Active Airflow Control
Using React Dampers


Whistler Housing Authority – Whistler, BC

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EFFECT OF AIRFLOW CONTROL
IN HIGH PERFORMANCE BUILDINGS

Active airflow control is a piece of the puzzle that helps deliver truly high performance in the built environment. High performance can mean thermal comfort, indoor air quality (IAQ), energy savings, low carbon emissions and protecting the building envelope.

Active airflow control is a system of controls and components that can vary the airflow in response to dynamic changes in the occupied space. The major components of an active airflow control system include variable airflow fans, independent airflow control dampers with actuators, airflow monitoring and controls.

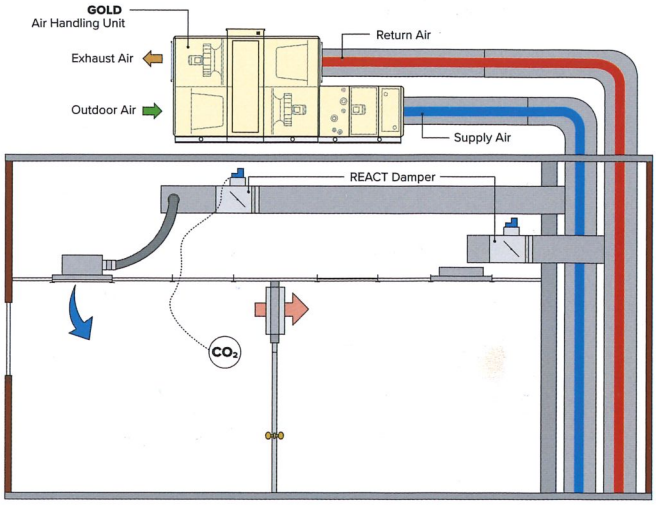

Fig. 1 *Active Airflow Control System set up for demand control ventilation*

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DEMAND CONTROL VENTILATION

To achieve indoor air quality (IAQ) the right amount of ventilation air must be delivered and the exhaust removed from the occupied space. A constant flow ventilation system will deliver the ventilation air once properly balanced by a professional test and balance contractor. While IAQ may be achieved with a constant flow system the energy use, carbon impact and operating cost will be high.

The solution is to advance to a demand control ventilation (DCV) system. By adding active airflow control to the design, it is now possible to deliver just the right amount of ventilation air to achieve IAQ based on real time space use. The rest of the time, the reduced airflow will deliver improved energy usage, low carbon emissions and reduced cost. To deliver DCV, an active airflow control system is used where each zone is controlled either by an occupancy, VOC, or CO_2 sensor (See Fig. 1).

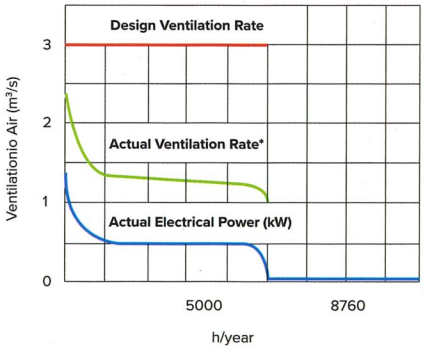

Fig. 2 *Measured Airflow Log with DCV for 1 year*

FIG. 2 shows actual ventilation airflow data and energy usage for an office building in Sweden. The system delivered the necessary IAQ while reducing the airflow on average to 42% of the design ventilation requirement resulting greatly reduced energy use, carbon impact and operating cost. Real world experience supports the demand control opportunity.

* The DCV system was sampled every hour for a year and never exceeded 76% of design airflow. For 80% of the time it averaged less than 45% of design airflow.

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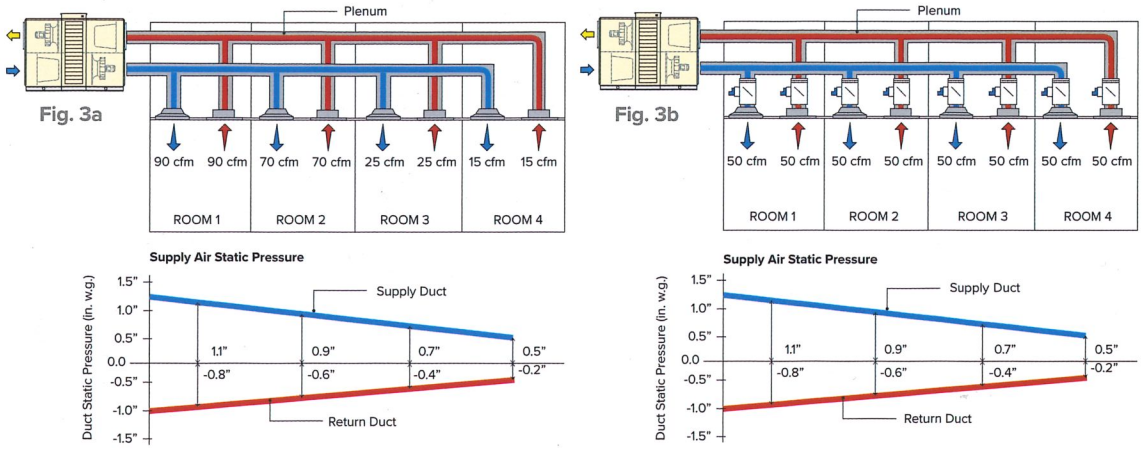
DYNAMIC BUILDING AIR BALANCE

