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MARK THROWER MANAGING EDITOR

The Importance of Ventilation

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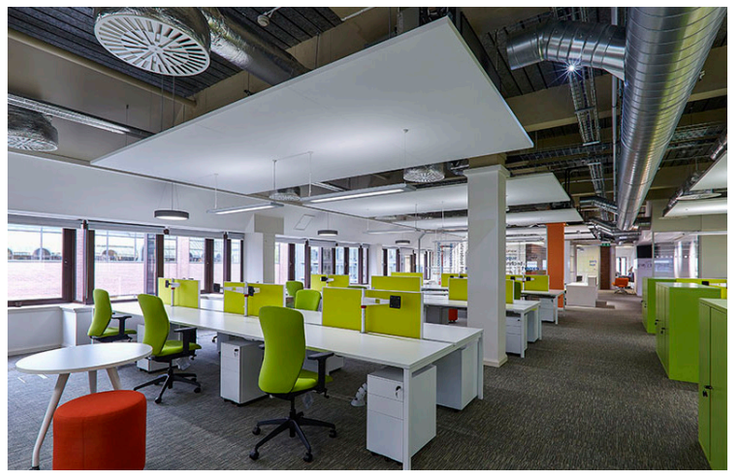
The current pandemic has raised awareness for the importance of ventilation requirements. It has drawn end users to review their ventilation provisions and with a range of items having to be considered. It has also shown the large number of end users who thought their air conditioning system was a ventilation system or they weren't meeting the ventilation requirements.

Before we go on, it is worth reminding ourselves why ventilation is important: it is needed to provide oxygen and to dilute pollutants (mainly carbon dioxide and odour). It is also used to assist in maintaining good indoor air quality by diluting and removing other pollutants emitted within a space but should not be used as a substitute for proper source control of pollutants. Ventilation is additionally used for cooling and perhaps to provide oxygen to combustion appliances (small commercial and domestic generally). Good ventilation is a major contributor to the health and comfort of building occupants.

Improving understanding

Now, during the difficult times we are living through, is an opportunity to garner an improved understanding of what a ventilation system is, the importance of it, and why it should be operating in line with ventilation design requirements. Many overlooked and poorly ventilated buildings will need addressing or they will simply not be occupied going forward. Little tolerance for not meeting guidance will be accepted.

While some industries may see a change in requirements relating to ventilation, it doesn't always subsequently mean an increase energy use. An increase in air volume through the ventilation will have an impact on the heating and cooling aspect for buildings though. However, with new technologies and the ability to refurbish air handling units, this could result in more air for less power. Where replacements are offered this will, in addition to using less power, possibly offer the opportunity to incorporate heat recovery components which the old system may not have had, or EC fans or improved controls. This will reduce heating and cooling energy use by being more effective and efficient, whether this is gas for boilers or electricity for chillers. It will certainly be expected to improve the environment for the users.



In cases of retrofit, having a contractor that understands the mechanical systems will be able to provide a solution that ensures your system meets the ventilation requirements while saving energy.

Air conditioning systems, for clarity in this context, are those which provide comfort heating and cooling. These systems have been a cost-effective method for providing both. However, if the system is not aligned with your ventilation then it can use more energy and provide poor environments, for example, users feeling draughts. It is important to understand the importance of ventilation to your air conditioning system. In certain circumstances where an air handling unit has heat recovery and the controls strategy is appropriate, this can provide free cooling which should reduce the use of the air conditioning system. This is also the case for the heating.

CIBSE Ventilation guidance

You can review your ventilation requirements by looking at Part F in England & Wales, and Section 3 in Scotland. In addition to this, the CIBSE publication, COVID 19 Ventilation guidance, is also a good reference document. Other readings

are provided in the reference list.

In the first instance, it is necessary to know the ventilation requirements for the building by simply referencing against the guidance documents at the same time consider the COVID guidance set out by Government.

