BSI Standards Publication

Surface cleaning appliances

Part 7: Dry cleaning robots for household or similar use — Methods for measuring the performance

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Full document details: BS EN IEC/ASTM 62885-7:2021+A1:2023

National foreword

This British Standard is the UK implementation of EN IEC/ASTM 62885-7:2021+A1:2023. It is identical to IEC/ASTM 62885-7:2020, incorporating amendment 1:2022. It supersedes BS EN 62929:2014, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC/ASTM text carry the number of the IEC/ASTM amendment. For example, text altered by IEC/ASTM amendment 1 is indicated by [A1] [A1].

The UK participation in its preparation was entrusted to Technical Committee CPL/59/6, Floor treatment appliances.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Date	Text affected
30 June 2023	Implementation of IEC/ASTM amendment 1:2023 with CENELEC endorsement A1:2023

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC/ASTM 62885-7:2021+A1

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Supersedes EN 62929:2014 and all of its amendments and corrigenda (if any)

English Version

Surface cleaning appliances - Part 7: Dry-cleaning robots for household or similar use - Methods for measuring the performance (IEC/ASTM 62885-7:2020)

Appareils de nettoyage des sols - Partie 7 : Robots de nettoyage à sec à usage domestique ou analogue - Méthodes de mesure de l'aptitude à la fonction (IEC/ASTM 62885-7:2020)

Geräte zur Oberflächenreinigung - Teil 7: Trocken-Reinigungsroboter für den Hausgebrauch und ähnliche Anwendungen - Verfahren zur Messung der Gebrauchseigenschaften (IEC/ASTM 62885-7:2020)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 59F/393/FDIS, future IEC/ASTM 62885-7, prepared by SC 59F "Surface cleaning appliances" of IEC/TC 59 "Performance of household and similar electrical appliances" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC/ASTM 62885-7:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-09-02
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-12-02

This document supersedes EN 62929:2014 and all of its amendments and corrigenda (if any).

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Endorsement notice

The text of the International Standard IEC/ASTM 62885-7:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60335-1:2010	NOTE	Harmonized as EN 60335-1:2012
IEC 60335-2-2:2019	NOTE	Harmonized as EN IEC 60335-2-2:—[1] (not modified)
ISO 2768-1:1989	NOTE	Harmonized as EN 22768-1:1993 (not modified)

[1] To be published. Stage at the time of publication: prEN IEC 60335-2-2:2020.

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European foreword to Amendment 1

This document (EN IEC/ASTM 62885-7:2021/A1:2023) consists of the text of document IEC/ASTM 62885-7:2020/AMD1:2022, prepared by IEC/TC 59 "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-02-20
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2026-02-20

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Endorsement notice to Amendment 1

The text of the International Standard IEC/ASTM 62885-7:2020/AMD1:2022 was approved by CENELEC as a European Standard without any modification.

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Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 62301	-	Household electrical appliances - Measurement of standby power	EN 50564	-
IEC/TS 62885-1	-	Surface cleaning appliances - Part 1: General requirements on test material and test equipment	-	-
IEC 62885-2	2016	Surface cleaning appliances - Part 2: Dry vacuum cleaners for household or similar use - Methods for measuring the performance	-	-
IEC 60704-1	-	Household and similar electrical appliances - Test code for the determination of airborne acoustical noise - Part 1: General requirements	EN 60704-1	-
IEC 60704-2-17	-	Household and similar electrical appliances - Test code for the determination of airborne acoustical noise - Part 2-17: Particular requirements for dry-cleaning robots	EN IEC 60704-2-17	-
ISO 554	-	Standard atmospheres for conditioning and/or testing - Specifications	-	-
ISO 2813	-	Paints and varnishes - Determination of gloss value at 20 degrees, 60 degrees and 85 degrees	EN ISO 2813	-

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SURFACE CLEANING APPLIANCES –

Part 7: Dry-cleaning robots for household or similar use – Methods for measuring the performance

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC/ASTM 62285-7 has been prepared by subcommittee 59F: Surface cleaning appliances, of IEC technical committee 59: Performance of household and similar electrical appliances, in co-operation with ASTM Committee F11: Vacuum cleaners, under the IEC/ASTM Dual Logo Agreement.

