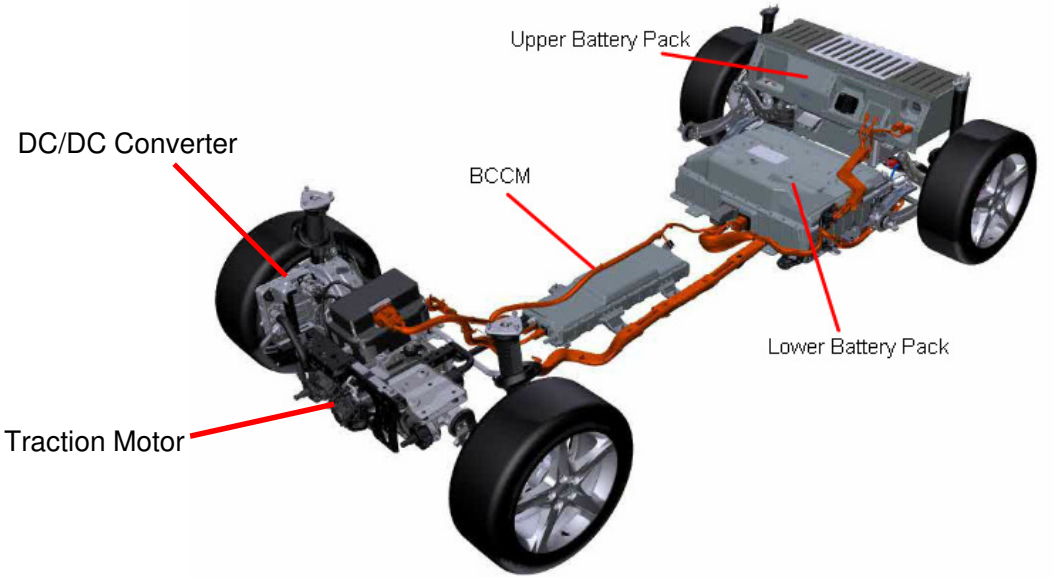
Lesson 3 Cooling System

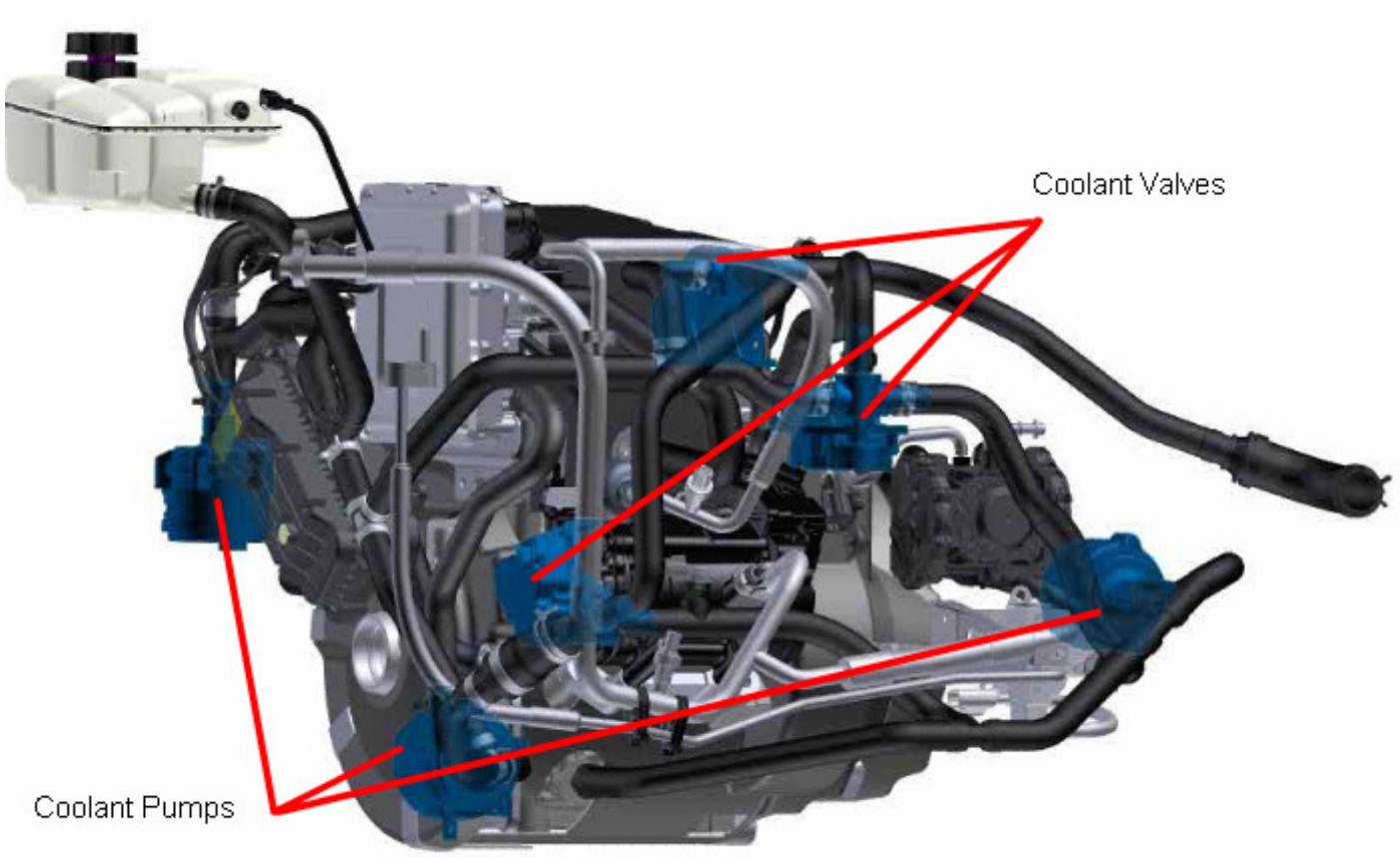
Cooling and Heating Systems

Cooling System



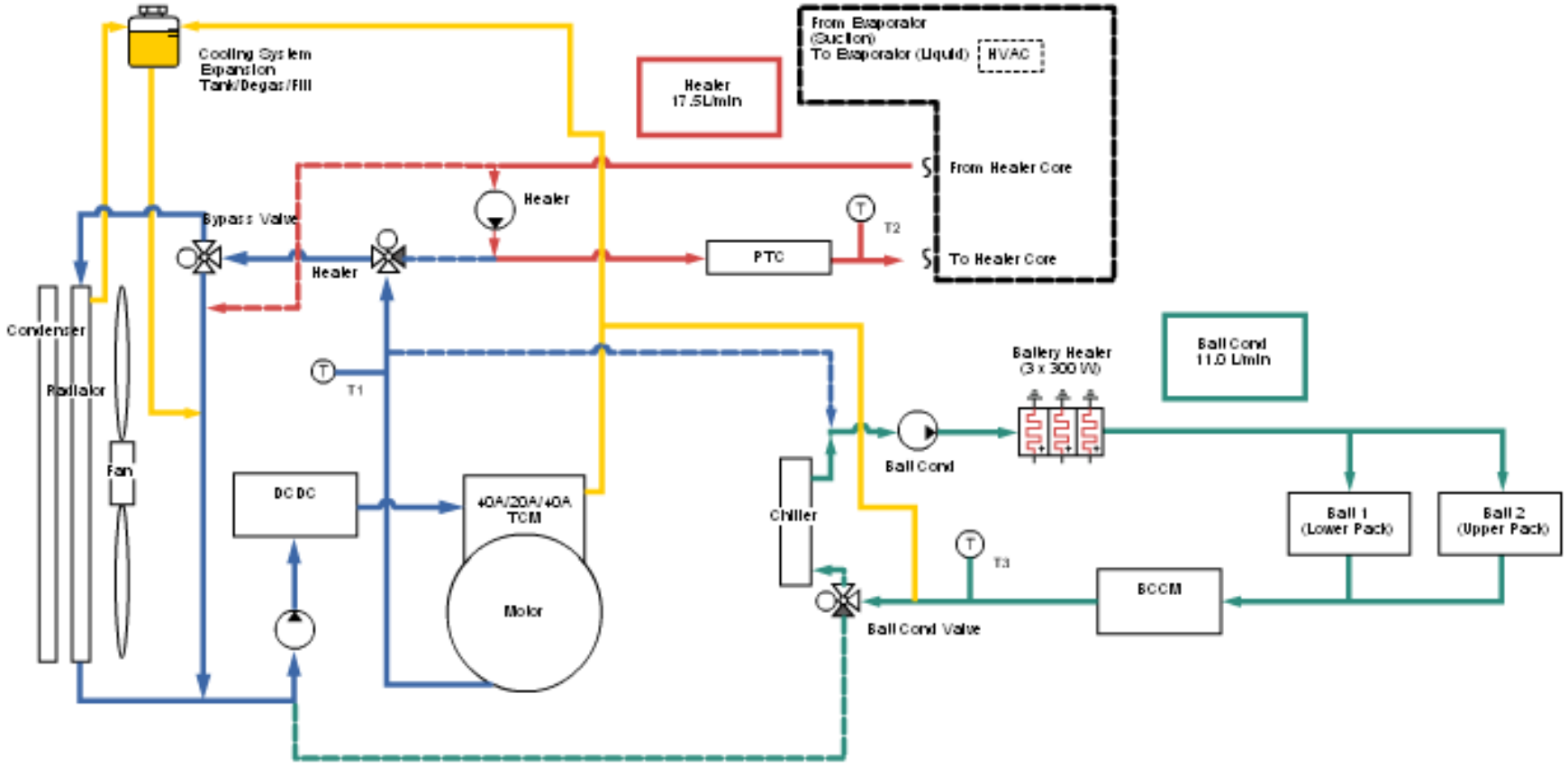
- The Focus Electric cooling system performs several functions. It cools the high voltage electronics including:
