

# Proposal for Asia Region

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\*\*Excluding China, Taiwan and India

## *Duct UVnano Filter Box*



Sept. 2021  
CAC Engineering Solution Team



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# Indoor Environment Trend

LG provides the most optimized solution for the customer by considering the customer's needs as the top priority and applying them to wide varieties of products

## Comfort

## Convenience

## Health



In addition to comfort and convenience, customer's needs in improving indoor air quality is currently increasing to create a clean and safe living environment

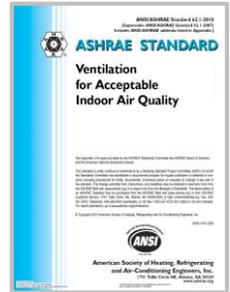
## Definition

\*\*Definition is in light of EPA (Environmental Protection Agency)

- Indoor air quality (IAQ) is the air quality within and around buildings and structures.
- IAQ is known to affect the health, comfort and well-being of building occupants.
- IAQ is affected by the concentration of pollutants (form of dust particles, microorganisms in the air).
- **If the concentrations exceed the limits suggested by the ASHRAE 62.1, the air quality is considered poor and may affect occupants.**

\*\*ANSI / ASHRAE Standards 62.1 and 62.2 are the recognized standards for ventilation system design and acceptable indoor air quality (IAQ)

Expanded and revised for 2019, both standards specify minimum ventilation rates and other measures in order to minimize adverse health effects for occupants



PM<sub>2.5</sub>

- Dust Particle
- Diameter : 2.5µm
- NAAQS : 35µg/m<sup>3</sup> in 24 hours

\*\*Ultrafine Dust : less than 2.5µm (PM 2.5) in diameter



PM<sub>10</sub>

- Dust Particle
- Diameter : 10µm
- NAAQS : 150µg/m<sup>3</sup> in 24 hours

\*\*Fine Dust : less than 10µm (PM 10) in diameter

- Particulate Matter Smaller than 2.5 Micrometers (PM 2.5)
  - When the building is located in an area where **the national standard or guideline for PM 2.5 is exceeded**, particle filters or air-cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces.
  - Particulate matter filters or air cleaners shall have a **Minimum Efficiency Reporting Value (MERV) of 11 or higher when rated in accordance with ANSI / ASHRAE Standard 52.2**
- Particulate Matter Smaller than 10 Micrometers (PM 10)
  - When the building is located in an area where **the national standard or guideline for PM 10 is exceeded**, particle filters or air-cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces.
  - Particulate matter filters or air cleaners shall have a **Minimum Efficiency Reporting Value (MERV) of 6 or higher when rated in accordance with ANSI / ASHRAE Standard 52.2**

\*\*NAAQS : National Ambient Air Quality Standards

\*\*ANSI : American National Standards Institute

\*\*ASHRAE : American Society of Heating, Refrigerating and Air-Conditioning Engineers

\*\*[Source] ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality

## Bacteria

- Bacteria are single-celled organisms made up of one cell that **can produce, survive, and reproduce on their own**.
- Bacteria are completely living cell, consisting of cell nucleus (DNA / RNA), cell wall and cell membrane.
- **The size of Bacteria is usually  $1\mu\text{m}\sim 5\mu\text{m}$ .**



## Virus

- Viruses are simple structures made up of nucleic acids and proteins that **can not live alone and survive parasitic on hosts**.
- Viruses are submicroscopic infectious agents that replicate only inside the living cells of an organism.
- Viruses can infect all kinds of living things, from animals and plants to microorganisms, including **bacteria** and animals.
- **The size of Viruses is usually  $0.003\mu\text{m}\sim 0.05\mu\text{m}$  ( $3\text{nm}\sim 50\text{nm}$ ).** **\*\* $1\mu\text{m} = 1000\text{nm}$**

**\*\*The size of the virus is relatively smaller than that of the bacteria (Size from 1/10 to 1/100 compared to bacteria)**

## Infectious Route

- Bacteria and Viruses are interpersonally infected through bodily fluids such as saliva and runny nose.
- **It's called droplet infection**, bacteria cause Tuberculosis or Pneumonia and viruses cause Corona-Virus or Influenza-Virus through these routes.
- **The droplet is a relatively large particle, usually larger than  $0.5\mu\text{m}$ .**

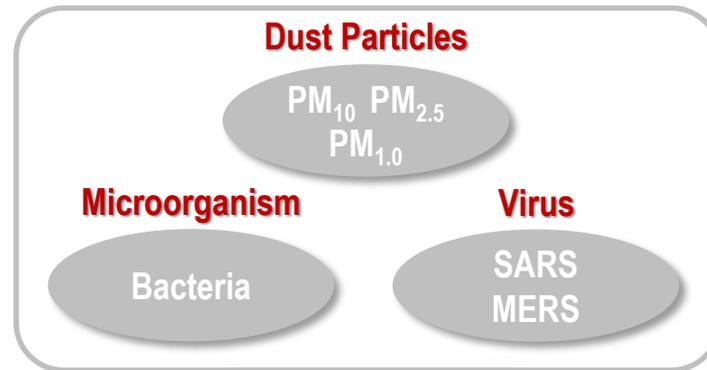


**\*\*Because the size of droplet is larger than air propagation, it can only fly up to about 1 meter**

# Indoor Air Quality (IAQ)

People's health and well-being is **influenced by the indoor air quality**

**\*\*According to EPA, people spend 90% of their time indoors**



**Impaired Learning**



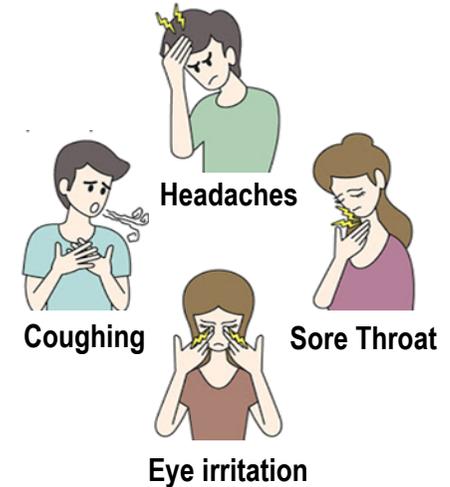
**Poor IAQ**

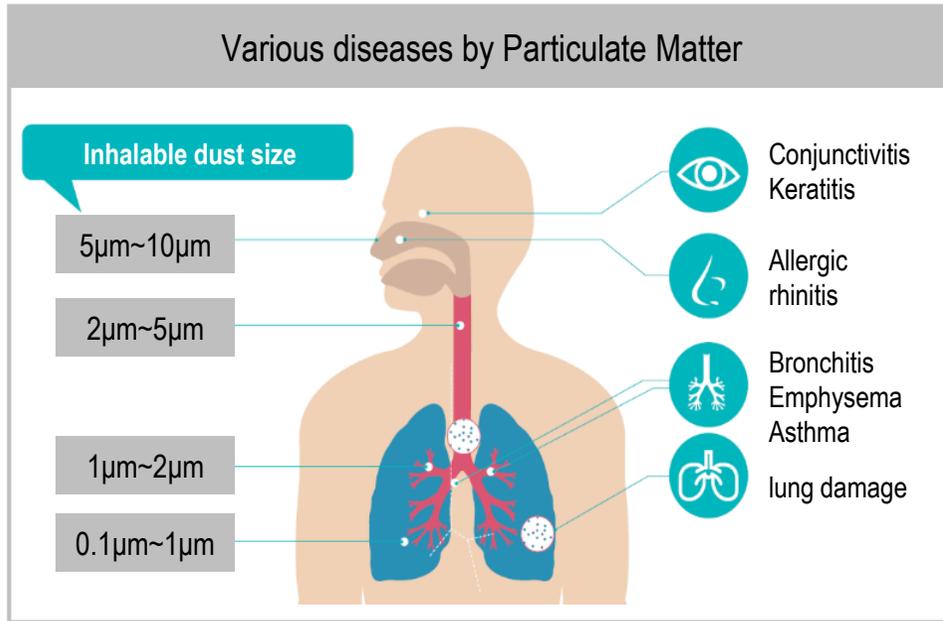


**Reduced Productivity**



**Sick Building Syndrome**





## ■ Fatal diseases by PM (Particulate Matter)

Worldwide, it is estimated that 2.8 million people die annually from indoor air quality, and in fact, **the risk of indoor pollutants is reported to be 1,000 times higher than that of outdoor air quality (by WHO)**. The scale of damage caused by fine dust is known to be 10 trillion won per year (by OECD)

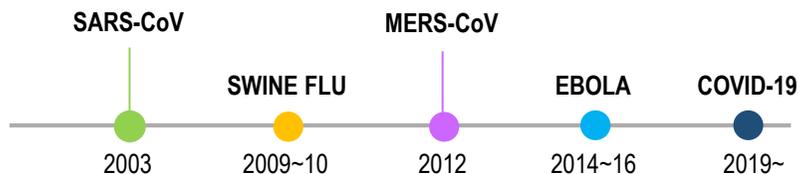
\*\*[Source]

Development and demonstration of a total indoor environment solution for a safe and comfortable life” by Korea Institute of Science and Technology Information

## ■ Virus-related fatal diseases

\*\*[Source] UN “State of the Future”

**The emergence of deadly diseases for the last two decades has greatly increased.** In the last 40 years, 39 new infectious diseases such as SARS, SWINE FLU, and MERS have been discovered, and about 17 million people died a year. Recently, a global pandemic has occurred due to the COVID-19.



Incidence has been increasing over the two decades.



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# Why LG?

## LG Duct UVnano Filter Box can provide the most suitable solution for Healthy Environment

### Needs for Healthy Environment

- Increased need for anti-bacterial and sterilization of indoor air quality as well as ultrafine dust removal
  - Increased requirement to prevent virus and bacterial contamination and improved management
- ASHRAE's Core Recommendations
  - Recommendation of installing MERV 13 Filter or higher rating filter

### Convenient Maintenance

- Facilitating filter maintenance
  - Accessible with 2 directions (Side direction / Bottom direction)



- Alarming display regarding filter replacement cycle through a wired remote controller
  - MERV 13 Filter : 960hr

\*\*The time the filter has been used until the rated air flow rate drops to about 30%  
\*\*The replacement cycle of filter may be different depending on the environment



### Provision for Sterilized and Cleaned Air

- Primary filtering through Pre-Filter
  - Large particles such as fine dust, bacteria, viruses in the form of droplets can be trapped
  - Reusable after washing with water



- Sterilization with UVnano
  - Irradiation of ultraviolet rays for sterilization
  - Sterilization on Pre-Filter where large particles are trapped
  - 99.99% Sterilization Performance certified by authorized institution
  - Semi-permanently without replacement



- Final filtering through MERV 13 Filter
  - Particles as small as 0.3µm in size can be trapped
  - Filtering Performance certified by authorized institutions
  - Compensation for pressure drop due to the filter box installation by setting E.S.P separately \*\*E.S.P : External Static Pressure



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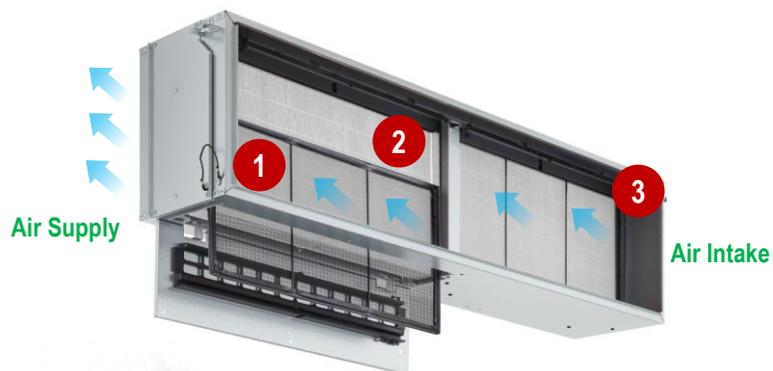
Maintenance

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# Air Purification Operation

LG Solution

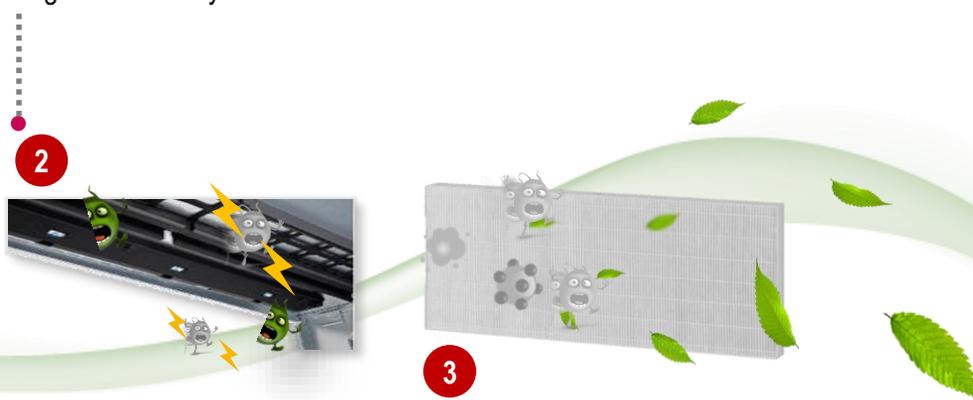
LG Duct UVnano Filter Box can effectively create a safe indoor environment by trapping and removing various harmful substances such as fine dust, bacteria and viruses in the form of droplets



1) Based on TÜV Rheinland test conducted according to LG test method in compliance with ISO 20743, removing 99.99% of percent of *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Klebsiella pneumoniae* after being exposed to UV LED lights for 4 hours (Tested Models : PBM13M3UA0, PBM13M2UA0, PBM13M1UA0)

## 2<sup>nd</sup> step. UVnano

- Sterilize bacteria and viruses parasitized on bacteria up to 99.99%<sup>1)</sup> by irradiating ultraviolet rays



2) Based on KCL (Korea Conformity Laboratories) test conducted in compliance with ASHRAE 52.2

## 1<sup>st</sup> step. Pre-Filter

- Trap large particles
  - Fine dust
  - Bacteria
  - Viruses in the form of droplets

## 3<sup>rd</sup> step. MERV 13 Filter

- Trap particles as small as 0.3 $\mu$ m in size<sup>2)</sup>
  - 0.3 $\mu$ m~1.0 $\mu$ m : 50% $\uparrow$
  - 1.0 $\mu$ m~3.0 $\mu$ m : 85% $\uparrow$
  - 3.0 $\mu$ m~10.0 $\mu$ m : 90% $\uparrow$

## Definition

- As a primary treatment filter, it is used for pre-treatment of HEPA filter and medium filter, etc. and usually removes large particulates that cause harm to the human body, such as dust in the atmosphere.
- Many commercial options for air Pre-Filters are available for the use of air filtration units at homes, workplaces, hospitals, hotels, transports etc. and in the respirators used by individuals.

