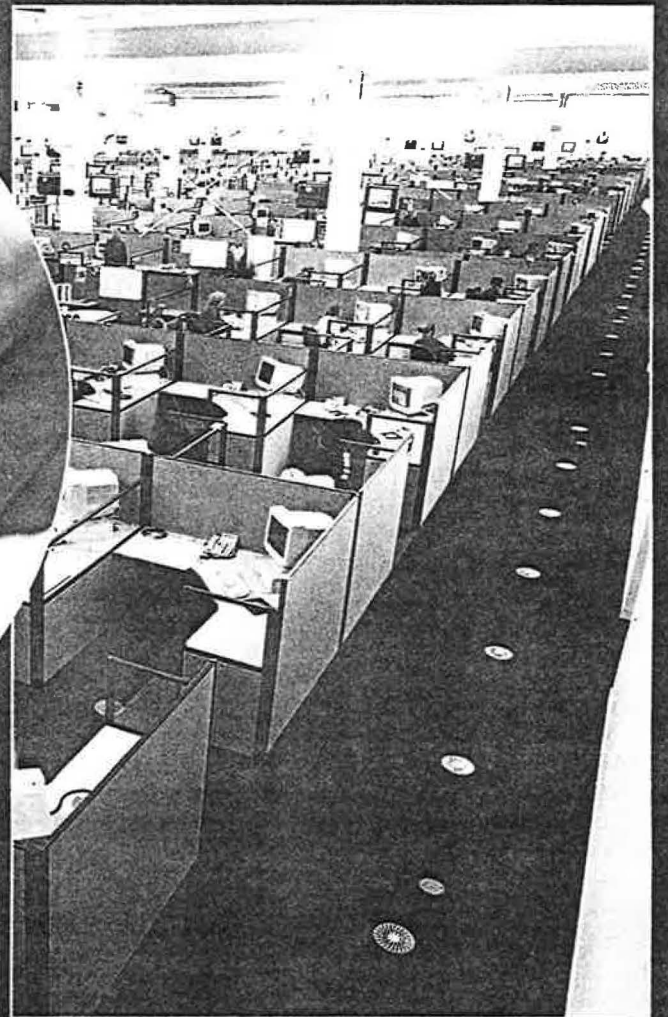
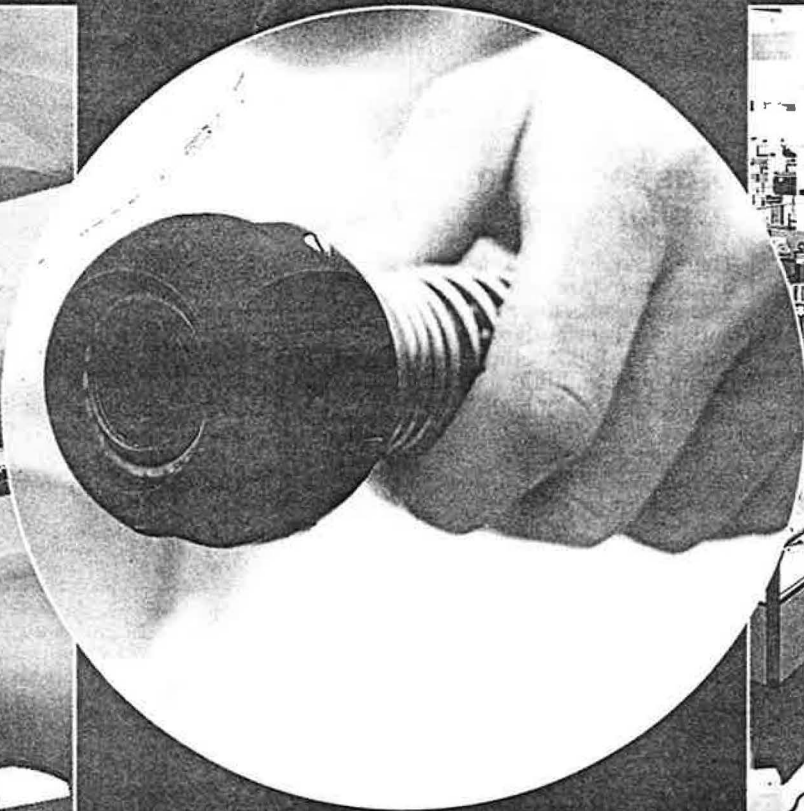
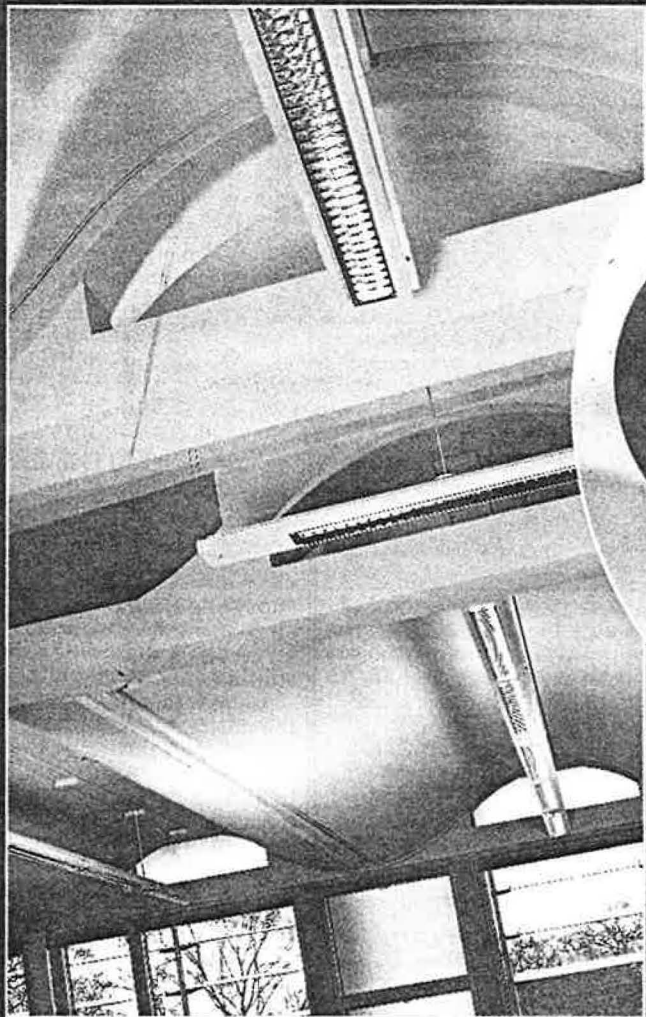


INDOOR AIR QUALITY



IMAGES OF INDOOR AIR QUALITY
 Above: Getting the inside story (F3)
 Left: Effective natural ventilation (F3)
 Right: Flexible air distribution for British Telecommunications (F2)

RESEARCH

Indoor air quality versus outdoor air quality

Too much ventilation can lead to unacceptable air quality indoors — especially in towns and cities, John Fletcher explains how to tackle the problem.

Fresh air is necessary to ensure internal pollutants such as body odours and off-gassing from building materials and fittings are diluted and removed and do not cause discomfort to building occupants. Providing fresh air is not a problem in most situations but if the building is near a busy road and the air intakes are at low level then the 'fresh air' may be heavily polluted.

Ideally, outdoor air quality (OAQ) should be assessed to ascertain whether pollution is a potential problem. There are two methods available for assessing OAQ — direct measurement of selected pollutants such as carbon monoxide or oxides of nitrogen from an AHU air intake near the suspected pollutant source or indirect assessment.

Direct measurement is best; however this method carries a cost penalty.

An alternative is indirect assessment, and a procedure for this is

detailed in ASHRAE Standard 62¹. This recommends that pollution data from local monitoring sites is compared to exposure limits.

