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Indoor Dehumidifier

SPS-KACA0020-6631: 2016

Korea Air Cleaning Association

Established on April 28th, 2016

<http://www.kaca.or.kr>

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Deliberation: Deliberation Board of Collective Standard

Established: April, 28th, 2016

Certification of Korea Air Cleaning Association

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Collective Standard of Korea Air Cleaning Association

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Indoor Dehumidifier

Indoor Dehumidifier

1. Scope of Application

This standard is applied to indoor dehumidifier that is used to reduce indoor humidity ('dehumidifier' hereinafter) and that uses less than 1,000 W of electric power consumption. Dehumidifier are divided into refrigeration-type and adsorption-type in general.

2. Normative References

THE FOLLOWING NORMATIVE REFERENCES ARE ESSENTIAL PART OF THIS STANDARD. ONLY NORMATIVE REFERENCES OF THE LATEST VERSIONS SHALL BE APPLIED.

KS C 0262 LIMITS AND METHODS OF MEASUREMENTS OF RADIO INTERFERENCE CHARACTERISTICS OF ELECTRICAL, ELECTRONIC AND INFORMATION EQUIPMENTS

KS C 9306 AIR CONDITIONER

KS C 9317 ELECTRIC DEHUMIDIFIER

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

KS C IEC 60335-40 HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES - SAFETY - PART 2 - 40 : PARTICULAR REQUIREMENTS FOR ELECTRICAL HEAT PUMPS, AIR - CONDITIONERS AND DEHUMIDIFIERS

SPS-KARSE B 0024-186 REFRIGERATING DEHUMIDIFIER

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.

a) Dehumidification Capacity

The definition of dehumidification capacity shall be in accordance with 3 of **KS C 9317 ELECTRIC DEHUMIDIFIER**. But unit is L/day.

b) Electric Power Consumption

The definition of electric power consumption shall be in accordance with 3 of **KS C 9317 ELECTRIC DEHUMIDIFIER**.

c) Dehumidification Efficiency

The total volume of electric power consumption divided by the amount of removed humidity from air per hour when a dehumidifier runs under rated conditions (specified in the standard): **L/kW·h**

d) Applied Area Size

The conversion of dehumidifying capacity into indoor floor size of a house or apartment: **m²**

e) Necessary Dehumidification Quantity

Dehumidifying load per unit size by ventilation rate (frequency): **L/h·m²**

4. Types

Humidifiers are divided into 2 types as follows.

a) **Refrigeration-Type Dehumidifier:** it refrigerates and condenses moisture in the air in a refrigerating part to dehumidify the moisture. There are 2 methods: refrigerant-based compressor type and thermoelectric element type.

b) **Adsorption-Type Dehumidifier:** it uses moisture absorbent (so-call 'desiccant') to absorb moisture in the air. 흡습제의 재생 기능이 포함된다. (원문의 내용 설명 부탁드립니다)

5. Rated voltage and Rated Frequency

It shall be in compliance with 5 of **KS C 9317 ELECTRIC DEHUMIDIFIER**.

6. General Requirements

6.1 General Requirements

It shall be in compliance with 4 of **KS C IEC 60335-1 HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES - SAFETY - PART 1 : GENERAL REQUIREMENTS**.

6.2 Individual Requirements

It shall be in compliance with **KS C IEC 60335-2-40**.

7. Performance Standard

7.1 Dehumidification Capacity

When it is tested according to **8.3**, it shall be above 100% of rated dehumidification capacity.

7.2 Electric Power Consumption

When it is tested according to **8.4**, it shall be below of 100% of rated dehumidification capacity for electric power consumption.

7.3 Dehumidifying applied area size

It shall be calculated in accordance with the method of **8.5**.

7.4 Noise Level

When it is tested according to **8.6**, it (the average of measured values) shall be in compliance with Table 1.

Table 1. Noise Level by Rated Dehumidifying Capacity

Rated Dehumidification Capacity (L/day)	Noise Level (dB)
Below 10	Below 40
10 ~ 20	Below 45
20 ~ 30	Below 50
Above 30	Below 55

8. Testing Method

8.1 Test Conditions

Each test shall be conducted under the conditions that meet the requirements as below.