## Role

- Pre-Filter protects the main air filters from getting clogged up with debris so they can trap microscopic pollutants.

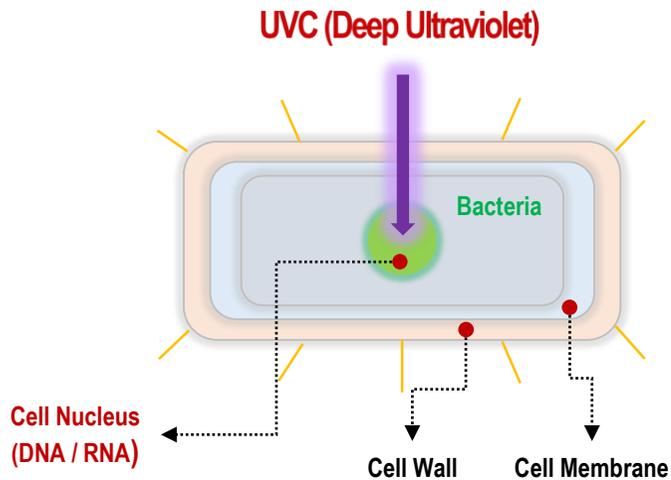
## Performance

- There are wide varieties of technologies and user defined requirements for Pre-Filters and therefore, there are no standardized regulations about the performance and effectiveness.

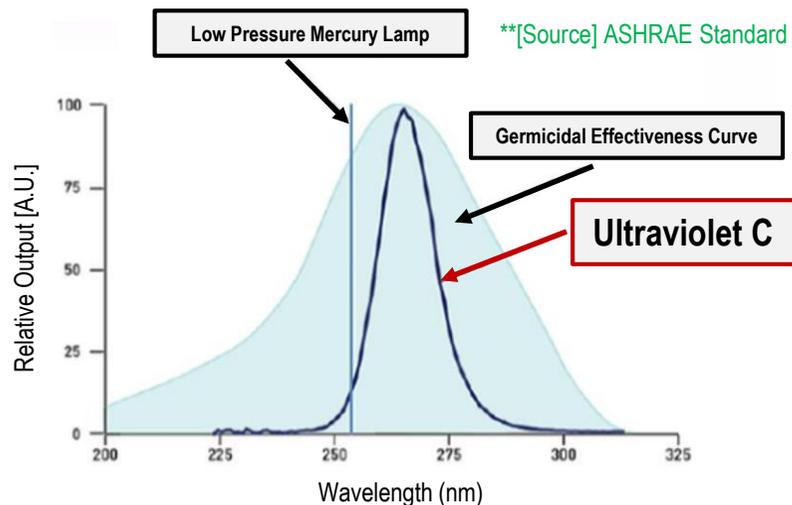
# The Effect of UVC Sterilization on Bacteria

UVC sterilization is the most powerful method to destroy bacterial DNA and RNA

## Process



- 1<sup>st</sup> step. UVC irradiation
  - 2<sup>nd</sup> step. Change the structure of DNA and RNA inside the cell nucleus
  - 3<sup>rd</sup> step. Stop the cell division function to prevent proliferation (Inactivation)
- UVC disinfection is achieved by inactivating DNA and RNA**



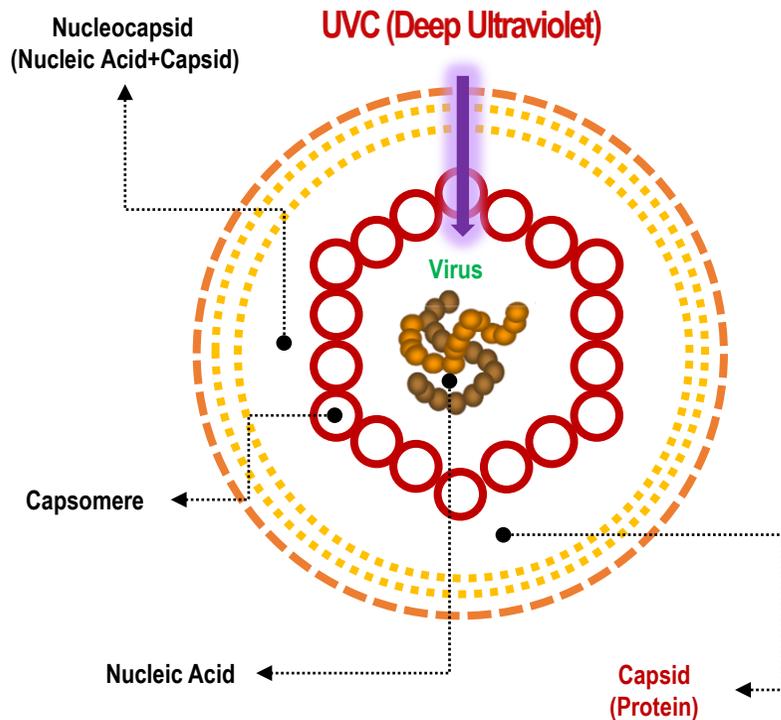
Ultraviolet Germicidal Irradiation is electromagnetic radiation that can destroy the ability of microorganisms to reproduce by causing photochemical changes in nucleic acids. Wavelengths in the UVC range are especially damaging to cells because they are absorbed by nucleic acids. The germicidal effectiveness of UVC peaks at about 260–265nm.

Name	Abbreviation	Wavelength (nm)	Notes
Ultraviolet C	UVC	100~280	Short-Wave, <b>Germicidal</b> Completely absorbed by the ozone layer and atmosphere, Hard UV
Ultraviolet B	UVB	280~315	Medium-Wave Mostly absorbed by the ozone layer and atmosphere, Intermediate UV
Ultraviolet A	UVA	315~400	Long-Wave Not absorbed by the ozone layer and atmosphere, Soft UV

# The Effect of UVC Sterilization on Viruses

In process of sterilizing bacteria through UVnano, viruses parasitized on bacteria can be simultaneously dissipated

## Process



1<sup>st</sup> step. UVC irradiation

2<sup>nd</sup> step. Destroy the outer protein coating of virus

- Currently, there is limited published data about the wavelength and duration of UVC irradiation required to inactivate viruses.
- In addition to understanding whether UVC irradiation is effective at inactivating a particular virus, there are also limitations to how effective UVC irradiation can be at inactivating viruses generally.

99.99% sterilization capability against bacteria in accordance with TUV Rheinland Standard

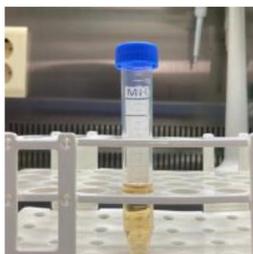
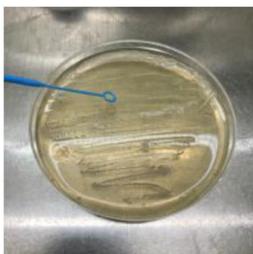


## Test Description

- Sterilization performance verification of the built-in UV LED in the UVnano filter box for the ducted indoor unit according to the proposed test specification.
- The model (PBM13M3UA0) is for air purification which is connected to return air side of the ducted indoor unit, M3 platform, of air conditioning system.
- UV LED module of the UVnano filter box is supplied with DC 12V from the combinable ducted indoor unit.
- The model (PBM13M3UA0) of UVnano filter box and model (ARNU60GM3A4) of ducted indoor unit have been tested as representative under proposed test condition.
- Since the outdoor unit of air conditioning system is not connected, the effect of refrigerant cycle and practical operation are not considered.
- The built-in UV LED for the sterilization is mounted over the Pre-Filter and has specification below.

### Specification of UV LED Module

Forward Voltage	Peak Wave Length	Radiant Flux
DC 5.3V	Max. 280nm Min. 265nm	3.5mW



## Test Procedure

- Bacteria

No.	Type	Strain Number
1	Staphylococcus aureus	ATCC 6538P
2	Staphylococcus epidermidis	ATCC 12228
3	Klebsiella pneumoniae	ATCC 4352

\*\*ATCC : American Type Culture Collection



● Membrane Filter

- Pre-culture each bacteria.
- Inoculate bacteria solution on the membrane filter.
- Attach 6 parts of the membrane filter on Pre-Filter with tape.
- Operate the indoor unit at low fan speed, through the remote controller.
- UV LED module operate as below sequence and duration.

UV LED Light Irradiation Logic	ON	OFF	ON
	2.0h	0.5h	2.0h

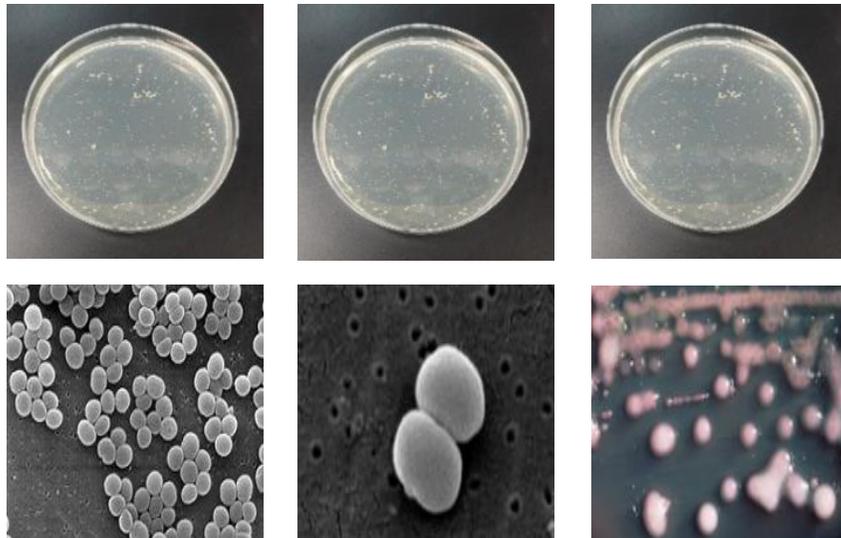


99.99% sterilization capability against bacteria in accordance with TUV Rheinland Standard

## Test Results

- The built-in UV LED module of tested model (PBM13M3UA0) has over 99.99% sterilization performance on average to bacteria at measuring points of the Pre-Filter under the proposed test condition.

Sterilization Efficiency Rate		
Staphylococcus aureus	Staphylococcus epidermidis	Klebsiella pneumoniae
> 99.99%	> 99.99%	> 99.99%



\*\*The resulting values are the measured values at 6 points set in the experiment  
 \*\*This result would be different at practical usage condition of air conditioning system

## Certified Test Report

\*\*Tested by TUV Rheinland Standard

**Verification**  
**Sterilization Performance for UVNano Filter Box**

Reference No.: KR21OLM6-001

TÜV Rheinland verifies that the built-in UV LED module in the representative model, PBM13M3UA0, of the UVNano filter box has sterilized bacteria on its pre-filter under the proposed test condition and combination with the ducted indoor unit, M3 platform, of air conditioning system.

