

SUMMARY OF PRACTICAL MEASURES FOR BUILDING SERVICES OPERATION

The following information is a summary of the COVID-19 guidance developed by the **BESA** - the Building Engineering Services Association - drawing on guidance issued by **REHVA** - the Federation of European Heating, Ventilation and Air Conditioning Associations with additional content from **CIBSE** - the Chartered Institution of Building Services Engineers and other industry bodies.

FURTHER READING

[BESA COVID 19 Guidance](#) - Guidance and support for members regarding COVID-19 / Coronavirus

[REHVA COVID 19 Guidance](#) - How to operate and use building services in areas with a coronavirus outbreak

[CIBSE COVID 19 Guidance](#) - Guidance for staff, members and visitors

IMPORTANT

- Preventing contamination and protecting public health is more important than thermal comfort.
- All works shall be undertaken with common protective measures including respiratory protection
- The maintenance personnel should follow standard safety procedures of dusty work, including wearing gloves and respiratory protection.
- Where users can intervene in the control of the ventilation make them aware of the benefit of these for reducing the circulation of infectious material.

FURTHER READING

[CLC- Site Operating Procedures v7](#)

[GN 1](#) - COVID-19 and Engineering Services: guidance

[GN 2](#) - COVID-19 and Engineering Services: guidance

PRACTICAL RECOMMENDATIONS FOR BUILDING SERVICES OPERATION

- Switch air handling units with recirculation to 100% outdoor air where possible

INCREASE AIR SUPPLY AND EXHAUST VENTILATION

- In buildings with mechanical ventilation systems extended operation times are recommended.
- Time ventilation to start at nominal speed at least 2 hours before the building usage time.
- Switch to lower speed 2 hours after the building usage time.
- It is not recommended to switch ventilation systems off in any buildings, even those temporarily vacated, but to operate them continuously at reduced speeds.

DEMAND- CONTROLLED VENTILATION SYSTEMS

- Change CO2 setpoint to lower, 400 ppm value, in order to assure the operation at nominal speed. Keep the ventilation on 24/7.
- At nights and weekends, do not switch ventilation off, but keep systems running at lower speed

TEMPORARILY VACATED BUILDINGS

(e.g. offices or educational buildings)

- Continue to operate ventilation systems continuously at reduced speed. This will ensure minimal energy usage but will help to remove virus particles out of the building and from surfaces.

OUTSIDE AIR

- Maximise the supply of outside air as much as reasonably possible while maintaining or increasing the social distancing (min physical distance 2-3m between persons) among employees in order to foster the ventilation cleaning effect.
- The purpose of maximising fresh air supplies is to dilute the concentration of possible contamination in the indoor air, so any introduction of outside air is to be encouraged, although consideration may need to be given to the quality of the outside air and any increase in pollutants that may be drawn in by increasing the ventilation rate.

WINDOW AIRING

- In buildings without mechanical ventilation the use of openable windows is recommended, even if this causes thermal discomfort. Consideration of which windows are opened may mitigate draughts, etc, by partial opening of higher level windows only where possible during colder periods.
- Transient areas such as stairs and corridors with no ventilation should have windows or doors opened to allow dilution ventilation wherever possible. However, fire doors should not be propped open and open windows at ground level may introduce security risks which should be assessed.
- In buildings with mechanical ventilation, window airing can be used to further boost ventilation, but the balance of air within the building envelope has to be considered to ensure no infiltration of foul air from washrooms enters other parts of the building when doors are opened to gain access.

