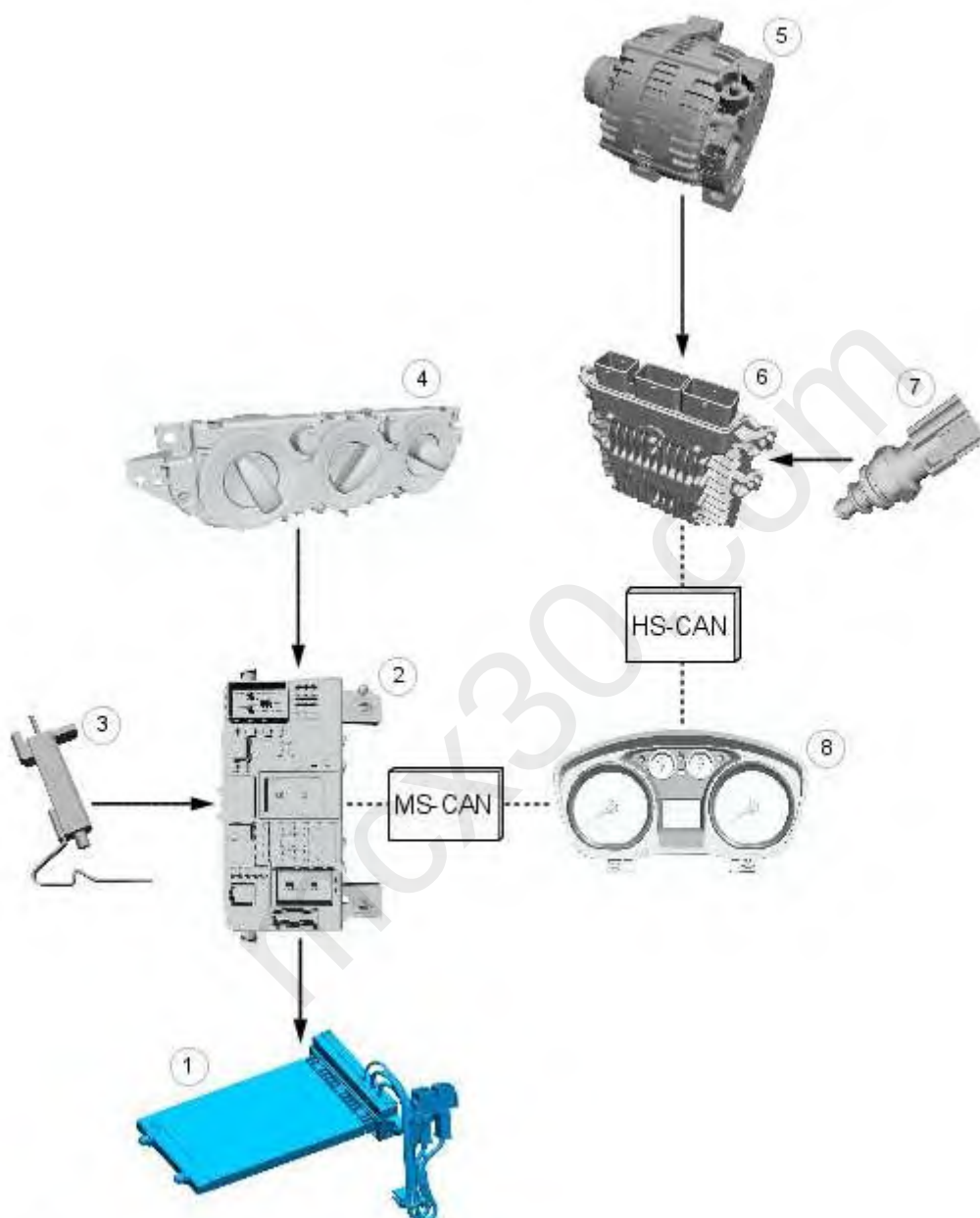


Description and Operation

System Diagram

Electric booster heater - vehicles with manual temperature control

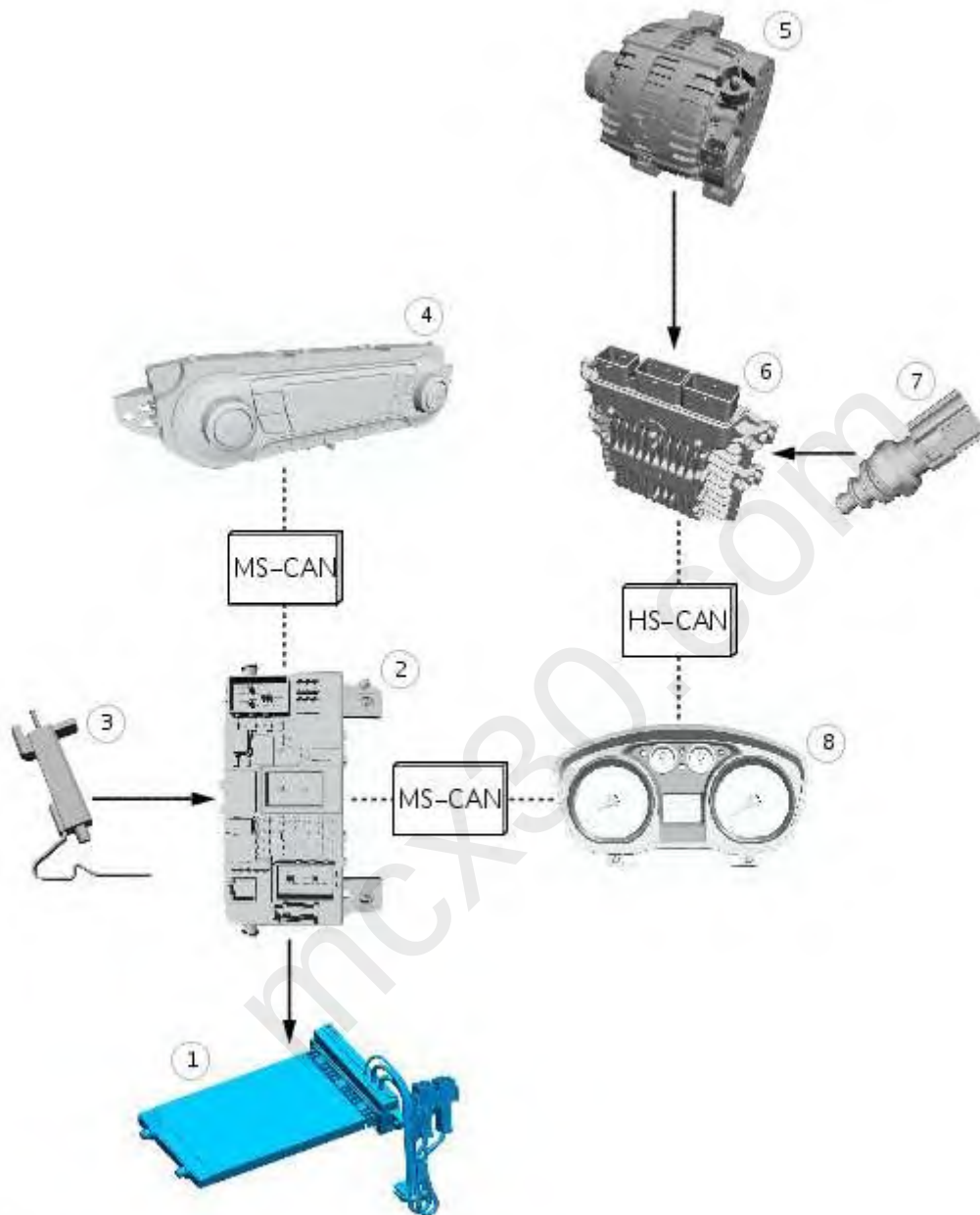


E97578

Item	Description
1	Electric Booster Heater Refer to Component Description:
2	GEM (generic electronic module)
3	Outside temperature sensor
4	Climate control system control assembly
5	Generator and Alternator

- | | |
|---|---|
| 6 | PCM (powertrain control module) |
| 7 | Coolant temperature sensor (ECT (engine coolant temperature) sensor)
Refer to Component Description: ECT |
| 8 | instrument cluster |