Sterilization Efficiency Rate		
<i>Staphylococcus aureus</i>	<i>Staphylococcus epidermidis</i>	<i>Klebsiella pneumoniae</i>
> 99.99 %	> 99.99 %	> 99.99 %

Holder : **LG Electronics Inc.**  
 84, Wanam-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 51554, Rep. of Korea

Product: **UVNano Filter Box**

Identification: **PBM13M2Uxy, PBM13M3Uxy**  
 ( x = A - Z or 0 - 9, y = 0 - 9 )

Applied Standard **Proposed test method**

Sang-Min Kim

Date: 2021.07.27

**TÜV Rheinland Korea Ltd. – Seoul 07298 – Republic of Korea**

99.99% sterilization capability against virus parasitized on bacteria in accordance with TUV Rheinland Standard



## Test Description

**\*\*A bacteriophage is a virus that infects and replicates within bacteria**

- Sterilization performance verification of the built-in UV LED in the UVnano filter box for the ducted indoor unit according to the proposed test specification.
- The model (PBM13M3UA0) is for air purification which is connected to return air side of the ducted indoor unit, M3 platform, of air conditioning system.
- UV LED module of the UVnano filter box is supplied with DC 12V from the combinable ducted indoor unit.
- The model (PBM13M3UA0) of UVnano filter box and model (ARNU60GM3A4) of ducted indoor unit have been tested as representative under proposed test condition.
- Since the outdoor unit of air conditioning system is not connected, the effect of refrigerant cycle and practical operation are not considered.
- The built-in UV LED for the sterilization is mounted over the Pre-Filter and has specification below.

### Specification of UV LED Module

Forward Voltage	Peak Wave Length	Radiant Flux
DC 5.3V	Max. 280nm Min. 265nm	3.5mW

## Test Procedure

- Virus and Bacteria

Species	Type	Strain Number
Virus	Phi X 174	ATCC 13706-B1
Bacteria (Host)	Escherichia coil C	ATCC 13706

**\*\*ATCC : American Type Culture Collection**



● Specimen

- Prepare virus (Phi X 174) and culture the host (Escherichia coil C).
- Inoculate virus solution on the cover class as specimen.
- Attach the 6 specimens as test group on Pre-Filter with tape.
- Operate the indoor unit at low fan speed, through the remote controller.
- UV LED module operate as below sequence and duration.

UV LED Light Irradiation Logic	ON	OFF	ON
	2.0h	0.5h	2.0h

99.99% sterilization capability against virus parasitized on bacteria in accordance with TUV Rheinland Standard



## Test Results

- The built-in UV LED module of tested model (PBM13M3UA0) has 99.99% sterilization performance to virus (Phi X 174) at measuring points of the Pre-Filter under the proposed test condition.

Sampling Point	Test Run	Sterilization Efficiency Rate	
		Individual	Average
①	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
②	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
③	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
④	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
⑤	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
⑥	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	

\*\*The resulting values are the measured values at 6 points set in the experiment  
 \*\*This result would be different at practical usage condition of air conditioning system

## Certified Test Report

\*\*Tested by TUV Rheinland Standard



**Verification**  
**Sterilization Performance for UVNano Filter Box**

Reference No.: KR213RKA-001

TÜV Rheinland verifies that the built-in UV LED module in the representative model, PBM13M3UA0, of the UVNano filter box has sterilized 99.99 % of virus, Phi X 174, on its pre-filter under the proposed test condition and combination with the ducted indoor unit, M3 platform, of air conditioning system.

Holder : **LG Electronics Inc.**  
 84, Wanam-ro, Seongsan-gu, Changwon-si,  
 Gyeongsangnam-do, 51554, Rep. of Korea

Product: **UVNano Filter Box**

Identification: **PBM13M2Uxy, PBM13M3Uxy**  
 ( x = A - Z or 0 - 9, y = 0 - 9 )

Applied Standard **Proposed test method**

Date: 2021.07.29 
  
 Sang-Min Kim

TÜV Rheinland Korea Ltd. – Seoul 07298 – Republic of Korea

99.99% sterilization capability against bacteria in accordance with TUV Rheinland Standard

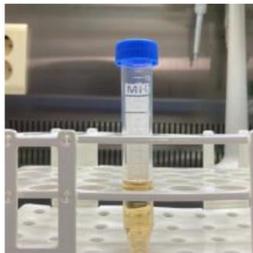
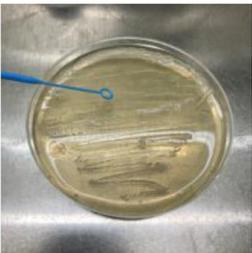


## Test Description

- Sterilization performance verification of the built-in UV LED in the UVnano filter box for the ducted indoor unit according to the proposed test specification.
- The model (PBM13M1UA0) is for air purification which is connected to return air side of the ducted indoor unit, M1 platform, of air conditioning system.
- UV LED module of the UVnano filter box is supplied with DC 12V from the combinable ducted indoor unit.
- The model (PBM13M1UA0) of UVnano filter box and model (ARNU24GM1A4) of ducted indoor unit have been tested as representative under proposed test condition.
- Since the outdoor unit of air conditioning system is not connected, the effect of refrigerant cycle and practical operation are not considered.
- The built-in UV LED for the sterilization is mounted over the Pre-Filter and has specification below.

### Specification of UV LED Module

Forward Voltage	Peak Wave Length	Radiant Flux
DC 5.5V	Max. 280nm Min. 265nm	3.5mW

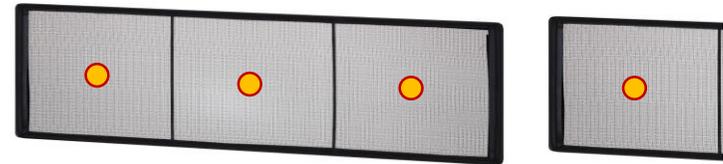


## Test Procedure

- Bacteria

No.	Type	Strain Number
1	Staphylococcus aureus	ATCC 6538P
2	Staphylococcus epidermidis	ATCC 12228
3	Klebsiella pneumoniae	ATCC 4352

\*\*ATCC : American Type Culture Collection



● Membrane Filter

- Pre-culture each bacteria.
- Inoculate bacteria solution on the membrane filter.
- Attach 4 parts of the membrane filter on Pre-Filter with tape.
- Operate the indoor unit at low fan speed, through the remote controller.
- UV LED module operate as below sequence and duration.

UV LED Light Irradiation Logic	ON	OFF	ON
	2.0h	0.5h	2.0h

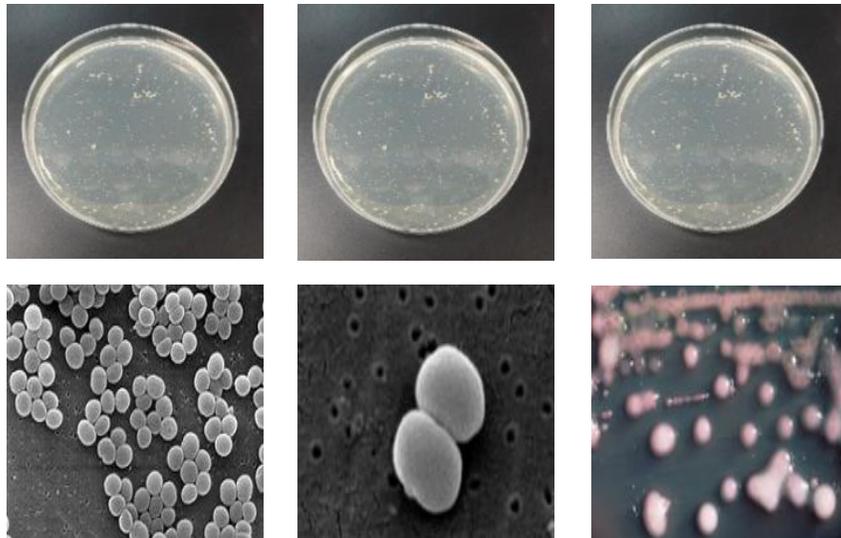
99.99% sterilization capability against bacteria in accordance with TUV Rheinland Standard



## Test Results

- The built-in UV LED module of tested model (PBM13M1UA0) has over 99.99% sterilization performance on average to bacteria at measuring points of the Pre-Filter under the proposed test condition.

Sterilization Efficiency Rate		
Staphylococcus aureus	Staphylococcus epidermidis	Klebsiella pneumoniae
> 99.99%	> 99.99%	> 99.99%



\*\*The resulting values are the measured values at 4 points set in the experiment  
 \*\*This result would be different at practical usage condition of air conditioning system

## Certified Test Report

\*\*Tested by TUV Rheinland Standard

**Verification**  
**Sterilization Performance for UVNano Filter Box**

Reference No.: KR21N9RC-001

TÜV Rheinland verifies that the built-in UV LED module in the representative model, PBM13M1UA0, of the UVNano filter box has sterilized bacteria on its pre-filter under the proposed test condition and combination with the ducted indoor unit, M1 platform, of air conditioning system.

Sterilization Efficiency Rate		
<i>Staphylococcus aureus</i>	<i>Staphylococcus epidermidis</i>	<i>Klebsiella pneumoniae</i>
> 99.99 %	> 99.99 %	> 99.99 %

Holder : **LG Electronics Inc.**  
 84, Wanam-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 51554, Rep. of Korea

Product: **UVNano Filter Box**

Identification: **PBM13M1Uxy**  
 ( x = A - Z or 0 - 9, y = 0 - 9 )

Applied Standard **Proposed test method**

Date: 2021.07.06 
  
 Sang-Min Kim

TÜV Rheinland Korea Ltd. – Seoul 07298 – Republic of Korea

99.99% sterilization capability against virus parasitized on bacteria in accordance with TUV Rheinland Standard



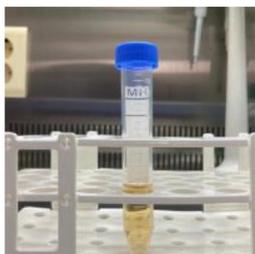
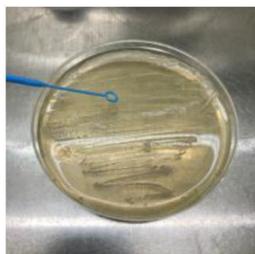
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### Specification of UV LED Module

Forward Voltage	Peak Wave Length	Radiant Flux
DC 5.5V	Max. 280nm Min. 265nm	3.5mW

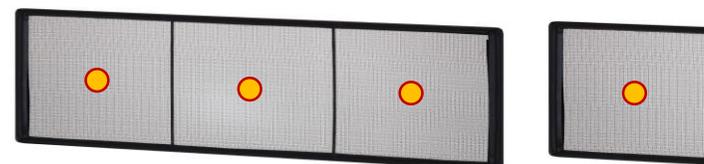


## Test Procedure

- Virus and Bacteria

Species	Type	Strain Number
Virus	Phi X 174	ATCC 13706-B1
Bacteria (Host)	Escherichia coil C	ATCC 13706

**\*\*ATCC : American Type Culture Collection**



● Specimen

- Prepare virus (Phi X 174) and culture the host (Escherichia coil C).
- Inoculate virus solution on the cover class as specimen.
- Attach the 4 specimens as test group on Pre-Filter with tape.
- Operate the indoor unit at low fan speed, through the remote controller.
- UV LED module operate as below sequence and duration.

UV LED Light Irradiation Logic	ON	OFF	ON
	2.0h	0.5h	2.0h

99.99% sterilization capability against virus parasitized on bacteria in accordance with TUV Rheinland Standard



## Test Results

- The built-in UV LED module of tested model (PBM13M1UA0) has 99.99% sterilization performance to virus (Phi X 174) at measuring points of the Pre-Filter under the proposed test condition.

Sampling Point	Test Run	Sterilization Efficiency Rate	
		Individual	Average
①	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
②	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
③	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	
④	1 <sup>st</sup>	99.99%	99.99%
	2 <sup>nd</sup>	99.99%	
	3 <sup>rd</sup>	99.99%	

\*\*The resulting values are the measured values at 4 points set in the experiment  
 \*\*This result would be different at practical usage condition of air conditioning system

## Certified Test Report

\*\*Tested by TUV Rheinland Standard

**Verification**  
**Sterilization Performance for UVNano Filter Box**

Reference No.: KR21P8ZW-001

TÜV Rheinland verifies that the built-in UV LED module in the representative model, PBM13M1UA0, of the UVNano filter box has sterilized 99.99 % of virus, Phi X 174, on its pre-filter under the proposed test condition and combination with the ducted indoor unit, M1 platform, of air conditioning system.

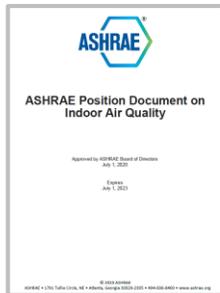
Holder :	LG Electronics Inc. 84, Wanam-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, 51554, Rep. of Korea
Product:	UVNano Filter Box
Identification:	PBM13M1Uxy ( x = A - Z or 0 - 9, y = 0 - 9 )
Applied Standard	Proposed test method
Date: 2021.07.29	 Sang-Min Kim

TÜV Rheinland Korea Ltd. – Seoul 07298 – Republic of Korea

MERV 13 Filter installation is recommended in accordance with ASHRAE to prevent the spread of infectious disease

## ASHRAE's Positions

- Based on risk assessment, the use of specific HVAC strategies supported by the evidenced-based literature should be considered, including the following :
  - Enhanced filtration (higher minimum efficiency reporting value [MERV] filters over code minimums in occupant-dense and / or higher-risk spaces).
- Non-healthcare buildings should consider the following modifications to building HVAC system operation :
  - Improve central air and other HVAC filtration to MERV 13 or the highest level achievable.
  - Add portable room air cleaners with HEPA or high-MERV Filters with due consideration to the clean air delivery rate.
- Healthcare buildings should consider design and operation to do the following :
  - Capture expiratory aerosols with headwall exhaust, tent or snorkel with exhaust, floor-to-ceiling partitions with door supply and patient exhaust, local air-HEPA-Grade filtration.



