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Cleaning robots for household use Dry-cleaning Methods of measuring performance (standards.iteh.ai)

Robots de nettoyage à usage domestique – Nettoyage à sec: Méthodes de mesure de l'aptitude à la fonction 090b25afl eeb/iec-62929-2014





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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLEANING ROBOTS FOR HOUSEHOLD USE – DRY-CLEANING: METHODS OF MEASURING PERFORMANCE

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International Standard IEC 62929 has been prepared by subcommittee 59F: Surface cleaning appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

The text of this standard is based on the following documents:

FDIS	Report on voting
59F/258/FDIS	59F/262/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this standard, the following print types are used:

- bold for terms defined in Clause 3.

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INTRODUCTION

In addition to the performance measurement methods which are included in this International Standard, a few more performance items have been reviewed and considered. The list of the performance items which have been discussed over time but have not yet been included comprises corner/edge dust pick-up, noise, docking, fall-off prevention, fibre pick-up and emissions.

The performance items which have been left out in this edition will be continuously reviewed and will soon be included in future editions of this standard.

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CLEANING ROBOTS FOR HOUSEHOLD USE – DRY-CLEANING: METHODS OF MEASURING PERFORMANCE

1 Scope

This International Standard is applicable to **dry cleaning robots** for household use in or under conditions similar to those in households.

The purpose of this standard is to specify the essential performance characteristics of dry **cleaning robots** and to describe methods for measuring these characteristics.

This standard is neither concerned with safety nor with performance requirements.

2 Normative references

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

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IEC 60312-1:2010, Vacuum cleaners for household use – Part 1: Dry vacuum cleaners – Methods for measuring the performance **1 ards.iten.ai**) IEC 60312-1:2010/AMD1:2011

IEC 62929:2014

ISO 554, Standard atmospheres for conditioning and/or/testing 55 Specifications 090b25afleeb/iec-62929-2014

ISO 679:2009, Cement – Test methods – Determination of strength

ISO 2768-1:1989, General tolerances -- Part 1: Tolerances for linear and angular dimensions without individual tolerance indications

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60312-1, as well as the following apply.

3.1

cleaning robot

automatic battery-powered cleaners

automatic floor cleaner that operates autonomously without human intervention within a defined perimeter

Note 1 to entry: The **cleaning robot** consists of a mobile part and may have a **docking station** and/or other accessories to assist its operation.

3.2

dry cleaning robot

cleaning robot that is intended to remove only non-liquid material from the floor using by means other than with the aid of solutions or liquids

¹ There is a consolidated edition 1.1 (2011), that includes IEC 60312-1:2010 and its amendment IEC 60312-1:2010/AMD1:2011.

Note 1 to entry: Typical means of cleaning include vacuum, brush(es), pad(s) and duster.

3.3

cleaning head

air intake nozzle at the bottom of the cleaning robot

Note 1 to entry: The width of the **cleaning head** is the width of the air intake nozzle in the direction of forward travel.

Note 2 to entry: It does not include any agitation device.

3.4

agitation device

motorized mechanical part or an air-blower attached to the **cleaning robot** used to assist dirt removal

3.5

docking station

base unit

unit that may provide manual or automatic battery charging facilities, dust removal from the robot, data processing facility or other robot support functions

3.6

passive cleaning head

cleaning head without agitation device

[SOURCE: IEC 60312-1:2010, 3.5, modified – "nozzle" has been replaced by "cleaning head".] (standards.iteh.ai)

3.7

IEC 62929:2014

visual tracking system VTS

measurement system which enables the tracking of robot position and orientation

3.8

secondary collection system

peripheral device outside of the robot that collects the dust from the cleaning robot

3.9

dust receptacle

container inside of the robot used to hold the collected dust

3.10

test

entirety / superset of all (test) runs and (test) trials of all samples to be measured for a single robot

3.11

trial

single instance of a performance measurement carried out under identical conditions that can be repeated multiple times

3.12

run

subset of a trial where one or more factors affecting the test results is (are) changed

3.13

pass traverse of the cleaning head over the test area

Note 1 to entry: The number of passes refers to the number of times the same test area has been traversed by the cleaning head.

