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<td>129</td>
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Operating- and Installation instructions

1 Explanation of icons

**DANGER** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

**WARNING** indicates hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

**CAUTION** indicates hazard with low level of risk which, if not avoided, could result in minor or moderate injury.

**NOTE** indicates possible damage to the product and special technical features.

The ✓ symbol means the paragraph contains requirements or an action.

The ▶ symbol means the paragraph contains a necessary action.

Paragraphs with the ▶ icon, refer to separate documents, available in the scope of delivery. The referred document(s) can also be requested at Webasto.

2 Intended use

**WARNING**

The installation of HVH is strictly limited to electrically instructed specialists for high voltage (DC).

The HVH (high-voltage heater) is integrated into the coolant circuit and connected to the electrical circuit. The HVH can be used for heating vehicle interiors or regulating the temperature of batteries using a high voltage connection between 100 V and 450 V. The HVH is controlled by the vehicle using an analogue 12 V signal, a PWM signal or a LIN connection. The HVH is currently approved for the following applications:

- Cars, LCVs, Trucks, buses in vehicle classes M, N and O
- Construction machines
- Agriculture and forestry machines
- Earth-moving machinery
- Caravans, motor homes, boats, pleasure craft
- Business and commercial premises or small businesses
- Industrial premises

3 General

**WARNING**

When the HVH is operated as a safety-relevant component in the vehicle:

- Error messages must be accessible to the operator (e.g., by a warning signal, a warning light or an indicator in the display).

**CAUTION**

- During handling, keep HVH (with disconnected connectors) dry. The IP classification (IP6K9K and IP6K7) is only valid if connectors are correctly installed.
- The coolant pump must be operated for 30 s before and 30 s after heating.
- Fill and bleed the HVH before installation.

**CAUTION**

- Do not use HVH in high voltage systems where voltages exceed 600 V. Maximum voltage HVH can withstand without damages is 600 V.
- To avoid a damaged ECU, always operate HVH together with a pre-charge circuit. Therefore, for a period > 5 ms, use a > 50 Ω pre-charge resistance to charge the HVH DC-Link capacitor. Alternatively increase the high voltage level slowly.
- The low voltage supply should be maintained for 5 s after cancelling the heat command. This makes it possible to shut down the electronic control unit (ECU) of the HVH in a controlled manner.
- Never short circuit HV + and HV - (e.g., to discharge the system). This would permanently damage HVH.
- An isolation monitoring system shall be applied in the vehicle to monitor the isolation resistance between the HVH and the chassis of the electric vehicle.

The HVH takes its power from the high voltage battery of the...
vehicle. It can be driven with voltages between 100 – 450 V DC. From 450 V down to min. 250 V, the HVH supplies the maximum heating capacity of 5 kW (450 V to 300 V for the 7 kW version). The HVH stops operating below 100 V. At voltages over 450 V, the HVH will shut down and lock-up. The power output of the HVH can be varied between 200 W and 5000 W (or 7000 W for 7 kW version) in increments of 50 W.

There are 3 options to control HVH. Depending on HVH model (factory setting), the following controls are possible:

■ Main switch (Analogue)
■ Pulse Width Modulation (PWM)
■ Local Interconnect Network (LIN).

Depending on control version, HVH can be set in 2 different ways:

■ For PWM or LIN control only: heating capacity; the vehicle control system sends an explicit setpoint heating capacity. The control unit for the HVH regulates the heating capacity within a specified temperature range.

■ Main switch, PWM and LIN control versions only: coolant temperature, the vehicle control system sends out a setpoint coolant temperature and regulates the heating capacity within the specified output limits so that the setpoint temperature is achieved and maintained.

**NOTE**
The power and temperature can be adjusted via LIN diagnosis and stored in a non-volatile memory. These values are used by the HVH after successful WriteDataByID Service with followed ECU Reset.

---

### 4 Scope of delivery

**Fig. 01: HVH scope of delivery**

1 High voltage heating (HVH)

---

### 5 Operation instructions

**NOTE**
HVH is operated using the vehicle control system.

---

### 6 Installation main switch (analogue, 12 V)

The model that is configured for using a main switch.

■ The HVH can be selected as a heater with main switch control (ON = 8..12 V at > 6 mA). PWM control is not possible with this control option.

■ If a voltage is supplied at the analogue input, the heater will be operated with the predefined setpoints for the maximum heating capacity of PTarget_Main = 7 kW (default) and Coolant Target Temperature = 85°C. The heater automatically regulates the heating capacity to achieve and maintain the coolant temperature.

**6.1 Main switch response**

■ When the heater is operated with the main switch input then the heater outputs 12 V at the analogue output (Pin 2) (= main switch response).