- a) Dehumidifier test shall be carried out in accordance with Annex 1 of **KS C 9306: 'Measuring Method of Refrigerating Capacity and Heating Capacity of Heat Pump'** (Picture) and in a test chamber with the same structure and the same environmental conditions as Picture 2 of Annex 1. However, the performance test can be performed in a constant temperature/humidity chamber as long as it can maintain testing conditions and keep one-way air current.
- b) Temperature conditions shall be in compliance with **Table 6 Temperature Condition in KS C 9317 ELECTRIC DEHUMIDIFIER**

Table 6 Temperature Condition in KS C 9317 ELECTRIC DEHUMIDIFIER

Condition	Dry-Bulb Temperature	Web-Bulb Temperature
Standard Condition	27.0±1.0	21.2±0.5

- c) Air inlet and outlet of a dehumidifier shall be inside the test chamber so it can't be affect by air current.
- d) Change of power voltage shall stay within $\pm 2\%$ of rated voltage; and change of frequency shall stay within $\pm 1\%$ f rated frequency.
- e) When measuring inside temperature of the test chamber, it shall be done where other thermal source or anything can't affect a dehumidifier. If possible, it is recommended to measure at the air inlet of the dehumidifier.
- f) If a dehumidifier has a temperature or humidity controller, shut it off.
- g) The minimum measuring unit of a scale that measure dehumidification capacity shall be lower than 10g; degradability shall be below 1/500. The scale shall be calibrated on regular base according to the calibration schedule of KOLAS.

8.2 Basic Test

The basic test shall be to check if all the requirements in **6** are met.

8.3 Dehumidification Capacity test

It shall be tested in accordance with according to Annex 1.

8.4 Electric Power Consumption Test

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%.

- a) 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 Dehumidification Performance**

- b) Run a dehumidifier for 30 minutes and measure electric power consumption every 10 minutes at the measuring condition of rated dehumidifying 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.
- c) Measure twice like b) and the average is set as electric power consumption.
- d) 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.

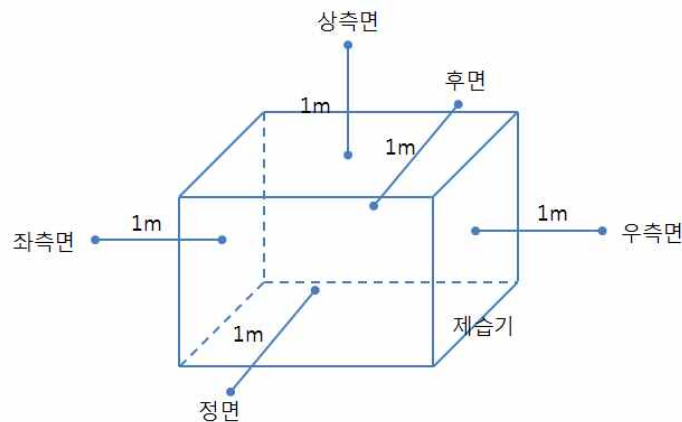
8.5 Dehumidifying Applied Area Size

It shall be in compliance with **Annex 2**.

8.6 Noise Level Test

Only noise shall be tested under the following conditions except additional functions of a dehumidifier (e.g. removing air cleaning filter). 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) A dehumidifier shall be placed on a flat and solid location and installed tightly not to shake. Here, make sure that a dehumidifier is not affected by wind pressure, vibration and/or electromagnetic fields, which can have impact on noise level.
- b) When measuring the noise of a dehumidifier, the background noise near the closest wall shall be lower by 8 dB(A) than that at the measuring points (Picture 1). In case of a dead room, however, it can not be applied.
- c) Run a dehumidifier at rated frequency and rated voltage. Here, for a dehumidifier equipped with a speed controlling device, it shall be set to maximum speed.
- d) Place a microphone at 1.0 meter away from the outer surface of the dehumidifier and measure noise.
- e) When testing noise level, the temperature and humidity inside of the test chamber shall be $27\pm 2^{\circ}\text{C}$ and $60\pm 10\%$.



상측면 (Upper Side), 좌측면 (Left Side), 우측면 (Right Side), and 정면 (Front Side), 제습기: Dehumidifier

Picture 1 - Measuring Noise (Dehumidifier)

9. Test

Test shall meet each of the requirements of be in compliance with **6** and **7** when carried out in accordance with **8**.

- a) Basic Test
- b) Dehumidification Capacity
- c) Electric Power Consumption
- d) Dehumidification Efficiency

10. Labeling

10.1 Label Requirements

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

- a) product name
- b) model name
- c) rated voltage and Frequency
- d) manufacturer and seller
- e) year and number of manufacturing
- f) type of refrigerant to use (only for a dehumidifier using refrigerant)
- g) rated dehumidification capacity (L/day)
- h) dehumidifying applied area size (m²)
- i) Rated Electric Power Consumption (W)
- j) dehumidifying efficiency (L/kWh)

10.2 Instruction Manual

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

Annex 1 Dehumidification Capacity Test

1. Scope of Application

This standard shall be applied to the measuring method of dehumidification capacity of a dehumidifier.