Electric booster heater - vehicles with automatic temperature control



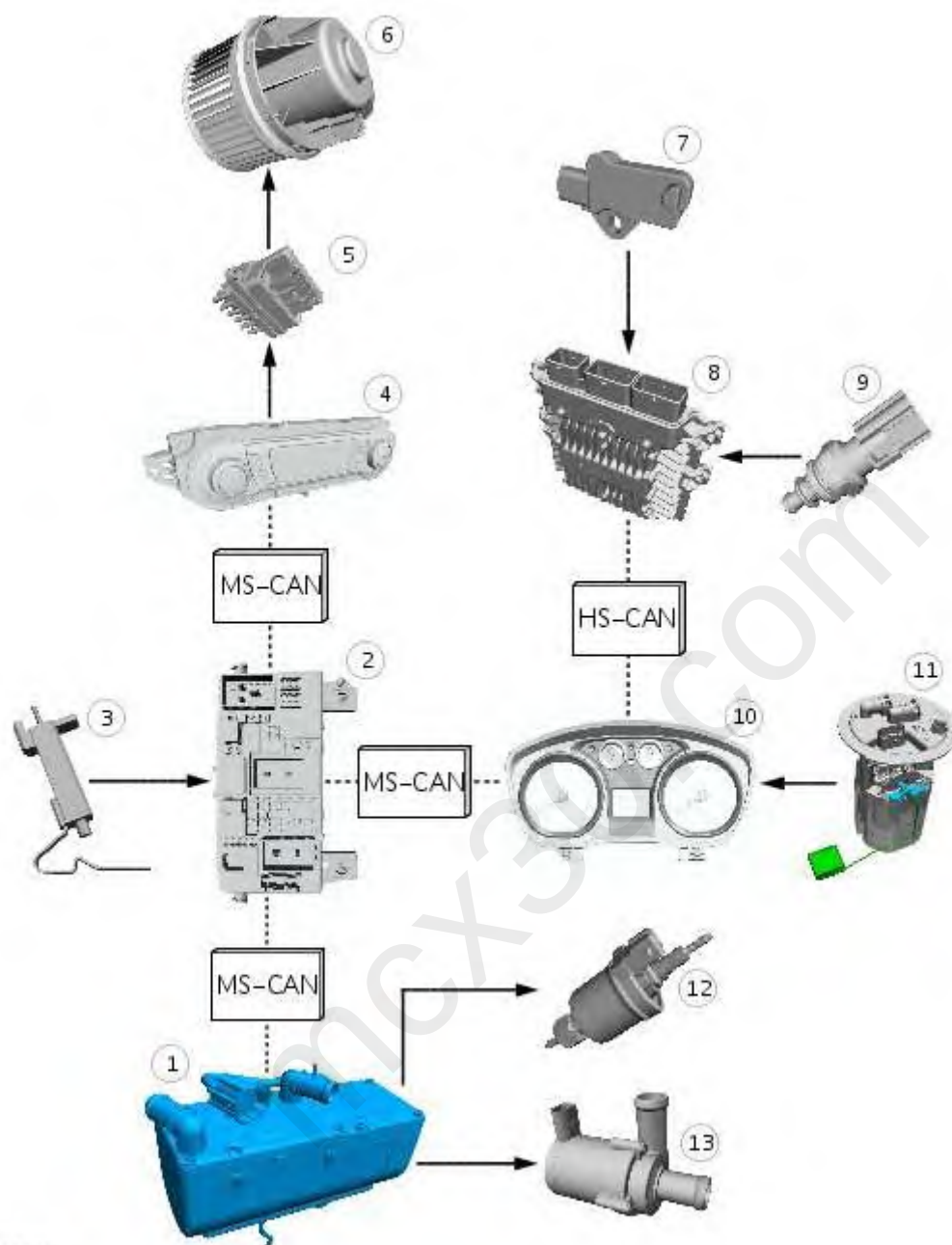
E97579

Item	Description
1	Electric Booster Heater Refer to Component Description:
2	GEM
3	Outside temperature sensor
4	Climate control system control assembly
5	Generator and Alternator
6	PCM
7	Coolant temperature sensor (ECT sensor)

[Refer to Component Description: ECT](#)

8 instrument cluster

Programmable fuel fired booster heater



E975 80

Item	Description
1	Fuel powered booster heater Refer to Component Description: Detailed illustration of fuel-fired heater
2	GEM
3	Outside temperature sensor
4	Climate control system control assembly
5	Blower control module
6	Blower motor
7	Crankshaft position (CKP) sensor
8	PCM
9	Coolant temperature sensor (ECT sensor)