It is published as a dual logo standard.

This first edition of IEC/ASTM 62885-7 cancels and replaces IEC 62929:2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 62929:2014:

a) the box test has been cancelled;
b) the set of straight-line tests have been extended to contain also tests on removal of different kinds of debris both from hard floors and carpets;
c) the set of straight-line tests also contains a test on the removal of fibres from carpets;

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d) as a miscellaneous test, a method for the determination of energy consumption has been added;

e) a separate clause on test material and equipment has been added.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
59F/393/FDIS	59F/401/RVD

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

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

In this standard, the following print types are used:

– terms defined in Clause 3: **bold type**.

A list of all parts in the IEC 62885 series, published under the general title *Surface cleaning appliances*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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INTRODUCTION

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

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

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1 Scope

This part of IEC 62885 is applicable to **dry-cleaning robots** for household use or under conditions similar to those in households.

The purpose of this document is to specify the essential performance characteristics of **dry-cleaning robots** that are of interest to users and to describe methods for measuring these characteristics.

〈A1〉 Due to the nature of the way this product operates in the home, comparisons with other types of surface cleaning appliances (e.g. dry vacuum cleaners) should not be made unless otherwise indicated. The cleaning performance methods, in particular, are only used to make comparisons with other **dry cleaning robots** and not with manually operated vacuum cleaner products. 〈A1〉

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 62301, *Household electrical appliances – Measurement of standby power*

IEC TS 62885-1, *Surface cleaning appliances – Part 1: General requirements on test material and test equipment*

IEC 62885-2:2016, *Surface cleaning appliances – Part 2: Dry vacuum cleaners for household or similar use – Methods for measuring the performance*

IEC 60704-1, *Household and similar electrical appliances –Test code for the determination of airborne acoustical noise – Part 1: General requirements*

IEC 60704-2-17, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 2-17: Particular requirements for dry cleaning robots*

ISO 554, *Standard atmospheres for conditioning and/or testing – Specifications*

ISO 2813, *Paints and varnishes – Determination of gloss value at 20 degrees, 60 degrees and 85 degrees*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62885-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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3.1
cleaning robot
automatic battery-powered cleaner
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 by means other than with the aid of solutions or liquids

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

3.3
robot cleaning head
cleaning head
air intake nozzle at the bottom of the **cleaning robot**

Note 1 to entry: This does not include **side brush**(**es**).

3.4
width of robot cleaning head
W
width of the air intake nozzle in the direction of forward travel

3.5
docking station
base unit
unit that can provide manual or automatic battery charging facilities, dust removal from the robot, data processing facility or other robot support functions

Note 1 to entry: For some robots, the docking station could come in the form of an external power supply.

3.6
pose tracking system
PTS
measurement system which enables the tracking of the **cleaning robot**'s position and orientation

3.7
dust receptacle
container inside of the **cleaning robot** used to hold the collected dust

3.8
test instance
entirety or superset of all trials of all samples to be measured for a single **cleaning robot** model

3.9
trial
single instance of a performance measurement carried out under identical conditions that can be repeated multiple times

3.10
run
subset of a **trial** where one or more factors affecting the test results is (are) changed

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3.11
pass
single traverse of the **cleaning head** over the **test area**

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

3.12
test area
area where the test dust, or debris, or fibre is distributed for the cleaning performance test

3.13
Wilton carpet
carpet as defined in IEC TS 62885-1

3.14
fully charged
point during charging when, according to the manufacturer's instructions, by indicator or time period, the product does not need to be charged anymore

3.15
fully discharged
point in use when the manufacturer's instructions state the product is fully discharged or the robot cannot restart the operation

3.16
side brush
rotating peripheral brush whose main function is to relocate the dust and debris along the floor and extend the cleaning reach beyond the **width of robot cleaning head**

4 General conditions for testing

4.1 General

During the tests, any external interference that affects the functions of the **cleaning robot** (e.g. sensors, processors and actuators) shall be minimized.

4.2 Atmospheric conditions

The test procedures and measurements shall be carried out under the following atmospheric conditions (in accordance with ISO 554).

Cleaning performance test:

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

All other tests:

Temperature:	(23 ± 5) °C
Relative humidity:	(45 ± 15) %
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.

