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human comfort are largely subjective. Even with research investigations where all environmental parameters are measured with meticulous care, the final evaluation is made by an individual in the form of a personal assessment against a series of grading 'steps' which are almost of an ad hoc nature. While there may be a degree of similarity between the reactions of a number of individuals to a particular combination of environmental parameters there will inevitably be statistical variations. You can satisfy some of the people some of the time or all of the people some of the time but...

In simple comfort terms where an airstream at a particular temperature and travelling at a particular velocity removes too much heat from an occupant's body surface, the subjective judgement will be that the environment is 'draughty'. Conversely, where too little heat is removed the judgement will be that the atmosphere is 'stuffy'. This indicates that 'draughts' and 'stuffiness' are not just a matter of air velocity, but a combination of velocity and dry and wet bulb temperatures. Air movement with suitable temperatures will be stimulating to occupants. Equally, too low an air movement can undermine comfort standards. The back of the neck and the ankles are normally quoted as body areas particularly sensitive to air movement - which may be due to the fact that typical clothing is less extensive in these areas.

### Improvements

■ Jet diffusion, both 'unaided' or 'free' and using a surface to modify the flow characteristics, achieves mixing by the velocity of movement of the airstream creating linear induction of the ambient air. This action progressively increases the size of the delivered jet while decreasing its velocity and diluting the original supply-air temperature differential. A free air jet will tend to promote greater entrainment than a surface-attached airstream.

By imparting a 'twist' to the air jet, induction occurs around the periphery of the jet as well as in a linear mode. The increased turbulence results in a higher induction characteristic, and a speedier dilution of the supply-air temperature differential.

As a result of this improved induction characteristic, the 'twist' jet can offer reliable diffusion and temperature differential dilution over a wide range of outlet velocities without the dumping of cold air. Thus, the principle is well suited to variable-air-volume (VAV) applications, with reliable performance at turn-down ratios as low as 30%. ■

\* Paul Jones works for Schako.

# Control is at the heart of the matter

Controlled ventilation in the workplace offers significant benefits to employee and employer alike, both physical and psychological, says Andrew Saxon

**T**HERE ARE A NUMBER of basic environmental requirements for people in commercial premises, including:

- *temperatures should be within acceptable limits*
- *there should be sufficient fresh air ventilation to eliminate odours, condensation, carbon dioxide etc*
- *noise levels should not be excessive*

Control of these may lead to comfortable working conditions. But, knowing that individuals are all comfortable under different conditions, and that when people control their own

" 89% of staff prefer non-air conditioned offices "

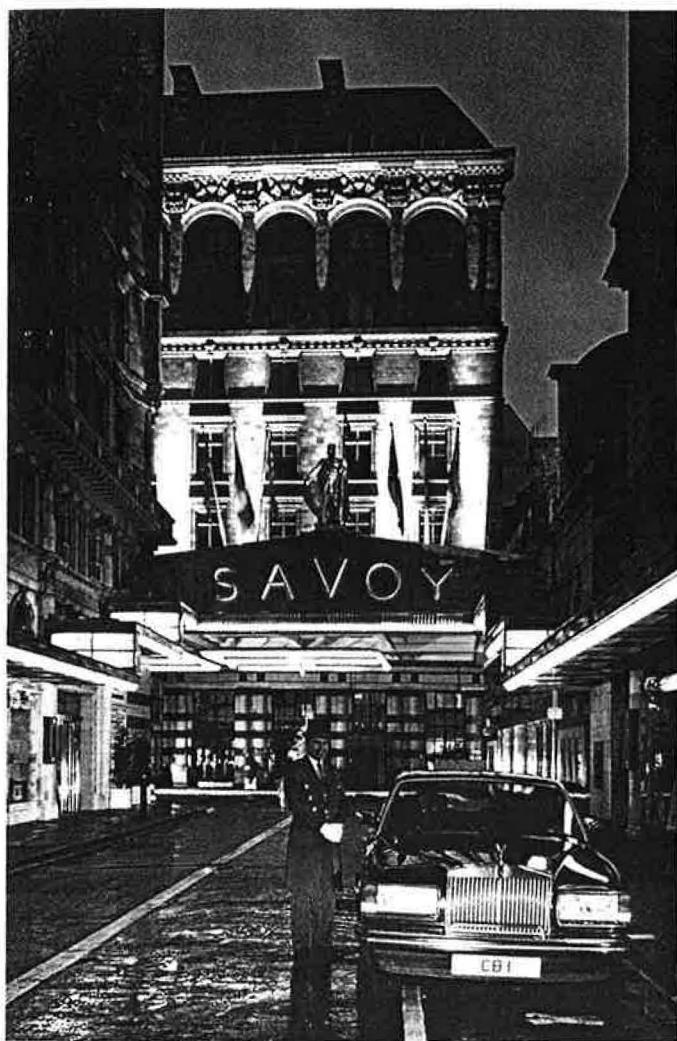
environment they are more tolerant of swings of temperature, ventilation and noise, they should have as much control over their own environment as possible. The buzz-phrase is: 'individual climate control'. This must, however, be achieved without unnecessary complication.