  - The DC to DC converter,
  - TCM/traction motor
  - HVBP
  - BCCM.
- The cooling system also provides heat in the passenger compartment .

Cooling System



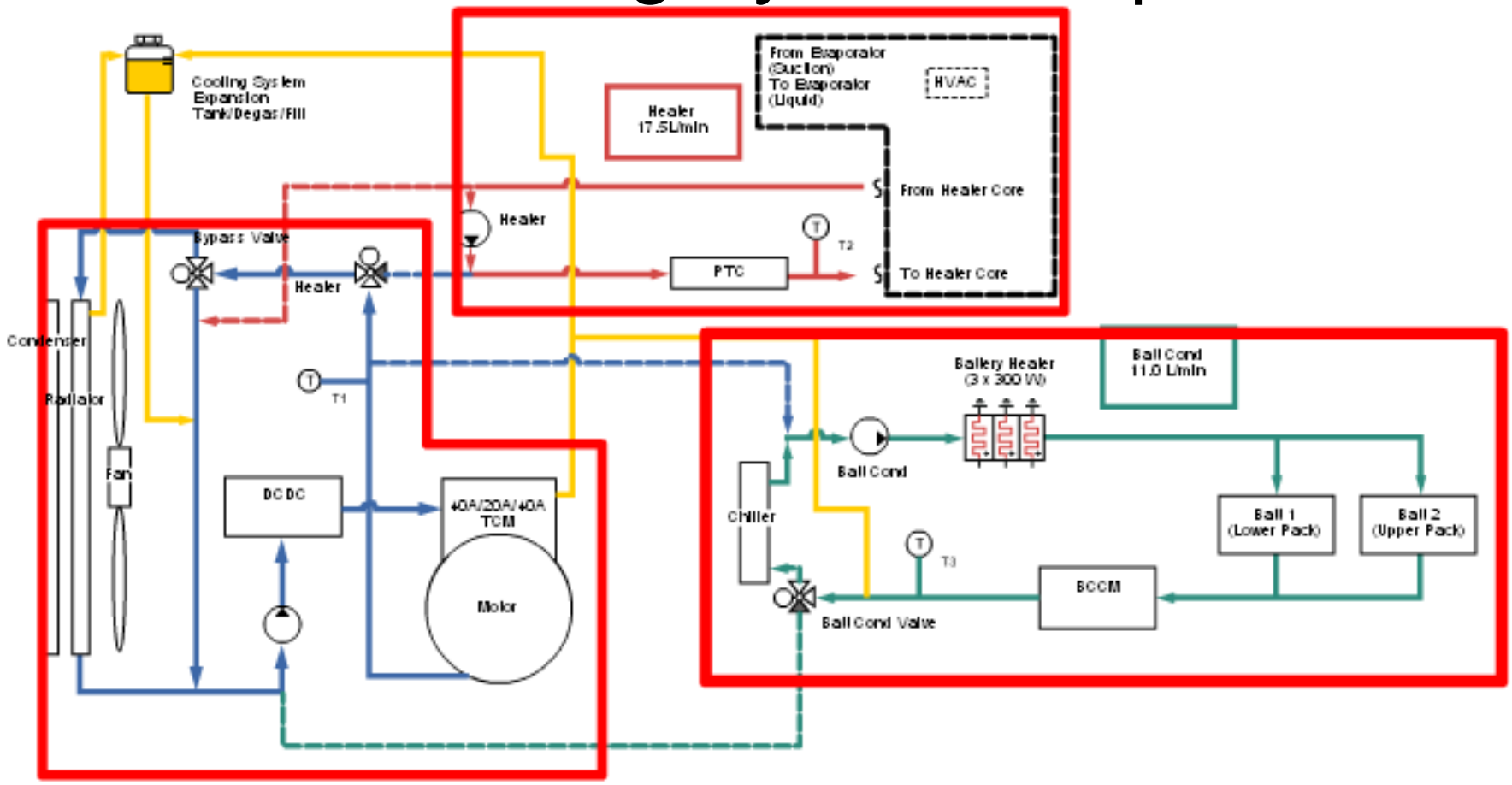
- The cooling system consists of three individual coolant loops, each of which has its own control valve and pump.