\*\*[Source] ASHRAE Position Document on Indoor Air Quality  
\*\*[Source] ASHRAE Position Document on Infectious Aerosols

## ASHRAE's Core Recommendations



### ASHRAE EPIDEMIC TASK FORCE

#### Core Recommendations for Reducing Airborne Infectious Aerosol Exposure

The following recommendations are the basis for the detailed guidance issued by ASHRAE Epidemic Task Force. They are based on the concept that within limits ventilation, filtration, and air cleaners can be deployed flexibly to achieve exposure reduction goals subject to constraints that may include comfort, energy use, and costs. This is done by setting targets for equivalent clean air supply rate and expressing the performance of filters, air cleaners, and other removal mechanisms in these terms.

1. *Public Health Guidance* - Follow all regulatory and statutory requirements and recommendations for social distancing, wearing of masks and other PPE, administrative measures, circulation of occupants, reduced occupancy, hygiene, and sanitation.
2. *Ventilation, Filtration, Air Cleaning*
  - 2.1 Provide and maintain at least required minimum outdoor airflow rates for ventilation as specified by applicable codes and standards.
  - 2.2 Use combinations of filters and air cleaners that achieve MERV 13 or better levels of performance for air recirculated by HVAC systems.
  - 2.3 Only use air cleaners for which evidence of effectiveness and safety is clear.
  - 2.4 Select control options, including standalone filters and air cleaners, that provide desired exposure reduction while minimizing associated energy penalties.
3. *Air Distribution* - Where directional airflow is not specifically required, or not recommended as the result of a risk assessment, promote mixing of space air without causing strong air currents that increase direct transmission from person-to-person.
4. *HVAC System Operation*
  - 4.1 Maintain temperature and humidity design set points.
  - 4.2 Maintain equivalent clean air supply required for design occupancy whenever anyone is present in the space served by a system.
  - 4.3 When necessary to flush spaces between occupied periods, operate systems for a time required to achieve three air changes of equivalent clean air supply.
  - 4.4 Limit re-entry of contaminated air that may re-enter the building from energy recovery devices, outdoor air, and other sources to acceptable levels.
5. *System Commissioning* - Verify that HVAC systems are functioning as designed.

\*\*[Source] Core Recommendations for Reducing Airborne Infectious Aerosol Exposure

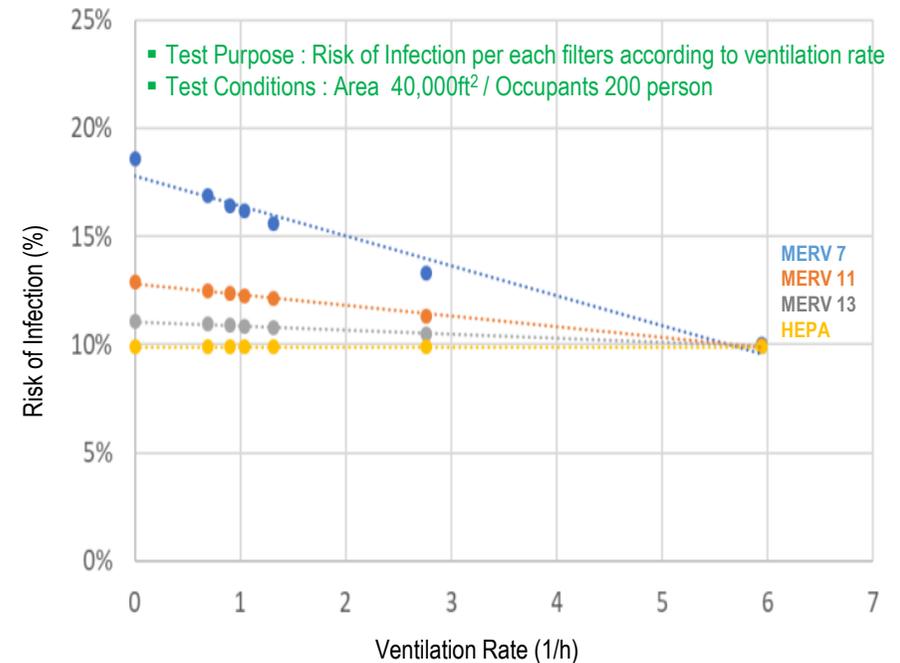
MERV 13 Filter is sufficient to suppress risk of infection when combined with the appropriate ventilation rate

## MERV Parameter

- Minimum Efficiency Reporting Values, or MERVs, report a filter's ability to capture larger particles between 0.3µm and 10µm.
- The rating is derived from a test method developed by ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers).
- The higher the MERV rating the better the filter is at trapping specific types of particles.

MERV Rating	Air Particles Size			Average Arrestance (%)	Removable Particles
	0.3µm ~ 1.0µm	1.0µm ~ 3.0µm	3.0µm ~ 10µm		
MERV 1	-	-	< 20%	< 65%	Pollen
MERV 2	-	-	< 20%	65% ~ 70%	Dust Mites
MERV 3	-	-	< 20%	70% ~ 75%	Spray Paint
MERV 4	-	-	< 20%	75% <	Carpet Fibers
MERV 5	-	-	20% ~ 35%	-	Mold Spores
MERV 6	-	-	35% ~ 50%	-	Cooking Dust
MERV 7	-	-	50% ~ 70%	-	Hair Spray
MERV 8	-	20% <	70% <	-	Furniture Polish
MERV 9	-	35% <	75% <	-	Lead Dust
MERV 10	-	50% ~ 65%	80% <	-	Flour
MERV 11	20% <	65% ~ 80%	85% <	-	Auto Fumes
MERV 12	35% <	80% <	90% <	-	Welding Fumes
MERV 13	50% <	85% <	90% <	-	Bacteria
MERV 14	75% ~ 85%	90% <	95% <	-	Smoke
MERV 15	85% ~ 95%	90% <	95% <	-	Sneezes
MERV 16	95% <	95% <	95% <	-	
MERV 17	99.97%	99% <	99% <	-	
MERV 18	99.997%	99% <	99% <	-	Viruses
MERV 19	99.9997%	99% <	99% <	-	Carbon Dust
MERV 20	99.99997%	99% <	99% <	-	

## Risk of Infection per Each Filter



- The use of filters of higher performance than MERV 11 with enhanced ventilation can reduce risk of infection.
- MERV 13 Filter can reduce risk of infection as much as HEPA Filter as the ventilation rate increases.

\*\*[Source] <https://www.epa.gov/indoor-air-quality-iaq/what-merv-rating-1>

\*\*[Source] ASHRAE Standard's experiment data

MERV 13 Filter has approximately 90% trapping efficiency when viruses spread in droplet form

## Particle Size Expectations

- The virus particle itself is very small, but it is sticky due to the lipid envelope as well as the sputum / saliva and therefore **clumps with other particles making them larger**.
- Several research studies offer insights not only into what size aerosols exist after expulsion from the human body, but in what size-fractions are viruses or bacteria actually present.
- The majority of the reported number of particles emitted during coughing, sneezing and breathing are smaller than 1µm in size, **but the actual measured viral RNA (infectious dose) is mostly in the size range greater than 1µm**.

Source	Sampling environment	Sampling location(s)	Particle size distribution of influenza virus reported			Assumed distribution of influenza virus in modified ranges for use with ASHRAE Standard 52.2 (F)		
			<1.7 µm	1.7-4.9 µm	>4.9 µm	0.3-1 µm	1-3 µm	3-10 µm
[51]	Urgent care clinic	Personal indoor	<1.7 µm	1.7-4.9 µm	>4.9 µm	19%	20%	62%
			32%	16%	52%			
			Stationary indoor (lower floor)	<1 µm	1-4.1 µm	>4.1 µm	13%	24%
[52]	Hospital emergency room	Combination of personal and stationary indoor	<1 µm	1-4 µm	>4 µm	4%	33%	63%
			4%	49%	47%			
			Stationary indoor (upper floor)	<1 µm	1-4.1 µm	>4.1 µm	9%	17%
[53]	Cough aerosol collection system	Personal cough airstream	<1 µm	1-4 µm	>4 µm	42%	15%	43%
			42%	23%	35%			
			Health center, daycare center, and airplanes	<1 µm	1-2.5 µm	>2.5 µm	36%	37%
[54]	Patient room with breathing manikin	Combination of personal and stationary indoor	<1 µm	1-4 µm	>4 µm	20%	50%	30%
			19.5%	75.5%	5%			
			Mean viral distribution across all studies				20%	29%
Standard deviation						14%	12%	18%
Relative standard deviation						0.70	0.44	0.36

## Filter Droplet Nuclei Efficiency

- Applying distribution ranges to typical filters, their efficiency at trapping the virus is determined if the efficiency at each range is known

[Filter Droplet Nuclei Efficiency]

$$= E1 \text{ Distribution of Virus} \times E1 \text{ Removal Efficiency} \\ + E2 \text{ Distribution of Virus} \times E2 \text{ Removal Efficiency} \\ + E3 \text{ Distribution of Virus} \times E3 \text{ Removal Efficiency}$$

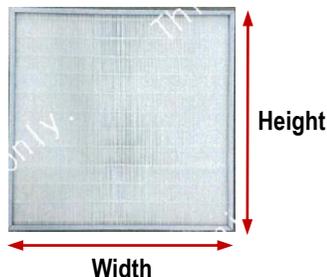
MERV Rating	Air Particles Size			MERV Rating	Filter Droplet Nuclei Efficiency
	E1 (0.3µm~1.0µm)	E2 (1.0µm~3.0µm)	E3 (3.0µm~10µm)		
MERV 4	10.3%	29.9%	11.9%	MERV 4	16.80%
MERV 5	8.0%	28.0%	33.0%	MERV 5	26.55%
MERV 6	7.8%	30.0%	43.5%	MERV 6	32.45%
MERV 7	10.8%	36.6%	55.6%	MERV 7	41.13%
MERV 8	15.1%	51.6%	73.7%	MERV 8	55.57%
MERV 9	17.8%	52.4%	84.8%	MERV 9	62.00%
MERV 10	16.6%	59.0%	86.7%	MERV 10	64.65%
MERV 11	33.9%	69.4%	90.1%	MERV 11	72.86%
MERV 12	37.6%	86.1%	99.8%	MERV 12	83.39%
MERV 13	66.3%	92.4%	97.8%	MERV 13	89.93%
MERV 14	81.4%	96.6%	99.3%	MERV 14	94.94%
MERV 15	86.4%	97.8%	99.1%	MERV 15	96.18%
MERV 16	95.0%	98.0%	98.0%	MERV 16	97.40%

- Calculating the efficiency of the filter when propagated in droplet form shows that MERV 13 Filter has 89.93%, which is 23.63% higher than E1 group removal efficiency.

MERV 13 Filtering capability rating in accordance with ANSI / ASHRAE Standard 52.2

## Test Conditions

Air Flow Rate (m <sup>3</sup> /s)	0.72
Test Aerosol Type	KCl
Dimension (W x H x D, mm)	600 x 600 x 50
Face Velocity (m/s)	2.0
Final Pressure Drop (Pa)	120
Temperature (°C)	20.4±0.5
Relative Humidity (%)	50.9±1.0



- The Minimum Efficiency Reporting Value (MERV) must be stated with the air velocity at which the filter was tested. For example, if the filter was tested with an air velocity of 374 FPM and was found to be MERV 13, the filter's Minimum Efficiency Reporting Value would be MERV 13 @ 374 FPM.
- ANSI / ASHRAE Standard 52.2 tests are to be conducted at one of seven airflow rates.

