



**Dinair**  
An AAF Company

# Corona Virus and Air Filters

# Session objectives

Let's approach this as a mutual learning exercise

After the presentation you should have:

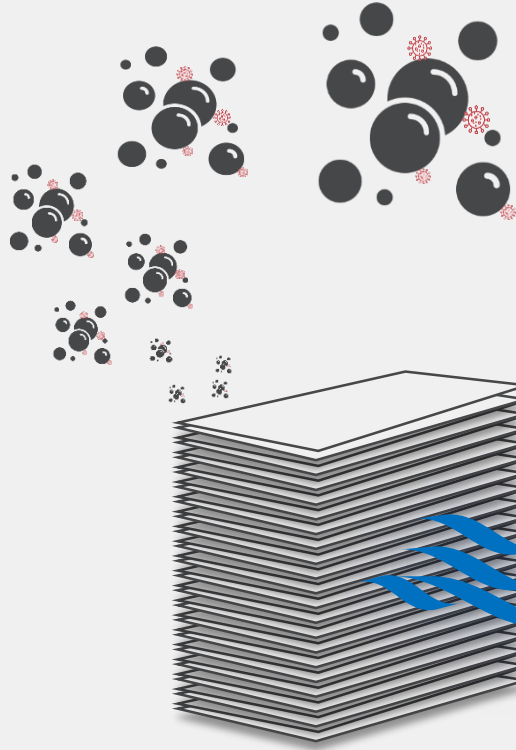
- Background information on SARS-CoV-2 (COVID-19) including safe guard measures
- Understanding on Aerosol and droplet transmission mechanism through air
- HVAC System Operational system and spreading of virusses
- Captured Virus by Filter Efficiency together with the amount of recirculation's per hour
- Knowhow on the correct filter selection to obtain a safe environment

*But with some etiquette rules ...*

- *Please put your voice on mute to avoid sound interference*
- *Questions can be mailed (or in the chat when there is enough time available) and will be assembled and answered*



# HEPA filters provide quite good protection.



*In general: The minimum deposition (or maximum penetration) of particles in HEPA filters is in the size range of around 0,1-0,2  $\mu\text{m}$  for glass media, for ePTFE/eFRM it's a little bit below. Towards smaller particles as well as towards larger particles the deposition is larger!*

*This fact, which at first glance seems astonishing, is based on the interaction of various physical effects.*

**For details see here in section mechanism:**

<https://en.wikipedia.org/wiki/HEPA>

*Please keep in mind that airborne transmission is not the only route for infections. If a person has e.g. viruses contaminated hands (by droplet deposition) and touches own mucous membranes (mouth, nose, eyes etc.) the infection can be transferred as well.*

# Survival of COVID-19 outside the body.



***Currently there is no common scientifically accepted information on the survival of COVID-19 virus outside the body.*** According to current news it was assumed that the time scale is minutes. Others are talking of hours or even days.

## ***Background information:***

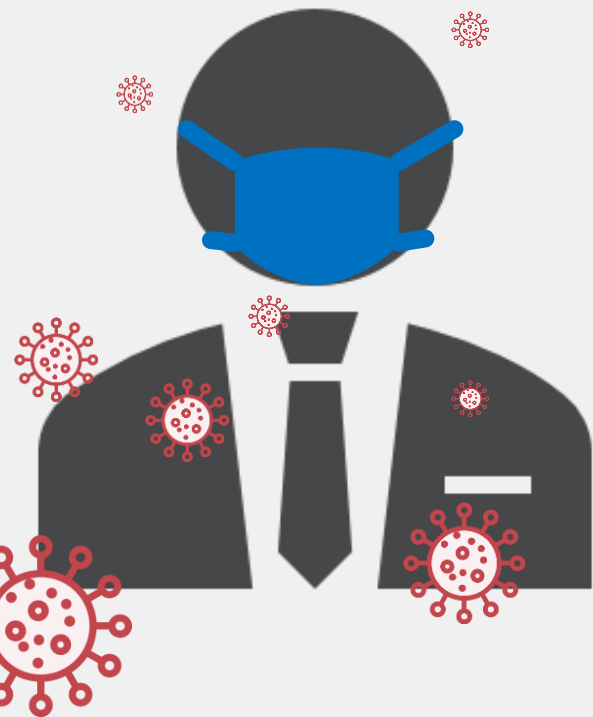
<https://www.health.harvard.edu/blog/as-coronavirus-spreads-many-questions-and-some-answers-2020022719004#q5> or  
<https://news.trust.org/item/20200228215640-n07fz>



***In general: "... such viruses tend to survive the longest in low-temperature, low-humidity environments, that is why you see lots of respiratory viruses during the winter."***

<https://news.trust.org/item/20200228215640-n07fz>

# No fit – No protection!



***Crucial is the facemask fit: No fit – No Protection!***

## ***Background information:***

<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks>

<https://www.hse.gov.uk/respiratory-protective-equipment/fit-testing-basics.htm>

[https://www.3m.com.au/3M/en\\_AU/safety-centers-of-expertise-au/respiratory-protection/fit-testing/](https://www.3m.com.au/3M/en_AU/safety-centers-of-expertise-au/respiratory-protection/fit-testing/)

# COVID-19 – Protection against infection

## 1. Hygiene

*The RKI recommends good hand hygiene, cough and sneeze etiquette as well as keeping a distance from the sick in regions with disease complaints due to the new corona virus. However, these steps are also advisable everywhere and at all times because of the flu wave.*