HUMIDIFICATION

- In buildings equipped with centralized humidification, studies have shown that maintaining humidity can have significant impact on the human body and its ability to fight off viral attack due to the strengthening of the respiratory system's immune defences and the extended viability of the virus itself both in terms of the rate of evaporation of the aerosol particles and the deactivation of the virus. This is true of covid-19 but also other seasonal respiratory ailments such as influenza.
- Further reading: [40 to 60% RH benefits to human health](#)

HEAT RECOVERY SECTIONS (in AHUs) – for MVHR units see the separate MVHR section

- Inspect heat recovery equipment to be sure that leakages are under control
- Under certain conditions virus particles in extract air can re-enter the building. Heat recovery devices may carry over virus attached to particles from the exhaust air side to the supply air side via leaks.
- Properly constructed, installed and maintained, rotary heat exchangers have almost zero transfer of particle-bound pollutants including air-borne bacteria, viruses and fungi.
- There is no evidence that virus-bearing particles would be an object of carry over leakage.
- It is not needed to switch rotors off. Normal operation of rotors makes it easier to keep ventilation rates higher.
- Higher ventilation rates are recommended as carry-over leakage is highest at low airflow.
- If leaks are suspected in the heat recovery sections, pressure adjustment or bypassing can be an option in order to avoid higher pressure on the extract side causing air leakages to the supply side.
- Pressure differences can be corrected by dampers or by other reasonable arrangements.
- Virus particle transmission via heat recovery devices is not an issue when a HVAC system is equipped with a twin coil unit or another heat recovery device that guarantees 100% air separation between return and supply side.

STOP RECIRCULATING AIR

- Any ventilation or air conditioning system (other than DX type fan coils covered elsewhere in this document) that normally runs with a recirculation mode should now be set up to run on full outside air where this is possible.
- Recirculation of air between spaces should be avoided if occupied by different people.
- The potential benefit to public health at this time outweighs the reduction in energy efficiency caused by not recirculating the air.
- Virus particles in return ducts can also re-enter a building when centralized air handling units are equipped with recirculation sectors. Therefore:
 - o avoid central recirculation
 - o close the recirculation dampers via the Building Management System or manually.
 - o Air filters fitted in AHU's and recirculation sections do not normally filter out particles with viruses effectively

DUCT CLEANING

- Continue with normal duct cleaning and maintenance procedures in line with agreed industry guidance; increase fresh air supply and avoid recirculation of air.
- Extra duct cleaning, over and above the normal duct cleaning and maintenance procedures is not necessary as ventilation systems are not a contamination source and viruses attached to small particles will not deposit easily in ducts.
- Viral material that settles in ductwork will become unviable over time. In the event that some viral material entered the ventilation and air conditioning systems prior to the buildings being vacated due to the current restrictions, it is extremely unlikely that the material will pose any risk when those buildings are re-occupied.
- Ensure you follow the guidance related to heat recovery and recirculation.

COIL CLEANING / DISINFECTION

- Traditional chemical cleaning products reach all parts of an AC unit and do not have any impact on the performance of the unit. However some cleaning products

may adversely affect some materials so manufacturers data sheets should be checked for compatibility.

- Only use products which meet EN 14476:2013 + A2 2019, as they are proven to kill all 7 of the known human coronaviruses.
- A pass against EN14476:2013 + A2 2019 to either limited spectrum viricidal activity, or full viricidal activity allows a claim against SARS-CoV-2 virus
- Most products have a required contact time, so please follow manufacturers guidelines to guarantee their efficacy
- Regularity of PPM (Planned Preventative Maintenance,) may alter depending on environment and location
- Regular 3 monthly intervals between visits, are recommended, or as specified in [SFG20](#).
- Follow manufacturers guidance for advice on PPE, preparation and application methodologies of the products.

FILTERS

- Central outdoor air and extract air filters must be replaced according to normal maintenance procedure when pressure or time limits are exceeded, or according to scheduled maintenance.
- To minimise risk when filters, and especially extract air filters, are changed HVAC maintenance personnel should carry out work in line with standard safety procedures.
- It is not normally possible to upgrade filters to HEPA standard as the fan(s) may not be sufficiently sized to cope with the additional pressure drop. Upgrading filters may necessitate upgrading fan motors as well, if possible.
- Where it is possible, however, to upgrade the filter grade then should be done as the removal of smaller particulate will consequentially help remove contaminated particles and should be seen as an integral part of the solution wherever possible. Some filters may be replaceable with a higher grade without significantly effecting fan performance – for example replacing a G4 panel filter with an ePM1 Bag filter may be an appropriate retrofit measure as the operational pressure drop across the ePM1 filter is 10pa lower than the equivalent G4 panel filter. The ePM1 60% is advisable as a minimum, with ePM1 80% recommended and on systems with recirculation should be installed on both the supply and extract side. For further reference on filters refer to [SFG001](#), [SFG003](#), and [SFG004](#).

