21st October 2021

Impact of Guidance Note on Ventilation and Indoor Air Quality (IAQ) For Residential and Non-Residential Setting During COVID-19 Pandemic.

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The three most recent coronaviruses that have emerged since 2002 and are life threatening are:

1. SARS – Severe Acute Respiratory Syndrome: Feb. 2003
2. MERS – Middle East Respiratory Syndrome: Sept. 2012
3. COVID-19 – cause by the virus name is SARS-CoV-2
   Jan. 2020

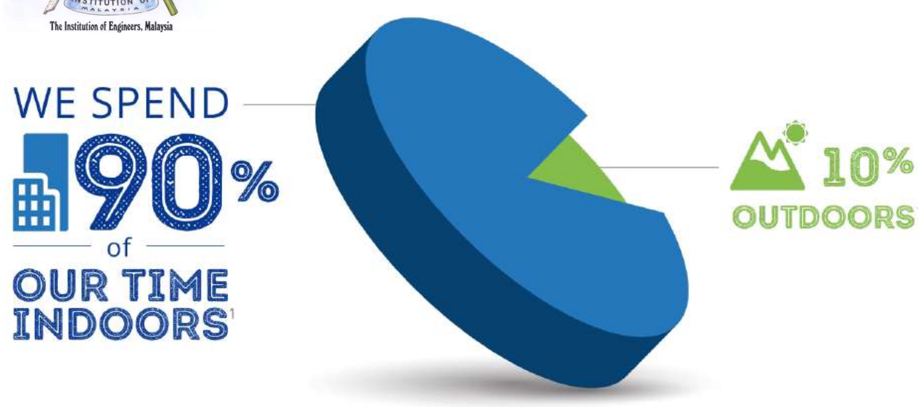
IAQ Definitions by USEPA

IAQ refers to the air quality within and around the buildings and structures, especially as it relates to the health and comfort of building occupants. Understanding and controlling common pollutants indoors can help reduce your risk of indoor health concerns.

Health effects from indoor air pollutants may be experienced soon after exposure or possibly, years later.

In commercial buildings, indoor air quality arise when there is insufficient quantity of ventilation air being provided for the amount of air contaminants present in the conditioned space.

The Institution of Engineers, Malaysia



Source 1: US EPA Region 1 (2013). Questions About Your Community: Indoor Air. Retrieved from http://www.epa.gov/region1/communities/indoorair.html
Graphics: http://naturalleader.com/thecogfxstudy

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Ministry of Human Resources Malaysia

Ministry of Health Malaysia

Guidance Note on Ventilation and Ventilation and Indoor Air Door (IAQ) For:

