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Household and similar electrical air cleaning appliances — Methods for measuring the performance —

Part 3-1: Particular requirements for reduction of microorganisms

Appareils électrodomestiques et analogues de purification de l'air — Méthodes de mesure de la performance —

Partie 3-1: Exigences particulières pour la réduction des microorganismes

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International Electrotechnical Commission

Method for Assessing the Reduction Rate of Key Bioaerosols by Portable Air Cleaners Using an Aerobiology Test Chamber

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IEC PAS 63086-3-1 has been prepared by the Association of Home Appliance Manufacturers (AHAM) and processed by IEC technical committee 59, Subcommittee 59N: Performance of household and similar electrical appliances. It is based on ANSI/AHAM AC-5-2022.

The text of this PAS is based on the following document

59N/XXX/DPAS

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Report on voting

59N/XXX/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned will transform it into an International Standard.

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INTRODUCTION

This Publicly Available Specification (PAS) contains test procedures for measuring the reduction by the air cleaner of micro-organisms suspended in the air in the specified test chamber. It also prescribes a method for measuring the operating power and stand-by power of the air cleaner. The test procedures may be applied to any brand or model of household and similar electrical air cleaners within the stated confines of the standard's limits of measurability for measuring performance.

The annexes to this PAS are included for informative purposes only unless the annexes are noted as normative.

Warning—The tests given in this document shall be performed by expert staff trained to handle microorganism-related techniques and in properly equipped laboratories under the supervision of a skilled microbiologist. Some of the test micro-organisms might be facultative pathogens for humans, animals and plants and requires a laboratory of an appropriate bio-safety level. National and international safety procedures for working with infectious biomaterials shall be followed to prevent any contamination of laboratory staff, apparatus, working place or environment in compliance with national standards or regulations. This document does not purport to address all of the safety aspects, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and ensure compliance with any national, regional or international regulatory conditions.

This PAS may involve hazardous materials, operations and equipment. This PAS does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this PAS to consult and establish appropriate safety and health practices and determine the applicability of any regulatory limitations prior to use.

29 International Electrotechnical Commission

30

31 **Method for Assessing the Reduction Rate of Key Bioaerosols by**
32 **Portable Air Cleaners Using an Aerobiology Test Chamber**

33

34

35 **INTRODUCTION**

36 Indoor air free of harmful microbes is important to the health of occupants. This is
37 particularly relevant with regard to increased time spent indoors.

38 Air cleaners are used to reduce the concentrations of microorganisms in indoor air.

39 The efficiency of such air cleaners to reduce airborne microorganisms can be assessed in test
40 chambers at controlled air temperature and relative air humidity.

41 **1. SCOPE**

42 This document specifies a method to evaluate the capability of portable household air
43 cleaners to reduce the concentration and viability of key experimentally generated
44 bioaerosols in a specified chamber.

45 The test is applicable to portable air cleaners commonly used in single room spaces such
46 as those based on mechanical filtration, ultraviolet (UV), ionizers, photocatalytic
47 oxidation, and ozone generators in-unit technology.

48
49 If the air cleaner does not claim to have the function of reducing microorganisms, this
50 standard may not be applicable unless it is being used to simply evaluate the
51 performance.

52
53 This document deals with measurement procedures regarding the reduction of the
54 microbial contamination related to electrical air cleaner appliances for household and
55 similar use.

56
57 This document does not apply to appliances intended to be used in medical, veterinary, or
58 pharmaceutical applications.

59
60 This document does not address sanitization, disinfection, or sterilization measures.

61
62 This document does not support, by itself any health-related claims or conclusions about
63 prevention or treatment of a disease or health improvement.

64
65 Note: IEC 63086-3-1 is created for Household and Similar Electrical Air Cleaners and is
66 not intended to conflict with or replace standards for commercial or industrial consumers.

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Note: In this standard, we do not suggest performance test methods that measure the by-products of either the interaction between microbes or between the air cleaner and the microbes tested in this standard. The formation of by-products is an important subject. The subject of measuring by-products is under study, and AHAM will address this in future documents.

Note: This standard does not apply to appliances intended for use in medical treatment locations, such as surgical suites, laboratories, medical treatment rooms, etc.

77 2. NORMATIVE REFERENCES

78 The following documents are referred to in the text so that some or all of their content
79 constitutes the requirements of this document. Only the edition cited applies for dated
80 references, and the latest edition of the referenced document (including any amendments)
81 applies for undated references.

82 ASTM E741-11(2017): *Standard Test Method for Determining Air Change in a Single Zone by*
83 *Means of a Tracer Gas Dilution*

84 ASTM E3273-21: *Standard Practice to Assess Microbial Decontamination of Indoor Air using*
85 *an Aerobiology Chamber*

86 GB21551.3-2010: *Antibacterial and cleaning function for household and similar electrical*
87 *appliances – Particular requirements for air cleaner*

88 ISO 3696: *Water for analytical laboratory use — Specification and test methods*

89 ISO 16000-9: *Indoor air — Part 9: Determination of the emission of volatile organic compounds*
90 *from building products and furnishing — Emission test chamber method*

91 ISO 16000-36: *Standard method for assessing the reduction rate of culturable airborne bacteria*
92 *by air cleaners using a test chamber*

