BORGWARNER

SPECIFICATION NUMBER
S3706 Rev A

E-RDC R23348

DATE: 2024-12-20

SPECIFICATION NAME

Application Guideline - High Voltage Coolant Heater – C1 Platform 800V

Abstract: This document describes basic product data and application guideline of C1 Platform 800V high voltage coolant heater.

Key words: Application Guideline, Basic Data, Performance, Interface

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Note

This document only describes the general characteristics of the C1 Platform 800V 7.4kW High Voltage Coolant Heater. For detailed information, please contact a BorgWarner Engineer.

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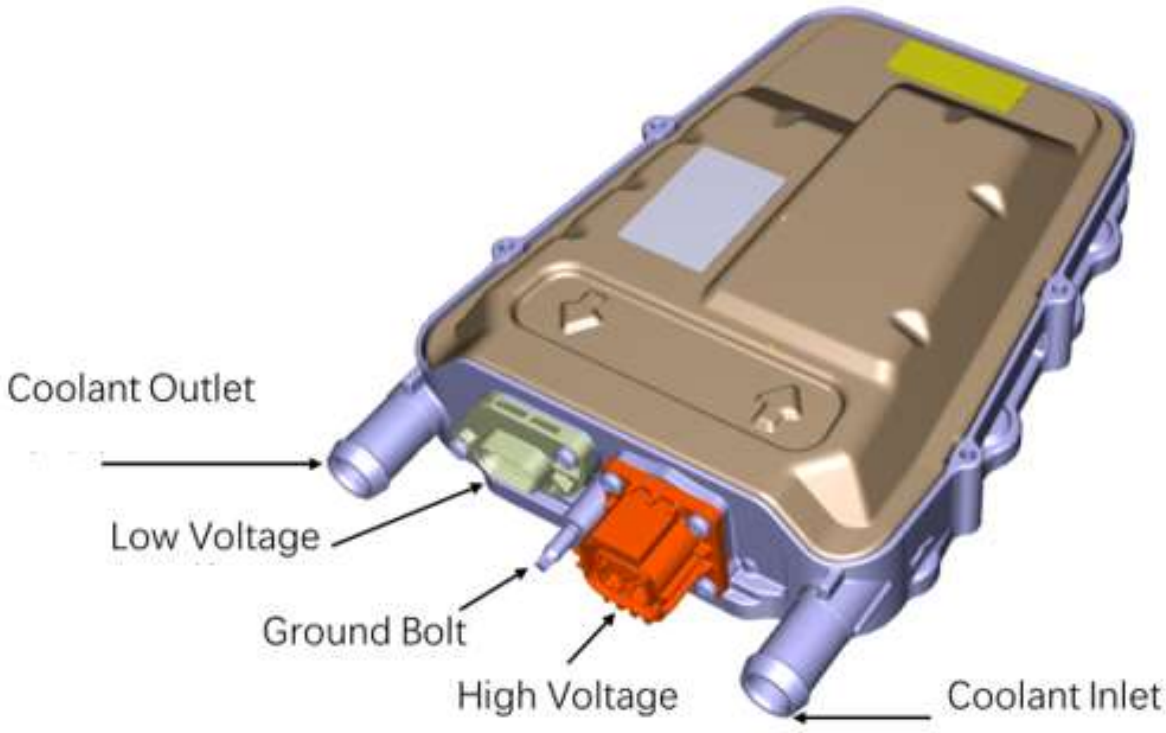
1 Product Introduction

1.1 Product Overview

State of the art batteries used in modern electric, and hybrid electric vehicles are designed to operate in a narrow operating temperature range. BorgWarner's C1 Platform 800V High Voltage Coolant Heater (HVCH) provides heat rapidly to help the vehicle's battery reach its optimal temperature quickly and maintain that optimum temperature throughout the drive cycle.

In addition, the C1 Platform 800V HVCH can be used to add heat to the cabin of the vehicle. Reaching a high cabin temperature not only creates a better driving experience for the driver and passengers but, is also essential to vehicle safety by allowing for a quick and consistent defrosting of the vehicle windows.

The C1 Platform 800V HVCH uses the latest thick film element (TFE) technology, which delivers great flexibility in terms of dimension and size of the heating elements. Developed to meet demand for high-performance systems that quickly generate heat, these HVCH heating elements are immersed in coolant for efficient heat transfer.



