Cold Box Pressure Relief Device

Overview
A cold box is a structural container used in the industrial gases industry. The main purpose of a box is to enclose and insulate the equipment required to separate air into its base elements. Condensed gases are released into the box if internal equipment leaks. A rapid increase in pressure may cause the box to rupture. When this occurs, perlite uncontrollably spills out into the environment, and the plant must be shut down. The resultant downtime and repairs are very costly to the owner and disruptive to the plant operation.

Objectives
The objective of this project is to design and build a prototype of a pressure relief device that can be installed on the cold box at various heights while the plant is in operation without the necessity of draining the free flowing insulation, perlite, contained within the box. The design must include: 1) a vertical relief opening with a permanent horizontal lift plate design that is unaffected by the elements, 2) a mechanical attachment method to attach and seal the device to the cold box, and 3) a porous barrier

Approach
- We gathered customer needs during a site visit at an Airgas® air separation plant
- We used an AHP Pairwise Comparison Chart to weigh customer needs
- We reviewed patents for pressure relief vents and found existing products on the market
- We used a QFD matrix to relate customer needs to specifications
- We developed three concepts and used a concept scoring matrix to pick the best one
- We created CAD models for our chosen concept
- We fabricated a full-scale prototype using available materials
- We tested the installation
- We recorded our results on video
- We tested the performance of our prototype using a pressure gage and regulator

Outcomes
- The test method shows that perlite may become compacted
- The pressure plate relieved pressure effectively
- The installation procedure is efficient and can be accomplished using readily available cordless tools
- The porous barrier contains perlite while releasing air
- The estimated cost of the final product will be about $720