2. Measuring Conditions

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

Table 1. Standard Measuring Conditions

Item	Condition
Voltage And Frequency	Rated voltage and frequency
Temperature/Humidity of Test Chamber	Conditions specified in Table 2. Minimum measuring interval is every 10 minutes.
Stabilization Time	More than 30 minutes. Until electric power consumption of a dehumidifier reaches normal state (less than 5% of error)
Slope of Test Specimen	Lower than 1°

3. Measuring Dehumidification Capacity

- a) Set the temperature/humidity condition of a test chamber to standard measuring condition. Temperature and humidity shall keep being monitored (at least every 10 minutes) and recorded.
- b) Set the control switch and the wind grill of a dehumidifier to maximum mode so that dehumidification capacity can be maximum.
- c) Run a dehumidifier at normal driving condition for 30 minutes and check if electric power consumption of the dehumidifier has reached the normal state.
- d) At the point electric power consumption of the dehumidifier has reached the normal state, measure the weight of test specimen [W_1 (kg).]
- e) Run the dehumidifier at normal driving condition for 3 hours from the point when the weight of test specimen W_1 (kg) is measured and then measure the weight of test specimen [W_2 (kg)].
- f) Dehumidification capacity(W) is determined by the following equation (A-1). Here, water density is 1 kg/L.

$$W = \frac{W_2 - W_1}{T} \times 24 \quad (\text{A-1})$$

Here, T is measuring time and 24 is means conversion factor.

Annex 2 Calculation Method of Applied Area Size

1. Scope of Application

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

This calculation method for necessary dehumidification quantity in a general house is easy enough so that a user can calculate it. In case the conditions of use are quite different from those specified here, separate calculation method shall be applied.

2. Necessary Dehumidification Quantity

2.1 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 dehumidification quantity is calculative with the following equations and under the conditions.

- a) Indoor condition before dehumidification is assumed equal to ambient air condition.
- 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 August humidity of 2008 - 2012 in those regions as standard ambient air condition for region. (Table 1)
- d) The standard size of indoor space is 1 m², and standard height of an ceiling is 2.4 m, which is the most common in general houses.
- e) We set indoor temperature after dehumidification to 26°C, and relative humidity to 50%. Here, indoor absolute indoor humidity (X_t) after dehumidification is 0.0105kg/kg, and specific volume after heating (v_t) is 0.8608m³/kg. (according to Psychometric Chart)

2.2 Calculation of Necessary Dehumidification Quantity

Necessary dehumidification quantity per unit size (1m²) and unit time (hour) [(ΔX)] is calculated in this equation (B-1). Here, water density is 1kg/L.

$$\Delta X = \left(\frac{X_o}{v_o} - \frac{X_t}{v_t} \right) \cdot 2.4 \cdot n \quad (\text{B-1})$$

Here, X_0 : absolute humidity of ambient air (kg/kg)

v_0 : specific volume of ambient air(m³/kg)

X_t : indoor absolute humidity after dehumidification (kg/kg)

v_t : indoor specific volume after dehumidification(m³/kg)

2.4: ceiling height (m)

n : change of air (1/h)

Table 1. Ambient Air Conditions of Sampled Cities (The Meteorological Administration)

Condition	Region						
	Seoul	Busan	Daegu	Daejeon	Kwangju	Wonju	Kangryung
Temperature°C	26.08	26.24	26.82	25.82	26.8	25.84	24.84
Relative humidity%	71.7	75.96	69.98	76.4	76.74	73.08	77.86
Specific Volume m ³ /kg	0.8675	0.8695	0.8701	0.8678	0.8721	0.8669	0.8641
Absolute Humidity kg/kg	0.01524	0.01632	0.01554	0.01601	0.01706	0.01531	0.01537

(Average temperature/humidity of August During 2008~2012)

2.3 Necessary Dehumidification Quantity Per 1 m²

Using Equation (B-1), daily dehumidifying quantity per 1 m² of 7 cities is calculated like in Table 2.

