case study | Wakefield House Adelaide

Objective: Energy savings, performance increase
Solution: EC fan retrofit
Measures: Replacement of existing centrifugal belt driven fan with EC plug fan within AHU
Conclusion: Increased airflow and cooling capacity with 50% reduction in fan energy

For commercial office buildings, up to 70% of the total energy use is attributed to the heating, ventilation, and air conditioning (HVAC) systems.

Fan energy is typically the most significant consumer of energy within a commercial building. Approximately 50% of energy can be saved by replacing the existing AC belt driven backward-curved fans throughout a building to EC plug fans.

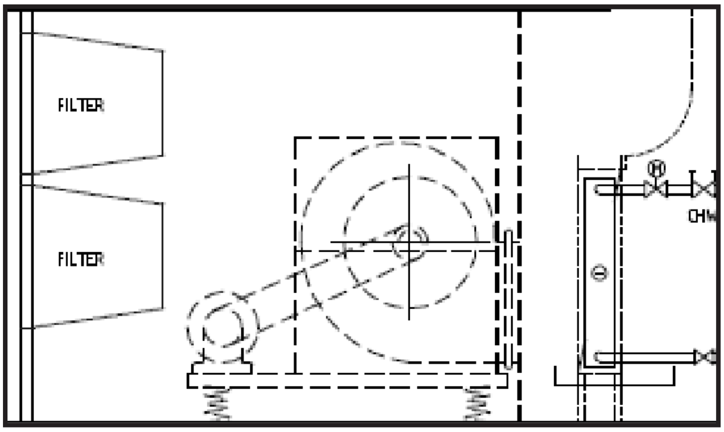
Wakefield House Building, Adelaide

The original fan and air handling unit (AHU) arrangement for level 14 of the government-owned Wakefield Building in Adelaide, which is typical throughout all floors of the building, comprised a coil face bypass arrangement, with air distributed via a belt driven backward curved centrifugal fan arrangement.

In October 2011, the existing fan was replaced by an ebm-papst EC Plug fan. Minor works to the damper were also performed.

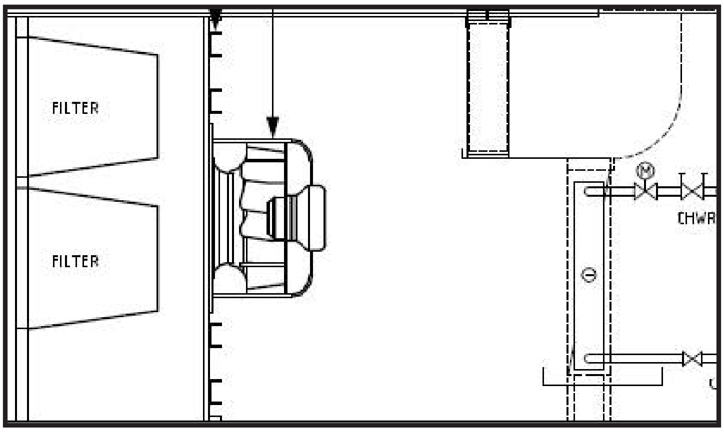
ebmpapst

Old System



The main issues with the above arrangement and system relate to performance and the ability to adequately distribute the air to the floor. Due to the system type and the fans proximity to the cooling coil, cooling capacity of the AHU is reduced as only part of the coil face is utilised. Air from the fan is only incident on part of the cooling coil, which then is reflected by insufficient capacity being delivered to the floor.

