

NOVEL EXPANSION AND CONTROL VALVES DESIGN FOR TWO-BED ADSORPTION COOLING SYSTEM

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Abstract

In this study, two novel ideas for the expansion valve and control valves of an adsorption cooling system (ACS) for vehicle air conditioning applications are suggested to reduce the weight and parasitic power consumption of the system. A check valve with cracking pressure of 3.5-7 kPa is proposed for the expansion valve and a combination of low-cracking pressure check valves and solenoid valves with an innovative arrangement is proposed for the control valves to heat up and cool down the adsorber beds. The proposed innovative designs can reduce the total mass of the ACS up to 10.5 kg (12%) and the parasitic power consumption of the control valves by 50%. The operating range of these new designs is investigated on a two-adsorber bed silica gel/CaCl₂-water ACS. The results show that the expansion valve and control valves operate effectively under heating and cooling fluid inlet temperatures of 70-100°C and 30-40°C, respectively, and coolant and chilled water inlet temperatures of 30-40°C and 15-20°C, respectively.