Cooling System Schematic



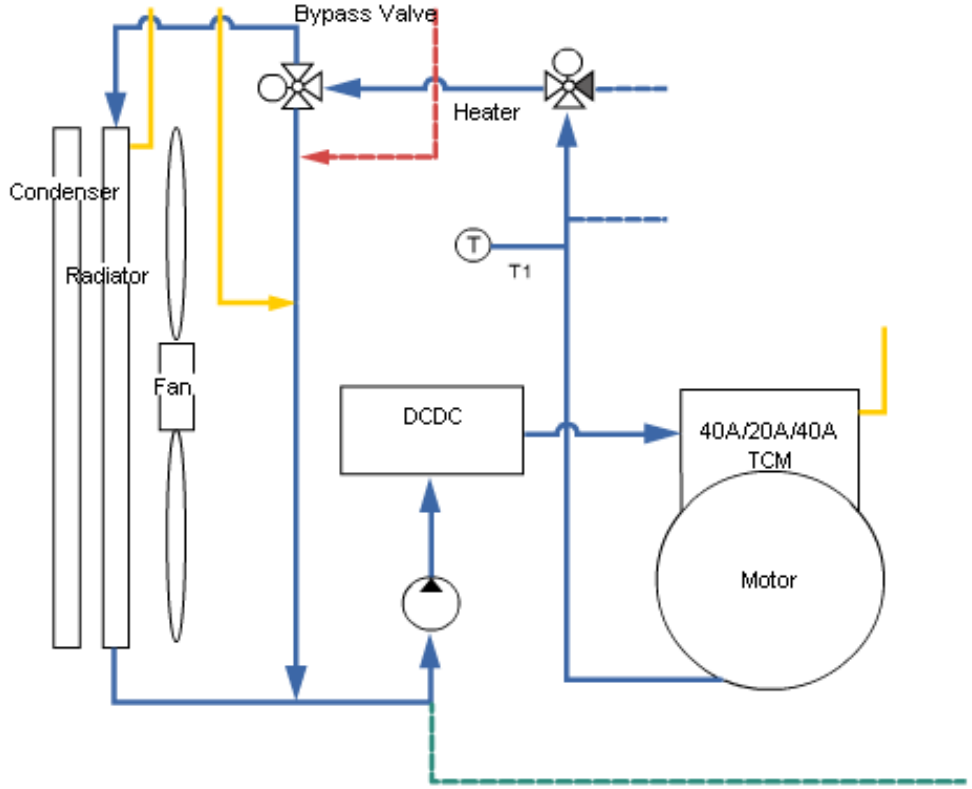
- The cooling system consists of three individual coolant loops, each of which has its own control valve and pump.
- Each coolant loop has its own temperature sensor

Cooling System Loops



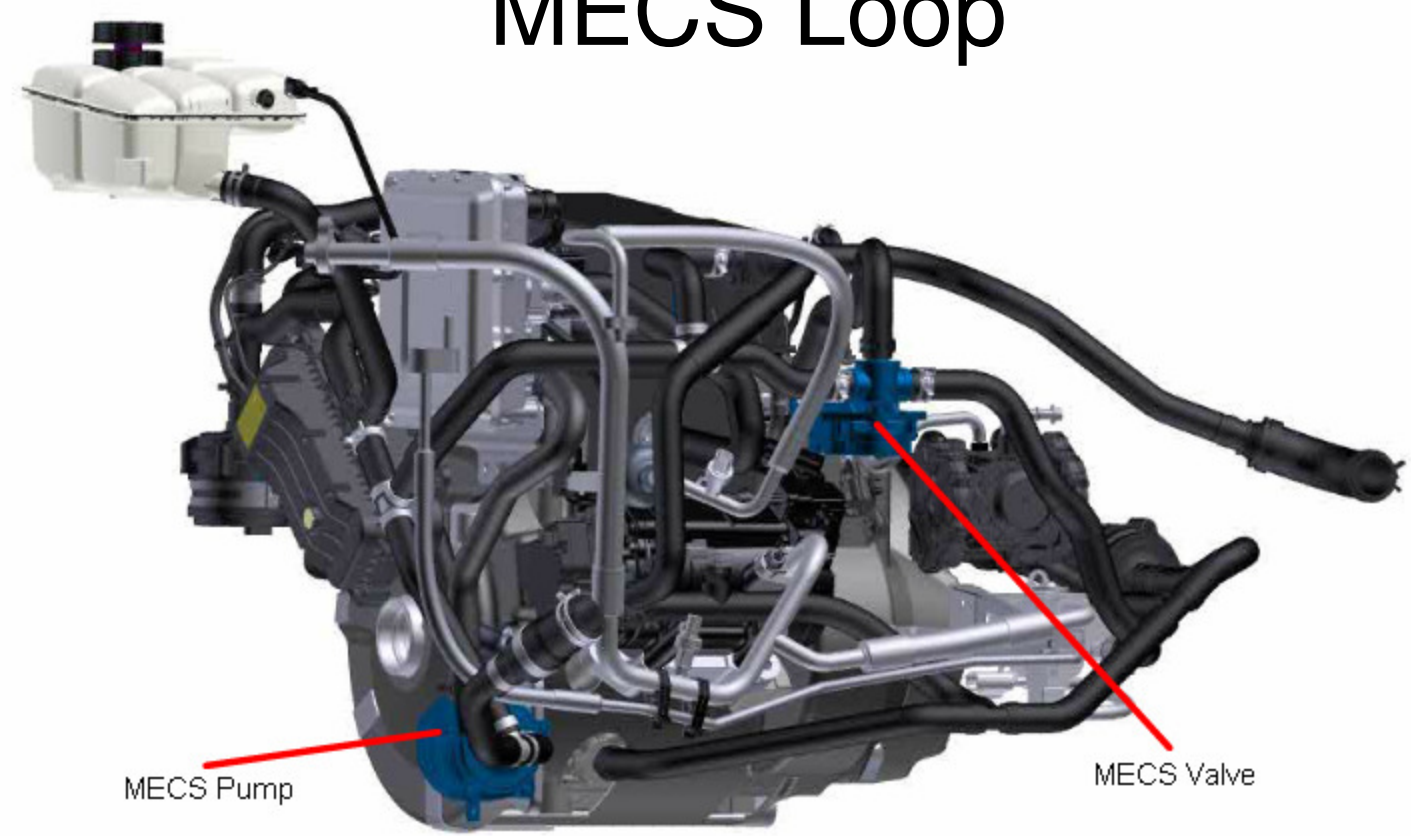
- Cooling loops may operate independently or be combined based upon valve position and pump operation.

