PADDECO

Components, Concepts & Types of Ventilation

Components, Concepts and Types of Ventilation

What is Ventilation?

Ventilation moves outdoor air into a building or a room, and distributes the air within the building or room. The general purpose of ventilation in buildings is to provide healthy air for breathing by both diluting the pollutants originating in the building and removing the pollutants from it

All of the fans, vents, ductwork and ventilation equipment together makes up a “ventilation system” to exchange indoor and outdoor air without wasting energy. Ventilation systems: exhaust, supply, balanced, and heat-recovery.

What Are the Different Types of Building Ventilation Methods?

Good ventilation is essential in any building. Without proper ventilation, air becomes stale and stagnant, which can cause everything from illness to damaged building contents because of humidity and improper temperature.

Purchasing the proper ventilation system that is installed by heating, ventilation, and air conditioning consultants is essential to have the benefits of proper air circulation that produces clean air.

Understanding Ventilation

Proper ventilation is important because airflow in a building affects so many things. Since buildings are closed-in spaces, natural ventilation is often prohibited; therefore, artificial ventilation must be installed to aid the flow of air.

There are various ways to achieve the best ventilation; each space must be considered individually, based on the type of building, its location, and any current airflow problems.

So it is important to work with technicians who are experts in the field of ventilation, since only the best commercial heating, ventilation, and air conditioning company will understand these systems and the difficulties that may be encountered to obtain the best ventilation. They also know any solutions available to remedy problems that are found.

What are the types of Ventilation?

- Natural Ventilation.
- Mechanical Ventilation.

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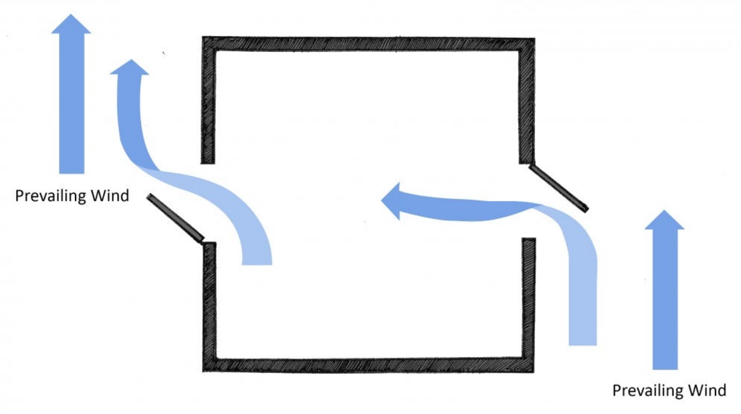
What is Natural Ventilation?

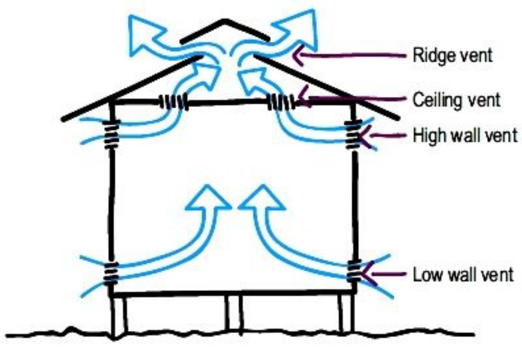
In case of natural ventilation, the air movement is caused by two factors:

- The difference between indoor and outdoor temperature
- Wind.

The bigger the both factors are the more intensive is the air change in rooms. This means that in colder weather conditions the rooms and the building is often over-ventilated and in warmer and windless weather, there is a lack of fresh air. As both of these factors are directly dependent on the external climate, the system is considered to be a non-controllable system. Users of the building cannot change the air volume rate no more than by switching it ON or OFF; this means by opening and closing the exhaust grilles.

Natural Ventilation uses forces of nature for most of ventilation (e.g. winds and thermal buoyancy force due to indoor and outdoor air density differences) drive outdoor air through purpose-built, building envelope openings. Purpose-built openings include windows, doors, solar chimneys, wind towers and trickle ventilators. This natural ventilation of buildings depends on climate, building design and human behaviour.





variety of ways to increase convection in the house and roof space.

What is Mechanical Ventilation?

Mechanical Ventilation is driven by Mechanical fans.

Fans can either be installed directly in windows or walls, or installed in air ducts for supplying air into, or exhausting air from, a room. For example, a circulation system such as a ceiling fan, which creates internal air movement, but does not introduce fresh air.

