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Author: Josh Bowman

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Title: Electric Vehicle Cabin Heat Operation

Applies To: Electric Vehicles

CHANGE LOG

Please refer to the change log text box below for recent changes to this article:

11/10/2021 - Initial Article Release

DESCRIPTION

This document will inform the user how the cabin heat system functions on an electric vehicle.

The cabin heat system interfaces to low voltage and control modules as shown in the boundary diagrams at the end of this document. Low voltage system supplies low voltage battery power to the coolant pump, stepwell heater, driver heater, fuel fired heater (FFH), HVDM, coolant control valve and smart control module so that components are operational. Vehicle Control Unit (VCU) controls and communicates with a number of components but the main functions for this system is to communicate and control the pump to regulate coolant flow, control the coolant valve to regulate heating through convection heaters, control of the stepwell and driver heater, monitor the coolant temperature using the two temperature sensors, control the heating through the electric heater and/or fuel fired heater, and monitor the coolant level status by reading the coolant level sensor.

Driver's Cabin

The driver cabin has several switches to control components within the cabin heat system. The smart control module is placed in the drivers cabins and it is used to regulate the fuel fired heater (if equipped). In addition there are three more swtiches, one to turn on the electric heater, one to turn on the booster pump and another to apply power to the convestion heater control valve (so the rotary knob will change flow).

Figure 1: Cabin Heat Switches

Item 1: Power to coolant control valve to the convection heaters
Item 2: Turns on electric heater
Item 3: Coolant Pump
Item 4: Flow control to the convection heaters

NOTE:

Please note, the switches are inconsistently being placed on the switch panel, so Switch 1 and Switch 2 could be swapped to what they operate. This can be verified by removing the switch and reading the labeling on the wiring.

Vehicle Heating Capacity Requirements

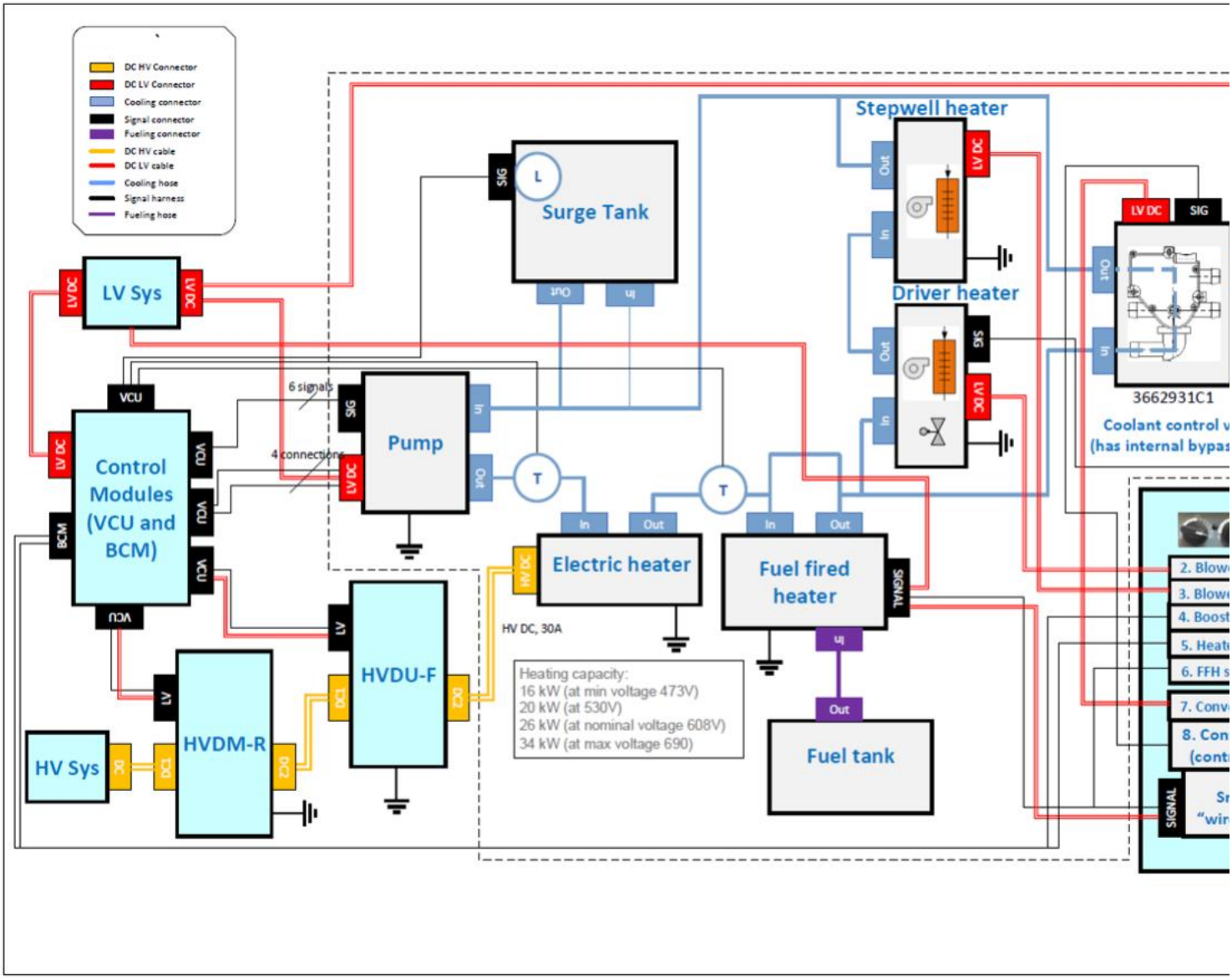
CE Bus, 276" WB, body length 34'11", 20 passengers
The assumed thermal comfort conditions is 20C/68F

NOTE:
The VCU does have an ambient temperature threshold which is less than 21C or 70F. This means the cabin heat will not operate unless the temperature meets the requirments.

