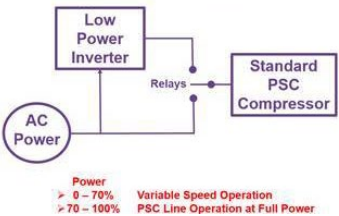


Sponsor: Regal Beloit Corporation

Project Description

- The focus of this research is to optimize the seasonal cooling performance of residential split-system heat pumps that use fixed speed PSC motors by modifying these systems with a novel inverter drive.
- The inverter drive enables the variable speed operation of traditionally fixed speed PSC motors. Performance at AHRI tests A2 and B2 remain unchanged, but the inverter allows for operation at E_v, F₁, and B₁ conditions.



Approach

- An off-the-shelf residential split-system fixed-speed heat pump is selected and tested in a pair of psychrometric chambers. The seasonal cooling performance is quantified by calculating SEER according to AHRI 210/240-2008.
- SEER is optimized as a function of component speeds in three phases named: VSHP 1; VSHP 2; and VSHP 3.
- In each phase of testing, a single component is isolated and its speed varied as the independent variable. SEER is determined as a function of the isolated component speed for a given phase. Each phase is defined in the table below.

Test Phase	Independent Variable	Variable Speed Components	Fixed Speed Components
VSHP 1	Compressor Speed	Compressor	Indoor Fan and Outdoor Fan
VSHP 2	Indoor Air Volume Flow Rate	Compressor and Indoor Fan	Outdoor Fan
VSHP 3	Outdoor Fan Speed	Compressor, Indoor Fan, and Outdoor Fan	None (Fully Variable Speed)

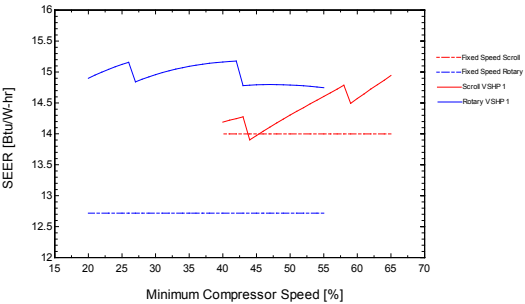
Discussion

- Isolating the three main power users of the system allowed for the relative SEER improvement of each component to be isolated.
- Varying the speed of the compressor had the largest impact on SEER improvement.
- Much higher system SEER improvements were achieved with the rotary compressors than with the scroll compressors.
- This method of variable speed motor operation offers benefits over both traditional fixed speed systems as well as the current methods used by variable speed systems

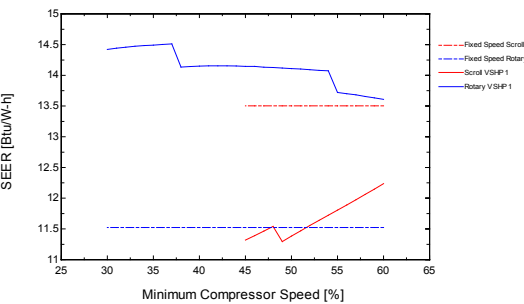
Results

- VSHP 1 results from testing two fixed speed heat pumps are shown.
- Each system was tested first with its original PSC driven scroll compressor, and then with a replacement PSC driven rotary compressor.

SEER Improvement of Scroll vs Rotary Compressors in a 5 Ton System



SEER Improvement of Scroll vs Rotary Compressors in a 2.5 Ton System



SEER improvements up to 33% have been achieved using the inverter drive.