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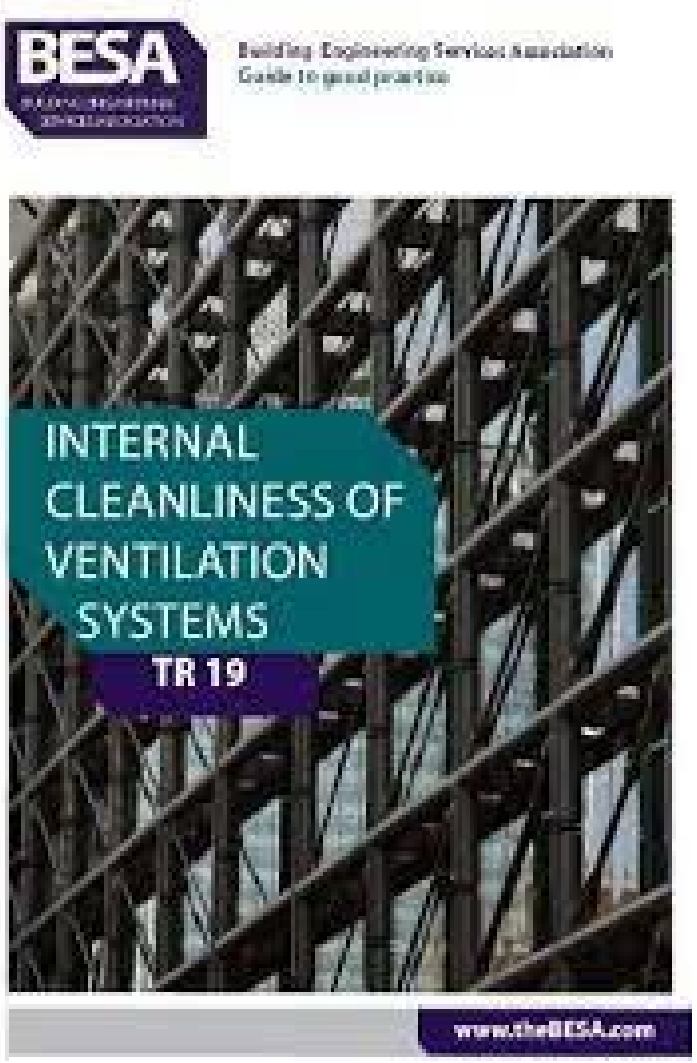
A GUIDE TO THE CLEANLINESS OF DUCTWORK SYSTEMS

Codes of Practice – Cleaning Ventilation Systems
BESA – TR/19
NAADUK – NAAD21

Air – Grease

No mention of the BSEHV11



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Cleaning & Maintaining Ductwork Systems

WHY?

- Ductwork systems must be regularly cleaned and maintained in order to • keep the system working efficiently and, most importantly, safely.
- All installed ductwork systems must operate in accordance with DW/144 • standards. In order to achieve such high standards, ductwork systems must
- be cleaned by a specialist cleaning contractor
- The quality of ductwork systems will slowly deteriorate over time and therefore need thorough cleaning. In order to maintain ductwork systems to DW/144 standards, cleaning is vital.
- Ductwork systems that are not cleaned and maintained may breach Health and Safety laws, therefore leading to a high risk of contamination to those who work, operate or play within close proximity.
- Ductwork systems are prone to harbouring certain hazardous contaminants, therefore must abide by COSHH Regulations. Failure to do so will again breach Health and Safety laws.

HOW?

- Ductwork systems are cleaned via entrance to one of the various access panels located at regular points along the ventilation system.
- All ductwork systems must have these access panels for cleaning and maintenance purposes.
- The following tables show the location and size these access panels must be, in accordance with DW/144 standards.

- Effectively Wet Clean – Dry Clean

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Dry Cleaning Methods

Generic name	Energy source	Method of removing deposit
Air Whip/Skipper Ball	Compressed Air (Low Volume)	A rubber hose or plastic ball that under pressure agitates the wall of the ductwork
Air Lance	Compressed Air (Low Volume)	Usually an air gun with a trigger that is able to direct compressed air locally
Air Nozzle	Compressed Air (High Volume)	Usually a plastic or metal ball placed on the end of a flexible hose. Compressed air leaving small openings in the ball propels the hose forward inducing the nozzle to closely traverse the internal surface of the duct
Hand Wipe	Manual	Wiping of the surface using a medium appropriate to the purpose
Hand Scrape	Manual	Removing heavy deposits by hand scraping
Hand Brushing	Manual	Brushing the surface using a brush appropriate to the purpose
Hand Vacuum	Electricity/Manual	Suction
Mechanical Brushing	Compressed Air and/or Electricity	Brushing the surface of the ductwork using mechanical action
Mechanical Brush and Air Technology Combined	Compressed Air/ Electricity	Brushing the surface of the ductwork using mechanical action and compressed air