■ If the heater is failing operation then the status will be a periodic repeated sequence depending on the heater status:
  - Temporary lock: 5 short, 1 long signals
  - Overheat lock (locked until next service): 5 short, 2 long signals
  - Permanent lock: continuous short signals

---

### 7 Installation Pulse Width Modulation (PWM)

The PWM signal is a 2-way signal. A control input signal is sent to HVH, a status output signal is sent to the vehicle.

**PWM flowchart:**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Control Input</th>
<th>PWM Status Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVH</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**7.1 PWM Function Overview:**

**PWM Control Input from vehicle to HVH:**

■ Target heat output (0 to 5 kW (7 kW))
■ Target coolant temperature (-40 to +90 °C)

**PWM Status Output from HVH to vehicle:**

■ Status Information
  - Off
  - Operation Status (power or temperature)
■ Fault Information
  - Temporarily lock
  - Overheat lock
  - Permanent lock

**7.2 PWM Hardware Requirements**

**Control input:**

■ The voltage level shall be 12 V DC up to a maximum of 27 V
■ Wake up voltage: 0.6 V

**Status output:**

■ Pull-down resistance from 1kΩ up to 10kΩ at a provided frequency of ≤ 100Hz
■ Maximum current: 130 mA

**7.3 PWM Software Requirements**

**NOTE**
Never operate a HVH PWM with a static 12 V signal

■ Slew-rate: The edge detection from input shall be at least a slew-rate of 15μs (20% - 80% of 5 V).
Frequency Input: 50 – 100 Hz any frequency outside this range will stop or prevent the heater to operate.
Frequency Output: +/- 50 Hz
Duty Cycle: Avoid very small Duty Cycles (DC < 2%) and avoid very large duty cycles (DC > 97%).
Sleep mode: When PW ratio = 0 for at least 11 s, HVH shall go into sleep mode.
The HVH starts heating mode when the PW for the capacity (Ptarget_x) is applied. The HVH independently regulates the maximum capacity Ptarget_x and the maximum temperature of 85°C.

7.4 Changing target temperature
The setpoint temperature can be changed via PW setting to the other setpoint temperature (TEMPERATURE_TARGET_SETPOINT_x).
Proceed as follows to change the setpoint temperature: The PW value for TEMPERATURE_TARGET_SETPOINT_x must be selected within a TempSetting-time window (starting when the PW is at least 2 s, finishing when 5 s has elapsed). If the PW value is changed within the TempSetting-time window between 0 < PW ≤ 5, the new setting for the TEMPERATURE_TARGET_SETPOINT_x must be confirmed. This must be done within the confirmation window (started when the PW is at least 2 s selected, finished when 5 s elapsed)
A change of the PW value between 21 < PW < 100 within the confirmation window will store and use the new TEMPERATURE_TARGET_SETPOINT_x.
NOTE
This setting will be done and stored in a none volatile memory.

7.5 PWM Control Input from vehicle to HVH

<table>
<thead>
<tr>
<th>PWM [%]</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Off (Sleep mode)</td>
</tr>
<tr>
<td>3</td>
<td>Standby, no heating</td>
</tr>
<tr>
<td>9</td>
<td>Configuration: TEMPERATURE_TARGET_SETPOINT_1 (default manufacturing = 85°C, e.g. used for cabin heating)</td>
</tr>
<tr>
<td>17</td>
<td>Configuration: TEMPERATURE_TARGET_SETPOINT_2 (default manufacturing = 35°C, e.g. used for battery heating)</td>
</tr>
<tr>
<td>25</td>
<td>Operation with Ptarget_1 (Default setting = 520W)</td>
</tr>
<tr>
<td>33</td>
<td>Operation with Ptarget_2 (Default setting = 1000W)</td>
</tr>
<tr>
<td>41</td>
<td>Operation with Ptarget_3 (Default setting = 1520W)</td>
</tr>
<tr>
<td>49</td>
<td>Operation with Ptarget_4 (Default setting = 2000W)</td>
</tr>
<tr>
<td>57</td>
<td>Operation with Ptarget_5 (Default setting = 2520W)</td>
</tr>
<tr>
<td>65</td>
<td>Operation with Ptarget_6 (Default setting = 3000W)</td>
</tr>
<tr>
<td>73</td>
<td>Operation with Ptarget_7 (Default setting = 4000W)</td>
</tr>
<tr>
<td>81</td>
<td>Operation with Ptarget_8 (Default setting = 5000W)</td>
</tr>
<tr>
<td>89</td>
<td>Diagnosis: Overheat Unlock (State: LockedUntilNextService)</td>
</tr>
<tr>
<td>96, 100</td>
<td>Standby, no heating</td>
</tr>
</tbody>
</table>

