

## Application Guidelines for the Wiring Closet Ventilation Unit

By David Roden

### Abstract

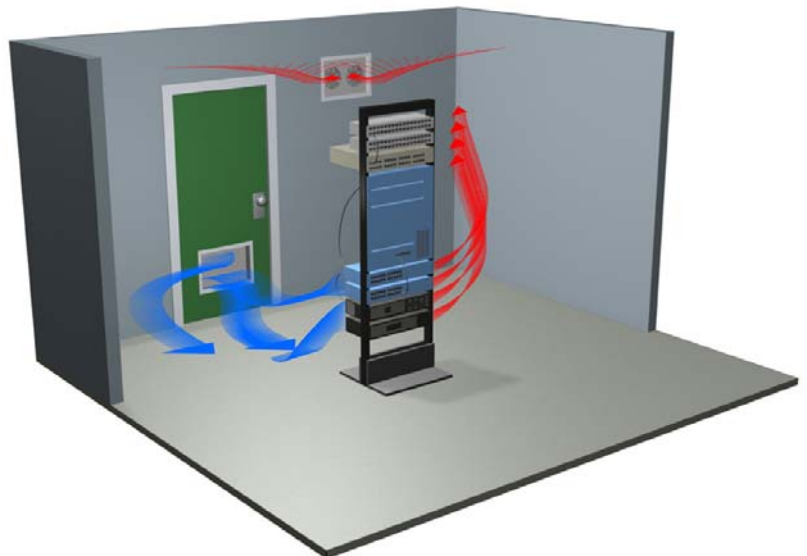
The Wiring Closet Ventilation Unit (WCVU) is a rapidly deployable wall and ceiling mount heat removal system designed specifically for the wiring closet environment. By exhausting hot air from the closet to an adjacent space, it allows conditioned air to enter the room and cool the load. This application note covers the best practices for deploying the WCVU.

### Introduction

Wiring closet heat loads are rising due to deployment of technologies such as Voice over IP (VoIP) and Power over Ethernet (POE). APC's Wiring Closet Ventilation Unit is a rapidly deployable fan-based heat removal system which offers mounting flexibility and simplicity of installation. This wall or ceiling mounted unit leverages the existing building air conditioning system to cool a wiring closet; the unit exhausts warm air, allowing conditioned air provided from the building system to enter via an air intake grille. See **Figure 1** for an illustration of a typical installation. The WCVU is designed specifically for the wiring closet environment and can be ideal for applications such as VoIP; especially as POE switches cause significant increases in power / heat in these environments.

*Figure 1 – Typical installation of a WCVU*

The WCVU is a fan-assisted ventilation device and is best suited for cooling loads in the range of 700 to 4500 watts. Below 700 watts of heat load it may be possible to use either conduction or passive ventilation in lieu of fan-assisted ventilation. Also, in non-critical closets, it may be possible for a single WCVU to handle up to 4500 watts of heat load. For additional discussion on the various strategies for cooling wiring closets and small IT rooms, refer to APC White Paper #68, "Cooling Strategies for IT Wiring Closets and Small Rooms."

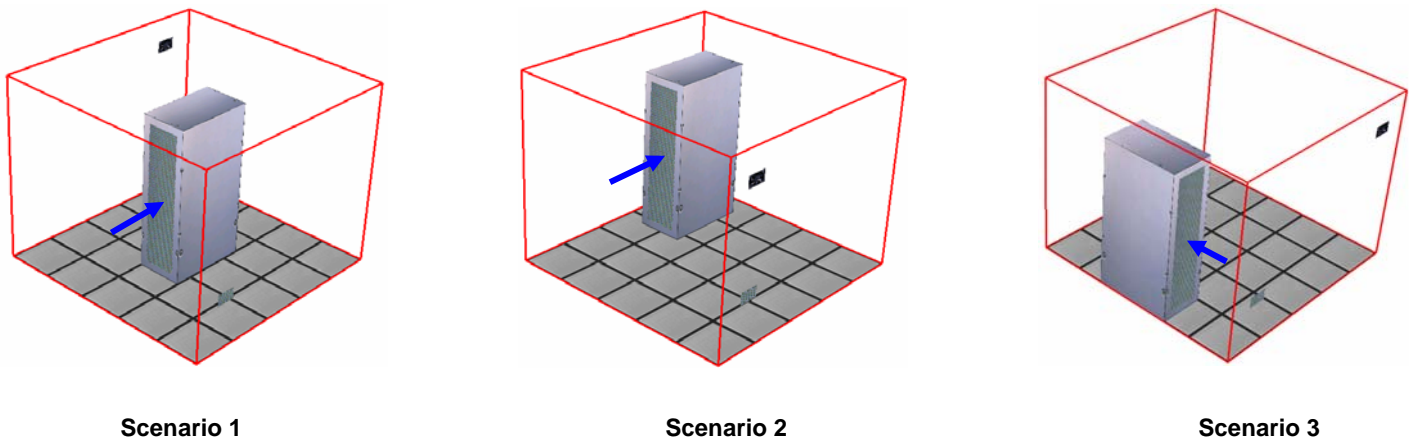


## Unit Placement

When installing the WCVU, the user must determine where to install the unit and intake grille to best provide cooling for the IT equipment in the room. Generally it is recommended that the WCVU be placed as high as possible on the wall, or in the ceiling (assuming a suitable plenum space exists), as it is extracting hot air from the room; and it is recommended that the intake grille be placed lower on the wall (or door), to take advantage of the coolest air in the adjacent space. The WCVU should exhaust the hot air into a space that can handle the additional heat load without negatively impacting any occupants or processes occurring in that area. Likewise, the intake grille should be connected to an adjacent space that has an excessive amount of conditioned air, so that the closet can be supplied adequately without impacting that space.