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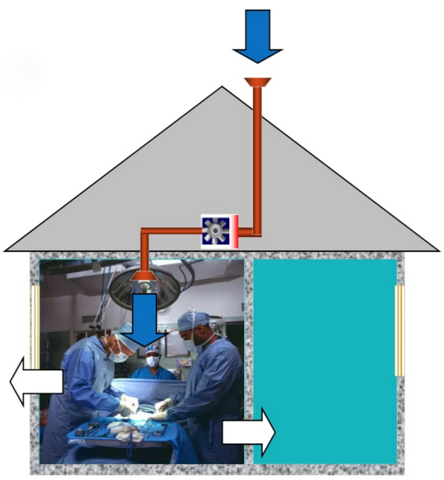
Ceiling Fan

The type of mechanical ventilation used depends on climate. For example, in warm and humid climates, infiltration may need to be minimized or prevented to reduce interstitial condensation (which occurs when warm, moist air from inside a building penetrates a wall, roof or floor and meets a cold surface). In these cases, a positive pressure mechanical ventilation system is often used in which fresh outside air is blown into the building by inlet fans, creating a higher internal pressure than the outside air.

Conversely, in cold climates, exfiltration needs to be prevented to reduce interstitial condensation, and negative pressure ventilation is used. For a room with locally generated pollutants, such as a bathroom, toilet or kitchen, the negative pressure system is often used.

In a positive pressure system, the room is in positive pressure and the room air is leaked out through envelope leakages or other openings. In a negative pressure system, the room is in negative pressure, and the room air is compensated by “sucking” air from outside.

Positive Pressure System



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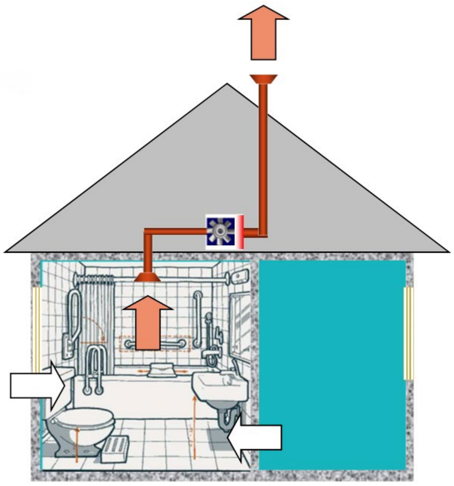
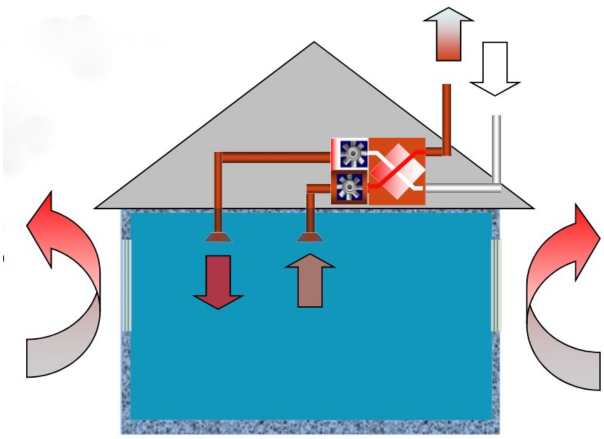
What is a vacuum system?

A vacuum system (negative pressure system), in which stale internal air is extracted from the building by an exhaust fan, creating lower pressure inside the building than the outside air.



What is a balanced system?

A balanced system that uses both inlet and extract fans, maintaining the internal air pressure at a similar level to the outside air and so reducing air infiltration and draughts.



What is heat recovery?

Heat recovery is a process of continuously preheating incoming cool supply air by warming it with the outgoing exhaust air. Warm air is not simply exhausted to outside. Highly efficient heat exchangers transfer a larger percentage of heat energy to incoming supply air.

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A Mechanical Heat Recovery Ventilation (MVHR) system offers a solution by bringing fresh air into all habitable areas without letting the heat escape.