No.	FPM (Feet Per Minute)	Velocity (m/s)
1	118	0.60
2	246	1.25
3	295	1.50
4	374	1.90
5	492	2.50
6	630	3.20
7	748	3.80

## Test Results

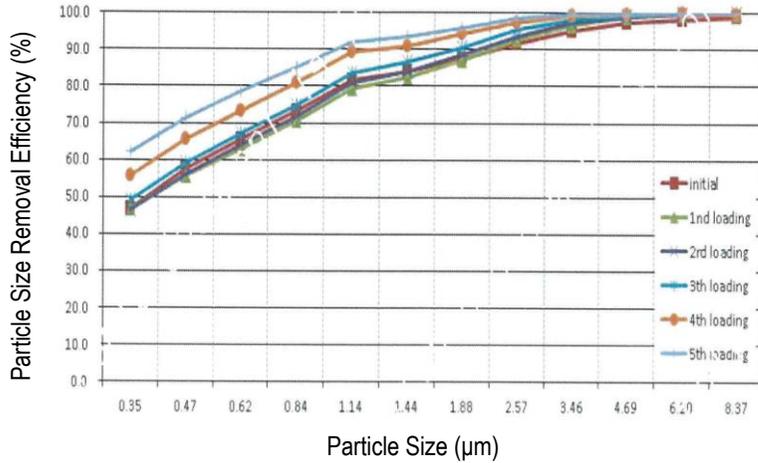
Initial Resistance (Pa)	38.0	<b>Composite Average Efficiency</b>	
		<b>E1</b>	<b>58.9%</b>
Final Resistance (Pa)	120.0	<b>E2</b>	<b>85.2%</b>
		<b>E3</b>	<b>97.4%</b>
<b>MERV Index</b>		<b>MERV 13 @ 0.72</b>	

- The twelve size ranges are placed in three larger groups.
- Averaging the Composite Minimum Efficiency for each of these groups will calculate the average Particle Size Efficiency (PSE), and **the resulting three percentages (E1, E2, E3) are then used to determine the MERV.**

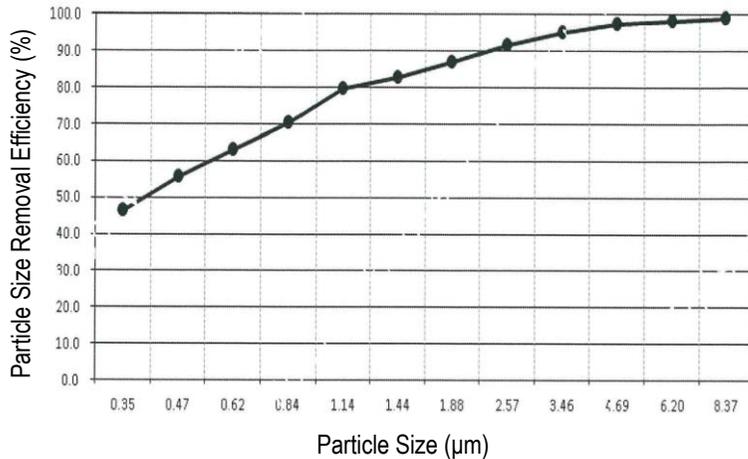
Range	Size (µm)	Group
1	0.30 ~ 0.40	E1
2	0.40 ~ 0.55	
3	0.55 ~ 0.70	
4	0.70 ~ 1.00	E2
5	1.00 ~ 1.30	
6	1.30 ~ 1.60	
7	1.60 ~ 2.20	E3
8	2.20 ~ 3.00	
9	3.00 ~ 4.00	
10	4.00 ~ 5.50	
11	5.50 ~ 7.00	
12	7.00 ~ 10.00	

MERV 13 Filtering capability rating in accordance with ANSI / ASHRAE Standard 52.2

## Test Results



[Particle Size Removal Efficiency after incremental dust loading]



[Composite Minimum Efficiency Curve]

## Certified Test Report

\*\*Tested by KCL (Korea Conformity Laboratories)

### TEST REPORT

9994-0210-4313-0021

1. NO : CT21-070086E
2. Client
  - Name : Dong Kwang NB Chemical Co.,Ltd
  - Address : 635-15, Mannyeon-ro, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, Republic of Korea
3. Date of Test : 2021.06.23 ~ 2021.07.27
4. Use of Report : For Submission of Accounts
5. Test Sample : High Efficiency Filter
6. Test Method  
(1) ANSI/ASHRAE Standard 52.2-2017
7. Test Results
  - 1) High Efficiency Filter

Test Item(s)	Unit	Test Method	Test Results	Remark	Loc.
MERV Index	-	(1)	13	-	A

  - Location  
A : 13, Yeon-ro, Deoksan-eup, Jincheon-gun, Chungcheongbuk-do, Republic of Korea

Affirmation

Tested By  
Name : Shin Cheol Woong

Technical Manager  
Name : Ji Chang-Min

This report is related with KOLAS and KS Q 150/IEC 17025  
Our report apply only to the standards or procedures identified and to the sample(s) tested unless otherwise specified. The test results are not indicative of the qualities of the lot from which the sample was taken or of apparently identical or similar products. The results of using only a portion of this report cannot be guaranteed. The authenticity of this test report can be checked on KCL website(www.kcl.re.kr).

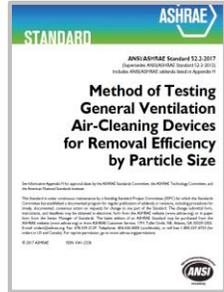
The above test certificate is the accredited test results by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.

2021.07.27

Korea Conformity Laboratories: President Yoon, Kap Seok *Yoon, Kap Seok*

Accredited by KOLAS, Republic of KOREA

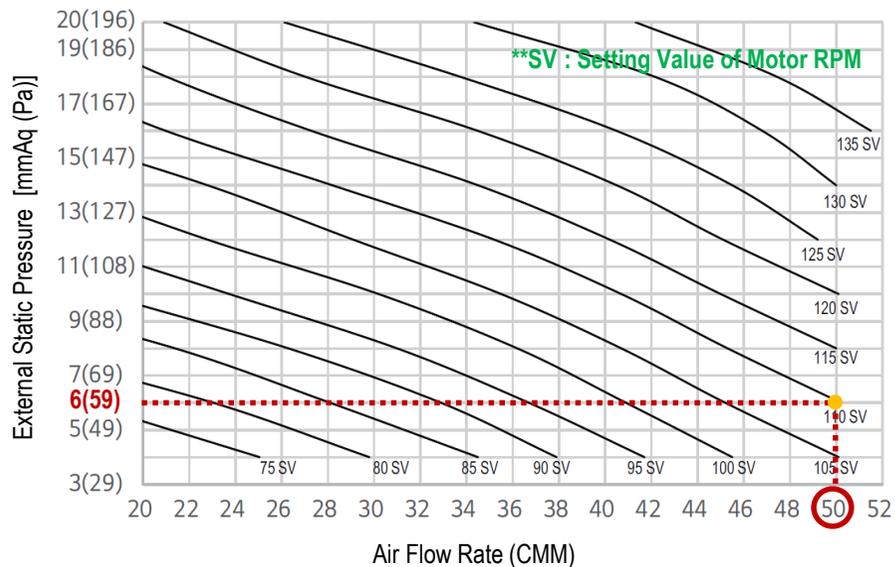
Result Inquiry : 13, Yeon-ro, Deoksan-eup, Jincheon-gun, Chungcheongbuk-do, Republic of Korea 82-43-753-3183



# Compensation for Pressure Drop

Pressure Drop due to the UVnano Filter Box installation can be compensated by changing indoor unit's E.S.P Setting Value

## M3 Platform (PBM13M3UA0)



## Calculation of E.S.P Setting Value

- Indoor Unit : ARNU54GM3A4  
High Static Pressure Ceiling Concealed Duct (VRF Indoor Unit)
- UVnano Filter Box : PBM13M3UA0
- When the UVnano Filter Box is not installed Default Setting
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 50CMM Based on High Air Flow Rate
  - Indoor Unit's Motor : 1010RPM
- When the UVnano Filter Box is additionally installed
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 50CMM
  - Indoor Unit's Motor : 1100RPM

\*\*The drop in air flow rate due to the installation of the UVnano Filter Box is compensated by adjusting the fan motor setting value according to the increase in external static pressure

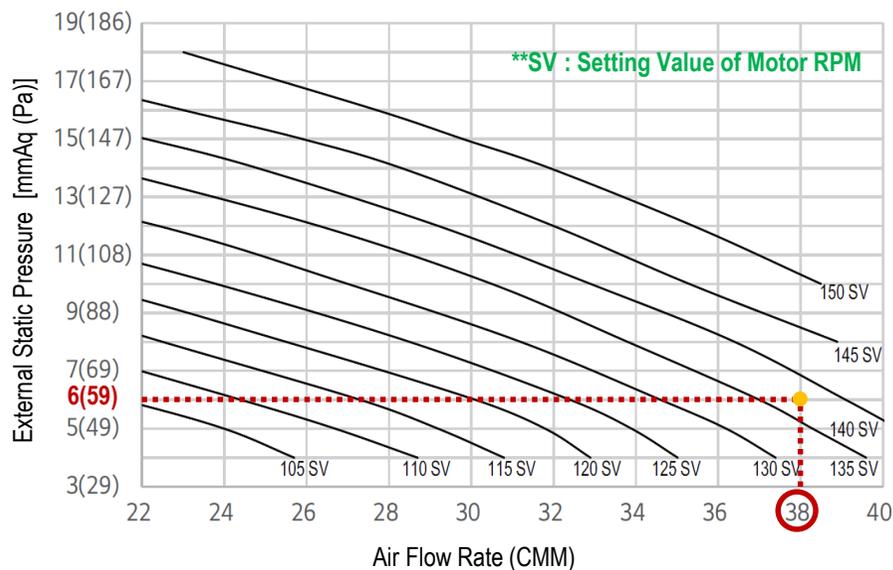
## Note

- When installing the UVnano Filter Box, it is necessary to change the indoor unit's E.S.P setting value by referring to Product Data Book
- The available range of External Static Pressure and Setting Value depends on the applied model

# Compensation for Pressure Drop

Pressure Drop due to the UVnano Filter Box installation can be compensated by changing indoor unit's E.S.P Setting Value

## M2 Platform (PBM13M2UA0)



## Calculation of E.S.P Setting Value

- Indoor Unit : ARNU42GM2A4  
High Static Pressure Ceiling Concealed Duct (VRF Indoor Unit)
- UVnano Filter Box : PBM13M2UA0
- When the UVnano Filter Box is not installed **Default Setting**
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 38CMM **Based on High Air Flow Rate**
  - Indoor Unit's Motor : 1180RPM
- When the UVnano Filter Box is additionally installed
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 38CMM
  - Indoor Unit's Motor : 1370RPM

\*\*The drop in air flow rate due to the installation of the UVnano Filter Box is compensated by adjusting the fan motor setting value according to the increase in external static pressure

## Note

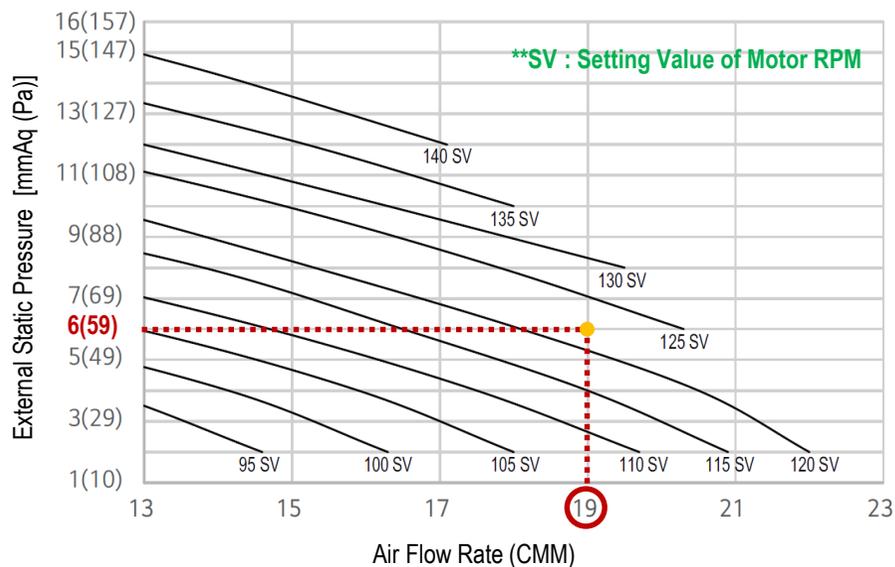
- When installing the UVnano Filter Box, it is necessary to change the indoor unit's E.S.P setting value by referring to Product Data Book
- The available range of External Static Pressure and Setting Value depends on the applied model

# Compensation for Pressure Drop

LG Solution

Pressure Drop due to the UVnano Filter Box installation can be compensated by changing indoor unit's E.S.P Setting Value

## M1 Platform (PBM13M1UA0)



## Calculation of E.S.P Setting Value

- Indoor Unit : ARNU24GM1A4  
High Static Pressure Ceiling Concealed Duct (VRF Indoor Unit)
- UVnano Filter Box : PBM13M1UA0
- When the UVnano Filter Box is not installed **Default Setting**
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 19CMM **Based on High Air Flow Rate**
  - Indoor Unit's Motor : 1100RPM
- When the UVnano Filter Box is additionally installed
  - External Static Pressure : 6mmAq
  - The Rated Air Flow Rate : 19CMM
  - Indoor Unit's Motor : 1220RPM