Refer to Component Description: ECT

10 instrument cluster

11 Fuel level sensor

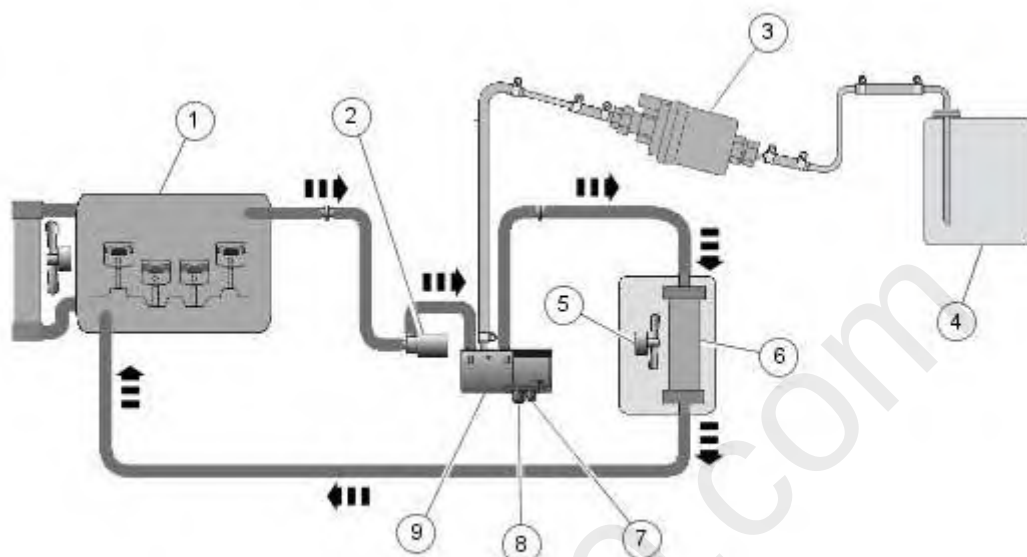
12 Fuel pump

Refer to Component Description:

13 Water pump

Refer to Component Description:

Coolant circuit - Programmable fuel fired booster heater



E97603

Item	Description
1	Engine
2	Water pump
3	Fuel pump
4	Fuel tank
5	Blower motor
6	Heat exchanger
7	Air Intake
8	Exhaust pipe
9	Auxiliary Heaters

System Operation

Electric Booster Heater

In diesel vehicles which give off little residual heat, a booster heater is used to heat the passenger compartment rapidly in the case of low ambient temperatures.

If the interior temperature has been set to HI, or if the heater controls have been switched to the highest setting, the two-zone air conditioning system sends an "electric booster heater ON" request signal to the [CAN \(controller area network\)](#) via the medium speed [GEM](#) bus. If a manual air conditioning system is installed, the signal is transmitted via a conventional cable connection.

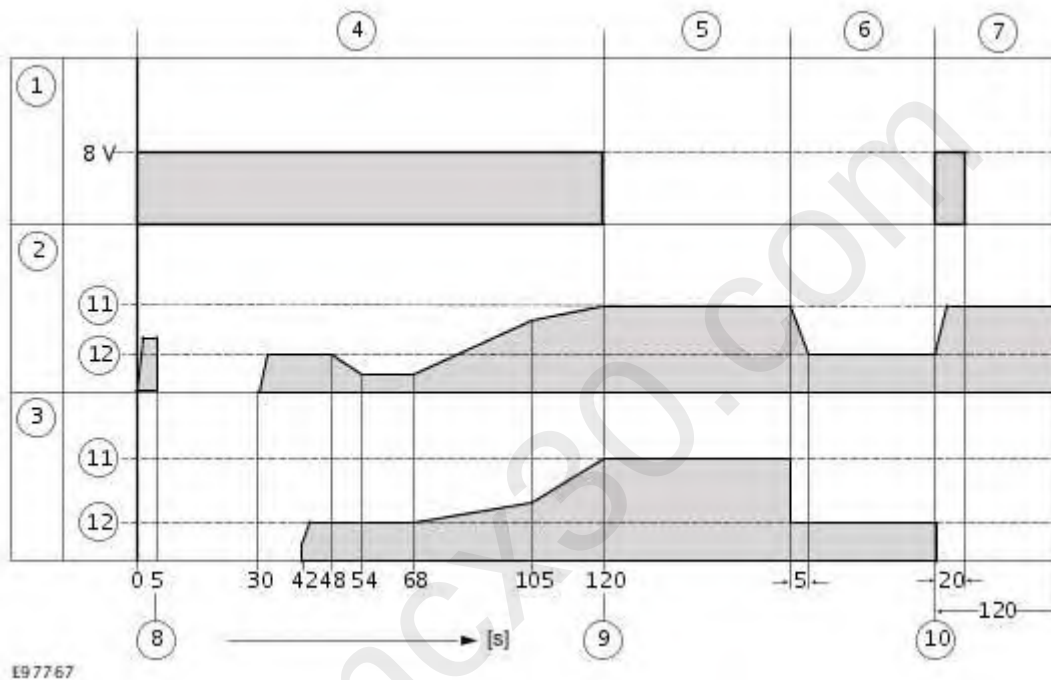
The GEM switches on the electric booster heater depending on the following parameters:

