Thermodynamic and Chemical Analysis of the Refrigeration Cycle with Consideration of Refrigerants

Overview
TMP manufacturing is responsible for creating quality walk-in coolers for clients. Recently the federal government has come up with updated standards for the efficiency of walk in refrigeration systems to be implemented by 2017. The EPA has proposed to phase out current refrigerants in favor of those with lower Global Warming Potential (GWP). Our main goal is to determine if we can make their refrigeration units more efficient with the implementation of these new guidelines.

Objectives
To increase the efficiency of the V-series unit for the sponsor in the most cost effective manner as possible. We focused on the implementation of different components including the compressor, condenser, evaporator, and the expansion valve to determine the most efficient combination of parts. Consideration of the chemical composition and thermodynamics of the refrigerants were also taken into account on their effect on efficiency and the environment.

Approach
- We first studied the basics of the refrigeration cycle in great detail
- Explored the existing products of TMP Manufacturing and met with sponsor
- Developed a concept map and criteria based on customer needs
- Looked into and discussed the components of refrigeration cycle for possible areas of improvement
- Reviewed upcoming proposals implemented by the DOE and EPA regarding improvements in efficiency and reduction of environmental impact
- Compared and contrasted the current 404A refrigeration standard with proposed 407A refrigeration standard
- Performed both thermodynamic and chemical analysis of refrigerants to determine theoretical performance and compared with existing data

Outcomes
R407A is a viable substitute for R404A due to its lower GWP and relatively easy retrofitting process.