MECS Loop



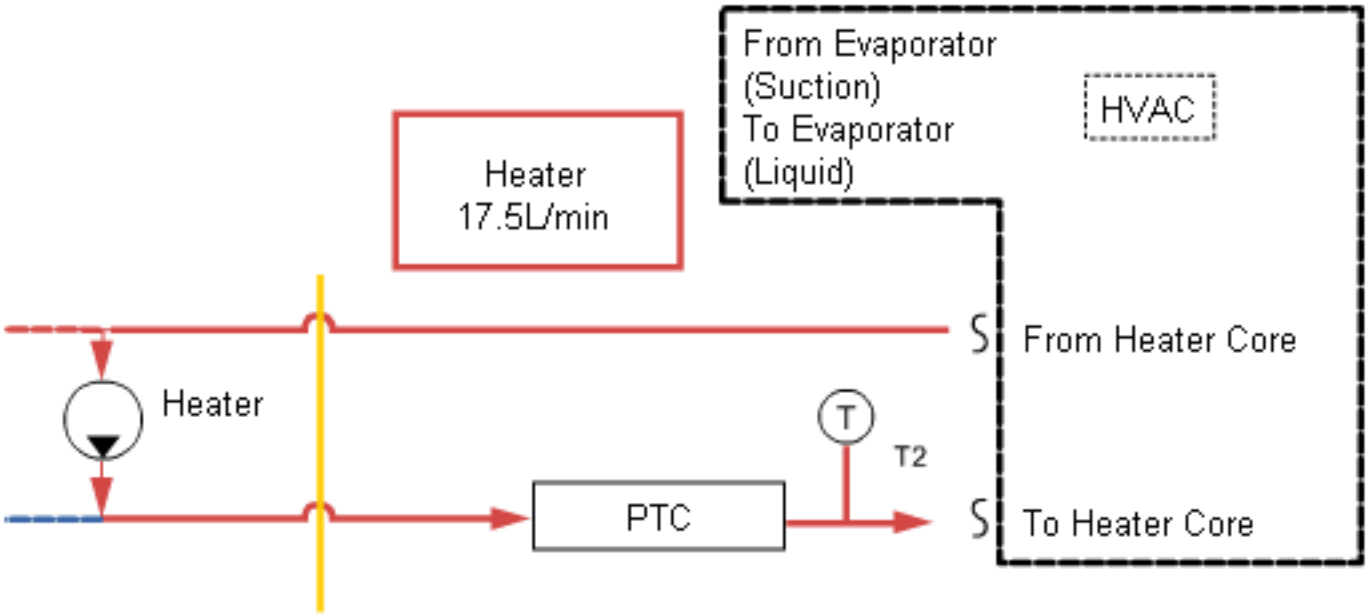
- The Motor Electronic Cooling System loop, or MECS, cools the TCM/traction motor and the DC/DC converter.
- 167F upper limit

MECS Loop



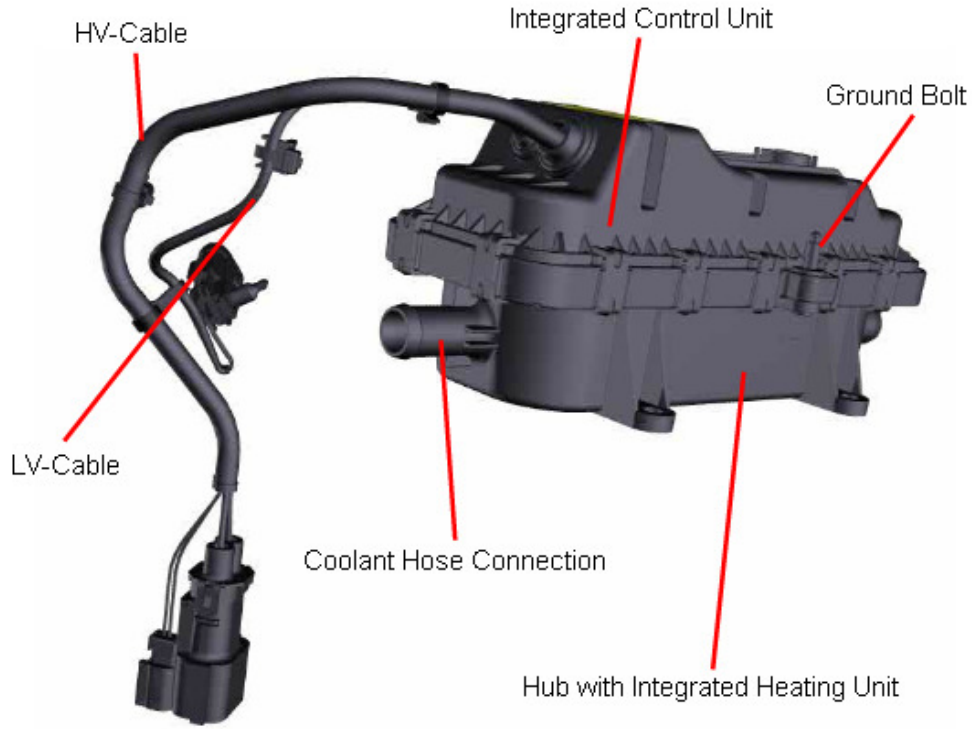
- The MECS pump is mounted low in the system below the DC to DC converter, toward the passenger side of the vehicle.
- The MECS valve takes the place of the thermostat on the base vehicle and is located in the center of the engine compartment just behind the radiator.

PTC Heater Loop



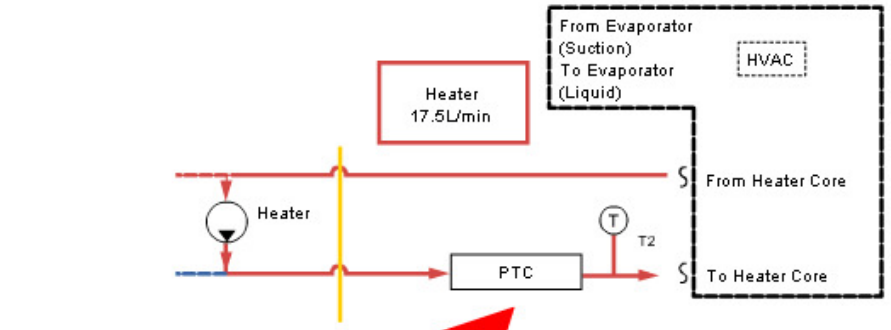
- This coolant loop moves through the Positive Temperature Coefficient, or PTC, heater, then to the heater core in the passenger compartment.
- As you learned earlier, the PTC heater is electrically fused in the high voltage power distribution box.

PTC Heater Loop



- The high voltage PTC heater heats the coolant as needed to provide heat and defrost in the passenger compartment.