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4.3 Lighting conditions

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

Intensity:	(200 ± 50) lx
Colour temperature:	2 000 K to 7 000 K

Measurements shall be made at floor level.

NOTE Lighting conditions for autonomous navigation/coverage test (Clause 7) are different from the general lighting conditions, which are defined in 9.3.3.

4.4 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.

Unless otherwise specified, 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 in accordance with the type of test (see 4.2).

Carpets that have already been used shall be stored beaten at standard atmospheric conditions in accordance with 4.2.

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.

4.5 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.

If possible, the software shall be updated to the latest available for the robot in the region of purchase in accordance with the manufacturer's instructions.

If available, the manufacture date, the serial number, and the software version of the samples shall be reported.

4.6 Preparation of the battery

Any unused Li-ion battery shall be fully charged and fully discharged once prior to conducting the first test on a **cleaning robot**. Any unused other type of battery shall be fully charged and fully discharged three times prior to conducting the first test on a **cleaning robot**.

Full discharge shall be done by carrying out one or more normal cleaning operation(s) in a clean area following the manufacturer's instructions until the robot ceases to function. Remove the charge station once it is in operation to ensure full discharge.

NOTE It is understood that some robots do not allow discharge below a certain energy level for battery protection. Full discharge means either low battery signal without robot motion or robot stops operation without being able to restart.

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4.7 Running-in of a new cleaning robot

Prior to the first test on a new **cleaning robot**, it shall be run in accordance with 4.6 for one battery cycle. Prior to conducting any series of tests, the age, condition, and history of the product shall be recorded.

4.8 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 before a test is carried out; and
- the operation mode of the robot can be selected and adjusted in accordance with the manufacturer's published instructions only before the test to fit the environment to be cleaned.

The mode and settings used for the test shall be recorded and reported.

Any safety-related device shall be able to operate.

4.9 Measurement of collected dust weight

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 should be treated as if they were a single component.

The dust receptacle and removable filtration units shall be carefully removed from the robot and weighed together.

For **cleaning robot**s equipped with separation devices, being part of the appliance, used to separate the dust from the air flow and/or having additional filters to be changed or cleaned by the user, without the use of tools, the weight of such specific devices shall be taken into account for dust removal ability.

Cleaning robots with disposable or reusable **dust receptacles** may have secondary filtration stage devices, which do not collect meaningful dust in removal ability tests, but which do impact on filtration and life tests. Replacement and/or maintenance of such devices shall be in accordance with relevant clauses and carried out in accordance with the manufacturer's instructions.

4.10 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:

Fibre measurement:

Resolution ≤ 0,001 g

Accuracy ≤ 0,005 g

All other measurement:

Resolution ≤ 0,01 g

Accuracy ≤ 0,02 g

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Recommended position measurement by pose tracking system:

Position resolution ≤ 1 cm

Position accuracy ≤ 1 cm

Orientation resolution ≤ 0.1°

Orientation accuracy ≤ 3°

Acquisition rate ≥ 30 Hz

Time measurement:

Resolution ≤ 0,1 s

Accuracy ≤ 0,2 s

The sampling rate of the pose tracking system shall be adequate to ensure the dynamic position accuracies as specified above.

4.11 Tolerance of dimensions

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

Table 1 – Tolerance of dimensions

Nominal size range mm	Tolerance mm
3 ≤ 6	±0,5
< 6 ≤ 30	±1,0
< 30 ≤ 120	±1,5
< 120 ≤ 400	±2,5
< 400 ≤ 1 000	±4,0
< 1 000 ≤ 2 000	±6,0
< 2 000 ≤ 5 000	±8,0
Values are taken from Table 1 of ISO 2768-1:1989.	

5 Cleaning performance – Straight line

5.1 General

This test is designed to isolate the performance of the cleaning system of the robot from the autonomous movement function at a nominal speed. This makes it possible to only assess the robot's ability to remove dust, fibre, medium size debris, and large debris. This facilitates direct comparison between **cleaning robots**. If the side brushes are removable, they shall be removed for all tests in Clause 5.

NOTE A method to evaluate the influence (or effectiveness) of the side brush will be investigated in future revisions.

5.2 Preparation of test

5.2.1 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**.

