ACTIVE VENTILATION SYSTEMS
PASSIVENT ACTIVE VENTILATION

Combining the advantages of natural and mechanical ventilation.

Passivent Active Ventilation uses the sound principles of natural ventilation combined with mechanical assistance and intelligent control. This combination gives very effective and energy-efficient ventilation throughout the year and in all weather conditions.

The Active Range of products has been especially developed for the Priority Schools requirement to mix the air before it is introduced to the room. In the output specification for the Priority School Building Programme PFI projects it states 2.8.43. (pg 67) Environmental Requirements ‘In naturally ventilated spaces, the Contractor shall provide mixing of ventilation air with room air to avoid cold draughts in the occupied zone during wintertime’ This allows operation throughout the year with reduced risk of cold draughts.

- Allows high levels of air movement to reduce overheating when required in hot weather
- Recovers heat from exhaust air in recirculation mode during cold weather
- Energy efficient – minimal energy use
- Controlled through an intelligent control system
- Simple and easy to integrate within the building
- Reduced capital and running costs compared with mechanical only systems
- Suitable for commercial, educational and similar buildings

Three operating modes:

Natural mode
For most of the year, Active Ventilation works on the natural ventilation principles of wind and convection. No energy is used for ventilation.

Boost mode
In high summer temperatures, boost fans operate to provide high levels of air movement, bringing more fresh air into the building and removing warm air. The building can be adequately ventilated and cooled even on hot days with no wind.

Recirculation mode
In cold winter temperatures, the fans bring in fresh air and temper it by mixing with the warm air already in the building. This reduces heat losses and provides more comfortable conditions.

This mode can also be used to provide night cooling in hot weather.

Two main Passivent Active Systems:

Atrium Systems
Where rooms are ventilated via an atrium using Active Atrium Transfer units; see pages 6 - 7.

Single Space Systems
Where a single large space is ventilated via Active Roof Terminals; see pages 8 - 9.
THE NEED FOR VENTILATION

All buildings need some form of ventilation. For commercial and similar buildings the requirement of the ventilation system is to remove excess CO₂ from the air, and ensure that the building does not get too warm and cause the occupants to overheat. In short, the main aim is to promote good indoor air quality.

**Air Quality**
Excess CO₂ in the air can cause occupants to feel tired, nauseous and even lead to headaches. These effects can reduce the ability of the occupants to work or learn, depending upon the use of the building.

**Overheating**
Getting the right temperature of the building is important; a hot building can lead to occupants feeling stuffy, making them sweat and feel uncomfortable, and even lead to them overheating. This again reduces the effectiveness of the work or learning and can have physiological repercussions.

**Ventilation Design**
A suitably designed ventilation system can address both concerns and can help to maintain set levels of both temperature and CO₂ within a building. It will allow sufficient fresh air in to dilute CO₂ concentration, and can allow cool air in when required to help reduce the internal temperature.

Of course, it is relatively simple on paper to provide a permanent supply of fresh air through apertures in the building, so that there is always fresh air for diluting CO₂ and reducing temperature. In reality however this uncontrolled ventilation is not practical as it will require the heating system to work harder than necessary in the winter, using more energy.

**Efficient Ventilation**
A ventilation system should allow controlled amounts of air in and out of the building, using as little energy as possible, whilst allowing the rates of air flow to be adjusted depending upon the conditions. The three main elements are:

- Efficient products using minimal energy
- Intelligent controls to only allow the right amount of air in and out
- Effective design, looking at all of the building’s requirements: design, use and occupancy
Passivent Active Ventilation combines the sound principles of natural ventilation with mechanical assistance and intelligent control. It provides more effective ventilation whilst also enhancing energy efficiency.

WHAT IS ACTIVE VENTILATION?

Natural ventilation

Uses no energy to move the air and works on the natural forces of wind and convection. Fresh air is brought in through the façade of the building or through roof terminals, is moved naturally through the building and finally exhausted, usually at high level through louvres.

It is usually controlled by an intelligent control system which regulates how much air is brought in and exhausted through controllable dampers.