7.6 PWM Output

Confirmation Status
Only used when the TEMPERATURE_TARGET_SETPOINT_x was modified:
When the TEMPERATURE_TARGET_SETPOINT_x was successfully modified the PWM output will be set for a duration of 5 s to:
TEMPERATURE_TARGET_SETPOINT_1 is used to PW 7%
TEMPERATURE_TARGET_SETPOINT_2 is used to PW 11%

Power-Up Status
The power-up status is used only once on power up to display which TEMPERATURE_TARGET_SETPOINT_x is set:
TEMPERATURE_TARGET_SETPOINT_1 is used then PW shall be 5s from power-up indicate PW=7% or
TEMPERATURE_TARGET_SETPOINT_2 is used then PW shall be 5s from power-up indicate PW=11%

WM Status Output from HVH to vehicle

<table>
<thead>
<tr>
<th>PWM [%]</th>
<th>Linked action / response from HVH</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5</td>
<td>Off</td>
</tr>
<tr>
<td>&gt; 5 and ≤13</td>
<td>Not used</td>
</tr>
<tr>
<td>&gt;13 and ≤21</td>
<td>Temp_act: ≤ 0°C and Pact &lt; Ptarget</td>
</tr>
<tr>
<td>&gt;21 and ≤29</td>
<td>Temp_act: &gt; 0°C to ≤ 40°C and Pact &lt; Ptarget</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical set PWM duty cycle [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>17</td>
</tr>
<tr>
<td>25</td>
</tr>
</tbody>
</table>
PWM [%] | Linked action / response from HVH | Typical set PWM duty cycle [%]
---|---|---
>29 and ≤37 | Temp_act: >40°C to ≤ 75°C and P act < T target | 33
>37 and ≤45 | Temp_act: >75°C and P act < T target | 41
>45 and ≤53 | Temp_act: ≤ 0°C and P act ≥ T target | 49
>53 and ≤61 | Temp_act: > 0°C to ≤ 40°C and P act ≥ T target | 57
>61 and ≤69 | Temp_act: > 40°C to ≤ 75°C and P act ≥ T target | 65
>69 and ≤77 | Temp_act: >75°C and P act ≥ T target | 73
>77 and ≤85 | Temporarily locked | 81
>85 and ≤93 | Overheat Lock | 89
>93 and ≤100 | Permanently locked | 96

**overheat issue**
- If the HVH is in overheating lock (locked due to overheating) this can be reversed twice using the the PW value for Overheat Unlock.

**NOTE**
- Unlocking the HVH requires a coolant outlet temperature < 70°C.

Following sequence shall be used for unlocking HVH:
- Set 85% < PW ≤ 93% for maximum of 5 s.
- Within the 5 s of step 1 the HVH shall be powered off.
- With following power-up the HVH will be unlocked.

**NOTE**
- The HVH can be unlocked a maximum of two times using the Overheat Unlock signal (89%). On the third occurrence, a permanent lock is activated for safety reasons.

Optional: a followed setting of 21% < PW ≤ 85% will start heating operation.

**8 Installation Local Interconnect Network (LIN)**

**8.1 Generation 1E - LIN interface**

**LIN general information**
- HVH shall be a LIN slave node following the LIN specification package 2.1.
- LIN bus speed is 19.2 kbps
- HVH will provide LIN frame IDs that are not send by other ECUs within the LIN network.
- Frame ID 35dez (LIN-master request: operation with power and Ttarget temperature)
- Frame ID 24dez (HVH-response frame 1: Power response LIN-Signals)
- Frame ID 40dez (HVH-response frame 2: Status, diagnosis, warning and damage response LIN-signals)
- LIN wake-up time < 100 ms.

The init values to be used after power-up are defined in the LDF-files provided by Webasto and listed in the chapter LIN interface. Within each LIN-Signal description the power-up value is defined.

The structure of the LIN Frame is shown in Fig. 02.

**8.2 LIN operation**

**Heating request**
- Purpose: switching the HVH on/off
- LIN-signal name: HVH_HeaterEnable

**Target temperature**
- Purpose: specifying the setpoint temperature for the coolant in HVH
- LIN-signal name: HVH_TargetCoolantTemp

**Power limit**
- Purpose: limiting the maximum power consumption
- LIN-signal name: HVH_MaxPower

**8.3 LIN messages**

**NOTE**
- All signal sizes 2 Bit, all encoding bit-mapped unless otherwise mentioned.

**HVH operation status**
- Purpose: shows the Operation Status of the HVH to the LIN-Master.
- LIN-Signal Name: HVH_Status