Whether the goal is temperature, humidity or IAQ control, the result is only as good as the system's ability to get the right amount of air to the space. Fig. 3a shows how the space closest to the air handling unit will get more air than the room furthest away unless airflow control is applied. If the system is constant volume airflow, then manual balancing dampers can be used. For variable airflow, adding active airflow control the right amount of air can be delivered and extracted from each space (see Fig. 3b). Not only will this deliver the intended result (IAQ or thermal comfort) it will avoid over pressurizing the space, driving air into the building envelope and risking serious damage to the building.

Fig. 3a *Space closest to air handling unit receives more air than other rooms*

Fig. 3b *Active airflow control is applied: the right amount of air is delivered and extracted.*



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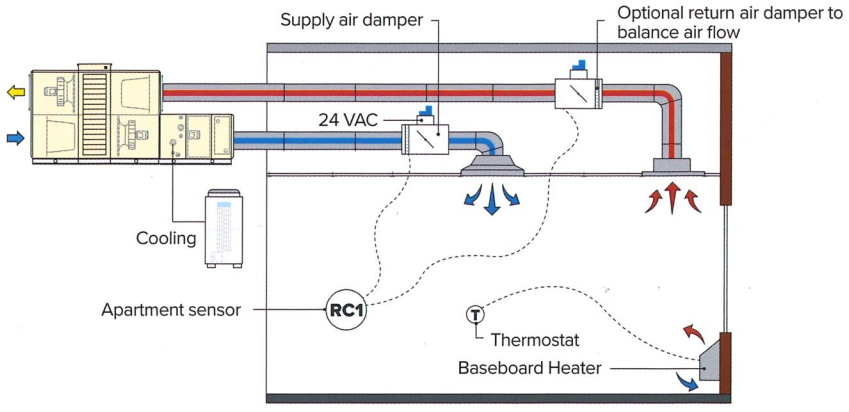
CENTRALIZED VENTILATION
IN MULTIFAMILY RESIDENTIAL BUILDINGS

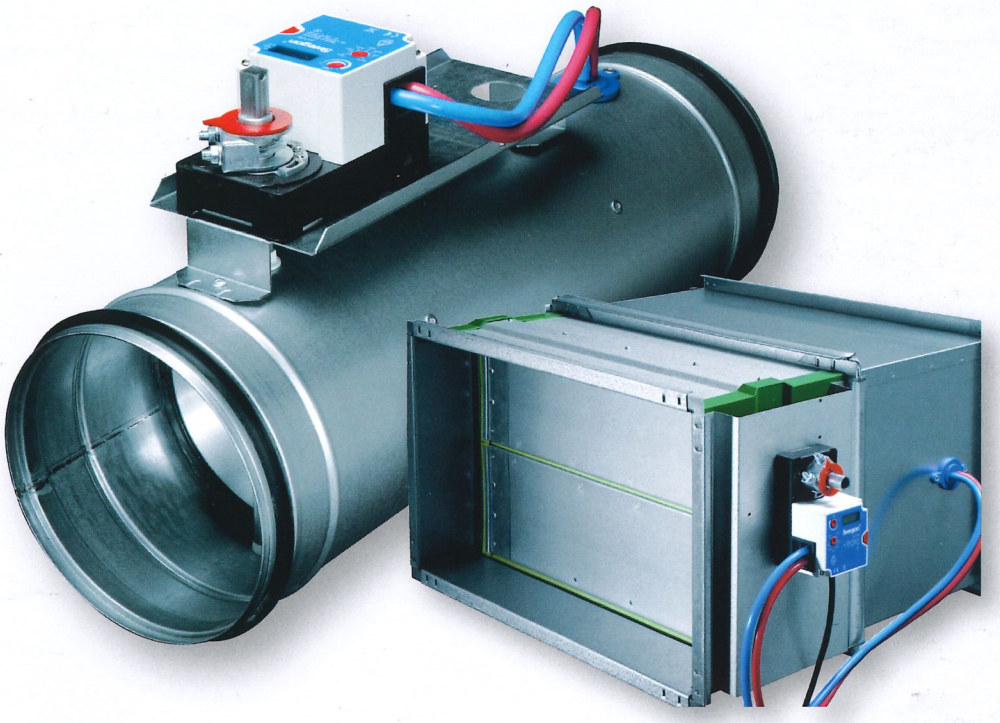
Fig. 4 *Ventilation system and controls layout for an apartment ventilation control*



