

Performance of a Half-height, Innovative Cooling Fan

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Abstract

An innovative cooling fan with distinguishing features such as ultra thinness, high performance, and quietness is proposed for notebook computers. In particular, the configuration of the proposed fan allows it to suck the largest volume of hot air from surfaces along the vertical direction and expel exhaust air onto the side surface along the horizontal direction, therefore, thinner notebook PCs can be designed. In order to achieve these characteristics, unique designs are required; a 13-blade impeller is designed for the centrifugal fan in stead of the common conventional design for axial fans, which is a complicated centrifugal blade shape design. A flat rectangular casing for the fan is designed with external dimensions of 89 mm × 76 mm × 13 mm. The casing contains a rotor impeller and a volute; the design of curved throat of the volute is complicated. The top and bottom surfaces, each, have one circular inlet hole. The side surfaces each have a long rectangular outlet hole. In this study, we focus on the P-Q performance curves of this centrifugal cooling fan designed for notebook PCs, the P-Q curves are obtained by numerical analysis and tests based on the

AMCA standard 210-85. When this fan is subject to real operating conditions, with regard to the maximum flow rate to the near cut-off point, the pressure P gradually increases from the fan inlet to the fan outlet. The average percentage (%) error in the flow rate Q was determined by both numerical analysis and AMCA test. Additionally, from the result of the standard CNS-8753 noise test, the fan noise level is 30~33 dBA and the flow field around the inlet, the outlet and the flow passage can be visualized by Particle Interference Visualization (PIV). Finally, according to the P - Q curve, it can be inferred that this cooling fan outperforms other comparable regular products available. The noise level is satisfactory, and the heat removal is good; hence this design is proposed for application in industry.

Keyword : centrifugal fan, AMCA, P - Q performance curve.