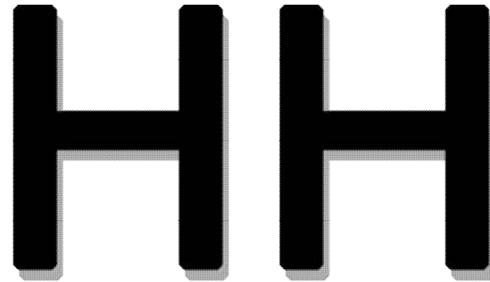


SPSPSPSP
SPSPSPS
SPSPSP
SPSPS
SPSP
SPS

KARSE B 0050



Indoor Humidifier

SPS-KARSE B 0050-6335: 2015

Korean Association of Air Conditioning Refrigerating
and Sanitary Engineers

Established on December 22nd, 2015
<http://www.karse.or.kr>

Table of Contents

1. Scope Of Application
2. Normative References
3. Terminology And Definition
 - 3.1 Vaporizing Humidifier (Filter Vaporizing Humidifier, Disc Vaporizing Humidifier)
 - 3.2 Ultrasonic Humidifier
 - 3.3 Centrifugal Spray Humidifier (Spray Humidifier)
 - 3.4 Electro-thermal Humidifier (Heater Thermal Humidifier, Electric Steam Humidifier)
 - 3.5 Electrode Humidifier
 - 3.6 Humidifying Capacity (Amount)
 - 3.7 Water Tank
 - 3.8 Frame (Body)
 - 3.9 Tank Capacity
 - 3.10 Applied Area Size
 - 3.11 Outlet Section
 - 3.12 Microbial Contamination
4. Types
 - 4.1 Vaporizing Humidifier (Filter Vaporizing Humidifier, Disc Vaporizing Humidifier)
 - 4.2 Ultrasonic Humidifier
 - 4.3 Centrifugal Spray Humidifier (Spray Humidifier)
 - 4.4 Electro-thermal Humidifier (Heater Thermal Humidifier, Electric Steam Humidifier)
 - 4.5 Electrode Humidifier
5. Rated Voltage And Rated Frequency
6. General Requirements
7. General Testing Conditions
8. Performance
 - 8.1 Safety Performance
 - 8.2 Product Performance
9. Testing Method
 - 9.1 Safety Test
 - 9.2 Product Test
10. Labeling
 - 10.1 Requirements
11. Precautions

Annex 1. Measuring Method of Humidifying Capacity
Annex 2. Calculation Method of Applied Area Size
Annex 3. Test Method of Microbial Contamination
Annex 4. Explanations

Indoor Humidifier

1. Scope of Application

This standard shall be applied to the safety and performance of indoor humidifier ('humidifier' hereinafter) that is installed in a general house and office room to raise indoor relative humidity ('humidity' hereinafter) and that uses single-phase alternating current and whose rated humidifying capacity is less than 10L/h.

Remark 1. in case it is a compound type, its main function shall be 'humidifying'.

Remark 2 a humidifier assembled on other equipment shall be in compliance with SPS-KARSE B 0028-0190.

2. Normative References

The following normative references are essential part of this standard. Only normative references whose issuing year is expressed shall be applied. For normative references whose issuing year is not expressed, only latest versions shall be applied.

SPS-KARSE B 0028-190 VAPORIZING HUMIDIFIER (INDUSTRIAL PURPOSE)

KS C IEC 60335-1 HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES - SAFETY - PART 1 :
GENERAL REQUIREMENTS

KS C IEC 60335-2-98 HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES - SAFETY - PART 2-98 :
PARTICULAR REQUIREMENTS FOR HUMIDIFIERS

KS C IEC 61672-1 ELECTRO-ACOUSTICS - SOUND LEVEL METERS - PART 1 : Specifications

3. Terminology and Definition

The terms used in this standard are defined as follows.