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Wet Cleaning Methods

- The introduction of cleaning chemicals or biocides should only be considered where a risk assessment has been carried out, the details recorded and any adverse effects of the applied chemicals have been assessed and determined with appropriate safe procedures set out in a formal method statement.
- Steam cleaning and high pressure water-wash are not recommended for ductwork that is situated above ceilings or in sensitive areas unless carried out in a controlled manner to contain leakage. Moisture can assist in the growth of micro-organisms and the system should be thoroughly dried prior to commissioning/re-commissioning.
- Careful consideration should be given to the use of chemicals and/or water for surfaces that are porous as permanent damage may result.
- Before applying wet cleaning methods care should be taken to ensure that condensed vapours and cleaning fluids can be removed from the ductwork system.
- The table below provides examples of wet cleaning methods.

Generic name	Method of removing deposit
Wet Vacuum	Suction
Chemical Clean	Softens or dissolves deposits
Hand Wash	Washing of internal surface using appropriate medium
Steam/High Pressure Water Wash	High pressure system used to dislodge/dissolve deposits

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Hazardous Contamination

- There are various hazardous contaminants that can be found in ductwork systems. They may include:
- Precipitated toxic, carcinogenic or otherwise particulate
- Condensed Vapours
- Pathogenic micro-organisms
- Specifiers should define any such likely or known hazards in accordance with COSHH.
- Regulations and contractors have a duty to satisfy themselves that hazards are known and accounted for.
- Specific risk assessments should be carried out and particular method statements provided to deal with hazardous contamination.
- Any swab sampling required to meet specific needs should be identified before work commences.

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Testing Methods for Dust Contamination

NADCA Test – suitable for square, rectangular dust, but not round.

PVT – not repeatable so not scientific. Now called European Test.

Vacuum Test (VT) – This is the preferred test.

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National Association of Air Duct Specialists UK

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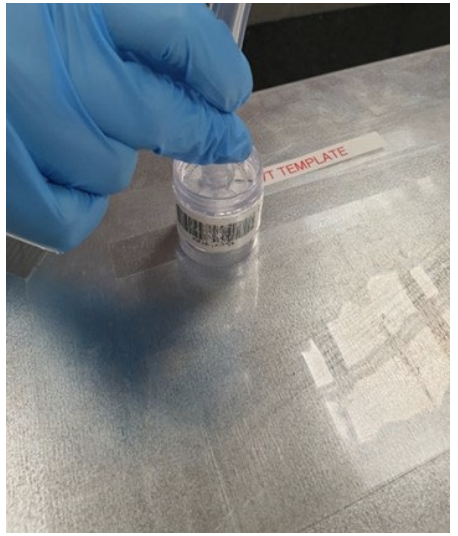
Vacuum Test

NAADUK recommends pre-weighed filter cartridges, Pre-Barcoded to prevent mistakes, and an independent laboratory to UKAS standards.

Note: If there is a covering of dust covering the internal duct surfaces, this test is unnecessary as a visual evaluation with / without a reference scale this supply duct would fail anyway.



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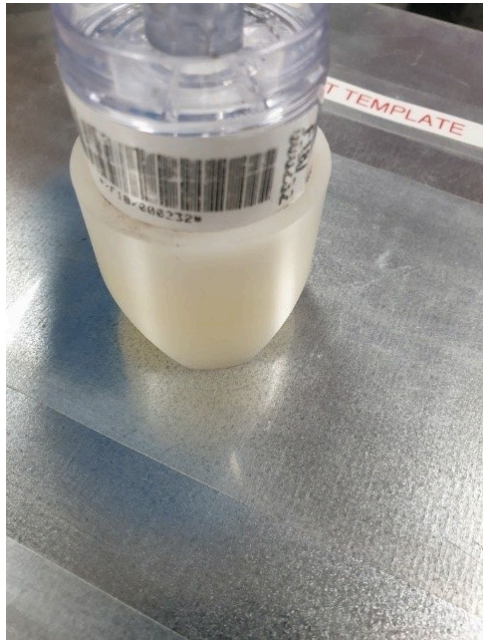
Adaptor for Circular Duct

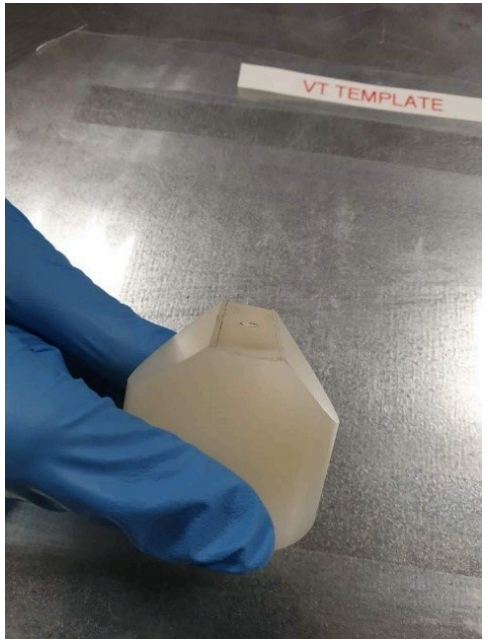
Why should an adaptor be used?