1.) Residential
2.) Non-Residential
3.) Healthcare Facilities
4.) Public Area

Ministry of Human Resources Malaysia

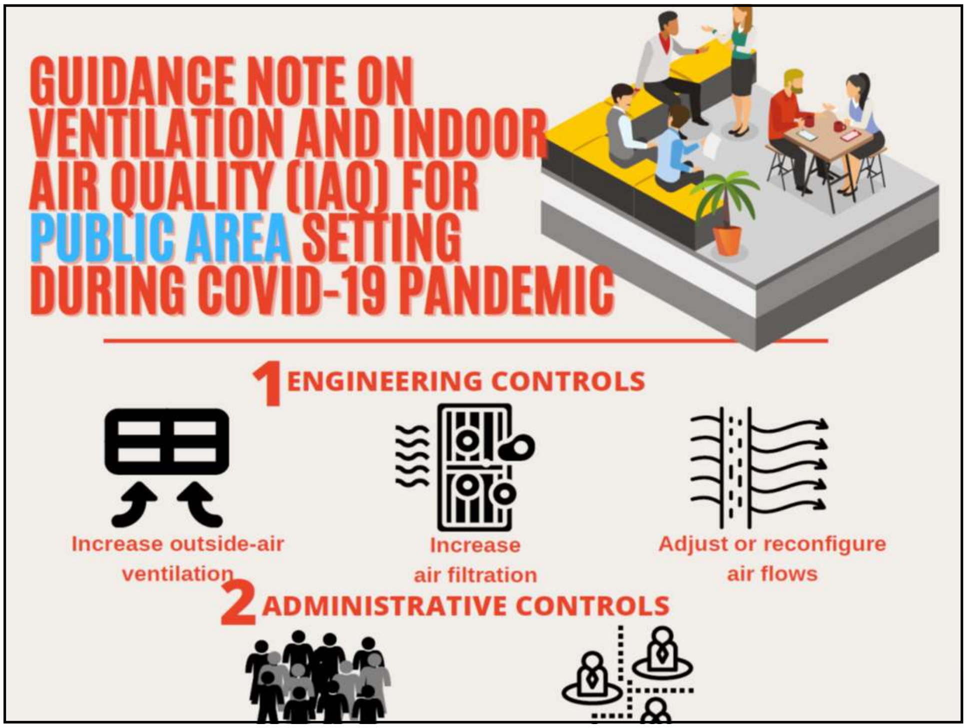
Ministry of Health Malaysia

GUIDANCE NOTE ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR PUBLIC AREA DURING COVID-19 PANDEMIC

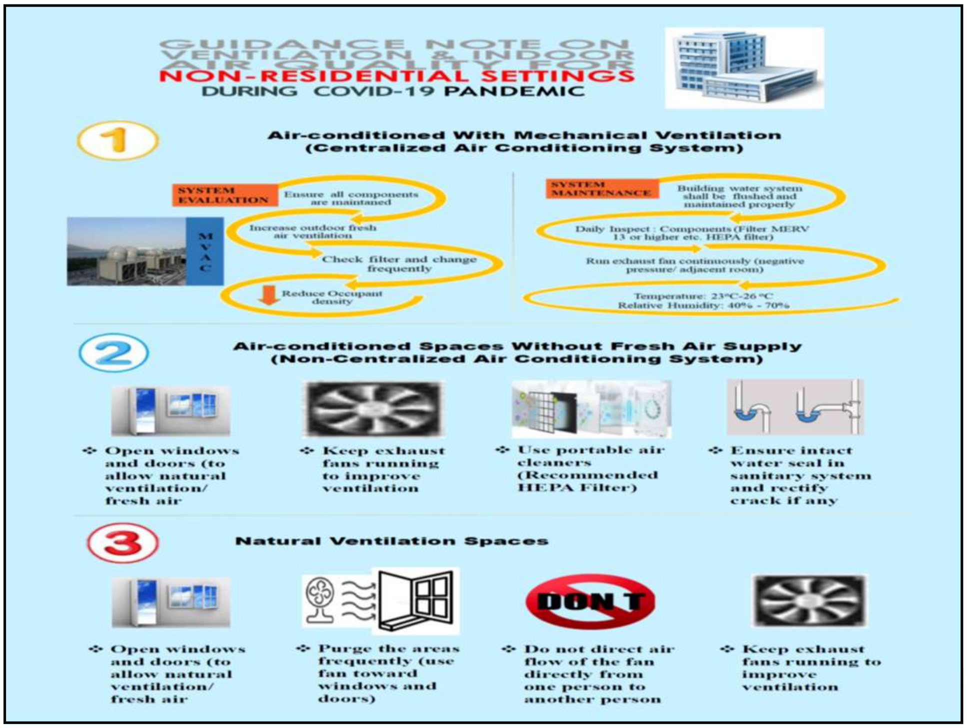
GUIDANCE NOTE ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR RESIDENTIAL SETTING DURING COVID-19 PANDEMIC

GUIDANCE NOTE ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR NON-RESIDENTIAL SETTING DURING COVID-19 PANDEMIC

GUIDANCE NOTE ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR HEALTHCARE FACILITIES SETTING DURING COVID-19 PANDEMIC


GUIDANCE NOTE ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR PUBLIC AREA SETTING DURING COVID-19 PANDEMIC
1 ENGINEERING CONTROLS
Increase outside-air ventilation
Increase air filtration
Adjust or reconfigure air flows
2 ADMINISTRATIVE CONTROLS


GUIDANCE NOTE ON VENTILATION & INDOOR AIR QUALITY FOR RESIDENTIAL SETTING DURING COVID-19 PANDEMIC
Operate exhaust fans to improve ventilation
Set temperature 23ºC - 26ºC
Improve thermal comfort by using electric fan
Open windows frequently for natural ventilation
Recommended to use air cleaner
General Guidance Applicable To All Homes (Landed Properties, Low/High Rise Apartments)
Open windows to ventilate room spaces with clean outdoor air. Leave a small opening when air-conditioner is in operation.
Operate electric fans to increase air movement and subsequently to enhance thermal comfort.


GUIDANCE NOTE ON VENTILATION & INDOOR AIR QUALITY FOR
NON-RESIDENTIAL SETTINGS
DURING COVID-19 PANDEMIC
1
Air-conditioned With Mechanical Ventilation (Centralized Air Conditioning System)
SYSTEM EVALUATION
Ensure all components are maintained
Increase outdoor fresh air ventilation
Check filter and change frequently
Reduce Occupant density
MVAC
SYSTEM MAINTENANCE
Building water system shall be flushed and maintained properly
Daily Inspect : Components (Filter MERV 13 or higher etc. HEPA filter)
Run exhaust fan continuously (negative pressure/ adjacent room)
Temperature: 23°C-26 °C
Relative Humidity: 40% - 70%
2
Air-conditioned Spaces Without Fresh Air Supply (Non-Centralized Air Conditioning System)
Open windows and doors (to allow natural ventilation/ fresh air
Keep exhaust fans running to improve ventilation
Use portable air cleaners (Recommended HEPA Filter)
Ensure intact water seal in sanitary system and rectify crack if any
3
Natural Ventilation Spaces
Open windows and doors (to allow natural ventilation/ fresh air
Purge the areas frequently (use fan toward windows and doors)
DON'T
Do not direct air flow of the fan directly from one person to another person
Keep exhaust fans running to improve ventilation


GUIDANCE NOTE TO BUILDING OWNERS AND BUILDING MANAGEMENTS ON VENTILATION AND INDOOR AIR QUALITY (IAQ) FOR HEALTHCARE FACILITIES SETTING DURING COVID-19 PANDEMIC
AIR-CONDITIONED FACILITIES WITH MECHANICAL VENTILATION
Minimize air recirculation
AHU Room
Increase ventilation rate
Modify airflow direction
Use high-efficiency filters
Reduce the max. room occupancy
Use portable air cleaner
• To increase the ventilation rate according to system capabilities.
• Consider reducing the maximum room occupancy.
• Modify airflow direction by relocating supply and return air devices if necessary.
• Set recirculation air dampers to a minimum according to system capabilities if possible.
• Use high-efficiency filters (at least MERV14 or F8 is recommended) in AHUs.
• Consider to use air-cleaning technologies that be able to kill microbe in AHUs or ducting.
• Consider to use a stand-alone ai cleaner with appropriate filters if no other (short-term) strategy can be adopted.
AIR-CONDITIONED FACILITIES WITHOUT FRESH AIR SUPPLY
Consider exhaust fans to increase
Open windows & doors
Add dedicated outdoor air supply and/or
Modify the position of the split unit or FCUs.

