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PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Method for measuring performance of portable household electric room air cleaners

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

METHOD FOR MEASURING PERFORMANCE OF PORTABLE HOUSEHOLD ELECTRIC ROOM AIR CLEANERS

FOREWORD

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IEC-PAS 62587 has been prepared by the Association of Home Appliance Manufacturers (AHAM) and processed by IEC technical committee 59: Performance of household and similar electrical appliances. It is based on ANSI/AHAM AC-1-2006

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
59/499/PAS	59/506/RVD

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

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

INTRODUCTION

This Publicly Available Specification (PAS) contains test procedures for measuring the relative reduction by the air cleaner of particulate matter suspended in the air in a specified test chamber. It also prescribes a method for measuring the operating power and standby power of the air cleaner. The test procedures may be applied to any brand or model of portable household electric room 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.

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.

METHOD FOR MEASURING PERFORMANCE OF PORTABLE HOUSEHOLD ELECTRIC ROOM AIR CLEANERS

1 Scope and object

This Publicly Available Specification establishes a system of uniform, repeatable procedures and standard methods for measuring specified product characteristics of portable household electric room air cleaners.

The standard methods provide a means to compare and evaluate different brands of portable household electric room air cleaners regarding characteristics significant to product use.

The standard methods of measurement are not intended to inhibit improvement and innovation in product testing, design or performance.

This standard method applies to portable household electric room air cleaners as defined in Clause 3.

This standard method includes definitions and safety characteristics of portable household electric room air cleaners of the types indicated.

This standard method measures the relative reduction by the air cleaner of particulate matter suspended in the air in a specified test chamber. It also prescribes a method for measuring the operating power and standby power of the air cleaner.

This standard method has defined limits of measurability based on the statistical accuracy of the methods. Based on a 95 % confidence limit (2 standard deviations), a clean air delivery rate (CADR) (see 3.5) cannot be distinguished between zero (0) and a CADR rating less than those CADR limits shown below. Therefore, this PAS only applies to air cleaners with minimum CADR ratings of:

Dust	CADR = 10 cfm
Cigarette smoke	CADR = 10 cfm
Pollen	CADR = 25 cfm

The maximum CADR values are determined based on theoretical maximum limits. The theoretical maximum limits are determined by the maximum number of initial available particles, the acceptable minimum number of available particles, an average background natural decay rate (from statistical study), the size of the chamber, and the available minimum experiment time. CADR values greater than those listed will not have the necessary statistical data required by this method. Therefore, the document only applies to air cleaners with maximum CADR ratings of:

Dust	CADR = 400 cfm
Cigarette smoke	CADR = 450 cfm
Pollen	CADR = 450 cfm

The precision of this document as based on a 0 CADR air cleaner expressed as 2 standard deviation limits (95 %) are:

Dust	CADR = ± 10 cfm
Cigarette Smoke	CADR = ± 10 cfm
Pollen	CADR = ± 25 cfm

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM E747, *Standard Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
aerosol spectrometer
device for measuring particle size distribution in room air (see Annex A)

3.2 Air circulating equipment

3.2.1
ceiling mixing fan
high volume ceiling fan used to mix the chamber during contaminant aerosol generation

3.2.2
recirculation fan
fan capable of producing between 300 cfm and 400 cfm and used for the purpose of maintaining a homogeneous environment within the chamber (as specified in Annex A)

3.3
aerodynamic particle size
classification of particle sizes as spheres of unit density based on terminal settling velocities

3.4
cigarette smoke diluter
device for reducing the concentration of cigarette smoke by a known factor to a level suitable for measurement

3.5
Clean Air Delivery Rate
CADR
measure of air cleaner performance by this test procedure.

NOTE Within the scope of this PAS, CADR is defined as the measure of the delivery of contaminant free air by a portable household electric room air cleaner, expressed in cubic feet per minute (cfm). More technically, clean air delivery rates are the rates of contaminant reduction in the test chamber when the unit is turned on, minus the rate of natural decay when the unit is not running, times the volume of the test chamber as measured in cubic feet (see 8.5). CADRs are always the measurement of a unit's performance as a complete system, and they have no linear relationship to air movement *per se* or to the characteristics of any particular particle removal methodology.

3.6 Design characteristics

3.6.1
fan with filter
air cleaners which operate with an electrical source of power and which contain a motor and fan for drawing air through a filter media

3.6.2
fan and electrostatic plates
air cleaners which operate with a fan with electrostatic plate or wires to electrostatically collect particulate matter; may include a filter(s)

3.6.3
fan filter with ion generator
air cleaners which incorporate an ion generator in addition to a fan and filter

3.6.4
ion generator
air cleaners which incorporate an ion generator only

3.6.5
other types

device which has the stated capability to reduce the concentration of particulate matter in a room

NOTE Such devices do not have to contain a fan and can incorporate any of the particle removal methods noted above.

3.7 Generators

3.7.1
aerosol generator
device which produces and disseminates liquid or solid particles that are suspended in air

3.7.2
cigarette smoke generator
aerosol generator which disseminates test cigarette smoke with particle sizes specified in 3.16.1 into the air.

3.7.3
dust generator
aerosol generator which disseminates test dust with particle sizes specified in 3.16.2 into the air

3.7.4
pollen generator
aerosol generator which disseminates test pollen with particle sizes specified in 3.16.3 into the air

3.8
High Efficiency Particulate Air filter
HEPA
air filter with greater than or equal to 99,97 % removal of dioctyl phthalate at 0,3 µm diameter

NOTE The fractional efficiency of such filters can be verified using Mil-Std-282 or IEST-RP-CC007.1.