The effect of poor OAQ will be reduced by the attenuating effect of the ventilation system but outdoor pollution can still be a problem where the proportion of outdoor air is significant — e.g. free cooling in summer. The obvious solution is to minimise outdoor air when the quality is poor, and this is the subject of a recent BSRIA publication². The publication was produced from the results of a research project part funded by the Department of Environment, Transport & the Regions under the Partners In Innovation Scheme.

The impact of poor OAQ may be higher than it need be if the building and HVAC system cause unnecessary ventilation, and this situation should be addressed before

considering the need for additional ventilation control. Examples of potentially unnecessary ventilation include openable windows in mechanically ventilated buildings and pre-occupancy purges. These purges are used to remove indoor pollutants, but they operate at peak rush hours and can increase the ingress of outdoor pollutants. Ventilation systems that apply internal pollutant controls, e.g. indoor air quality (IAQ) sensors as part of a demand controlled ventilation system, may also cause unnecessary ventilation. IAQ sensors can respond to external pollutants entering the ventilation system which, in turn, results in an increased ventilation rate.

Ventilation control techniques

Minimising ventilation when the OAQ is poor obviously requires a

ventilation system that is capable of reducing the outdoor air proportion. This is achieved through increased recirculation or airflow reductions, systems that employ full outdoor air with heat recovery are generally not appropriate. There are a number of

"The impact of poor OAQ may be higher than it need be if the building and HVAC system cause unnecessary ventilation"

different control options described in BSRIA Technical Note TN 5/98 entitled 'Ventilation control and traffic pollution'². Two options are a simple timeclock and direct-pollutant measurement. If the OAQ is known to be regularly poor, a timeclock can be set up to minimise outdoor air during rush hours (e.g. 7 to 10 a.m. and 4 to 7 p.m.). Alternatively OAQ can be measured directly, and it is recommended that carbon monoxide (CO) is the pollutant measured for the following reasons.

CO setpoint:	Notes:
• 4.5ppm (0.5ppm deadband.	• The WHO one hour CO exposure limit is 25 p.p.m. A lower 5 p.p.m. setpoint is appropriate because it indicates (through correlation) that other pollutants, notably NOx are likely to be unacceptable.
CO reading:	
• five minute average instead of instantaneous readings.	• A five minute average is long enough to prevent unrepresentative pollutant spikes from activating the control but short enough to be responsive.
Control when on:	
• Full recirculation for a short period followed by a fresh air rate that ensures the average over a one hour period is the recommended minimum.	• Applying full recirculation initially blocks outdoor pollutant ingress whilst maintaining the average minimum rate over an hour prevents indoor pollutant sources from becoming a problem.
• If thermal comfort is compromised return to existing control.	• Temperature control should have priority over pollutant control because it is unlikely that poor air quality will cause occupants more discomfort than poor thermal comfort in the short term.
Control when off:	
• Purge with 100% outside air for a period equivalent to four air changes.	• A purge will remove pollutants that have built up from indoor sources and four air changes is the minimum period required to ensure complete removal.

Measuring the carbon-monoxide content of outdoor air provides the basis for a ventilation control strategy.

• CO demonstrates a high degree of correlation with other urban pollutants such as oxides of nitrogen and

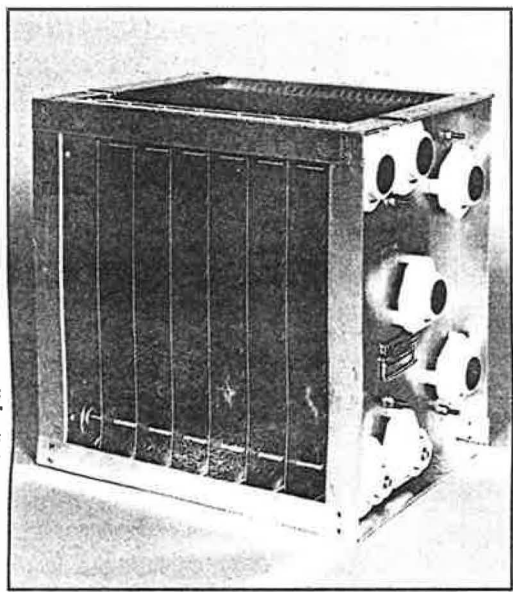
polycyclic aromatic hydrocarbons and can therefore be used to infer
to page 20

from page 19
overall external air pollution
• Ambient CO can be measured using industrial electrochemical sensors, whereas most pollutants require expensive analysers. Also the output of the sensors is directly compatible with a BMS.
The table details a simple ventilation control strategy using CO measurement and the reasons why each of the

control facets are applicable.
References
1. ASHRAE Standard 62-1989. Ventilation for Acceptable Indoor Air Quality. ISSN 1041-2336.
2. Ventilation Control and Traffic Pollution. BSRIA Technical Note TN 5/98.
John Fletcher is a senior research engineer with the Building Services Research & Information Association, Old Bracknell Lane West, Bracknell, Berks RG12 7AH.

Electrostatic air cleaners get reliability improvements

Trion has enhanced the design of its T Series electrostatic air cleaners to improve their performance and reliability. These units incorporate a stainless-steel spike ioniser rather than tungsten wires which are prone to breakage during cleaning.
The improved units include a special stand-off ceramic insulator as standard. These insulators are said to be more reliable than conventional glass or polyester. Tests have also demonstrated a high resistance to electrical shorting and they can achieve an arc track ratio up to three times less than conventional insulators. The new insulators are located outside the airstream to reduce the build up of contaminants and consequent arc over.
Rubber boot connections prevent moisture and contaminants damaging high-voltage wires.
Designed for industrial air cleaning, there are eight units providing airflows from 1000 to 17 000 m³/h.
Reader Reply No. 121



New features in Trion's T Series electrostatic air cleaners significantly improve performance and reliability.

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BALANCED THINKING

Where two fans are better than one

Balanced ventilation with heat recovery is now a practical prospect in smaller premises, explains Christopher Stride.

There is no doubt that in terms of environmental concerns, codes of practice and technical standards are shifting the whole ethos of commercial building design away from high-energy strategies — where full air-conditioning is essential — to greener methods of creating equable and comfortable interiors. This is where ventilation technology is able to assume a leading role.

Small-scale heat recovery

Powered ventilation is seen as the low-energy route to creating better environments, especially where heat recovery is a principal component of system design. Until recently, however, popular perceptions of this approach saw these

recovery techniques applying solely to large industrial and commercial applications where energy savings could offset additional capital costs. At the same time the idea of heat reclaim in smaller commercial ventilation systems was regarded as either uneconomic or a shade too 'alternative'.

That attitude has changed dramatically with the advent of compact and much more affordable air-to-air heat exchangers which are now plugging the gap that automatic controls could not. With these units it is now possible to recover up to 70% of the heat which controlled ventilation methods inevitably remove.

In the new concept, through-the-wall heat recovery ventilation units exhaust stale air while



Modern through-the-wall ventilation units provide a balanced 2-way flow of air with energy exchange between the two airstreams. This is Vent-Axia's HR500.

introducing warmed fresh air from outside. Typical of this genre is my company's HR500 single room heat recovery unit. Such units employ a polymeric plate heat exchanger cube to interleave outgoing warm air with incoming fresh air, without the two streams mixing. When combined with a surface-mounted controller, the ventilation unit can operate at 550 m³/h in heat-recovery mode or as a 900 m³/h extract fan for single-room installations such as offices, computer rooms, classrooms, swimming pools and other health and leisure-industry applications.

Cooled spaces

Units of this type also provide the ideal solution for maintaining cooled-

room environments by supplying fresh pre-cooled air to maintain oxygen levels and reduce stuffiness.

There is an additional dimension to energy efficiency in smaller commercial premises, and that is the provision of extraction fans with super-efficient, long life motors capable of reducing electrical power consumption by up to 80%. As an example, our LoWatt fan range uses a new generation of electronically controlled DC stepped-motor-driven fans which consume just 2.3W compared to 15 to 20W for conventional designs.