*For handling on site, the VDBW generally recommends the same rules of conduct that also apply to normal influenza. The most important thing is hygiene: "The corona virus requires more hygiene awareness in the population - both in public and in personal space," emphasizes Dr. Wolfgang Panter, President of the VDBW. You should often wash your hands and use disinfectant in case of contact with infectious material. You could meet business partners, but you shouldn't shake hands.*

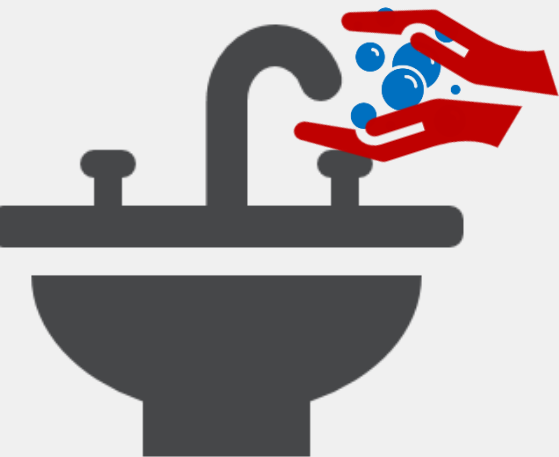
*In high-risk areas, it is essential to avoid large crowds of people, which also means taking the subway or bus, where people are close together. Apart from the risk of infection if someone coughs or sneezes, the pathogen can also be transmitted by droplet infection when exhaling purely (see "Breathing Mask").*

*Important for everyone: Good hand hygiene, i.e. regular washing with soap, a safe distance of one to two meters from sick people, as well as coughing and sneezing in the crook of the arm or in a clean, disposable handkerchief. Breathing masks are not necessary for healthy people, says Prof. Oliver Witzke, director of the Clinic for Infectious Diseases at the University Medical Center in Essen. And also constant disinfection of the hands is superfluous.*

### **Source:**

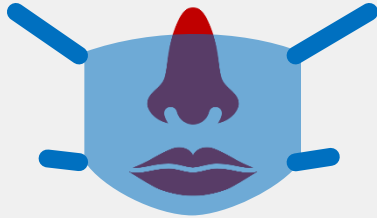
<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*



# COVID-19 – Protection against infection

## 2. Breathing Mask



*Infection with diseases that are primarily transmitted by droplets - for example, loud speaking, calling or coughing within two meters – can be avoided by wearing a breathing mask. Such masks can also prevent a potential smear infection by preventing you from gripping your mouth and nose with dirty hands. "A breathing mask is useful because the droplet infection is transmitted through the mouth and nose," explains the Vice President of the Association of German Company and Works Physicians. V., Dr. Anette Wahl-Wachendorf. However, the wearer should ensure that the mask is properly seated so that pathogens cannot penetrate from the side. And depending on how much you speak and how wet your mask gets, you should change it at least two to three times a day.*

*In the course of the Sars epidemic 2002/2003, some studies aimed to suggest a protective effect for so-called filter particle masks (FFP3 masks). But these were not normal masks like those seen on the street in Asia or in our operating room, but rather special fine particle masks that are hardly practical for everyday use because you cannot walk around for long. "Of course, an FFP3 mask provides better protection, but even simple mask models can intercept viruses , provided that they close tightly," adds Prof. Dieter Köhler, former medical director of the lung clinic at Grafschaft in Schmallenberg.*

*So-called surgical face masks are supposed to ensure that no potentially infectious droplets enter the surgical area from the respiratory tract of surgeons. In this respect, it makes sense to wear a mask to protect other people, for example, as a flu patient. "When it comes to avoiding that an infected patient infects other people, his respirator mask must not contain any valves," emphasizes Prof. Köhler.*

*In pictures from the regions of China affected by the corona virus, people often wear face masks or respiratory masks, which most people in this country have known primarily from the dentist or from the operating room. In China, masks are worn very often anyway, especially because of air pollution, says Salzberger, Vice President of the Robert Koch Institute (RKI). In Asia, it was in some way an act of courtesy to put on a mask as a sick person in order to spread fewer pathogens.*

### **Source:**

<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*

# COVID-19 – Protection against infection

## 3. Vaccination

*In the fight against the new lung disease Covid-19, the World Health Organization (WHO) wants to speed up the search for a vaccine and effective medication. There are four possible candidates for a vaccine, two of which I hope will prove promising, says WHO chief scientist Soumya Swaminathan. One of the most pressing tasks is the development of simpler tests for the detection of infections.*

*According to Swaminathan, the first vaccine tests on humans could begin in three to four months (as of February 2020). A certified vaccine for widespread use will probably only be available in 18 months. Several existing drugs are currently being tested to see if they can help Covid 19 patients. The WHO would develop guidelines for this as soon as possible.*

### **Source:**

<https://www.lungenaeerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*





# COVID-19 – Official safeguards



*According to the Robert Koch Institute (RKI) in Berlin, a strategy of containment is currently recommended in this country. Attempts are made to identify infected people as early as possible. As a precaution, their contact persons should spend 14 days in quarantine. Even if not all sufferers and their contacts were found in time, these steps slowed down the spread of the pathogen in the population.*