- Engine coolant temperature is below 60 °C.
- Ambient air temperature is below 10 °C.
- Sufficient generator capacity is available.

The electric booster heater electronics activate three output stages as a function of a pulse width modulated signal **PWM (pulse width modulation)** generated by the **GEM**. The output stages switch the three heating elements of the electric booster heater ON or OFF individually, whereby the heating periods of the individual elements can overlap. Due to the variable switch-on duration, continuously variable temperature control is possible. The overall heating power of the three heating elements is linearly proportional to the **PWM** signal. If the **PWM** signal is below 10% or above 95%, the electric booster heater is not activated.

The electric booster heater is switched off when an engine coolant temperature of 70°C or an ambient air temperature of 20°C is exceeded.

Fuel-fired heater - function diagram



Item	Description
1	Glow plug
2	Combustion Air Blower
3	Fuel pump
4	Fuel-fired heater on
5	Fuel-fired heater - large regulating step
6	Fuel-fired heater - small regulating step
7	Fuel-fired heater off
8	Blower motor on
9	Flame detection
10	Blower motor off
11	Large regulating step
12	Small regulating step

Boost heat mode

When the engine is running, the booster heater helps the engine to heat the passenger compartment at low ambient temperatures.

When the coolant temperature reaches 30 °C, the control unit transmits a switch-on signal for the passenger compartment blower via the CAN bus. When the coolant temperature drops, the blower remains on until the temperature reaches 20 °C whereupon it is deactivated.

The fuel tank must be filled to at least 14% for the system to be switched on. If the fuel level drops below 8% then the system is switched off.

In boost mode, the fuel fired booster heater is only switched on if all of the following criteria are met:

- Engine speed above 500 rpm. The fuel fired booster heater is not allowed to start up while the engine is being cranked; this prevents a shut-down due to low voltage if the battery charge is low.
- Ambient temperature below 5 °C.
- Fuel level above 14% of total capacity.
- Function is active on the trip computer menu.

One of the following conditions is sufficient to switch off the booster heater in boost heat mode:

- Engine speed below 500 rpm.
- Ambient temperature above 11 °C.
- Function is active on the trip computer menu.
- Fuel level below 8% of total capacity.

Programmable fuel fired booster heater

The programmable fuel fired booster heater has two operating modes:

- Instant start
- Programmed start

The heater status is displayed on the instrument cluster display. The parking heater mode is controlled via a menu in the message centre. The fuel fired booster heater can be activated and deactivated via the message centre. (If set to 'Auto' the system is activated, if set to 'Off' the system is completely deactivated)

Immediate start-up of the booster heater

This function enables the fuel-fired booster heater to be switched on manually when the engine is not running. This function is activated via the menu on the driver information system.

The ignition key must be in the II" position before this menu can be accessed. The timer function of the booster heater remains active when the ignition key is in position "0".

After an immediate start-up of the booster heater it is switched off again after 30 minutes (or if the fuel level in the fuel tank drops below 8%). The booster heater stops within 2 minutes of the engine starting. This leaves enough time to check whether the switch-on conditions for boost heat mode have been met, thus preventing the booster heater from having to switch off and switch back on again. The heater can be switched off manually at any time from the menu.

