CONAIRE™

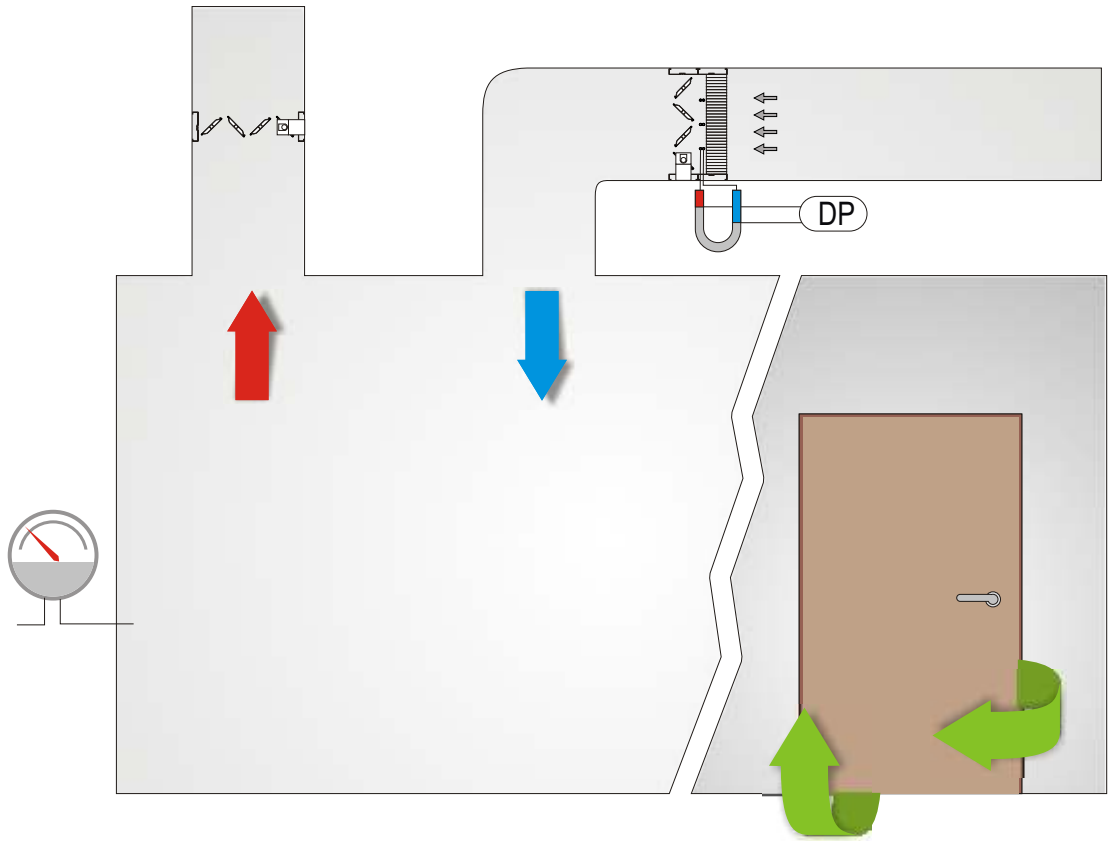
Conaire Knowledge Series Papers 15

CONTAMINATION CONTROL THROUGH ROOM PRESSURISATION

Proper room pressurisation is critical for preventing unwanted air transfer. In chemical and biological research facilities chemical fumes and airborne biological agents must be prevented from migrating out of laboratory rooms to non-laboratory areas. Air must be prevented from flowing into spaces that require a high degree of cleanliness and purity, such as food and drug processing operations. The absence of airborne particulate is especially critical for microelectronics and optical manufacturing. Proper room pressurisation is vital for protecting the medical staff and patients from exposure to harmful and sometimes deadly airborne pathogens in treatment facilities.

A. PRESSURISATION AND DIRECTIONAL AIRFLOW

The potential direction of air transfer is always from an area of higher static pressure (termed the positively pressurised area) to an area of lower static pressure (referred to as a negatively pressurised area). The difference between the static pressure of two rooms or spaces is commonly referred to as the differential pressure.