Advantages and disadvantages

+ Energy efficient – minimal energy use
+ Can be controlled through intelligent control system
+ Minimal noise issues as no mechanical plant
+ Simple and easy to integrate within the building
+ Difficult to move high levels of air in summer months
+ Does not allow recovery of heat, so hot air is exhausted directly outside

Features & Benefits

- Low power fan uses minimal energy only when required during peak summer and low winter temperatures
- Energy bills can be reduced through saved heating and cooling costs whilst the system operates in mechanically assisted modes
- Three operating modes allow the most energy efficient mode to be used as and when necessary
- Two systems allow the Active strategy to be used in different building layouts and types
- Intelligent controller ensures the system runs in the correct mode according to factors such as CO₂ concentrations, internal and external temperatures
- Based primarily on natural ventilation strategy so does not require large and costly mechanical plant
- Recirculation mode mixes the incoming air to minimise the risks of cold draughts in winter

Typical Mechanical Supply / Exhaust System

Fresh air is supplied and exhausted from the room through a network of supply and exhaust ducting, mechanical plant and terminals.

The system boosts when required to regulate the flow of air for the space. Sometimes a heat recovery fan system is used to recover the energy from the exhaust air.

Advantages and disadvantages

+ Can allow high levels of air movement
+ Can be used with heat exchanger to recover heat
+ Can use significant amount of energy, leading to higher running costs
+ Noise from plant can cause disturbance
+ Can be difficult to incorporate ducting and sizeable plant
+ Requires maintenance leading to increased running costs
+ Higher capital costs against natural ventilation

Passivent Active Range

Combines the advantages of natural ventilation with the advantages of mechanical ventilation; a ventilation solution which uses minimal energy yet can provide high levels of air movement during summer periods. Can also be used in re-circulation mode in the winter to recover heat by mixing the incoming air.

Advantages

+ Can allow high levels of air movement
+ Can be used to recover heat in re-circulation mode
+ Energy efficient – minimal energy use
+ Can be controlled through intelligent control system
+ Simple and easy to integrate within the building
+ Reduced capital and running costs against mechanical systems
Active Atrium Transfer
A unique system which not only offers the flexibility of the Active range, providing the three operating modes, but also includes SoundScoop technology to reduce the noise transfer between rooms. The Active Atrium Transfer unit is designed for use in buildings with atria. It can be demonstrated to meet the Acoustic requirements of BB93.

The system is designed so that each room adjoining the atrium, such as a classroom, has two Active Atrium Transfer devices to achieve acoustic guidelines and airflow capacity, so meeting the relevant requirements.

Three operating modes
The system uses one of three operating modes depending on the needs of the building and outside temperatures.

Mode 3 is not always needed as Mode 1 can be used in winter with a CO2-controlled and well positioned façade inlet.

Mode 1 Natural
Most of the year
In mid-season temperatures, fresh air from outside enters the room through façade inlets. The air is warmed by occupants and equipment in the rooms and is drawn naturally through the Active Atrium Transfer unit, exhausting through outlets at the top of the atrium which acts as a passive stack. Operates for the majority of the time using the high capacity flow rate of the units. This mode enables control over indoor air quality and temperatures.

Mode 2 Boost
Peak summer temperatures
During peak temperatures, façade inlets are left open to allow fresh air to enter the room. The air is then extracted through the Active Atrium Transfer unit, running boost fans if required. This mode can be manually selected by the occupant. This mode allows the ventilation rate to be boosted to control peak summer time temperatures.

Mode 3 Recirculation
Low winter temperatures; also for summer night cooling
Operates when outside temperatures are low and façade inlets are closed. The fans in the Active Atrium Transfer units (two in each room) operate in opposite directions, one drawing in fresh tempered mixed air from the atrium, the other extracting warm CO2-laden air from the room. The atrium is ventilated to maintain a source of good indoor air quality for the rooms.

This mode ensures good air quality, reduces the risk of draughts and reduces the load on the heating system. It can also provide secure night cooling ventilation.
Case construction
Marine grade structural timber.

Acoustic performance
Independently tested to BS EN 20140-10:1992 and ISO 140-10:1991, and can be shown to comply with Building Bulletin 93 and the Priority School Acoustic Specification.

Installation
Positioned between the atrium and adjoining rooms. Can be installed through a bulkhead or plasterboard ceiling, or where there is a suspended ceiling using the adjustable ceiling adaptor.

Recommended fixing: to soffit with brackets supplied.