Christopher Stride is marketing manager with Vent-Axia Ltd, Fleming Way, Crawley, Sussex RH10 2NN.

Waterloo gets the call from British Telecommunications

Flexible air distribution in British Telecommunications' call-handling centre in Northern Ireland is achieved by floor diffusers supplied by Waterloo Air Management. The WFO diffusers offer a choice of vertical or horizontal air patterns.

Nearly 1000 diffusers were installed by Weir McQuiston as outlets for the displacement air system. Their 'flip-over' design allows them to be switched between horizontal and vertical air patterns, and they can be incorporated into any conventional raised access floor tile up to 50 mm thick.

Balancing the system in such a large space as this call centre is made possible by an incremental damper which facilitates throttling of the airflow.
Reader Reply No. 122

Spreading the 'clean' air message

'There is no such thing as "clean" air, only levels of cleanliness, especially in an office or public place,' says Marjorie Nicholson, recently appointed group communication manager of Fenchurch Environmental Group and previously director of the smokers' rights group FOREST.

'Most of the substances in the air that do cause harm cannot be seen or smelt, and it is awareness of those that needs to be raised.'

Her work at FOREST included researching solutions to how employers could accommodate smokers as well as non-smokers. This involved researching every aspect of indoor air quality and speaking with manufacturers of air-cleaning and filtration equipment.

She published her first paper on sick-building

syndrome and the role of environmental tobacco smoke in 1994.

Since then, she has written widely on the subject, addressed seminars on the issue and worked with employers on developing smoking policies that accommodate rather than discriminate.



Former smokers' rights champion Marjorie Nicholson has joined air-cleaning and filtration specialist Fenchurch Environmental Group.

Washroom air quality

Carefully controlled levels of ozone are used to sterilise and deodorise air in washrooms by Airstream's Neutrazone. The ozone breaks down airborne and surface bacteria.

Dosing levels of less than 0.1 part per million are used, below half the relevant safe maximum level of 0.2 parts per million laid down by the Health & Safety Executive.

Because no chemicals are used, there are no labour or material cost of replacement associated with Neutrazone.

Mains powered, Neutrazone produces ozone at a maximum rate of 20 mg/h, sufficient for deodorising washrooms up to 60 m³. Tests are said to have shown that 99% of all bacteria are killed within an hour of exposure to ozone. Unlike techniques using formalin or ethylene oxide solutions, ozone leaves no potentially toxic residues.
Reader Reply No. 123



Airstream's Neutrazone uses electrically generated ozone to sterilise and deodorise washrooms of up to 60 m³.

RESEARCH

Effective natural ventilation for offices

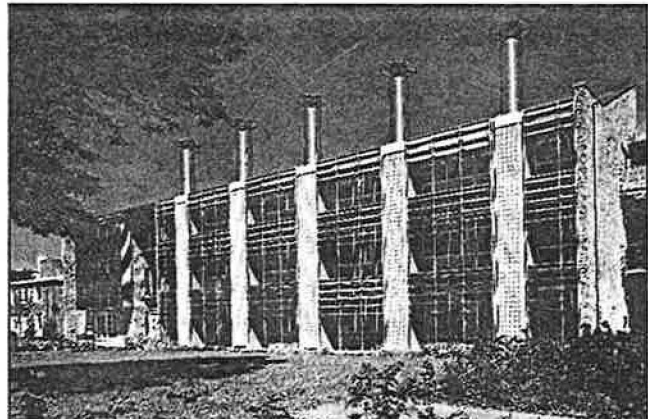
Natural ventilation needs to be as tightly designed and controlled as any other service, explains Earle Perera.

Over a 30-month period, a European project known as NatVent has been looking at ways of overcoming the technical barriers to low-energy natural ventilation in office buildings.

Holistic concept

The project team, which draws together expertise from throughout Europe, has concluded that natural ventilation is not just about operable and openable windows. It is, rather, a holistic design concept that is now being used in the architectural design of large offices and other building types. Design is centred on using passive ventilation, based on the 'stack' (temperature) effect and wind-pressure differentials, to supply fresh air to building interiors even when the windows are closed. As part of this process, designs incorporate atria or internal stairwells which, in some instances, use low-energy fans to provide 'assisted natural ventilation' (i.e. low-energy ventilation).

However, for any ventilation strategy to succeed, it should be based on the principle that adequate ventilation is essential for the health, safety and comfort of building occupants, but that excessive ventilation leads to energy waste and sometimes to discomfort. The aim of good design is therefore to 'build tight —



The BRE's Environmental Building was monitored by the NatVent project. It has large areas of openable windows on both sides of the building. The top openings are controlled by the building-management system and the lower windows are opened manually. Natural cross ventilation is provided by the prevailing south-west wind. Cellular offices on the north side of the building receive fresh air that enters the south side and passes through voids in the sinusoidal floor slabs to the north. On days when there is very little wind, cross ventilation is helped by five external stacks. Hopper windows connecting the ground- and first-floor offices to the stacks are opened by the BMS. Stale air rises naturally up the stacks, and fresh air is drawn in through the hopper windows.

ventilate right'; that is, to minimise uncontrolled (and, usually, unwanted) infiltration by making the building envelope airtight while providing the required ventilation with 'fresh' air in a controlled manner. A building cannot be too tight but it can be under-ventilated.

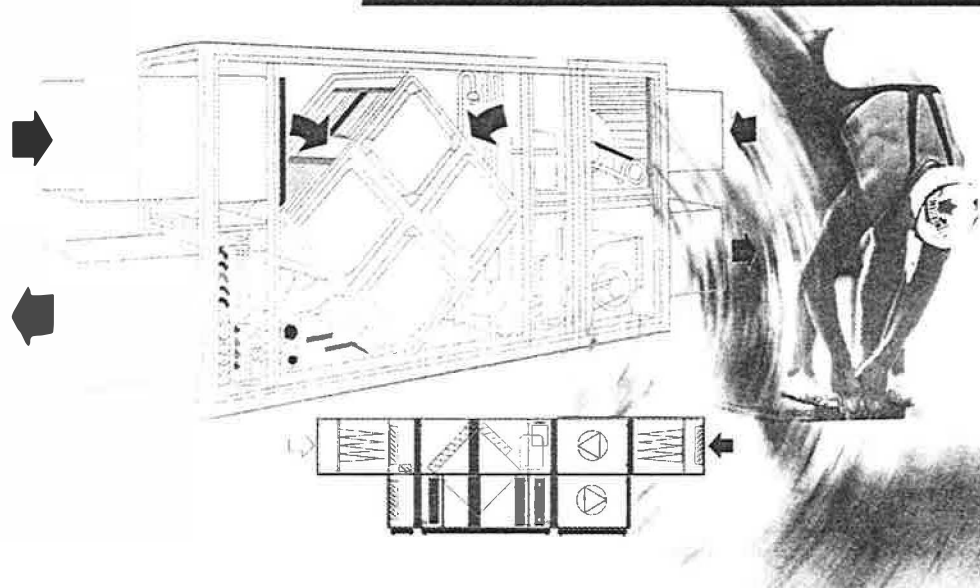
Urban areas

There is much general guidance available for the design of natural ventilation. However, there is a perception in the commercial marketplace,

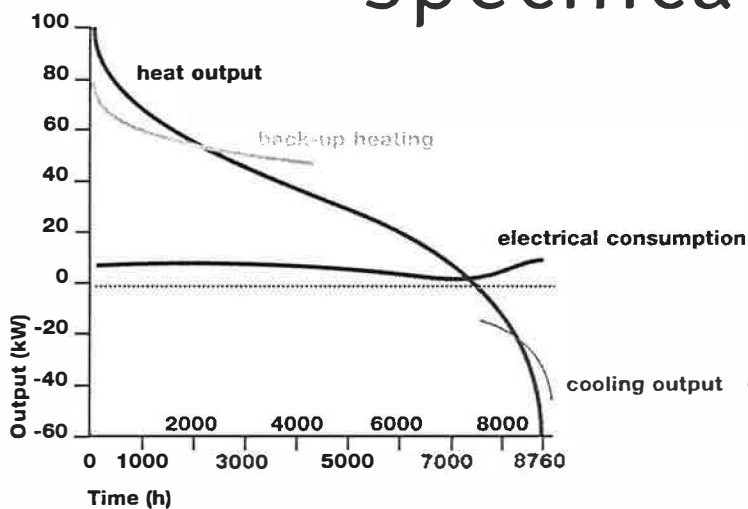
that certain specific technical barriers exist which prevent a wider uptake — in particular in urban areas and city centres. The project has identified five major issues.