Optional: a followed setting of 21% < PW ≤ 85% will start heating operation.
LIN-Signal Name: HVH_WarnHvOutOfRange
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | High voltage out of range
10 | Not used
11 | SNA - Signal not available

HVH low voltage warning
Purpose: Issue at Low Voltage Supply (12V).
LIN-Signal Name: HVH_WarnULoOutOfRange
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Low voltage out of range
10 | Not used
11 | SNA - Signal not available

HVH coolant temperature out of range
Purpose: Shows coolant temperature out of range.
LIN-Signal Name: HVH_WarnCooltTOutOfRange
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Coolant temp too high
10 | Not used
11 | SNA - Signal not available

HVH internal communication error
Purpose: Shows internal HVH communication error (SPI interface issue between LV and HV processor).
LIN-Signal Name: HVH_WarnFltInCom
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Communication issue
10 | Not used
11 | SNA - Signal not available

HVH overheating
Purpose: Shows heater core resistor (hardware detected fault) or PCB-temp, inlet coolant temperature is too high.

**NOTE**
The HVH can be unlocked a maximum of two times using the Overheat Unlock signal. On the third occurrence, a permanent lock is activated for safety reasons. The procedure for unlocking the HVH is set out in the workshop manual.

LIN-Signal Name: HVH_WarnOverheat
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Overheat issue
10 | Not used
11 | SNA - Signal not available

HVH damage protection
Purpose: Shows operation of HVH is denied due to internal HW protection (e.g., HV current short circuit protection, hotspot of heater core detected, HW error lock active).
LIN-Signal Name: HVH_FailHvProtection
LIN Bit-Value | Logical value
---|---
00 | protection inactive
01 | protection active
10 | Not used
11 | SNA - Signal not available

HVH coolant outlet temperature sensor fault
Purpose: Shows coolant outlet temp sensor defect.
LIN-Signal Name: HVH_FailSensorTOut
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH coolant inlet temperature sensor fault
Purpose: Shows coolant inlet temp sensor defect.
LIN-Signal Name: HVH_FailSensorTIn
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH core temperature sensor fault
Purpose: Shows core temperature sensor defect.
LIN-Signal Name: HVH_FailSensorTOverheat
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH DC-DC voltage out of range
Purpose: Shows DC-DC generated Voltage is out of Range.
LIN-Signal Name: HVH_FailDCDCConverter
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH high-side current out of range
Purpose: Shows current consumption at high voltage out of range.
LIN-Signal Name: HVH_FailHighCurrent
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH damage HV driver
Purpose: Shows short or open circuit at IGBTs (high and low side drivers).
LIN-Signal Name: HVH_FailDriver
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available

HVH damage memory
Purpose: Shows memory error at low or high voltage processor.
LIN-Signal Name: HVH_FailMemory
LIN Bit-Value | Logical value
---|---
00 | no issue
01 | Damage
10 | Not used
11 | SNA - Signal not available
8.4 Diagnosis

Purpose: these are in general measurements or evaluation values used only for HVH information.

HVH-LIN Error

The Signal is generated if any LIN protocol issue is detected by the LIN Software driver of the HVH. The signal is not used by the HVH for failure interpretation or to store event triggered data - e.g. error log incl. snapshot data.

LIN-Signal Name: RsErr_HVH

<table>
<thead>
<tr>
<th>LIN Bit-Value</th>
<th>Logical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>communication OK</td>
</tr>
<tr>
<td>1</td>
<td>LIN protocol issue</td>
</tr>
</tbody>
</table>

HVH Outlet Temperature

Purpose: shows the HVH measured coolant outlet temperature.

LIN-Signal Name: HVH_Coolant_Out_Temp

Signal values assignments

<table>
<thead>
<tr>
<th>LIN Bit-Value</th>
<th>Logical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>range: 0..255</td>
<td>-40..214 ºC</td>
</tr>
<tr>
<td>scaling = 1</td>
<td>scaling = 1</td>
</tr>
<tr>
<td>Offset = -40</td>
<td>Offset = -40</td>
</tr>
<tr>
<td>255</td>
<td>SNA - Signal not available</td>
</tr>
<tr>
<td>Power-Up / Init: SNA</td>
<td>unit: °C</td>
</tr>
</tbody>
</table>

HVH Inlet Temperature

Purpose: shows the HVH measured coolant inlet temperature.

LIN-Signal Name: HVH_Coolant_In_Temp

Signal values assignments

<table>
<thead>
<tr>
<th>LIN Bit-Value</th>
<th>Logical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>range: 0..255</td>
<td>-40..214 ºC</td>
</tr>
<tr>
<td>scaling = 1</td>
<td>scaling = 1</td>
</tr>
<tr>
<td>Offset = -40</td>
<td>Offset = -40</td>
</tr>
<tr>
<td>255</td>
<td>SNA - Signal not available</td>
</tr>
<tr>
<td>Power-Up / Init: SNA</td>
<td>unit: °C</td>
</tr>
</tbody>
</table>

HVH high voltage level

Purpose: shows the actual measured high voltage level at the HVH.