3.14

4.3

dust area

area where the **test** dust is distributed for the dust removal **test**

4 General conditions for testing

4.1 **Atmospheric conditions**

Unless otherwise specified, the test procedures and measurements shall be carried out under the following atmospheric conditions (in accordance with ISO 554):

Temperature:	(23 ± 2) °C
Relative humidity:	(50 \pm 5) %
Air pressure:	86 kPa to 106 kPa

Temperature and humidity conditions within the specified ranges are required for good repeatability and reproducibility. Care shall be taken to avoid changes during a test.

4.2 Lighting conditions

Unless otherwise specified, the test procedures and measurements shall be carried out under the following lighting conditions TANDARD PREVIEW

(200 ± 50) (standards.iteh.ai) Intensity:

Colour temperature: 2 000 K to 6 000 K

Measurements shall be made on the floor level. https://standards.iteh.a/catalog/standards/sist/8b74ac59-2555-490d-838c-

090b25afleeb/iec-62929-2014 Test equipment and materials

To minimize the influence of electrostatic phenomena, measurements on carpets shall be carried out on a level floor consisting of a smooth untreated pine plywood or equivalent panel, at least 15 mm thick and of a size appropriate for the test.

Equipment and materials for measurements (devices, test carpets, test dust, etc.) to be used in a **test** shall, prior to the **test**, be kept for at least 16 h at standard atmospheric conditions according to 4.1.

Carpets that have already been used shall be stored unbeaten at standard atmospheric conditions according to 4.1.

When not in use, carpets shall be hanging free, or lying flat, pile upwards and uncovered. Carpets shall not be rolled when stored between testing. Carpets that have been rolled shall be laid flat for a minimum of 16 h before use.

4.4 Number of samples

All measurements of performance shall be carried out on the same sample(s) of the cleaning **robot** with its attachments, if any. During a set of tests the sample robot shall not be changed.

A minimum of three samples of the same model shall be tested.

4.5 Running-in of a new cleaning robot

Prior to the first test on a new cleaning robot it shall be kept running on a clean hard floor for at least 10 min to ensure adequate running-in.

Prior to conducting any series of tests, the age, condition, and history of the product shall be recorded.

4.6 **Preparation of battery**

Any unused battery shall need to go through at least one full charge and complete discharge cycle prior to conducting any series of tests.

Complete discharge shall be done by carrying out a normal cleaning operation following the manufacturer's instructions.

4.7 Operation of the cleaning robot

Unless otherwise specified.

- the cleaning robot, its attachments, the docking station and any accessories shall be used and adjusted in accordance with the manufacturer's instructions for normal operation before a **test** is carried out, and
- the operation mode of the robot can be selected and adjusted according to the manufacturer's published instructions only before the test to fit the environment to be cleaned.

Any safety-related device shall be able to operate.

Measurement of dust receptacle weight D PREVIEW 4.8

For the dust removal test, it is required to weigh the dust receptacle. If the dust receptacle is removable the receptacle shall be carefully removed from the robot and the receptacle shall be weighed.

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https://standards.iteh.ai/catalog/standards/sist/8b74ac59-2555-490d-838c-If the dust receptacle is not removable and/ia_secondary collection system needs to be used to remove the dust collected in the receptacle the weight increase of the removable receptacle in the secondary collection system shall be weighed and recorded.

For the robot that does not have a **dust receptacle** and only uses wiping pad the weight of the pad shall be measured instead of the dust receptacle.

If the dust receptacle is not removable and a secondary collection system is not used to remove the dust collected in the receptacle the complete cleaning robot shall be reweighed.

4.9 Measurement resolution and accuracy

Unless specified in the test methods the resolution and the accuracy of the measurement device shall be as follows.

Weight measurement:

Resolution \leq 0,01 g

Accuracy ≤ 0.02 g

Position measurement by vision:

Coverage test

Position resolution \leq 3 cm

Position accuracy \leq 5 cm

Sampling rate \geq 30 Hz

Straight line test

Position resolution \leq 1 cm

Sampling rate \geq 30 Hz

Average speed test

Position resolution \leq 1 cm

Position accuracy < 1 cm

Sampling rate \geq 30 Hz

Time measurement:

Resolution \leq 0,01 s

Accuracy \leq 0,02 s

4.10 Tolerance of dimensions

For all dimensions which are not presented as a range and no tolerance is specified the tolerance shall be determined as Table 1.