KEMENTERIAN KESIHATAN MALAYSIA

KEMENTERIAN SUMBER MANUSIA

2. The Need for Ventilation Control in Non-Residential Settings

In view of the need to carry out multiple control strategies, addressing the issues on ventilation is of paramount importance especially in non-residential buildings. These premises may include workplaces in which employees spend a major part of their working day especially for those who work indoors as well as those who are the clients and customers of the establishments. Other non-residential areas include schools and universities, accommodation buildings, religious and commercial spaces.

3. Carrying out a Risk Assessment

It is known that the load of the virus potentially released in a building depends on the activities performed inside, the number of occupants and whether or not the occupants are wearing mask. It is of importance that a risk assessment be carried out to facilitate the implementation of relevant countermeasures and to assess the minimum ventilation rate per person. If it is not possible to improve the ventilation, then action must be taken to adjust the maximum building occupancy.

Industry Code of Practice on Indoor Air Quality 2010

DOSH Malaysia Ministry of Human Resources*

Table 1: List of Indoor Air Contaminants and the Maximum Limits

Acceptable Range for Specific Physical Parameters – 2010

Parameter	Acceptable range
(a) Air temperature (b) Relative humidity (c) Air movement	23.0 – 26.0 °C 40 – 70% 0.15 – 0.50

List of Indoor Air Contaminants and acceptable limits

Indoor Air Contaminants	Eight-hours time-weighted average airborne concentration		
	ppm	mg/m^3	cfu/m^3
Chemical contaminants			
(a) Carbon dioxide	C1000	-	-
(b) Carbon monoxide	10	-	-
(c) Formaldehyde	0.1	-	-
(d) Ozone	0.05	-	-
(e) Respirable particulates	-	0.15	-
(f) Total volatile organic compounds (TVOC)	3	-	-
Biological contaminants			
(a) Total bacterial counts	-	-	500
(b) Total fungal counts	-	-	1000

a) Systems Evaluation

Carry out checks to ensure all components and controls of the Centralized Mechanical Ventilation Air-Conditioning (MVAC) system are maintained and functioning as per design.

i. The components include Chillers, pumps, Air Handling Unit (AHUs), Fan Coil Unit (FCUs), Controls, Sensors (Carbon monoxide, Carbon dioxide, Temperature, etc.) Variable Speed Drive (VSDs), intake and exhaust fans, chilled water and condenser water systems, air flow and circulation systems in ducting.

ii. It is advisable to increase outdoor fresh air ventilation by opening outdoor air dampers 100% in order to increase effective dilution ventilation per person. The recommendation from World Health Organization (WHO) is a minimum 10 L/s person of fresh air.

iii. Reduce occupant density in air-conditioned spaces.

iv. Checking filter seals to avoid bypass. Changing of filters according to the recommended maintenance frequency where it should be done during non-operation periods, with the MVAC system turned off.

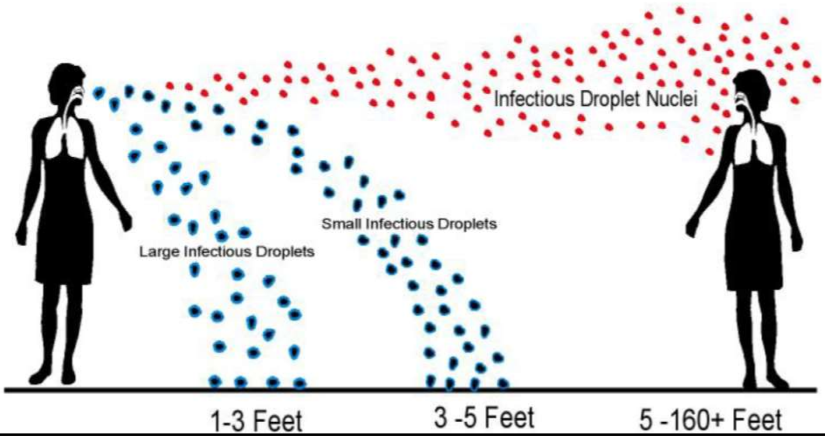
1.) What is the impact of the DOSH Guidance Note

2.) The recommendation from World Health Organization is 10 l/s person (20 cfm/person).

Airborne Transmission depends on people to launch viruses into the air. People can shed this many Flu Viruses into the air:

1. Coughing	3,000+
2. Sneezing	3,000+
3. Breathing	Nose-None Mouth-Varies
4. Talking/Singing	1,000+
5. Vomiting	1,000+
6. Diarrhea*	20,000+

Infectious Droplets & Droplet Nuclei travel lengths



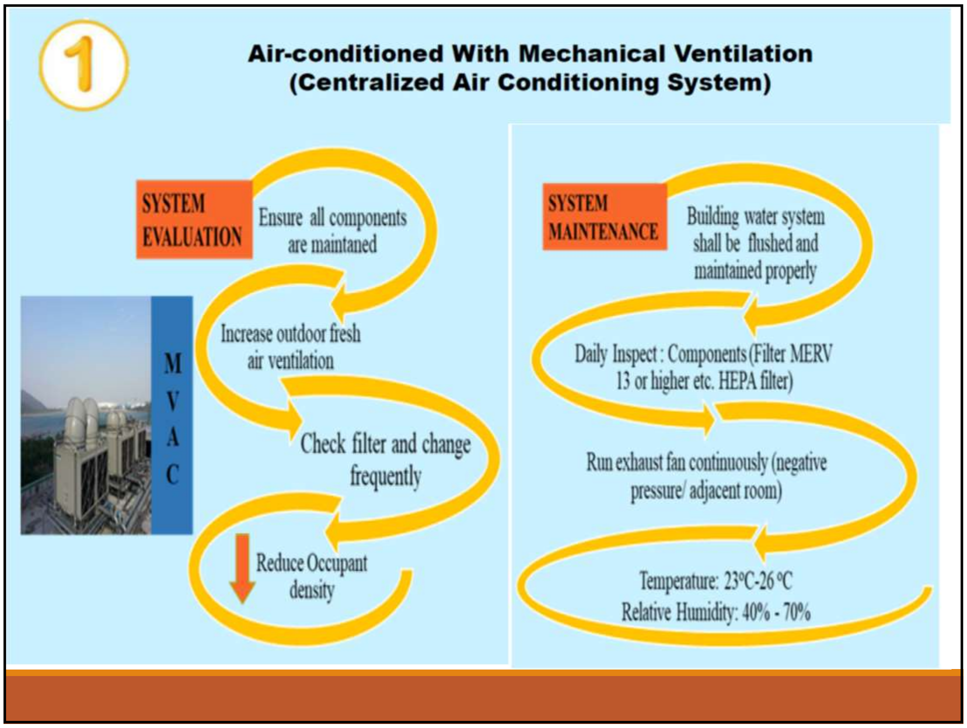
4. Guidance for Air-Conditioned Spaces with Mechanical Ventilation (Centralized Air Conditioning System)

