

Coolant valve selection

A brief guide to the selection of coolant valve options for ICEs, HEVs and BEVs

With energy efficiency and heat scavenging requirements, previously separated thermal systems are now functionally integrated, resulting in architectures that use multiple valves to control the various modes of operation to redirect heat from one system to another. While ICE vehicles and HEVs primarily require heat to be removed efficiently – with some redirection to the cabin in winter – the competitive BEV market requires this precious heat to be scavenged from multiple sources.

SOLENOID VALVES: THE COST-EFFECTIVE CHOICE FOR ICE AND HEV

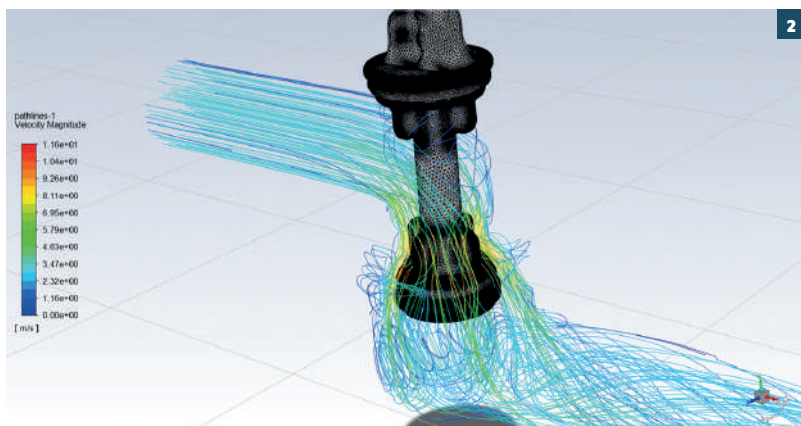
Solenoid valves are the simplest form of electric actuation. When the coil receives an electric current, the mobile core undergoes a translational movement and actuates a piston in the valve. This enables simple on/off actuation. There is no current consumption in the rest position (off), but maintaining the actuated (on) position requires constant current draw. Costs are kept low as there is no magnet or electronics involved.

The valve design also implies a notable pressure drop as the flow must negotiate the piston geometry. This pressure drop creates indirect energy consumption through the pump.

Solenoid valves are best used when the energy source in the vehicle is not a primary issue (typically ICE and HEV vehicles) or when part cost is paramount.

ROTARY VALVES: THE FLEXIBLE CHOICE FOR BEV

When energy consumption – direct and indirect – needs to be minimized, the rotary valve design excels. Pressure drop can be reduced to a minimum and the actuation requires electrical current



1: Bontaz is able to supply a range of solenoid, rotary and complex coolant valves

2: CFD simulation allows for the flow thorough valves to be optimized to reduce pressure drop and energy usage

only to change its position but not to maintain it. Furthermore, the proportional control enables precise temperature control through flow mixing or flow splitting.

While DC actuators can also be used, the BLDC motor type offers the best performance, with high durability and reduced noise. Three-way proportional and four-way positional rotary valves constitute the basic blocks of a modern BEV flow-control coolant system and are available as off-the-shelf solutions at Bontaz. Combining these valves can create any type of thermal system architecture.

COMPLEX VALVES: THE OPTIMUM CHOICE

Though a combination of basic rotary valves can achieve any desired system architecture, further optimization can be sought to reduce the overall costs, packaging and mass involved. In this case, the specific development of a complex rotary valve achieves the best results. A well-optimized complex valve can replace several discrete valves while maintaining the same functionality. Bontaz experts can work in collaboration with the customer to develop the optimum bespoke valve.

FURTHER OPTIMIZATION: PHYSICAL INTEGRATION

For further optimization beyond system integration, the physical integration of components and especially coolant valves into manifolds and thermal modules is another important technological trend. ©

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