



STEFFEN PEUKER

Steffen Peuker holds the James L. Bartlett, Jr. Professor position in the Mechanical Engineering Department at the California Polytechnic State University in San Luis Obispo and is the Director of the HVAC&R Program. His research interests are in HVAC&R applications.

FUNDING

ASHRAE Grant \$5,000

PARTNERSHIP

Department Funds \$1,000

DURATION

8 months to design, build and test

CONTACT

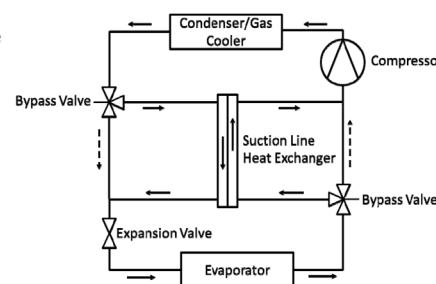
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R744 Transcritical Educational Demonstration Unit California Polytechnic State University – San Luis Obispo, CA, USA

OUR STORY

Considering the environmental impact refrigerants and refrigeration systems can have on the environment and global warming, educating students on alternative, more environmentally friendly options is a high priority. Natural refrigerants are of interest because of their low Global Warming Potential (GWP). Among the natural refrigerants, R744 (CO₂) has the unique property of having a relatively low critical temperature, 31°C or 87.8°F. Since other commonly used refrigerants do not have such a low critical temperature, R744 is the only refrigerant that could see transcritical operation conditions. As a result, the high side pressure of a transcritical R744 vapor compression system is not fixed but can be chosen based on expansion valve settings. Since R744 is a natural refrigerant with a GWP of 1 as well as being nontoxic and nonflammable, it is one of the possible alternatives to replace HFC refrigerants for certain applications.



OUR PROJECT

Mechanical senior design students in the HVAC&R concentration, working in a team of 4 students, built a vapor compression system using R744 (CO₂) as the refrigerant. Besides the condenser/gas cooler, evaporator and compressor, the system includes a suction line heat exchanger with bypass, a variable expansion valve and a variable speed fan for the evaporator. The unit can be operated under several different conditions, for example, transcritical operation, with or without suction line heat exchanger, and optimizing high side pressure to improve the efficiency (COP).

The unit is used as a lab demonstration unit for hands-on educational purposes regarding alternative refrigerants and serves students taking HVAC&R courses at Cal Poly to learn about the unique properties of an R744 vapor compression system. Furthermore, the unit is used during events to educate the public about environmentally friendly refrigerants.