As the transmission of SARS CoV-2 virus through the air is likely, the possible airborne exposure to the virus should be controlled in air-conditioned spaces. Hence, changes to building operations including the air-conditioning and mechanical ventilation systems can reduce air borne exposures.

a.) Systems Evaluation

System Evaluation:

Inspect HVAC equipment, systems, and controls to check for existing issues.



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iii. Reduce occupant density in air-conditioned spaces.

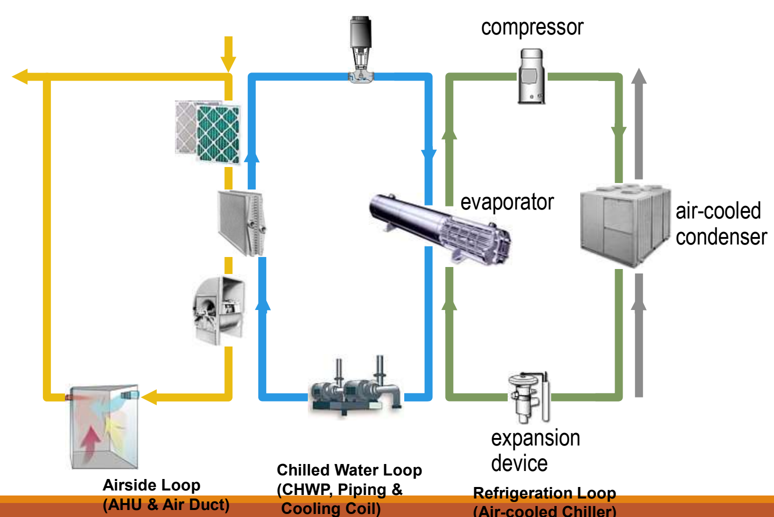
iv. Checking filter seals to avoid bypass. Changing of filters according to the recommended maintenance frequency where it should be done during non-operation periods, with the MVAC system turned off.

System Evaluation:

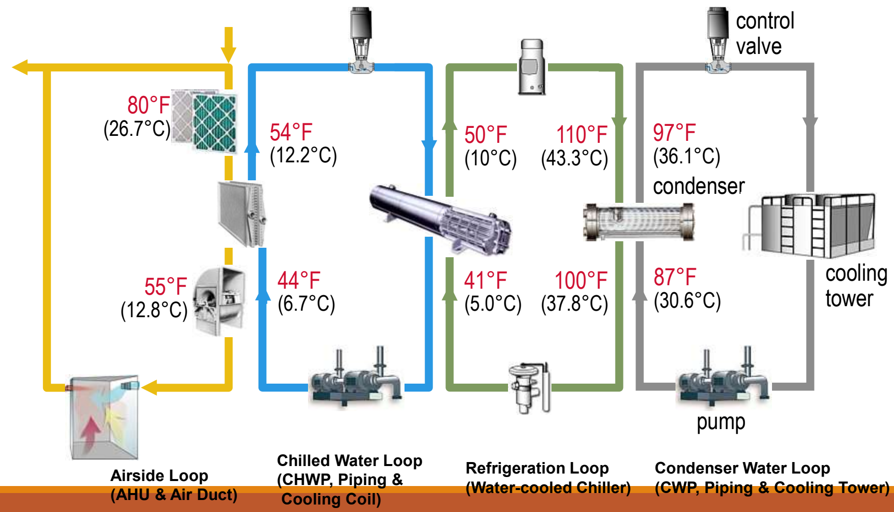
Inspect HVAC equipment, systems, and controls to check for existing issues and are functioning as per design

The components include Chillers, pumps, Air Handling Unit (AHUs), Fan Coil Unit (FCUs), Controls, Sensors (Carbon monoxide, Carbon dioxide, Temperature, etc.) Variable Speed Drive (VSDs), intake and exhaust fans, chilled water and condenser water systems, air flow and circulation systems in ducting.

Air-Cooled Chiller System



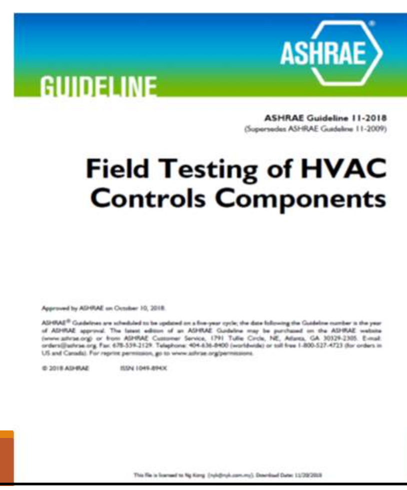
Water Cooled Chiller System



System Evaluation:

Analyze each HVAC system for appropriate engineering controls to improve its potential to reduce virus transmission.