When taking samples on circular ducting it should be used to make sure there is direct contact with the ducting.

These adaptors can be used in circular ducts as well as flat ducts.



Adaptor fitted to filter capsule



Side View

Top View

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Deposit Thickness Test (DTT)

This is used to assess the level of deposit build up within ventilation ductwork.

NAADUK can’t recommend this test as it is typically not sensitive enough to be used for post clean verification.

A competent company should be able to carry out any required sampling and should use a nominated UKAS laboratory.

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Testing For Microbiological Contamination

DIFCO Contact Slide

Agar Plate

What could lead to potentially harmful organisms in the air?

- Poor hygiene standards
- Poor maintenance
- Non-maintenance

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Different Cleaning Methods (Air)

1. Hand Vacuuming
2. Rotary Brushing
3. Air Lance
4. Air Whip / Skipper Balls
5. Hand Wiping
6. Hand Brushing / Sweeping

In all cases a negative air machine (air mover) should be used to prevent dust debris getting into the surrounding environment.

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Hand Vacuuming

This is the most common method, using a high efficiency filtered vacuum unit with appropriate attachments.

Rotary Brushing

Pneumatic

Rotary brushing is one of the most common methods.

Rotary brush systems feature vacuum units and rotary brushes, used to dislodge dust and other particles from the air duct. They use reversing directional brush machines, either pneumatic or electrical powered. In all cases a negative air machine (air mover) should be used with appropriate filtration.

Electric

In most cases, the brush is linked to the vacuum unit with a flexible pipe, meaning it can move through twists and turns inside the vents, as the motor spins the brush like a drill.

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Air Lance

This is a flexible airline with attached gun and regulator.

It lowers or increases the pressure to clean off delicate areas, i.e. linings, or to dislodge the build-up of dust in difficult areas.

It should be used with a negative air machine.

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Air Whip / Skipper Balls

This can be several multi tubes of a nozzle or a faced nozzle with predrilled holes angled to drive the air whip and lead down the duct, dislodging the dust.

A compressor forces air out of the small holes along the nozzle, which creates enough air pressure to get rid of any dust from the internal surfaces of the ductwork.

Must be used with a negative air machine.

Skipper Balls

Air Whip

Hand Wiping

This can be done in the dry from using **lint-free** or a form of **antistatic dust cloths**.

Some cleaning agents can be sprayed onto the duct to help clean particularly stubborn areas as long as all COSHH standards are applied.

Hand Brushing / Sweeping

This is used mainly on very large ducts and then the debris is bagged for collection and disposal.

Lint-Free Cloth

Antistatic Dust Cloth

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Filters

Why do filters need to be inspected thoroughly?

Badly fitted or incorrect filters and not changing filters regularly are the biggest contributors to duct contamination.

What kind of filters are designed to remove small particles from the air?

- HEPA filters
- Panel Filters
- Electrostatic Filters

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Filters cont.

There may be changes to much higher and more combination filter systems. This might involve electrically charged, charcoal and filter combination, including UV light systems.

All new designs will now be under review because of the COVID-19 virus and potential future pandemics.

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The Importance of Air Filtration

- Air filters ensure healthy indoor air by removing harmful fine dust (e.g. pollen, bacteria, yeasts and moulds)
- They keep air handling equipment clean, keeping it hygienic and efficient

Why are air purity requirements constantly improving?

- Industrial processes are increasingly sensitive and sophisticated
- Stricter environmental legislation
- More people with health-conscious attitudes

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Benefits From Using Air Filters

Air filters must be used to clean the air to protect people's health.

- Urban air quality is polluted by small PM1 particles and gases coming from combustion and diesel engines.
- Ultrafine particles like PM1 are the most damaging form of fine particles because the particles go directly into the bloodstream.
- Bacterial and fungal spores must be removed from the air stream.

The most common air filters in comfort ventilation are ePM1, ePM2,5 and ePM10. ePM1 is recommended in buildings like schools, hospitals, offices and apartments.

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Maintenance of Air Filters

The filter service life is determined by the following factors:

- Hygiene issues (e.g. microorganisms, fungal spores, odours)
- Economic efficiency
- Reaching the final pressure drop specified for the filter system
- Defective filter

When replacing the filter using PPE all filters across the entire duct cross-section should be changed **at the same time** and while the system is **at standstill**.

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Maintenance cont.

What should I do with contaminated filters?

