PRODUCT APPLICATION GUIDE | CONTROLS

SPACE AIR PRESSURE CONTROL

Properly controlling air pressure in buildings and interior spaces is critical to meet HVAC application requirements and preserve building structural integrity. A building or space with positive air pressure (space air pressure higher than ambient air pressure) pushes air out through the building or space envelope. A building or space with negative air pressure (space air pressure lower than ambient air pressure) pulls in outdoor air or air from adjacent spaces. Pressurizing a space or building to be positive or negative depends on the function and purpose of the controlled and adjacent spaces.

Most general-purpose buildings and spaces are controlled to have a slightly positive space air pressure to minimize infiltration of unconditioned air. Specialized spaces such as laboratories, operating rooms, patient rooms, and kitchens may require negative space air pressure, relative to adjacent spaces, to keep harmful contaminants and/or undesirable odors from exfiltrating beyond the specialized space.

For example, indoor swimming pool spaces are very humid and can contain chloramine gas, a corrosive byproduct of the chlorine sanitizing process. Maintaining pool spaces at negative air pressure, relative to outdoor air and adjacent space air pressures, protects pool building structures and materials from harmful condensation and corrosion, while keeping chlorine odors out of adjacent spaces.

CONTROL SPACE AIR PRESSURE BY MODULATING AIRFLOW

If the air volume entering a space is greater than the air volume leaving a space, the space air pressure will be positive. Conversely, if the air volume entering a space is less than the air volume leaving a space, the space air pressure will be negative. Accurately sensing and controlling the differential pressure between an adjacent space and/or the outdoors requires thoughtful air pressure sensor placement.

Space air pressure control may be achieved by modulating one or more of the following airflow components:

- Exhaust air fan (centralized exhaust)
- Mixing dampers
- Return air fan
- Supply air fan

IMPORTANT: When selecting airflow components to maintain space air pressure, note that each component can be driven by only one input variable.

On the following pages are three strategies for controlling space air pressure using the above components.

THREE SPACE AIR PRESSURE CONTROL SCENARIOS

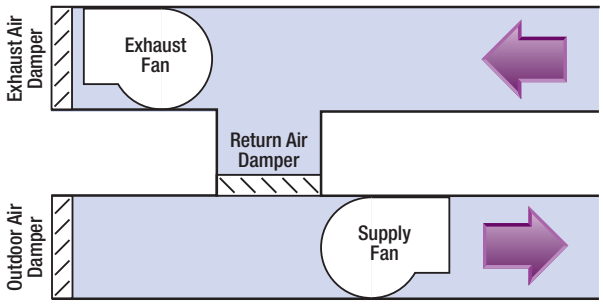
1. CONTROLLING SPACE AIR PRESSURE USING CENTRALIZED EXHAUST FAN MODULATION

Using an exhaust fan to control space air pressure is a preferred and common method that can be implemented for almost any space. While the exhaust fan independently controls space air pressure, the supply fan and outdoor air damper are still available to independently modulate the ventilation and makeup airflows as required for demand-controlled ventilation, variable air volume, or economizer operation.

Capabilities summary for this scenario:

- Space air pressure control component
  - Centralized exhaust fan
  - A majority of the space exhaust air travels through a centralized modulating exhaust fan.
- Space air pressure control capability
  - Positive
  - Negative
- Supply fan modulation
  - Constant volume or VAV
- Outdoor air damper modulation
  - 0–100% outdoor air as required for space ventilation
- Advantages
  - Space air pressure control is an independent control loop.
  - Supply fan and outdoor air damper can be controlled for DCV, VAV, or economizer operation.
- Disadvantages
  - Requires centralized exhaust. A majority of the exhaust from the controlled space must flow through the exhaust fan.

PRESSURE CONTROL BY EXHAUST FAN



Using a centralized exhaust fan to control space air pressure is a preferred and common method for almost any space. Note that the exhaust fan shown here is in the air handling unit, but it may be located elsewhere.

NOTE: If a space pressure reading is not available, airflow monitoring devices may be used. An exhaust fan may be controlled such that the exhaust cfm tracks the monitored incoming outdoor air cfm, plus (or minus) an offset. Similarly, for systems without an exhaust fan, a return fan may be controlled such that the return cfm tracks the monitored supply cfm, plus (or minus) an offset.