Check calibration per the guidance in ASHRAE Guideline 11-2018, *Field testing of HAVC Control Components.*



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iii. Reduce occupant density in air-conditioned spaces.

iv. Checking filter seals to avoid bypass. Changing of filters according to the recommended maintenance frequency where it should be done during non-operation periods, with the MVAC system turned off.

ASHRAE®

STANDARD

ANSI/ASHRAE Standard 62.1-2019
(Supersedes ANSI/ASHRAE Standard 62.1-2016)
Includes ANSI/ASHRAE addenda listed in Appendix O

Ventilation for Acceptable Indoor Air Quality

See Appendix O for approval dates by ASHRAE and the American National Standards Institute.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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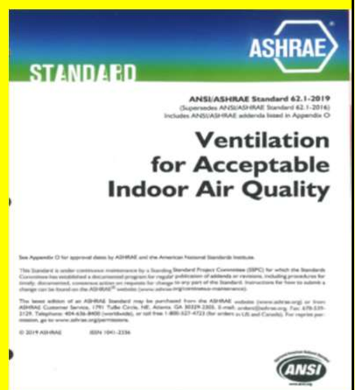
Approved American National Standard ANSI

ASHRAE Std 62.1-2019– Ventilation For Acceptable Indoor Air Quality

1.) Ventilation Rate Procedure (VRP)
2.) Indoor Air Quality Procedure (IAQ)
3.) Natural Ventilation



The recommendation from World Health Organization is 10 l/s person (20 cfm/person).

How?
What is the impact on our energy bill?

The recommendation from World Health Organization is 10 l/s person (20 cfm/person).

But WHO is silent on the occupant density?

Alternatively, the CDC's guide for Ventilation in Buildings FAQ 9, mentions the use of portable CO_2 sensors with a limit of 800ppm as an indicator of sufficient ventilation. https://www.cdc.gov/coronavirus/2019-ncov/community/ventilation.html#fans

Purpose of Ventilation

Why do the codes all address ventilation?

- Life, safety and welfare of building occupants

Indoor contaminant

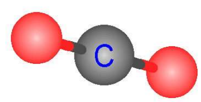
Particles in the Air:

1. **Dust**
2. **Allergens**
3. **Mold & Flower Spores**
4. **Bacteria**
5. **Viruses**
6. **Smoke / Smogs**
7. **Odors**
8. **VOCs**
9. **…**

Dilution

Bring in OA that is cleaner than space air.

Carbon Dioxide (2)



Carbon dioxide (CO_2) has been used as a surrogate for indoor pollutants emitted by humans and correlates with human metabolic activity.

- Humans are the main indoor source of carbon dioxide.
- Indoor levels are an indicator of the adequacy of outdoor air ventilation relative to indoor occupant density and metabolic activity.

CO_2 measurements are important as an indicator of the ventilation effectiveness for occupied buildings.

What is the fastest and most economical way to determine whether the ventilation rate in your office or home is effective, good enough or meet the requirement of 10 l/s per person?

Invest in a Portable CO2 Sensor

1

Install a Multi-Function Wall-Mount Air Quality Monitor in your office

Acceptable Range for Specific Physical Parameters – 2010

Parameter	***Acceptable range***
(a) Air temperature	***23.0 – 26.0 ºC***
(b) Relative humidity	***40 – 70%***
(c) Air movement	***0.15 – 0.50***

List of Indoor Air Contaminants and acceptable limits

Indoor Air Contaminants	***Eight-hours time-weighted average airborne concentration***		
	ppm	**mg/m³**	**cfu/m³**
Chemical contaminants			
(a) Carbon dioxide	***C1000***	***-***	***-***
(b) Carbon monoxide	***10***	***-***	***-***
(c) Formaldehyde	***0.1***	***-***	***-***
(d) Ozone	***0.05***	***-***	***-***
(e) Respirable particulates	***-***	***0.15***	***-***
(f) Total volatile organic compounds (TVOC)	***3***	***-***	***-***
Biological contaminants			
(a) Total bacterial counts	***-***	***-***	***500***
(b) Total fungal counts	***-***	***-***	***1000***

2

ASHRAE STD 62.1-2019 - Ventilation For Acceptable Indoor Air Quality

ASHRAE

STANDARD

ANSI/ASHRAE Standard 62.1-2019
(Supersedes ANSI/ASHRAE Standard 62.1-2016)
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ANSI

Ventilation is the key to Sustainable IAQ and ASHRAE Standard 62.1 is the most widely used Standard by most Local Authorities and HVAC Engineers in the world.

Acceptable Indoor Air Quality is defined as air in which there are no known Contaminants at harmful Concentrations as determined by Cognizant Authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction.

1.) Ventilation Rate Procedure (VRP) –

is a prescriptive procedure with a table of minimum required outdoor airflow rates per occupant for a variety of non-

residential occupancies.

The airflow rate per square foot of building floor area is based-

on the design occupancy density and the required flow rate per person, adjusted to reflect the air distribution system used.

1.) Ventilation Rate Procedure (VRP)

$$V_{bz} = R_p.P_z + R_A.A_Z$$ **(PEOPLE + AREA COMPONENT)**

Where $\mathbf{V_{bz}}$ = Design outdoor airflow required in the breathing zone of the occupied space or spaces in a zone,i.e the breathing zone outdoor air flow

$\mathbf{A_z}$ = Zone floor area: the net occupiable floor area of the zone m^2 (ft^2)

$\mathbf{P_z}$ = zone population: the largest number of people expected to occupy the zone during typical usage.