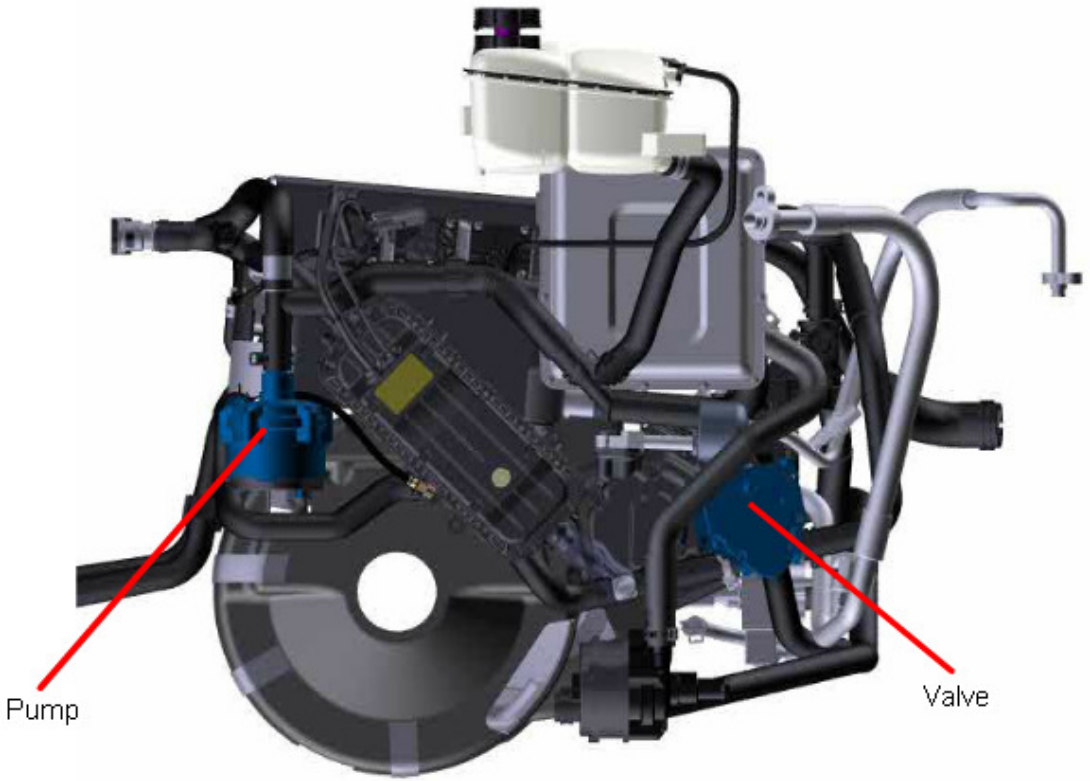
PTC Heater Loop



179F upper limit

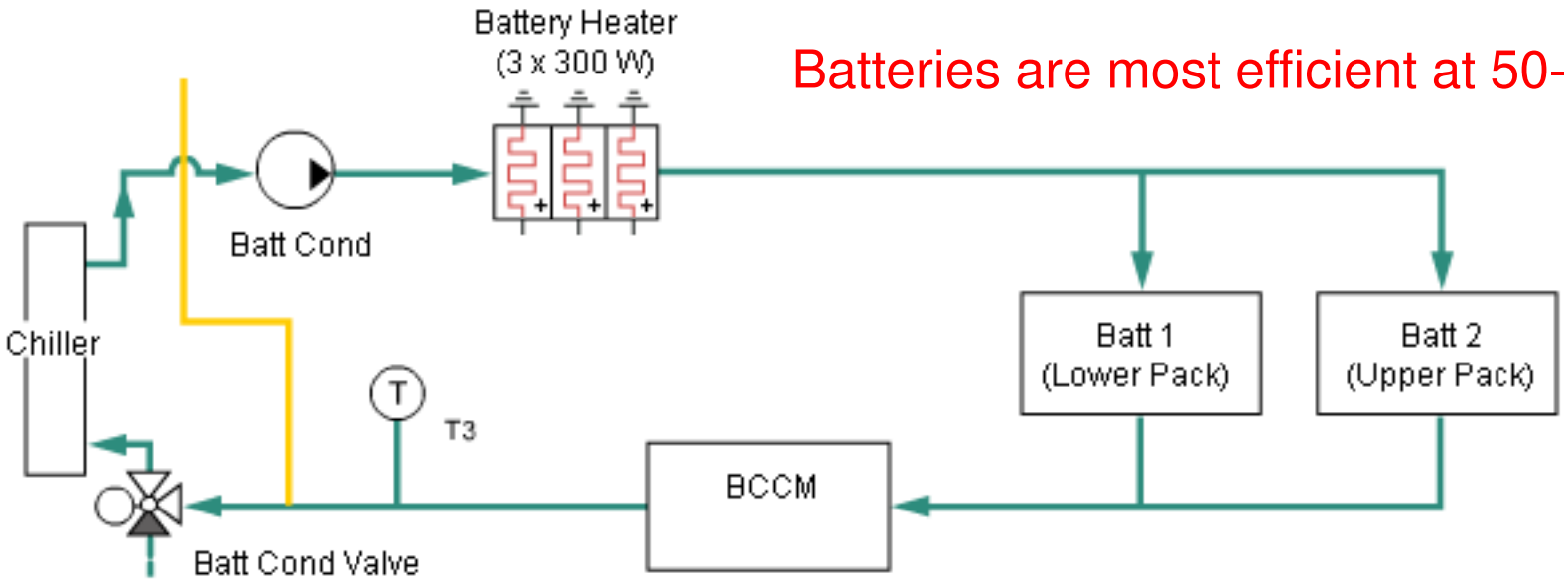
- During operation coolant is pumped through the PTC heater to raise coolant temperatures as necessary.
- Coolant then moves to the heater core where its heat is dispersed by the fan in the plenum.
- It then continues the loop back to the PTC heater.

PTC Heater Loop



- Coolant flow is initiated by a pump located next to the heater.
- Coolant flow is directed by a corresponding valve is located on the passenger side below the DC to DC converter.

HVBP and BCCM Loop



- The high voltage battery packs and battery charger control module temperatures are controlled using their own cooling loop.
- This loop uses a chiller to remove heat from the coolant to prevent the HVBP temperatures from exceeding battery