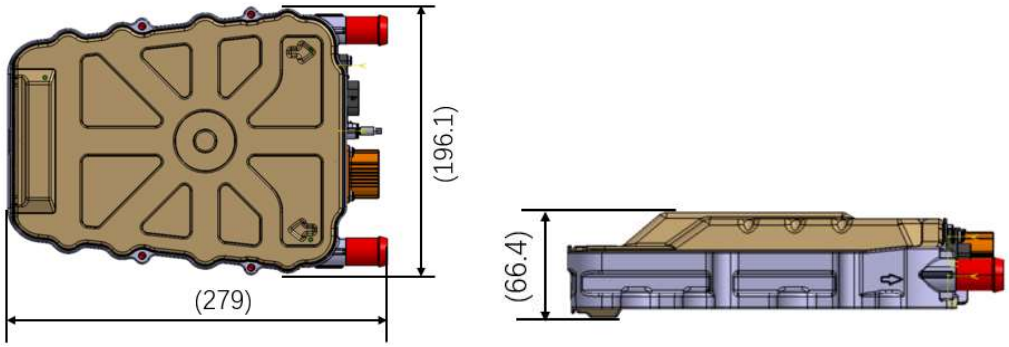
1.2 Basic Data

Item		Data
Weight (without coolant)		2.3 ± 0.1 Kg
Coolant	Glycol + Water	50% + 50%
Energy Consumption and Heating Performance	Heating performance (Thermal)	Max. 7.0 kW
	Energy consumption (Electrical)	Max. 7.4 kW
	Efficiency	⩾ 95% at Tcoolant=60 ℃ , 10L/min
Power Supply	HV range	240 ~ 855 VDC
	LV range	8 ~ 17.5 VDC
Temperature Requirement	T_operation_heating (coolant)	-40 ~ 90℃
	T_operation_standby (coolant)	-40 ~ 115℃
	T_operation (ambient)	-40 ~ 125℃
	T_storage (ambient)	-40 ~ 125℃
Coolant Pressure Requirement	Operating pressure	Max. 2.5±0.1 bar (G)
	Operating pressure peak	4 ±0.1 bar (G) (1hrs)
	Negative pressure	0.018 bar min (A)
Current Range	Rated Working Current (LV)	70±15 mA at 12V
	Max. working current (LV)	250mA at 8-17.5V
	Sleep mode current (LV)	< 0.1mA
	Working current range (HV)	0 ~ 18A (avg)
Controllability	Step	⩽60W (depends on customer spec)
	Target	Outlet temperature/ Power
	Accuracy	±2.5℃ at Tcoolant=20-75°C, 5-15L/min
Communication	LIN	LIN 2.1 / LIN2.2
Safety	Functional safety	Surface temperature safety goal (not exceed 250 ℃) through product solution.
	Passive discharge	< 60V in 60s acc. to ISO6469-3.3
	Insulation resistance	>100MΩ at 1000VDC
	Dielectric strength	3900 VDC
	IP protection class	IP6K9K, IP6K7
EMC	acc. to <CISPR 25> <ISO 11452> <ISO 7637> <ISO 10605>	
Life Time	15 years or 8000 h heating time acc. to MBN LV124	
Electrical Factors (For reference)	Equivalent X Capacitor	10uF ±20%
	Equivalent Y Capacitor	< 15nF

2 Product Boundary and Interface

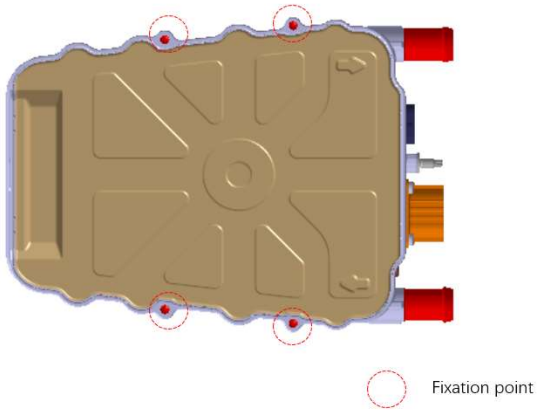
2.1 Outline

Outline：L×W×H =279 mm * 196.1 mm * 66.4 mm



2.2 Mounting Points

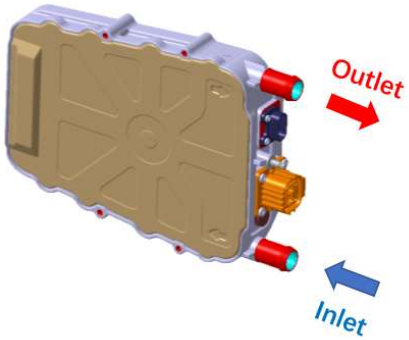
The HVCH is mounted to the vehicle using 4x 4.5±0.15mm diameter holes in aluminum housing. For detailed dimension please refer to 3D model and 2D drawing.