*Official protection measures focus primarily on flights from China. For example, the pilots will be able to inform the tower about the state of health of the passengers on board before landing in Germany. Travelers from China should use forms to indicate how they can be reached within the next 30 days. This should be available to the airlines over this period in order to be able to find contact persons in the event of infection - including who was sitting next to whom. Fever measurements at airports will not stop the spread, says Federal Health Minister Jens Spahn (CDU), who discussed these new measures with the federal states.*

*According to this, clinics should report suspected cases to RKI centrally in the future, and not only as previously confirmed cases. There is a coordination office in the federal RKI, which also coordinates with the federal states. There is also exchange with other EU countries and the World Health Organization (WHO).*

*Other official protective measures are fundamentally possible. The local health department assesses whether they are*

*necessary according to the specific circumstances of the individual case, as the ministry explains. The Infection Protection Act stipulates, for example, that state authorities can restrict or prohibit events and other large gatherings of people. Bathing establishments and community facilities such as schools, day-care centers, asylums and holiday camps can be closed in whole or in part. Authorities can order quarantine for people who are ill, suspect, or suspect to be infected. They can be prohibited from performing certain professional activities. In principle, the competent authority can also oblige people not to leave the place where they are or to not enter certain places until the necessary protective measures have been taken. In this respect, fundamental rights of freedom of the person, freedom of assembly and the inviolability of the home could in principle also be restricted. But: A healing treatment may not be ordered, the law says.*

*In an emergency, the nationwide Infection Protection Act (IfSG) regulates the essentials. A spokesman for the Bavarian Ministry of Health summarized: "If necessary, important fundamental rights such as freedom of the person, freedom of assembly or inviolability of the apartment as well as the right to physical integrity can be restricted." Authorities may request blood samples and smears from skin and mucous membranes, according to Stephan Rixen, a lawyer from Bayreuth. A suspect of illness and contagion - as the law puts it - can also be imposed on a professional ban. To protect others, people could also be segregated in a suitable hospital or in another suitable manner, the law says.*

## **Source:**

<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*

# COVID-19 – Official safeguards

## 1. Suspected cases



*If there is a suspicion, certain criteria have to be checked first: Does someone show signs of a respiratory illness such as coughing or pneumonia? And has he been in a risk area in the past 14 days? Or has he had contact with a sick person in the past 14 days? If so, the patient is examined by a doctor, including hygiene measures such as protection over the mouth and nose. The reason for the 14-day period is that the incubation period - the span between infection and onset of symptoms - can probably be 2 to 14 days.*

*Anyone who has had contact with infected people should report to their health department regardless of the symptoms. The same applies to travelers from high-risk areas with symptoms. All others contact the office or the family doctor, who can arrange for a laboratory examination if Sars-CoV-2 is suspected. However, those affected should definitely call there before going to the doctors office - similar to suspected flu, because there is also a great risk of catching other patients in the waiting room. Then, in practice, precautions can be taken against further infections and hygiene measures.*

*Ideally, a sample is taken from the lower and upper airways during the examination. The virus is detectable in the cough expectoration. The evaluation takes almost five hours, plus the time for courier transports to the laboratory.*

*Anyone who has reasonable suspicion that they are infected with Sars-CoV-2 should avoid unnecessary contacts and stay at home – just like with flu. Also important, for everyone: Good hand hygiene, i.e. regular washing with soap, a safe distance of one to two meters from sick people, and coughing and sneezing in the crook of the arm. Or in a clean, disposable handkerchief. Breathing masks are not necessary for healthy people, says Prof. Oliver Witzke, director of the Clinic for Infectious Diseases at the University Medical Center in Essen. And constant disinfection of the hands is superfluous.*

### **Source:**

<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*

# COVID-19 – Official safeguards

## 2. Home quarantine

*So far, it is usually not necessary to stay in a clinic if you are infected with the novel corona virus. Because the vast majority of those infected either do not fall ill at all or only slightly as with a cold. If you have symptoms, you can make an appointment with your family doctor by telephone.*

*According to previous experience, the Sars-CoV-2 virus is highly contagious. In order to reliably interrupt infection chains, the Robert Koch Institute demonstrably recommends infected people to be placed in "home quarantine". For a period of 14 days, which corresponds to the maximum duration of the previously known incubation period, the following rules should apply:*

- *Individual accommodation in a well ventilated room.*
- *Limiting contacts with other people, especially if they belong to a risk group. This primarily includes people with a weakened immune system, chronically ill people, the elderly and pregnant women.*
- *Roommates and family members should generally be in other rooms or keep a minimum distance of at least one to two meters.*
- *The use of shared spaces should be kept to a minimum and should be separated, time-wise, as far as possible. These rooms, especially the kitchen and bathroom, must be cleaned regularly and well ventilated.*
- *Regular thorough washing of hands before and after preparing food, before eating, after using the toilet. It is best to use disposable paper towels to dry.*
- *When coughing or sneezing, cover your mouth and nose with disposable handkerchiefs or use the crook of the arm - and sneeze in a different direction.*
- *Daily contact with doctor and health department to act quickly in case symptoms occur.*

### **Source:**

<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*



# COVID-19 – Official safeguards

## 3. Quarantine

*The authorities take care to identify possible cases early, isolate them and take hygiene measures to prevent them from spreading further.*

*If a person suffers from the new corona virus, they must be isolated. There are different levels. Affected patients could in principle be isolated in every hospital, said the spokesman for the German hospital association, Holger Mages. All you need is a single room. Some clinics have special isolation rooms that can be entered through a double door system. But that is not absolutely necessary. It is important that basic hygiene measures such as hand disinfection and mouth protection are observed and that the staff wear protective clothing as soon as they have close contact with the patient.*