- Combating summer overheating.
- Air and noise pollution in urban areas and city centres.
- Variability of weather around buildings and the dependence of natural ventilation on these variable driving forces.
- Recovering heat from natural ventilation systems — of concern to countries

to page 22



meets all technical specifications



Designed in Scandinavia with a Coefficient of Performance (COP) in excess of 6.0, the DanX range of ventilation equipment is a proven performer in the efficient usage of energy.

The DanX uses the combination of fixed or rotary air to air recuperators and heat pump technology to produce a packaged ventilation system that will efficiently satisfy all of your buildings heating and cooling requirements.

Fact: The Kyoto agreement legislates that the UK must reduce its emissions of greenhouse gases to 12.5% below 1990 levels between 2008 and 2012. The labour government has further promised that the UK should achieve reductions of 20% by 2010.*

Fact: Energy used in the operation of buildings themselves accounts for between 30% & 50% of the UK's present emissions of carbon dioxide.*

Energy efficiency is now becoming a marketable product in its own right, which everyone responsible for a building must consider. At Dantherm we have years of experience servicing the efficiency needs of the Scandinavian market. In the UK we are experts in the design of ventilation for commercial buildings and have many years of experience to offer in swimming pool and leisure markets.

*Source: UK Climate Change Programme DETR


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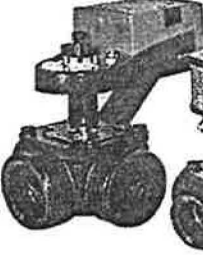
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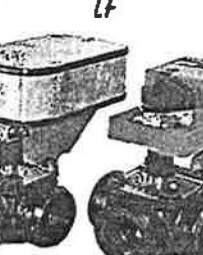


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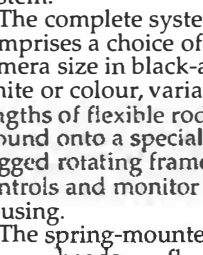
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Getting the inside story

Colour and black-and-white monitoring and video-recording of the interior of ductwork can be achieved with Radiodetection's Gatorcam system.

The complete system comprises a choice of camera size in black-and-white or colour, variable lengths of flexible rod wound onto a special rugged rotating frame, and controls and monitor in one housing.

The spring-mounted camera heads are flexible and can be navigated through multiple 90° bends. The camera head incorporates eight LEDs to illuminate the inside of the ductwork. The LEDs can be dimmed to reduce glare and improve vision in the duct and quality of the recording.

A distance counter shows how far the rod has been extended into the ductwork.

Reader Reply No. 124

from page 21

with very cold winters.
 • Integrating and maintaining natural ventilation systems.

The project team has looked in depth at these issues, and has come up with the following solutions.

"The aim of good design is to 'build tight — ventilate right' "

- A low-pressure-drop inlet for attenuating external air and noise pollution in urban areas together with design tools for the sizing and location of inlets.
- A very low-pressure-drop vent with controlled

incoming airflow to account for variable external weather conditions.

- A low-energy fan-assisted system to recover heat for use in the colder climates.
- Hardware window prototypes and control algorithms for controlled night cooling to minimise summer overheating.

• A simple design tool integrating all the elements of NatVent.

A guidebook and a CD-ROM on the NatVent work are being prepared and will be available shortly from BRE (Contact: Earle Perera on 01923 664877). These will contain details about the project and its participants, reports on all the technical areas covered

including results from monitoring 19 low-energy office buildings in Europe, design tools as well as information on hardware developed from the project.

The project has been funded partly by the European Commission under the Joule Programme, and by funding organisations within each participating country. The UK support has been provided by the Department of the Environment, Transport & the Regions through the Partners in Technology (now Partners in Innovation) Programme.

Earle Perera is with the Building Research Establishment, Garston, Watford WD2 7JR.

AIR FILTRATION

Building a healthy environment

For old and new structures, air filtration systems can help eradicate major health problems caused by sick building syndrome, explains Norman White.

If your workforce is plagued by respiratory problems, nausea, headaches, dizziness and fatigue, it may not be the

staff causing the sickness — it could be the building they work in.

Sick building syndrome (SBS) is widely seen as the result of builders failing to provide adequate air filtration and circulation in buildings constructed in the years after the oil crisis of the mid-1970s. In a bid to minimise energy costs, ventilation and air filtration was reduced to create virtually sealed offices.

Add to this modern office designs and practice — with photocopiers and printing machines giving off toxic gasses and particles — and SBS steadily increases.

Official disease

Now that the World Health Organisation has recognised SBS as an official disease, a common source of the problem — poor ventilation — should be tackled by installing adequate air-conditioning systems in new buildings or when refurbishing old premises.

Reports since the 1980s show that doctors nationwide say that the number of patients displaying symptoms like headaches, dizziness, nausea, fatigue and skin conditions has escalated.

In addition, more serious symptoms have been on the rise. These have included respiratory problems, catarrhal deafness and tinnitus, together with loss of memory and concentration. All were linked by the fact that patients worked or lived in modern buildings where air quality was poor.

Recurring ill health

Initially, the medical world linked these symptoms to other causes — including the pace of modern life — but the influence of inadequate ventilation and filtration has come to be seen as an important cause of recurring ill health. To maintain healthy surroundings, control systems should incorporate filters and a proportionate mix of 'fresh air' with circulated air. The Health & Safety Executive guide on sick building syndrome recommends a fresh-airflow of 8 l/s per person in a non-smoking area.

Sometimes air-ventilation systems are fitted without filters and 90 to 95% of the air is recirculated, so if a bug is going around, that also

gets recirculated.

If a building already has a filtered system, or if one is being installed, it is imperative that the correct grade filters are fitted properly and that the ductwork is clean and regularly serviced and inspected.

Rules and regulations

As far as the law is concerned, local authorities and other office-based organisations should be aware of regulations covering air quality in the workplace.

"The influence of inadequate ventilation and filtration has come to be seen as an important cause of recurring ill health"

Relevant European Union Directives have been implemented in the UK by the Workplace (Health, Safety & Welfare) Regulations 1992 and apply to virtually all types of workplace. New buildings have had to comply since the end of 1992, whilst existing workplaces have had to follow suit since January 1996. Under the regulations, employers have a duty to ensure the workplace is 'adequately ventilated so that stale, hot or humid air is replaced at a reasonable rate by fresh or purified air'.

My company's filters are used in many famous buildings and by leading companies. They include Canary Wharf the House of Lords, British Aerospace, Marks & Spencer, Liverpool's Walker Gallery and London-based Lloyd's.

The cost

Those who believe the planning, installation and maintenance of an efficient and effective system is an unnecessary expense should consider the potential alternative costs.

A report in America has identified SBS as a possible factor in up to 5000 cancers every year, costing the US national purse around £30 million in terms of sick leave, medical costs and lost production.

With cases already making their way into American courts, employers with 'at-fault' buildings in the UK may well face future legal action by disgruntled employees.

It is not just people who are affected by SBS. Very fine dust particles and gas molecules can adhere to paintings and artworks, causing discolouration, requiring specialist cleaning. Sulphur dioxide

to page 23

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from page 22

in very low concentrations can do long-term damage to irreplaceable works of art.