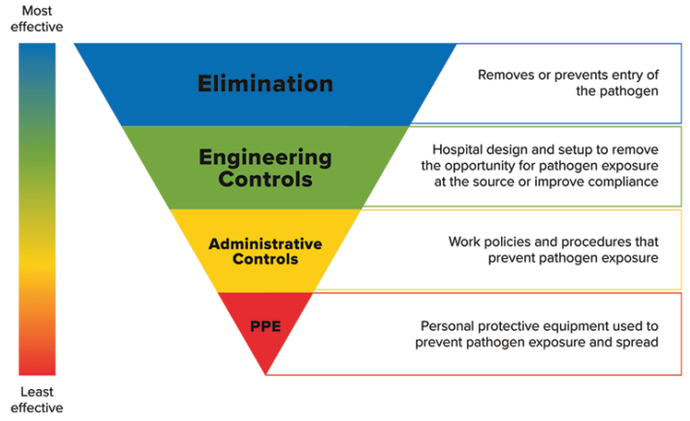
Don't recirculate air

The CIBSE COVID guidance states: "It is preferable not to recirculate air from one space to another. But in certain weather conditions closing the recirculation dampers in some systems may make the supply air unacceptably cold and cause a reduction in the rate of supply of outside air to the occupied spaces below the recommended minimum (10 l/s/person for typical offices) in order to maintain an acceptable temperature. In these instances, there is a balance between two risks: the greater risk arising from recirculating some air of cross-contamination between rooms or zones, which is relatively low risk, against the risk of increasing contaminant build-up as a result of not maintaining adequate provision of outside air, which poses higher risks. Recirculation should be considered if this is the only way of maintaining adequate provision of outside air to occupied spaces without causing undue occupant thermal discomfort."

The next step is to check that the ventilation system can meet these requirements. While you might assume that a ventilation system is designed to meet the requirements, there may be a gap due to the age of the system (performance drop) or changes in the building from design. In some instances, it may be prudent to physically measure the air flows from the main plant and then identify any areas which may not be balanced or being poorly served (downstream in grilles or ducts). Government Guidance highlights: "areas less than 5l/s/person or greater than 1,500ppm CO_2 should be identified and prioritised.....ensure sufficient at 10-15l/s/person or lower than 800ppm CO_2."

Where systems are not meeting requirements then you would need to increase from other measures or look to capitalise on upgrading the system. Upgrading the system regardless can often offer an energy saving, but before we highlight where those opportunities lay and the penalties in existing systems, let's run through what can be done to increase ventilation in buildings and what this means in practice. Bearing in mind it is advised to "increase ventilation levels where possible with the limiting factor not to compromise the overall thermal comfort all the same."

Figure 1: Traditional infection control pyramid adapted from the US Centers for Disease Control



Increasing air flow

Methods to achieve this include changing set points to increase air flow in some way, or reducing the CO_2 sensor limit if used in controlling adaptively, opening windows, or other natural ventilation provisions (trickle vents for example). So, whether you are increasing the air flow from the mechanical ventilation or from natural means, this needs to be related to the heat/cooling provision. For example, the boilers in a building will be sized on infiltration rates which will be lower than what you now have in most cases. Is there going to be enough boiler capacity, if not, then you are going to compromise thermal comfort.

If you are purging periodically during the day (increasing air flows to flush buildings), is the boiler capacity going to be sufficient to have reasonable heat up times that don't impact on thermal comfort? It may be that purging during the day happens in more local areas rather than a whole building to spread the increased load across time. But then will that be effective at flushing the building in some areas but not others? Some short periods of thermal discomfort may be acceptable in some cases but not in others; the building operator will have to make that choice or gain that knowledge.

In doing so, there needs to be clear communication, engagement and managed change with the occupants/users. Changes to occupants/user environments should not be undertaken in a directive way but in a sensible, managed and engaging way. It will not be enough just to explain away thermal comfort issues as we need to do this for COVID reasons.

There may also be a bit of trial and error as learning and understanding of the new operations take place. Operators will need buy in to this from at least a majority of a building's occupants.