Questions have been raised in relation to what special measures should be taken at this time when dealing with maintenance tasks, the changing or cleaning of filters, etc. It is important to emphasise that many measures that should be taken are standard practice and should always be taken, not just during the present pandemic crisis.

- **PPE:**
 - o Correct PPE should always be worn. At this time these will include disposable gloves, an FFP3 mask, goggles, and preferably a disposable coverall suit.
 - o Face fit testing must be completed before the wearing of any tight fitting RPE. It is important to note that if the RPE type changes due to lack of supplies then further face fit testing must be completed.
- **General considerations:**
 - o Consider the type of system or area being served:
 - Does it normally work under a negative or positive pressure?
 - Does shutting the fan down create an issue in the area around the maintenance engineer

whereby you are potentially drawing foul air towards the engineer or into the duct/equipment when access panels are opened or removed?

- Can air be drawn through the system while the filter(s) are removed?
- o Switch the fans off before opening access panel doors to remove the filters and allow any air flow to cease and an equalization of the pressure to be established. No air should be flowing through the system without the correct filter in place and the operative should not be exposing themselves to any foul air flowing through or towards the system.
- **Disposable filters (common uses include AHUs, etc.):**
 - o Should be handled, whenever possible, by the cardboard frame and the filter media left untouched. They should be handled with care to avoid the shaking loose of particulate matter in the filter media.
 - o The filter(s) should be immediately bagged to contain any particulate which does shake loose.
 - o The bag(s) should be tied securely before being moved.
 - o At this time, and if possible, the filter(s) should be left for at least 72 hours before being disposed of in a secure storage area.
- **Washable plastic filters (common uses include modern Air Conditioning systems):**
 - o Should be handled, whenever possible, by the frame edges and the filter media left untouched. They should be handled with care to avoid the shaking loose of particulate matter in the filter media.
 - o The filter(s) should be immediately bagged and taken to a secure washing area.
 - o The filter(s) should be scrubbed in warm, soapy water for a minimum of 20 seconds in line with recommendations for the washing of hands as a preventative measure.
 - o The filter(s) must be dried before being re-inserted into the equipment.
- **Personal hygiene:**
 - o The Government recommended cleaning procedures should always be followed on completion of each stage of the work and before leaving site in relation to hand washing, disposal or storage of coveralls, etc. In particular you should not handle clean filters with the same gloves that you removed them with to minimise any risk of cross contamination.
 - o At all times personnel should refer to the [latest guidance available](#).

FURTHER READING

[SFG 001](#) Air Filter selection to provide clean healthy indoor air quality for city buildings

FAN COIL UNITS

including DX fan coils connected as a single split or part of a multi-split or VRF system)

- The spread of COVID19 has been linked to a number of factors in indoor environments, and there is still much research to determine the exact mechanisms including the impact of airflows within a space. Terminal units such as fan coils and DX units usually provide both local cooling/heating and fresh air and so are often integral to the distribution of fresh air in a building.
- During the Spring and Summer, the guidance generically

was to increase outside air as much as possible by adding mechanical ventilation and/or opening windows. As the outside temperature has dropped this has created issues in buildings where the indoor temperature has become too cold – and frequently dropping below the minimum statutory temperature for occupied buildings – and this is creating a heating load that is often unattainable with existing plant or is imposing an energy demand that is unaffordable and wasteful. See section MHRV Units (below) for further information on ways to mitigate this problem.

