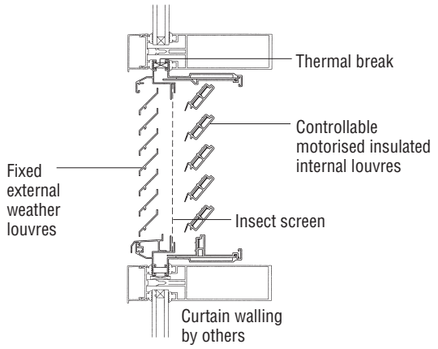
System Design

Passivent use the AirSoft® calculation tool (based on CIBSE AM 10 and BS 5925 and developed in conjunction with Oscar Faber) to size passive stack ventilation openings, and to evaluate various approaches to a robust Passivent natural ventilation design.

By designing a PSV strategy to provide 5 l/s per person in winter, Passivent can meet the BB 101 performance requirements to:

- Maintain average CO_2 levels below 1500ppm and
- Provide the minimum ventilation rate of 3 l/s per person in all seasons: winter, mid-season and summer.

Passivent Aircool® ventilator



Insulated controllable louvres with access panel removed showing actuator unit

Further information

Contact Passivent for further information on the design of natural ventilation systems for education buildings.

TECHNICAL HOTLINE 01732 850770

References

Building Regulations Approved Document F 2006 *Means of ventilation*

DfES Building Bulletin 101 2006 *Ventilation of School Buildings*

CIBSE AM10 *Natural Ventilation in Non-Domestic Buildings*

BS 5925: 1991 *Code of practice for ventilation principles and designing for natural ventilation*

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Natural Ventilation for Schools

Meeting the Regulatory Requirements

Building Regulations Approved Document F
Building Bulletin 101 Ventilation of School Buildings
DfES guidance

passivent

Natural Ventilation - A low energy strategy

Low energy natural ventilation is an increasingly important design requirement for non-domestic buildings and specifically schools. In comparison with air conditioning or mechanical ventilation it can bring economic, environmental and user benefits.

Passive Stack Ventilation (PSV) strategies for schools, designed using DfES guidance, can provide controllable ventilation all year round that will meet building regulations whilst avoiding draughts, thermal discomfort and unnecessary energy waste.

Building Regulations Requirements: Approved Document F

The Building Regulations now apply to schools. The fundamental requirement of the regulations Part F, as given in Approved Document F 2006 is:

"There shall be adequate means of ventilation provided for people in the building."

This requirement will be satisfied by following the appropriate design guidance for the type of building. For schools and educational buildings the specific guidance is given in DfES Building Bulletin 101 Ventilation of School Buildings.

Building Bulletin 101: Performance Standards

The Building Regulations, and BB 101, adopt a performance-based approach to maintaining adequate indoor air quality and set maximum average concentrations for pollutants. In schools, carbon dioxide (CO_2) is the key indicator of indoor air quality and hence ventilation performance.

The main performance standards which schools ventilation is required to meet in all teaching and learning spaces are:

- The concentration of carbon dioxide averaged over the whole day should not exceed 1500ppm.

A ventilation rate of 5 l/s per person for the period of the normal occupied day will easily meet this requirement.

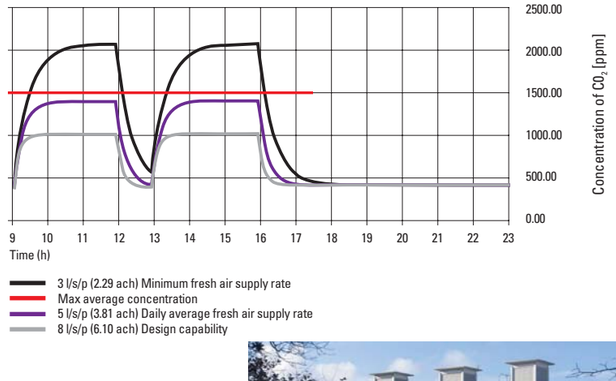
- The minimum ventilation rate should be 3 l/s per person when spaces are occupied, plus a design capability to achieve a rate of up to 8 l/s per person for the normal number of occupants.

Modelling CO_2 Levels

DfES has issued additional guidance on ventilation performance and carbon dioxide levels in classrooms to supplement BB 101. A simple model set up by Faber Maunsell establishes the steady state levels of CO_2 in a classroom over the school day at three different ventilation rates (see graph).

Steady state CO_2 levels at different ventilation rates

The graph shows that the requirements to maintain CO_2 levels below the maximum average concentration of 1500 ppm over the school day can be achieved at a ventilation rate of 3 l/s per person.
If a rate of 5 l/s per person is provided then the CO_2 levels will not exceed 1500 ppm at any time during the day.



Meeting BB 101: Natural Passive Stack Ventilation

Passive stack ventilation is considered the most effective natural ventilation strategy as it uses a combination of cross ventilation, convection (warm air rising) and the venturi effect (wind passing over an exhaust terminal causing suction).

Passive Stack Ventilation (PSV) strategies designed by Passivent use a combination of Passivent Aircool® window/wall ventilators to provide automatic control of CO_2 levels, and Passivent roof-mounted Airstract® terminals to exhaust the used air from the occupied spaces. Such strategies provide controllable ventilation all year round whilst avoiding draughts, thermal discomfort and unnecessary energy waste.

The aforementioned combination of Aircool® and Airstract® Ventilators allows incoming air to be drawn through the occupied spaces from the façade. This cross-flow and passive stack strategy allows ventilation of deep plan spaces - up to twice the depth into a building compared to uncontrolled single-sided ventilation - and ensures effective distribution of fresh air. It also provides effective and secure night cooling, as internal and external temperature differences are greater at night, which increases air flow and distribution.

PSV strategy for schools

Seasonal Control: Summer and Mid-Season

In summer and warmer mid-season periods the ventilation rate can be modulated from 5 l/s per person and up to the design capability of 8 l/s per person or above using a combination of Aircool® window/wall ventilators and windows. The Aircool® units will automatically provide sufficient fresh air to maintain average CO_2 levels below the 1500ppm threshold along with some cooling effect during warmer periods.

Winter and Mid-Season

In winter and cooler mid-season periods windows cannot provide the fine level of control required to maintain indoor air quality (BB 101, 5.4.1) and maintain thermal comfort by avoiding draughts.

Aircool® window/wall ventilators offer the ideal solution as they can control the ventilation rate automatically. They can also be sited behind radiators or ducted into ceiling voids to allow pre-heating of incoming air before it is distributed to the spaces.

The increase in convection driving force in colder weather means that the relatively small and cost-effective Aircool® window/wall ventilators can provide sole control of CO_2 levels during winter conditions. Controls will precisely and automatically adjust ventilation rate according to CO_2 levels. A control strategy will be proposed to meet customer requirements (see Passivent Controls brochure).

Control system for PSV

Actuators control both Aircool® and Airstract® units operating between 20°C fully closed and 24°C fully open