

The Practicality of Adaptable Geometry Centrifugal Pumps in U.S. Navy Systems

by

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Abstract

Unlike traditional impeller trimming, mechanically varying centrifugal pump impellers or volutes can significantly affect pump performance. This thesis explores the potential for performance enhancement by variable impellers as an alternative to, or possibly in conjunction with, popular pump improvement methods like adjustable speed drives (ASD) and permanent impeller trimming. A review of the theory, existing technology, and potential for future advancement creates the foundation for the final assessment and comparison.

The methods developed in the thesis are applied to a case study of the United States Navy *Arleigh Burke*-class guided missile destroyer (DDG-51 class) firemain to propose appropriate impeller trimming to improve system performance, resulting in an annual fuel savings of nearly 10,000 gallons per ship. Although the DDG firemain is used as the primary example throughout the thesis, the review of pump improvement methods could be applied to many Navy, military, or civilian pumping systems. Additionally, the inclusive analysis that the thesis provides may serve as a helpful starting point for future centrifugal pump research and concept development.

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