- The intent of this precautionary interim guidance is to:
 - a) maximise the introduction of outside air from central plant into the space to dilute any Covid19 droplets suspended in the air.
 - b) reduce potential cross contamination between rooms.
 - c) limit the recirculation air volumes and in room air velocities in shared/open plan spaces to allow any COVID19 droplets to settle out of the airstream and reduce the radius they might be distributed over.
- Whether the unit should be switched off depends on the location, use, and occupation density of the area it serves.
 - o If the unit serves an area occupied by one person with access of other persons limited or prohibited and the air recirculation is all local to that zone, then there is no harm in having the fan coil operational as normal. Any contaminated droplets of moisture in exhaled air will only be recirculating to the person who exhaled it in the first place. The fan coil should be switched off when that person leaves the zone in case others enter in their absence and the surfaces be cleaned down before it is switched back on again.
 - o If the unit serves a multiple occupied area, and there is insufficient fresh air being supplied into the zone, then it is advisable to switch the fan coil off as the potential for air flow distributing a contaminated air droplet towards other people is higher.
 - o If the unit serves a multiple occupied area and it cannot be switched off, or where there is a good supply of fresh air being supplied into the zone, then care should be taken as to where people are in that area in relation to the air flow emanating from the unit, and the fan speed should be turned down to a low speed setting to minimise air throw.

INACTIVATION BY MAINTAINING RAISED COIL TEMPERATURES:

- On the fan coil heat exchanger surface, it is possible to inactivate the virus by heating up fan coils to 60°C for one hour or 40°C for a period of 24 hours each day. If possible the system should switch to full heating mode early each morning or every evening, or at a time when the building or affected room is unoccupied, to allow the coil temperature to rise to 60°C for at least an hour with the fan on low speed to ensure the control thermistor maintains a demand for heating for as long as possible and therefore maintains a high coil surface temperature. If the system is not capable of maintaining a 60°C flow/coil temperature then controls should be set to ensure a 40°C coil temperature is maintained for 24 hours.
- Where the fan coils are served by a VRF/VRV system there may be insufficient heat supply available from the outdoor unit to reach or maintain a high enough coil temperature for a sustained one hour period at all indoor units. In these cases it is recommended that the deactivation regime be stepped so that a proportion of indoor units are run simultaneously for an hour and then another portion run when that first portion shuts down, etc, until all indoor units have been able to maintain the

60°C coil temperature for at least an hour. For example, where there are 8 indoor units on a single outdoor unit it may be sensible to arrange the disinfection of units 1, 3, 5 and 7 for an hour and then switch to units 2, 4, 6 and 8. This will depend very much on the set up of the system as you would want to ensure sufficient capacity at each unit and in different rooms wherever possible to prevent thermistors shutting units down too soon.

- Where fan coils cannot be switched off, fans should be continuously operated to avoid resuspension of virus sediment in filters when the fan is turned on. Continuous operation and exhaust ventilation will remove virus particles. Local room cleaners should be considered in these cases. (see Room Air Cleaners section below)
- Coarse filters within fan coil units do not effectively filter small particles but still might collect particle matter.
- Increasing filter grade may put an undue strain on the fan motor causing burn out, or in the case of DX fan coils cause liquid refrigerant to slug back to the outdoor unit damaging the compressor. For this reason, it should only be done where the air flow can be maintained at a suitable level.

MHRV Units

- Non centralised or local Mechanical Heat Recovery Ventilation (MHRV) devices are an energy efficient solution for delivering ventilation air and creating air changes within a building. Because the supply air is pre-heated using energy recovered from the return air, less energy is required to maintain space temperatures during the heating season.
- MHRV units utilise heat exchangers which are made from paper materials to transfer waste heat energy from the return air stream to the supply air stream. There will always be a small percentage of air leakage inside the MHRV and around the heat exchanger and this is known as the 'Internal leakage rate'.
- Typically, MHRV units will have internal leakage rates of around 8-10%. However, the latest REHVA guidance recommends that leakage from heat recovery units should be below 5%. In order to achieve this lower rate, it is recommended that system pressures are reconfigured so that the supply air system pressure is greater than the return air system pressure.