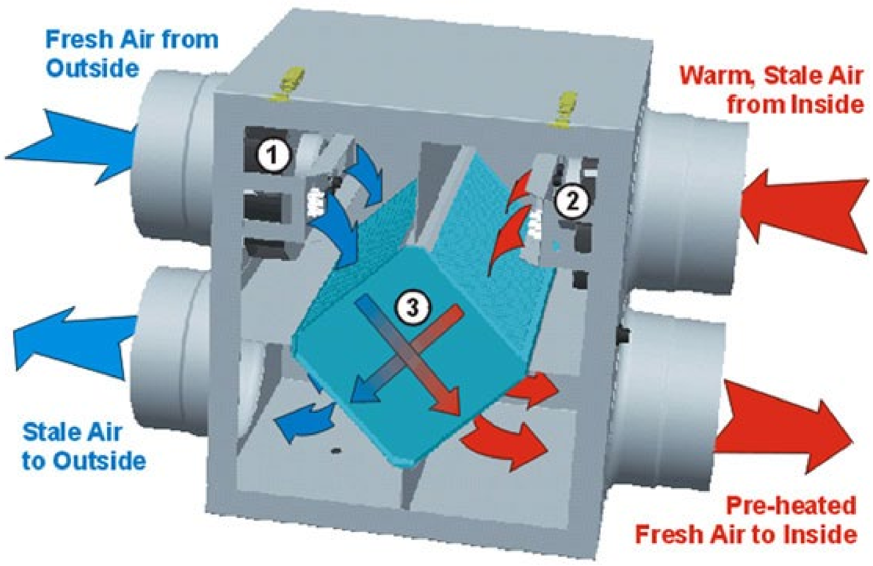
Stale air contaminated with humidity, toxins and smells is extracted from grilles in toilets and wet rooms. Areas such as bathroom, en-suite, utility rooms and kitchens allows a constant or demand oriented air flow volume to be extracted.

Fresh air is fed directly from outside into the ventilation system initially through a filter, then the heat taken from the extracted air is used to warm the fresh filtered air in the heat exchanger and then enters the ducting system. By continuously supplying preheated air into living areas and extracting contaminated air from wet rooms, you create a whole house ventilation system. Air is allowed to circulate from supply air rooms to rooms with extract via undercuts on all internal doors and / or by the use of transfer grilles.

With the increasing number of new builds and refurbishments to a high standard of insulation together with new legislation, there is an increase demand for the use of heat recovery products.

This demand is now greater than even before to provide improved indoor air quality and save energy.

Heat Recovery System:



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Air handling unit (AHU)

An air handler, or air handling unit (often abbreviated to AHU), is a device used to regulate and circulate air as part of a heating, ventilating, and air-conditioning (HVAC) system.

Air handling units can be supplied in a range of sizes, and with a variety of capabilities, but typically they comprise an insulated box that forms the housing for; filter racks or chambers, a fan (or blower), and sometimes heating elements, cooling elements, sound attenuators and dampers (that can be operated manually or automatically to regulate or prevent specific air flows). In some situations, such as in swimming pools, air handling units might include dehumidification.

In commercial developments, mechanical ventilation is typically driven by air handling units (AHU) connected to ductwork within the building that supplies air to and extracts air from interior spaces. Typically AHU comprise an insulated box that forms the housing for; filter racks or chambers, a fan (or blower), and sometimes heating elements, cooling elements, sound attenuators and dampers. In some situations, such as in swimming pools, air handling units might include dehumidification.

Attenuators

(SILENCERS) reduce noise produced by fan units and other equipment within Heating, Ventilating and Air Conditioning (HVAC) systems. Generally mounted within the system's ductwork, they ensure that a specific noise criteria is achieved within the internal or external areas served.

Diffusers

Directs the air flow and reduces the velocity of the air.
Air diffuser: a circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes, and arranged to promote mixing of primary air with secondary room air.

Actuators

Is the control for a motorised damper.
An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system. An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.

Variable Air Volume (VAV

Variable Air Volume (VAV) is a type of heating, ventilating, and/or air-conditioning (HVAC) system. Unlike constant air volume (CAV) systems, which supply a constant airflow at a variable temperature, VAV systems vary the airflow at a constant temperature.

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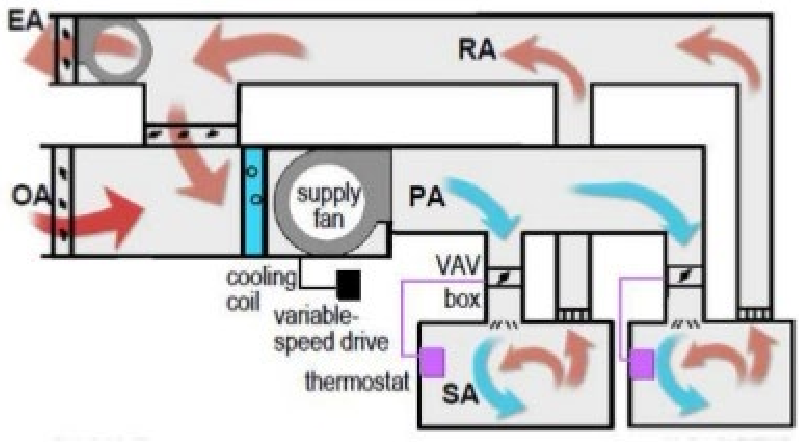
The advantages of VAV systems over constant-volume systems include more precise temperature control, reduced compressor wear, lower energy consumption by system fans, less fan noise, and additional passive dehumidification.