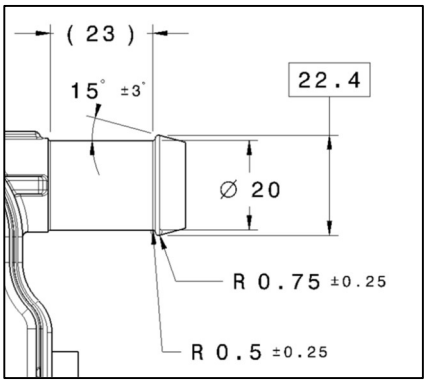


ST4.8×16 or M5 screw are recommended for mounting the HVCH to the bracket or vehicle component. The driving torque for the fasteners should be set to match the chosen mounting interface.

2.3 Inlet and Outlet

Same inlet and outlet spigots on the C1 Platform 800V HVCH share the same design. A detailed view is shown below. It is recommended to connect to the spigots usings a hose and clamp in accordance with QC/T 621 and DIN 3021.



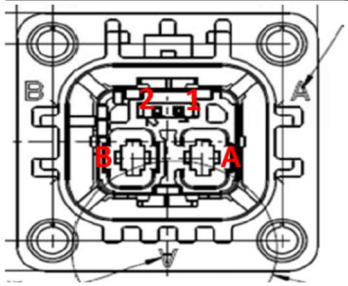


Proper connection of the inlet hose to the inlet spigot and the outlet hose to outlet spigot is critical. Failure to properly connect the hoses or to the connect the hoses in a reverse orientation could result in loss of function or permanent damage to the heater.

2.4 Electrical Interface

2.4.1 HV Connector

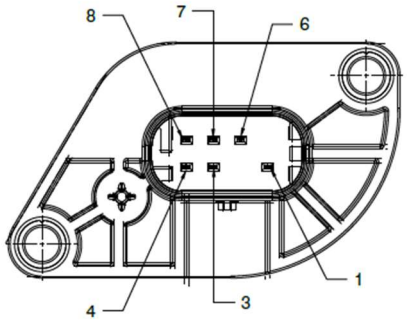
HV Connector	**Cable Connector**
Supplier: Jonhon	Supplier: Jonhon
Series: EVH2	Series: EVH2
Type: EVH2-N2ZJ-SA	Type: EVH2-N2TK-SDA



1	Interlock 1
2	Interlock 2
A	HV+
B	HV-

2.4.2 LV Connector

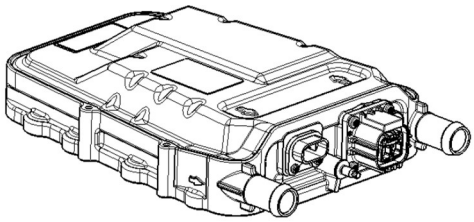
LV Connector	**Cable Connector**
Supplier : BorgWarner Made Type: E2700067981 Equal to Hirschmann 955-007-...00	Supplier: Hirschmann Type: 805 031 551

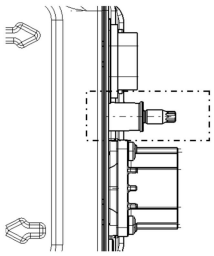


LV CONNECTOR	
PIN 1	12V+
PIN 2	NC
PIN 3	INTERLOCK 1
PIN 4	INTERLOCK 2
PIN 5	NC
PIN 6	NC
PIN 7	LIN
PIN 8	GND

2.4.3 Ground Bolt

A ground bolt is available to ground the HVCH housing. An M6 nut is recommended to fix the cable harness to the ground bolt. Recommended fasten torque: 7±1Nm