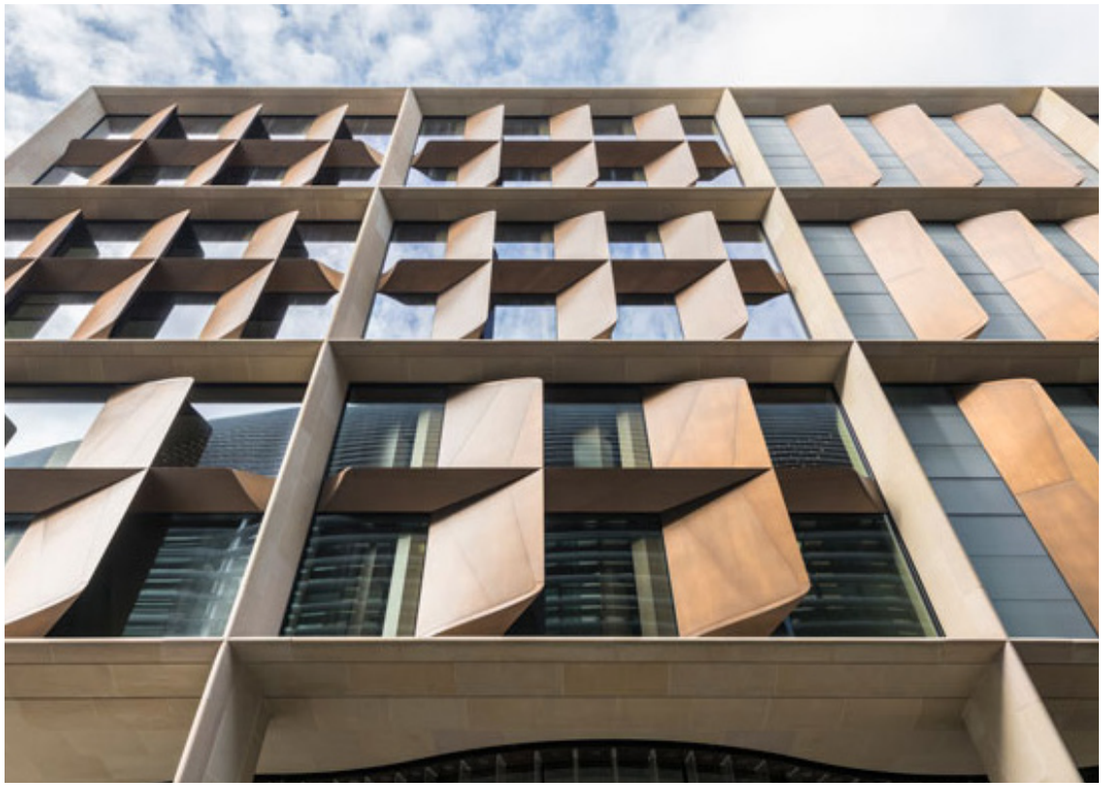
It is worth noting that thermal comfort of users is not the same for everyone (like I needed to say this to most operators), but there is a perception aspect to consider if occupants are being heated/cooled perhaps intermittently. There may well be additional draughts to take into consideration. These changes of thermal comfort may be perceived even into periods when temperatures are at good levels. We like steady conditions. So, operators may need to think about visual aids around temperature and active engagement/communication to manage expectations. You may have to go and speak to them regularly.

Another capacity aspect could be around the heater battery. While these are oversized to a certain extent, the age will impact on their effectiveness from dirt/debris on both sides. There may also be valves which are nearing end of their useful life and not fully opening and restricting flow. This may mean that ventilation air is provided at lower temperatures and fighting against separate heating systems, like LTHW radiators.

Take seasonality into account

Operators will have to take seasonality into consideration too, as this would be more an issue in the heating season than in the late spring.

Similarly, in ventilation systems using heat pumps for heating and



cooling, these need to be reviewed in a similar way of available capacity to meet increased requirements.

Learning about your systems, limitations, and options for operations is key but keep the focus on occupants/users too as you do it. It's not the building you are trying to reduce the likelihood of getting COVID, it is the occupants. Naturally, they should be at the forefront of the changes/provisions and be part of that. It will also make them feel they are in a safe environment. This is not something we are used to think about when it comes to offices.

Consider transference carefully

For heat recovery systems, operators need to understand transference from exhaust to supply air streams. This will need to be considered more greatly for both transference and the system's ability to have reduced heat recovery. The system may not have the flexibility now required and may need to be adapted.

The main energy penalties are as follows:

- increased air volumes mean increased heating and cooling of the air;
- increasing air volumes too much may impact on boiler efficiency;
- increased air volumes will increase fan/motor power required;
- in some systems turbulence may also mean increased pressure drops and so will impact fan/motor power required (restricted designs or poorly designed mainly);
- poor inlet air quality to system (increase filtration and subsequently pressure drops across filters); and
- internal heat gains in summer and cooling/air losses in winter (from fabric or system).

What are the energy opportunities?

- improve the controls, mainly through CO_2 sensors, but not exclusively;
- check controls and sensors are working within expected bands/tolerances or just operable in the first place;
- upgrade fans and motors to new more efficient motors or banks of EC fans;
- check fan belts are appropriately tightened;
- fix any air leaks;
- consider additional DX coils for heat recovery which will maximise heat recovery while maintaining air quality and humidity;
- DX coils for heat recovery may also eliminate multiple split units or remove wasted energy from condensers;
- reconfigure any systems that are out of balance – systems are only efficient once effective;
- look to reduce pressure drops (cleaning, improving grilles etc.);
- ground pre-conditioning; and
- more localised control.