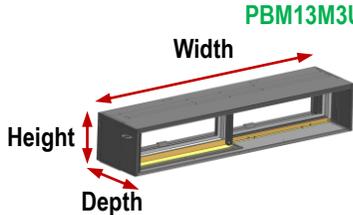
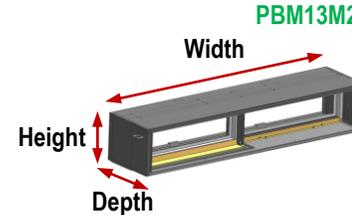
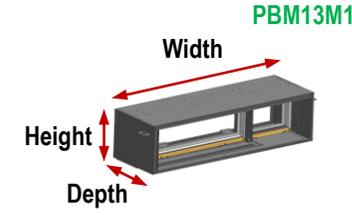
\*\*The drop in air flow rate due to the installation of the UVnano Filter Box is compensated by adjusting the fan motor setting value according to the increase in external static pressure

## Note

- When installing the UVnano Filter Box, it is necessary to change the indoor unit's E.S.P setting value by referring to Product Data Book
- The available range of External Static Pressure and Setting Value depends on the applied model

# [Specification] LG Duct UVnano Filter Box

LG Solution

Product		Unit	M3 Platform	M2 Platform	M1 Platform
<b>Duct UVnano Filter Box</b>			<b>PBM13M3UA0</b> 	<b>PBM13M2UA0</b> 	<b>PBM13M1UA0</b> 
Filter Box	Net Size (W X H X D)	mm	1,250 X 360 X 280	1,250 X 270 X 280	900 X 270 X 280
	Shipping Size (W X H X D)	mm	1,396 X 418 X 358	1,396 X 328 X 358	1,044 X 328 X 358
	Net Weight	kg	11.6	10.5	8.5
	Shipping Weight	kg	15.8	14.3	11.5
Pre-Filter	Mesh	-	34 X 39	34 X 39	34 X 39
	Color	-	Black	Black	Black
UVnano	UVC LED Model	-	LTPL-G35UV275TWA	LTPL-G35UV275TWA	LTPL-G35UV275TWA
	UVC LED Quantity	EA	8	8	8
Filter (1)	Size (W X H X D)	mm	600 X 341 X 50.8	600 X 251 X 50.8	600 X 251 X 50.8
	Quantity	EA	2	2	1
	Grade	-	<b>MERV 13</b>	<b>MERV 13</b>	<b>MERV 13</b>
Filter (2)	Size (W X H X D)	mm	-	-	250 X 251 X 50.8
	Quantity	EA	-	-	1
	Grade	-	-	-	<b>MERV 13</b>

\*\*Grade : ASHRAE 52.2

# Contents

Introduction

Why LG

LG Solution

**Reliability / Safety**

Maintenance

Appendix

LG Duct UVnano Filter Box has been designed by **considering reliability and safety**

**Reliability Assurance for Users**

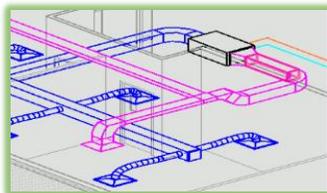
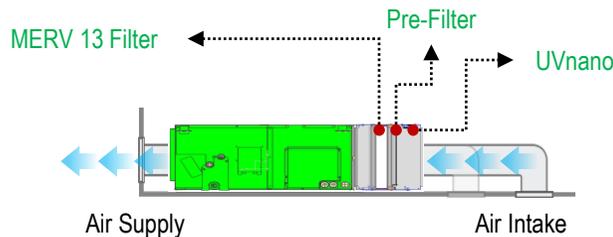
- No UVC exposure to users since the light is only directed towards the inside of the filter box



\*\*Direct UVC exposure may damage eyes, skin, lungs

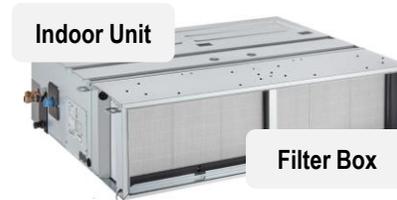


- Enhanced prevention of UVC leakage when additionally installing fully-enclosed ducting at the side of air intake



**Secure Structure for installation and maintenance**

- The safety of installers and service engineers is considered when installing and maintaining the filter box
- The filter box is previously assembled to the indoor unit and installed at the same time when installing indoor units



\*\*No electrical hazard due to no power disconnection

- The filter box only operates when the indoor unit operates. So, it is possible to prevent the risk such as UVC exposure and electrical hazard when maintaining filter boxes



\*\*Direct UVC exposure may damage eyes, skin, lungs



\*\*No electrical hazard due to no power-down

Interlocking Operation



LG HVAC Systems

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**Maintenance**

Appendix

LG Duct UVnano Filter Box has been designed to facilitate maintenance

Easy Filter Management

- Pre-Filter
  - Reusable after washing with water
  - Replacement recommended after washing 2~3 times



\*\*Using the warm water and the neutral detergent

- UVnano
  - Semi-Permanently without replacement



- MERV 13 Filter
  - Replacement recommended within 3~6 months of use
  - Possible to check the accumulated usage time of MERV 13 Filter through Standard III wired remote controller

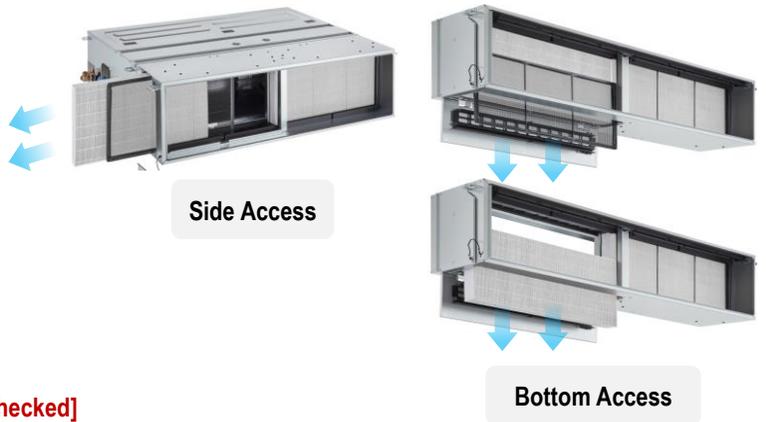


\*\*When replacing MERV 13 Filter, additionally checking the status of Pre-Filter is recommended

\*\*Standard III wired remote controller should be installed to check the accumulated usage time of MERV 13 Filter  
 [If Standard III wired remote controller is not installed, the accumulated usage time of MERV 13 Filter can not be checked]

Convenient Filter Replacement

- Possible to replace filters through access with 2 directions (Side direction / Bottom direction)



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Maintenance

Appendix

# App. LG IAQ Solution Map

LG products can supply various and advanced IAQ Solution according to needs of building type

● : Applicable

		Space															
		Lobby	Office Room	Class Room	Meeting Room	Restaurant (Cafeteria)	Library	Guest Room	Atrium	Retail Store	Kitchen	Bed Room	Living Room	Operating Room	Patient Room	Intensive Care Unit	Isolation Room
Segment	Residence										●	●	●				
	Office	●	●		●	●											
	Hotel	●				●		●									
	Hospital	●											●	●	●	●	
	Education	●	●	●		●	●										
	Shopping Mall					●			●	●							
	Retail									●							
Comfort	Temperature	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Humidity			●								●	●	●	●	●	●
	Ventilation	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Air Flow		●	●	●		●								●		
Convenience	Wi-Fi									●	●	●	●				
	Human Detection			●	●							●	●				
Health	Clean Air	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●
	UV LED	●		●		●	●		●	●				●	●	●	●
	Air Quality Information		●	●		●	●			●							
	Pressure Control	●				●					●			●	●	●	●

# App. National Ambient Air Quality Standards (NAAQS)

## NATIONAL AMBIENT AIR QUALITY STANDARDS

For locations within the United States, the following table shows the ambient air quality standards that determine the regional air quality status of “attainment” or “non-attainment” for the building location.

**TABLE I-1 National Ambient Air Quality Standards (NAAQS)<sup>1</sup>**

Pollutant	Primary Stds.	Averaging Times	Secondary Stds.
Carbon Monoxide	9 ppm (10 mg/m <sup>3</sup> )	8-hour <sup>(1)</sup>	None
	35 ppm (40 mg/m <sup>3</sup> )	1-hour <sup>(1)</sup>	None
Lead	1.5 µg/m <sup>3</sup>	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 µg/m <sup>3</sup> )	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM <sub>10</sub> )	Revoked <sup>(2)</sup>	Annual <sup>(2)</sup> (Arith. Mean)	
	150 µg/m <sup>3</sup>	24-hour <sup>(3)</sup>	
Particulate Matter (PM <sub>2.5</sub> )	15.0 µg/m <sup>3</sup>	Annual <sup>(4)</sup> (Arith. Mean)	Same as Primary
	35 µg/m <sup>3</sup>	24-hour <sup>(5)</sup>	
Ozone	0.08 ppm	8-hour <sup>(6)</sup>	Same as Primary
	0.12 ppm	1-hour <sup>(7)</sup>	Same as Primary
		(Applies only in limited areas)	
Sulfur Oxides	0.03 ppm	Annual (Arith. Mean)	—
	0.14 ppm	24-hour <sup>(1)</sup>	—
	—	3-hour <sup>(1)</sup>	0.5 ppm (1300 µg/m <sup>3</sup> )

<sup>(1)</sup> Not to be exceeded more than once per year.

<sup>(2)</sup> Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM<sub>10</sub> standard in 2006 (effective December 17, 2006).

<sup>(3)</sup> Not to be exceeded more than once per year on average over three years.

<sup>(4)</sup> To attain this standard, the three-year average of the weighted annual mean PM<sub>2.5</sub> concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m<sup>3</sup>.

<sup>(5)</sup> To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m<sup>3</sup> (effective December 17, 2006).

<sup>(6)</sup> To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

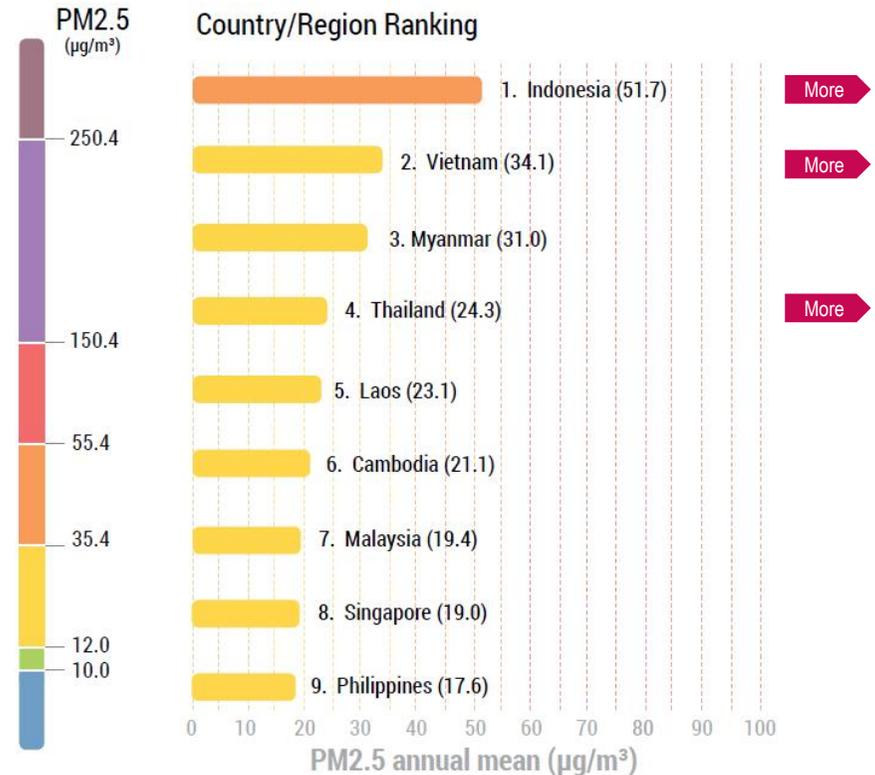
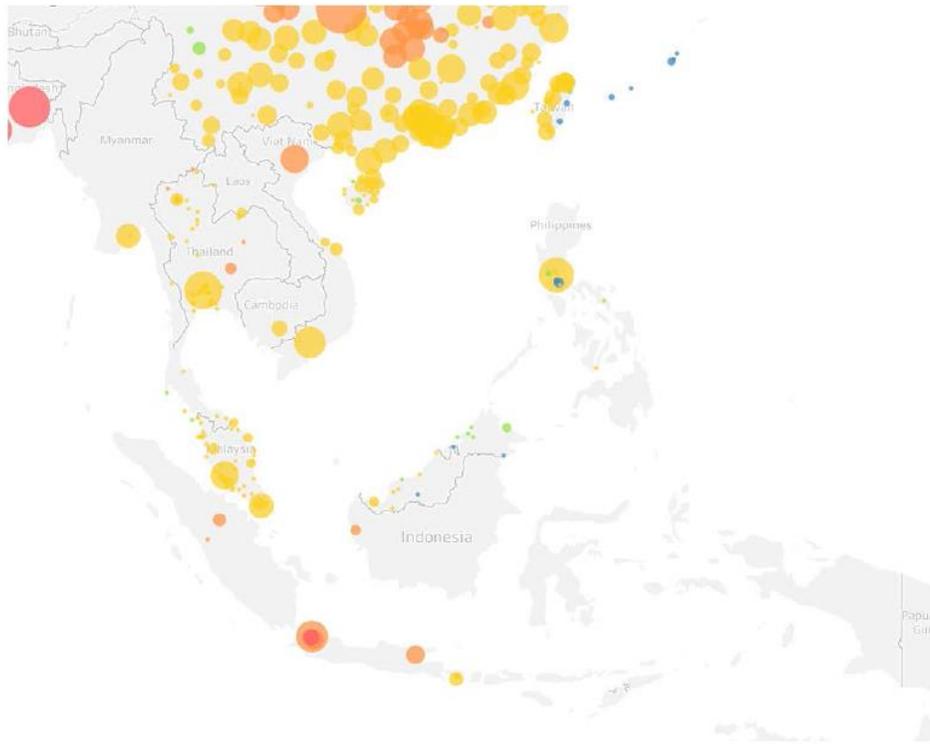
<sup>(7)</sup> (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1, as determined by Appendix H. (b) As of June 15, 2005, the EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) areas.