Designers now recognise the importance of such decentralisation when trying to ensure that buildings meet the (often opposing) needs of both owners and occupants.

And growing awareness of how proper levels of controlled ventilation, coupled with previous and likely legislation, can help improve the quality of the indoor climate and comfort levels means designers are increasingly keen to find cost effective, energy efficient solutions.

### Absenteeism

■ One of the best ways in which a facilities manager can help is to avoid sick building syndrome factors and so reduce absenteeism. Narrow plan, naturally ventilated, and non-air conditioned buildings inherently score well, as they also do in energy costs. So lower absenteeism which leads to higher productivity goes hand in hand with lower energy costs in a high perfor-



mance building.

Savings of at least 1.5 days per person per year from avoidance of sick building factors have been quoted by Healthy Buildings International, following a survey of offices in several countries.

Another recent survey carried out for Richard Ellis by The Harris Research Centre, reported that no less than 89% of office staff preferred non-air conditioned offices.

#### **Profit**

■ And with annual energy usage for air conditioned buildings typically £7-£10/m<sup>2</sup> higher than naturally ventilated buildings, the impact can be measured in terms of profit, as well as improved productivity and reduced absenteeism.

Investigations by the World Health Organisation and governmental committees have clearly identified deficiencies in the indoor climate as a major cause of sick building syndrome. Poor air quality, excessive temperatures, dirty workspaces and the lack of any means for occupants to control their own environment all contribute to SBS and consequent health problems, productivity losses, poor morale and reduced profits.

It was long thought that people were the only source of pollution in occupied spaces. But today it is acknowledged that there are many factors which contribute to the pol-

▲ The world famous Savoy hotel in London is to be fitted with a Modular climate control system from Biddle Air Systems.

ENQ NO 212

“Narrow  
plan,  
naturally  
ventilated  
buildings  
score  
well”

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# Space Air Mobiles

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**“ Savings of 1.5 days per person annually from avoiding sick building factors ”**

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lution of indoor air. A wide range of materials (plaster, steel, plastic, wood, textiles etc.) are used in construction today and many emit pollutants that can affect indoor air quality.

This is supported by the fact that despite existing standards being met, people still frequently complain of poor air quality in buildings.

A recent Audit Study on indoor air quality covered 56 European office buildings in nine countries. Some 30% of the occupants perceived the indoor air as unacceptable although ventilation levels averaged as much as 25 litres/person - much greater than current ventilation standards.

### Materials

■ This dissatisfaction can be traced back to the building itself (including the hvac system) being a source of pollution. Thus it is essential in both new-build and refurbishment to use low-polluting materials.

The building as a pollution source is just one issue to be considered in new guidelines and standards. Other issues are the option of temperature and

### EUROPEAN DRAFT PRE-STANDARD prENV 1752

		Additional Ventilation for Building	
		Minimum Ventilation Rate ie. for people only	Low Polluting Building
Category	(l/s/m <sup>2</sup> )	(l/s/m <sup>2</sup> )	(l/s/m <sup>2</sup> )
A	0.7	1.0	2.0
B	0.5	0.7	1.4
C	0.3	0.4	0.8

### THIS CORRESPONDS TO EACH PERSON OCCUPYING 14M<sup>2</sup>

Category		
A	15% PD	10 l/s/person
B	20% PD	7 l/s/person
C	30% PD	4 l/s/person

humidity on ventilation requirements, health considerations, comfort, the use of filtration to improve air quality and dealing with tobacco smoke.

Experts are studying and updating existing standards for ventilation. A draft of a European pre-standard for ventilation of commercial buildings is

being discussed, and in the USA similar work is being carried out for a revision of the ASHRAE 62 ventilation standard.

