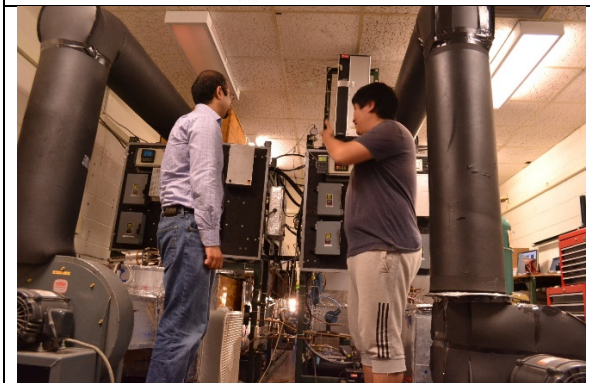
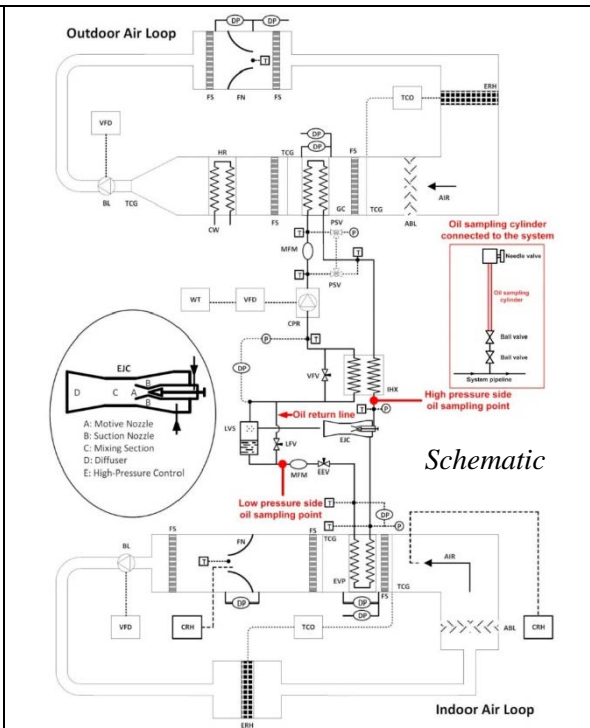


3. MEL 2413: AC & HP Systems Lab

- Purpose and capability: This versatile systems lab can be used to explore the performance of AC and HP systems for a variety of different applications and refrigerants such as R744, R1234yf, R410A, R134a. Ready for low-GWP alternatives. Highly accurate capacity and energy efficiency (COP) results are obtained from two entirely independent energy balances that are taken on the air-side and the refrigerant-side of the system components under test. The two energy balances agree within $\pm 3\%$ under normal test conditions.
- Current project: The system is currently equipped to operate as a transcritical R744 ejector system. It is being used for studies in ejector cycle performance optimization with high-side pressure control, comparison of different variable ejector designs, low-cost ejector design, and ejector cycle oil circulation rates.
- Components: i) Counterflow microchannel evaporator and condenser; ii) a fixed displacement, reciprocating, transcritical R744 compressor with a nominal speed of 1800 min^{-1} and a cooling capacity of approximately 5 kW at conditions typical for AC operation; iii) A variable frequency drive is used to control compressor speed from 400 to 1800 min^{-1} ; iv) two closed-loop wind tunnels house the evaporator and gas cooler; v) Variable-speed blowers and electric heaters to control air flow rate and inlet temperature to the gas cooler and the evaporator; vi) Internal oil separator in compressor to achieve OCRs on the order of 1%; vii) Multiple sampling locations to measure cycle OCR
- Sensors and data acquisition: Type-T thermocouples, absolute and differential pressure transducers, and Coriolis-type mass flow meters are used to obtain both air-side and refrigerant-side measurements. Steady-state data is recorded every 6 s with a customized LabVIEW DAQ interface.
- Operating conditions: Gas cooler and evaporator air-side inlet temperature ranges are 28 to 45 °C and 25 to 35 °C, respectively. The high-side pressure can be varied from 7500 kPa to 12000 kPa.
- Uncertainty: Thermocouples have ± 0.5 °C absolute, differential pressure transducers have $\pm 0.11\%$ to $\pm 0.5\%$ full scale and Coriolis-type mass flow meter have $\pm 0.2\%$ reading uncertainty.



Adjusting parameters in transcritical R744 ejector system test