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expert building service engineers

HVAC and water systems
Safe operation guide

Updated - HVAC and water systems safe operation guide

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Good ventilation – natural or mechanical – is one of the best ways of fighting coronavirus/COVID-19 and diluting virus particles that might be present in the workplace.

This is a guidance document on currently known best practice for, heating, ventilation, air conditioning (HVAC) and water systems, in relation to SARS-CoV-2 – the virus that causes COVID-19.

SARS-CoV-2 ("the virus") is most likely to spread from within your building, rather than through supply or fresh air. Therefore, the removal of existing air and the introduction of fresh air into a building is essential in fighting the spread of the virus.

This guidance informs, facility managers, maintenance personnel and building owners on how to operate HVAC and water systems, to help prevent the spread of the virus. This is applicable for non-clinical commercial and public buildings, i.e. where only occasional occupancy of infected persons are expected.

The term, "virus particles" can be used interchangeably with airborne contaminates, due to the airborne nature of the virus.

To minimise risk of the spread of the virus in this context, there are three main practical measures to begin with.

- **Introduce** as much outside fresh air as is reasonably possibly and comfortable.
- **Avoid** the re-circulation of existing indoor air and the transfer of air from one room or zone into another. Re-circulation should be avoided unless there is no other way of ventilating a poorly ventilated area; while the transfer of air from one room into another should be avoided due to the risk of spreading virus particles to other occupied spaces.
- **Carryout** normal periodic planned preventative maintenance (PPM). If it has been postponed due to building closure, it is recommended that maintenance procedures re-commence immediately.

Before any of that, begin with a health and safety risk assessment – like you might do for any other hazard – in conjunction with a qualified engineer.

Contents

Heating

Heating systems can operate normally and without adjustment, as the virus is a tough and resilient, meaning changes to temperatures in the environment will not make much impact.

Ventilation

Ventilation plays a key role in dilution of virus particles in poor ventilated spaces, as particles can linger in a space with no outside fresh air. Thus poorly ventilated spaces carry an increased risk.

Therefore, as a precaution, supply of outside air should be increased where possible, particularly in poorly ventilated spaces. This will dilute virus particles and reduce the risk of exposure to occupants.

The ventilation rate can positively influence exposure and virus particle deposition rates at far field exposure, not in close contact situations (near field).

- Natural (non-mechanical) ventilation

Buildings that contain no mechanical ventilation must utilise passive forms of ventilation, such as, windows, vents and other apertures.

- To help remove virus particles from the building environment, supply as much outside air as is reasonable possible.
- Utilise openable windows more than normal, however the thermal comfort of building occupants must be considered, especially during cooler months.

- Open windows at least 15 minutes before room occupation.
- Openings don't need to be as wide during cooler months, as natural forces (wind) are more prevalent and forceful.
- During periods of warm weather, windows should be kept open overnight to purge the air in a room, as long as the security of the building is not comprised.
- Fire doors should not be kept open to boost ventilation levels, unless they are fitted with automatic closers, due to their importance in the event of a fire. Automatic closers can keep fire doors open, but automatically release the door to close once the fire alarm is activated.

• Mechanical ventilation

Mechanical ventilation is a strong ally in fighting and limiting the spread of virus particles, as it supplies fresh outside air directly into a building. Mechanical ventilation also helps to dilute virus particles by removing stale air, reducing the risk of exposure to occupants.

- To help remove virus particles from the building environment and from surfaces, supply as much outside air as is reasonable possible – taking into account thermal comfort and energy spend.
- Switch air handling units (AHUs) with re-circulation to full fresh air (or 100% supply air). Please note, not all AHUs can perform this function; while those that can, could increase your energy costs due to higher performance settings. However, that cost must be weighed up against building occupant health benefits during a pandemic.
- Close re-circulation dampers in centralised air handling units. However, if this results in inadequate conditions, from the reduction in the supply of outside air, the risk of re-circulation must be balanced against the risk to occupants from virus particle build-up and zonal transfer of air between rooms or spaces.
- Supplement mechanical ventilation with the use of openable windows to boost ventilation levels.

- On automated windows and vents, use the manual override to boost ventilation if external conditions are favourable.
- Extend ventilation hours of operation to:
  Before occupation – at least 1 hour before building usage at nominal speed.
  After occupation – at least 1 hour after building usage at low speed.
- Change the carbon dioxide (CO2) setpoint to a lower value to maximise air flow. This must be balanced against maintaining comfort levels for occupants.
- Cleaning of ventilation ductwork is not effective, as the virus will become unviable over time, should it deposit in ducted ventilation.
- Relative humidity should be kept above 40% and below 60%, achieving the lowest possible risk of virus transmission. Human immune response is at its most effective at this level of relative humidity.

