A Energy-Efficient Fan System for Dual-Duct Constant Volume Air-Handling Units

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The single-fan, dual-duct (SFDD) constant volume air-handling units have been installed in many medical facilities, office buildings and library facilities since the 1940's. They are especially popular in hot and humid climates, since these systems provide solid relative humidity control and good air circulation, while requiring less maintenance. When the constant speed fan is used, static pressure at both hot and cold ducts are higher than the set point under partial load conditions. Terminal box dampers become over-pressurized, which creates noise and vibration problems, and causes excessive airflow in some of the buildings where single actuator terminal boxes are used.

The performance of the SFDD systems can be improved by converting to dual-fan, dual-duct (DFDD) systems. A dedicated hot air fan is added to the system and variable speed drives are added to both hot and cold air fans. The fan speeds are controlled to maintain required static pressures at select duct locations. Dual-fan conversion requires major mechanical retrofits.

This paper presents an energy efficient fan system (E^2FS). The E^2FS uses a variable speed drive (VSD) on the existing fan. The E^2FS modulates the fan speed to maintain the minimum static pressure of either the hot and cold air duct at its required value. The E^2FS reduces the maximum static pressure by setting the minimum static pressure at the set point, which leads to significant fan power savings under normal operation conditions. The E^2FS significantly improves the SFDD system performance without major retrofits.