- They should be transported carefully and disposed according to local legislation

Before installing new filters, what do I need to do?

- Check, clean and repair if necessary the connections between filter frames and partitions
- Clean the filter frames (or the filter housing) and the sealing faces

Do I need to perform regular maintenance?

- Visually inspect coarse and fine dust filters and particle measurements on particular air filters of classes H and U
- Optical and / or electrical differential pressure gauges and indicators need to be checked
- If testing is impossible, the filter should be replaced after the period specified by the manufacturer

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Transport and Storage

How should filters be transported?

- They should be transported and stored in their original packaging, preferably on pallets

Where should they be stored?

- Indoors, protected against rain / moisture and at temperatures above freezing point

What needs to happen prior to assembly?

- Filters should not be unpacked until right before assembly
- When unpacking, avoid touching the delicate filter medium
- They should be checked for any transport damage – damaged filters should not be used

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Disposal of Filters

Filters should be disposed in an environmentally friendly way. They should be bagged up to prevent contamination, and PPE must be worn when changing filters.

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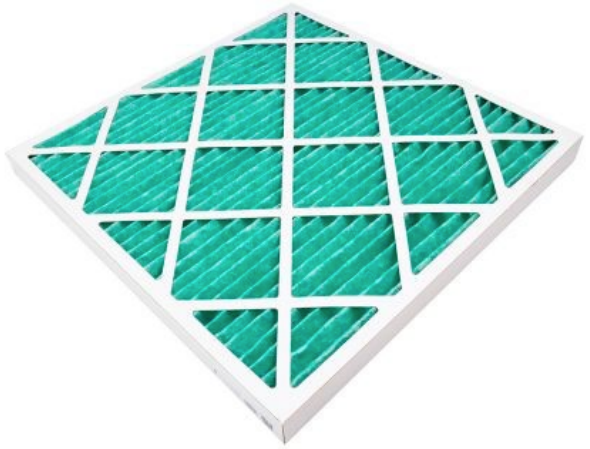
Examples of Commonly Used Filters:

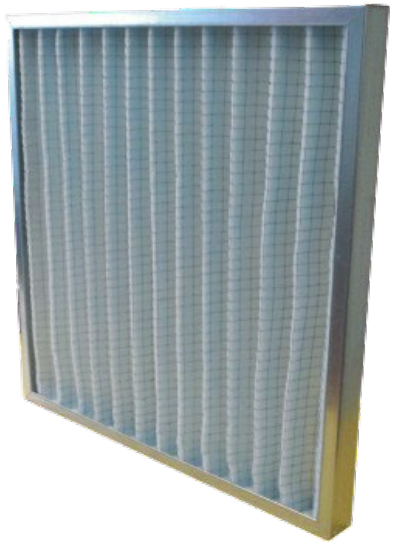
Panel Filters

Energy saver pleated panel filter



Hi-Capacity panel filter

Metal Filter



Fire Rated Metal frame pleated panel filter

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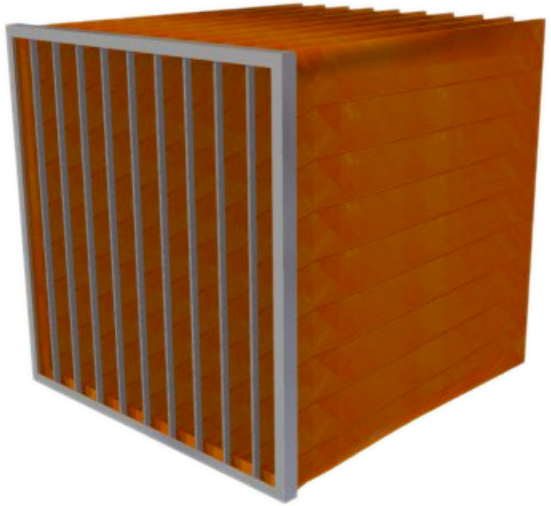
Bag Filters



Clean pack – Synthetic bag filters

Jay Flow – Glass bag filters

Reloadable Filter

Re-loadable galvanised steel frames and a range of cut media pads

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Compact Filters

Compact Minipleat Filters with 25mm Header and Microfine Glass Fibre Media

Compact Minipleat panel filters with header frames

HEPA Filters

UHV high volume HEPA filter with steel case

Laminar flow HEPA panel filter, for use in controlled contamination environments

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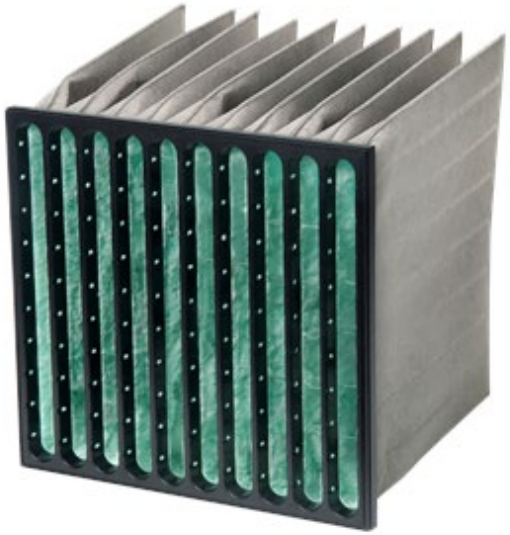
Molecular Filter



The Carboflow range of combination filters are essentially two filters in one. Activated carbon media combined with microfine glass fibre.