So what can building managers do? They should certainly be aware of the role that air filters play in providing a barrier against unwanted particles entering the building.

Remedy

In museums, for example, carbon filters have proved to be the best form of protection for paintings and artifacts as they actually absorb polluting gases. Whilst this type of filtration may appear expensive, it is much less pricey than the long-term costs of specialist cleaning and erosion which may occur.

The installation and maintenance of filters represents a very small proportion of running a building, yet they often get overlooked to the



Norman White — to maintain healthy surroundings, control systems should incorporate filters and a proportionate mix of fresh air with circulated air.

detriment of the general well-being of the building. A typical air conditioning and ventilation system uses low- to medium-efficiency panel filters, which are inexpensive and can be changed frequently, as pre-filters to protect and extend the life of secondary higher

efficiency bag or rigid filters.

The inclusion of carbon filters is not restricted to specialist sites. Their use in addition to normal filtration systems in office buildings can help to combat SBS in a working environment by removing volatile organic compounds caused by odours from paint, furnishings, carpets and photocopiers.

Building managers are left with little choice — backed up by regulations — but to provide adequate ventilation and a supply of clean, fresh air for people working within new and old buildings. Air filtration plays a vital role in helping fulfil that obligation — and could prevent employers from counting the higher cost of a constantly sick workforce.

Norman White is marketing manager with Interfilta (UK) Ltd, Rossendale Road Trading Estate, Farrington Road, Burnley BB11 5SY.

ODOURS

Achieving natural air quality

Air that is of too high a quality leads to dissatisfied people, according to Diotima von Kempki.

The importance of odours in indoor air has been under-estimated, despite research demonstrating that they directly influence how we perceive the quality of the air and how productive we are.

Where attention is paid only to eliminating annoying odours such as those emitted by building materials, furnishings, carpeting, ventilation systems and people, complaints of stuffy and artificial air still persist — even when using optimal filter systems. The percentage of those dissatisfied remains between 15 and 40%.

Dissatisfaction

In addition, a traditional approach of eliminating all odours causes neutral or 'dead' air, which affects us in much the same way as being in a pitch-dark or sound-proof room. We become disoriented in the same way that the absence of light or sound confuses us. The result is an increase in the dissatisfaction rate.

Achieving optimum indoor air quality and increasing productivity requires not only eliminating annoying odours but also introducing positive olfactory substances to create an olfactory comfort that improves productivity

and mimics the olfactory composition of fresh, natural outdoor air.

The key is to complement thermal comfort with olfactory comfort by maintaining a uniform concentration of olfactory substances at a level between where our sense of smell begins to notice odours and where we consciously recognise odorous substances in the air. Research has shown that the optimum satisfaction rate lies between these two thresholds — in addition to avoiding overdose which results from perfumed air.

Strict requirements

Achieving this goal requires meeting strict technical and aromacological requirements.

"A traditional approach of eliminating all odours causes neutral or 'dead' air, which affects us in much the same way as being in a pitch-dark or sound-proof room"

First, only appropriate olfactory systems with controls cable of securing constant and uniform distribution of olfactory substances at just above the threshold level should be used. These systems must take into account the main parameters, particularly air volume, temperature and humidity.

Second, a tailored mix of complex olfactory structures should be developed for each

building.

Defining the mix requires a careful consideration of four factors.

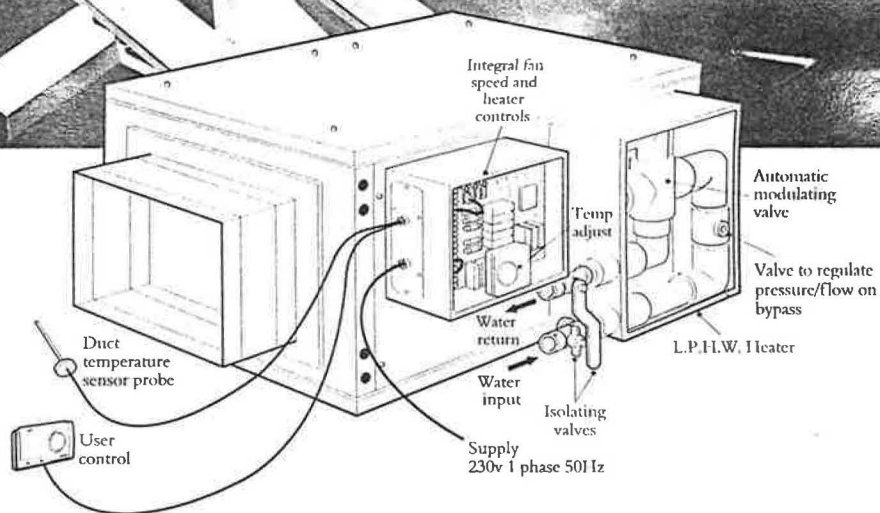
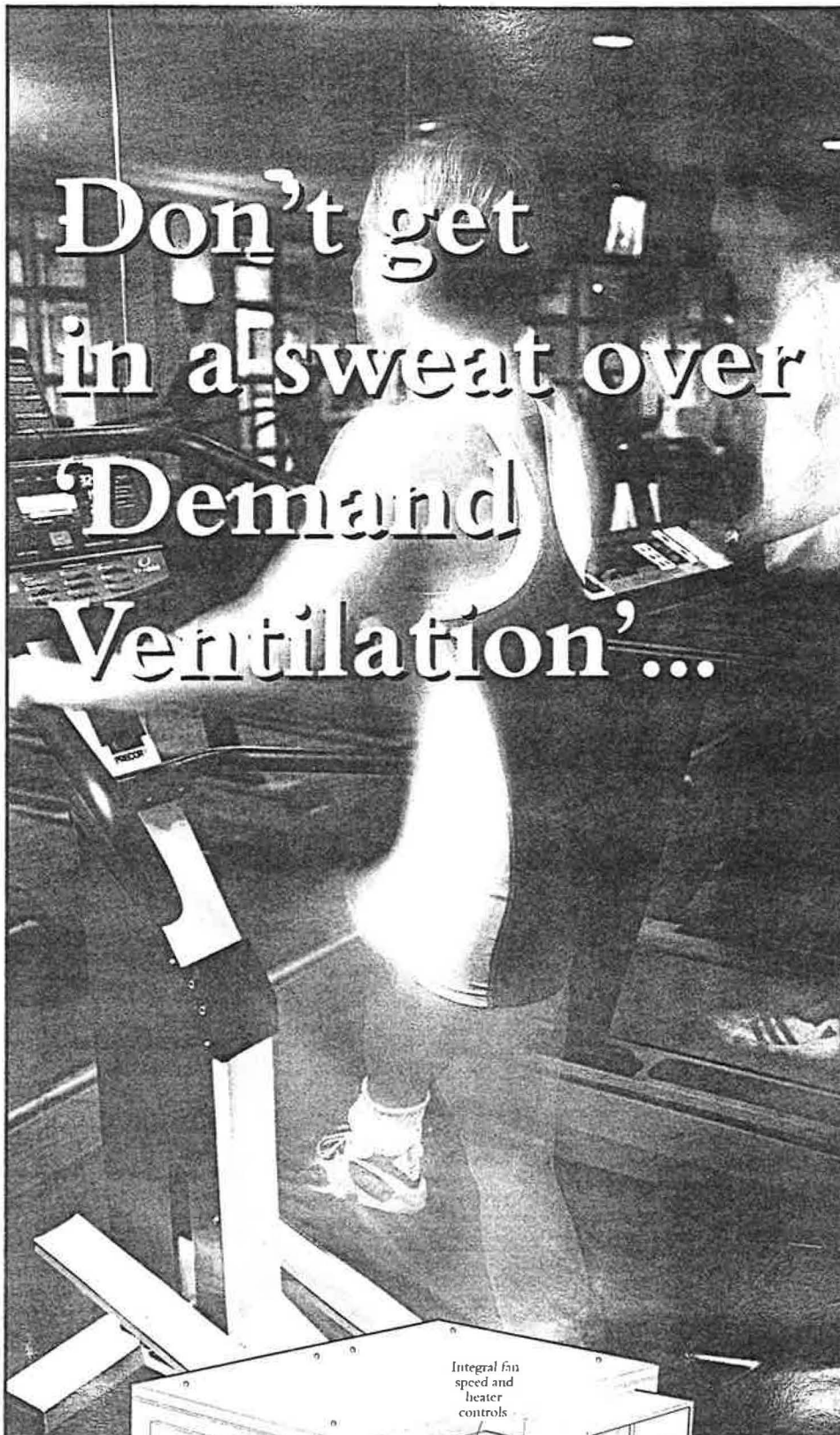
- Average number of room occupants.
- Existing emissions of odours from building materials, furnishings, carpeting, cleaning materials, ventilation systems and people.
- Activity taking place in the building.
- Building occupants' expectations of the indoor air, given the activity taking place.