• Fan coil unit (FCU) ventilation

A fan coil unit (FCU) is designed to condition localised room air – either using re-circulated air only or a combined mixture of re-circulated air and fresh outside air. FCUs are generally located in a void area, either above the ceiling or beneath the floor.

- The mixture of fresh and re-circulated air is only possible in the ceiling unit, due to its proximity to the ducting system. These FCUs can help to dilute virus particles due to the fresh air supplied by mechanical ventilation from the AHU.
- Floor-based fan coil units cannot benefit from access to the mechanical ducting system; therefore, they are only capable of re-circulating air in a room or area. If this area cannot be adequately supported by other forms of mechanical or natural ventilation, the use of these FCUs is deemed counterproductive and a risk to the health of building occupants.

• Heat recovery ventilation systems

Heat recovery systems are effective energy savers and work based on using the energy from extracted exhaust air in a building, to condition incoming fresh supply air.

- If a bypass function is available, it should be utilised to ensure maximum air changes are achieved.
- Air handling units (AHUs) fitted with rotary heat exchangers or thermal wheel heat recovery systems are most prone to leakages – from exhaust to supply air flows. This is due to poor installation or maintenance. This runs the risk of re-circulating extracted virus particles back into the ventilation system. Therefore, it is prudent to have this device inspected by a competent engineer to check that fans are in the recommended configuration and to prove that no leaks from exhaust to supply occur.
- As an additional safety measure, a purging sector can be fitted to rotary or thermal wheel systems. The purge is designed to virtually eliminate cross contamination of air flows in heat recovery systems. The purging sector is an specially designed mount that cleans the thermal wheel with fresh air while physically blocking re-circulated stale air from re-entering the system.
- If a rotary or thermal wheel heat recovery system is the only way of supplying fresh air flows into a building or space, then it is advisable that this function remains in operation, as its use outweighs the risks of stagnant air in poorly ventilated areas.
- Plate heat recovery systems – also in AHUs – are a much safer, as exhaust and supply air does not mix. However, failures can occur, therefore, it is prudent to have this device inspected by a competent engineer to prove that no leaks occur.
- An AHU fitted with run-around coil heat recovery is considered safe due to the complete separation of supply and exhaust air flows.

• Toilet ventilation

Toilet ventilation exists to remove stale air and odours from indoor toilet areas. It is important to gain an understanding of how toilet ventilation is provided – either natural or mechanical – so that pressure balances are not upset, causing the inadvertent reverse air flow to other rooms or spaces.

- Care and consideration should be exercised around mechanical exhaust air flow from toilets to other internal areas.
- Toilet ventilation systems should operate 24/7, if feasible.
- If mechanical ventilation exists within the toilet, the use of openable windows should be avoided. This is because it may reverse the flow of air and potentially send contaminated air out of the toilet block when doors open – owing to a change in pressure. An advice sign may be required to explain this measure and to discourage the opening of windows. External standalone toilet blocks are the exception to this rule, as they have no surrounding rooms to receive potentially contaminated air.
- If no mechanical ventilation exists, openable windows should be kept open as long as possible, taking into consideration both security and comfort.
- Toilets should be flushed with lids closed to prevent potential aerosol plumes containing virus particles from being released. The risk of transmission of virus particles from the faeces of an infected person and the fecal-oral pathway appears to be low.

• Filters

Air filters are an important protection measure in containing contaminants and supplying clean air to building occupants.

- **Disposable air filters (outside units)**

- High efficiency particulate air (HEPA) – capable of filtering out virus particles – are of particular benefit in re-circulation systems, however, they should not be retrofitted to systems that are not designed for their use. Air leakages could occur, offsetting any benefit of the filters' high efficiency.
- There is no significant risk of virus particles entering through outdoor fresh or supply air systems, therefore, standard filters are presumed a reasonable risk prevention measure. Ensuring regular planned preventative maintenance (PPM) inspections take place will see supply air systems operating at their most efficient.
- If filter replacement is required as part of periodic PPM then maintenance should be carried out without delay. Clogged or blocked filters will reduce fresh supply air flow – negatively affecting indoor air quality.
- As is standard practice when replacing filters, the filter should be handled by its cardboard frame – without touching the filter media. Care should also be taken not to shake loose anything collected within the filter media – the filter media should be treated as if it contains active microbiological material.
- It is also important that filter changes do not exceed operating hours or time limits, as microbiological growth can be supported.