$\mathbf{R_p}$ = outdoor airflow rate required per person as determined from Table 6-1

$\mathbf{R_a}$ = outdoor airflow rate required per unit area as determined from Table 6-1

Ventilation Rate Procedure

People Component **Building Component**

Outdoor Air Ventilation Rate for Breathing Zone

$$V_{bz} = R_p P_d + R_b A_b$$

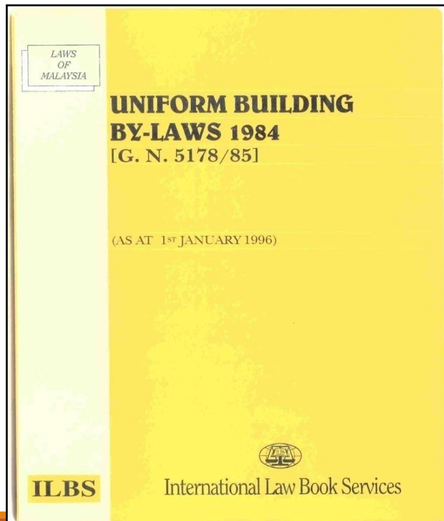
Minimum cfm/Person x Number of People + Minimum cfm/sq ft x Building Area

malaysiaGBC

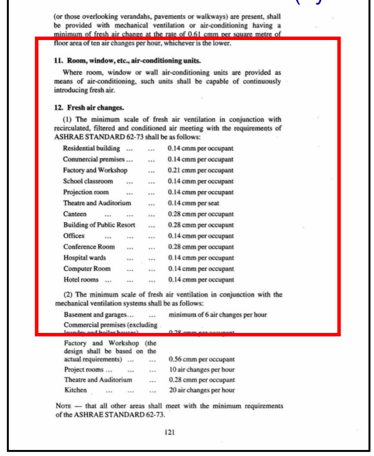
TABLE 6-1 MINIMUM VENTILATION RATES IN BREATHING ZONE

Occupancy Category	People Outdoor Air Rate R_p		Area Outdoor Air Rate *Ra*		Default Values		
					Occupant Density	Combined Outdoor Air Rate	
	cfm/ person	L/s person	cfm/ft²	L/s m²	#1000 ft² or #100 m²	cfm/ person	L/s person
Office Buildings	COPY						
Office Space	5	2.5	0.06	0.3	5	17	8.5
Reception areas	5	2.5	0.06	0.3	30	7	3.5

Building code requirements



Extract from Third Schedule (By-law 41)



(or those overlooking verandahs, pavements or walkways) are present, shall be provided with mechanical ventilation or air-conditioning having a minimum of fresh air change at the rate of 0.61 cmm per square metre of floor area of ten air changes per hour, whichever is the lower.

11. Room, window, etc., air-conditioning units.

Where room, window or wall air-conditioning units are provided as means of air-conditioning, such units shall be capable of continuously introducing fresh air.

12. Fresh air changes.

(1) The minimum scale of fresh air ventilation in conjunction with recirculated, filtered and conditioned air meeting with the requirements of ASHRAE STANDARD 62-73 shall be as follows:

Residential building	0.14 cmm per occupant
Commercial premises	0.14 cmm per occupant
Factory and Workshop ...	0.21 cmm per occupant
School classroom	0.14 cmm per occupant
Projection room	0.14 cmm per occupant
Theatre and Auditorium ...	0.14 cmm per seat
Canteen	0.28 cmm per occupant
Building of Public Resort ...	0.28 cmm per occupant
Offices	0.14 cmm per occupant
Conference Room	0.28 cmm per occupant
Hospital wards	0.14 cmm per occupant
Computer Room	0.14 cmm per occupant
Hotel rooms	0.14 cmm per occupant

(2) The minimum scale of fresh air ventilation in conjunction with the mechanical ventilation systems shall be as follows:

Basement and garages... ...	minimum of 6 air changes per hour
Commercial premises (excluding laundry and boiler houses)	0.28 cmm per occupant
Factory and Workshop (the design shall be based on the actual requirements)	0.56 cmm per occupant
Project rooms	10 air changes per hour
Theatre and Auditorium ...	0.28 cmm per occupant
Kitchen	20 air changes per hour

Note — that all other areas shall meet with the minimum requirements of the ASHRAE STANDARD 62-73.

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ASHRAE Standard 62.1-2016, "*Ventilation for Acceptable Indoor Air Quality*," specifies minimum ventilation rates and indoor air quality that will be acceptable to the human occupants of a building.

- **Considers Chemical, Physical, and Biological Contaminants**.

Table 6-1 Minimum Ventilation Rates in Breathing Zone

(PEOPLE COMPONENT ONLY)

Rp , Flow rate per person or per unit area (ASHRAE 62.1 -2019) e.g.

Office space – 5cfm/person (2.5 l/s / person)
Mall & supermarket – 7.5 cfm/person
Restaurant & Café – 7.5 cfm/person
Lecture hall – 7.5 Cfm/person
Games arcade / Casino – 7.5 Cfm/person
Computer & Science Lab – 10 Cfm/person
Disco & Aerobics room – 20 Cfm/person

ASHRAE Std 62.1-2016 – Ventilation For Acceptable Indoor Air Qualy

1.) Example : Ventilation Rate Procedure (VRP)

$V_{bz} = R_p.P_z + R_a.A_z$

Where V_{bz} = Design outdoor airflow required

A_z = floor area = 1,000 sq. ft. , P_z = population = 5 people (20m2/person)

R_p = outdoor airflow rate required per person as determined from Table 6-1 = 5 cfm/person

R_a = outdoor airflow rate required per unit area as determined from Table 6-1 = 0.06 cfm/ft2

$V_{bz} = R_p.P_z + R_a.A_z$ = 5 x 5 + 0.06 x 1,000

= 85 cfm i.e 17cfm/person (8.5 l/s)