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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 trial, be cleaned in accordance with the manufacturer's instructions until its weight is within 1 % or 2 g of its original weight, whichever is lower.

A **dust receptacle** made of textile is not permitted to be cleaned by brush and water unless allowed by the manufacturer's instructions.

A plastic **dust receptacle** shall be cleaned following the instructions in the user manual. If the **dust receptacle** is cleaned with water, it shall be well dried 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.

The whole robot including dust collecting parts shall be pre-treated in accordance with 4.4 in order to minimize the influence of humidity.

Prior to each **trial**, 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 **trial**, following the manufacturer's instructions.

5.2.2 Preconditioning of test floor

The test floor shall be cleaned before each **trial**.

5.2.3 Pre-treatment of test carpet

5.2.3.1 General

Before recordable testing is carried out, any new carpet shall be pre-conditioned in the manner described in IEC TS 62885-1.

5.2.3.2 Conditioning of test carpet

Prior to each **trial**, the test carpet shall be cleaned to remove remaining dust and preconditioned as described below. For cleaning of the test carpet, it is recommended to use a suitable carpet-beating machine such as described in 5.3.3.2 in IEC 62885-2:2016.

If a carpet-beating machine is not used, the carpet shall be placed upside down on a rigid mesh support and beaten by hand or with an active nozzle. After the beating, one sequence of five double strokes at (0,50 ± 0,02) m/s over the **test area**, the acceleration area and the deceleration area, with the forward stroke in the direction of the carpet pile (direction of manufacturing) with a vacuum cleaner, which has good dust removal ability, shall be carried out to remove remaining dust. The whole **test area**, the acceleration area and the deceleration area shall be cleaned with the cleaning machine.

5.2.3.3 Verification and preconditioning of test carpet

After cleaning of the test carpet, the **cleaning robot** under test shall be equipped with a clean **dust receptacle** (see 5.2.1) and be used to verify that the carpet has been cleaned to the point where no dust pick-up is discernible. This point is considered to be reached if the amount of dust removed from the carpet during one trial of five cleaning **pass**es over the **test area** (refer to 5.5.3 without spreading dust) is less than 0,2 g. If the amount is greater than 0,2 g, this step is repeated until the requirement is achieved.

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NOTE Even if the equipment for removing remaining dust from the carpet is known to be sufficiently reliable to leave the carpet in an acceptable condition, it is still important to carry out this procedure of preconditioning to ensure that the effect of humidity on the carpet is minimized.

To prevent a gradual filling of the carpet with dust, the weight of the test carpet should be maintained as close as possible to that of the initially clean carpet.

5.2.3.4 Embedding dust or fibre into the test carpet

The dust or fibre shall be embedded into the test carpet by carrying out ten double strokes over the carpet, parallel with the direction of the pile, using a roller in accordance with 7.3.6.1 (dust embedding roller) of IEC 62885-2:2016.

The speed of the roller over the **test area** shall be a uniform 0,5 m/s ± 0,02 m/s, with the forward stroke being in the direction of the pile. It is important to ensure that the **test area** is completely and evenly rolled. The carpet is then left for a period of 10 min to recover from rolling.

5.3 Test mode

5.3.1 General

The straight-line cleaning test requires the robot to move straight forward at a nominal speed calculated from the normal operation mode, see 8.3. There are some other functions required for the straight-line cleaning test, which shall be provided within a test mode.

This mode shall enable the robot to perform a repeatable test mode action in which it shall be driven forward in a straight line, at a fixed speed for the defined minimum distance (refer to 5.3.3). The test mode shall satisfy the entire relevant safety requirement.

This test mode action can then be repeated multiple times depending on the nature of the test (e.g. for multiple-**pass** testing).

In the absence of the test mode, the robot shall be tested with a mode (e.g. a remote-control mode) that generates a reasonably straight motion (**test area** coverage as close to 100 % as possible) in the straight-line test speed. The fact that the straight motion was generated by a mode other than the test mode shall be reported.

If a guiding method is used to ensure the straight motion of the robot, care shall be taken to minimize the effect on the mobile behaviour of the robot.

The test mode shall be readily available at no additional cost.

If a reasonably straight motion cannot be generated, then the test cannot be properly executed, and the test can be skipped.

