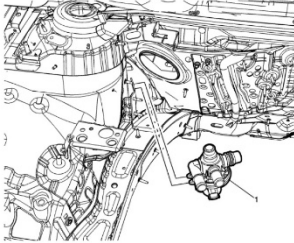



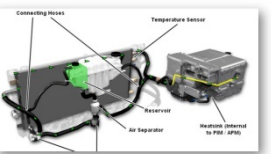
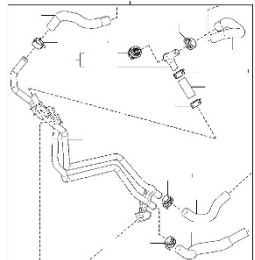
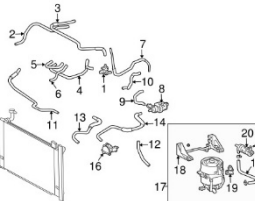






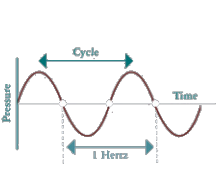

Vehicle Electrification System Standards

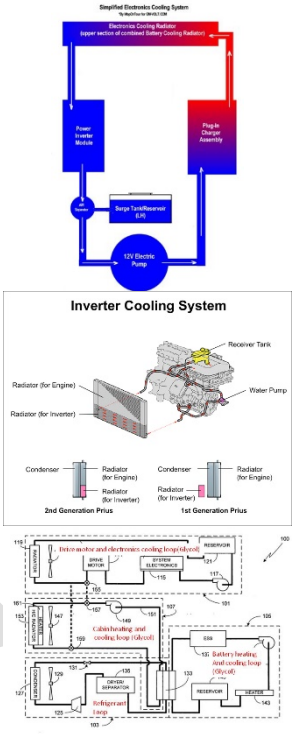

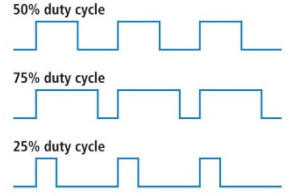

XI. High Voltage Power Electronics Cooling Systems

XI.a Acronyms and Definitions

| Name | Acronym | Definition | |
|--------------------------------------|---------|---|---|
| 2/3/4 Way Valve | | <p>Drive Motor Battery Coolant Flow Control Valve Replacement</p>  |  |
| 50/50 Glycol-Deionized Water Mixture | | <p>The cooling system is designed to transfer heat from a component to the coolant, so it can be delivered to the radiator and the heat can be removed by way of air movement passed the radiator core tubes. Coolant will operate most efficiently to absorb heat when blended with the proper amount of (deionized) water. A mixture percentage based on the lowest temperatures typically seen in your climate. Most regions are best suited to a 50/50 water-antifreeze mixture which will provide protection from a low of -34°F to a high of 265°F. In addition, maintaining proper freeze point protection ensures corrosion inhibitors remain at intended levels.</p> |  |

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| Air Separator | | The air separator is designed to purge air from the power electronics cooling system. The component separates air from the coolant returning from the heat exchanger, and passes the air to the reservoir, avoiding air going to the pump inlet by slowing the coolant flow down, without adding a pressure drop in the system. |   |
| Connecting Hoses | | Hoses, of various sizes, that connect the heat exchanger, pumps, and control system in a series or series-parallel flow pattern permit liquid coolant to flow between the components in the cooling system circuit. |   |
| Coolant Pump (Electric) | | Electric coolant pump for automotive products is a pump that driven by a 12v, 24v or 48v and is typically a series or permanent magnet brush dc motor. However, more recent designs are placing 3-Phase brushless 12V pump motors into the cooling circuits. The pump is powered by dc source (battery). It pressurizes the coolant to and has a high flow rate ensure the coolant circulates properly to components in the cooling system |  |
| Coolant Reservoir | | The coolant reservoir is a container that holds the excess or overflowing coolant which is used in the system. The coolant reservoir is usually pressurized, is attached to the radiator and the engine with hoses, and is a central component in the system |  |
| Coolant Temperature Sensor | CTS | A device that senses the temperature of a liquid by using a corresponding change in resistance with a change in temperature. Typically, a CTS uses a negative temperature coefficient design to decrease resistance as the temperature of the liquid increases. |  |