ASHRAE Std 62.1-2016 – Ventilation For Acceptable Indoor Air Qualy

1.) Example : Ventilation Rate Procedure (VRP)

$V_{bz} = R_p.P_z + R_a.A_z$

Where V_{bz} = Design outdoor airflow required

A_z = floor area = 10,000 sq. ft. , P_z = population = 100 people (100%)

R_p = outdoor airflow rate required per person as determined from Table 6-1 = 5 cfm/person

R_a = outdoor airflow rate required per unit area as determined from Table 6-1 = 0.06 cfm/ft2

$V_{bz} = R_p.P_z + R_a.A_z$ = 5 x 100 + 0.06 x 10,000

= 1,100 cfm i.e 11cfm/person (5.5 l/s per person)

b.) In conditions where the minimum recommended ventilation rate '**10 L/s per Person**' is not met, the number of persons permitted in the air-conditioned space shall be **reduced** accordingly.

ASHRAE Std 62.1-2016 – Ventilation For Acceptable Indoor Air Qualy

1.) Example : Ventilation Rate Procedure (VRP)

$V_{bz} = R_p.P_z + R_a.A_z$

Where V_{bz} = Design outdoor airflow required

A_z = floor area = 10,000 sq. ft. , P_z = population = 80 people (80%)

R_p = outdoor airflow rate required per person as determined from Table 6-1 = 5 cfm/person

R_a = outdoor airflow rate required per unit area as determined from Table 6-1 = 0.06 cfm/ft2

$V_{bz} = R_p.P_z + R_a.A_z$ = 5 x 80 + 0.06 x 10,000 = 400 + 600

= **1,000 cfm** i.e **12.5 cfm/person (6.25 l/s)**

ASHRAE Std 62.1-2016 – Ventilation For Acceptable Indoor Air Qualy

1.) Example : Ventilation Rate Procedure (VRP)

$V_{bz} = R_p.P_z + R_a.A_z$

Where V_{bz} = Design outdoor airflow required

A_z = floor area = 10,000 sq. ft. , P_z = population = 60 people (60%)

R_p = outdoor airflow rate required per person as determined from Table 6-1 = 5 cfm/person

R_a = outdoor airflow rate required per unit area as determined from Table 6-1 = 0.06 cfm/ft2

$V_{bz} = R_p.P_z + R_a.A_z$ = 5 x 60 + 0.06 x 10,000 = 300 + 600

= 900 cfm i.e 15 cfm/person (8.5 l/s per person)

ASHRAE Std 62.1-2016 – Ventilation For Acceptable Indoor Air Qualy

1.) Example : Ventilation Rate Procedure (VRP)

$V_{bz} = R_p.P_z + R_a.A_z$

Where V_{bz} = Design outdoor airflow required

A_z = floor area = 10,000 sq. ft. , P_z = population = 40 people (40%)

R_p = outdoor airflow rate required per person as determined from Table 6-1 = 5 cfm/person

R_a = outdoor airflow rate required per unit area as determined from Table 6-1 = 0.06 cfm/ft2

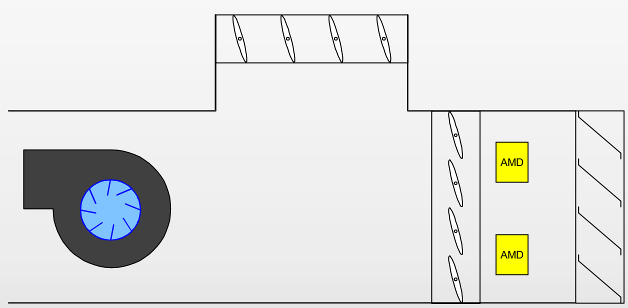
$V_{bz} = R_p.P_z + R_a.A_z$ = 5 x 40 + 0.06 x 10,000 = 200 + 600

= 800 cfm i.e 20 cfm/person (10.0 l/s per person)

3. Actual Measurement

Outdoor Air Measuring Device for AHU

Place the airflow measuring station upstream of the intake damper.



Typical (OAMS) Outdoor Air Monitoring System.

Placement allowed by one manufacturer to within 10mm upstream of open damper blade.

5. Guidance for Air-Conditioned Spaces without Mechanical Ventilation (Non-Centralized Air Conditioning System)

a) Increase room ventilation rate by the following:

i. As frequent as possible, open windows and doors to allow cross natural ventilation and to let fresh air into the space, unless outdoor air quality is poor or weather does not permit. When windows and doors are open, usage of the air conditioning system should be kept at a minimum or turned off completely.

ii. Existing exhaust fans in places like toilets or kitchen, should be operated at maximum capacity. Operable windows and doors should be opened but the ones near the fans shall be closed to avoid air flow short circuiting.

❖ **Open windows and doors (to allow natural ventilation/ fresh air**

❖ **Keep exhaust fans running to improve ventilation**

❖ **Use portable air cleaners (Recommended HEPA Filter)**

What systems are available to sterilize, capture, inhibit and/or kill air borne Flu viruses?

1.) MERV Rated Filters (Minimum Efficiency Reporting Value) HEPA Filters

2.) Germicidal UV Lights (UVGI)

3.) Magnetized Air Media Filtration

4.) Cold Plasma Bi-Polar Ionization

5.) Photo-Catalytic Oxidation (PCO)

6.) EAC (Electronic Air Cleaners)

7.) Ionisers

8.) Low Density Engineered Ozone System.

9.) Gas Phase Filtration

What systems are available to sterilize, capture, inhibit and/or kill air borne Flu viruses?

1.) Germicidal UV Lights (UVGI)

2.) Ionizers

Purpose of Ventilation

Why do the codes all address ventilation?