3.1 Vaporizing Humidifier

A humidifier that uses the method to send air to humidifying media (disc, filter, etc.), add humidity to the air, and send wet air out.

3.2 Ultrasonic Humidifier

A humidifier that uses the method to emit radiate ultrasonic energy into water with a vibrator and spray the water into the air.

3.3 Centrifugal Spray Humidifier

A humidifier that uses the method to reduce water into mist by centrifugal force and spray the water into the air.

3.4 Electro-thermal Humidifier

A humidifier that uses the method to heat water with a eclectic heater and humidify the air.

3.5 Electrode Humidifier

A humidifier that uses the method to put electrodes in the water, heat current flowing in the water, and thus humidify the air.

3.6 Humidifying Capacity

Humidifying amount per hour (mL/h) measured by a specified method specified while a humidifier is running at standard conditions of measurement.

3.7 Water Tank

A container that stores water in the device (not including a humidifier whose cartridge tank is detachable)

3.8 Body

The whole part of a water tank equipped with electric parts.

3.9 Tank Capacity

For a cartridge type, it is water amount when a water tank is fully filled with water. (For a tank directly supplied with water, it is water amount when a water tank is filled with water up to a water supply limit.)

3.10 Applied Area Size

The conversion of humidifying capacity into indoor floor size of a house or apartment.

3.11 Outlet (Discharge Portion)

An area where humidity is discharged from the device into indoor air.

3.12 Microbial Contamination

The extent that indoor space is contaminated with microorganism when a humidifier runs at rated mode.

4. Types

Humidifiers are divided into 5 types by humidifying method as follows.

4.1 Vaporizing Humidifier (Filter Vaporizing Humidifier, Disc Vaporizing Humidifier)

4.2 Ultrasonic Humidifier

4.3 Centrifugal Spray Humidifier (Spray Humidifier)

4.4 Electro-thermal Humidifier (Heater Thermal Humidifier, Electric Steam Humidifier)

4.5 Electrode Humidifier

5. Rated voltage and Rated Frequency

Rated voltage: single-phase alternating current 220V

Rated Frequency: 60Hz

6. General Requirements

The general requirements of a humidifier shall be in compliance with 4 of KS C IEC 60335-1.

7. General Testing Conditions

The general testing conditions of a humidifier shall be in compliance with 5 of KS C IEC 60335-1.

8. Performance

8.1 Safety Performance

Electric shock protection of live part; driving of motor-based driven equipment; rated input power and current; temperature rise; current leakage during driving; dielectric strength, excessive voltage; tolerance to moisture; overload protection of transformer and related circuits, abnormal driving; safety and mechanical hazard; structure; internal wiring; parts; power connection and external flexible cable; external wire terminals; grounding connection; screw and connection; spatial distance; creeping distance and solid insulation; thermal resistance and fire resistance; corrosion resistance; radioactivity, toxicity, and other similar hazard shall be in accordance with **KS C IEC 60335-2-98**.

8.2 Product Performance

8.2.1 Humidifying Capacity

When it is tested according to Annex 1, it shall be above 90% of rated humidifying capacity.

8.2.2 Humidification Applied Area Size

It shall be calculated according to Annex 2.

8.2.3 Electric Power Consumption

When it is tested according to 9.2.3, it shall be below 110% of manufacturer's electric power consumption.

8.2.4 Noise Level

When it is tested according to 9.2.4, the average of measured values shall be in compliance with Table 1.

Table 1. Noise Level by Rated Humidifying Capacity

| Humidifying Capacity(mL/h) | Noise Level (dB(A)) |
|----------------------------|---------------------|
| ~ 300 | Below 30 |
| 301 ~ 500 | Below 40 |
| 501 ~ | Below 50 |

8.2.5 Microbial Contamination

When it is tested according to 9.2.5, it shall be below 30 CFU/m³.