Sitesafe Filter Unit

For removal of formaldehyde and other low boiling point aldehydes. Used in mortuary, hospitals, undertakers etc.

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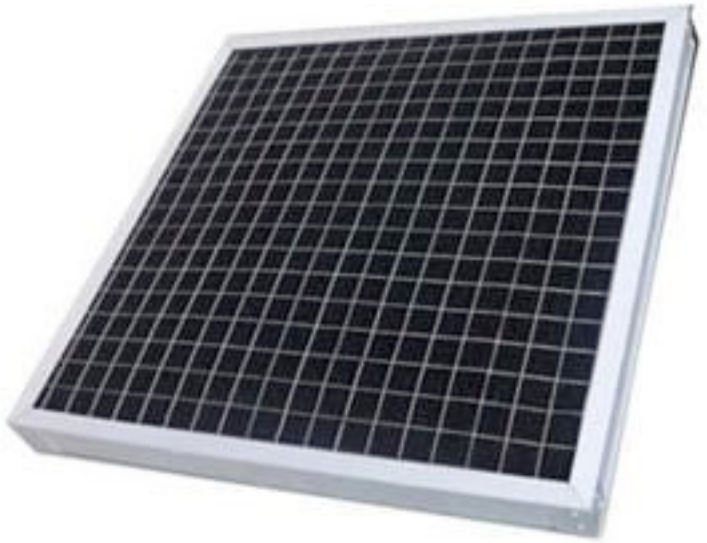
Carbon Filters

Carbon filter odour reduction panel. Typically used for air supply drawn from busy road areas, car parks of from under flight paths



Loose fill panels. Range of carbon activated carbon panels often used for museums, archives, etc.

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Access Panels

Variety of Access Panels

Access panels should be to BSEN12097 specification and not obstructed

They should have quick release panels and not be riveted or screwed on

All access panels should be labelled and accessible

Access panels should be installed every 15m

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Standards for Access Panels – BS EN 12097 Specification

- Requirements for the shape, dimension and location for access panels for cleaning and service in ductwork systems
- Access panels can be closed and opened repeatedly without damage or cutting into the duct
- Access components must match the performance of the ductwork in terms of strength and air tightness
- Easy opening panels
- The access components should allow cleaning
- Ductwork mounted components that prohibit cleaning must have a point of access from both sides
- Sharp pointed screws not to be used within 1m of opening

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Access Panel Location

In-line equipment	Location
Control dampers	Both sides / Up-stream panel
Fire dampers	Both sides / To suit damper maintenance
Heating/cooling/re-claim coils	Both sides / Panel on both sides
Attenuators (rectangular)	Both sides / Up-stream panel
Attenuators (circular)	Both sides / Up-stream panel
Filter sections	Both sides / Up-stream panel
Air turning vanes	Both sides / Up-stream panel
Changes in direction	One side
In-duct fans/devices	Both sides / Up-stream panel
Inlet/exhaust louvre	One side / One panel to suit
Intermediate cleaning panels	As and Where Required

In cases where human access is required because the ductwork is too large to be cleaned mechanically, human access should be allowed subject to a risk assessment.

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Opening sizes suggested for access to rectangular and flat oval ducts:

Duct size up to longest size major axis	Recommended dimension of opening	
200mm	300mm	150mm
300mm	300mm	200mm
400mm	450mm	300mm
>500mm	450mm	450mm

Opening sizes suggested for access to circular ducts:

Duct size up to	Recommended dimension of opening	
310mm	250mm	150mm
450mm	400mm	300mm
550mm	400mm	300mm
>600mm	500mm	400mm

