Performance Analysis of Heating Blower for Conveyor Dryer Using Computational Fluid Dynamics

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This study is based on a comprehensive analysis of a heating blower system using Computational Fluid Dynamics (CFD) with the Ansys 16 software platform. The system is designed to function as a heating system for a conveyor dryer. The heating blower system consists of a motor-coupled propeller with a 7.5-inch diameter, along with an electrically powered heating coil enclosed within a duct. The novel system is designed to enhance the turbulence in the heating area to ensure zero stagnation and enhanced drying conditions at the outlet. This analysis comprises the detailed design of the blower fan, heating coil, air inlet, and outlets. A three-dimensional transient flow simulation is done to the specified fluid domain with major boundary conditions to evaluate the performance of the designed system. The final design was re-arranged to perform the simulation by assigning required boundary conditions as 2000 rpm of propeller speed, and 3000 Wm-3 of heat generation rate, and 100 Wm-2K-1 of heat transfer coefficient under forced convection. The tetrahedron cells with sliding mesh settings for the inside air were selected to ensure the convergence of the solution. Reynolds stress model was used with the fluent solver with standard wall function and energy equations. The results have clearly shown that the assigned heat generation rate and blower spinning rate are capable of maintaining the average outlet temperature nearly at 305 K which satisfies the requirement of drying. Further streamlined plots, and vector plot in all domains proves that the drying area has high turbulence and zero stagnation points which leads to enhanced heat-exchanging performance.

Keywords: *Computational fluid dynamics, Heating, Sliding mesh, Turbulence, Dryer*