5.3.2 Access to test mode

The precise nature of access to the test mode shall be clearly stated by the manufacturer and it shall be simple to execute. Once the access operation is complete, it shall leave the machine in an idle state.

NOTE Examples of access methods to the test mode could be to require the user to have a combination of buttons on the machine pressed when the robot is switched on or for a combination of buttons to be held for a period of time, which would not occur during normal robot operation. The only condition is that this access method is to be documented.

Once in the idle state, the user shall be able to initiate the execution of a single test mode action (refer to 5.3.3) at one of two speeds, s_{avg_hard} and s_{avg_carpet}, either by a method available on the robot (such as a button press) or a remote means. s_{avg_hard} and s_{avg_carpet} shall be calculated following the method described in 8.3.

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Once the test mode action has been completed, then the machine shall return to its idle state, ready to execute another test mode action if required.

It shall be possible to pick the machine up and reposition it without the machine exiting the idle state.

It is expected that the user shall be able to exit this mode either via an instruction or via a power down/up cycle.

5.3.3 Test mode action

The test mode action involves the machine starting from a stationary pose and driving in a straight line before coming to a stop.

The straight-line cleaning speed of the robot, either s_{avg_hard} or s_{avg_carpet} shall be maintained through the **test area** and the pass-through area (equal to the longitudinal length of the robot), refer to Figure 1. The acceleration and deceleration areas are provided for the robot to accelerate up to the straight-line cleaning speed and decelerate down to a stop.

All efforts shall be made to achieve a straight-line path. It is, however, understood that the robot may not execute a precise straight-line path. If the resultant missed coverage of the **test area** is significant, the test may not be able to be run, and this fact shall be reported.

NOTE 1 The velocity and the distance mentioned above are the observed quantities, not the commanded input.

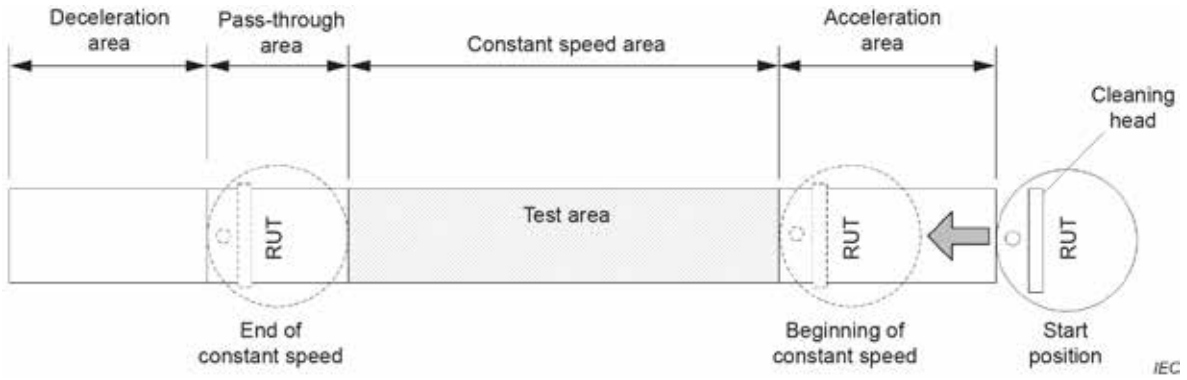

Figure 1 – Test mode action

During the execution of the test mode, the robot's basic cleaning systems shall be active in their standard operating mode. All other "enhanced" cleaning systems that would prevent the straight motion of the robot (e.g. dust sensor) shall not be active.

NOTE 2 Necessary steps to verify that the test mode is equivalent to the standard operating mode can be taken. For example, intake pressure and acoustic noise can be compared between the test mode and the standard operating mode.

5.3.4 Speed verification

It is understood that the actual motion executed by the robot will not be precisely as described above owing to various external influencing factors, such as slip on the traction systems or resolution of the guidance system. The actual observed speed at which the action is executed shall be the required speed ± 10 %.

If the speed does not comply to the conditions specified above, the non-compliance shall be reported.

The speed at which the test is performed shall be reported along with the results.

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5.4 Dust removal from hard floor

5.4.1 Test bed

The test bed is identical to that described in 9.1.1.

5.4.2 Preparation of test

5.4.2.1 Preconditioning of test floor

Refer to 5.2.2.