To summarise below (from CIBSE/Government guidance documents):

- understand your ventilation system and ventilation requirements;
- understand where you may have poorly ventilated spaces or areas;
- increase the ventilation rate as much as reasonably possible; this may require changes to CO_2 set points (for both mechanical ventilation and automated windows);
- avoid recirculation/transfer of air from one room to another unless this is the only way of providing a sufficient rate to all occupied rooms;
- recirculation of air within a single room where this is complemented by an outside air supply is acceptable as this helps to provide more outside air to occupants and can help to maintain thermal comfort;
- where thermal (or enthalpy) wheels are installed to recover heat, then a competent engineer/technician should check that the configuration and operating conditions are such that any leakage across the device is from the supply side to the extract side, to minimise the risk of transferring contaminated air into the supply.

In addition to the points above:

- think about cleaning ductwork and ventilation systems regularly. Refer to SG20 or O&M manuals; and
- update maintenance and assess operability of system components.

To highlight a wider appreciation of disease control there is more to mitigating COVID transmissible risks and we have concentrated only on the ventilation systems (see hierarchy in Fig 1).

In most cases it would be expected that ventilation requirements and new expectations can be meet easily but where not, embracing it can mean an opportunity for better building environments.

Further reading

Ventilation Requirements in buildings:

1) https://www.gov.uk/government/publications/ventilation-approved-document-f

2) https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/

General overview of Energy use of Ventilation:

3) https://www.aivc.org/sites/default/files/members_area/medias/pdf/Guides/GU03%20GUIDE%20TO%20ENERGY%20EFFICIENT%20VENTILATION.pdf

COVID specific or related:

4) https://www.cibse.org/coronavirus-covid-19/emerging-from-lockdown

5) https://www.gov.uk/government/publications/emg-role-of-ventilation-in-controlling-sars-cov-2-transmission-30-september-2020

6) https://www.rehva.eu/fileadmin/user_upload/REHVA_COVID-19_guidance_document_V3_03082020.pdf

7) https://www.cdc.gov/niosh/topics/hierarchy/default.html

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CPD SERIES 18 | MODULE 07 | FEBRUARY 2021

ENTRY FORM

AIR CONDITIONING

Please mark your answers below by placing a cross in the box. Don't forget that some questions might have more than one correct answer. You may find it helpful to mark the answers in pencil first before filling in the final answers in ink. Once you have completed the answer sheet, return it to the address below. Photocopies are acceptable.

QUESTIONS

1) What are the main reasons for good ventilation in buildings?
- ☐ Remove odours and pollutants
- ☐ Provide oxygen
- ☐ Minimise CO2 levels
- ☐ All of the above

2) Where will you find ventilation requirements for buildings in England and Wales?
- ☐ Part F
- ☐ Part M
- ☐ Part 3
- ☐ Part K

3) What areas are seen as priorities in buildings from new Guidance?
- ☐ 5 l/s/person or 800ppm
- ☐ 5 l/s/person or 1500ppm
- ☐ 10 l/s/person or 800ppm
- ☐ 10 l/s/person or 1500ppm

4) All buildings should not have a purging cycle during normal operations?
- ☐ True
- ☐ False

5) What is the limiting factor for increasing ventilation rates?
- ☐ Boiler capacity
- ☐ Thermal comfort of occupants
- ☐ Number of occupants
- ☐ Location and outside air quality

6) What is important if a change is required for occupants?
- ☐ Clear communication
- ☐ Active engagement
- ☐ Consideration of their working environments
- ☐ All of the above

7) Heat recovery systems shall need to be reviewed for transference?
- ☐ True
- ☐ False

8) What retrofit items may save energy while allowing you to increase ventilation rates?
- ☐ Fixing air leaks
- ☐ Installing EC fans
- ☐ Localised controls
- ☐ All of the above

9) Where can you find information on maintenance expectation of building services?
- ☐ PG20
- ☐ SG20
- ☐ Section 3
- ☐ Section F

10) What is the most effective way for infection control?
- ☐ Elimination
- ☐ Controls
- ☐ PPE
- ☐ Trial and Error

PLEASE COMPLETE YOUR DETAILS BELOW IN BLOCK CAPITALS

Name ..... (Mr. Mrs, Ms) .....

Business .....

Business Address .....

.....

.....

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..... Post Code .....

email address .....

Tel No. .....

COMPLETED ANSWERS SHOULD BE MAILED TO:

The Education Department, Energy in Buildings & Industry, P.O. Box 825, GUILDFORD, GU4 8WQ. Or scan and e-mail to editor@eibi.co.uk. All modules will then be supplied to the Energy Institute for marking

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