- **Washable re-useable air filters (indoor air conditioning units)**

- As is standard practice when cleaning filters, the filter should be handled by its frame – without touching the filter media. Care should also be taken not to shake loose anything collected within the filter media – the filter media should be treated as if it contains active microbiological material.
- Filters should be immediately bagged and taken to a secure area for cleaning.

- **Safe handling of filters**

Standard procedures apply when removing filters and as a precaution, when inspecting mechanical ventilation systems.

- Personal protective equipment (PPE) for dusty work – including, gloves, goggles and respiratory protection – must be worn.
- Disposable filters should be disposed of in a sealed bag and left, where possible, in a secure storage area for at least 72 hours, before being destroyed.
- Standard protection safety procedures should be strictly obeyed by maintenance personnel.
- Read the technical bulletin from the Air conditioning and Refrigeration European Association (AREA) and their best practice safety advice.

Read about mechanical ventilation systems and the maintenance service they require for optimal efficiency.

Air conditioning

Air conditioning supplies conditioned air to an indoor room or area for either the comfort of the occupants or for a business process. It is important to understand the type of air conditioning system in a building because it could either help or hinder the movement of virus particles.

Centralised air conditioning system

Ducted or centralised units typically supply fresh outside air, to rooms or zones within a building, conditioned to a required local temperature.

- Centralised air conditioning is deemed safe due to its mechanically ventilated supply of fresh outside air.

Local split air conditioning units

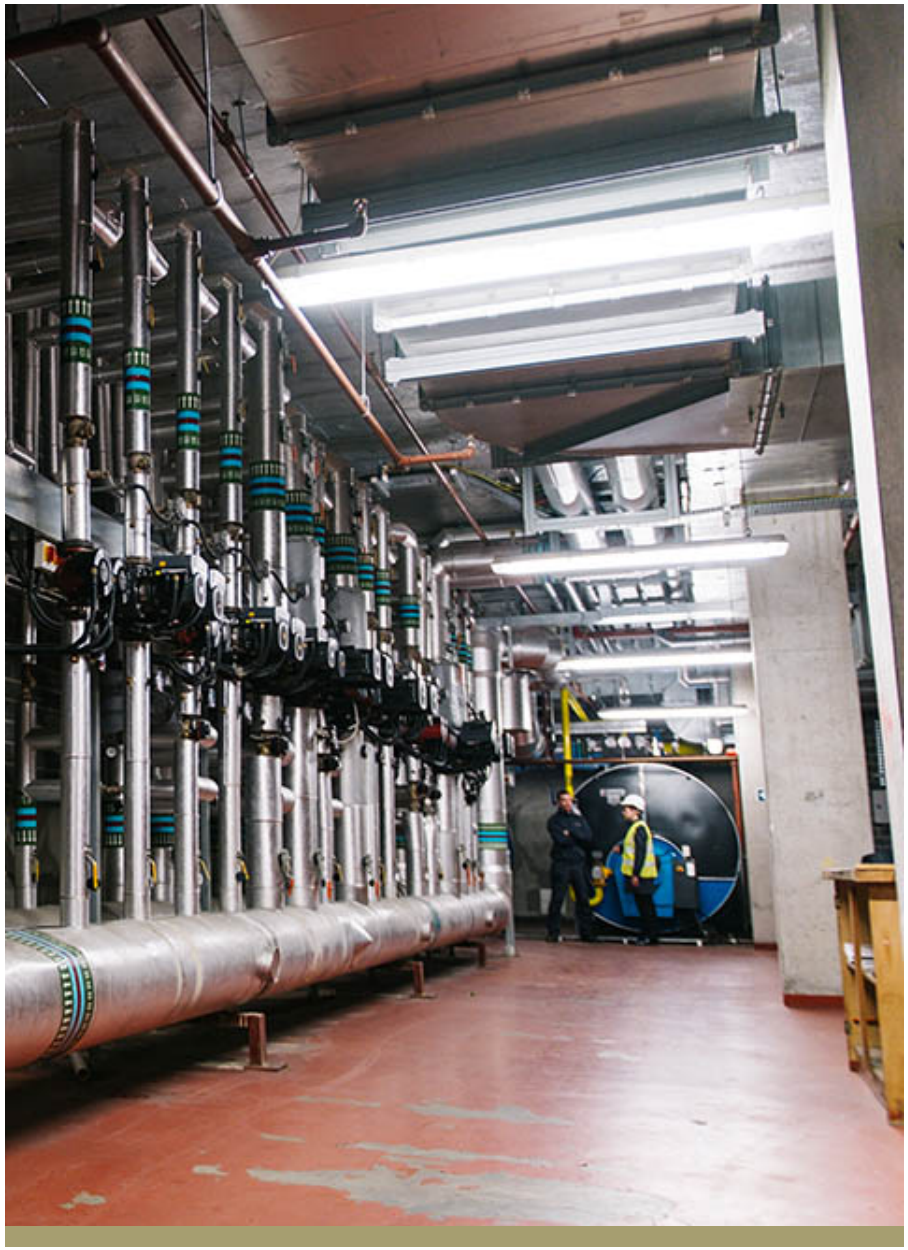
Local or split air conditioning units condition air within a local space only. They do not provide any fresh outside air, instead they re-circulate the air in a room or the local space served. Consequently, these units cannot dilute virus particles in the air.