5.4.2.2 Pre-treatment of cleaning robot

Refer to 5.2.1.

Replaceable filters and dust collection parts (e.g. dust pad) shall not be replaced within the same **trial**.

5.4.2.3 Speed of test pass on hard floor

The **pass**es shall be executed at the speed s_{avg_hard}, as described in 8.3.

Refer also to 5.3.4.

5.4.2.4 Distribution of test dust

Test dust Type 1 in accordance with 7.2.2.1 in IEC 62885-2:2016, shall be distributed with a mean coverage of (50 ± 0,1) g/m^2 as uniformly as possible over the **test area**. The amount of test dust to be used is calculated from the formula (W − 0,02) m × 0,7 m × (50 ± 0,1) g/m^2, where W is the **width of robot cleaning width** in metres and the length of the **test area** is 0,7 m.

NOTE 1 For uniform distribution of the test dust, a manual dust spreader as described in Figure 2 can be used.

NOTE 2 To ensure the distribution of the test dust only within the **test area**, a masking frame with size of the **test area** can be used. When such frame is used, testers need to make sure the dust attached on the masking frame gets dropped onto the **test area**.

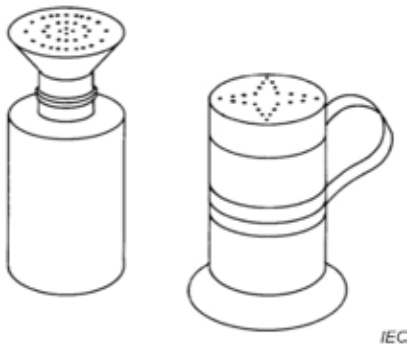

Figure 2 – Dust distribution devices

5.4.3 Test method

After the preparation process is completed in accordance with 5.4.2, the **dust receptacle** shall be weighed as specified in 4.9 (M_0).

The **cleaning robot** shall be switched on and placed into test mode using the method provided by the manufacturer (refer to 5.3.2).

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The **cleaning robot** shall be placed at the start position specified in Figure 18, with the centre of the **cleaning head** aligned with the centreline of the **test area**.

It is important to ensure consistent alignment of the robot with the **test area** on the test bed. During the setup process, an alignment device such as a laser pointer can be used for the validation of a proper alignment. The **cleaning robot** shall perform a single **pass**.

After the movement of the **cleaning robot** has stopped, the receptacle shall be carefully removed and reweighed as specified in 4.9. The weight of the dust (M_i) shall be calculated as the difference between this value and M_0.

Without cleaning the robot and the receptacle, the next **pass** shall be performed. After each **pass,** the receptacle shall be carefully removed and reweighed as specified in 4.9.

A single cleaning **trial** consists of N **pass**es (straightforward motion), where the number N shall be chosen by the tester. The dust on the test bed (even outside of the **test area**) shall not be cleaned before the end of the whole **trial**. If any of the **pass**es does not fully cover the **test area**, the whole **trial** shall be discarded, and the **trial** shall be repeated.

The cleaning **trial** (with N **pass**es) shall be repeated twice more. Before each **trial**, the robot and the receptacle shall be conditioned in accordance with 5.2.1.

For the dust removal tests only, if the spread of any of accumulative dust pick-up rates p_i (defined in 5.4.4) from three **trials** is larger than 10 %, two more **trials** shall be added.

5.4.4 Determination of dust removal ability

The dust pick-up rate shall be calculated with

$$p_{i,k} = \frac{M_{i,k}}{M_k}$$

where

$p_{i,k}$ is the accumulated dust pick-up rate from the i-**pass** over the **test area** calculated from the k^{th} **trial** (percent);

M_k is the total weight of dirt initially distributed in the **test area** (g) for the k^{th} **trial**;

$M_{i,k}$ is the measured accumulative weight of dirt picked up after the i^{th} **pass** (g) for the k^{th} **trial.**

Upon completion of n **trials**, the final pick-up percentages for hard floor P_i is calculated as follows:

$$P_i = \frac{\sum_{k=1}^{n} p_{i,k}}{n}$$

where

P_i is the final accumulated *i*-**pass** pick-up rate (percent) where i = 1, 2, 3,…, N;

n is the number of **trials**.

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