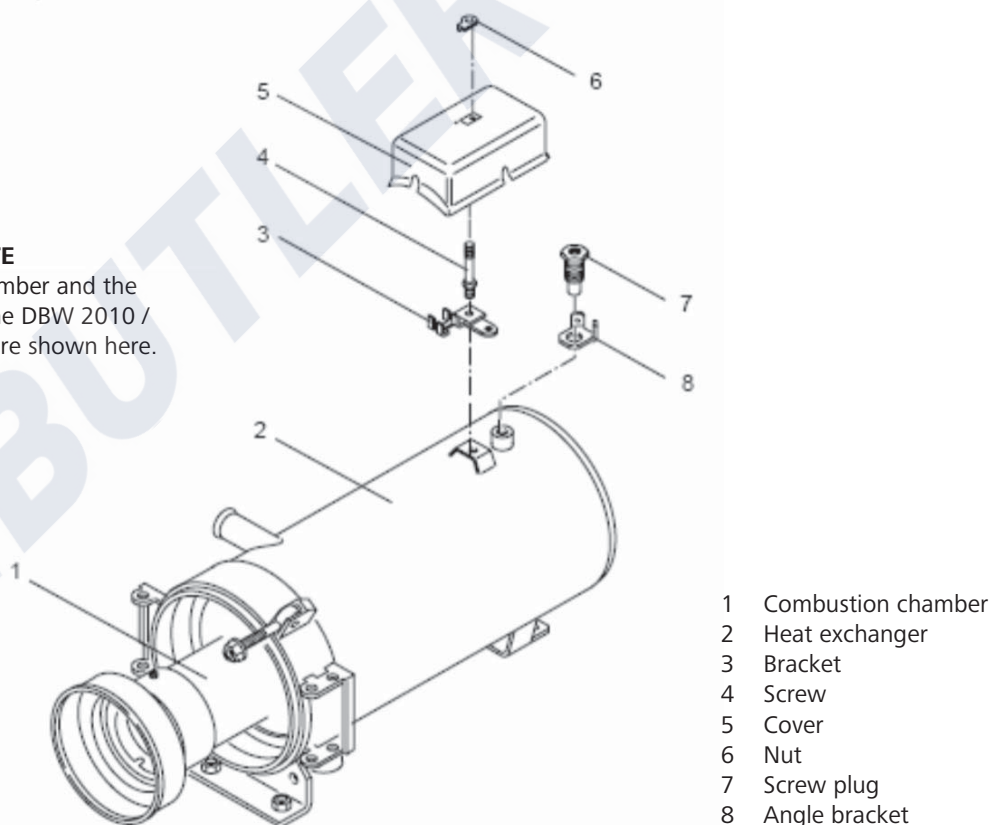


Fig. 915 Replacing combustion chamber and heat exchanger

9.2.20 Replacing nozzle holder

9.2.20.1 Removal

1. Swing away burner head (see 8.5.1).
2. Remove ignition electrodes (see 9.2.14.1).
3. Remove high-pressure nozzle (see 9.2.10.1).
4. If necessary, remove nozzle holder pre-heating unit (see 9.2.11.1).
5. Remove solenoid valve (see 9.2.16.1).
6. Loosen screw fittings on pressure line (16, Fig. 912) and take off pressure line and remove.
7. Remove screws (23) and take off nozzle holder plate (24).
8. Remove screws (27), take off nozzle holder (15) and remove.
9. Carry out works on stripped down components (see 9.1.1).

9.2.20.2 Installation

1. Move nozzle holder (15, Fig. 912) into installation position and fasten with screws (27).
2. Tighten screws to 5.5 Nm.
3. Move nozzle holder (24) into installation position and fasten with screws (23).
4. Tighten screws to 5.5 Nm.
5. Move pressure line (16) into installation position and tighten screw fittings to 6 ± 0.6 Nm.
6. Install solenoid valve (see 9.2.16.2).
7. If necessary, install nozzle holder pre-heating unit (see 9.2.11.2).
8. Install high-pressure nozzle (see 9.2.10.2).
9. Install ignition electrodes (see 9.2.14.2).
10. Swing in burner head (see 8.5.1).