*People who have had close contact with those affected must be informed and monitored by the responsible health authority. They would first be registered by name, asked about symptoms, and if necessary, laboratory tests would also be carried out, explains Berlin-based virologist Christian Drosten. The RKI also recommends isolation in the hospital until it is clear whether a person classified as suspected has the virus. If the test result is positive, the insulation would remain.*

*The Ministry of Health points out that such measures worked in 2002/2003 for Sars' lung disease, which also originated in Asia. This could have prevented the spread of the Sars pathogen.*

### **Source:**

<https://www.lungenaerzte-im-netz.de/krankheiten/covid-19/schutz-vor-ansteckung/>

*This is a German website – Please use translation mode in Google Chrome*





**Dinair**  
An AAF Company

# Corona Virus and Air Filters

HOW TO REDUCE VIRAL  
CARRIERS IN THE AIR FLOW

VERSION + 01 +

# New SARS-CoV-2 (COVID-19) Research

Viable SARS-CoV-2 found detectable in aerosols

**SARS-CoV-2 is now the official name for the virus that causes the coronavirus disease COVID-19.**

- Causes acute respiratory disease and gastrointestinal disease
- Survivability rates per new study in *The New England Journal of Medicine*, authored by scientists from National Institutes of Health, CDC, UCLA, and Princeton University:
  - 3 hours = Aerosol
  - 4 hours = Copper
  - 24 hours = Cardboard
  - 2-3 days = Plastic/Steel

## Sources:

*New Coronavirus Stable For Hours on Surfaces*

<https://www.nih.gov/news-events/news-releases/new-coronavirus-stable-hours-surfaces>

*The Species Severe Acute Respiratory Syndrome-related Coronavirus : Classifying 2019-ncov and Naming It Sars-cov-2*

<https://www.nature.com/articles/s41564-020-0695-z>

# Transmission Mechanisms

1. **Smear infection** due to contact with contaminated surfaces such as mucous membranes, doorknobs, cell phones, computer keyboards and mice, contaminated protective equipment and filters etc.



**Wash you're hands and reduce touching your face!**



[https://www.wetter.com/news/so-wird-eine-grippe-uebertragen\\_aid\\_565fec1bcebfc0634a8b4571.html](https://www.wetter.com/news/so-wird-eine-grippe-uebertragen_aid_565fec1bcebfc0634a8b4571.html)



<https://www.netdoktor.at/krankheit/schmierinfektion-6937673>



<https://bnn.de/lokales/karlsruhe/per-troepfchen-oder-als-schmierinfektion-so-uebertraegt-sich-das-coronavirus>



[https://praxistipps-images.chip.de/iH0DlvuHr5\\_iWFRtu5suk\\_tPQulc=/0x0/filters:format\(jpeg\):fill\(000,true\):no\\_upscale\(\)/praxistipps.s3.amazonaws.com%2F2020-03%2Fivabalk\\_0.jpg](https://praxistipps-images.chip.de/iH0DlvuHr5_iWFRtu5suk_tPQulc=/0x0/filters:format(jpeg):fill(000,true):no_upscale()/praxistipps.s3.amazonaws.com%2F2020-03%2Fivabalk_0.jpg)



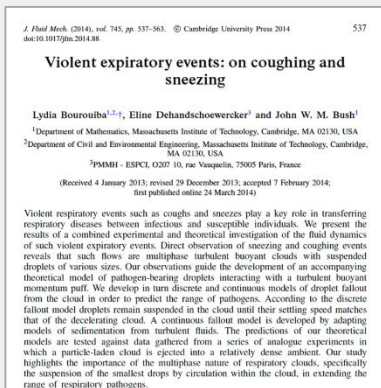
# Transmission Mechanisms

STUDY RESULTS SUGGEST THAT VIABLE SARS-COV-2 MAY BE LOCALLY AEROSOL TRANSPORTED WHICH COULD EXPLAIN TRANSMISSION IN COMMUNITY SETTINGS.

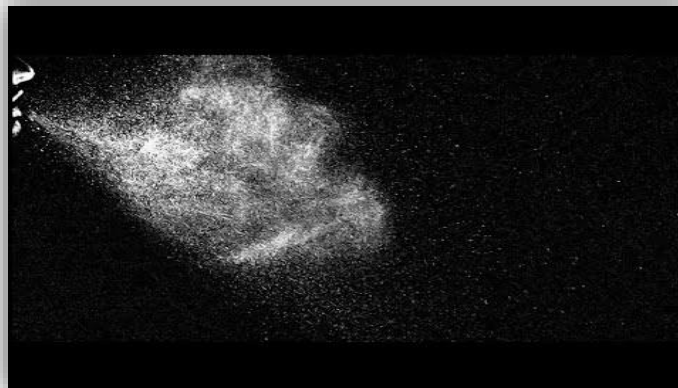
2. **Droplet infection** from nasal mucus or sputum when coughing and sneezing; main transmission mechanism; “larger” droplets of nasal mucus and coughing sputum  $>10\text{ }\mu\text{m}$  can fly several meters; the smaller they are, the more they fly.



