Abstract

Commercially available electric powered heat pumps are commonly used to cool building air in the summer and heat building air in the winter. In these designs a reversing valve rotates to allow the heat pump system to move heat into a building in the winter and move heat out of a building in the summer. Through compression and heat exchange current systems can attain a Coefficient of Performance (COP) between 2.5 and 3.5. Although thermodynamic theory puts an upper limit on the COP those limits have yet to be obtained with traditional heat pump systems. The ideal COP (sometimes called the “Carnot” COP) is subpar in most heat pump systems, typically 30% of ideal in standard electric heat pumps and 50% of ideal for advanced residential units.

Boise State University has developed technology that enables a smaller lift ($T_H-T_i$ in the ideal COP equation) and a higher temperature $T_H$, both resulting in a substantially higher COP. This new technology has produced a COP calculated at 5.1 in cold conditions and a COP of 12.6 in warm conditions. This new design can also be effectively used to connect to a hot water heater and transfer heat from the heat pump system when the system is not needed for heating or cooling the building envelope. As an added benefit, because of systems efficiency, a reduction in the overall size of the system generates savings in the initial cost of materials and installation.

Advantages

- Substantially higher COP levels
- Use of heat pump system to heat hot water heaters
- Cost savings in material and installation

Boise State is looking for a Licensee, sponsor or development partner for this technology.

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