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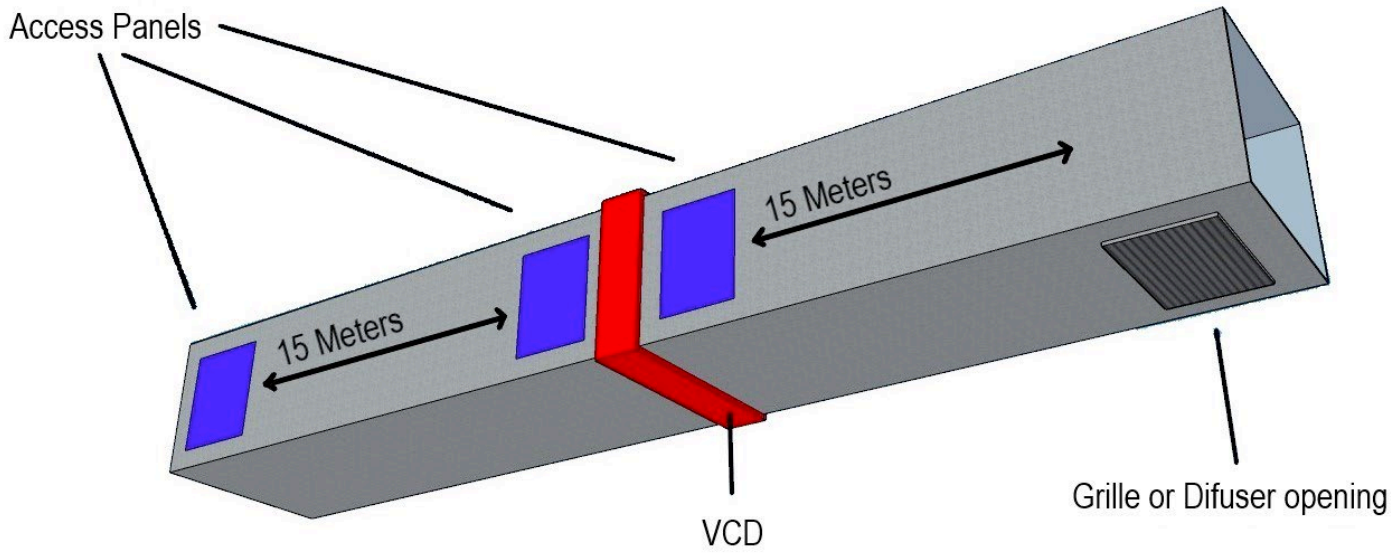
Fitting Access Panels

There must be enough access panels to allow cleaning of all surfaces, using openings already in place e.g. Grille / Diffuser openings.



Some manufacturers may not recommend large access panels are located too close together because it may interfere with structural integrity.

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Access Panels

Hatches fitted into the duct provide access for cleaning and maintenance.

They are either curved for round duct – although saddles can be fitted – and rectangular doors installed OR square for a square duct.

They must be **airtight** and to the **same integrity or fire rating** as existing ductwork.

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Ceiling Tile Access Panel

Ceiling Access Panels can provide easy access for electrical or insulation equipment repairs / replacements.

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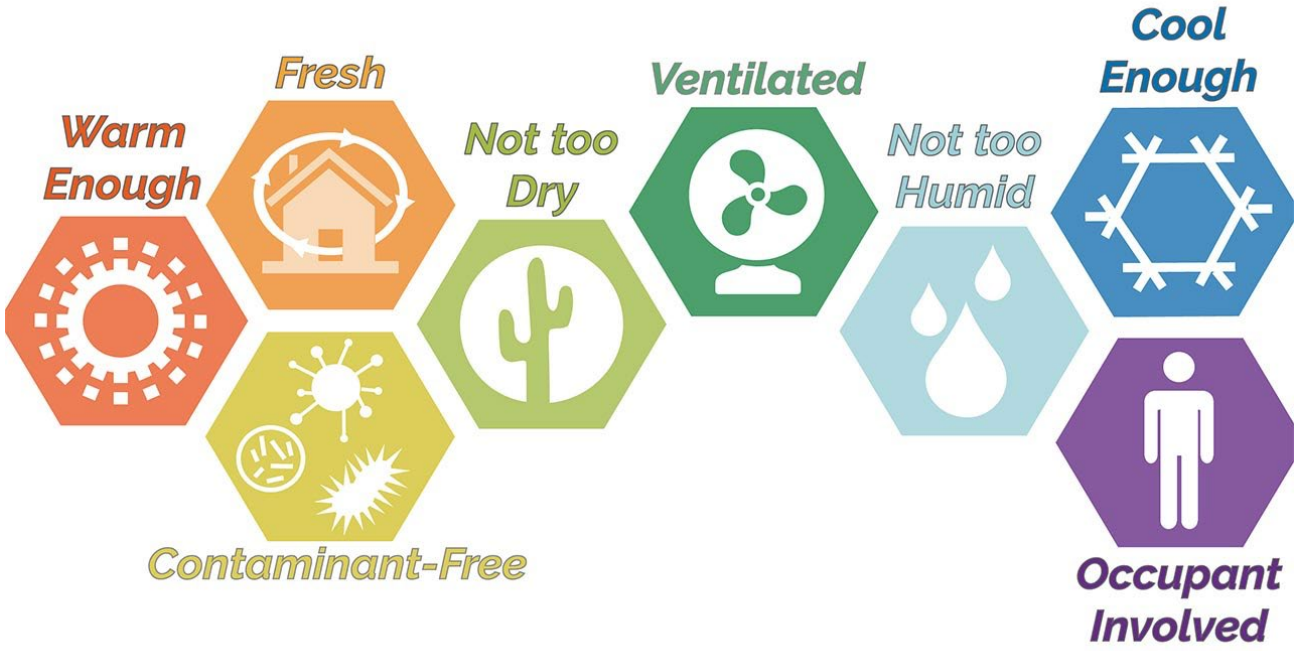
COVID-19

Coronavirus has shown the importance of air conditioning in helping to prevent the spread of the virus inside buildings.