The first two factors determine the influence of odours on the well-being of the room occupants. Analysis of the last two ensures that only those odours are introduced into the indoor environment that will meet the expectations of the room occupants.

It is also important to recognise that not all substances are suitable for dispersion into indoor air. Some substances can exhibit both relaxing and stimulating effects, while others can exhibit relaxing effects but also act as depressants.

Among the characteristics of substances that should be considered are their perceived intensity, volatility and stability with respect to air volume, pressure and temperature — and any changes in these values at different levels of relative humidity. These substances also have to withstand conditions in air-conditioning ducts and exhibit the required characteristics once dispersed into air.

Diotima von Kempki is president of Air Vitalising Systems in Düsseldorf, Germany. This article is based on a recent conference co-sponsored by the American Society of Heating, Refrigerating and Air-Conditioning Engineers.



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RESEARCH

Microbes — blame humidity, not filters

Brian Taylor describes research into the growth of microbes in ventilation systems and their control.

Microbial agents have been identified for many years as a health risk in indoor air, but many microbial problems are related to indoor condensation and could be controlled by designing improved

ventilation systems. A study by Dr Möriz of the University of Berlin, sponsored by Camfil, has shown that the microbial problems associated with intake-air filters, in particular, occur when the

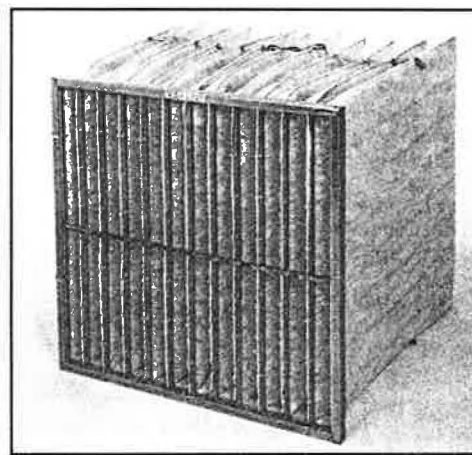
relative humidity (RH) exceeds 80% for three days. As it is difficult in many applications to avoid a high RH in these filters, it was found that by installing high-quality filtration in two stages, the microbial growth could be reduced to a low level.

Strategy

The first stage of the filter arrangement requires a quality of at least F7, which should be replaced after a maximum of one

year's operation or earlier, if the final pressure drop is reached. As the second-stage filter is not exposed to the high RH and effectively stops micro-organisms and particles, it can remain in position twice as long as the first, provided the final pressure drop is not reached. Again the filter must be of a high quality — at least F7.

To keep microbial growth to the absolute minimum, not only should attention be paid to the filters, but the ventilation



Research shows that high-quality air filtration, to at least the F7 standard achieved by this Camfil Hi-Flo bag filter, is needed to reduce microbial growth to a low level.

plant must be designed so that the RH is always below 90%, with the average over a 3-day period being less than 80% in all parts of the system.

fostered microbial growth, the experiments showed that air temperature had a strong influence on the development and transmission of fungi, compared to bacteria.

Extended tests

These recommendations are based on the results of both field and laboratory tests over an extended period. In one of the field experiments, the pre-filters of two large HVAC systems were equipped with three different types of new air filters. Over a period of 13 weeks, the concentrations of airborne micro-organisms were measured in varying climatic conditions — upstream and downstream of the filtration — and on the media surfaces.

A comparison between the field and laboratory tests has led to a new understanding of how micro-organisms react with air filters — periodically alternating the climatic conditions and the stream of air through a filter will cause all the collected micro-organisms to die rapidly. This will not happen however, if the average RH exceeds the 80% mark.

“Microbial problems associated with intake-air filters occur when the relative humidity exceeds 80% for three days”

As a result of Dr Möriz's study, premises can, for the first time, be characterised and the hygienic considerations of the HVAC systems optimised to avoid the critical operating conditions which may cause microbial growth on air filters.

Treatments

A further project, funded by ASHRAE in the USA, looked at whether microbial growth could be inhibited by using an 'anti-microbial' treatment. Following literature searches, laboratory tests and field studies on products from both media manufacturers and filter companies, a comparison of the results concluded that there was no difference in microbial growth between treated and untreated air filters.

In the laboratory tests, which were conducted in parallel with the field trials, samples of the same air filters were exposed to an airstream for 21 days to study the reaction of micro-organisms and to determine if microbial growth had occurred. These tests were performed in special climate chambers under constant climatic conditions. As well as discovering that a high RH

Brian Taylor is managing director of Camfil Ltd, Knowsley Park Way, Haslingden, Lancs BB4 4RS.

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Getting the measure of carbon dioxide

Carbon-dioxide emissions are under-rated as a way to gauge the effectiveness of ventilation systems, according to Craig Booth of air-hygiene specialist System Hygienics.

He explains, 'They are an excellent surrogate measure for other contaminants that may be building up if the fresh-air replacement in a ventilation system is inadequate. But in the absence of any standard for environmental systems, there is a great deal of confusion over what level of exposure should be considered acceptable.'

The industrial/occupational level of 5000 parts per million is widely accepted as the standard for environmental exposure in offices and similar locations, according to Mr Booth. 'Our experience indicates that environmental exposure levels should be an order of magnitude lower, perhaps no greater than 650 parts per million,' he says.

Monitoring by System Hygienics has shown that even at the 650 p.p.m. level, staff in 20% of cases have complained of poor ventilation and stuffiness. Carbon dioxide levels in outdoor air range from 300 to 425 p.p.m.

Because it is seen as such an effective indicator of ventilation-system conditions, System Hygienics advises its customer to have carbon-dioxide checks included in their inspection and monitoring programme.

Reader Reply No. 125

HYGIENE

To clean or not to clean? — and other questions

Does your ductwork need cleaning? How often, and how well? Steve Lorriman has the answers to all these worrying questions.

Nowadays most of us are aware of the potential health and hygiene risks associated with dirty air-conditioning ductwork systems. Recent stories and articles have warned of the dangers that lurk within ductwork. Although we are aware that ducts should be cleaned, there are many issues about which most people are not well informed.

How do I know that my ductwork needs cleaning?