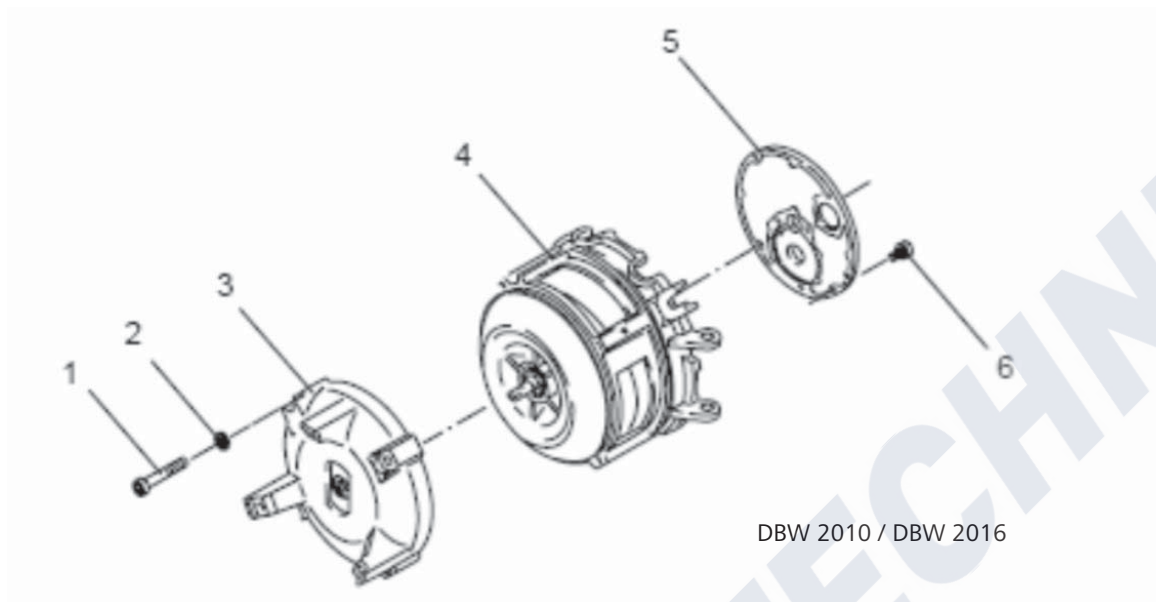
9.2.21 Replacing combustion air fan

9.2.21.1 Removal

1. Remove burner head (see 9.2.8.1).
2. Remove motor (see 9.2.9.1).
3. Remove screws (6, Fig. 916) from nozzle holder plate (5).
4. Remove screws (1) and washers (2).
5. Pull motor support (3) off shaft.
6. Remove combustion air fan (4).
7. Carry out works on stripped down components (see 9.1.1).

9.2.21.2 Installation

1. Only DBW 2010/2016:
Check gap at fan impeller (see 9.1.1.4)
2. Move combustion air fan (4, Fig. 916) into assembly position and fasten on nozzle holder plate (5) with screws (6).
3. Tighten screws (6) to 5.5 Nm.
4. Fit motor support (3) on shaft and fasten with screws (1) and washers (2).
5. Tighten screws (1) to $5.5 + 1$ Nm.
6. Install motor (see 9.2.9.2).
7. Install burner head (see 9.2.8.2).



- 1 Screw (3)
- 2 Washer (3)
- 3 Motor carrier

- 4 Combustion air fan
- 5 Nozzle holder plate
- 6 Screw (4)

Fig. 916 Replacing combustion air fan

10 Packing, Storage and Shipping

10.1 General information

If the heater or its components are sent to Webasto for testing or repair, it must be cleaned and packed in such a way that it is protected against damage during handling, transport and storage.

IMPORTANT

If an entire heater is returned, then it must be completely drained. It must be ensured that no fuel or coolant can escape during packing and/or shipping.

The coolant inlet and outlet connections and the fuel lines must be sealed off with blind plugs.

The ambient temperatures indicated in section 4 must not be exceeded for storage.

Appendix A

Periodic Heater Maintenance

The heater should be checked at regular intervals, however at the latest at the start of the heating period (point in time of weather-dependent increased use of heater).

The maintenance intervals specified in the following refer to usual applications and requirements at average usage. If the heater use differs from the average, the intervals can be shortened or extended accordingly.

Please contact your responsible Webasto partner in corresponding cases.

Test/Maintenance Work	Important Notes	Test Results		Measured Values, Conducted Repairs
		OK	Not OK	
1. Electrical connections a) Disconnect plug-in electrical connections to wiring harness, examine for oxidation, spray and reconnect after carrying out Point 5. b) Check electrical fuses for oxidation and/or transfer resistance.	Use suitable contact spray, e.g. Special Contact Spray (Order No. 101322).	<input type="checkbox"/>	<input type="checkbox"/>	
2. Heat exchanger a) Examine for dark burn spots on paint (local overheating). b) Examine for leaks. c) Clean heater outside and inside.	Determine the cause of overheating if necessary (e.g. water circuit); check temperature limiter.	<input type="checkbox"/>	<input type="checkbox"/>	
3. Fuel system a) Check the fuel lines and connections for leaks. b) Replace the fuel filter insert with seal. c) Open fuel shut-off valves if present. d) Fuel pump and fuel lines. e) Replace fuel screen with seals in the pump.	Ensure leak-tight connection in fuel supply and return line! Tighten screw fittings and hose clamps. Replace pump and lines every 5 years.	<input type="checkbox"/>	<input type="checkbox"/>	
4. Burner head a) Check combustion-air intake opening for clear passage. Swing away burner head: b) Examine housing inside for collections of fuel caused by leaks. c) Clean inspection window of flame monitor. d) Check condition of ignition electrodes. e) Replace atomiser nozzle.	Replace bent electrodes. In case of coke build-up, shorten replacement interval for fuel filter.	<input type="checkbox"/>	<input type="checkbox"/>	
5. Exhaust system a) Check exhaust pipe for clear passage and clean if necessary. b) Remove combustion chamber from heat exchanger, examine both parts for damage and soiling and clean or replace if necessary. c) Mount combustion chamber and install burner head. Ensure firm connection to heat exchanger when doing so. d) Reconnect electrical plug-in contacts.		<input type="checkbox"/>	<input type="checkbox"/>	