On a system with an average velocity of 5m/s, 50m of supply duct and 50m of return duct, it would take approx. 20-30 seconds to re-introduce the virus back into the room. The virus could multiple in a recirculated air environment.

Fan coil units could be fitted with UV-C germicidal lights but it would be expensive



The following diagrams show how air is distributed through different ventilation systems and how this can help spread diseases.

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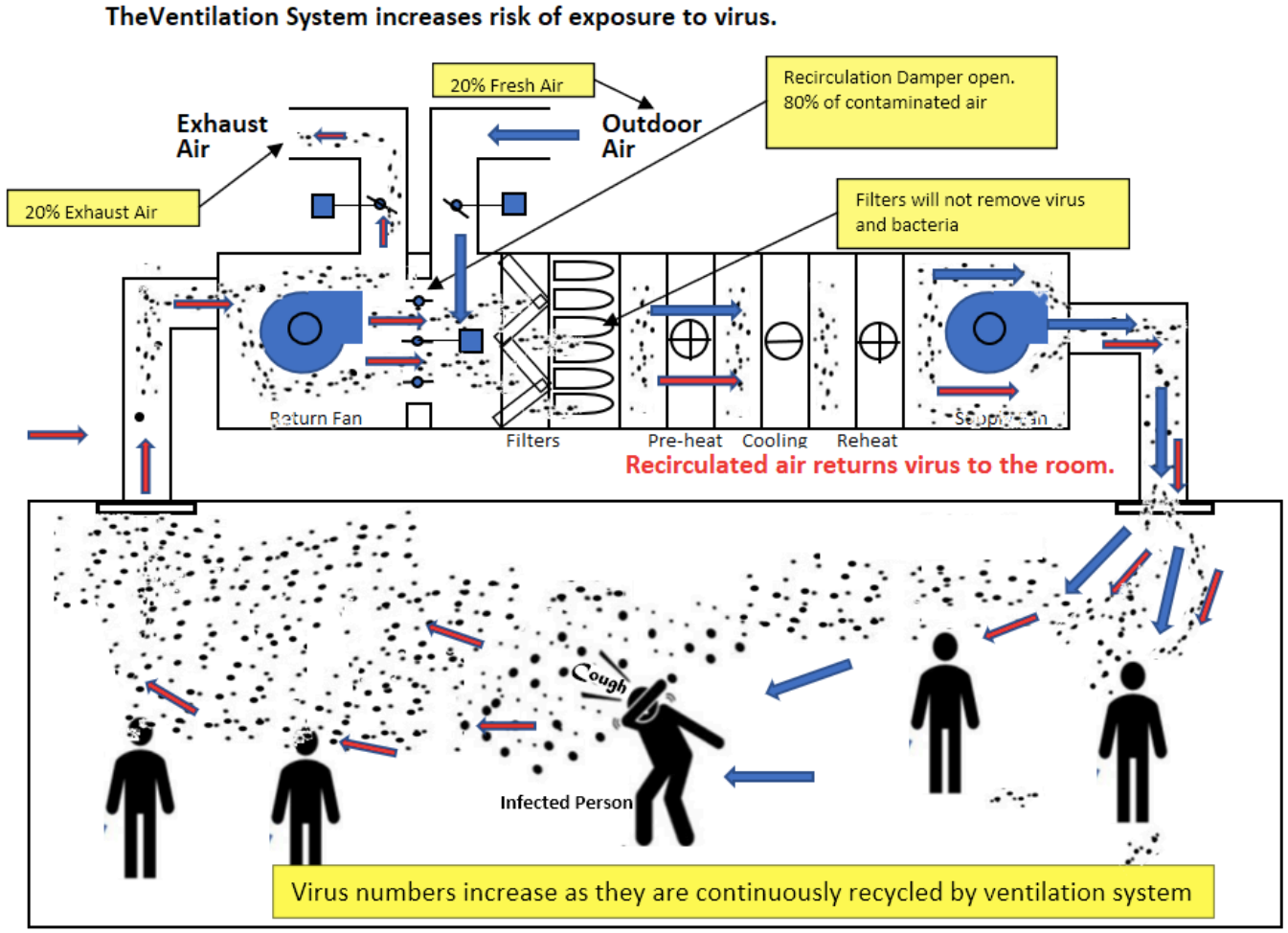
3. Effect of 100% Recirculation in a Building

Why is there an increased risk of infection?