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| Cooling Fan (Radiator) | | An electrical radiator cooling fan is device that assists in regulating engine temperature by pulling or pushing air through a radiator. Electrical cooling fans traditionally use DC motors that utilizes energy from the vehicle electrical system |  <p><small>Only one part of sub-assembly is diagram included. See Item Specifics for Reference # Diagrams may not be specific to your vehicle. See Compatibility for vehicle-specific diagrams.</small></p> |
| Deionized Coolant | DI Coolant | Deionized water can also be referred to as DI Water and simply means all the ions have been removed. This is important for applications where the highest purity water needs to be used. Deionized water has many applications where it is favored due to its high purity. In industrial situations involving machining or high temperatures, deionized water helps by having low conductivity, and in turn, this helps lower the temperatures during manufacturing. Automotive applications such as coolant systems see the benefit of using deionized water by increasing the lifespan of the motor. The reason deionized water is preferred is due to its resistance to electricity from it not having charged ions to carry a charge. |  |
| Frequency (Hertz) | Hz | The SI unit of frequency, equal to one cycle per second. |  <p>1 Hertz = 1 Cycle Per Second Above and Below the Atmospheric Pressure Line</p> |
| HVAC Controller | | An electronic, dedicated microcontroller that controls the operation of the HVAC system. The HVAC controller is typically located in the HVAC control head electronic assembly. For the Power Electronics Cooling Loop, the HVAC Controller or the PCM could control the speed of the electric coolant pump position of coolant control valve. |  |

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| <p>Power Electronics Cooling Loop</p> | | <p>A cooling loop is the route that liquid or air travels throughout a connected system to cool components that are part of the loop.</p> |  <p>The diagrams illustrate two cooling systems. The top diagram, 'Simplified Domestic Cooling System', shows a loop with a '12V Electric Pump', 'Super Capacitor (SC)', 'Power Inverter', and 'Electric Cooling Radiator'. The bottom diagram, 'Inverter Cooling System', shows a more complex setup with 'Receiver Tank', 'Water Pump', 'Radiator (for Engine)', 'Radiator (for Inverter)', and 'Condenser' components, comparing '2nd Generation Plus' and '1st Generation Plus' designs.</p> |
| <p>Powertrain Control Module</p> | <p>PCM</p> | <p>A power-train control module, abbreviated PCM, is an automotive component, a control unit, utilized in vehicle control systems. Its operation is to control engine functions but, can also control transmission functions. For the Power Electronics Cooling Loop, the HVAC Controller or the PCM could control the speed of the electric coolant pump position of coolant control valve.</p> |  <p>A photograph of a rectangular Powertrain Control Module (PCM) with several electrical connectors on top and a label that reads '400AAA'.</p> |
| <p>Pulse Width Modulation</p> | <p>PWM</p> | <p>Pulse-width modulation (PWM) is a modulation process or technique used in most control systems for encoding the amplitude of a signal right into a pulse width or duration of another signal, usually a carrier signal, for transmission. The purpose of PWM is to control the power that is supplied to various types of electrical devices, most especially to inertial loads such as AC/DC motors. PWM is also known as duty cycle</p> |  <p>Three square wave graphs illustrating different duty cycles: 50% duty cycle (high for half the period), 75% duty cycle (high for three-quarters of the period), and 25% duty cycle (high for one-quarter of the period).</p> |
| <p>Radiator (Heat Exchanger)</p> | | <p>A heat exchanger is a system used to transfer heat between two or more fluids. Heat exchangers are used in both cooling and heating processes. The fluids may be separated by a solid wall to prevent mixing or they may be in direct contact</p> |  <p>A photograph of a metal radiator with a grid of cooling fins and various ports on the top and bottom.</p> |

To comment or offer suggestions on this standard, contact Ken Mays:

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