---

**Features & Benefits**

- Low energy boost fan uses minimum energy when compared to mechanical systems
- Re-circulation mode reduces heating energy used, saving energy costs
- High level inlet in winter reduces the potential for perceived draughts by the occupants
- High level inlets in summer allow the system to operate a night cooling strategy, using cooler night-time air to reduce the temperature of the building's thermal mass
- SoundScoop technology targets speech and footfall frequencies, the main cause of disturbance via air transfer devices
- High Cd (coefficient of discharge) value provides lower resistance to airflow, meaning that more air can pass through, reducing the number of units required per room
- It can be demonstrated to meet the Acoustic requirements of BB93

---

**Dimensions**

<table>
<thead>
<tr>
<th>Wall opening width x height (mm)</th>
<th>Active Atrium Transfer unit length (mm)</th>
<th>free area (m²)</th>
<th>weight (kg) (high spec foam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>643 x 344</td>
<td>1540 (600 SoundScoop)</td>
<td>0.10</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>1840 (900 SoundScoop)</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>2140 (1200 SoundScoop)</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>1248 x 344</td>
<td>1589 (600 SoundScoop)</td>
<td>0.20</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>1889 (900 SoundScoop)</td>
<td></td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>2189 (1200 SoundScoop)</td>
<td></td>
<td>102</td>
</tr>
</tbody>
</table>
**Active Roof Terminal**
The Active Roof Terminal is designed for applications where a single room space is ventilated directly through the roof.

An innovative product which combines Passive Stack Ventilation during the majority of the year, a boosted stack system in peak summer temperatures, and downwards displacement ventilation and re-circulation during the winter.

The Active Roof Terminal comprises a structural base unit which houses the damper, mixing chamber and boost fan, and a double bank louvred terminal which provides excellent weathertightness and airflow. Combined they provide effective and efficient ventilation throughout the year.

Patent applied for.

**Three operating modes**
The system uses one of three operating modes depending on the needs of the building and outside temperatures.

Mode 3 is not always needed as Mode 1 can be used in winter with a CO₂-controlled and well positioned façade inlet.

---

**Mode 1 Natural**
*Most of the year*

In natural mode the Active Roof Terminal acts as a passive stack. Fresh air is brought in through low-level opening windows or louvres. Warm air rises and is exhausted at high level through the Active Roof Terminal. This is a purely passive mode and the fan does not operate. This mode enables control over indoor air quality and temperatures.

---

**Mode 2 Boost**
*Peak summer temperatures*

To avoid overheating within the room, the single boost fan in the Active Roof Terminal extracts high volumes of air from the space and exhausts it to the outside. Fresh air is brought in through low-level opening windows or louvres. During unoccupied periods when windows are closed and the temperature rises, the Active Roof terminal both supplies and exhausts air. This ensures a fresh environment when the room is occupied again. This mode allows the ventilation rate to be boosted to control peak summer time temperatures.

---

**Mode 3 Recirculation**
*Low winter temperatures; also for summer night cooling*

Low-level openings are closed, preventing cold draughts. Fresh air is brought in at high level through the Active Roof Terminal. With the fan running, the incoming fresh air mixes with interior warm air in the Active Mixing Chamber, providing tempered fresh air to the room.

The same strategy can be used for secure night cooling in summer.
Construction
Terminal cladding and louvres manufactured from fire-retardant high-impact ABS on an aluminium frame, and mounted on an aluminium frame connected to a base unit of marine grade plywood from renewable forests.

Colour
Terminal: any standard RAL/BS colour.
Base unit: white clad below roof line.
Ceiling cover grille: white as standard, or any standard RAL/BS colour.

Weather resistance
Double bank louvres achieve Class A at 1.5m/s, independently tested at BSRIA to BS EN 13030:2001.

Wind resistance
Resistant to continuous wind loads at 51m/s, demonstrated by independent BRE tests.

Biological resistance
Louvres exclude most birds in compliance with BRE Digest 415, 1996. 4mm insect screen behind the louvres excludes large insects.

Dimensions
<table>
<thead>
<tr>
<th>Size overall (mm)</th>
<th>1250 x 1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof opening required (mm)</td>
<td>1160 x 1160</td>
</tr>
<tr>
<td>Height, standard (mm)</td>
<td>1391</td>
</tr>
<tr>
<td>Weight (kg): Terminal base with mixing chamber</td>
<td>100</td>
</tr>
<tr>
<td>Weight (kg): Terminal</td>
<td>50</td>
</tr>
</tbody>
</table>

Installation
The Active Roof Terminal comprises two main elements: the sub-base unit which houses the modulating damper, Active mixing chamber and fan, and the double bank louvred terminal, with low-resistance air flow into and out of the building.

The sub base unit is fixed to the structure to support the terminal. It is supplied with the necessary fixing brackets and can be used on flat or pitched roofs. The louvred terminal is fixed in position over the sub-base assembly.