- Life, safety and welfare of building occupants

Indoor contaminant

Particles in the Air:

1. **Dust**
2. **Allergens**
3. **Mold & Flower Spores**
4. **Bacteria**
5. **Viruses**
6. **Smoke / Smogs**
7. **Odors**
8. **VOCs**
9. **…**

Dilution

Bring in OA that is cleaner than space air.

Hisense

Qingdao Hisense Hitachi Air-conditioning Systems Co.,Ltd.

GUANGDONG DETECTION CENTER OF MICROBIOLOGY

ANALYSIS AND TEST RESULT

Report No.: 2020FM01878R02

Testing Virus	Actuation Duration	No.	Total Virus In The Air($TCID_{50}/m^3$)	Killing Rate (%)
Influenza A virus H3N2（A/PR/8/34）Host name: MDCK cells	0(CK)	1	4.85×10^6	
		2	2.86×10^6	
		3	4.53×10^6	
	1h	1	<90	>99.99
		2	<90	>99.99
		3	<90	>99.99
The results of killing rate test have eliminated the influence of natural extinction factors of microorganisms in the air.				

Report No.: 2020FM01878R01

Actuation Duration	Testing Microorganisms	No.	Total Bacteria In The Air(cfu/m^3)	Killing Rate (%)
0(CK)	Staphylococcus aureus ATCC 6538	1	3.4×10^6	
		2	3.8×10^6	
		3	3.4×10^6	
2h	Staphylococcus aureus ATCC 6538	1	9.1×10^2	99.93
		2	9.1×10^2	99.94
		3	9.1×10^2	99.94
0(CK)	Escherichia coli 8099	1	4.4×10^6	
		2	4.5×10^6	
		3	3.7×10^6	
2h	Escherichia coli 8099	1	9.1×10^2	99.94
		2	1.8×10^3	99.90
		3	9.1×10^2	99.94

(Blank below)

intertek
Total Quality. Assured.

CB02-TICK-C02EE-0000001
Page 1/2

Certificate

Certificate "Independently Tested"
Certificate No.: CB02-TICK-C02EE-0000001

The mentioned product is in compliance with the mentioned test requirements.

Certificate Holder
Qingdao Hisense Hitachi Air-conditioning Systems Co., Ltd
No. 218, Qianwangang Road, Economic and Technological Development Zone, Qingdao, China

Brand name
Hisense

Manufacturing Site
Qingdao Hisense Hitachi Air-conditioning Systems Co., Ltd
No. 218, Qianwangang Road, Economic and Technological Development Zone, Qingdao, China

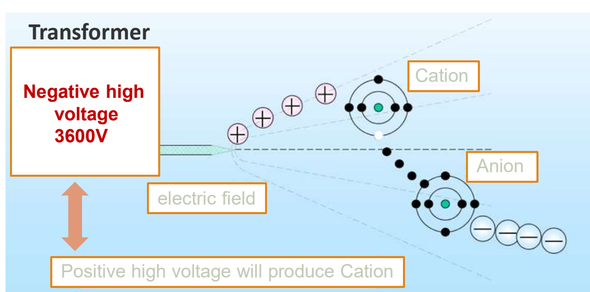
Product
Ceiling Ducted Type Air Conditioner

Type
AVE-09HCFRL

☒	Section 2.1	Bacteria Elimination	√	Escherichia coli killing rate 99.9%
			√	Staphylococcus aureus killing rate 99.9%
☒	Section 2.2	Virus Killing	√	H3N2 killing rate 99.9%

What is anion and anion generator

Principle of Anion Generator



Cations are neutralized by negative high voltage

After working continuously for 4 hours stop for half an hour

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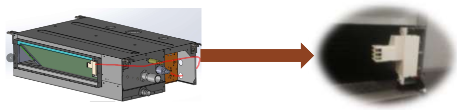
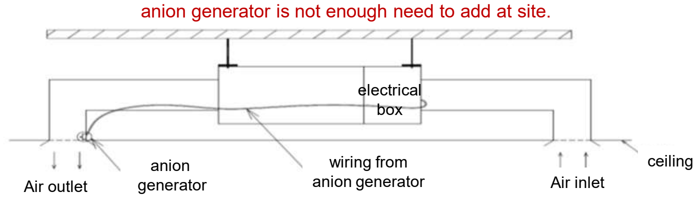
Product Information

Without duct： Fix the anion generator to outlet flange,the wiring from anion generator extends directly from the outside of FCU to inside of the electrical box.



With duct： Fix the anion generator to each air outlet, if the wiring from anion generator is not enough need to add at site.



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Product Information

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RECOMMENDATIONS….

1. **Wear a mask & wear it properly.**
2. **Keep a distance away (1 – 2 m)**
3. **Wash your hand frequently and sanitize common "touch" areas.**
4. **Coughing/sneezing occupants stay at home or wear a mask.**
5. **If you are sick, stay home.**
6. **If at home, open all doors and windows esp. morning for natural ventilation whenever weather permits.**
7. **Increased fresh air ventilation - Dilution**
8. **Maintain Relative Humidity of 50% - 65%**
9. **Get the highest MERV rated filter that your filter rack and air handling fan can tolerate.**
10. **Put as much UV light within your coil plenum to achieve a 99.9% single pass kill rate.**
11. **Consider the various systems available for additional viral sterilization.**

2. Wash your hand frequently and sanitize common "touch" areas.

Source: Nippon Paint

Open Windows

Outdoor Air Quality

Motorists passed a highway toll gate covered by thick haze in Kuala Lumpur, Malaysia, Thursday, Aug. 11, 2005. The ominous haze that has shrouded parts of Southeast Asia this month is just one visible element of a much larger problem that is choking hundreds of thousands to death every year across the region, the World Health Organization said. (AP Photo/Andy Wong)

Three Cs

The Institution of Engineers, Malaysia

Thank You

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