9. Testing Method

9.1 Safety Test

Electric shock protection of live part; driving of motor-based driven equipment; rated input power and current; temperature rise; current leakage during driving; dielectric strength, excessive voltage; tolerance to moisture; overload protection of transformer and related circuits, abnormal driving; safety and mechanical hazard; structure; internal wiring; parts; power connection and external flexible cable; external wire terminals; grounding connection; screw and connection; spatial distance; creeping distance and solid insulation; thermal resistance and fire resistance; corrosion resistance; radioactivity, toxicity, and other similar hazard shall be in accordance with **KS C IEC 60335-2-98**.

9.2 Product Test

9.2.1 Humidifying Capacity

It shall be in accordance with Annex 1.

9.2.2 Applied Area Size

It shall be calculated according to Annex 2.

9.2.3 Electric Power Consumption

Power supply shall be rated frequency 60 Hz ($\pm 1\%$). Rated voltage shall be adjusted to single-phase alternating current 220 V($\pm 1\%$).

The minimum measure unit shall be below 0.1 Wh and measuring error shall be below 1%.

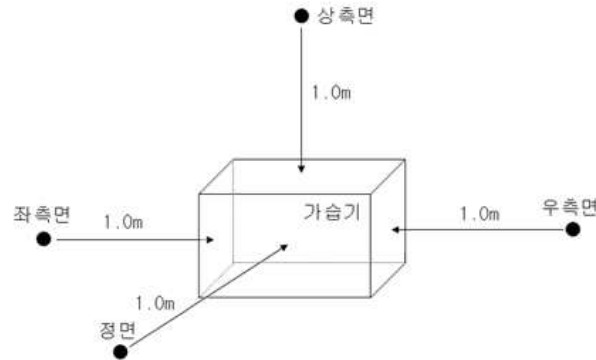
- When measuring electric power consumption, the running conditions of the test chamber and its environment conditions shall be in compliance with Annex 1 **Measuring Method of Humidification Performance**.
- Run a humidifier for 30 minutes and measure electric power consumption every 10 minutes at the measuring condition of rated humidifying capacity. Measure more than 3 times and get an average of 3 measured values that stay within 5% error between initial electric power consumption and last electric power consumption.
- Measure twice and the average is set as electric power consumption.
- When the error of the measured values exceeds 5%, sum the electric power volume of 10 minutes and divide it by time (10 minutes) to get electric power consumption.

9.2.4 Noise Test

It shall be tested under the following conditions. Noise meter shall be one (class 2) specified in KS C IEC 61672-1 or a better one. Set a noise meter at frequency weight A and measure noise at 4 points shown in Picture 1 and get the average.

- A humidifier shall be placed on a flat and solid location and installed tightly not to shake. Here, make sure that a humidifier is not affected by wind pressure, vibration and/or electromagnetic fields, which can have impact on noise level.
- When measuring the noise of a humidifier, the background noise near the closest wall shall be lower by 8 dB(A) than that at the measuring points. In case of a dead room, however, it can not be applied.
- Ruin a humidifier at rated frequency and rated voltage. Here, for a humidifier equipped with a speed controlling device, it shall be set to maximum speed.
- Place a microphone at 1.0 meter away from the outer surface of the humidifier and measure noise.

Annex 1 Measuring Method of Humidification Performance



상측면 (Upper Side), 좌측면 (Left Side), 우측면 (Right Side), and 정면 (Front Side), 가습기: Humidifier

Picture 1. Measuring Noise

9.2.5 Microbial Contamination

It shall be tested in accordance with Annex 3.

10. Labeling

The following items shall be marked on a humidifier where it is easy to notice and hard to be erased.

- product name
- model name
- rated voltage and frequency
- year and number of manufacturing
- humidifying capacity
- applied area size
- manufacturer and seller (when a manufacturer is not a seller of this product)
- electric power consumption (w)

11. Instruction Manual

When there is something the requires a user's attention, it shall be expressed on the humidifier, its package, and/or instruction manual.

The instruction manual shall describe how to fill water, clean the device, and remove water scale in detail.

