

Design Optimization of a High Speed Motor Driven Centrifugal Compressor

Challenge: Design a centrifugal compressor to be used in a blower application.

Results: An efficient compact design.

Impact: High efficiency design achieves compression at reduced power.

The manufacturer of a high speed, motor driven compressor was seeking a new centrifugal compressor design to be used in a water aeration application. The compressor needed to be powered by a high speed electric motor. In order to satisfy the customer's weight requirement, the design had to be compact.

The project began with a meanline design and analysis. It was determined that in order to gain a more efficient compressor design tradeoffs would need to be considered quickly and efficiently; such as speed, blade number, diffuser type, and back sweep. Using CFD Computational Fluid Dynamics (CFD) software a three-dimensional compressor design (Figure 1) was achieved.

The manufacturer then built and tested the prototype. The testing of the compressor achieved an 82% isentropic efficiency. This increased efficiency was considerably higher compared with its competitors. Since this analysis, the compressor has gone into full scale production.



Figure 1: High Speed Compressor Design.