FURTHER READING

[TB/048/4: TB/015 COVID19 and air conditioning systems](#)
[HSE Guidance – Coronavirus and AC systems](#)
[REHVA COVID-19 Guidance](#)
[CIBSE COVID-19 Guidance](#)

VENTILATION GRILLES

- Care should be taken with any ventilation grilles that can be blocked, e.g. floor grilles for displacement ventilation and occupants educated on the purpose and benefits of these.

ROOM AIR CLEANERS IN SPECIFIC SITUATIONS

- Room air cleaners with HEPA filter efficiency can effectively remove particles from the air in a comparable way to ventilation.
- Devices that use electrostatic filtration principles (not the same as room ionizers!) often work quite well. Studies have shown electrically charged hydroxyl radicals to be very effective in combatting viruses and contamination in air.
- If an air cleaner is used, locate the device close to the breathing zone. However, increasing regular ventilation is much more efficient.

- UV cleaning equipment for the supply air or room air treatment can be effective in killing bacteria and viruses in health care facilities.
- In all cases where localised room air cleaners are used it is important to ensure they are positioned in a location within the room which best treats the air within that room, and that the use of the air cleaner does not instil a false sense of security in the user.
 - o If portable room air cleaners are being used then they must be positioned so that the air in the room is evenly and adequately treated by that room air cleaner. They should not be pushed into corners so that they are "out of the way" for convenience. This may result in the cleaner only treating a small part of the occupied space air.
 - o Use of a portable or fixed room air cleaner does not eradicate the need for other additional measures such as improved ventilation rates, good maintenance and cleaning regimes, and/or deactivation regimes during shutdown periods, for example. You should not assume that because you are using a portable air cleaner that other measures can be relaxed.
 - o Room occupants should be made aware of the importance of the room air cleaner and its proper use with regard to its position in the occupied space. Notices would be useful in this respect to advise occupants not to switch off the units.

TOILET FACILITIES

- Exhaust ventilation systems of toilets should always be kept on 24/7, and relatively negative pressure must be maintained in the room air to help avoid faecal-oral transmission.
- If toilet seats are equipped with lids it is recommended to flush the toilets with closed lids in order to minimize the release of droplets and droplet residues from plumes in the air. It is important that water seals work all time. Therefore, organise that building occupants are instructed to use the lids.
- Opening toilet windows should be avoided as this may cause a contaminated airflow from the toilet to other rooms. In the absence of adequate exhaust ventilation from toilets and window airing in cannot be avoided, it is important to keep windows open in other spaces in order to achieve cross flows throughout the building.

DISPOSAL OF WASTE

- All materials including old filters, should be carefully bagged and disposed of safely.
- Appropriate PPE should be worn.

FURTHER READING

[SFG004 Clean Indoor Air](#)
[SFG003 LCC Energy Datasheet](#)
[Hydroxyl Radicals laboratory tests](#)

DEVELOPMENTS IN FM

FM RELATIONSHIPS

- Continue to develop relationships and true partnerships with clients/tenants
- Communication and connection have never been more important in the FM/client/tenant relationship.
- Occupants must be informed of changes of use of installed systems to understand the positive impacts and importance of settings not being tampered with.