3 Requirement to Vehicle

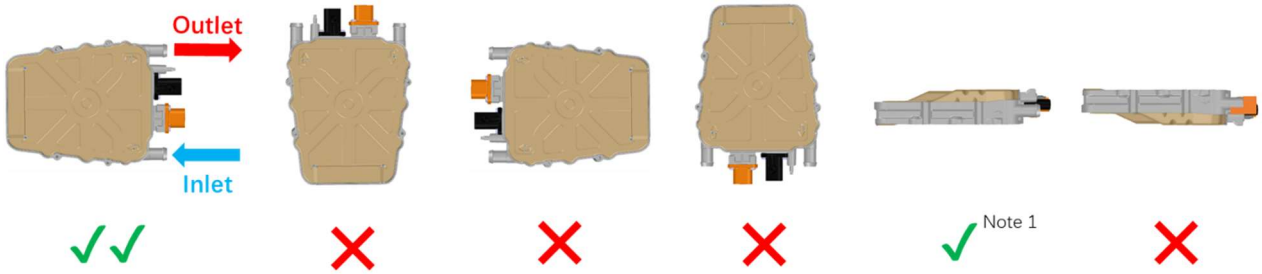
3.1 Mounting Requirement

1） The HVCH should be installed as indicated below to allow for any trapped air to easily exit the heater with the coolant. Overheating of the HVCH may occur if air is trapped inside the heater which may trigger software protection or may result in permanent damage to the heater.

2） HVCH should not be set in the highest position of vehicle coolant system.

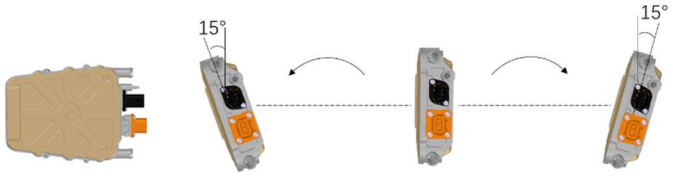
3） When HVCH is set at a local top point (e.g. ‘Ω’ structure) of coolant system where bubble is easy to be stuck, an exhaust port is needed at outlet position.

4） The product should be mounted as illustrated below.



Note 1: So far this orientation is not used in production vehicle. If this orientation is used, the OEM shall verify with BorgWarner if any extra validation is required.

Suggested mounting angle is as below:



5） Enough space should be reserved for service and diagnostics. Enough tool space should be reserved for handling clamps and nuts for the inlet and outlet spigots, and the ground bolt. At least 50mm should be reserved around the HV and LV connectors to allow for connecting and disconnecting the cables.

6） When initially filling or changing coolant or parts of coolant system, vacuum filling of coolant is required.

3.2 Power Supply Requirement

3.2.1 High Voltage Requirement

1) HV+ and HV- should not be reversed. Failure to comply with this requirement could result in damage to the heater or an unsafe condition for the vehicle and the operator.

2) A dedicated fuse is recommended in HV circuit to protect HVCH and related parts.

3) Under some conditions, the HVCH has a risk of loss of isolation. The vehicle system shall ensure a reliable isolation monitoring system and isolation failure handling mechanism.

3.2.2 Vehicle Low Voltage Supplier Requirement

1) In order to successfully store diagnostic information, the HVCH requires the process below to be followed when shutting down:

   a) Trigger heater to start sleep process.
   b) Wait for 4s to allow the HVCH to store diagnostic information.
   c) The HVCH will transition into sleep mode and power may now be disconnected.

3.3 System Control Strategy Requirement

3.3.1 Error Signal Debouncing

It is recommended to have an error signal debouncing strategy of LIN master controller. The master controller is suggested to record the error and report after continuously receiving LIN error signal for 2s or more.

3.4 Coolant System Requirement

1) The LIN master shall send the real flow rate to the HVCH. This is required to ensure that the HVCH can provide a proper power under different flow rate.

2) The vehicle coolant pump should start at least 5 seconds before heat is requested from the HVCH in order to ensure that the coolant flow is stable.

3) Coolant flow of at least 1L/min shall be ensured when heating is requested from the HVCH

4) A stable flow of coolant is required from the vehicle coolant pump whenever heat is requested from the HVCH.

5) An after run strategy should be implemented for the vehicle pump after the HVCH is no longer requested to provide heat. After heat is no longer requested from the HVCH, the coolant system pump should continue running for a period of time (min. 5 seconds) to help remove residual heat on the heating element.

6) If the coolant system has some issue/error (pump, coolant flow, etc.) and coolant flow can no longer be supplied to the heater, then heating request to the HVCH should be stopped immediately.

7) Organic coolant is recommended. Inorganic coolant containing silicate, phosphate or nitrite should be avoided.