VAV AIR CONDITIONING SYSTEM



<u>A Fan Coil Unit (FCU)</u> is a simple device consisting of a heating and/or cooling heat exchanger or 'coil' and fan. It is part of an HVAC system found in residential, commercial, and industrial buildings.

Typically, a fan coil unit is not connected to ductwork, and is used to control the temperature in the space where it is installed, or serve multiple spaces. It is controlled either by a manual on; off switch or by thermostat.

<u>Types of fan coil units</u>

1. Two-pipe fan coil units:

Two-pipe fan coil units have one supply and one return pipe. The supply pipe supplies either cold or hot water to the unit depending on the time of year.

2. Four-pipe fan coil units:

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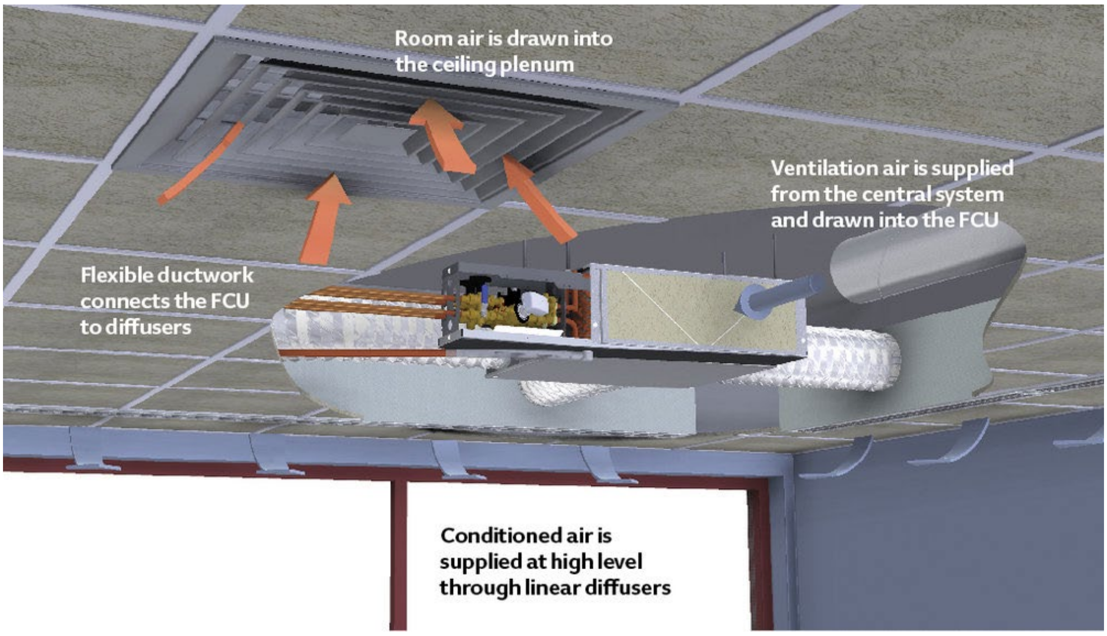
Four-pipe fan coil units have two supply pipes and two return pipes. This allows either hot or cold water to enter the unit at any given time. Since it is often necessary to heat and cool different areas of a building at the same time, due to differences in internal heat loss or heat gains, the four-pipe fan coil unit is most commonly used.



Local Exhaust Ventilation

The definition of a **local exhaust ventilation** (LEV) system is: an engineering control system to reduce exposures to airborne contaminants such as dust, mist, fume, vapour or gas in the workplace. Simply put it is something that sucks an airborne contaminant out of the workplace.

A local exhaust system that extracts local sources of heat or contaminants at their source, such as cooker hoods, fume cupboards and so on.