**Keep distance, the further the better!**  
**Wear mask to protect others!**



<https://doi.org/10.1017/jfm.2014.88>



<https://www.youtube.com/watch?v=piCWfGwysu0>



# Transmission Mechanisms

STUDY RESULTS SUGGEST THAT VIABLE SARS-COV-2 MAY BE LOCALLY AEROSOL TRANSPORTED WHICH COULD EXPLAIN TRANSMISSION IN COMMUNITY SETTINGS.

- Airborne transmission;** even if viruses usually do not fly around freely, they can still be carried on carrier particles, e.g. airborne droplets  $<10\mu\text{m}$ , this is still not 100% proven for SARS-CoV-2 but can be assumed.



**Keep more distance, social isolation!**  
**Wear mask to protect yourself!**



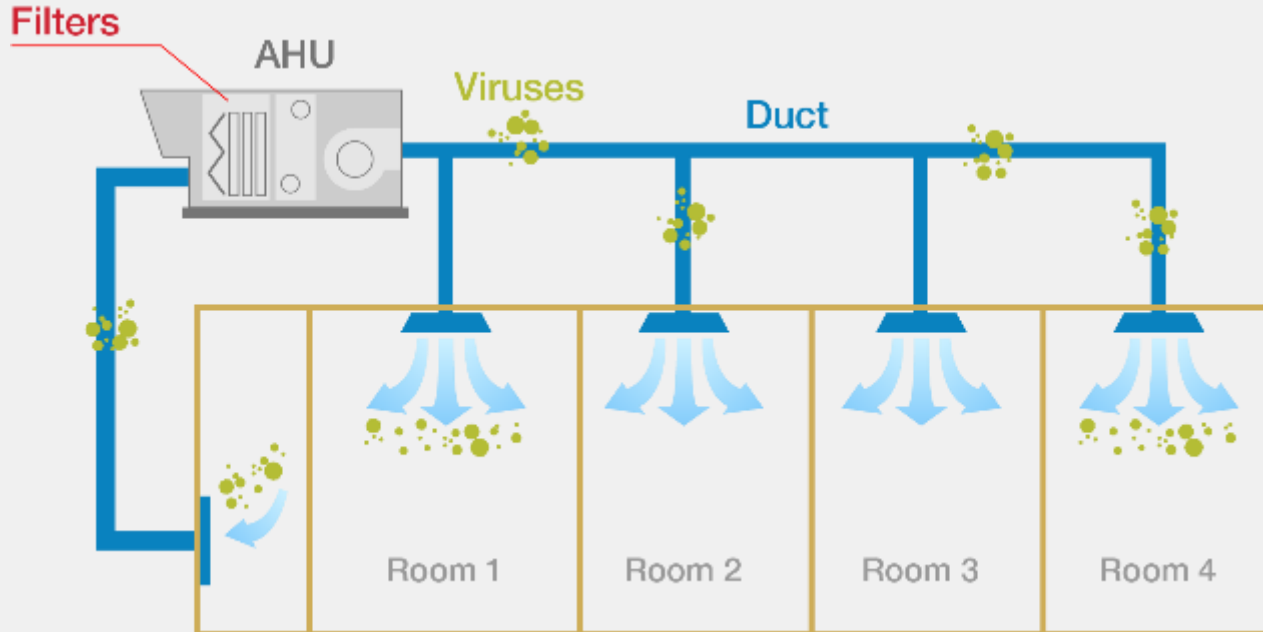
- Latest studies by the Universities of Bologna, Bari and Milan indicate a potential **connection between PM pollution and COVID\_19 infection spread in Italy.**
- Still not proven beyond any doubt and must be further investigated!



“Tiny” droplets of nasal mucus and coughing sputum in  $\mu\text{m}$  range can fly several meters ( $>10\text{m}$ ); the smaller they are, the more they fly.