3.9
natural decay
reduction of particulate matter due to the natural phenomena in the test chamber, principally agglomeration, surface deposition (including sedimentation), and air exchange

3.10
particulate matter removal
reduction of particle number concentration in air due to the operation of the air cleaner

3.11 Portable room air cleaners

3.11.1
portable household electric room air cleaner
electric appliance with the function of removing particulate matter from the air and which may be moved from room to room

3.11.2
floor type room air cleaner
designed to stand alone on the floor of a room and are designated as stand-alone floor models by the manufacturer

NOTE Appliances of this type are tested on the floor as close to the center of the chamber as possible.

3.11.3
table type room air cleaner

designed to set on a table or counter by the manufacturer

NOTE Appliances of this type are tested on the table stand at the center of the chamber.

3.11.4
wall type room air cleaner
designed either to attach to a wall and are designated as wall mountable by the manufacturer or as a plug-in unit

NOTE A wall type unit includes the appropriate wall mounting brackets or specifically designated instructions to mount the room air cleaner integrally to the wall (i.e. not a shelf). Appliances of this type are tested on the wall mount stand placed at the center of the chamber (see Figure G.1).

3.11.5
combination type room air cleaner
designed to operate in one or more orientations/positions (floor, table, wall) as designed by the manufacturer

NOTE A combination type room air cleaner may be tested at the center of the room on either the floor, table, or wall mount stand, according to how it has been designated by the manufacturer (see 3.11.2, 3.11.3, 3.11.4).

3.11.6
ceiling type room air cleaner
designed to be mounted on the ceiling and are considered outside the scope of this method as defined in Clause 3

NOTE Uniform testing practices and statistical examination of such appliances have not been conducted.

3.11.7
plug-in type room air cleaner

fixed location appliance directly connected to an electric receptacle (outlet) by means of direct plug-in (no electric cord)

NOTE Appliances of this type are tested at the lower level electrical receptacle of the plug-in type test stand as shown in Figure G.1.

3.12
particle number concentration
number of particles per cubic centimeter of room air

3.13
room size
maximum suggested room size for an air cleaner

NOTE The room size is determined by mathematical modelling of steady state and is based on the CADR requirement to remove 80 % of cigarette smoke particles between 0,1 micron and 1,0 microns on a continuously steady-state basis. See 8.6 and Annex E.

3.14
terminal settling velocity
maximum velocity achieved by a particle under given conditions

3.15
test chamber

room size chamber for determining performance in removing particulate matter from the air

NOTE The specifications for the chamber are in Annex A.

3.16 Test particulate matter

3.16.1
cigarette smoke
produced by burning cigarette tobacco with air forced through the cigarette's filter having particle sizes detected from 0,10 µm to 1,0 µm diameter

3.16.2
air cleaner fine fraction test dust (Arizona road dust)
commercially available test dust with particle sizes detected from 0,5 µm to 3,0 µm

3.16.3
pollen
particulate matter naturally occurring from plants; pollen used is paper mulberry pollen (non-defatted) with a particle size range of 5 µm to 11 µm, including fragments

4 General conditions for measurement

4.1 Electrical supply

4.1.1 General

Standard frequencies and voltages for the CADR testing and operating power test are listed under 4.1.2 and 4.1.3. Other frequencies and voltages may be used to produce CADR values. The specific electrical supply conditions shall be concurrently reported with the applicable CADR values.

NOTE Refer to Clause 9 for the measurement of operating power test.

4.1.2 Frequencies

Operate air cleaner at one of the following frequencies:

Europe	50 Hertz
North America	60 Hertz
Japan	50/60 Hertz
China	50 Hertz
Australia and New Zealand	50 Hertz

4.1.3 Voltage

Operate air cleaner at one of the following voltages:

Europe	230V
North America	115V
Japan	100 V
China	220 V
Australia and New Zealand	230 V

NOTE See Clause 10 for the voltage requirements for the measurement of standby power test.

4.2 Test chamber ambient temperature

Chamber ambient temperature shall be 21 ºC ± 3 ºC (70 ºF ± 5 ºF) with a relative humidity (RH) of 40 % ± 5 % for CADR and the measurement of operating power tests.

NOTE Refer to Clause 10 for the temperature for the measurement of standby power test.

4.3 Chamber air exchange rate

The chamber air exchange rate shall be less than 0,03 air changes per hour as determined by ASTM E747 or an equivalent method.

4.4 Chamber particulate concentrations

4.4.1 Measurability

The acceptable range of particle concentrations for the initial test condition (time (t) =2 minutes for cigarette smoke; t = 0 minutes for dust and pollen) are:

Cigarette smoke	24 000 particles/cm^3 to 35 000 particles/cm^3 (diluter may be required)
Sampling period	(20 s at 0,06 L/min ± 5 %)
Dust	200 particles/cm^3 to 400 particles/cm^3
Sampling period	(20 s at 1 L/min ± 5 %)
Pollen	4 particles/cm^3 to 9 particles/cm^3
Sampling period	(20 s at 1 L/min ± 5 %)

NOTE Use of a particle counter with different flow rates than the ones specified above is acceptable as long as the particle counter provides equivalent performance characteristics.

The lower limit of instrument measurability is based on a minimum of 10 particle counts and is defined by the practical counting limits of particle measuring instrumentation. These are:

Dust	0,03 particles/cm^3
Cigarette smoke	20 particles/cm^3
Pollen	0,03 particles/cm^3

4.4.2 Test chamber background level

This is the allowable level of particulate matter in the test chamber prior to the introduction of the test material. This level is not to be greater than the lower limit of instrument measurability.