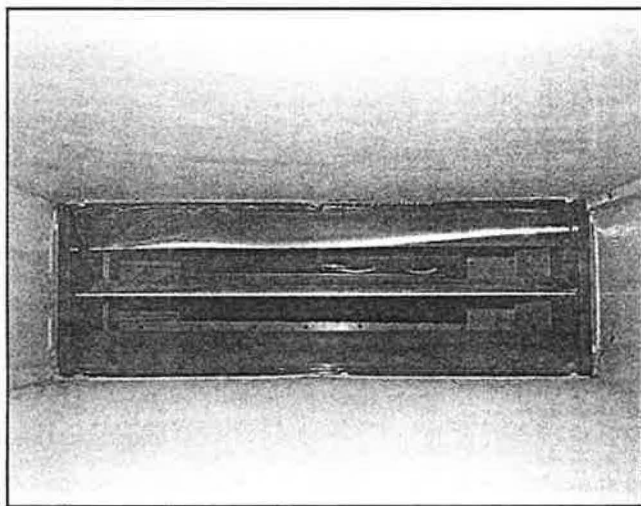
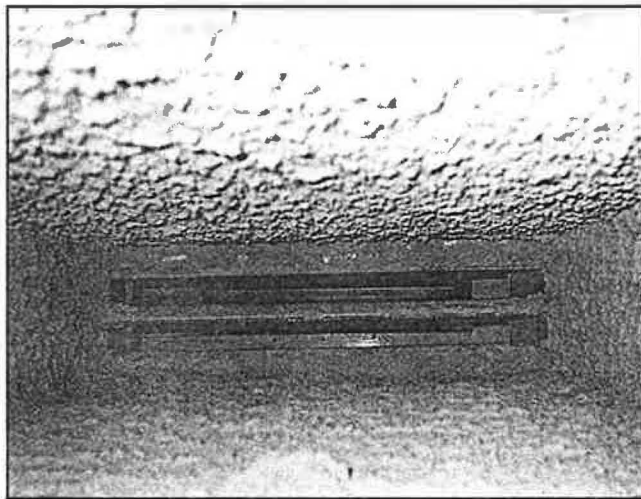
There are several ways of identifying a potentially contaminated air-conditioning system prior to cleaning. Often we are called in when a client notices dirty smutts coming out of the supply grilles that start to discolour decorations and ceiling tiles.

If it is necessary to establish exact hygiene levels, various tests can be undertaken by specialist cleaning contractors, and most will be happy to visit the site and undertake a full survey of any system.

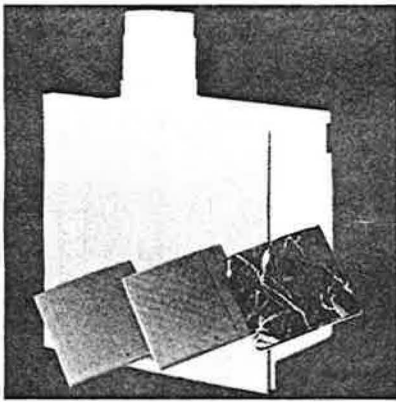
The tests that can be utilised include visual examination with photographic equipment and fibre optics to examine normally inaccessible areas of ductwork, swab tests to establish microbiological contamination and airborne-particle testing. Vacuum tests based on the US National Air Duct Cleaners Association (NADCA) standard can also be undertaken.

How often should my ductwork be cleaned?

The frequency of cleaning any ductwork



Squeaky clean — these shots of ductwork before and after cleaning show the remarkable transformation that can be achieved by specialist cleaning companies.



A NEW FACELIFT

The revolutionary new QuietVent concept from Helios Ventilation Systems combines lowest noise levels within a truly brilliant design. The QuietVent is available in either flush or surface mounting casings with the added advantage of choosing a fascia to meet any colour co-ordination requirement.

These new fascia plates are available in stunning yet subtle colours including various marble effects.

The QuietVent is very easy to fit with simple bolt-free connection of the fan unit, simply press in and fix using bayonet plugs. The slim fascia has no openings in the front panel and the innovative 3" centrifugal fan operates at sound levels below 34dB(A) at one metre on the 60m³/h flush-fitted model.

The fascia plate features a filter change display indicator clearly showing the degree of dirt in the filter. Easy to remedy, just flip up fascia and replace with a clean filter.

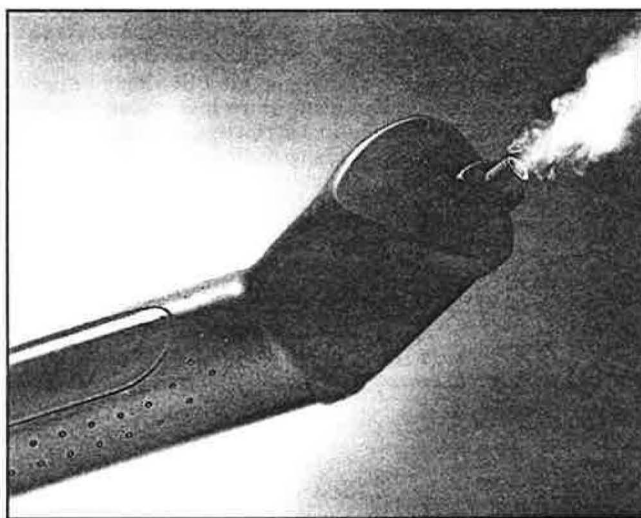
The unit can be fire rated for 90 minutes with the optional two room version and all casings are complete with back-draught shutter that can be fitted in any one of four positions to suit the individual application. Choice of three air volumes 30, 60 and 100m³/h complete with a choice of adjustable run-on timer and dynamic humidity sensor.

The Helios QuietVent is available from a nationwide network of distributors with Helios trained operatives always on hand to discuss customers' 'handling air' problems.

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Fax: 01206 228501
E-mail: Heliosfans@AOL.com
Reader Reply No 000

Reader Reply No. 27

Knowledge comes in clouds



Air-movement patterns can be revealed using this hand-held instrument from Draeger.

The slightest of air movements in heating-and-ventilating, laboratory or industrial applications can be revealed by Draeger's Cumulus air-current indicator. Battery powered, it produces a harmless cloud of smoke as a single cloud or a continuous stream for up to three minutes. It is said to be particularly useful for detecting leaks and where dispersion or ventilation efficiencies may need to be checked.

Cumulus is a hand-held instrument. Fitting an ampoule containing the smoke-generating fluid creates clouds with the same density as ambient air.

The cloud can be used to test the integrity of air-tight systems or to determine different airflows in a workplace. It can also be used to determine the most appropriate measuring points for any air analysis or monitoring.

Reader Reply No. 126

system often depends upon the specific use of that system and the areas it is serving. The Workplace (Health, Safety & Welfare) Regulation 5 imposes a duty to clean mechanical ventilation systems 'as appropriate' and ACOP 22(A) states that regular maintenance (including, as necessary, inspection, testing, adjustment, lubrication and cleaning) should be carried out at suitable intervals.

Obviously a system serving a hospital operating theatre should be cleaned more regularly than one serving, say, a factory area, due to the nature of the working environments. Also the type of filtration, regularity of maintenance and

location of the building/air intakes all play an important role in determining the frequency of cleaning.

Will it be necessary to install access doors?

This very much depends upon the age of the system, the conditions within it and the cleaning methods to be employed. Normally any older systems that have not been cleaned before will require some type of access to be installed to facilitate the clean itself. The number of doors necessary will be dictated by the style of the installation (i.e. amount of turning vanes, re-heat batteries, size of ductwork

to page 26

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Reader Reply No. 28

from page 25 etc).

Most specialist ductwork cleaning companies will install access doors as part of the cleaning programme and can give advice on the quantity required and the best locations during an initial site survey.

Which is the best method of ductwork cleaning?

Many different ductwork cleaning methods are available, and each one promises to be more efficient and cost effective than the next. They range from rotary brushing, sectional extraction, compressed-air lances, high-velocity vacuuming and various manual methods such as hand wiping and brushing.

In reality, each of these systems work well in different scenarios, so it is impossible to name one technique as the best. Rotary brushes work particularly well on small diameter circular ductwork, and manual vacuuming works better on larger ductwork where man access is available.

When choosing a specialist ductwork cleaning contractor the best approach is to find a company which uses all of the above-mentioned cleaning systems and therefore can adapt to various situations and circumstances found within a modern air-conditioning system.

What about microbiological contamination?

It is quite normal in air-conditioning ductwork

systems for there to be a certain amount of non-pathogenic environmental micro-organisms. Considerable research is underway to establish acceptable and non-acceptable levels of colonisation.