THREE SPACE AIR PRESSURE CONTROL SCENARIOS (continued)

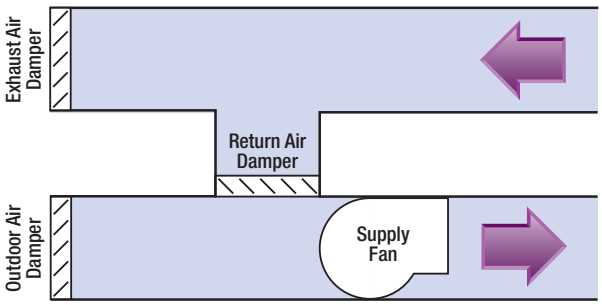
2. CONTROLLING SPACE AIR PRESSURE USING DAMPER MODULATION

In this scenario, air dampers balance space air pressure by modulating the return/recirculating air damper inversely to the OA damper. Dampers can also modulate airflow for demand-controlled ventilation or economizer operation although this may cause under-pressurization or over-pressurization of the space. Over-pressurization may require an exhaust fan to relieve the additional outdoor air brought in during economizer mode. Without an exhaust fan, this strategy cannot generate a negative space air pressure.

Capabilities summary for this scenario:

- Space air pressure control components
  - Air dampers
- Space air pressure control capability
  - Positive (without other exhaust systems)
  - Negative (with other exhaust systems)
- Supply fan modulation
  - Constant volume or VAV
- Damper configuration
  - Outdoor air damper
  - Recirculation (mixing) damper
  - Exhaust damper, which may be a gravity/ barometric damper or controlled to track the outdoor air damper
- Centralized return air configuration
  - Duct or plenum return, required

PRESSURE CONTROL BY DAMPERS



In this scenario, air dampers modulate to balance space air pressure. When used on systems with constant volume duct work, this method keeps supply airflow constant, ensuring balanced air delivery to every diffuser.

- Advantages
  - When used on systems designed with constant volume duct work, this method keeps supply airflow constant, ensuring air delivery to every diffuser as balanced (for example, when supplying air to a kitchen with a separate office at the end of a duct run, or to labs that require air distribution to all diffusers).
  - May be used to maintain negative pressure in spaces that already have exhaust air systems, such as labs or kitchens
- Disadvantages
  - Can only maintain negative space air pressure when there is a separate exhaust system serving the same space

NOTE: If a space pressure reading is not available, airflow monitoring devices may be used. An exhaust damper may be controlled such that the exhaust cfm tracks the monitored incoming outdoor air cfm, plus (or minus) an offset.

THREE SPACE AIR PRESSURE CONTROL SCENARIOS (continued)

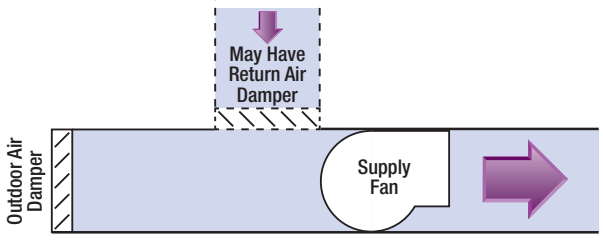
3. CONTROLLING SPACE AIR PRESSURE USING SUPPLY FAN MODULATION

Supply fan modulation is often used to control space air pressure with DOAS (dedicated outdoor air) applications. Typically, the purpose of this outdoor airflow is to meet code-required ventilation requirements, CO_2 demand control, or to replace (make up) exhausted air, such as in kitchens or labs.

Capabilities summary for this scenario:

- Space air pressure control component
  - Modulating supply fan
- Space air pressure control capability
  - Positive
  - Negative (when used with other exhaust systems such as lab fume hoods or kitchen exhaust hoods)
- Centralized unit return fan or exhaust fan configuration
  - None
  - May have a return/recirculating air damper used to conserve energy when the space is unoccupied
- Damper configuration
  - 100% outdoor air for ventilation or makeup air (during occupied periods)
- Advantages
  - Used for specific applications such as labs or kitchens that have variable exhaust airflow systems (independent of the AHU) with no other spaces served by the DOAS supply ductwork. In these configurations, the supply fan provides makeup air to balance exhaust airflows and maintain a positive or negative space air pressure.
  - If serving a single space, or when serving a smaller space, the tendency for a modulating supply fan to dump air out the first few diffusers may not be a concern, thus allowing the energy savings generated by a modulating supply fan to be realized.
- Disadvantages
  - When used with systems designed with constant volume duct work, this method varies the supply airflow and cannot ensure air delivery to every diffuser as balanced. Air dumping may occur at the first few diffusers in the line and supply air may not make it to the end of the duct run.

PRESSURE CONTROL BY SUPPLY FAN



Controlling space air pressure by modulating the supply fan is often used with DOAS (100% outdoor air) applications.