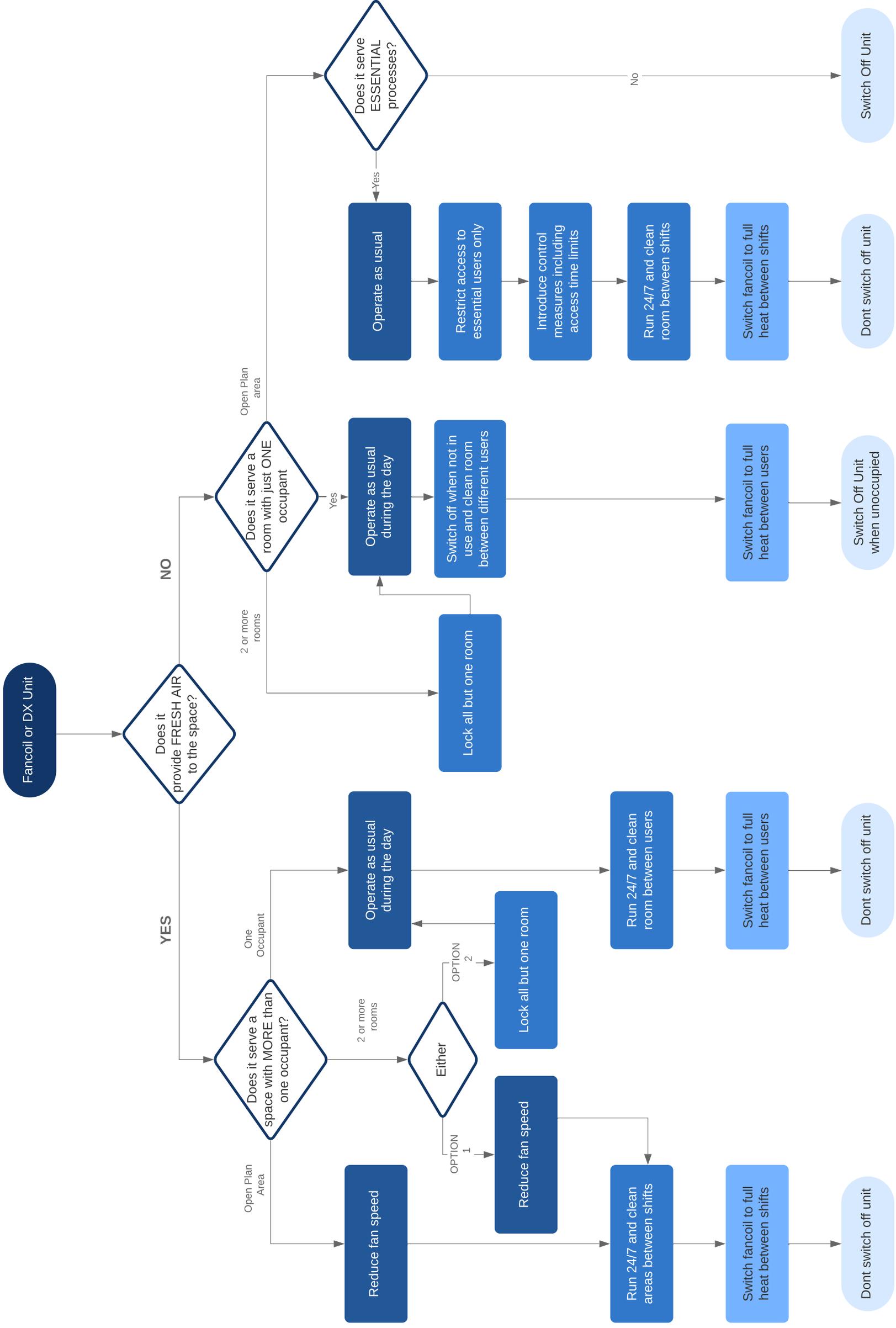
INDOOR AIR QUALITY AND SMART TECHNOLOGY

- Utilise the 'internet of things' devices, that provide real-time data from field device measured factors that can predict maintenance needs. Real-time data can also be useful in demonstrating the quality of the air in an occupied space is consistently good for human occupation and identify patterns of peak periods where additional methods of work may be employed to mitigate further as necessary. CO2 levels give a good immediate indication of the environmental air quality.
- Maximise the capture of data and utilise it to add strategic value to organisational performance and provide records of environmental conditions.

