

Active Exhaust System

Sponsor: Polaris Industries

Sponsor's General Mission: Understand the riding experience. Live the Riding experience. Work to make it better.

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Team Member Names: Katherine R. Kaspar (ME), Christopher J. Vath (ME), Benjamin J. Dauwalter (ME), Stephen D. Johnson (ME), Charles R. Zarembinski (EE)

Senior Design Clinic I-II (ENGR 480-1) Project Description: Develop an active exhaust system that reduces the sounds emissions of a 2009 Victory Hammer motorcycle to less than 80 dB under conditions specified in EDE directive 97/24 chapter 9.

Major Design Requirements:

1. Pass the EU drive-by test
2. Tonal quality unchanged
3. Torque reduction less than 12%
4. Horsepower reduction less than 12%
5. Aesthetics
6. BOM increase less than \$250 per motorcycle

Project Summary:

The Polaris project required driven individuals who could both work cooperatively and individually to complete tasks and achieve goals. The purpose of the project was to reduce the sound level of the exhaust through an active exhaust system for Victory's Hammer motorcycle. This decrease in sound level would allow the motorcycle to pass European Union sound regulations. The team first researched other possible solutions to decreasing sound levels. Although other viable solutions were found it was confirmed an active exhaust system using a butterfly valve was the best possible solution. Initial testing of a valve system included manufacturing valve plates of various sizes and running sound tests in a dynamometer to determine which reduced the most noise without hindering performance. After two design iterations, a tightly packaged valve housing was developed that would withstand both heat and corrosion of normal operation. After extensive research, an actuator was purchased and logic was written that would accurately control the valve. Finally a cable system was designed to link the actuator with the valve assembly. The success of the project depended on the ability to adapt to changing configurations while keeping the project goals in mind. Each member of the team had to demonstrate leadership, creative thinking, and flexibility in order to stay within the scope of the project.



Figure 1: Members of Team Victory

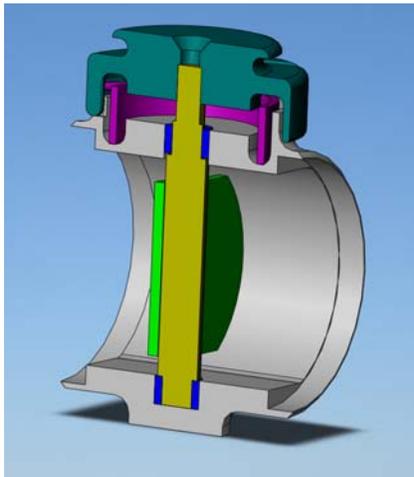


Figure 2: Cross-Section View of Valve Assembly

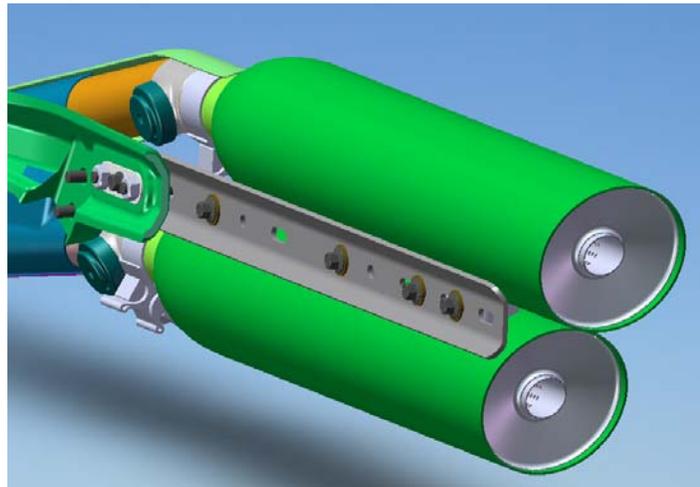


Figure 3: Valve Assembly Welded into Exhaust