Concepts NREC
EXPERTS IN TURBOMACHINERY

The Holmes Group

CASE STUDY

New Quieter Fan Also Improves Performance and Appearance

The Holmes Group of Milford, MA, is a leading manufacturer of fans and other small appliances featuring contemporary design and superior function. The Holmes® brand of consumer/commercial fans is typically sold through major home improvement centers and includes a high-velocity floor fan designed for cooling large areas. One of their models, a 20-inch diameter, multiple-speed fan, needed improvement in performance, along with quieter operation and a more fashionable appearance – the three formed-metal paddle blades were noisy and made the product look dated.

The previous generation Holmes high-velocity floor fan (left) compared to quieter and more efficient new design (right).

Concepts NREC was asked to develop a new design with a 20% increase in airflow, along with a decrease in noise, compared to the existing model. The appearance of the fan blades also needed to be somewhat unique since each fan manufacturer tends to use shapes that are recognizable as their brand. And there were other criteria to consider. The successful new design had to be resolved quickly to meet production schedules, and the fan had to be easy and economical to manufacture. In shaping the improved blades, Concepts NREC's extensive experience in high-speed axial compressors and fans, along with its advanced aerodynamic design software, was a distinct advantage in establishing a successful design approach. To determine the correct blade loading for optimal performance and low noise, Concepts NREC modified the design until the analysis indicated that the objectives were met. The resulting design criteria established a shrouded-rotor fan configuration (rather than open blading) which reduced vibration and noise.

A unique type of blade stacking was then introduced, which created a distinctive appearance. The new design uses seven blades in place of the previous three, and the entire impeller is engineered to be injection-molded in plastic (rather than formed in sheet metal). These design and material changes also help reduce fan noise by 2 to 3 dba. Acoustic testing was used to refine the "nice" sound of the new fan by eliminating the pure tones that many people find intrusive. The new design is engineered to be inexpensively produced using The Holmes Group's existing manufacturing capabilities. To evaluate the new design before committing to tooling, The Holmes Group produced SLA (stereolithography) resin models that Concepts NREC then tested on a custom-built air-flow rig to validate the increased airflow predicted for the improved aerodynamic design.

All objectives were accomplished

Testing proved the design predictions to be accurate. Measured at maximum operating speed, the quieter and more contemporary-looking fan delivered the required 20% increase in airflow, and development was completed on schedule. The Holmes Group presented the newly designed fan to their customers for an evaluation of its improved performance, reduced noise, and modern aerodynamic appearance. The response was so overwhelmingly positive that major retailers made purchase commitments to the full extent of annual production.

Following the success of the large 20-inch fan, The Holmes Group asked Concepts NREC to develop three small quiet fans for their redesigned line of small humidifiers. To achieve the level of performance and lower noise required, the new designs reflected the kind of blade loading that might be found in a jet engine. To further smooth and quiet the airflow, these fans included a cone over the motor hub, a plenum around the impeller, and a grill designed at the same angle as the flow to scoop the air out without introducing vortices. The new humidifier fans met all performance requirements and appearance objectives. Concepts NREC has since engineered new fans for larger Holmes brand humidifiers, and other quiet fan designs were developed.