1. Scope of Application

This standard shall be applied to the measuring method of humidification capacity of a humidifier.

2. Standard Measuring Conditions

Measuring condition shall meet the standard measuring conditions in Table 1.

Table 1. Standard Measuring Conditions

| Item | Measuring Condition |
|---|---|
| Voltage (V) | Same as Rated Voltage |
| Frequency (Hz) | 60 |
| Room Temperature (°C) | 20 ± 1 |
| Water Temperature (°C) | 20 ± 1 |
| Humidity (%) | 30 ± 3 ⁽¹⁾ |
| Aging (°) (h) | 1 |
| Used Water Type (°) | Tap Water |
| Slope of Test Specimen (degree) | Below 1 |
| Air Current | At 1.5 m/s, but not direct contact the inlet and outlet of the test specimen |
| Measuring Points on Test Specimen: Temperature Humidity | <p>온도·습도 측정위치 시험체 본체로부터 약 30cm 떨어진 본체 높이의 거의 중앙부에서 시험체의 수증기·바람의 영향이 적은 곳</p> <p>측정대</p> <p>약 30cm</p> <p>70±25cm</p> <p>약 30cm (about 30cm), 시험체 (Test Specimen), 측정대 (Measuring Table) 온도·습도.....: Measuring point of temperature and humidity 시험체,..: It is almost the central point of the height of a humidifier, 30cm away from the test specimen (the humidifier)</p> |

Note 1. In case the humidity of the test chamber is not more than 30%, it is OK to measure at humidity of 30% to 50%. However, the measured values shall be adjusted with determinant conversion formula of humidifying capacity.

Note 2. When conducting the performance test, a humidifier shall be run for a certain time before test so that the performance of the test specimen can be measured uniformly. Here, it shall be run under the same environmental conditions as actual test and the operation conditions shall be according to a manufacturer's conditions. In addition, pre-treatment that a manufacturer requests shall be taken in advance to prevent affect on humidifying capacity. Aging is not applied here.

Note 3. Aging of water in the water tank starts counting from the state of full water. No water is fed to the tank during the test.

3. Measuring Method

Set a humidifier to standard measuring conditions and age it. Then start to measure the capacity in accordance with the followings.

- Stop running the test specimen after aging and measure right away the total weight of a humidifier [W1(kg)], temperature [t1(°C)], and relative humidity [H1(%)] and record them. And start measuring right away. However, there is no need to adjust water temperature to 20°C. Water temperature right after aging can be considered equal as that at the beginning of measurement.
- Measuring time is an hour. But, rapid change of humidification quantity by change if water level in the tank is from the fourth hour. In addition, when standard level is reached before the set time, that is the point when measurement is terminated.
- Stop running the humidifier when measuring time passes and measure right away the total weight of a humidifier [W2(kg)], temperature [t2(°C)], and relative humidity [H2(%)] and record them.

4. Determination of Humidifying Capacity

a) Humidifying capacity is determined with this equation. Here, water density is 1 kg/L.

$$W = \frac{W_1 - W_2}{T} \quad (\text{L / h})$$

Here, W: humidification quantity(L) during measuring; T: measuring time(h). When the humidity of the test chamber is not more than 30%, the following conversion formula of humidifying capacity shall be applied to calculate the capacity.

b) Conversion Formula of Humidifying Capacity

When the humidity of the test chamber is not more than 30%, a test condition shall be chosen between 30% and 50%, and the humidity level shall be maintained during measuring. In addition, maintain $|H_1 - H_2| \leq 5\%$ and apply this equation to convert it.

$$W_0 = W \frac{h_0' - \frac{\psi_0}{100} hD_0}{h_1' - \frac{\psi_1}{100} hD_1} \quad (\text{L})$$