# App. AQI (Air Quality Status) of Southeast Asia

Southeast Asia's emission sources include vehicle exhaust, biomass burning, industry and coal-based energy production. The region is also susceptible to strong seasonal variations. Open burning, the agricultural practice of quickly clearing land for cultivation of future crops, commonly influences air quality across borders from July to November.

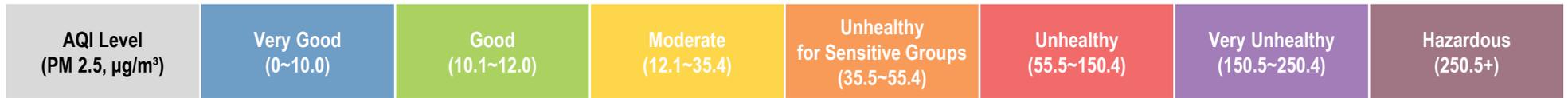


\*\*AQI (Air Quality Index) is used to communicate to the public how polluted the air currently is or how polluted it is forecast to become

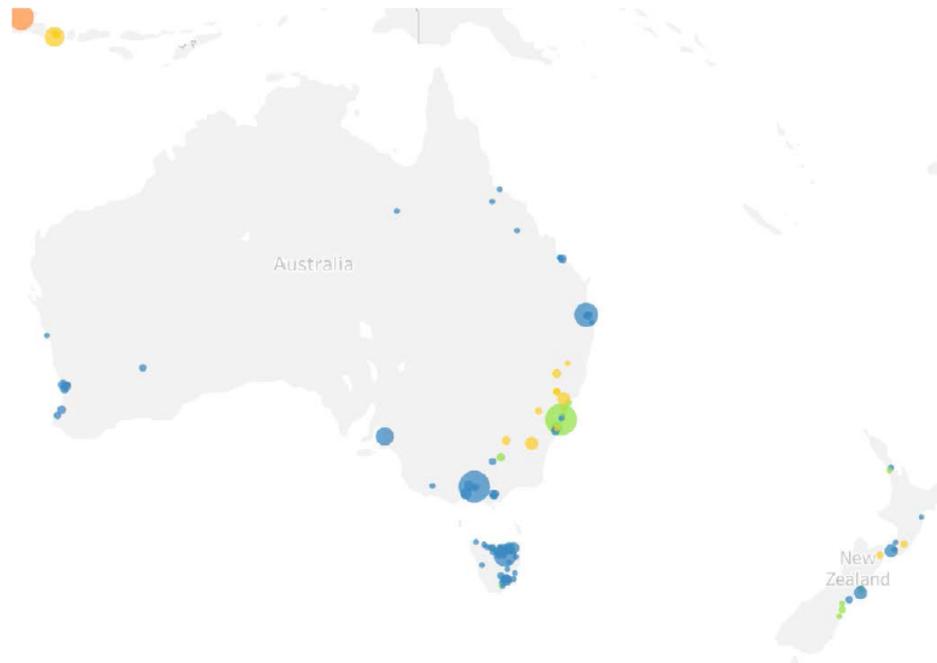


# App. AQI (Air Quality Status) of Oceania

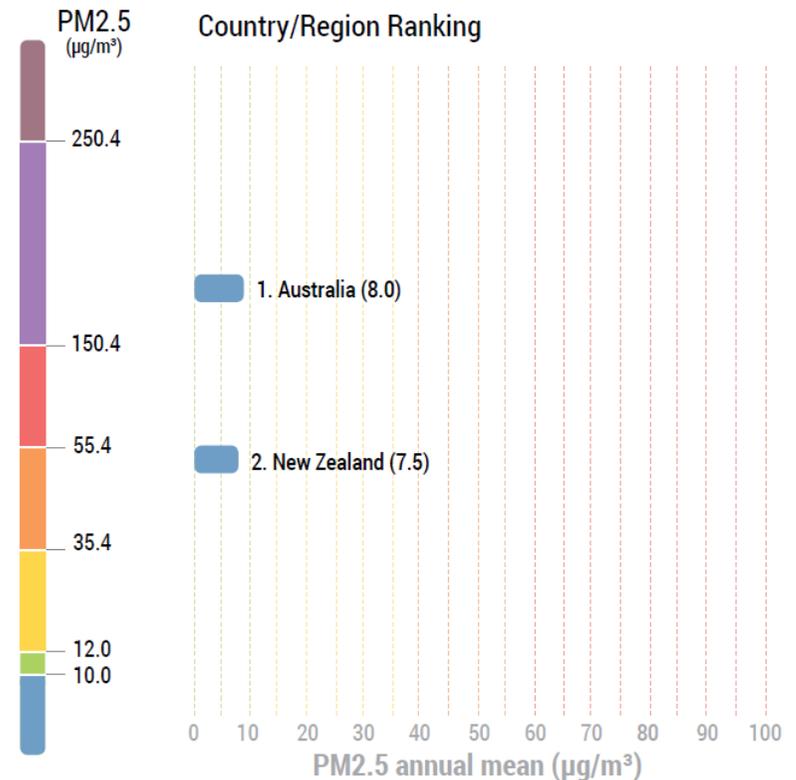
Despite representing two of the cleanest countries for PM2.5 pollution, 21% of cities here still exceed WHO targets for annual PM2.5 pollution, which were caused by the Australian bushfires in late November and December 2019.



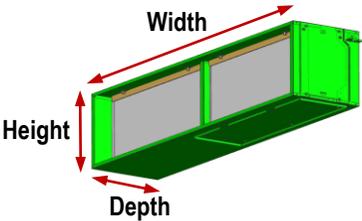
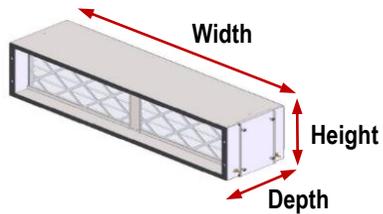
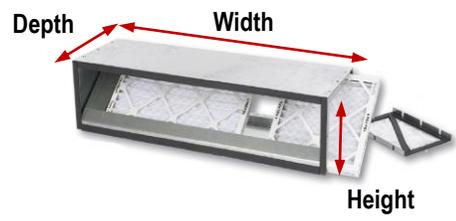
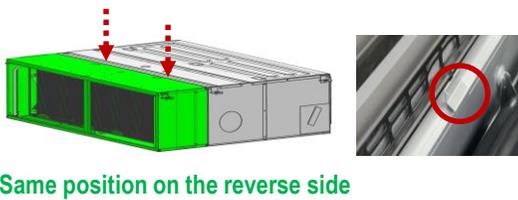
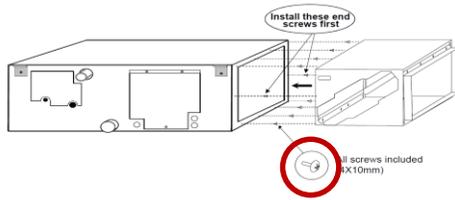
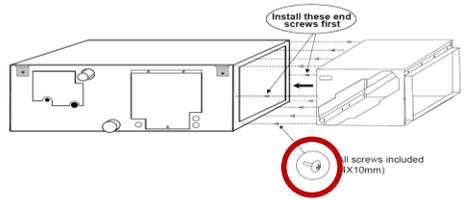
\*\*AQI (Air Quality Index) is used to communicate to the public how polluted the air currently is or how polluted it is forecast to become



Available cities with real time monitoring in 2019



# App. Competitors Comparison

Model		LG (PBM13M*UA0)	DAIKIN (DACA-FXMQ)	MITSUBISHI (FBM Series)
Product				
Size (W*H*D, mm)	Type I	1,250 X 360 X 280	1,384 X 298 X 279	1,400 X 254 X 330
	Type II	1,250 X 270 X 280	990 X 298 X 279	1,100 X 254 X 330
	Type III	900 X 270 X 280	686 X 298 X 279	900 X 254 X 330
Weight (kg) including filters	Type I	11.6	12.2	18.6
	Type II	10.5	9.4	14.5
	Type III	8.5	6.7	11.8
Filter Size (W*H*D, mm)	Type I	600 X 341 X 50.8 (2EA)	1,366 X 289 X 95	1,372 X 356 X 50.8
	Type II	600 X 251 X 50.8 (2EA)	965 X 289 X 95	1,016 X 356 X 50.8
	Type III	600 X 251 X 50.8 (1EA) 250 X 251 X 50.8 (1EA)	667 X 289 X 95	864 X 356 X 50.8
Filter Rating		MERV 13	MERV 13	MERV 13
UVC LED		●	-	-
Filter Box Assembly	Fastened with 4 Brackets and Screws		Fastened with Screws	Fastened with Screws
				

\*\*Type I : Based on LG's M3 Platform  
 \*\*Type II : Based on LG's M2 Platform  
 \*\*Type III : Based on LG's M1 Platform

## Installer Mode

\*\*What installers should do after installing the filter box

Installer Back OK OK

indoor unit physical address >

Individual IDU control >

Heating by sensing floor temper < Not Use >

UVnano < Not Installed >

**Filter Box < Not Installed >**

Installer Back OK OK

indoor unit physical address >

Individual IDU control >

Heating by sensing floor temper < Not Use >

UVnano < Not Installed >

**Filter Box < Installed >**

- Changing setting value is needed through installer mode after filter box installation : [Not Installed] → [Installed]

Installer Back OK OK

IDU operation time >

Indoor temperature master/slave >

Indoor unit physical address >

Individual IDU control >

**UVnano < Not Installed >**

Installer Back OK OK

IDU operation time >

Indoor temperature master/slave >

Indoor unit physical address >

Individual IDU control >

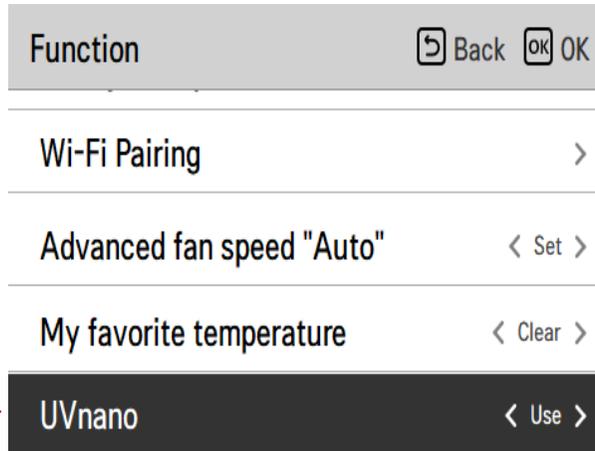
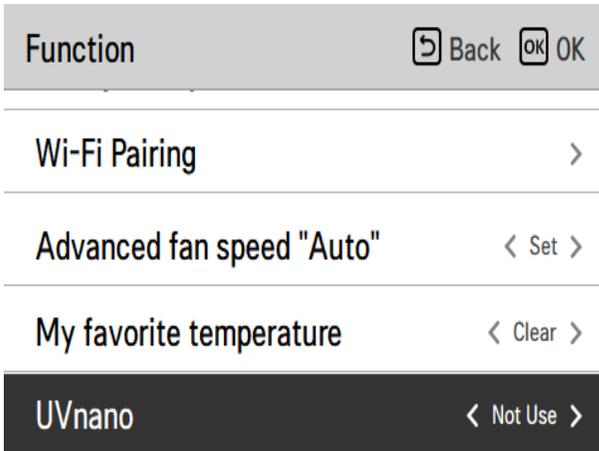
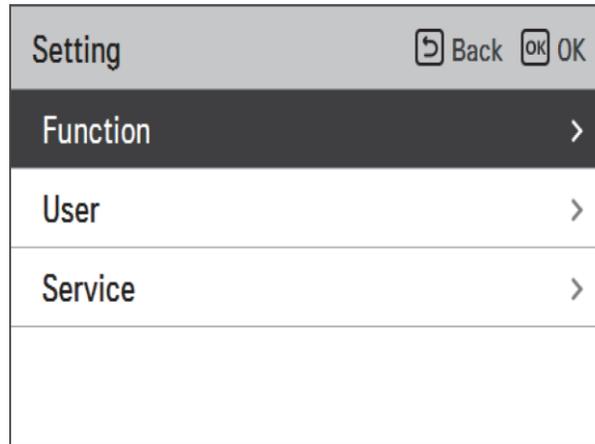
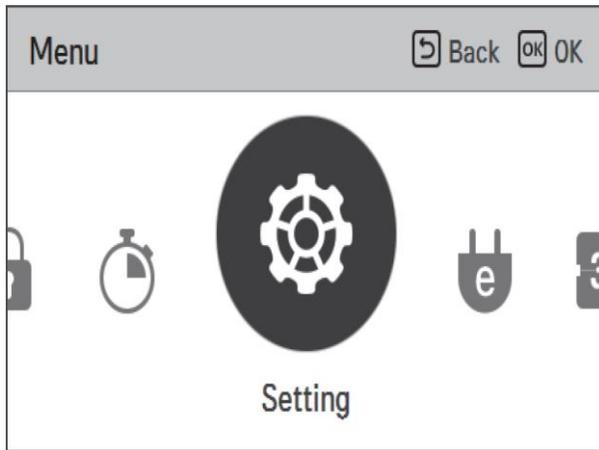
**UVnano < Installed >**