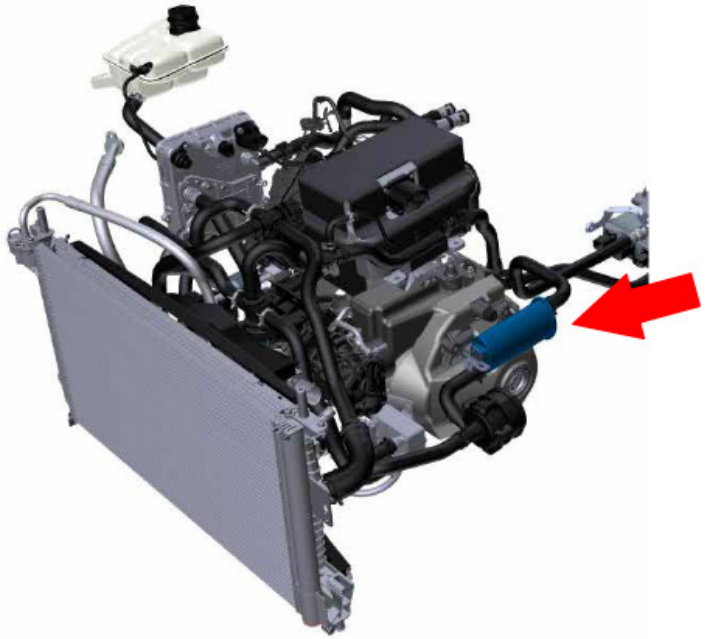
HVBP and BCCM Loop

Chiller

A/C Compressor

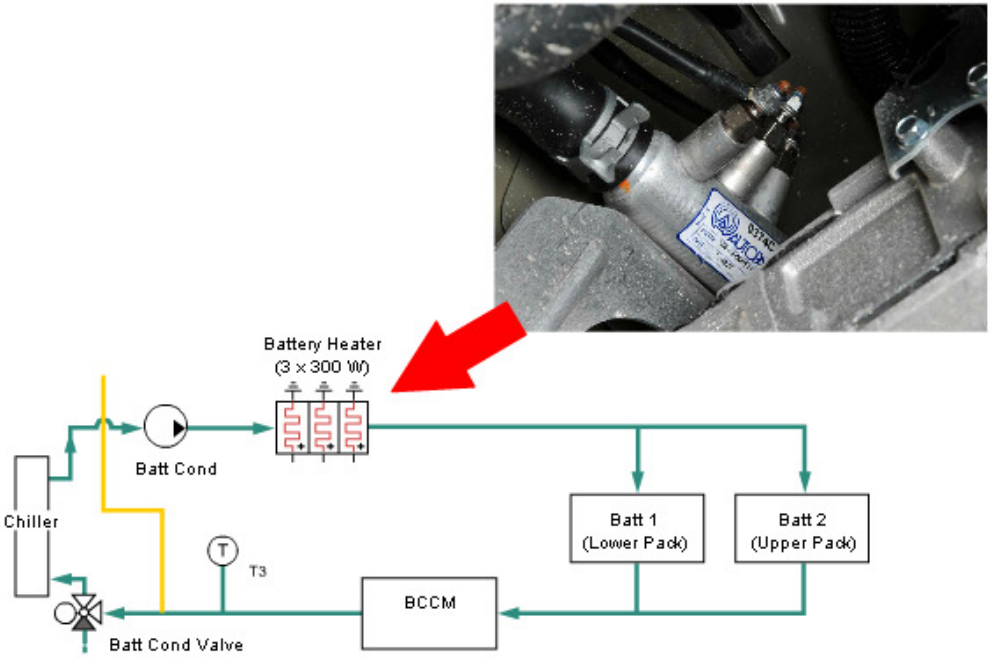
- The chiller is connected to the vehicle's air conditioning system by AC hoses and has its own thermostatic expansion valve and evaporator.
- The A/C compressor is commanded on whenever the chiller is required to cool the coolant to control HVBP temperatures.
- This may occur during vehicle operation or when the vehicle is charging.

HVBP and BCCM Loop



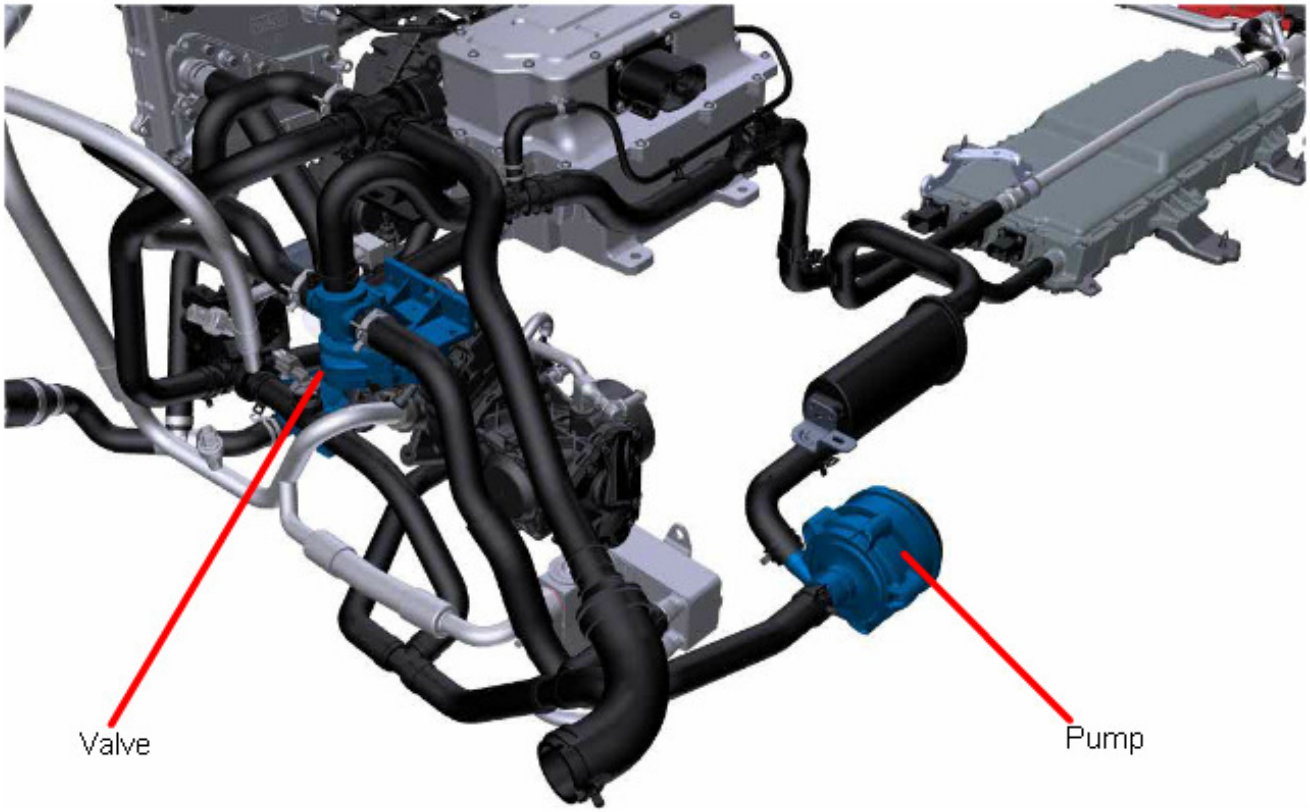
- This coolant loop has a unique coolant filter mounted in-line within the coolant hose below the driver side powertrain mount.
- Replace coolant (flush) and filter at 150,000 miles, or if batteries and/or radiator are replaced

HVBP and BCCM Loop



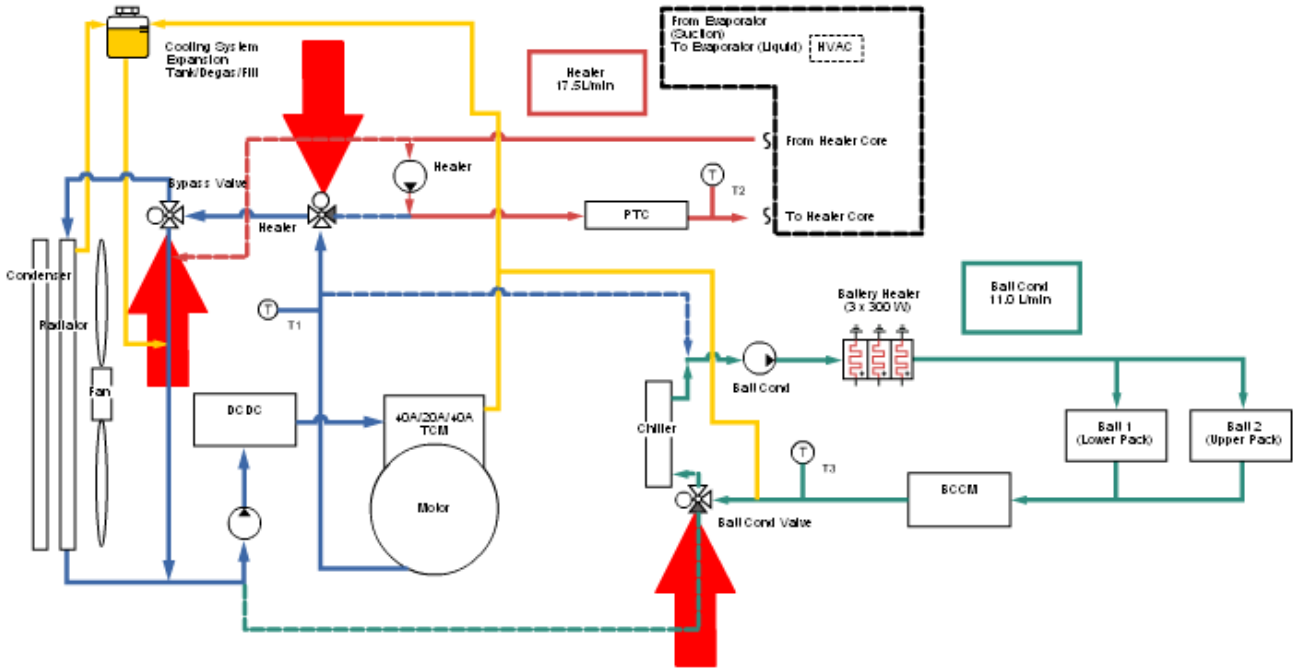
- This loop of the cooling system also has heaters to maintain optimum battery temperatures during charging.
- This heater uses 3, 12-volt heating elements that are similar to glow plugs found on diesel engines.
- During heater operation the heated coolant is pumped in parallel to both the upper and lower battery packs as needed.