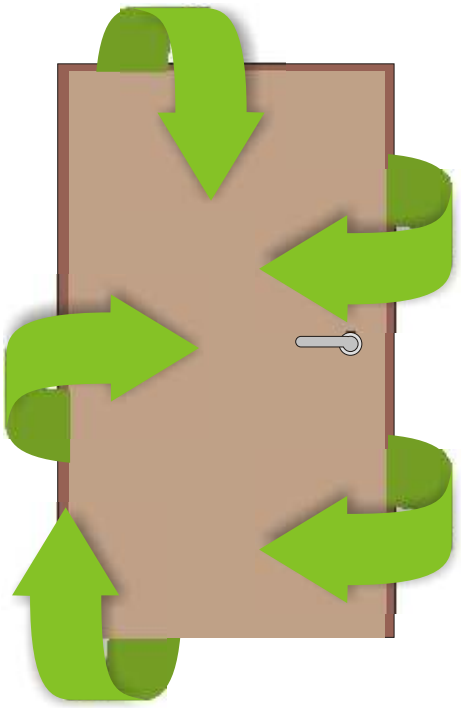


B.
LEAKAGE AREA

Although the positive or negative pressurisation relationship between spaces establishes the potential for air transfer or airflow, there must be an opening between the spaces for airflow to actually occur.

Typically, such openings are the combination of unintentional construction related gaps created by the transverse of mechanical components (pipes, electrical conduit, ventilation ducts, etc.) and the necessary clearance openings around doors. All of these openings are cumulatively referred to as a room's leakage area.

If there is absolutely no leakage area (a room is totally and perfectly sealed off) then no airflow takes place, even though a differential pressure exists between the room and its adjacent space. However, except for extreme situations (such as a Biological Level 4 Laboratory), there is little reason to try to attain a perfect seal or barrier between most pressurised spaces. Personnel typically need to freely enter and leave, and materials often need to be transported into and out of such spaces. Thus, a perfect seal or barrier is not a practical solution for the prevention of unwanted air transfer. This is the fundamental reason for maintaining a differential pressure relationship; it is the most practical way to prevent unwanted air transfer. The required differential pressure relationship is created and maintained by a properly designed and controlled ventilation system.



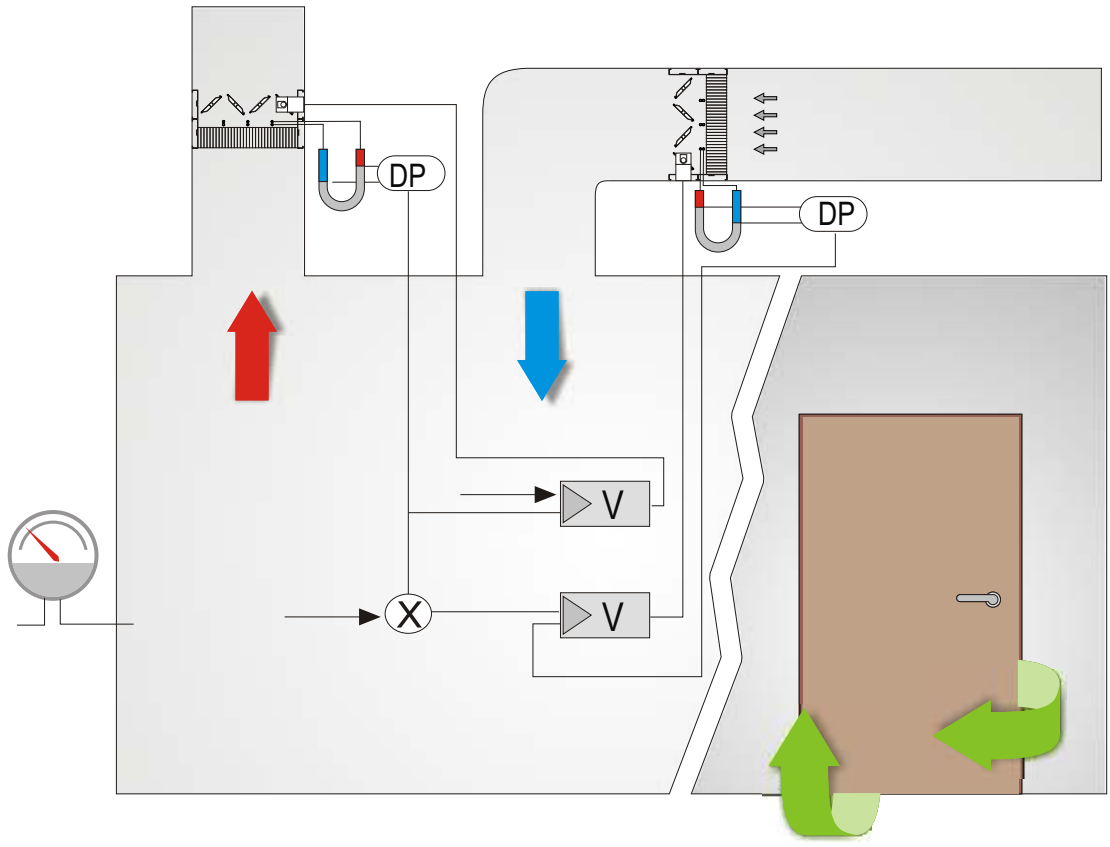
CONTROL METHODS

The most commonly used control methods to provide proper pressurisation in rooms are the Volumetric Flow Tracking Control Method, Differential Pressure sensing Control Method and Cascade Control Method. Each of these methods is described as under::