In pr ENV1752, the new European draft pre-standard, three categories of

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The Alliance & Leicester building society has carried out testing of a Gebhardt Kilcheat Rotavent fan at its Wigan building to assess energy use and airflow. The company replaced a six-year-old fan with a double inlet, double width, belt driven centrifugal fan from the Edenbridge-based company on the basis that the replacement would use as much as 42% less energy for the same airflow



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**“It is essential to use low-polluting materials to avoid dissatisfaction”**

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indoor air quality are proposed. Category A corresponds to 15% of dissatisfied people, Category B to 20% and Category C to 30%.

The designer and the building user/owner, therefore, have the option of using ventilation rates for the lowest or the highest levels of indoor air quality.

Approximately 20% of existing buildings could be considered to be low polluting buildings, and 1.0, 0.7 and 0.4 l/s/m<sup>2</sup> should be added to the ventilation rate for people only for categories A, B and C respectively.

Where a building is not low polluting then double these European draft pre-standard pr ENV1752 ventilation rates for the building should be used.

### National

■ It should be noted that, even including ventilation for non-low polluting buildings, pr ENV1752 prescribes lower minimum ventilation levels (Category C) than most present national standards.

Fan convectors, fan coils, mini-air handling units and other air conditioning products have been available for some time with a fresh air capability. But the introduction of the fresh air is



▲ The automated postal processing centre at Chelmsford houses the 700 strong workforce of Royal Mail Anglia. Kershaw Mechanical Services won the £1.1m contract to fit all the mechanical services including a ventilation system with secondary high velocity warm air heating, air conditioning and building management system. The company said it benefited from being one of the first contractors on site.

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in an inefficient, relatively uncontrolled manner.

For example, fan convectors with a damper allow either 100% fresh air ventilation or zero fresh air ventilation (re-circulation), with no flexibility if the number of people in the room increases or decreases. Other products feature a modulating damper which is, say, half

open if 50% ventilation is required.

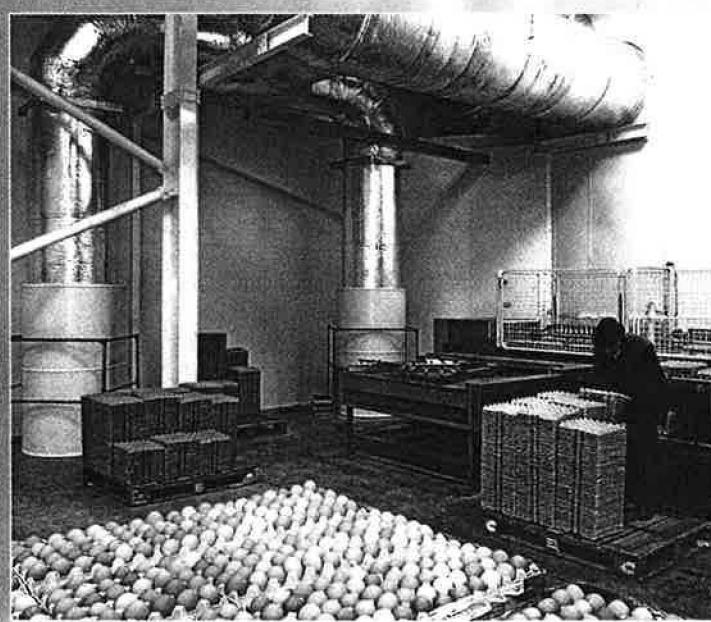
Independent research at Delft Technical University, Holland, also demonstrated that with a damper on a fan convector half open there is no certainty that all the incoming fresh air will leave the unit through the discharge grille.

Air will always travel the path of least resistance. If internal pressures are not precisely controlled, with a damper half open, air may actually leave the unit through the recirculation grille - causing cold draughts along the floor. This does not satisfy the requirement for controlled, draught-free ventilation.

### Cycling

■ Further work established that the best way to control the introduction of fresh air is to have the damper cycling between fully open and fully closed, over a short optimised time period. The amount of time the damper is at each extreme determines the volume of fresh air being introduced into the room, via the discharge grille, in a precise and controlled manner. ■

\* Andrew Saxon works for Biddle Air Systems



► Displacement ventilation designed by East Midlands Electricity is providing comfort conditions for the workforce as well as close control of the temperature for nine million eggs a week at the Daylay Foods egg-grading plant in Lincolnshire. The prewrap area is held at 12°C, the grading and sizing area is maintained at 18°C, and the cold store must be kept at 10°C with a total cooling load of 400kW

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