Computational Fluid Dynamics (CFD) Analysis of airflow and thermal performances

ebm-papst UK uses its CFD analysis service to solve a customer’s airflow problem and enable them to get their new product range to market.

CFD, or Computational Fluid Dynamics to give it its full title, is the application of mathematics and computing to fluid flow and heat transfer problems. Using this cutting edge analysis tool in conjunction with epUK’s mechanical CAD system it is possible to simulate the flow of gases, liquids and heat in and around any piece of equipment.

ebm-papst UK were approached by a commercial ventilation OEM with a problem. Their latest product was ‘noisy’ and despite extensive testing they were unable to find the source of the rhythmic ‘tumble dryer’ type noise. This problem was preventing them releasing their new product onto the market as scheduled.

The customer’s development unit was sent to epUK and the problem was replicated on the airflow test rig where the 3 – 4 second period of the noise was noted along with pressure fluctuations.

Having obtained CAD models of the product a CFD model was constructed to examine the airflow and pressure characteristics. The initial static analysis didn’t reveal any problems so a lengthier, in-depth dynamic analysis was performed. This revealed a problem with the inlet geometry to the fan that was causing an unstable vortex. It was the movement of this vortex that was the source of the ‘tumble dryer’ type noise. It was noted that the oscillation period of the vortex in the analysis matched the period of the rhythmic noise heard on the airflow test rig. It could also be seen that the pressure fluctuations seen on the test rig were present in the CFD model.

The ideal solution to the problem would be to re-route the inlet airflow however this was not possible within the size constraints of the product. An alternative was to install a small baffle plate to prevent the moving vortex from forming. This was added to the CFD model and the dynamic analysis re-run which proved the solution would work. To verify the solution on the customers development unit a wooden baffle was fitted and the tests re-run resulting in the noise completely disappearing as had the pressure fluctuations.

ebm-papst UK’s CFD analysis service is available to all its customers to assist in the correct application of ebm papst fans and controllers in their equipment.

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