FEATuRES & BENEFITS
- Low energy boost fan uses minimum energy when compared to mechanical systems
- Re-circulation mode reduces heating energy used, saving energy costs
- Mixing and high level inlets in winter reduce the potential for perceived draughts by the occupants
- High level inlets in summer allow the system to operate a night cooling strategy, using cooler night-time air to reduce the temperature of the building’s thermal mass
- High Cd (coefficient of discharge) value provides lower resistance to airflow, meaning that more air can pass through, reducing the number of units required per room
- Double banked louvres provide maximum rain rejection
- The unique terminal design does not require a vertical internal divider, and therefore the flow performance is independent of wind direction. This ensures the system flow performance does not stall during adverse wind directions
**Intelligent control**
The effective intelligent control of the system ensures optimum efficiency. The Active Range uses the Active Controller as the brains to control operation. The Controller links to local actuators, sensors, overrides, and an indicator panel. The main components of an Active Range control system are:

*External temperature sensor*
This relays temperature information to the Active Controller. According to the temperature (based on set points determined at the design stage) the system operates in the most efficient mode.

*Local room sensors*
Combined temperature and CO2 sensors monitor air quality and feedback information on internal temperature and CO2 levels to the Controller. One sensor is located in each room, or multiple sensors in large open spaces.

*Local room overrides*
A touch-sensitive override is mounted in each room to allow the occupants to close or boost the system as they desire. The manual override is returned to the auto position after a set time period, determined at design stage.

*Fan Controller*
This controls the operation and direction of the fan unit in the Active units and determines which mode the system will operate in.

*Mixing Chamber / Motorised Louvre (Active Roof Terminal)*
This controls the operation of the Mixing Chamber which manages the airflow through the Roof Terminal and determines which mode the system will operate in. The motorised louvre controller ensures the correct amount of air is supplied to the room to meet demand.

**Active Controller**
This has built-in set points which determine the operating mode. It is the brains of the system, using the data from the sensors to activate the controllers/actuators as required. For example, if CO2 is above the set point the Controller would tell the occupants, via the Indicator Panel, that windows need to be opened, as well as increasing the opening of the sub-base damper. This allows more airflow to dilute CO2 concentration.

**Indicator Panel**
This tells the occupants what action they need to take in order to achieve good air quality. It is usually used as an indicator to open or close windows or louvres, controlling the flow of fresh air into the building whilst in natural or boost mode.
TYPICAL CONTROL SCHEMES

Active Transfer - Atrium System

Classroom
- Optional Window / Louvre actuator
- Average temperature and CO2 sensor
- Fan controller
- Override and average temperature sensor
- Manual window indicator
- Override and average temperature sensor
- Override and average temperature sensor
- Active controller

Active Roof Terminal - Single Space System

Classroom
- External temperature sensor
- Fan controller
- Average temperature and CO2 sensor
- Manual window indicator
- Override and Average temperature sensor
- Override and Average temperature sensor
- Active controller
FURTHER INFORMATION

Services
Passivent has its own in-house research team dedicated to developing techniques and products for natural ventilation, and is a leading partner in some of the most important research projects in this field including NatVent™, a consortium of European organisations headed by BRE.

We offer a comprehensive design and advisory service tailored to your specific project, covering both natural ventilation design and product selection. Advanced Airsoft™ software based on CIBSE AM10 is used to calculate sizes of air inlets and outlets to achieve optimum performance.

Installation
Installation and commissioning service through an independent network of Passivent MasterCare installers. Extended design warranty available through MasterCare.

Names of approved installers can be provided on request.

Quality Assurance
Passivent products are designed, developed and manufactured under a BS EN ISO 9001 quality management system, giving an independently audited assurance that the products will fulfil their intended purpose.

Environment
Passivent conducts all business processes under a BS EN ISO 14001 quality management system, giving an assurance that all activities are carried out having minimal impact upon the environment.

Other products
Passivent market a range of other ventilation and daylighting products for commercial and domestic buildings including:

- Natural (passive) ventilation systems
- iMEV - Intelligent mechanical ventilation systems
- Mixed mode cooling systems
- Aircool ventilators for windows, curtain walling and walls
- Airstract roof terminals for passive stack and other natural ventilation systems
- Airscoop wind-driven ventilation terminals
- Natural daylighting systems including Sunscoop tubular rooflights and Metrodome rooflights