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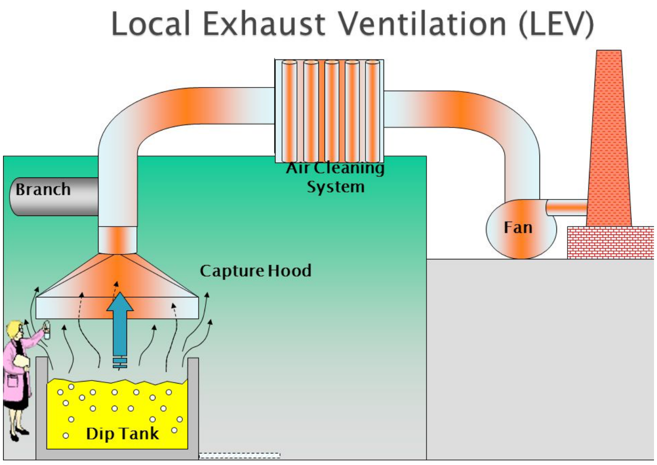

Most systems consist of the following:

• **Hood** – where the contaminant enters the LEV
• **Ducting** - to transport the contaminant and air
• **Fan** – To power the system • Discharge – To release extracted air to a safe place
• **Air cleaner or arrestor** – to filter or clean the extracted air (not all systems have this type)

Types of LEV System

There is a huge variety of LEV systems that differ in shape and size.
The main types of system are as follows:

- Total Enclosure – the process is totally enclosed and the air extracted from the enclosure e.g. glove boxes/blasting cabinets/ CNC machines
- Partial Enclosure – the process is not totally enclosed and the operator can access the process. Air is pulled passed the operator and into the enclosure e.g., spray booths and milling machines
- Capture Hoods – the process is not enclosed by the system; the contaminant is pulled into the system e.g. ventilated bench, down draft table, welding extract, solder tip extraction, low level room extraction for liquid nitrogen areas or solvent stores, integrated extraction on equipment such as saws and sanders
- Receiving Hoods – the process is not enclosed by the system; the process provides the energy to deliver the contaminant to the hood e.g. canopy hoods over furnace or oven

Air Changes

Air changes per hour, or air change rate, abbreviated ACH or ACPH, is a measure of the air volume added to or removed from a space (normally a room or house) divided by the volume of the space.

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How to calculate air changes per hour?

In plain English, we're changing CFM into Cubic Feet per Hour (CFH). Then we calculate the volume of the room by multiplying the room height times the width times the length. Then we simply divide the CFH by the volume of the room.

Here's an example of how a full formula works:
Now, compare 7.5 air changes per hour to the required air changes for that type of room on the *Air Changes per Hour Table below*. If it's a lunch or break room that requires 7-8 air changes per hour, you're right on target. If it's a bar that needs 15-20 air changes per hour, it's time to reconsider.

Application	Air changes per hour
Banks	4 to 6
Cafes/Coffee Bars	10 to 12
Cellars	3 to 10
Changing Rooms	6 to 10
Cinemas/Theatres	6 to 10
Conference Rooms	8 to 10
Dance Halls	10 to 12
Dark rooms	10 to 15
Dental Surgeries	12 to 15
Entrance Halls	3 to 5
Factories/workshops	8 to 10
Garages	6 to 10
Gymnasiums	6 to 8
Hospital Wards	6 to 8
Kitchens – commercial	15 to 30
Laundries	10 to 15
Libraries	3 to 4
Offices	4 to 6
Public House Bars	6 to 10
Restaurants	10 to 15
Schoolrooms	4 to 6
Shops/supermarkets	8 to 10
Showers/Bathrooms	15 to 20
Stores/Warehouses	3 to 6
Swimming Baths	15 to 20
Toilets – public	6 to 8
Utility rooms	15 to 20

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Damper

A damper is a valve that stops or regulates the flow of air inside a duct, VAV box, air handler, or other air handling equipment. A damper may be used to cut off central air conditioning (heating or cooling) to an unused room, or to regulate it for room-by-room temperature and climate control.

Its operation can be manual or automatic. Manual dampers are turned by a handle on the outside of a duct. Automatic dampers are used to regulate airflow constantly and are operated by electric or pneumatic motors, in turn controlled by a thermostat or building automation system.

Automatic or motorized dampers may also be controlled by a solenoid, and the degree of air-flow calibrated, perhaps according to signals from the thermostat going to the actuator of the damper in order to modulate the flow of air-conditioned air in order to effect climate control.

Pressure Classifications

Duct systems are often divided into three pressure classifications:

- **Low Pressure Systems** - where fan static pressures are less than 3 in WC (750 Pa) and duct velocities in general less than 1500 fpm (7.5 m/s)
- **Medium Pressure Systems** - where fan static pressures are in the range 3 to 6 in WC (750 - 1500 Pa) and duct velocities in general less than 2500 fpm (12.5 m/s)
- **High Pressure Systems** - where fan static pressures are in the range 6 to 10 in WC (1500 - 2500 Pa) and duct velocities in general less than 4000 fpm (20 m/s)

Medium pressure classification is commonly used for primary main ductwork like fan connections, risers and main distribution.

Low pressure classification should be used for secondary ductwork like runouts and branches from main ducts to end terminals.