93 JEMA 1467-2015: *Appendix D - Evaluation test for removing performance of floating virus*

94 JEMA 1467-2015: *Appendix E - Evaluation test for restraining performance of indoor adhered*
95 *virus*

96 JEMA 1467-2015: *Appendix F - Evaluation test for restraining performance of virus caught by*
97 *the filter*

98 **3. TERMS AND DEFINITIONS**99 **3.1 Air Cleaner**

100 electrically powered household or similar, appliance that employs one or multiple
 101 technologies to reduce, destroy, and/or inactivate one or more types of indoor air
 102 pollutants [Source: IEC 63086-1 modified]

103 **Note to entry:** the term **Air Purifier** is defined as an Electrically powered
 104 device that is basically built of a fan and a set of components possessing
 105 the ability to capture and/or (partially or totally) destroy air pollutants
 106 [Source: ISO 16000-36] but PAS 63086-3-1 has chosen to not use this
 107 term in this document as it may not be possible to totally destroy an air
 108 pollutant.]

109 **3.2 Background Concentration**

110 quantity of **microbes** in the chamber after the chamber has undergone cleaning
 111 and prior to any testing or addition of **microbes** via nebulization

112 **3.3 Bacteria**

113 prokaryotic, single-celled, microscopic organism with peptidoglycan cell wall

114 **3.4 Bacteriophage or phage**

115 group of **viruses** that infect **bacteria** or **fungi**

116 **3.5 Bioaerosol**

117 airborne particle that is composed of or derived from biological matter (such as a
 118 bacterial cell, fungal or bacteria spore, **virus**, or endotoxin)

119 **3.6 Biological Safety Levels (BSL)**

120 series of protections relegated to autoclave-related activities that take place in
 121 particular biological labs

122 Note to entry: This includes individual safeguards designed to protect laboratory
 123 personnel, as well as the surrounding environment and community. For BSL
 124 level expectations, a lab should follow the most recent version of the WHO
 125 Laboratory Biosafety Manual, the CDC Biosafety in Microbiological and
 126 Biomedical Laboratories (BMBL) or the Canadian Biosafety Standards and
 127 Guidelines.

128 **3.7 CADR (Clean Air Delivery Rate)**

129 measure of **air cleaner** performance by this test procedure

130

131 Note to entry: Clean Air Delivery Rate (CADR) is defined as the measure of the
132 delivery of contaminant-free air, within the defined particle size range, by an **air**
133 **cleaner**, expressed in cubic feet per minute (cfm) or cubic meters per hour. Clean
134 Air Delivery Rates are the rates of contaminant reduction in the test chamber
135 when the **air cleaner** is turned on, minus the rate of **natural decay** when the **air**
136 **cleaner** is not running, multiplied by the volume of the test chamber as measured
137 in cubic feet or cubic meters (see Section 8.5). CADRs values are always the
138 measurement of an **air cleaner** performance as a complete system, and they have
139 no linear relationship to air movement per se or to the characteristics of any
140 particular particle removal methodology.

141
142 Note to entry: For this standard we use the designation of m-CADR which is the
143 clean air delivery rate for microbes.

144 **3.8 Colony Forming Units (CFU) for bacteria and fungi**

145 unit of measurement by which the number of culturable **microbes** (*Bacteria and*
146 *fungi*) is expressed

147 **3.9 Device Under Test (DUT)**

148 test sample of the **air cleaner** undergoing examination

149 **3.10 Fungi**

150 multicellular eukaryotic organisms without chlorophyll and with cell walls

151 **3.11 Impaction**

152 sampling of the airborne **microbe** by inertial separation on a semisolid agar surface

153 **3.12 Impinger method**

154 glass or plastic device for the collection of air samples into a liquid medium
155 through a scrubbing action.

156
157 Note to entry: The liquid volume is subsequently utilized for dilution and
158 inoculation of counting plates.

- 159 **3.13 Initial Concentration**
- 160 concentration of **microbes** inside the chamber immediately at the start time of
- 161 sampling of either the **natural decay** or the total decay
- 162 **3.14 Maximum Performance Mode**
- 163 through manual operation the DUT is set to the highest flow rate with all air
- 164 cleaning functions switched on, set to maximum, where applicable, and with all
- 165 filters in place
- 166 Note to entry: If the DUT has zero flow rate, the m-CADR is measured with all
- 167 air cleaning functions switched on.
- 168 **3.15 Microbes (also known as Microorganisms)**
- 169 microscopic living beings that cannot be seen with the naked eye, including
- 170 **bacteria**, protozoa, **viruses** and **some fungi**/fungal components
- 171
- 172 Note to entry: They are common in the environment as well as in/on our own
- 173 bodies.
- 174 **3.16 Microbial Reduction**
- 175 reduction rate of viable **microbe** is measured by comparing the concentration of
- 176 the **microbe** after nebulizing a microbial suspension inside the chamber with the
- 177 concentration determined after a defined running time (testing time) of the **air**
- 178 **cleaner**
- 179 Note to entry: The microbial reduction rate is expressed as natural log reduction
- 180 over time.
- 181 **3.17 Natural Decay**
- 182 rate of reduction of the airborne concentration of viable microbiological
- 183 contaminants as measured without an air-cleaning device operating in an
- 184 aerobiology chamber
- 185
- 186 Note to entry: The **natural decay** rate is expressed as natural log reduction
- 187 over time.
- 188
- 189 **3.18 Plaque Forming Units (PFU)**
- 190 Unit of measurement by which the number of viable **viruses** is expressed
- 191 **3.19 Virus**