Nominal size range mm	Tolerance mm
3 ≤ 6	± 0,5
> 30 ≤ 120	
> 120 < 400 tandard	Is.iteh.ai) _{± 2,5}
> 400 ≤ 1 000	± 4,0
https://standards.iten.a/catalog/standa	rds/sist/8b74ac59-255 6-9 90d-838c-
$> 2\ 000 \le 5\ 00090b25afleeb/i$	ec-62929-2014 ± 8,0
NOTE Values are taken from Table 1 of	SO 2768-1:1989.

Table 1 – Tolerance of dimensions

5 Dust removal test – Box

5.1 General

This **test** is designed to give indicative data on the dust removal capability of a robotic cleaner, while allowing it to function and move in an autonomous way in an open area with no obstacles. Navigation strategies differ, so the dust removal result shall always be reported with time taken to deliver that score, to allow for relative comparison between different products.

NOTE 1 Dust removal scores are a factor of both the unit's dust removal system and navigation strategy so cannot be directly compared with dust removal results from manually operated vacuum cleaners as per IEC 60312-1.

NOTE 2 As robotic cleaners can and will make autonomous decisions about how best to navigate the box **test** area, it is unlikely that any two **runs** of a robot with same **test** conditions will ever follow exactly the same cleaning pattern. As such, it is understood that there will be a level of inherent variation in this **test** that cannot be designed out, which could be reflected in the dust pick up scores even over the same length of time from the same start position.

5.2 Dust removal from hard flat floors

5.2.1 Test bed

The length and the width of the **test** bed shall be 2 000 mm \times 1 150 mm as specified in Figure 1. The height of the wall surrounding the **test** bed floor shall be 300 mm tall. The inner

side of the wall shall be untreated pine wood colour. The ceiling height of the room in which the **test** is executed shall not be higher than 3 500 mm. The **test** bed has one **dust area** of 1 300 mm \times 500 mm centred in the **test** bed as shown in Figure 1. The **test** floor shall be untreated laminated pine tree plate or equivalent (more detail of the floor specification is under consideration) and its thickness shall be at least 15 mm.

To prevent the entrapment of the **test** dust beneath the wall during the **test** the gap between the wall and the floor shall be properly sealed.

5.2.2 Preparation of test

5.2.2.1 Preconditioning of test floor

The test floor shall be cleaned so that no dust remains prior to any subsequent test.

5.2.2.2 Pre-treatment of cleaning robot

If the **cleaning robot** is designed to be used with disposable **dust receptacles** it shall, prior to each **test**, be equipped with a new **dust receptacle** of the type recommended or supplied by the manufacturer of the **cleaning robot**.

If the cleaning robot is provided with a reusable dust receptacle (as the sole original dust receptacle or as an enclosure for disposable dust receptacles) the dust receptacle shall, prior to each measurement, be cleaned according to the manufacturer's instructions until its weight is within 1 % of its original weight DARD PREVIEW

A dust receptacle made of textile is not permitted to be cleaned by brush and water.

A plastic **dust receptacle** shall be clean<u>ed following the</u> instructions in the user manual. If the **dust receptacle** is cleaned with water it shall be dried wells before any test and measurement.

Some reusable receptacles consist of a rigid container and an integral filter. In this case the container and the filter are considered to be the receptacle and shall be treated as if they were a single component.

Any replaceable filters and dust collection parts (e.g. dust pad) shall be preconditioned as instructed in each **test** procedure.

Dust collecting parts shall be pre-treated in order to minimize the influence of humidity.

Prior to each **test run**, replaceable filter(s) and dust collection parts (e.g. wiping pad) in the robot (or in the **secondary collection system**) shall be replaced with new ones.

The battery shall be fully re-charged prior to each **run** following the manufacturer's instructions.

5.2.2.3 Distribution of test dust

The **test** dust shall consist of dolomite sand with the grain size distribution as defined in the Mineral dust – Type 1 table in 7.2.2.1 of IEC 60312-1:2010.