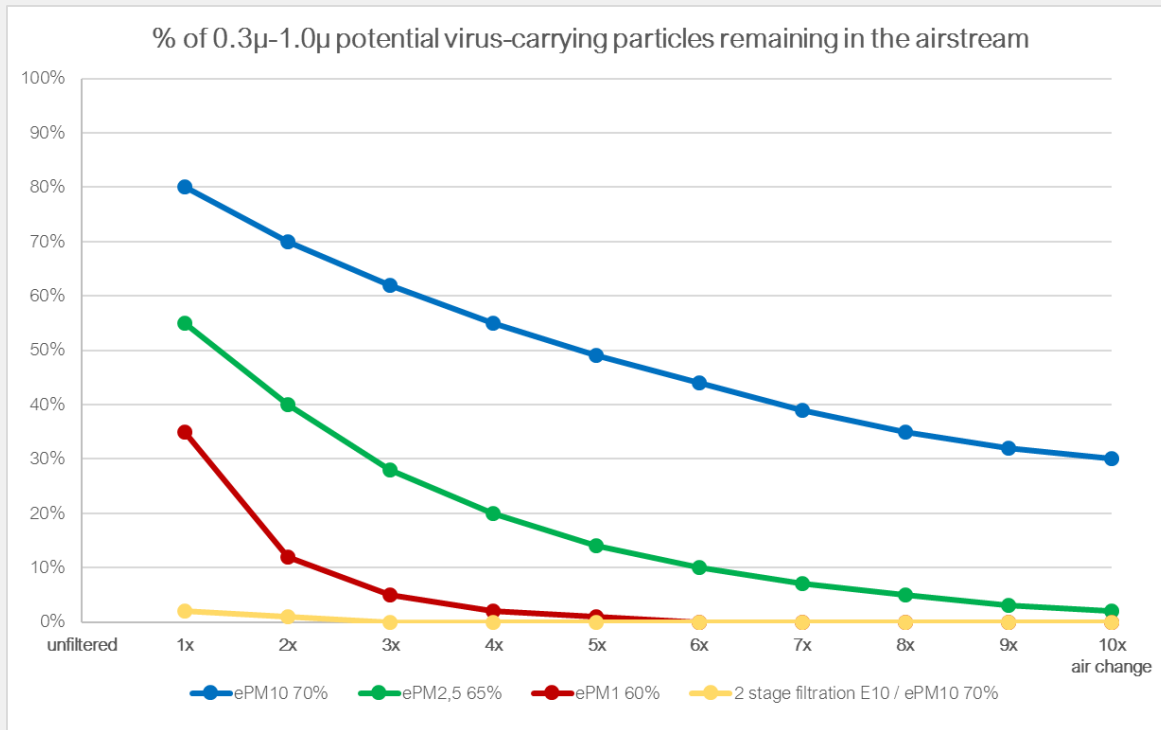
# HVAC System Operational Assumptions

- HVAC equipment will circulate the air in rooms, heat/cool the air, and then re-circulate to the room.
- Given an air change rate of approx. 7 times per hour\*, living viruses (assuming 3-hour life) can be carried by particles and circulate 21 times and spread throughout the building within the ducts.







\*Given 5,500 m<sup>2</sup>. building with AHU operating at 12,000 m<sup>3</sup>/h (using a bank of four 600x600 filters with an avg. airspeed of roughly 2,2 m/s)

# Captured Virus Carriers by Filter Efficiency



Assumes virus carried by 0.3-1.0 $\mu$  aerosolized droplet or dust particle

Filter		Compact/Pocket
ePM10/M5		20%
ePM2.5/M6		45%
ePM1/F7		50-65%
E10 (85% @MPPS)		98%

\*Note: Some particles may settle out as they circulate through a building. However, there is no reliable way currently to predict that rate, nor is there a way to predict how many new virus-carrying particles may replace those that have settled out.

# Supply Air (SUP) Categories

Category	Description	General Ventilation	Industrial Ventilation
<b>SUP1</b>	WHO (2005) guidelines limit values multiplied by a factor x 0,25 (annual mean for $PM_{2.5} \leq 2.5 \mu g/m^3$ and $PM_{10} \leq 5 \mu g/m^3$ ).	-	<b>Applications with high hygienic demands.</b>  Hospitals, pharmaceuticals, electronic and optical industry, supply air to clean rooms...
<b>SUP2</b>	WHO (2005) guidelines limit values multiplied by a factor x 0,5 (annual mean for $PM_{2.5} \leq 5 \mu g/m^3$ and $PM_{10} \leq 10 \mu g/m^3$ ).	<b>Rooms for permanent occupation.</b>  Kindergartens, offices, hotels, residential buildings, meeting rooms, exhibition halls, conference halls, theaters, cinemas, concert halls...	<b>Applications with medium hygienic demands.</b>  Food and beverage production...
<b>SUP3</b>	WHO (2005) guidelines limit values multiplied by a factor x 0,75 (annual mean for $PM_{2.5} \leq 7.5 \mu g/m^3$ and $PM_{10} \leq 15 \mu g/m^3$ ).	<b>Rooms with temporary occupation.</b>  Storage, shopping centers, washing rooms, server rooms, copier rooms...	<b>Applications with basic hygienic demands.</b>  Food and beverages production with a basic hygienic demand...
<b>SUP4</b>	WHO (2005) guidelines limit values (annual mean for $PM_{2.5} \leq 10 \mu g/m^3$ and $PM_{10} \leq 20 \mu g/m^3$ ).	<b>Rooms with short-term occupation.</b>  Restrooms, storage rooms stairways...	<b>Applications without hygienic demands.</b>  General production areas in the automotive industry...
<b>SUP5</b>	WHO (2005) guidelines limit values multiplied by a factor x 1,5 (annual mean for $PM_{2.5} \leq 15 \mu g/m^3$ and $PM_{10} \leq 30 \mu g/m^3$ ).	<b>Rooms without occupation.</b>  Garbage room, underground car parks...	<b>production areas of the heavy industry.</b>  Steel mill, smelters, welding plants...

# Selecting filter efficiency



				Supply Air Quality (SUP)				
				SUP1*	SUP2*	SUP3**	SUP4	SUP5
annual mean				PM2.5 ≤ 2.5 µg/m <sup>3</sup> PM10 ≤ 5 µg/m <sup>3</sup>	PM2.5 ≤ 5 µg/m <sup>3</sup> PM10 ≤ 10 µg/m <sup>3</sup>	PM2.5 ≤ 7.5 µg/m <sup>3</sup> PM10 ≤ 15 µg/m <sup>3</sup>	PM2.5 ≤ 10 µg/m <sup>3</sup> PM10 ≤ 20 µg/m <sup>3</sup>	PM2.5 ≤ 15 µg/m <sup>3</sup> PM10 ≤ 30 µg/m <sup>3</sup>
				ePM1	ePM1	ePM2.5	ePM10	ePM10
worse OAQ ↓	Outdoor Air Quality (OAQ)	PM2.5 µg/m <sup>3</sup>	PM10 µg/m <sup>3</sup>	70%	50%	50%	50%	50%
		ODA1	≤ 10    ≤ 20	80%	70%	70%	80%	50%
		ODA2	≤ 15    ≤ 30	90%	80%	80%	90%	80%
		ODA3	> 15    > 30					

