

The Effect of Cooling Tower Fan on the Performance of the Chiller Plant

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Abstract : This study delves into the crucial influence of cooling tower fan operation on the performance of a chiller plant, with a specific focus on the Chiller Plant at SVNIT. Continuous operation of the chiller plant led to unexpected damage to the cooling tower's belt drive, rendering the cooling tower fan non-operational. Consequently, the efficiency of heat transfer in the condenser was significantly impaired. In response, we analyzed and calculated several vital parameters, including the Coefficient of Performance (COP), heat rejection in the condenser (Q_c), work required for the compressor (W_c), and heat absorbed by the refrigerant in the evaporator (Q_e). Our findings revealed that in the absence of the cooling tower fan, relying solely on natural convection, the COP of the chiller plant reached a minimum value of 5.49. However, after implementing a belt drive to facilitate forced convection for the cooling tower fan, the COP of the chiller plant experienced a noteworthy improvement, reaching approximately 6.27. Additionally, the utilization of forced convection resulted in an impressive reduction of 8.9% in compressor work, signifying enhanced energy efficiency. This study underscores the critical role of cooling tower fan operation in optimizing chiller plant performance, with practical implications for energy-efficient HVAC systems. It highlights the potential benefits of employing forced convection mechanisms, such as belt drives, to ensure efficient heat transfer in the condenser, ultimately contributing to improved energy utilization and reduced operational costs in cooling.

Keywords : cooling tower, chiller Plant, cooling tower fan, energy efficiency, VCRS.

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