Programmed start-up of the booster heater

The driver can use a menu to adjust the time at which the vehicle is to be pre-heated. The following options are available:

- Time setting. One or two times can be programmed for each day of the week. It is possible to program days either individually or together in groups (Mon-Sun/Mon-Sat/Mon-Fri).
- Time and data setting

With the first option, the fuel-fired booster heater will start repeatedly without needing to be reprogrammed. However, if the engine hasn't been run since the last programmed start,

the fuel-fired booster heater will not start up the second time so as to prevent the battery from being discharged.

The length of time required to pre-heat the vehicle is calculated in the control unit of the fuel-fired booster heater and is based on two temperature values:

- Ambient air temperature: this message is taken from the **GEM** via the **CAN** bus.
- Coolant temperature: this is determined via an internal sensor in the fuel-fired booster heater.

The maximum heating time is 30 minutes at an outside air temperature of -10 °C or lower. The heating time decreases proportionally with increasing ambient temperature until the ambient temperature reaches +15 °C. Then the minimum heating time is 10 minutes. The parking heater is deactivated at temperatures above +15 °C.

The sequence for a programmed start of the booster heater is as follows:

- Two minutes before the start of the maximum heating time the driver information system/instrument cluster sends an activation message to the fuel-fired booster heater via the **CAN** bus.
- The fuel-fired booster heater calculates the required heating time and, if necessary, sends a delay request on the **CAN** bus.
- At the calculated time, the fuel-fired booster heater starts up. The conditions for start-up are: engine not running and amount of fuel in the fuel tank is above 14% of maximum.
- When the coolant temperature reaches +30 °C, the control unit of the fuel-fired booster heater sends a request to switch on the passenger compartment blower.
- Eight minutes after the programmed switch-off time, the booster heater stops heating mode and starts a run-on operation to clean the system's spark plugs.
- Ten minutes after the switch-off time, the post-cleaning operation is complete. The additional ten minutes run-on time provides some leeway in case the driver is late arriving.

After a programmed start-up of the booster heater it is switched off again after the heating time has elapsed (or if the fuel level in the fuel tank drops below 8%). The booster heater stops within 2 minutes of the engine starting. This leaves enough time to check whether the switch-on conditions for boost heat mode have been met, thus preventing the booster heater from having to switch off and switch back on again. The heater can be switched off manually at any time from the menu.

Whilst the fuel-fired booster heater is in additional heating mode and/or parking heating mode, the instrument cluster receives a fuel consumption signal; this is used to re-calculate the vehicle's remaining range and fuel consumption data.

Emergency shutoff

In the event of an accident in which the airbags are deployed, the control unit of the fuel-fired booster heater receives a message on the **CAN** bus from the restraints control module (RCM). When this message is received, the booster heater system switches off immediately.

The booster heater control module deactivates the system and does not respond to further messages on the **CAN** bus. The booster heater control module needs to be activated with WDS.