LIN-Signal Name: HVH_HV_Voltage

Signal values assignments

<table>
<thead>
<tr>
<th>LIN Bit-Value</th>
<th>Logical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>range: 0..1023</td>
<td>0..800 V</td>
</tr>
<tr>
<td>scaling = 1</td>
<td>1 V</td>
</tr>
<tr>
<td>Offset = 0</td>
<td>Offset = 0</td>
</tr>
<tr>
<td>1024</td>
<td>SNA - Signal not available</td>
</tr>
</tbody>
</table>

HVH Actual Power

Purpose: shows the actual used power by the HVH to achieve the coolant target.

LIN-Signal Name: HVH_Power_Actual

Signal values assignments

<table>
<thead>
<tr>
<th>LIN Bit-Value</th>
<th>Logical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>range: 0..1023</td>
<td>0..20480 Watt</td>
</tr>
<tr>
<td>scaling = 20</td>
<td>20</td>
</tr>
<tr>
<td>Offset = 0</td>
<td>Offset = 0</td>
</tr>
<tr>
<td>1024</td>
<td>SNA - Signal not available</td>
</tr>
</tbody>
</table>

8.5 UDS-Diagnosis

The standard LIN 2.1 Diagnosis frames (see LDF file Frame ID 0x3C / 0x3D) will be used to map Universal Diagnosis Services / Sub-Services and Data.
Positioning:

**NOTE**
- The permitted orientations need to be met in order to guarantee de-aeration under every condition. Any orientation of the HVH, deviating from Fig. 04 is not permitted. All shown angles regard the max. values for planning the HVH installation into the vehicle. Vehicle inclines of 10° in any direction are considered and validated on top of the above described figures.
- Installation according to Fig. 04 in order to bleed the coolant circuit correctly. Where there are specifications from the vehicle manufacturer, these must be observed.

Every reasonable precaution should be taken in positioning the heater to minimize the risk of injury and damage to personal property.
- Search for a location that can be accessed if replacement might be necessary.
- Never install the heater inside the passenger compartment.
- Connect coolant lines without sharp angles to ensure coolant flow.

The following guidelines are to be considered if the HVH is installed without an existing coolant circuit:
- The total coolant volume is as small as possible, to ensure a quick heat up of the system.
- The coolant pump position is always under the HVH position in order to ease the bleeding of the cooling system.

**NOTE** Minimum coolant volume 1.5 l
- The coolant pump position is always under the HVH position in order to ease the bleeding of the cooling system.
- The highest point of the HVH is situated under the coolant expansion tank.

**NOTE**
- Do not install HVH:
  - In the direct radiated heat range of exhaust systems
  - Below the wading line of the vehicle
  - Above the coolant expansion tank.
- Ensure automatic bleeding. Install HVH as low as possible. The heater and coolant pump both should be able to bleed air automatically. This is particularly relevant for a coolant pump that is not self-priming.
- The HVH – as the main heating source for the cabin – shall be positioned in the coolant circuit upstream of the vehicle HVAC inlet and downstream of the coolant pump.

Always install HVH directly behind the coolant pump.

Fig. 04: Permissible installation positions for the heater

9.2 Install HVH in vehicle

**NOTE**
- Use self-tapping drill screws to fasten the HVH to a bracket (Screw HEX T25 DIN 267-30 5x13 -10.9)

9.3 Cooling system

To ensure the full heat transfer, the intended coolant flow for Fig. 06 is shown in the graphs (Fig. 07 and HVH). To avoid coolant evaporation and cavitation:
- The coolant flow shall start min. 30 s before heating.
- The coolant flow shall stop min. 30 s after stop of heating.

Fig. 05: Mounting holes

The HVH has got four mounting holes to screw it onto a bracket. These fastening points are placed along the balance point of the heater and will not increase its outer dimension.

Fig. 06: Coolant flow HVH 50
9.4 HVH coolant stubs

Fig. 07: Coolant flow HVH 70
A Coolant flow
B Coolant outlet temperature

9.5 Installation of coolant hoses

NOTE
Minimum coolant hose diameter: 20 mm
Never connect the HVH inlet to the outlet of the vehicle coolant flow

Fig. 08: Dimensions of coolant stubs
Stubs dimensions see Fig. 08 (according to DIN 3021 – C19).

9.6 Coolant pump

✓ Ensure the correct direction of flow of the HVH to the vehicle coolant circuit.