Using central ventilation in multifamily residential buildings offers a more efficient system, lower maintenance/operating cost, and fewer exterior wall penetrations compared to decentralized ventilation systems. Adding active airflow control to the design approach allows:

> Set back, Normal, Boost airflow levels (20–50% above normal airflow) by apartment to enhance IAQ
> Free cooling (economizer) to reduce energy usage and improve carbon footprint by avoidance of running mechanical cooling in shoulder seasons
> Balanced airflows to manage infiltration/exfiltration
> Humidity control with a Boost Plus option with up to 100% above normal airflow

SWEGON REACT DAMPER



The Swegon React Damper is a critical component of an active airflow control system. It offers;

> Pressure independent airflow control
> An easy-to-configure unit mounted controller (no need for tools or additional software)
> Airflow monitoring
> Taps for initial airflow balancing/commissioning for airflows as low as 11 cfm at 0.15 in. w.c.
> Very low air pressure drop while maintaining high turn-down for added energy savings and reduced sound levels
> 5% airflow measurement accuracy to deliver the required airflow and meet IAQ goals

The React Damper can be used for;

> Temperature control
> Humidity control
> Demand Control ventilation (CO_2, VOC or occupancy)
> Multifamily apartment airflow control including Passive House setback-normal – Boost requirement – Also offers the option of free cooling/economizer and winter humidity spike control in air tight buildings.
> Constant airflow (in a VAV duct system)
> Constant pressure (in a VAV duct system)

The React Damper is available in;

> Round ø4 – 24 in. (11 – 6,120 cfm)
> Rectangular 6 × 6 – 48 × 28 in. × in. (50 – 16,800 cfm)

For more information on Active Airflow Design and Swegon products, visit swegonnorthamerica.com

CONTROL DAMPER BASICS

Controller

An electronic device that is programmed to command the actuator what to do based on inputs from the sensor(s). It may be stand alone or networkable (Modbus, etc.)

Sensor

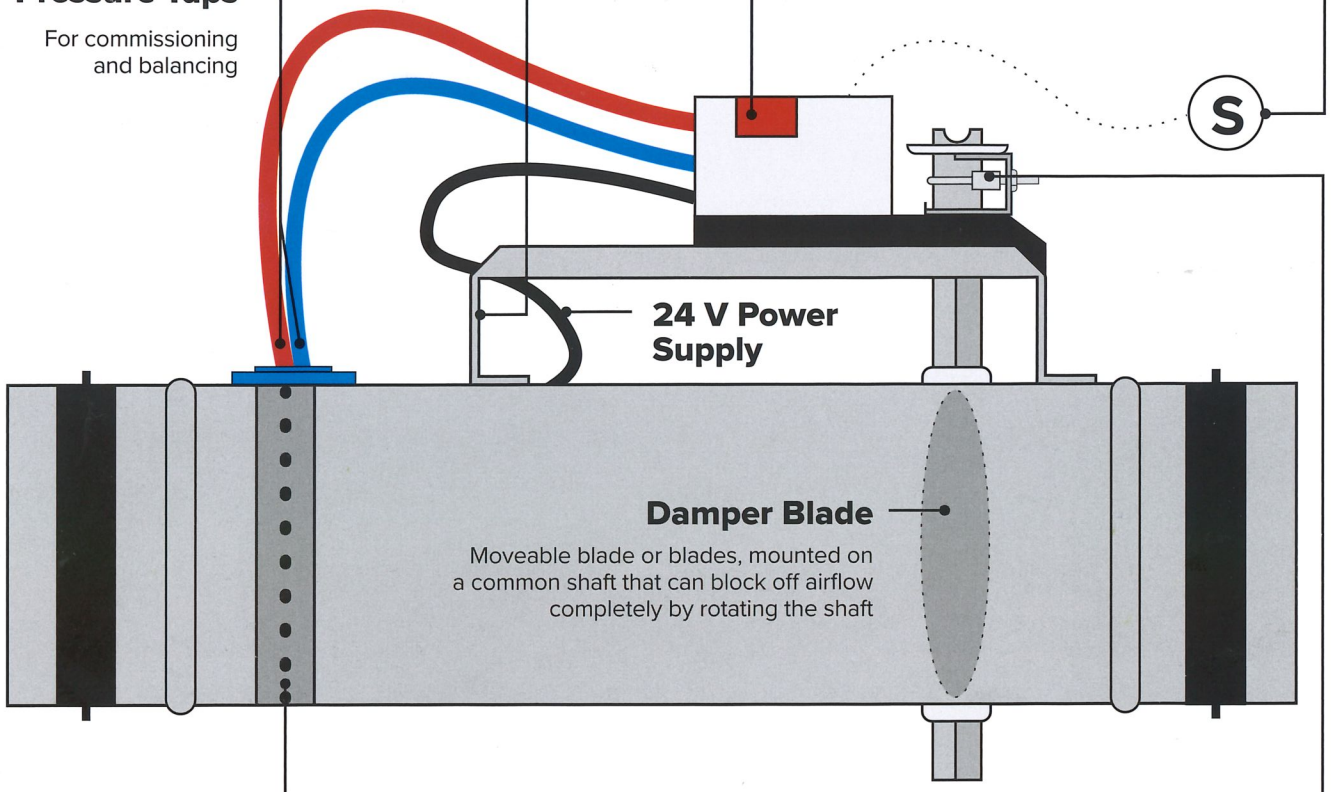
A device that will measure a specific parameter (temperature, CO_2, humidity, pressure etc.) and provide that information to the controller. These sensors can be duct or wall mounted. Most sensors will require 24 Vac power source and wiring from the sensor to the damper controller. The signal from the sensor to the controller is hardware dependent. The sensors used with React dampers use a 0-10 Vdc signal.

