Abstract

An air refrigeration cycle intended for future use in the ME 134 class was designed, built and tested. The cycle would provide freshmen mechanical engineering students an introduction into the field of Heating, Ventilating, and Air Conditioning (HVAC). In the cycle, air at 1500 psig is pre-cooled in a regenerative heat exchanger. The pre-cooled high pressure air is expanded through a pressure reducing valve to near atmospheric pressure. Through the Joule Thompson effect, the temperature of the air decreases. The cycle was designed to reach temperatures as low as -100°F and freeze 4 ounces of water in 40 minutes. During initial testing the system did not perform as designed. Additional analysis was performed based on the test results and modifications to the system were made. After the modifications were made, the system still did not perform as expected. However, temperatures as low as -5°F were observed and 0.5 ounces of water was frozen in 45 minutes.

Introduction

The concept for this senior project was first introduced at a meeting of the Cal Poly Heating, Ventilating, and Air Conditioning (HVAC) Industry Advisory Board (IAB). The HVAC IAB was formed to promote the HVAC industry at Cal Poly. During a curriculum subcommittee meeting for the lower division classes, a member of the committee suggested creating an HVAC related lab experiment for the ME 134 class. Since all incoming freshmen had to take this introductory class, all mechanical engineering students would be exposed to HVAC early in their college career. The experiment would have to be simple and catch the attention of the students.
Figure 12. Completed Air Refrigeration Cycle