Fig. 10: Coolant pump, self-bleeding
✓ Ensure the correct direction of flow of the coolant pump to the vehicle coolant circuit.
✓ Control and diagnosis of coolant pump by vehicle system.
✓ The installation position of the coolant pump must be chosen so that the coolant pump is self-bleeding.

NOTE
- Coolant pump should run before HVH is switched on.
- Install the coolant pump in such a way that trapped air can escape upward.
- Incorrect installation can result in malfunctions of the coolant pump.

9.7 Checking

After the heater and all coolant-carrying components have been installed, the entire coolant system must be checked for leaks with the system pressure specified by the vehicle manufacturer.

10 Labels

10.1 Type label(s)

Fig. 11: Type labels
Type label on heater (Fig. 11; 1):
✓ Remove the years indicated that are not applicable at the time of installation (A).
Type label duplicate (2) for attaching to the vehicle:
✓ If the type label on the heater is not visible after installation, attach the type label duplicate such that it is clearly visible in a protected area on the vehicle.
✓ Remove the years indicated that are not applicable at the time of installation (A).
10.2 HV Warning label

The HV warning label is attached to the heater.

**WARNING**
Possible electrocution
The presence of a high voltage device must be clearly indicated (ECE R100):
The HV warning label must be visible for a mechanic when HVH is installed in the vehicle (for example when the vehicle needs repair or maintenance).
If the sticker is not visible on the HVH itself:
▸ Attach an additional HV warning label in a clearly visible location (on a nearby bracket).

11 Wiring harness installation

**WARNING**
Possible electrocution and/or fire
Do not install wiring close to parts that get hot during operation, moving parts or sharp edges of the vehicle.

The HVH has a ground connection and 2 electrical connectors, one low voltage connector (LV) with the controls and one high voltage connector (HV) for power supply.

11.1 General (heater connectors)

▸ Disconnect the batteries (high and low voltage) before installing the HVH.
▸ Connect the wiring properly. Connections must be clean and free of damage. Ensure the connection is secured.

11.2 Low voltage ground connection (with ring terminal)

**NOTE**
Ring terminal location (to vehicle):
Do not damage parts. Check the surrounding area before drilling.
▸ Connect one side of the ground cable to the body of vehicle and the other to the unique position on the heater. See Fig. 13.
Vehicle side:
– clean from paint or grease if necessary.
– Protect against corrosion.
▸ If necessary: when finishing the drill process, clean drilled hole.
▸ Place the cable lug on the ground connection bolt.
▸ Pre-fix the nut by hand.
▸ Place the wrench (ring or open-end type) on the nut.
▸ Place the Torx wrench on the PE bolt (alternatively nut bit or pipe wrench).
▸ Tighten the nut while locking the PE bolt. Tightening torque: 8 ± 0.8 Nm.

11.3 High voltage connection

**CAUTION**
▸ Install and connect a 30 – 40 A fuse between HV+ and vehicle supply voltage.
▸ Use a pre-charge resistance of at least 50 Ω. Otherwise the DC-Link capacitor will lead to an uncontrolled high current flow that exceeds the specified range and with that will result in a permanent damage of the HVH.

The HVH is equipped with a 10 µF DC-Link capacitor (between HV+ and HV-). This capacitor must be charged before connecting the high voltage supply and before starting the HVH.
The heater is discharged within 10 s (>60 V DC).

**NOTE**
HV+ and HV- must never be short-circuited (e.g. to rapidly discharge the system).
11.4 Low voltage connection

**NOTE**
- Make sure to connect ground cable first.
- HVH LIN version: Only connect HVH to the vehicle LIN.

- Install and connect a 30 – 40 A fuse between HV+ and vehicle supply voltage.
- Connect the high voltage cable to the vehicle, use the vehicle specific installation instructions.
- Connect the orange high voltage connector to the HVH. Ensure that the connection is secured; a clicking noise indicates that the connector is properly installed.

<table>
<thead>
<tr>
<th>Signal name</th>
<th>Description</th>
<th>Signal name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 12 V+</td>
<td>Connection to vehicle battery</td>
<td>12 V+</td>
<td>Connection to vehicle battery</td>
</tr>
<tr>
<td>2 Analogue output (12V)</td>
<td>Analogue output PWM response when the analogue output is configured for use</td>
<td>Analogue output Main switch response when the analogue output is configured for use</td>
<td></td>
</tr>
</tbody>
</table>

12 Initial start-up

- Check if all connections mentioned in this installation instruction have been done.
- Use the installation instruction for the specific HVH version and the vehicle specific operation instructions to start the heater.
- Check if the heater heats according to specification.
- Ensure that there is sufficient coolant supply at least 30 s before and after HVH operation.
- Check for coolant leaks.