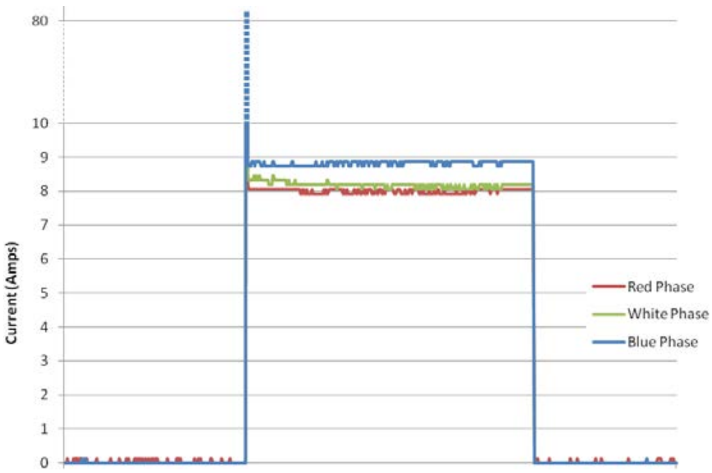
New System



The new ebm-papst EC Plug fan was installed away from the cooling coil, and the damper was rearranged above the cooling coil in the bypass ductwork. The new damper was installed to provide an equivalent pressure drop to the cooling coil, which provides more stable distribution and controllability of supply air. The EC Plug fan pressurises the plenum chamber and rather than delivering an uneven air profile as per a centrifugal fan it provides uniform air pressure and therefore volume across the whole cooling coil, achieving greater capacity from the coil.

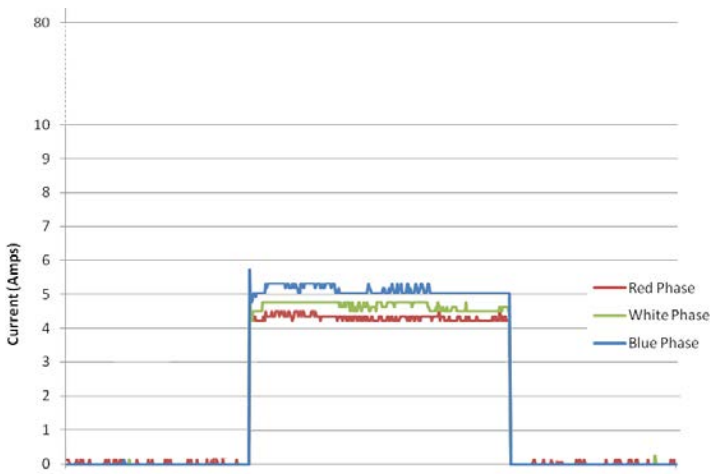
Old Fan current

Starting currents for each day, which exceed 80 Amps, whereas the average current across the phases throughout daily fan operation is 8.55 Amps.



New fan current

Starting currents now approach 6 Amps and the average current across the phases throughout daily operation of the EC plug fan is 4.7 Amps.



Old Performance

Contributing to the insufficient capacity is the reduction in supply air to deliver cooling to the floor. Locating the fan so close to the cooling coil creates turbulence and increases the system static, which in turn reduces the supply air quantity by approximately 10-15% from design. When combined with the reduced performance of the cooling coil, the net reduction in capacity to the floor is approximately 45% from design.

New Peformance

As part of the upgrade works, airflow was increased by 10% returning the supply air quantity to the design figure and combined with the resultant increased coil efficiency, cooling delivered to the floor was increased by approximately 15-20%.

Summary

System	Starting current	Operating Current	Annual kWh	CO_2 Emissions	Annual Operating Cost
Old Belt Driven Centrifugal Fan	>80 A	8.55 A	18,637.3	12.7 tonnes	$ 3,541.09
New EC Plug Fan	<6 A	4.7 A	9,166.6	6.2 tonnes	$1,741.66
Savings			**9,470.7**	**6.5 tonnes**	**$1,799.43**

Supply air flow	+10%
Cooling capacity	+20%
Fan energy used	-50%

NGA 2011 scope 2 emission factor for consumption of purchased electricity of 0.68 kg CO2 -e/kWh was used. The comparison assumes an average daily operation of 10.5 hours, with energy costing $0.19 / kWh. Fan running time is also assumed to be 5 days per week, 51 weeks per year. A power factor of 0.85 has been used for the existing belt fan, while a power factor of 0.95 was used for the EC plug fan.

ebm-papst A&NZ Pty Ltd
AU Tel: +61 3 9360 6400
NZ Tel: +64 9 837 1884
email: sales@ebmpapst.com.au
www.ebmpapst.com.au
www.ebmpapst.co.nz

ebmpapst