- To reduce the risk of re-circulated virus particles to building occupants, local or split air conditioning units should only be used if ventilation levels can be increased in other ways, i.e. through the use of openable windows.
- A low fan speed should be utilised with louvres angled to direct air flows across the ceiling, rather than down on top of occupants.
- These units should operate continuously for the duration of occupants' stay as the pressure shock from on/off unit control could dislodge virus particles from surfaces and re-suspend them in the air.

Water systems – Legionnaires disease

Legionnaires disease and its effects bare some relation to COVID-19/ SARS-CoV-2, therefore it should be to the forefront of any risk assessment in re-entering a vacant or little used building.

- Legionnaires disease is caused by legionella bacteria.
- Similar to the virus, legionella bacteria is inhaled through aerosols – created by water – that are invisible to the eye. The disease can be fatal, especially to people over the age of 40, due to their weaker immune systems.
- Buildings are a perfect breathing ground for bacteria growth, owing to their heat, ideal temperatures and the presence of little used water pipework.
- Legionella bacteria favours temperatures of between 25°C to 45°C, with 37°C an ideal temperature. Coincidentally, 37°C is the temperature we like our water at and is also the normal core temperature for the human body.
- Hot water should be stored at 60°C and delivered to taps at 50°C.
- Cold water should be stored below 20°C. Whilst temperatures below 20°C don't kill legionella bacteria – it remains present but doesn't proliferate. Indeed, legionella bacteria has been found in ice, therefore cold does not kill legionella bacteria.
- Little used outlets should be flushed on a weekly basis. Both little used outlets and dead legs pose the greatest risks in a system.
- Flushing of water outlets is one of the most menial tasks but one of the most important. Therefore, staff performing flushing need to be educated through training, to understand why this menial task is so important.



There is often an increase in cases of Legionnaires disease towards the end of the summer, when people return to their homes, having been on holidays. The stagnant water in vacant homes during warm summer months provides a perfect breathing ground for legionella bacteria growth. The same could be said for a little used or unoccupied work building.

Read our further information on Legionnaires disease: causes; signs and symptoms; those at risk; prevention; treatment; testing; risks, national guidelines and your legal obligation.

Further information

Novel enveloped virus

SARS-CoV-2 is a novel coronavirus, meaning it is new. Studies, evidence and knowledge are constantly evolving and updating, as new information emerges.

SARS-CoV-2 is also an enveloped virus, so it does not survive well with the use of soap and alcohol solutions of at least 70%. Please do not forget to keep washing your hands as a protection measure.

The information in this guide was compiled with the help of the below listed organisations and Thermodial's expert technical knowledge of HVAC systems and building service engineering.

Planned preventative maintenance (PPM)

Thermodial's approach to heating, ventilation, air conditioning and water systems is a risk-based PPM approach. PPM is a risk averse measure, ensuring uptime of operation critical systems, providing a safe and secure environment for your staff.

Talk to Thermodial about preventative maintenance to support your businesses' critical needs or explore our full PPM capabilities.

Key guidance source materials (Click icons to access)

- Air Conditioning and Refrigeration European Association (AREA) - **COVID-19 technical bulletin** for advice on special measures
- Chartered Institute of Building Service Engineers (CIBSE) - emerging from lockdown: **ventilation guidance** (version 5, July 2021)
- Federation of European Heating, Ventilation and Air Conditioning Associations (REHVA) - **COVID-19 guidance document**
- Health Protection Surveillance Centre (HPSC) - **National Guidelines for the Control of Legionellosis in Ireland 2009**
- World Health Organisation (WHO) - **water, sanitation, hygiene, and waste management for SARS-CoV-2** protecting human health during infectious disease outbreaks