- 80% of air containing the virus is reintroduced to the room
- The filters aren't removing virus and bacteria
- Increased number of contaminated droplets in contact with people / on surfaces and work stations
- Longer exposure time to virus and bacteria
- Contact with the infected person is not necessary to be exposed to the virus



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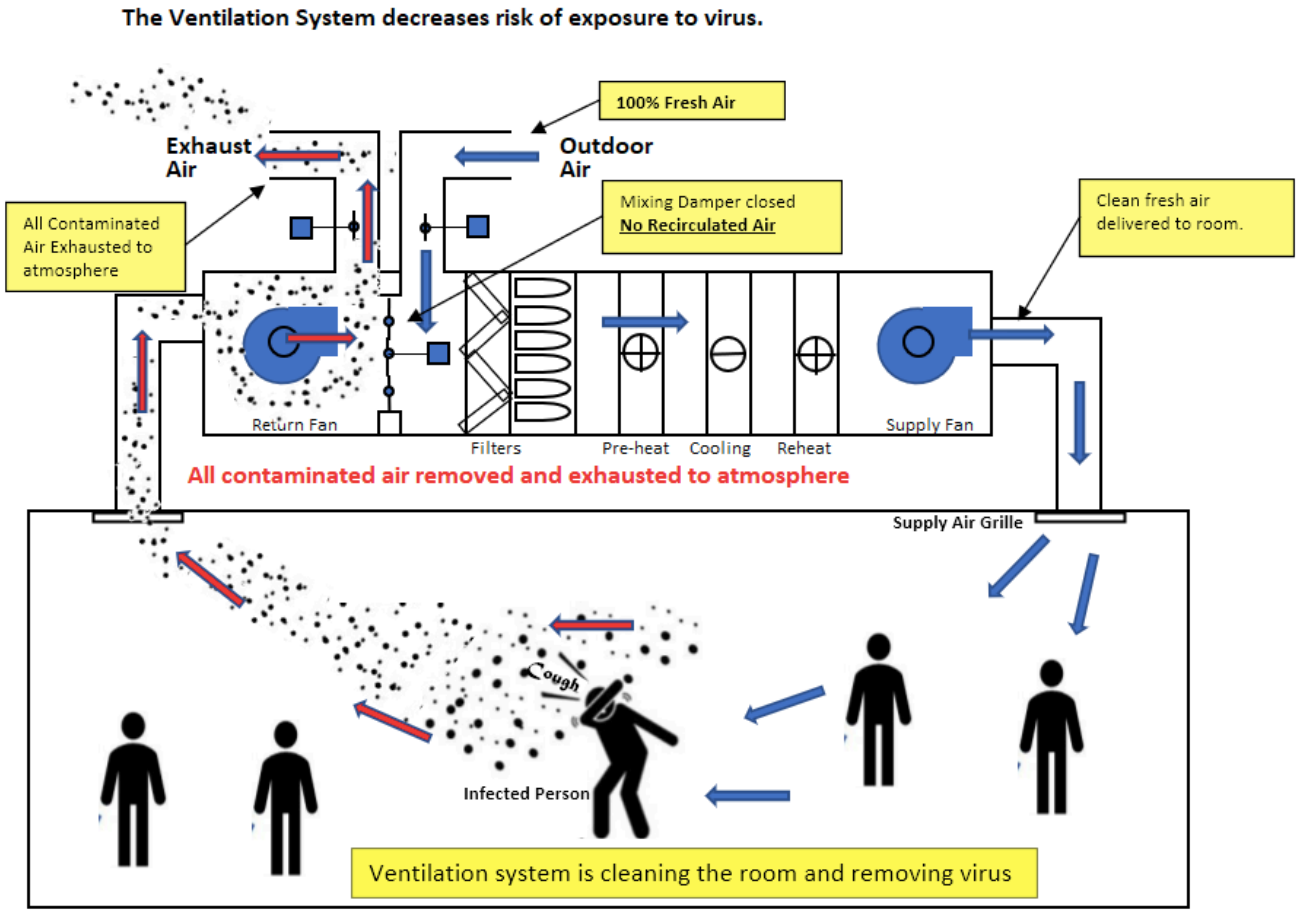
4. Effect of 100% Fresh Air in a Building

Why is there a reduced risk of infection?

- The ventilation system is cleaning the air in the room
- Most / all of the contaminated air is being removed
- 100% fresh air is coming into the room
- Contaminated droplets are taken away from people by the airflow
- Reduced number of contaminated droplets on surfaces and workstations
- Minimum exposure time to virus and bacteria



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