HVBP and BCCM Loop



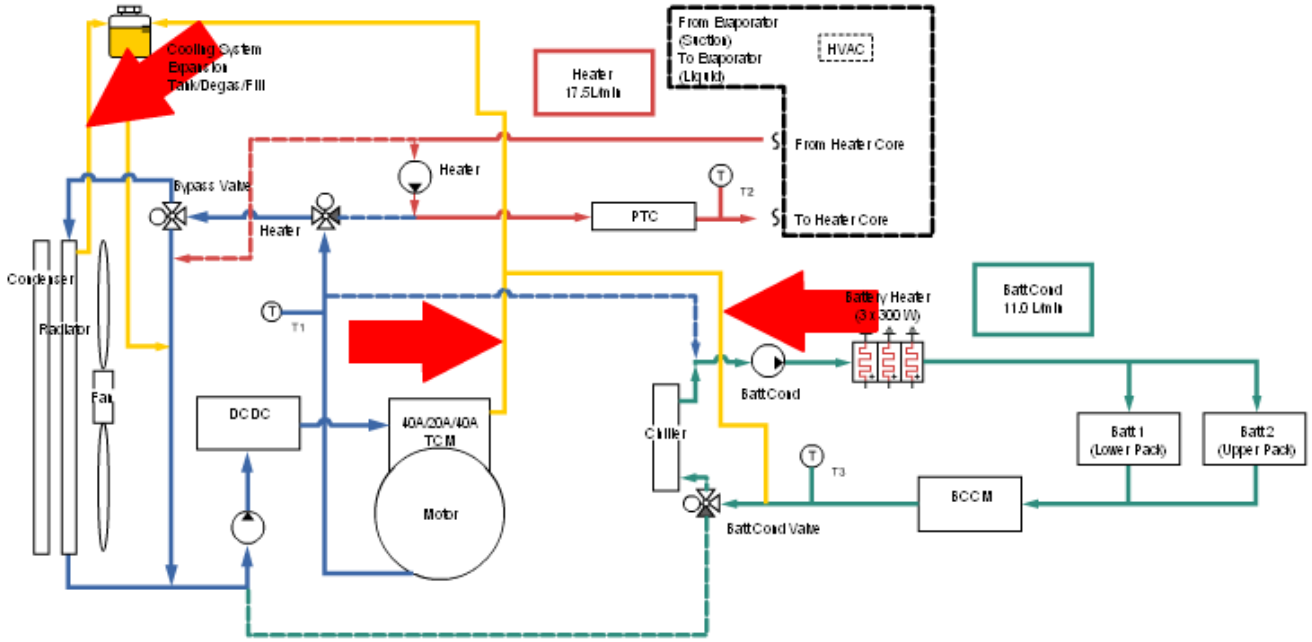
- The pump for this loop is located on the left side of the engine compartment below the powertrain mount.
- Its corresponding valve is located behind the radiator below the MECS valve.

Cooling Loop Interaction



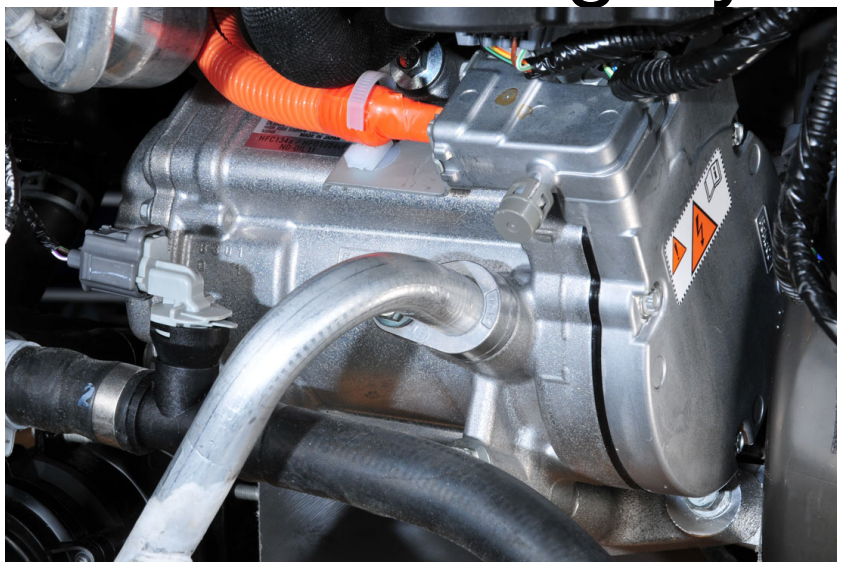
- The three cooling system loops may be combined or isolated as commanded by the PCM, to ensure optimum vehicle operation.
- Coolant is directed as commanded by the PCM by changing the positions of the three coolant valves electronically.