Test/Maintenance Work	Important Notes	Test Results		Measured Values, Conducted Repairs
		OK	Not OK	
6. Water system a) Clean water-filter insert if present. b) Open water shut-off valves if present.		<input type="checkbox"/>	<input type="checkbox"/>	
7. Operating check a) Open shut-off valve in return line if present. b) Check heater operation. c) Watch for smoke in run-on; replace nozzle if necessary.	After at least 10 min. Heating mode.	<input type="checkbox"/>	<input type="checkbox"/>	

Appendix B

Maintenance plan Rail

Maintenance plan / measurement report			
for Webasto heaters of the type DBW 2016 in rail vehicles			
<p>General</p> <p>The heater must be inspected at least annually according to the following table.</p> <p>To carry out the maintenance, the appropriate Workshop Manual has to be used.</p> <p>* This maintenance plan is to ensure that the maintenance and operation of the heaters matches with the relevant provisions of the Eisenbahn-Bundesamt (EBA, Federal Railway Authority, Germany).</p>			
Address of the operator		Date of measurement	
		Installes in rail vehicle	
Heater data			
Type of heater			
Rated power in kW			
Year of commissioning			
Fuel	Winter diesel	Arctic diesel	
Test/Maintenance Work	Important notes	Measured values, conducted repairs	Test results
			OK not OK
<p>1. Electrical connections</p> <p>a) Disconnect plug-in electrical connections to wiring harness, examine for oxidation, spray and reconnect after carrying out Point 5.</p> <p>b) Check electrical fuses for oxidation and/or transfer resistance.</p>	Use suitable contact spray, e.g. Special Contact Spray (Order No. 101322Z)		
<p>2. Wärmeübertrager</p> <p>a) Examine for dark burn spots on paint (local overheating).</p> <p>b) Examine for leaks.</p> <p>c) Clean heater outside and inside.</p>	Determine the cause of overheating if necessary (e. g. water circuit); check temperature limiter.		

Maintenance plan (part 1 of 3)

Test/Maintenance Work	Important notes	Measured values, conducted repairs	Test results	
			OK	not OK
3. Fuel system a) Check the fuel lines and connections for leaks. b) Replace the fuel filter insert with seal, resp. throw-away filter. c) Open fuel shut-off valves if present. d) Check fuel pump and fuel lines.	Ensure leak-tight connection in fuel supply and return line! Tighten screw fittings and hose clamps. Pumpe und Leitungen alle 5 Jahre austauschen.			
4. Burner head a) Check combustion-air intake opening for clear passage. Swing away burner head: b) Examine housing inside for collections of fuel caused by leaks. c) Clean inspection window of flame monitor. d) Check condition of ignition electrodes. e) Replace atomiser nozzle (only by nozzle approved by Webasto).	Replace bent electrodes. In case of coke build-up, shorten replacement interval for fuel filter.			
5. Exhaust system a) Check exhaust pipe for clear passage and clean if necessary. b) Remove combustion chamber from heat exchanger, examine both parts for damage and soiling and clean or replace if necessary. c) Mount combustion chamber and install burner head. Ensure firm connection to heat exchanger when doing so. d) Reconnect electrical plug-in contacts. e) Measurements. Setpoints and procedure are listed in Chapter 6 of the workshop manual. ambient temperature [°C] exhaust temperature [°C] CO ₂ [Vol.-%] CO [ppm] amount of soot (-) pressure fuel pump [bar]	Replace combustion chamber every 3 years. Limits according to directive 2001/56/EG recommended measuring device: * approx. 400 °C 9,5 to 11,5 Vol.-% < 1000 < 4 11,5 bar			
6. Water system a) Clean water-filter insert if present. b) Open water shut-off valves if present.				

Maintenance plan (part 2 of 3)

Test/Maintenance Work	Important notes	Measured values, conducted repairs	Test results	
			OK	not OK
7. Operating check a) Open shut-off valve in return line if present. b) Check heater operation. c) Watch for smoke in run-on; replace nozzle if necessary.	After at least 10 min. Heating mode.			

Summary

- The result corresponds with the requirements
- The result does not correspond with the requirements (further action required)

The inspection or adjustment was performed:

Date:

Name:

Place:

Department:

*) MSI 150
 Euro Flue gas analyzer 5600593