ANNEXES

- Fan coil use decision chart
- Risk Assessment template for recording zonal fan coil use considerations

Note: This document is based on knowledge available at the time of publication and is meant for general purposes, not for reliance on in relation to specific technical legal issues, in which case you should always seek independent advice. No responsibility of any kind for any injury, death, loss, damage or delay however caused, resulting from the use of this advice and recommendations contained herein is accepted by the authors or others involved in its publication(including the building Engineering Services Association). **February 2021**





Risk Assessment of Air Conditioning or Ventilation system fan coil units

(please read BESA VG002 latest version from <https://www.thebesa.com/covid19/besa-covid19-guidance/> in conjunction with this risk assessment)

A risk assessment sheet shall be completed for each fan coil unit or group of units in a common zone to account for local zone issues such as temporary screens which will divert/disrupt air patterns, the use of oscillating louvres, etc. This risk assessment applies to uses where the occupancy is of a sedentary nature only. Higher respiratory occupancy raises the risk of contamination of air in the zone considerably.

Client / Site Location

Part 1 – Stop	<i>Before you start</i>		Yes	No	N/A
	Are you authorised and qualified to undertake the situation?				
	Have you read the latest version of BESA VG002 and the accompanying fan coil decision chart?				
	Have you measured mechanical fresh air volumes into the zone?				
	Are the fresh air volumes into the zone recorded anywhere? (logbooks, O&M Manuals, etc., for example)				
	Does the fresh air volume meet or exceed the minimum requirements of CIBSE Guides A and B? (see below for guidance on this)				
	<p>CIBSE Guide A suggests a minimum supply air rate of 10 litres per second per person for office applications. To reduce risk of occupants in a building it is essential that the viral load is reduced by maximising the fresh air supply and so any measured fresh air supply needs to be in excess of this figure, or the relevant figure for the application as defined in CIBSE Guide B.</p> <p>A minimum of double the normal fresh air supply rate is needed at the present time and as much as reasonably practical or possible is recommended with a target of trebling the normal rate. If more than double the normal ventilation rate cannot be achieved then consideration shall be given to using localised air cleaners such as UVC mobile units.</p>				
	If the zone is single person occupied, are there control measures in place to prevent other people entering the zone?				
If the zone is occupied by more than one person, is it essential to operate the fan coil unit(s)?					
Has the zone had any risk assessment carried out by you or other parties resulting in seating plans or occupancy level control measures?					
Has any seating plan taken into account air flow or discharge from fan coil units?					
If a zone occupant may be seated or present in a direct line between the fan coil outlet and another person, are they beyond the air throw of the fan coil?					
Is the fan coil needed to assist the distribution of the fresh air being introduced to the zone?					
Is there a register of person(s) who are in the zone to assist future tracing requirements?					
If answer is 'No' to any of the above, take required action or report to your supervisor. If in doubt ask!					
Part 2 – Think	Safety and Health Assessment (if the hazard is present tick the box)				
	Occupants in close proximity to others				
	Insufficient fresh air available				
	Insufficient air movement or distribution of the fresh air within the zone				
	Cleanliness of the fan coil heat exchanger				
	Local controllers should be disabled to avoid tampering / unauthorised adjustments				
	Other risk identified (state below)				
<p>Circle any ticks for hazards that are significant and for which there are no (or inadequate) controls.</p> <p>If you have circled any hazards, Part 3 needs to be completed and additional controls put in place before systems should be used.</p>					



Risk Assessment of Air Conditioning or Ventilation system fan coil units (cont.)

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Client / Site Location

Additional Safety Assessment (continue on separate sheet if required)

Part 3 - Act

Hazard (circled from Part 2)	Control Measures / Precautions	Remaining Risk (H / M / L)
Name		Signature of employer or self employed person
Date		

Part 4 - Review

End of Job Review			
Are there any lessons for next time?	Yes	No	
Has the work created any new hazards	Yes	No	
<p>If you have answered 'Yes' to either of these questions, make a brief note below and tell your supervisor.</p>			
<p>If you have identified significant hazards in section 2 and been unable to fully address or mitigate them in section 3 then fan coil units should be left switched off until such time as the risks can be mitigated.</p>			