\*min. filtration requirement ePM1 50% at final stage

\*\*min. filtration requirement ePM2.5 50% at final stage

\*\*\*some countries (e.g. Sweden may have national guidelines)

Source: EUROVENT 4/23-2018 „Selection of EN ISO16890 rated air filter classes for general ventilation applications“, 2nd edition, published Oct 1, 2018

# Reduce Virus-Carrier Sized Particles with High Efficiency Filters

Filter Selection				
Existing Requirement	Proposal according EN 16798	# of circulations to Capture >95%	Our Proposal	# of circulations to Capture >95%
ODA 1	ePM1 70%	3 x (97%)	> ePM <sub>1</sub> 95%	1 x = 95% @ ePM <sub>1</sub> 2 x = 99,8 @ ePM <sub>1</sub> 3 x = 99,99 @ ePM <sub>1</sub>
ODA 2	ePM1 80%	2 x (96%)		
ODA 3	ePM1 90%	2 x (99%)		

- Initial pressure drop may increase. cycle should stay the same as existing filter.
- The above mentioned efficiencies can be obtained by single filter or filter combination is the several filter stages of the air handling unit.

# Combination of Filters

First Stage	Second Stage	Installed	# of Circulations to Capture 95% ePM1	Please Note
55% ePM <sub>1</sub>	-	VVXL ΔP int. 75 Pa (F7), 592 x 592 x 292	> 4 x	Less preferred
98% ePM <sub>1</sub>	-	BioCel V HXL E10, ΔP int. 150 Pa (E10), 592 x 592 x 440	> 1x	Single filter, high efficiency, secure
70% ePM <sub>10</sub>	55% ePM <sub>1</sub>	DriPak SF ΔP, int. 90 Pa (M6) 592 x 592 x 635 --- VVXL 55% ePM <sub>1</sub> , ΔP int. 75 Pa (F7) 592 x 592 x 292	> 3 x	165 Pa system resistance
65% ePM <sub>2,5</sub>	85% ePM <sub>1</sub>	DriPak SX, ΔP int. 150 Pa (F7) 592 x 592 x 635 ---- VVXL 85% ePM <sub>1</sub> , ΔP int. 130 Pa (F9) 592 x 592 x 292	> 2x	280 Pa system resistance, better selection possible with lower resistance and higher efficiency
60% ePM <sub>1</sub>	98% ePM <sub>1</sub>	DriPak NX, ΔP int. 65 Pa (F7) 592 x 592 x 635 --- BioCel V (H)XLA 95, ΔP int. 150 Pa (E10) 592 x 592 x 292	> 1x	After the first pass, particle reduction is > 99,5% @ ePM1 while total resistance is 215 Pa.

# Recommended Filtration Solutions



# Perfect Pleat<sup>®</sup> ISO Coarse 70%

## PREFILTER

- Low initial resistance
- 100% synthetic high-loft media
- Highest performing self-supported pleat
- Consistent media with controlled fiber size and blend
- Mechanical efficiency – does not rely on electret charge technology
- Antimicrobial available



# DriPak® GX ePM10 60-75% / M5

PREFILTER

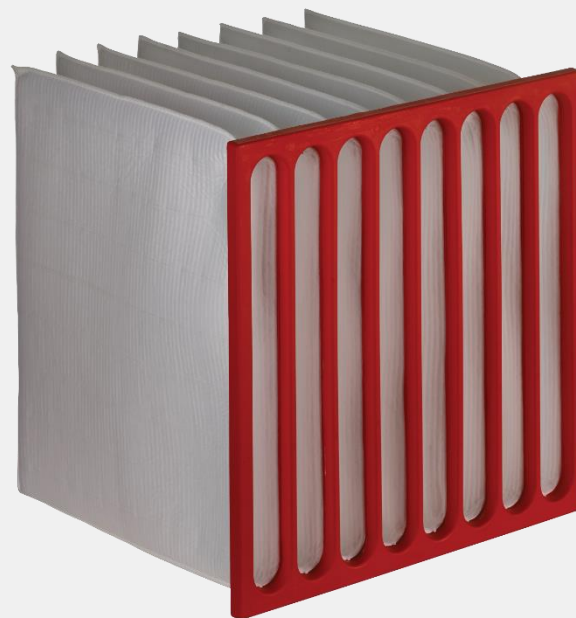


- 3x higher efficiency on 0.3-1 $\mu$ m particles as-compared to ISO Coarse / G3 filters
- 2x more efficient on 1-3 $\mu$ m particles as-compared to ISO Coarse / G4 filters
- Increase life time of downstream final filters
- Significantly improve protection from bioaerosol hazards
- ePM10 60-75% / M5

# DriPak<sup>®</sup> NX ePM1 60-85% / F7-F9

PREFILTER OR SECONDARY FILTER

- Highest media amount of small particle efficiency layer in a pocket filter
- Low initial resistance
- 100% synthetic media
- Available in ISO ePM1 60-85 % efficiencies