Here,

W₀: conversion rate of humidification quantity at standard measuring condition

W: actual humidification quantity at actual measuring condition (W₁-W₂)

h₀: web-bulb temperature change and saturated water partial vapor pressure at standard measuring condition (1.303 kPa at constant web-bulb temperature change and saturated water partial vapor pressure at 20°C and 30%)

ψ₀: relative humidity at standard measuring condition (% , 30% in this standard)

hD₀: dry-bulb temperature change and saturated water partial vapor pressure at standard measuring condition (2.337 kPa at 20°C)

h₁: web-bulb temperature change and saturated water partial vapor pressure at actual measuring condition (kPa)

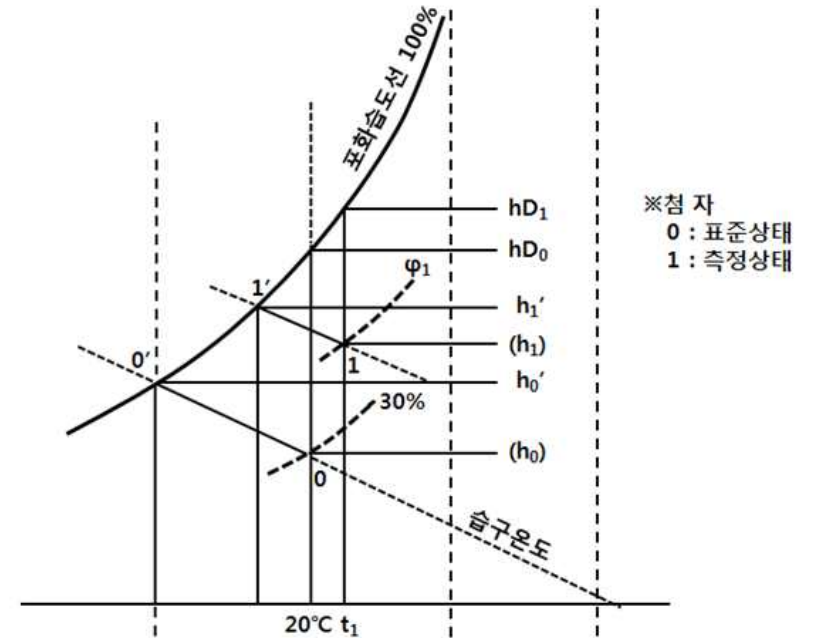
ψ₁: relative humidity during measuring (%)

hD₁: dry-bulb temperature change and saturated water partial vapor pressure at actual measuring condition (kPa)

$$\text{Humidification Capacity} \frac{W_0}{T} = \frac{W}{T} \frac{h_0' - \frac{\psi_0}{100} hD_0}{h_1' - \frac{\psi_1}{100} hD_1} \quad (\text{L/h})$$

※ Substitute the value at standard condition for the denominator for $h_0' - \frac{30}{100} hD_0$. 0.6019 is the standard value.

$$1.303 - \frac{30}{100} \times 2.337 = 0.6019$$



Picture 1. Psychrometric Chart

습구온도 (web-bulb temperature), 포화습도선 (Saturated Humidity Line), 첨자(Note), 표준상태 (Standard Condition), 측정상태 (Measuring Condition)

Annex 2 Calculation Method of Applied Area Size

1. Scope of Application

This standard specifies the calculation of applied area size of the humidifying capacity that is calculated in Annex 1 and descriptions in a catalogue and instruction manual.

2. Calculation Method of Humidification Quantity Necessary for A General House

When using a humidifier, necessary humidification quantity shall be calculated and rated humidifying capacity shall be determined in consideration of purpose of use, type, size, and structure of indoor space to humidify, and vapor generating from an indoor humidifier to install.

The calculation method in this standard is aimed for humidification quantity necessary in a general house. In case the conditions of use are quite different from those specified here, separate calculation method shall be applied.