1. VOLUMETRIC FLOW TRACKING CONTROL

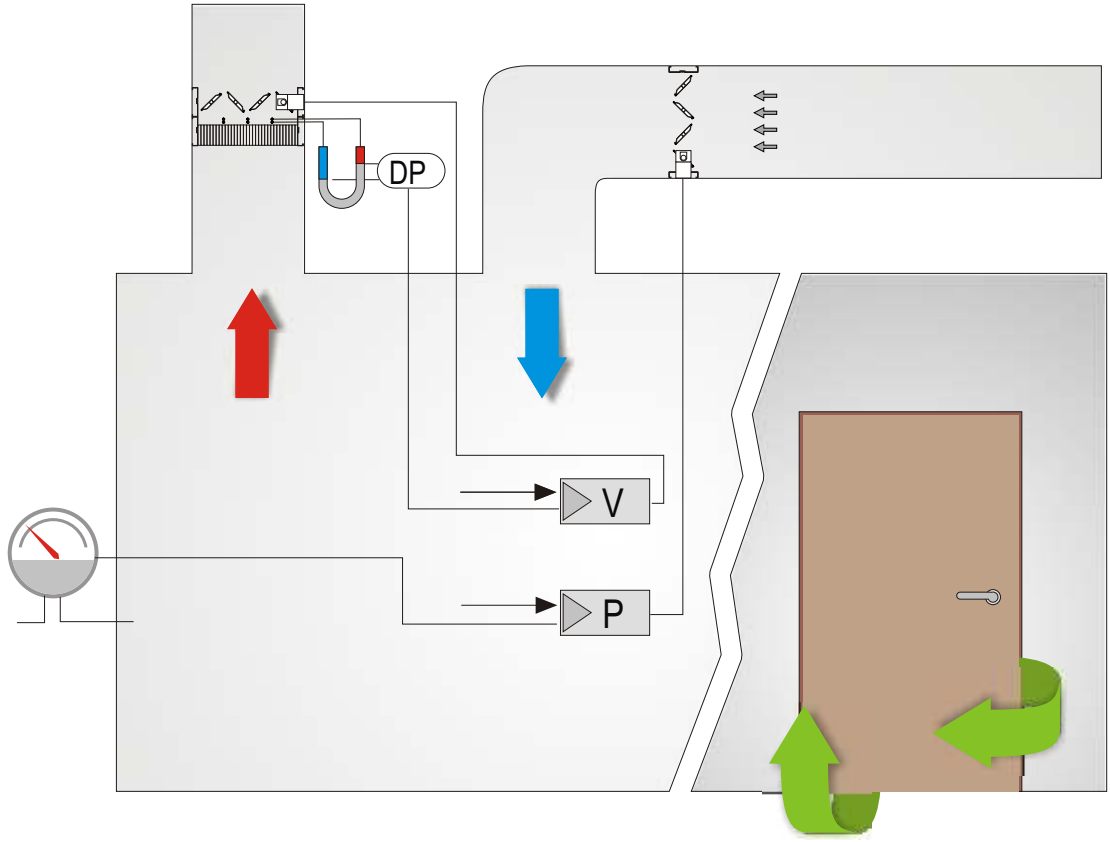
It maintains the desired differential pressure relationship between rooms or spaces by maintaining a specific difference (termed the Airflow Tracking Offset) between the air supplied to and the total amount of air exhausted from a room or space.

In this technique accurate volumetric flow measurement is made using Conaire's lab management VAQ station in HVAC ductwork which features advanced control and motorised assembly to achieve ultra rapid control (less than 3 seconds) which is required to attain stable pressurisation values when fume hood sash is opened.



2. DIFFERENTIAL PRESSURE SENSING CONTROL

In the Differential Pressure Sensing Control Method the desired differential pressure relationship between rooms or spaces is maintained by adjusting the air supplied to the room and the total amount of air exhausted from the room or space by employing a quick response motorised volume control damper in HVAC ductwork and a differential pressure sensor that is installed in room.