It is therefore advisable that once a system is cleaned of all physical signs of contamination, it is then biocidally disinfected to reduce the risk of microbiological contamination. This is a safe process that can be done whilst the building is unoccupied using either fogging or manual spraying techniques with a broad-spectrum biocide.

How can I be sure that the ductwork cleaning has been undertaken properly and effectively?

The most effective way of establishing this is by visual inspection of the ductwork to ensure it is free from contamination. Similar tests can be undertaken to those before cleaning and results compared. Pre- and post-cleaning reports can also be undertaken by ductwork cleaning contractors — including photographs, test certificates and all other relevant documentation.

Once a ductwork system has been effectively cleaned it is advisable to arrange regular inspection and testing of the system to monitor the environment and ensure conditions are maintained at an acceptable level.

Steve Lorrain is managing director of H2O (Essex) Ltd, Unit 1a, Annwood Lodge, Arterial Road, Rayleigh, Essex SS6 7UA.

Ventilation monitoring service checks compliance with regulations

Building-services cleaning and hygiene specialists Swiftclean offers a monitoring service for ventilation systems. It is designed to ensure that the levels of cleanliness and hygiene laid down in the 'Workplace (health, safety and welfare) regulations 1992' and related approved

codes of practice are achieved.

The services can be tailored to meet the specific requirements of individual installations. It provides an economic means for facilities and building managers to establish if their systems need cleaning and to maintain reasonable

and acceptable levels of cleanliness at all times.

This service is based around the use of a magnetic induction gauge which measures deposits at key points throughout a system, giving a mean thickness read out for comparison with the minimum acceptable levels laid down in HVCA guidance (60 µm for supply and return systems and 180 µm for extract systems).

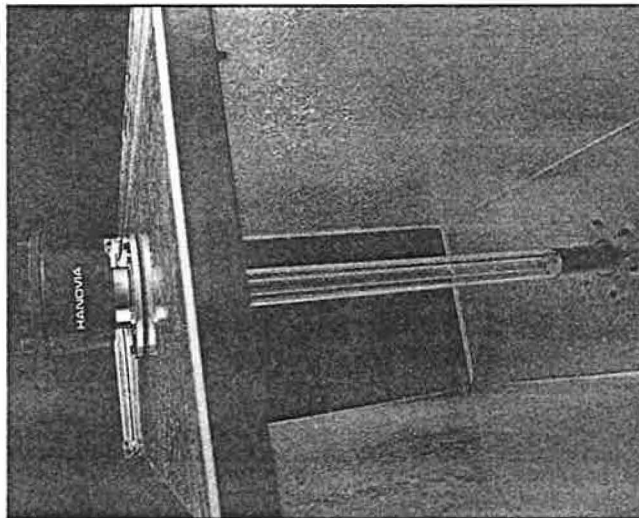
System layout and plant location drawings are recorded in a log book, which lists the required types and sizes of filters and provides an ongoing record of previous inspections, relevant technical information and a schedule of planned preventive maintenance

where required. Three levels of service/inspection are available.

- Testing — to establish and record the thickness of deposits at designated locations and summarise any remedial action required.
- Inspection — to provide a detailed visual check of fresh-air intakes, air-handling units and a predetermined cross section of in-line plant, dampers, heat exchangers and terminals.
- Micro-biological test — enabling swab samples or contact plates to be taken for independent laboratory analysis to establish total viable counts of fungi and bacteria.

Reader Reply No. 130

UV disinfection unit makes light work of killing bugs



This Hanovia disinfection unit exposes airflows of up to 2 m³/s to ultra-violet at wavelengths designed to kill micro-organisms. Kill rates well in excess of 99% have been achieved for organisms such as Staphylococcus aureus and Pseudomonas aeruginosa, common airborne pathogens.

This method of disinfection works by destroying the DNA of micro-organisms. The only maintenance required is to replace the UV arc tube twice a year.

Reader Reply No. 128

Ventilation fans designed for speed of installation

The Airvac+ range of axial ventilation fans introduced by Greenwood Air Management comprises 18 models with a number of features to facilitate easier and quicker installation.

Combined with existing domestic fans, Greenwood offers 58 different product solutions for whole-house, kitchen, utility-room and bathroom/shower room and toilet applications. They exceed Building Regulations ventilation requirements.

All fans in the Airvac+ range are available with the required control options, which include PIR, delay on timers, humidistat/time and safe extra-low voltage.

Installation features include a screwless, clip-in terminal block to eliminate the need for wire stripping and make for easier wiring access. The cable can be routed through the top or back of the fan via a reversible grommet. A non-crush spigot design enables the tightest of installations to be achieved, and electrical isolation is built in.

Other features include thermal operated shutters and a clip-on grille to provide quick access for cleaning and maintenance.

Reader Reply No. 129



Greenwood Air Management has added to its range of domestic fans with the Airvac+ range

Fans Direct joins the extractor-fan market

Fans Direct has added a 12 in fans for installing in a window or through a wall to its product range. It is aimed at premises such as pubs, clubs, restaurants and leisure centres to help them comply with the new Government code of practice on smoking in the workplace.

Available on next-day delivery, there are three models. The basic model comes without a controller. The next version has a 12 V recessed 3-speed controller. The third model has a controller giving fully automatic operation with temperature, humidity and PIR sensors.

The grille comes in a choice of three colours — grey, black and wood finish.

Reader Reply No. 131



12 in fans are offered on next-day delivery by Fans Direct to help meet Government guidelines on smoking in the workplace.

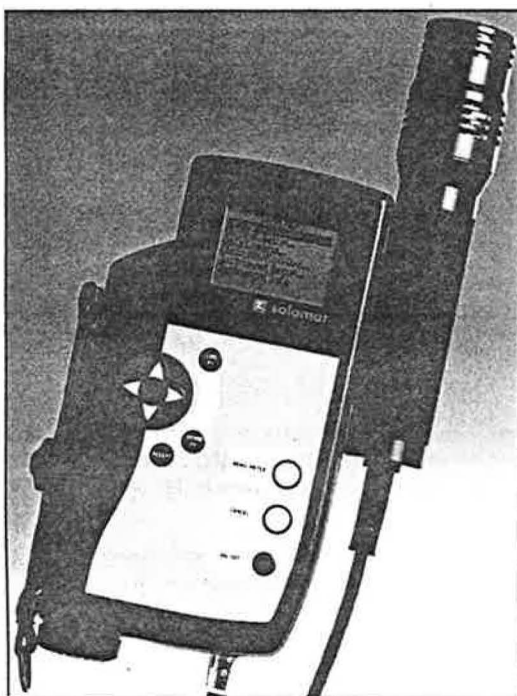
Enhancing the measurement of carbon dioxide in air

Solomat now offers a new generation of non-dispersive infra-red detection (NIDR) sensor for measuring carbon dioxide with its IAQ Surveyor instrument for proactive measurement of indoor-air quality and diagnosing IAQ problems.

NIDR technology is quicker to calibrate than electrochemical cells and remains stable for a year, compared with a month. Other advantages include high reliability, consistent operation and the ability to provide continuous unattended measurement.

This new sensor has a battery life of 30 hours, which is more than double that of other similar models.

Reader Reply No. 127



The benefits of measuring carbon dioxide using a new generation of non-dispersive infra-red detector are available with Solomat's IAQ Surveyor.

Monitors and analyses air-quality data and comfort

Airflow Developments has introduced a hand-held instrument for assessing indoor air quality and comfort levels.

It measures temperature, relative humidity, carbon monoxide and, using non-dispersive infra-red technology, carbon dioxide. Sensors are also available for air velocity, differential and rotational speed.

This instrument is menu driven and programmable for long-term monitoring. It can also be used for spot checks.

Software for further analysis and data reporting using Windows is included.

Reader Reply No. 132



Suitable for spot checks or long-term measurement is this IAQ monitor from Airflow Developments.