All in a swirl

The most critical aspect of the operation of any air-distribution system is the way that conditioned air is delivered to the occupied space, says Paul Jones

NUMEROUS TYPES of supply-air outlets have been used over the years. The impetus for development has varied between aesthetic demands and the quest for improvements in technical performance. In some cases, new designs have been based on a pragmatic empirical appreciation of the principles of fluid flow. In other instances, developments have evolved from protracted aerodynamic testing using smoke traces and other techniques over a wide range of temperature differentials for both cooling and heating functions.

The performance criteria to be met by an effective air outlet device includes the following capabilities:

- Project the air over a given distance.
- Deliver the air with a known directionality, which can be preset.
- Offer good diffusion performance, ensuring thorough mixing of the delivered airstream with the ambient air, thus promoting rapid decay of the supply-air temperature differential.
- Have provision for regulating the 'spread' of the delivered airstream from a thin 'pencil'configuration to a 'broadwash' arrangement, as required.
- Have low resistance to airflow.
- Have good acoustic characteristics, particularly with regard to regenerated air noise.
- Be easily adjustable so that particular aspects of performance can be varied in-situ.

Planned

■ In performance terms, it is important for all of the above characteristics to be predictable. This enables particular devices to be selected with confidence, and, similarly, for performance adjustments to be made generally on a planned basis. There is always likely to be a need for performance 'tuning' where final adjustments are made during commissioning, or subsequently, to match precisely the required criteria. Other requirements for an outlet device, unrelated to technical performance, are that it should have an aesthetically acceptable appearance and should be reasonably economical to manufacture, preferably in a number of different materials.

As stated earlier, the criteria for

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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 turbulance 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

THERE 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 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.

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

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-