Degas System



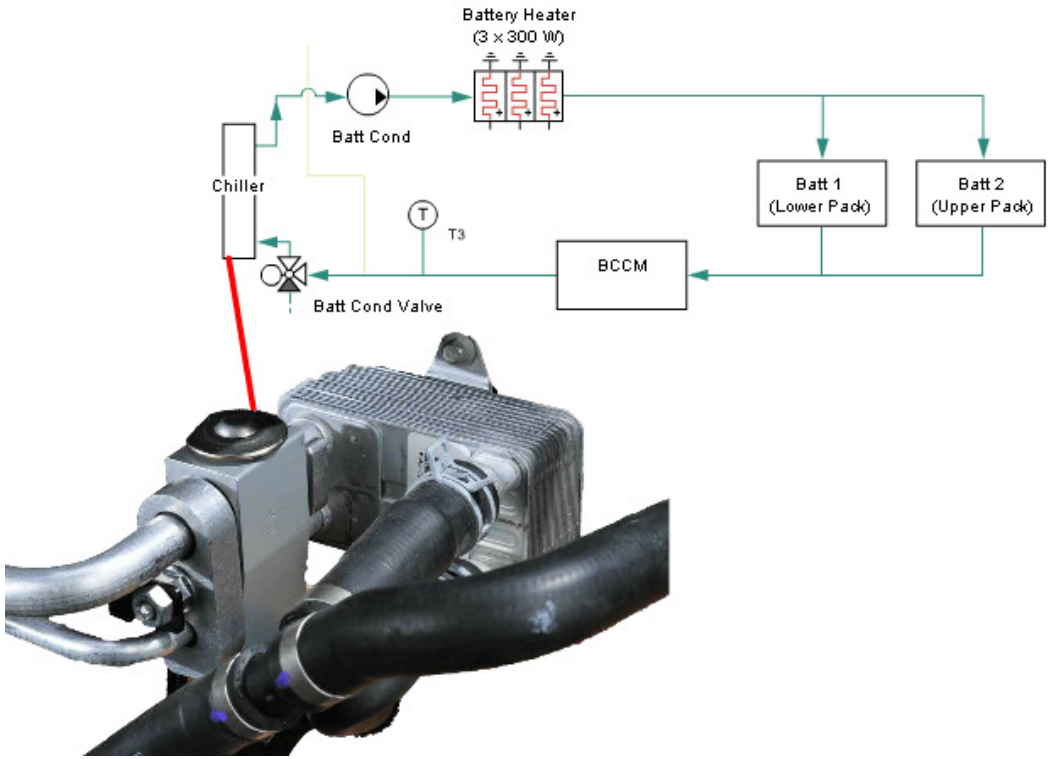
- The Focus Electric degas bottle is carryover from the base Focus and uses both degas ports.
- One degas port goes to the radiator and the other degas port goes to the powertrain and HVBP.
- However, the coolant level for all three loops is maintained from the single degas bottle.

Air Conditioning System



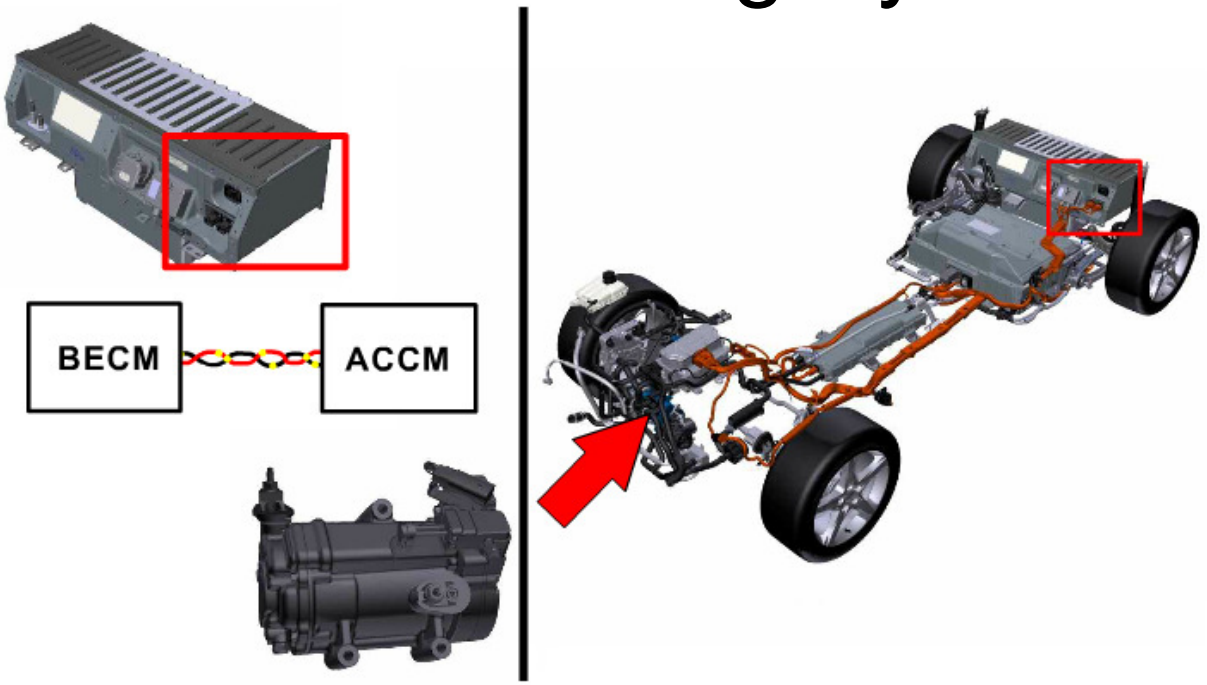
- The Focus Electric air conditioning system operates conventionally.
- However, it is used not only for passenger comfort but also to maintain optimum HVBP temperature.
- The A/C compressor uses a high voltage motor to drive the compressor.
- Integrated into the compressor is the Air Conditioning Control Module, or ACCM.

Air Conditioning System



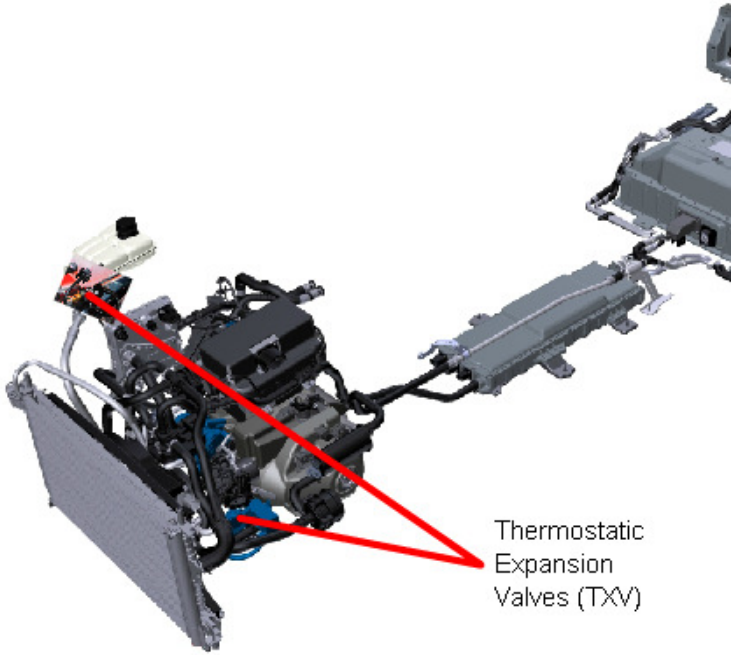
- As you learned earlier, the A/C system also has a chiller.
- This is an auxiliary evaporator with it's own Thermostatic Expansion Valve, or TXV.
- Mounted at the front of the traction motor, the chiller cools the coolant to reduce high voltage battery pack temperatures.

Air Conditioning System



- During normal operation the A/C compressor can be commanded on by the driver to cool the passenger compartment.
- However, the A/C system can also be activated by BECM signals to the ACCM.
- BECM activation will occur to cool the coolant going into the HVBP in order to maintain optimum battery temperatures.

TXV's



- There are two TXVs that can be turned on or off based upon cooling requirements of the driver and/or to cool the HVBP.
- The Heating, Ventilation and Air Conditioning, or HVAC TXV is located beneath the degas bottle in the engine compartment and is part of the cabin air conditioning line.
- And, as you learned earlier, the other TXV is part of the chiller.

Questions??