Component Description

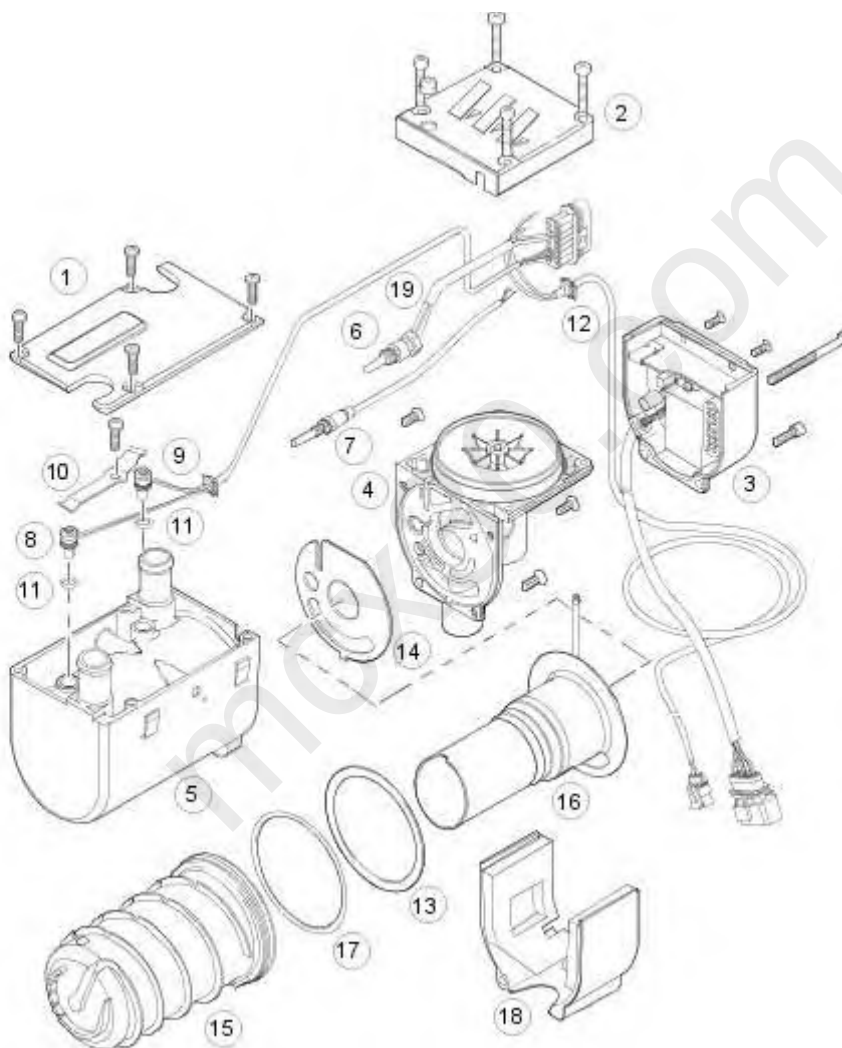
Electric Booster Heater



E9762 1

The electric booster heater consists of three individual heating elements, which are incorporated into a single housing. It is controlled by the generic electronic module (GEM), taking into account the following factors:

Detailed illustration of fuel-fired heater



E85035

Item	Description
1	Cooling sleeve cover
2	Combustion air blower cover
3	Fuel fired additional heater module
4	Combustion Air Blower
5	Cooling sleeve
6	Glow plug
7	Flame sensor

8	Overheat Sensor
9	ECT
10	Compression spring
11	'O' Ring
12	Internal wiring harness - fuel fired additional heater
13	Gasket
14	Gasket
15	Heat exchanger
16	Combustion chamber
17	'O' Ring
18	Combustion blower motor cover
19	Glow plug wiring harness

Flame sensor

If the flame goes out independently during operation of the booster heater, a restart is carried out. If the booster heater does not ignite within 90 seconds of fuel delivery or if the flame goes out within 15 minutes of starting, a lockout will be implemented by the flame sensor.

Lockout can be cancelled by switching the booster heater off then on again, although this may only be repeated at most 2 times.

Overheat Sensor

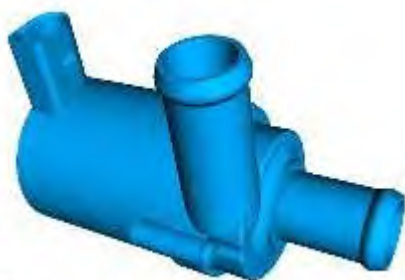
The overheating sensor enables the fuel-fired booster heater module to determine the coolant temperature, protecting the heater from overheating. The overheating sensor is installed next to the coolant temperature sensor under a cover on the top of the fuel-fired heater.

In the event of overheating (lack of water, poorly ventilated coolant circuit), the fuel supply to the heater is interrupted and a lockout occurs. After the cause of the overheating has been eliminated, the heater can be restarted by switching it off and on again, if the coolant temperature is below 70°C. If the heater overheats ten times in a row, the control unit is locked.

ECT

The fuel-fired booster heater module uses the temperature sensor to determine the coolant temperature, which it then uses to set the starting and stopping time. The coolant temperature sensor is installed next to the overheating sensor under a cover on the top of the fuel-fired heater.

Water pump



E97646

The coolant pump is located on the holder for the fuel-fired heater on the bulkhead in the rear of the engine compartment. The coolant pump is driven by a built-in electric motor and circulates the coolant in the engine cooling system. The delivery rate for the pump is 820l/h at a delivery pressure of 0.1 bar.

Fuel pump



E97647

The fuel required for the fuel-fired heater is taken from the fuel system by a fuel pump fitted in the fuel tank and is delivered to the heater via a fuel line.

The fuel pump is an electric piston pump which meters the corresponding fuel volume for the fuel-fired heater according to a cycle set by the fuel-fired heater module.

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