Below is a relative system performance table showing ambient temperature vs heating capacity and power draw.

Ambient Temperature	Heating Capacity (Steady State Average)	Assumed System Efficiency (Steady)	Power Draw (average)
F/C	kW	-	kW
-10 / -23.3	39.8	0.7	56.85714286
0 / -18	34.6	0.7	49.42857143
10 / -12.2	28.9	0.7	41.28571429
20 / -6.7	23.6	0.7	33.71428571
30 / -1.1	18.1	0.7	25.85714286
40 / 4.4	12.7	0.7	18.14285714
50 / 10	7.3	0.7	10.42857143
60 / 15.6	1.8	0.7	2.571428571

Please Note, the below boundary diagrams are for reference only and are subject to change


DC HV Connector
DC LV Connector
Cooling connector
Signal connector
Fueling connector
DC HV cable
DC LV cable
Cooling hose
Signal harness
Fueling hose
LV Sys
Surge Tank
Stepwell heater
Driver heater
3662931C1
Coolant control v
(has internal bypas
Control Modules (VCU and BCM)
6 signals
4 connections
Pump
Electric heater
Fuel fired heater
HV DC, 30A
Heating capacity:
16 kW (at min voltage 473V)
20 kW (at 530V)
26 kW (at nominal voltage 608V)
34 kW (at max voltage 690)
Fuel tank
HVDU-F
HVDM-R
HV Sys
2. Blow
3. Blow
4. Boost
5. Heat
6. FFH s
7. Conv
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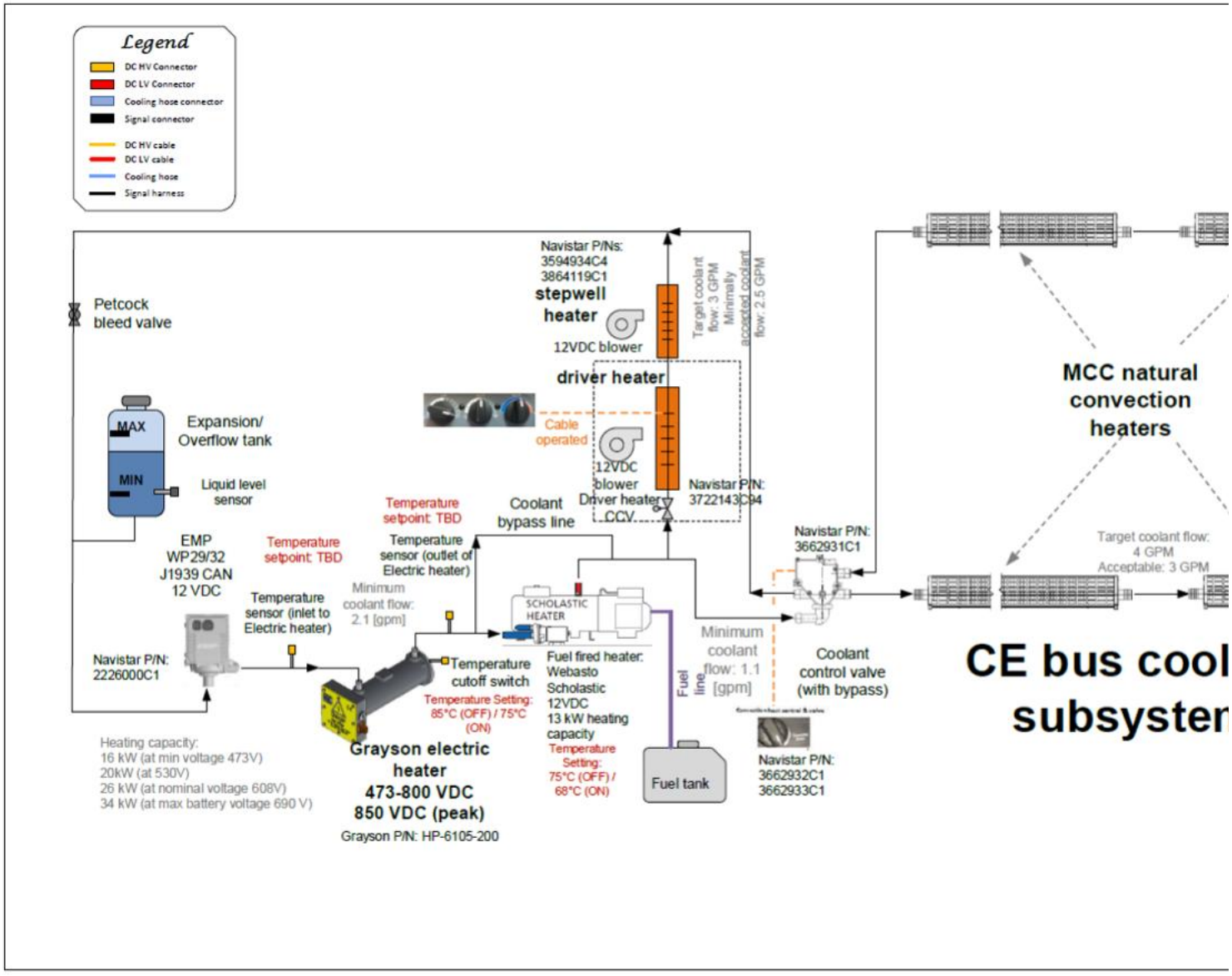

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