13 Legal requirements

HVH has been type-tested and approved in accordance with ECE-R-122 (heater) and ECE-R-10 (EMC)

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Typ approval number</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECE R122</td>
<td>E1 00 0465 HVH 50</td>
</tr>
<tr>
<td>E1 00 0482</td>
<td>HVH 70</td>
</tr>
</tbody>
</table>

The stipulations of these regulations are binding in the area covered by EU Directive 70/156/EEC and/or 2007/46/EC (for new vehicle models from 29/04/2009) and should also be observed in countries where there are no specific regulations. Failure to follow the installation instructions and the notes...
contained therein will lead to all liability being refused by Webasto.

Disposal end of life

WEEE directive: This symbol indicates that this product is not to be disposed of among regular household waste, according to WEEE directive 2012/19/EC and your national law. This product must be handed over to a designated collection point or to an authorized collection site for recycling waste electrical and electronic equipment.

14 Noise emission

The noise emission of HVH is below the threshold value, mentioned in chapter 1.7.4.2. u) of the machine directive 2006/42/EG.

15 Technical data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HVH 50</th>
<th>HVH 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>LIN 2.1 / PWM / Main switch</td>
<td></td>
</tr>
<tr>
<td>Heating capacity [kW]</td>
<td>0.2 ... 5</td>
<td>0.2 ... 7</td>
</tr>
<tr>
<td>Supply voltage, maximum [V]*</td>
<td>250…450</td>
<td>300…450</td>
</tr>
<tr>
<td>Passive discharge</td>
<td>&lt; 60 V in 10 s (ISO 6469-3.3)</td>
<td></td>
</tr>
<tr>
<td>Dielectric strength [V DC]</td>
<td>3,010</td>
<td></td>
</tr>
<tr>
<td>Burst pressure [bar]</td>
<td>7 ± 0.1</td>
<td></td>
</tr>
<tr>
<td>Pressure peaks during operation [bar]</td>
<td>5 ± 0.1</td>
<td></td>
</tr>
<tr>
<td>Operating pressure [bar]</td>
<td>2.5 ± 0.1</td>
<td></td>
</tr>
<tr>
<td>Temperature range heating (°C)</td>
<td>-40...+90</td>
<td></td>
</tr>
<tr>
<td>Coolant temperature range °C</td>
<td>-40...+120</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range °C</td>
<td>-40...+125</td>
<td></td>
</tr>
<tr>
<td>Storage temperature range °C</td>
<td>-40...+125</td>
<td></td>
</tr>
<tr>
<td>Current consumption idle [mA] at 12 V</td>
<td>&lt; 60</td>
<td></td>
</tr>
<tr>
<td>Coolant flow rate [l/h]</td>
<td>&gt; 250</td>
<td></td>
</tr>
<tr>
<td>Absolute altitude [m]</td>
<td>&lt; 5,500</td>
<td></td>
</tr>
<tr>
<td>LV connection</td>
<td>LV FEP connector 8 PIN integrated de-aerating membrane</td>
<td></td>
</tr>
<tr>
<td>Electrical protection</td>
<td>ISO 6469 Part 3 / ECE R100</td>
<td></td>
</tr>
<tr>
<td>Functional safety</td>
<td>ISO26262</td>
<td></td>
</tr>
<tr>
<td>HV connection (default)</td>
<td>TYCO HVA280</td>
<td></td>
</tr>
<tr>
<td>IP Protection class</td>
<td>IP 6K9K IP6K7</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>284x200x54</td>
<td></td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

* : See also „15.1 Supply voltage and power output“ on page 12.

15.1 Supply voltage and power output

![Graph showing heat output relative to operation voltage](image)

- **A** Heating capacity
- **B** Supply voltage
  1. 0 - 600 V: Diagnostic function
  2. < 100 V: No heat output
  3. 100-250 V: Restricted heating capacity (HVH 50 and HVH 70)
  4. 250 - 300 V: Restricted heat output (HVH 70 only)
  5. 250 - 450 V: Max. heat output
  6. > 450 V: No heat output (> 600 V heater damage)
15.2 CE-declarations of conformity

**Fig. 20: HVH 50**

<table>
<thead>
<tr>
<th>Directive</th>
<th>Harmonised Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN ISO 12100-1:2010</td>
<td>EN ISO 12100:2010</td>
</tr>
<tr>
<td>DIN EN 61000-6-2:2008-09</td>
<td>DIN EN 61000-6-2:2008</td>
</tr>
<tr>
<td>DIN EN 61300-2-2:2010</td>
<td>DIN EN 61300-2-2:2010</td>
</tr>
<tr>
<td>EN 61000-6-1:2007</td>
<td>EN 61000-6-1:2007</td>
</tr>
</tbody>
</table>