Table 2. Necessary Dehumidification Quantity per Unit Size by General House Type

Region	Necessary Dehumidification Quantity per Unit Size (L/day·m ²)	
	Apartment	General House
Seoul	0.232	0.309
Busan	0.284	0.379
Daegu	0.245	0.326
Daejeon	0.270	0.360
Kwangju	0.318	0.424
Wonju	0.241	0.322
Kangryung	0.264	0.352

2.4 Rated Dehumidification Capacity and Dehumidifying Applied Area Size

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

b) Table 3 shows the calculation of rated dehumidifying capacity and applied area (floor) size.

c) In case of rated dehumidification capacity and dehumidifying applied area size not specified in Table 3, use Seoul standard necessary dehumidification quantity in Table 2 to calculate necessary dehumidification quantity.

Example: when rated dehumidification capacity is 6L/day, dehumidifying applied area size of apartment is $6/0.232 \approx 26\text{m}^2$.

Table 3. - Rated Dehumidification Capacity and Dehumidifying Applied Area Size (Seoul Standard)

Rated Dehumidification Capacity (L/Day)	Dehumidifying Applied Area Size (M ²)	
	Apartment	General House
1	4	3
5	22	16
10	43	32
15	65	49
20	86	65
25	108	81
30	129	97
35	151	113
40	172	129

Note) Description Method

Rated dehumidification capacity: 20 L/day

Applied floor size: apartment is 86 m², and general house is 65 m²

Annex 3 Explanation

Annex 3 is to explain the provisions of this standard and the related, so it shall not be deemed as part of this standard.

1. The Purpose of Establishing Standard

A dehumidifier is a product necessary to create pleasant environment conditions of human activities by reducing indoor humidity. As the climate of Korean peninsula has recently changed to a subtropical climate, more dehumidifiers are used. Domestic indoor dehumidifiers are mostly used during summer season. As of 2013, it is estimated that about 400,000 indoor dehumidifiers are used. As the use of indoor dehumidifier increases, Energy Efficiency Standard and Labels System has been applied since July 1st, 2012 to the effect that consumers can obtain energy efficient products easily and manufacturers (importers) produce or import energy efficient products even from the stage of production and importation. The system stipulates that a dehumidifier manufacturer or importer express an energy consumption efficiency grade so that consumers can distinguish energy saving products. In addition, consumers want to purchase a dehumidifier of capability suitable for the size of their residential area. There was a standard ((**KS C 9317-ELECTRIC DEHUMIDIFIER**)) under which dehumidifying applied area size can be certified before, but the calculation of necessary dehumidification capacity for area size was difficult and complicated. Moreover, as new types of dehumidifiers such as adsorption-type dehumidifier were launched in the market and dehumidification capacity increased, electric power consumption also increased. Therefore, it was necessary to improve the existing standard. In addition, since there was not a main actor to manage a new standard, it could cause consumers to get confused on the performance and quality of a dehumidifier. Accordingly, a new standard was made to cope with the new change and help consumers easily and better understand the applied area size by dehumidification capacity. This standard is aimed to satisfy both producers and consumers with products of above-average quality and performance and improve the competitiveness of products by specifying type of product, quality standard, and performance and test.

2. Background of Establishing Standard

Standards of dehumidifier are established and applied in USA, Japan and other countries. In Korea, **KS C 9317 (ELECTRIC DEHUMIDIFIER)** was prepared to standardize dehumidifiers and provided information of test methods on dehumidifying capacity, applied area size, and dehumidifying efficiency. However, as dehumidifying capacity of a dehumidifier was more demanded to increase and new types of dehumidifiers were introduced. accordingly, it was necessary to revise the existing KS Standard. In this respect, Korea Air Cleaning Association organized the **EXPERT COMMITTEE OF INDOOR DEHUMIDIFIER COLLECTIVE STANDARD** and built a draft of the revision on the basis of **KS C 9317 (ELECTRIC DEHUMIDIFIER)**. And it gathered opinions from related fields (business, schools, certification authorities and so on) and finalized this standard.

3. Scope of Application

This standard can be applied to a dehumidifier using lower than 1,000W, which can be used not only in a general house and apartment, but also office room building.

4. Considerations

Like an air conditioner, a dehumidifier is easy to increase the chance of pollution by microorganism because damp air condenses in its evaporator and water is formed. According to many of previous studies, much microorganism is generated and discharged at the beginning of operation of a household and car air

conditioner and it can do harm on those who are vulnerable to pollution such as infants, young children and seniors. Since a dehumidifier is an electronic appliance mainly used for wet and damp summer season during which microorganism actively proliferates, it is imperative to test and evaluate the safety from discharge of microorganism. Therefore, it is necessary and worth adding tests on discharging safety of microorganism for consumers to choose safe products easily.