3. Necessary Humidification Quantity

3.1 Setting Standard Conditions

Indoor temperature and humidity in a general house change by outdoor conditions, indoor conditions before heating (temperature, humidity, air current, and such), moisture absorption and moisture proofing of indoor finish materials, and the number of occupants. In this standard, however, necessary humidification quantity is calculative with the following equations and under the conditions.

- a) Indoor condition before heating is assumed equal to ambient air condition. (In reality, the former is better than latter.)
- b) Change of air is different by the structure of a building, but we assume general house is **1.0**, and apartment is **0.75**.
- c) To balance sampling and considering regional population density, we choose **6** cities and set the average of January humidity of last 30 years in those regions as standard ambient air condition for region. (Table 2.)
- d) The standard size of indoor space is **1 m²**, and standard height of an ceiling is **2.4 m (V = 2.4 m³)**, which is the most common in general houses.
- e) We set indoor temperature after heating to **20°C**, and humidity to **60%**. Here, indoor absolute indoor humidity after heating is **Xi=0.00873 kg/kg**, and specific volume after heating is **Vi = 0.842 kg / kg**. (according to Psychometric Chart)
- f) necessary humidification quantity per 1 m² (ΔX) is calculated in this equation.

$$\Delta X = V \left(\frac{X_i}{V_i} - \frac{X_o}{V_o} \right) n$$

Equation 1

Here,

ΔX : necessary humidification quantity (L/h, water density is 1kg/L)

V: spatial volume of indoor (m³)

Xi: indoor absolute humidity after heating (kg / kg)

Vi: specific volume for Xi (m³/kg)

Xo: absolute humidity of ambient air (kg / kg)

Vo: specific volume for Xo (m³/kg)

n: change of air (frequency/h)

Table 2. Ambient Air Conditions of Sampled Cities (The Meteorological Administration)
(Average of 1985 ~ 2014)

| Condition | Region | | | | | | Remarks |
|--------------------------------------|----------|----------|----------|----------|----------|----------|---------|
| | Seoul | Busan | Incheon | Daegu | Daejeon | Kwangju | |
| Temperature°C | - 2.4 | 3.2 | - 2.1 | 0.6 | - 1.6 | 0.6 | |
| Humidity% | 59.8 | 48.3 | 61.5 | 54.4 | 65.9 | 67.7 | |
| Specific Volume ml/kg [*] | 0.7693 | 0.7858 | 0.7703 | 0.7782 | 0.7720 | 0.7789 | |
| Absolute Humidity kg/kg [*] | 0.001845 | 0.002288 | 0.001946 | 0.002139 | 0.002174 | 0.002664 | |

3.2 Necessary Humidification Quantity Per 1 m²

Using Equation 1, humidifying quantity per 1 m² of 6 cities is calculated like in Table 3.

Table 3. Necessary Humidification Quantity Per Unit Size by Ventilation Rate (Frequency)

(Unit: mL/h-m²)

| Region | Change of Air (frequency/ h) | |
|---------|------------------------------|---------------------|
| | 0.75 (Apartment) | 1.0 (General House) |
| Seoul | 14.1 | 18.9 |
| Busan | 13.2 | 17.6 |
| Incheon | 14.1 | 18.7 |
| Daegu | 13.5 | 18.0 |
| Daejeon | 13.5 | 18.0 |
| Kwangju | 12.3 | 16.4 |

3.3 Expression of Applied Area Size

a) In expressing the applied floor size of a humidifier in terms of 'range', the average necessary humidification quantity of Korea is set to a standard value and Seoul is chosen as a representative sample. And the humidification quantity per unit size of multiple dwelling houses is set as maximum humidifying area and the range of applied floor size shall be a standard.

b) Table 4 shows the calculation of rated humidifying capacity and applied area (floor) size.