The single most important factor is the orientation of the make up air intake grille relative to the IT equipment. CFD analysis shows that the best results occur when the grille is directly facing the inlet of the equipment. **Figure 2** shows the three room layouts that were modeled; in all cases the WCVU was situated high on one of the walls, the intake grille lower on a wall and a 3 kW rack was located in the room; the blue arrow indicates the airflow into the equipment rack. Scenario 3 was the best performing, with the lowest average rack inlet temperature, by more than 10 °F (5.5 °C).

*Figure 2 – Layout scenarios considered during CFD analysis*



## Room Construction

The Wiring Closet Ventilation unit is designed to be installed in either a standard drywall partition or a drop ceiling. The ceiling installation is typically the easiest, often requiring only a utility knife and a step stool or ladder. The WCVU can be placed in

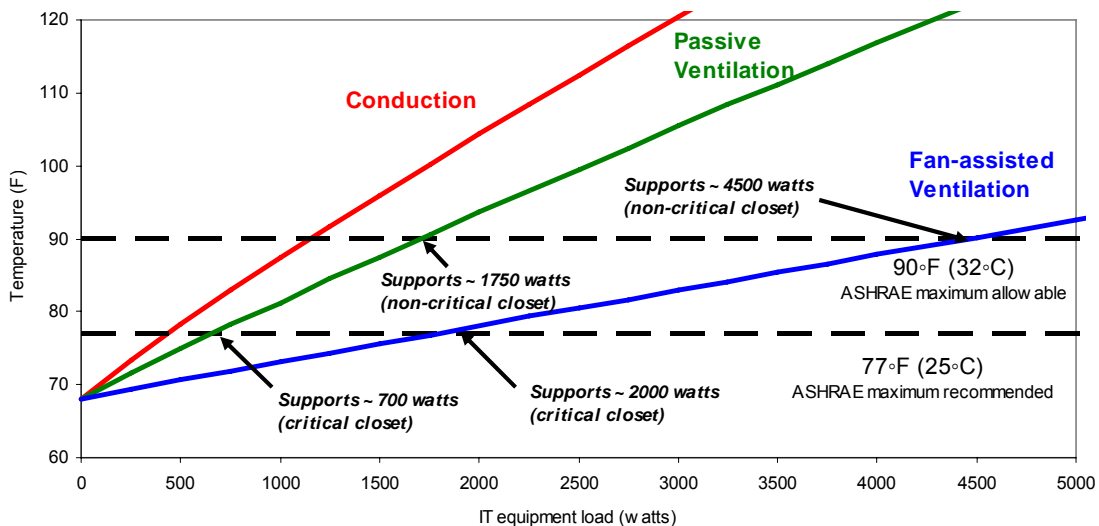
masonry walls, however, it is not specifically designed for this and field provided mounting hardware may be required to complete this installation. The WCVU is not suitable for use in conjunction with fire walls.

## Capacity and Redundancy

The WCVU is nominally rated for removing up to 3 kW of heat. This value is based on 475 CFM (807 m<sup>3</sup>/hr) of unit airflow (fans on high speed) and 160 CFM/kW, the airflow per power consumption ratio that is typical for most IT equipment. For practical purposes however, the criticality of the equipment and the targeted average temperature in the closet will determine the capacity ranges where the WCVU is suitable. With a critical equipment closet, the target room temperature is normally 77°F (25°C), the WCVU can adequately remove up to 2 kW of heat. In a non-critical closet, the user can target 90°F (32.2°C), and use the WCVU to remove up to 4.5 kW of heat. The temperature rise of a ventilated closet as a function of IT load is shown in **Figure 3**.

For greater capacity it is possible to install multiple WCVUs in a single room. Bear in mind, the spaces supplying the conditioned air and receiving the hot exhaust air must be capable of meeting the airflow requirements.

*Figure 3 – Closet temperature versus IT load – fan-assisted ventilation*



## Redundancy

A second WCVU can be installed for redundancy. The redundant unit can either run continuously or be powered from a switched outlet that is activated when the primary unit fails. The dry contact output from the primary WCVU can be used to signal the device that controls the outlet for the back-up unit.

The WCVU can also serve as back-up ventilation supporting a dedicated air conditioning system. In closets where having N+1 air conditioners is impractical, the WCVU can ventilate the room whenever the primary cooling unit fails.

### Wiring Closet Ventilation Unit with Environmental Management

The combination of the WCVU with an Environmental Manager (EM), shown in **Figure 4**, allows the user to control the WCVU based on a preset temperature. Using the switched outlet of the EM and the temperature probe, the WCVU can be turned on and will ventilate the closet only when the user defined temperature set point is reached. The web card allows for remote monitoring, so this system can be ideal for emergency back-up heat removal for locations without maintenance or security personnel.

*Figure 4 – ACF301EM - WCVU with environmental management*



## Conclusions

The Wiring Closet Ventilation Unit can provide effective heat removal in a wide variety of spaces and heat loads. Following a few simple best practices when placing the units will help ensure a successful deployment:

- Orient the IT equipment intake to face the conditioned air inlet grille
- Place the WCVU high on the wall or in the ceiling
- Use redundant or multiple units as needed
- Avoid using through fire resistant walls

### About the Author:

**David Roden** is the Product Manager for Small System Cooling at American Power Conversion (APC). Previously David was the Senior Applications Engineer for precision cooling solutions at APC, supporting data center projects worldwide. Prior to joining APC, David served as an officer in the United States Army. He received a Bachelors degree in mechanical engineering from Rensselaer Polytechnic Institute in Troy, NY and is a member of ASHRAE.