**Fig. 21: HVH 70**

<table>
<thead>
<tr>
<th>Directive</th>
<th>Harmonised Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN ISO 12100-1:2010</td>
<td>EN ISO 12100:2010</td>
</tr>
<tr>
<td>DIN EN 61000-6-2:2008-09</td>
<td>DIN EN 61000-6-2:2008</td>
</tr>
<tr>
<td>DIN EN 61300-2-2:2010</td>
<td>DIN EN 61300-2-2:2010</td>
</tr>
<tr>
<td>EN 61000-6-1:2007</td>
<td>EN 61000-6-1:2007</td>
</tr>
</tbody>
</table>
MITTEILUNG
ausgestellt von:
Kraftfahrt-Bundesamt
die Erweiterung der Genehmigung
für einen Typ eines Bauteils nach der Regelung Nr. 122

COMMUNICATION
issued by:
Kraftfahrt-Bundesamt
approval extended
of a component type pursuant to Regulation No. 122

Abschnitt I
Section I
Allgemeines
General

1.1 Marke (Firmenname des Herstellers): Make (trade name of manufacturer):
Webasto Thermo & Comfort SE

1.2 Typ: Type:
HA

Abschnitt II
Section II

1. Zusätzliche Angaben (falls zutreffend): Additional information (where applicable):
entfällt not applicable

2. Technischer Dienst, der die Prüfungen durchführt:
Technical service responsible for carrying out the tests:
DEKRA Automobil Test Center der DEKRA Automobil GmbH
DE-01998 Klettwitz

Handelsbezeichnungen wurden aktualisiert
updating of general commercial descriptions

Nummer der Genehmigung: 000465, Erweiterung 02
Approval No.:
Kraftfahrt-Bundesamt
DE-24932 Flensburg

Nummer der Genehmigung: 000482
Approval No.: E1

Datum: 05.12.2016
Date: 05.12.2016

Kraftfahrt-Bundesamt
DE-24932 Flensburg

Nummer der Genehmigung: 000465
Approval No.: 02

Datum: 05.12.2016
Date: 05.12.2016

Kraftfahrt-Bundesamt
DE-24932 Flensburg

MITTEILUNG
ausgestellt von:
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die Erweiterung der Genehmigung
für einen Typ eines Bauteils nach der Regelung Nr. 122

COMUNICATION
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Abschnitt I
Section I
Allgemeines
General

1.1 Marke (Firmenname des Herstellers):
Make (trade name of manufacturer):
Webasto Thermo & Comfort SE

1.2 Typ:
Type:
JA

03: HVH 50

04: HVH 70
2

Nummer der Genehmigung: 000482, Erweiterung 01
Approval No.:

1.2.1 Handelsbezeichnung(en):
General commercial description(s):
HVH 50 PLUS

1.3 Merkmale zur Typidentifizierung, falls an der Einrichtung vorhanden:
Means of identification of type, if marked on the device:
Typbezeichnung
type

1.3.1 Stelle, an der diese Merkmale angebracht sind:
Location of that marking:
auf dem Gehäuse und nach dem Einbau zusätzlich am Fahrzeug
on the housing and after the installation additional on the vehicle

1.4 Name und Anschrift des Herstellers:
Name and address of manufacturer:
Webasto Thermo & Comfort SE
DE-82205 Gilching

1.5 Stelle, an der das ECE-Genehmigungszeichen angebracht ist:
Location of the ECE approval mark:
auf dem Gehäuse
on the housing

1.6 Anschrift(en) der Fertigungsanlage(n):
Address(es) of assembly plant(s):
Webasto Thermo & Comfort SE (Werk Neubrandenburg)
DE-17033 Neubrandenburg

Abschnitt II
Section II

1. Zusätzliche Angaben (falls zutreffend):
Additional information (where applicable):
entfällt
not applicable

2. Technischer Dienst, der die Prüfungen durchführt:
Technical service responsible for carrying out the tests:
DEKRA Automobil Test Center der DEKRA Automobil GmbH
DE-01998 Klettwitz

3. Datum des Gutachtens:
Date of test report:
06.11.2016

4. Nummer des Gutachtens:
Number of test report:
201537157 (1. Erweiterung)

5. Gegebenenfalls Bemerkungen:
Remarks (if any):
entfällt
not applicable

6. Ort: DE-24932 Flensburg
Place:

Date:

8. Unterschrift: Im Auftrag
Signature

(Jörg Burgkhardt)
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Tel: 0395 5592 444
E-mail: technikcenter@webasto.com

www.webasto.com