Table 4. - Rated Humidifying Capacity and Applied Area (Floor) Size

| Rated Humidifying Capacity (mL / h) | Applied Floor Size, m ² (Apartment, Change of Air 0.75/h) | Rated Humidifying Capacity (mL/h) | Applied Floor Size, m ² (General House, Change of Air 1.0 Times/h) |
|-------------------------------------|--|-----------------------------------|---|
| 200 | 14 | 200 | 11 |
| 300 | 21 | 300 | 16 |
| 400 | 28 | 400 | 21 |
| 500 | 35 | 500 | 26 |
| 600 | 43 | 600 | 32 |
| 700 | 50 | 700 | 37 |
| 800 | 57 | 800 | 42 |
| 900 | 64 | 900 | 48 |
| 1000 | 71 | 1000 | 53 |

Note) Description Method

Rated Humidifying Capacity 500mL/h

Applied floor size: apartment is 35 m² (change of air: 0.75 times/h), general house is 26 m² (change of air: 1.0 times/h)

Annex 3 Test Method of Microbial Contamination

1. Scope of Application

This standard shall be applied to the test method of microbial contamination of a humidifier.

2. Test Conditions and Target Microorganism

2.1 Test Conditions

It shall be temperature 23 ± 5°C, relative humidity 30%.

2.2 Announced Fungi

The following announced fungi are used for this test.

staphylococcus aureus: it shall be tested in accordance with ATCC 6538 and KCTC 1916.

* ATCC: American Type Culture Collection, Rockvill, Mary land, U.S.A

* KCTC: Korean Collection for Type Cultures

3. Measuring Equipment and Device

3.1 Test Chamber

The size of the test chamber shall be **8.0±0.2m³** (standard spatial volume: **2m×2m×2m**) and it is airtight container (made of glass or acrylic (resin)). A test specimen is placed at the center of the test chamber. When the specimen is a desktop type, it shall be installed **75cm ± 25** above the floor. Use a Bioaerosol collector and sample out microorganism specimen from the center of the chamber, but should be separated **50cm** from the test specimen. It shall be equipped with a fan vortexer on the upper part of it and keep running. The air current inside the chamber shall be below **1.5 m/sec**.

3.2 Incubator

Incubator shall be able to maintain up to **50°C** at room temperature.

3.3 Bioaerosol Collector

Cascade impactor method is applied when using a Bioaerosol collector. The flow rate of absorbing air shall be constant and measurable.

3.4 Culture Media for Microorganism

Put and dissolve **15g** of pancreatic digest of casein, **5g** of enzymatic digest of soybean meal, **5g** of NaCl, and **15g** of agar in **1L** of distilled water and adjust pH to **6.8 ± 0.1**. It is possible to use commercial one (e.g, Difco 236950). Pour culture media that sterilized with steam at high pressure (autoclaving) at **121°C** for **15** minutes evenly on the culture plate of microorganism and let it get hard. And then dry it in a natural condition until its monster on the surface does not run over the surface of the culture media. It is possible to use a commercial product.

3.5 Dilution Solution

Treat one of peptone dilution solution (peptone:1.0g, water: 1L; pH: 7.0 ± 0.1), phosphoric acid buffer solution (KH₂PO₄:42.5mg, MgCl₂:190mg, water:1L; pH: 7.2 ± 0.5), and distilled water by autoclaving and use it.

3.6 Sterilizer

Dry heat sterilizer shall be able to maintain at **80°C to 300°C**. Autoclave (high-pressure sterilizer) shall be able to maintain stream pressure **1055g/cm²** and temperature of **(121 ± 1)°C**.

3.7 Colony Counter

It shall be equipped with a magnifier (magnifying glass) and a lighting device and it plate on which a Petri dish is placed shall be plotted **1 cm** in line so that it can be easy to count the number of colonies.

3.8 Water

In general, tap water is used in a test, so this test also uses tap water. When tap water is used, it shall be aged a day (24 hours) in a sterilized container so it can't not affect with residual chlorine.

3.9 Test Specimen

As for test specimen, its surface, air channel, and water tank shall be sterilized with **70%** ethyl alcohol; be dried; and placed on germ-free table for test.