- Changing setting value is needed through installer mode regarding UVnano function : [Not Installed] → [Installed]

 **If setting values of filter box and UVnano are not designated properly, it may malfunction**

## User Mode (Function Setting)

\*\*What users should choose to use the filter box

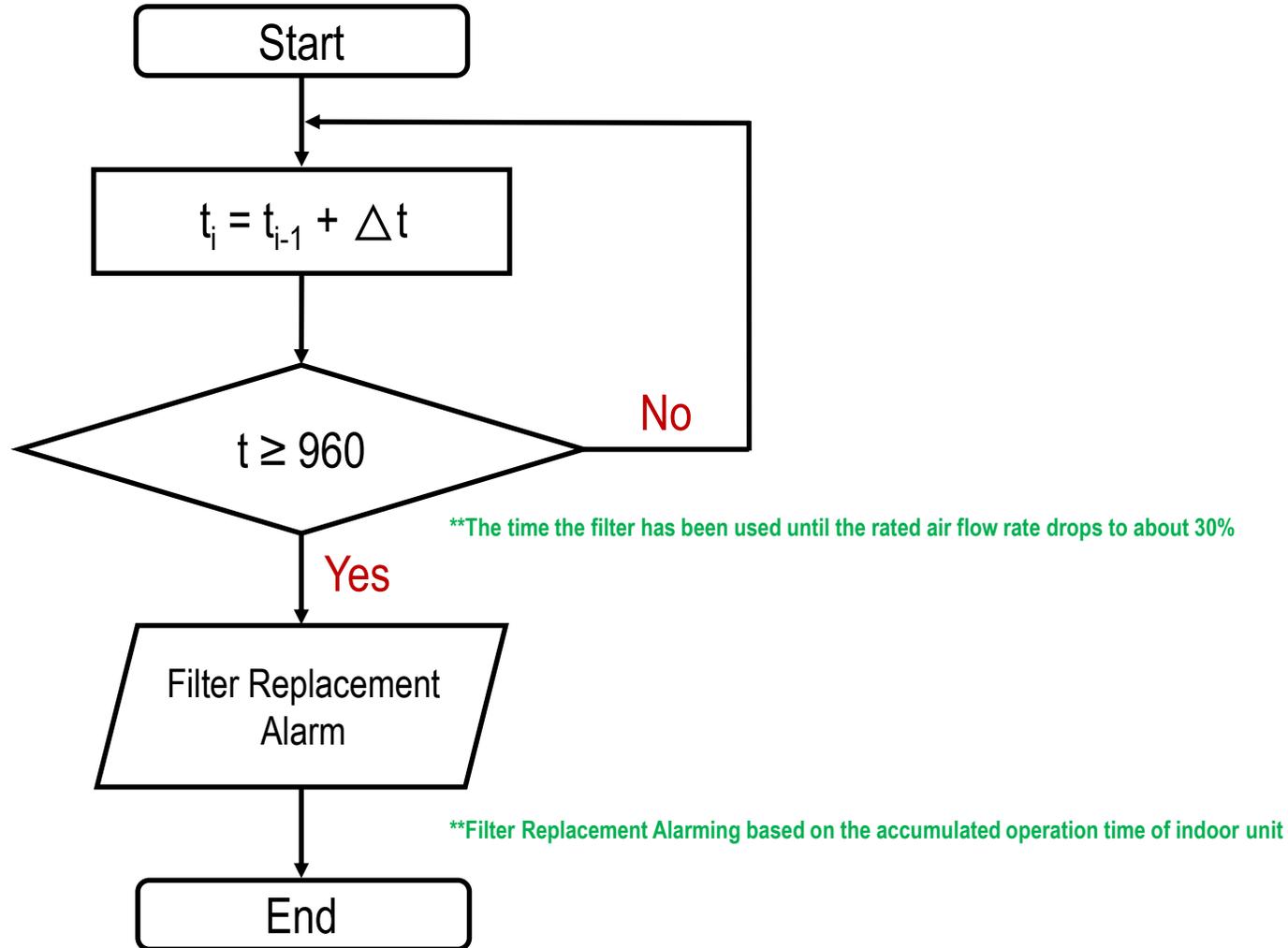


▪ Changing setting value is needed through function setting regarding UVnano function : [Not Use] → [Use]

 If setting value of UVnano is not designated properly, it may malfunction

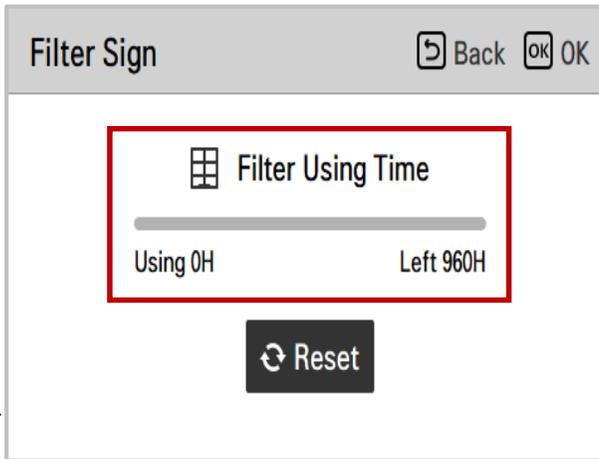
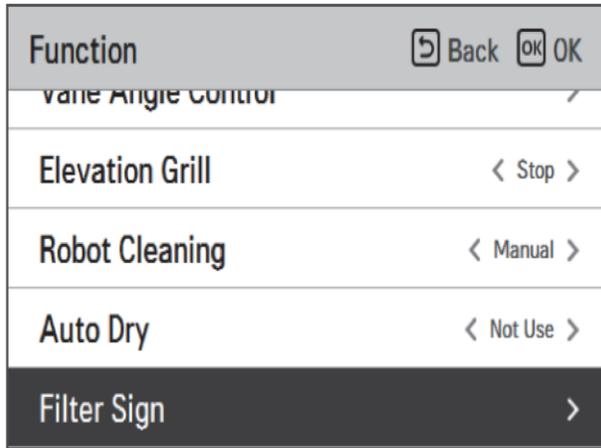
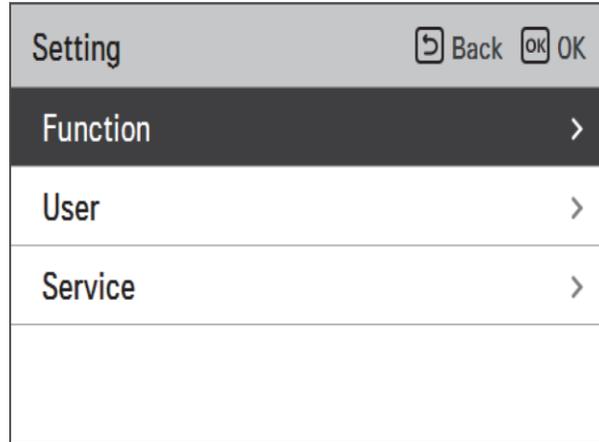
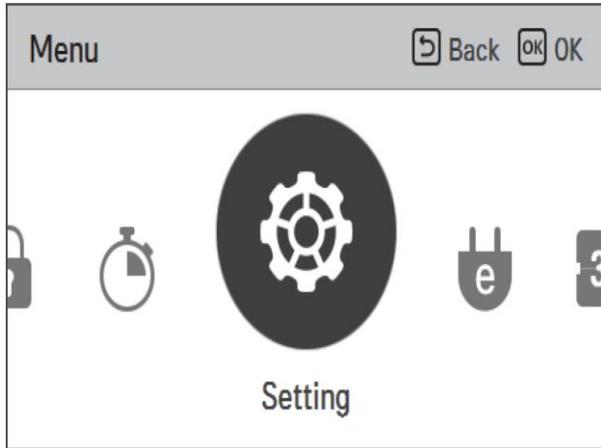
# App. Alarming Display regarding Filter Replacement Cycle

## Flow Chart



# App. Standard III Wired Remote Controller Setting – Filter Check

## User Mode (Function Setting)



- Possible to check the usage time of MERV 13 Filter and set initialization of MERV 13 Filter through function setting



## Quality Label



UVNano Filter Box  
Boîte à nano filtre UV  
Caja de Filtro UVNano  
UV Nano Filtre Kutusu  
Корпус фильтра UVNano  
Корпус фільтра UVNano  
صندوق فلترة UVNano  
**PBM13M3UA0**  
RATED CURRENT / CORRIENTE NOMINAL  
TENSÃO NOMINAL / ANMA AKIMI  
НОМИНАЛЬНЫЙ ТОК / НОМИНАЛЬНИЙ СТРУМ  
التيار المقدر : Max. 0.18(0,18) A  
UV-C Lamp  
Lampe UV-C  
Bombilla UV-C  
UV-C lambası  
УФС-лампа  
УФС-лампа  
مصباح UV-C  
Rated Voltage  
Tension nominale  
Tensión nominal  
Nominal Gerilim : 12 V~  
Номинальное напряжение  
Номинальна напруга  
الفولتية المقننة  
Rated Power Input  
Puissance absorbée nominale  
Entrada de energia nominal  
Nominal Güç Girişi : 2.16 W  
Номинальная потребляемая мощность  
Номинальна споживана потужність  
دخل القدرة المقننة  
MADE IN KOREA / FABRICADO EN COREA  
FABRICADO NA COREIA DO SUL  
KORE'DE ÜRETİLMİŞTİR  
СДЕЛАНО В КОРЕЕ / ЗРОБЛЕНО В КОРЕЇ  
صنع في كوريا



   
(REV00) MEZ68944801

## UVC Caution Label



**CAUTION / ATTENTION**

Ensure that the product is turned off when you remove the service panel.

Servis panelini çıkarırken, ürünün KAPALI olduğundan emin olun.

Assurez-vous que le produit est éteint, lorsque vous retirez le panneau de service.

Al retirar el panel de servicio, asegúrese de que el producto esté APAGADO.

عند إزالة لوحة الخدمة، تأكد من إيقاف تشغيل المنتج.

При демонтаже сервисной панели убедитесь, что изделие ВЫКЛЮЧЕНО.

Під час демонтажу сервісної панелі переконайтеся, що виріб ВИМКНЕНИЙ.

(REV00) P/No. MEZ67886908

## Caution Label



 **CAUTION / ATTENTION**

Be sure to remove the vinyl wrapping from the filter before using the product.  
If the product is used without removing the vinyl wrapping, it will prevent wind from blowing and may cause product failure.

Ürünü kullanmadan önce, filtreden vinil sarğıyı çıkardığınızdan emin olun.  
Vinil sarğı çıkartılmadan ürün kullanılırsa, rüzgarın esmesi engellenir ve ürünün bozulmasına neden olabilir.

Assurez-vous de retirer la pellicule de vinyle du filtre avant d'utiliser le produit.  
Si le produit est utilisé sans retirer la pellicule de vinyle, l'air ne pourra pas souffler et ceci pourrait endommager le produit.

Asegúrese de quitar el envoltorio de vinilo del filtro antes de usar el producto.  
Si se utiliza el producto sin quitar el envoltorio de vinilo, eso evitará que el viento sople y podría causar fallas en el producto.

تأكد من إزالة غلاف الفينيل من الفلتر قبل استخدام المنتج.  
في حالة استخدام المنتج دون إزالة غلاف الفينيل، فسوف يمنع هبوب الرياح وقد يتسبب في تعطل المنتج.

Перед использованием изделия снимите виниловую упаковку с фильтра.  
Наличие виниловой упаковки на изделии препятствует обдуву воздушным потоком и может привести к поломке изделия.

Перед початком використання виробу зніміть вінілову упаковку з фільтра.  
Наявність вінілової упаковки на виробі перешкоджає обдуванню повітряним потоком і може призвести до поломки виробу.



MEZ67886909  
Rev.00\_070121



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