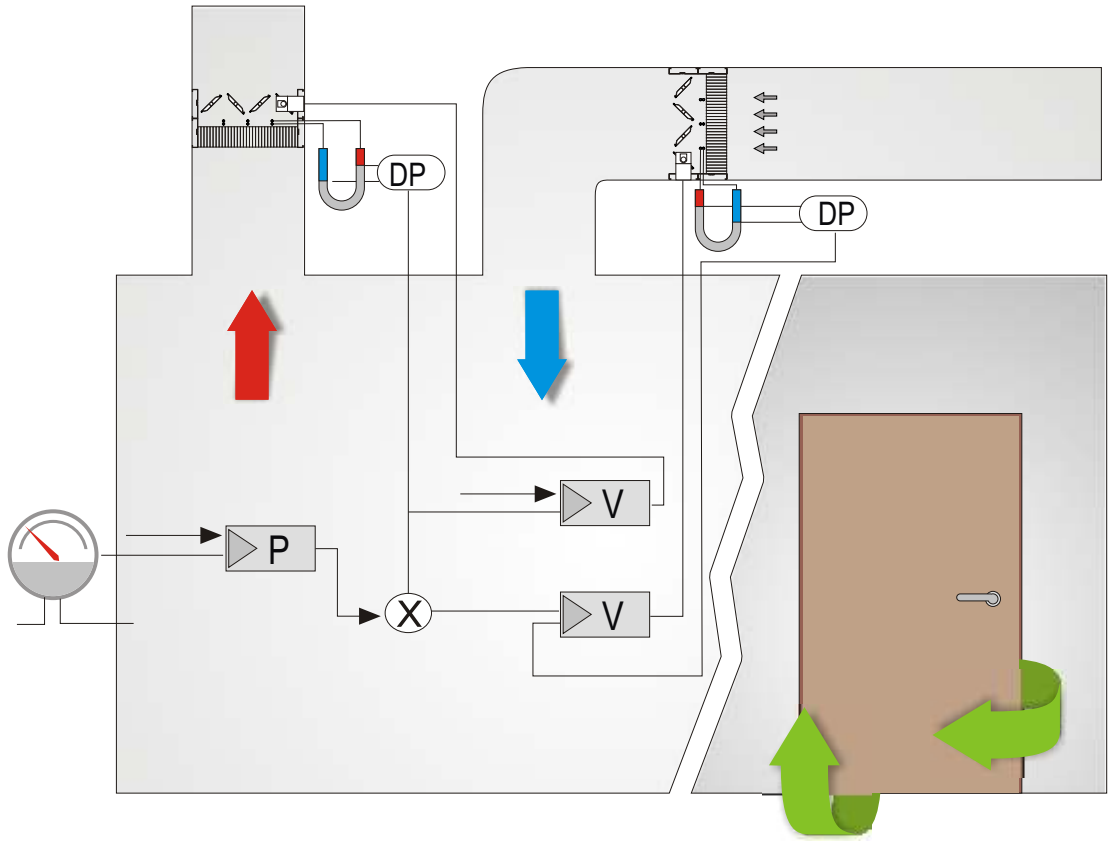
3. CASCADE CONTROL

This method combines the control functionality of both volumetric airflow tracking and differential pressure sensing. In this technique Conaire's lab management VAQ station is used with differential pressure sensors.

Although flow tracking is the preferred method for maintaining laboratory room pressurisation and ensuring fast fume hood response, there may be valid reasons to ensure that a specific

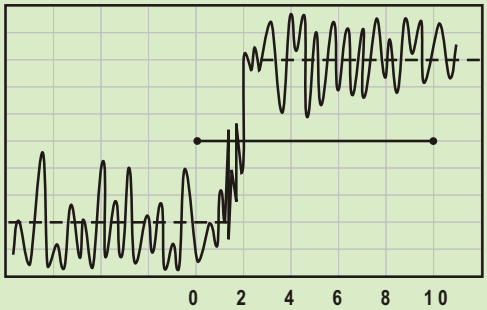
room differential pressure level is maintained. When this is necessary, cascaded pressure control can be applied to retain the superior speed and stability of airflow tracking and also ensure that the desired differential pressure value is maintained.

This control arrangement will compensate for differential pressure variations that might occur over the long term.



COMPARISON OF TIME NEEDED TO OBTAIN NEW VALUES AFTER ROOM AIRFLOW CHANGE

ROOM DIFFERENTIAL PRESSURE



DUCT AIRFLOW MEASUREMENT