4. Test Method of Microbial Contamination at the Outlet

4.1 Culturing Microorganism Specimen

Inoculate strain in the prepared culture media with a sterilized loop and cultivate it at **(37 ± 1)°C** for **24 hours** (shaking at constant temperature). The suspension of the cultivated microorganism (by shaking) shall be diluted by step.

4.2 Measuring Microorganism Background Concentration

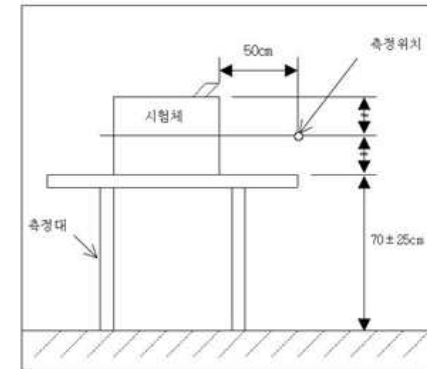
To minimize the intervention of microorganism existing in the test chamber, background concentration shall be measured first. Cleaning state of the inside chamber shall be checked with bare eyes and then run floating germs (Bioaerosol) collector, which is sterilized, in the chamber for less than 10 minutes at a constant airflow and then record total intake airflow. The concentration shall be kept low under **15 CFU/m³**. In case the concentration is above the standard, measure it again. Clean the surface of the chamber and test specimen with **70%** ethyl alcohol before the test and sterilize them with UV lamp to maintain the background concentration stays within the range of the standard.

4.3 Injection (Inoculation) of Microorganism Specimen

Inject **100mL** of diluted solution of culture medium (C.4.1) into the storage water tank or a water tank of test specimen. When the diluted solution of culture medium is put into the water tank, the count of Staphylococcus aureus in the storage tank or water tank area shall be **10⁴~10⁵CFU/mL**.

4.4 Collection Method of Specimen Under Test Specimen (humidifier) in Operation

Microbial contamination at the outlet shall be measured and tested while a humidifier is running at a rated mode, considering the common usage conditions in a house and office room. Test sample of microorganism shall be collected in this procedure: (i) confirming the initial concentration in the test chamber examining; (ii) running the test specimen (humidifier) at a rated mode until its humidity saturation level in the chamber reaches **55%** ; and then collecting the sample with a Bioaerosol collector at 50cm from the outlet of the test specimen in operation and at **70 ± 25 cm** above it.



시험체 (Test Specimen), 측정대 (Measuring Table), 측정위치 (Measuring Point)

Picture 2. Testing Location at Outlet and Collecting Point of Sample

4.5 Cultivation, Counting and Evaluation of Microorganism

Right after collecting microorganism sample with a floating-germ collector, cultivate the culture plate with it in the incubator (**37±1°C**) for 24 hours and count grown colony. The counts shall be expressed and recorded in **CFU (Colony Forming Units)**. only the culture plate with grown colony shall be evaluated. In case there is no grown colony, cultivate it again. In case the same tests are repeated, the error of plate counts shall not deviate from **10%** from the average (**SD > 10%**). In case that he count of colony obtained from the measurement of background concentration is above **10%** or **15 CFU/m³** of the measure of initial microorganism test before the test specimen runs, pre-contamination of the test chamber is worth doubting. Therefore, clean the chamber with **70%** ethyl alcohol and sterilize the indoor are of the chamber with UV. And test shall be given again. The measuring error of the bacterial counts (**CFU/m³**) at the outlet /m³ shall not be above **10%**.

5. Standard Management of Microorganism Test

In general, microorganism test requires high skills and experiences because test objects are alive. Therefore, the range of error is relatively broad. For accurate test and result, it is recommended to conduct same test more than 3 times or use more than 3 replicates at a simultaneous test and the average shall be used. The standard management of others microorganism tests shall be in compliance with “KS M ISO 13843 **Water quality-Guidance on Validation of Microbiological Test Methods**.”