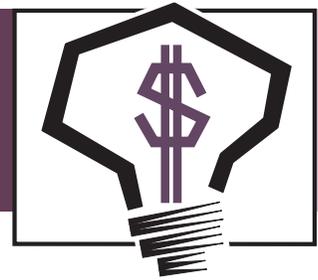


INVENTIONS & INNOVATION

Project Fact Sheet



NOVEL 4-WAY REFRIGERANT REVERSING VALVE FOR HEAT PUMPS

BENEFITS

- Potential to reduce U.S. electrical energy consumption and CO₂ production by approximately 5.5 billion barrels of oil (equivalent) and 10.5 billion kg of CO₂ over a 20 year period with 25 percent market penetration
- Raises heat-pump energy efficiencies by more than 1 percent
- Potential to reduce refrigerant pressure drop through the valve by 60 percent
- Lowers manufacturing costs
- Offers a simple design and improved reliability

APPLICATIONS

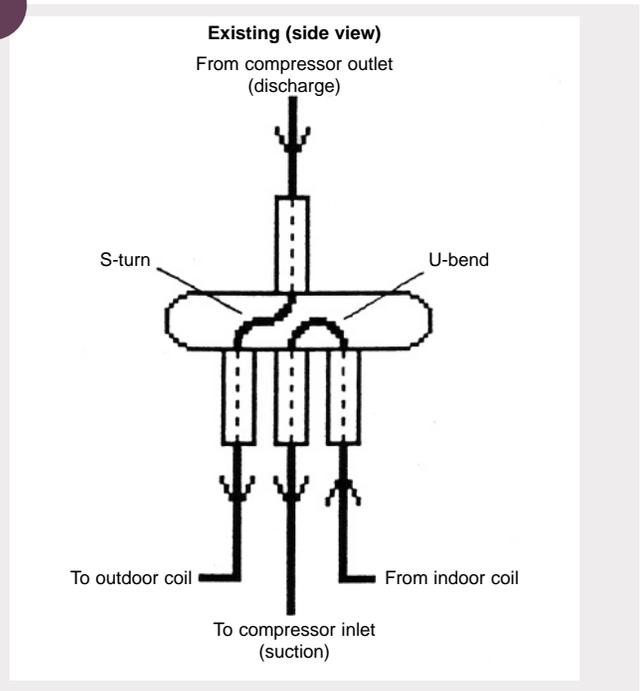
The novel 4-way refrigerant reversing valve was specifically designed for heat pumps. For this reason, the valve has immediate applications in heat pumps currently being manufactured worldwide. These heat pumps are in operation as space conditioners in residences, schools, offices, motels, stores, and industrial plants. Heat pumps are also used in non-space conditioning applications. For example, heat pumps are used to heat and cool swimming pools.

NEW 4-WAY REVERSING VALVES SIGNIFICANTLY REDUCE REFRIGERANT PRESSURE DROPS WHILE INCREASING HEAT PUMP ENERGY EFFICIENCY

A heat pump is designed to provide summer cooling, as well as winter heating, for both industrial and residential consumers. In a typical heat-pump installation, the unit contains an indoor and outdoor coil, compressor, and reversing valve. The reversing valve enables the heat pump to operate in either the heating or cooling mode by switching the refrigerant flow path through the indoor and outdoor coils, thereby changing the functions of the two heat exchangers. However, studies have shown that conventional refrigerant reversing valves cause pressure drops and undesired heat exchange that leads to a 5 to 10 percent degradation of heat-pump performance.

A new invention, a 4-way refrigerant reversing valve for heat pumps, offers a patent-pending reversing valve applicable in all types of heat-pump systems, including both air-source and water-source. The invention has been designed to provide significant economic and environmental improvements over existing 4-way refrigerant reversing valve technology.

EXISTING 4-WAY REFRIGERANT REVERSING VALVE



A new, 4-way refrigerant reversing valve will simplify the U-bend and S-turn structure of existing valves, making heat pumps more energy efficient and leading to reduced heating and cooling costs for consumers.



Project Description

Goal: Bring the invention into the prototype development stage.

Conventional reversing-valve technologies are complex and require the refrigerant to make either a 180-degree, U-bend turn (low-pressure side) or an S-shaped turn (high-pressure side) within the valve. Both turns cause an additional drop in pressure and undesired heat exchange, leading to a 5 to 10 percent degradation in heat performance.

By changing the shape of the turns and internal components of the valve, the technology offers a simpler structure that may result in a smaller-size reversing valve. The new valve will reduce pressure drop through both refrigerant streams, resulting in higher heat-pump cooling and heating capacities and lower compressor power input, which will increase overall energy efficiencies. In addition, the simpler design will enable the new valve to be manufactured with fewer parts. For this reason, the invention may be less expensive than current reversing valves. Also, with fewer internal moving parts, the invention will likely offer improved product reliability.

Darin W. Nutter is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- The invention is currently transitioning from computer modeling and laboratory testing to prototype development. The prototypes will be used to develop performance specifications necessary for commercialization.
- The inventor and the University of Arkansas have been in contact with the two major manufacturers of 4-way pressure valves concerning license possibilities. The willingness of these and other valve manufacturers to consider the invention's potential indicates the importance of new, improved efficiency technology in the heat-pump market.

Economics and Commercial Potential

Consumers' increasing demand for energy-efficient and environmentally friendly heating and cooling appliances drives the heat-pump industry. In 1995, *Contracting Business* magazine conducted an extensive study of nearly 80,000 households to measure consumer awareness and interest in comfort systems (central heat and/or air conditioning). The results of this research revealed that 46.4 percent of consumers believe energy costs are the most important factor when purchasing a new home comfort system.

The air-conditioning industry has made great progress over the past 2 decades in improving the efficiency of its products as it tries to meet this demand. However, there is still room for added efficiency improvements. Heat-pump manufacturers admit that improvements to the air-pressure drop problem, energy efficiency, and product cost are needed. This new technology specifically addresses these issues. If the 4-way refrigerant reversing valve is able to perform as anticipated by the inventor, it should be well received by industry.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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