Bracket

Designed to mount actuator and controller. Allows damper body to be insulated without interfering with component operation.

Pressure Taps

For commissioning and balancing



Damper Blade

Moveable blade or blades, mounted on a common shaft that can block off airflow completely by rotating the shaft

Airflow Sensor

Dampers come in two main types, dependent control and independent control. For independent control dampers some form of air measuring device is required. They are typically pitot tube style so pneumatic tubing is connected to the controller which then calculates airflow.

Actuator

Electric actuator that can rotate the damper blade shaft thus opening and closing the damper. The motor must have enough torque to be able to close the damper against air pressure. The larger the damper, the larger the actuator. Dampers are typically 24 Vac but other voltages are available. In addition to power, the damper will also receive a signal to tell it how much to move. Common signals include 0-10 Vdc, 4-20 mA, 0-135 Ohm and floating setpoint control. React Dampers use 0-10 Vdc signal. As an option, actuators can include a spring which will drive the damper closed if power is interrupted.

Typical airflow control damper and its components. They can be round (shown) or rectangular in just about any size or shape.

CASE STUDY

Whistler Housing Authority
Whistler, BC

Swegon

SCOPE & SUCCESS

HVAC System and Solutions worked with their client, Whistler Housing Authority and Mechanical Engineer Pinchin Ltd. on this project which features Swegon GOLD series ERVs, a VRF heat pump system and integration with Swegon REACT Dampers. **The development consists of 24 rental apartment units to be operated by the Whistler Housing Authority.**

HIGHLIGHTS

> Exceeds the Resort Municipality of Whistler's sustainability requirements for wood frame

> Savings and operational costs due to the Swegon VAV solution

> 30% savings on equipment capital cost compared to decentralized ventilation solutions

OVERVIEW

1020 Legacy Way – Whistler, BC collaborated with Integra Architecture on an employee housing project committed to environmentally sensitive practices.

The low-rise apartment project is set to meet Passive House standards exceeding the Resort Municipality of Whistler's sustainability requirements for wood frame. The development consists of 24 rental apartment units to be operated by the Whistler Housing Authority.

! CHALLENGE

MEET (AND EXCEED) PASSIVE HOUSE STANDARDS AND SUSTAINABILITY REQUIREMENTS AS PER WHISTLER'S RESORT MUNICIPALITY'S GUIDELINES

SOLUTION

HVAC SYSTEMS AND SOLUTIONS is proud to be a part of this project. A key part of HVAC System's design included a centralized ventilation solution, including a high-performance ERV, integrated VRF post-heating and post-cooling, and control dampers.

SWEGON GOLD SERIES Passive House Certified ERV with a heat recovery ratio of +85% and VRF heat pump system with COP of 4.4 meet the building's challenging air filtration and energy targets. **SWEGON REACT DAMPERS** are integrated into the system design to provide individual suite control, cooling and heating to each suite, and a free cooling option.

RESULT

HVAC SYSTEM'S centralized ERV, VRF heat pump and REACT damper solution for Whistler Housing Authority saved 30% on the equipment capital cost compared to a decentralized ventilation solution. The VAV solution in conjunction with the centralized system has the potential to present large savings on operating cost, avoid over/under ventilation and provide cooling in each suite. Providing mechanical equipment with built-in control smooth the commissioning and balancing process for this project.

PASSIVE HOUSE: REACT DAMPER INTEGRATION WITH GOLD ERV SCHEMATIC