# VariCel® VXL(E)

SECONDARY FILTER



- 50% more media area (VXLE version) provides greater airflow capacity and lowers resistance
- Maximum dust-holding capacity extends filter life, minimizing operating costs
- Higher overall particle efficiency as compared to pocket filters with similar ISO ratings
- Excellent performance in difficult operating conditions
- Can be used in high-velocity systems, operating at up to 3,8 m/s
- Fiberglass media increases in efficiency over the filter's life, will not decrease due to loss of charge
- Available in ISO ePM2.5 and ePM1 efficiencies

# VariCel® V XLH

## SECONDARY FILTER

- Increased protection against the transmission of airborne diseases
- High filtration efficiency – up to EPA filtration class E10
- Minimum 95% efficient on 0.3µm
- Repellent media arranged in vertical pleats to maximize drainage of moisture and ensure maximum efficiency
- Faceguards on the downstream side provide increased stability and robustness



# MEGAcel<sup>®</sup> | eFRM

HEPA FILTER



- Expanded fluoro-resin membrane (eFRM) media offers up to 50% lower resistance than glass media
- 8X stronger than glass media
- Highly resistant to corrosive environments (acids, alkalis, and organic substances)
- Lowest off-gassing properties available
- Withstands pressure up to 5,000 Pa
- 99.95% and 99.995% at MPPS, H13 and H14
- Compatible with all common test methods, including high-concentration oil-based aerosol testing with PAO.
- Available in ISO ePM2.5 and ePM1 efficiencies
- Antimicrobial available

# AstroDuct HEPA

INLINE DUCT HEPA HOUSINGS



## Features and Benefits

- Filter housing for HEPA filters with 292 length
- Made of Aluzinc
- Thickness of insulation: 50 mm
- Door hinged on the left or right
- For multiple filters: aluminum profile construction

## Applications

- Intended for regular airflow in commercial, industrial and institutional applications
- Pre- or final filtration in general air handling units
- Pre-filtration for critical cleanroom applications
- Upgrading of existing systems for better indoor climate and energy efficiency

# AstroSafe SC1000

## Bag In/Bag Out Containment System

- Safe, reliable method for removing contaminated particles in hazardous environments
- Turn-key solution for containment of bacteria and viruses
- Maintenance personnel are protected from direct contact with hazardous contaminants
- Self-contained unit includes HEPA filter, prefilter, Bag In/Bag Out system, Isolation Damper, Base, Exhaust Stack





# Protective Equipment

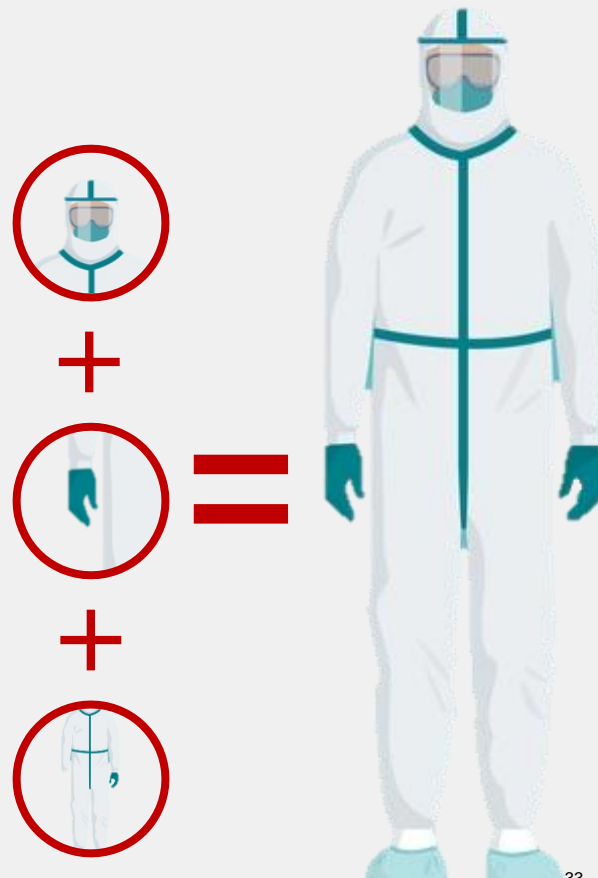
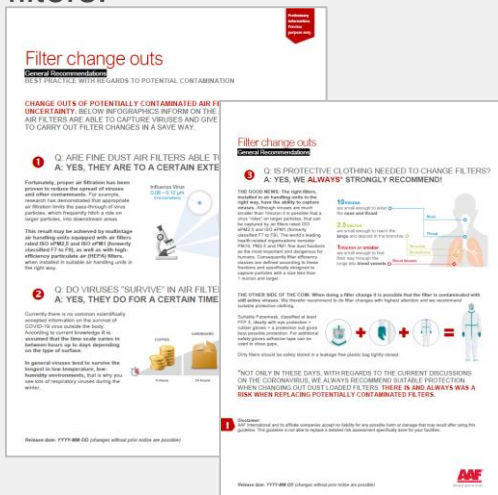
THERE IS **AND ALWAYS** WAS A RISK WHEN REPLACING POTENTIALLY CONTAMINATED FILTERS.

Not only with regards to the current discussion on the coronavirus we **ALWAYS RECOMMEND** suitable protection when changing out dust loaded filters.

**Suitable  
Facemask,**  
classified at  
least FFP 3,  
ideally with eye  
protection

## Rubber gloves

**Protection suits** give best possible protection. For additional safety, adhesive tape can be used to close gaps between suit/gloves and suit/shoes



Bringing clean air to life.™