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Interested committees:

Title: BS EN IEC/ASTM 62885-11 Surface cleaning appliances

Part 11: Wet-cleaning robots for household or similar use - Methods for measuring the performance

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## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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|                  |                        |
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| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/Figure/ Table/Note | Type of comment | Commend (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |



**59F/519/CD**

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

**IEC/ASTM 62885-11 ED1**

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**2025-02-14**

SUPERSEDES DOCUMENTS:

**59F/486/NP, 59F/494A/RVN**

|                                          |                                  |
|------------------------------------------|----------------------------------|
| IEC SC 59F : SURFACE CLEANING APPLIANCES |                                  |
| SECRETARIAT:<br>Sweden                   | SECRETARY:<br>Mr Ingvar Eriksson |
| OF INTEREST TO THE FOLLOWING COMMITTEES: | HORIZONTAL FUNCTION(S):          |
| ASPECTS CONCERNED:                       |                                  |

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TITLE:

**Surface cleaning appliances - Part 11: Wet-cleaning robots for household or similar use - Methods for measuring the performance**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**Surface cleaning appliances - Part 11: Wet-cleaning robots for household or similar use - Methods for measuring the performance –**

## FOREWORD

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IEC/ASTM 62885-11 has been prepared by a Joint Working Group of subcommittee 59F, Surface cleaning appliances, of IEC technical committee 59: Performance of household and similar electrical appliances, and ASTM Committee F11: Vacuum cleaners.

It is an International Standard, published as a dual logo standard.

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

| Draft | Report on voting |
|-------|------------------|
|       |                  |

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

The language used for the development of this International Standard is English [*change language if necessary*].

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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 [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

## INTRODUCTION

Technical specifications of materials used for wet cleaning are under transfer in TS 62885-1 standard. As soon as this transfer will be effective, this standard will refer to TS 62885-1 for the material specification. In the meanwhile, to ease the review of this document, these specifications are integrally kept in this draft version of the edition.

This draft version of the edition still includes the energy consumption measurement in 8.1. This clause will be transferred to 62885-10 (Battery-related items for cordless surface cleaning appliances) standard for battery related energy consumption. However, several comments were made to find a methodology to additionally measure energy consumption related docking station additional functionalities. The working group is still working on this methodology, the main difficulty being to separate energy consumption related to docking station consumption, and energy consumption related to the operation of the wet hard cleaning robot for a certain surface. In the future versions of the edition, energy consumption related to battery shall be referred to 62885-10 standard, but energy consumption related to dock consumption shall be evaluated in this document.

The determination of the carpet detection ability in 8.4.4.5 needed to be changed to represent moistening detection of the carpet instead carpet touch by the mop which is not easy to identify for some robots' technologies. The working group is working on a new approach. This approach is based on the visualisation of the carpet moistening by the robot thanks to IR technology. IR camera is showing the lower temperature of the evaporation of water on the floor. The 8.4.4.5 of this version of the edition gives an overview of the methodology considered, and of the output forecasted.

Further reading:

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* [IEC 60704-2-17 \[1\]](#)

ISO 2439, *Flexible cellular polymeric materials - Determination of hardness (indentation technique)* [ISO 2439 \[2\]](#)

ISO 3386-1, *Polymeric materials, cellular flexible - Determination of stress-strain characteristics in compression - Part 1: Low-density materials* [ISO 3386-1 \[3\]](#)

ISO 5011, *Inlet air cleaning equipment for internal combustion engines and compressors - Performance testing* [ISO 5011 \[4\]](#)

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full - Part 1: General principles and requirements* [ISO 5167-1 \[5\]](#)

ASTM F431, *Standard Specification for Air Performance Measurement Plenum Chamber for Vacuum Cleaners* [ASTM F431 \[6\]](#)

IEC 60335-1:2010, *Household and similar electrical appliances - Safety - Part 1: General requirements* [IEC 60335-1:2010 \[7\]](#)

IEC 60335-1:2010/AMD2:2016 [IEC 60335-1:2010/AMD2:2016 \[8\]](#)

IEC 60335-2-2:2019, *Household and similar electrical appliances - Safety - Part 2-2: Particular requirements for vacuum cleaners and water-suction cleaning appliances* [AMD2:2016 IEC 60335-2-2:2019 \[9\]](#)

ISO 679:2009, *Cement - Test methods - Determination of strength* [ISO 679:2009 \[10\]](#)

ASTM F2607-08:2014, *Standard test method for measuring the hard surface floor-cleaning ability of household/commercial vacuum cleaners* [ASTM F2607-08:2014 \[11\]](#)

THRUN, S., BURGARD, W., and FOX, D. Probabilistic Robotics. MIT Press, Cambridge, MA, 2005 [\[12\]](#)

# Surface cleaning appliances - Part 11: Wet-cleaning robots for household or similar use - Methods for measuring the performance –

## 1 Scope

This part of IEC 62885 is applicable for measurements of the performance of wet hard floor 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 wet hard floor cleaning robots that are of interest to users and to describe methods for measuring these characteristics.

In the case of [multi-purpose cleaning robot](#), this document only addresses the performance, navigation and mobility related to the wet cleaning functionality.

This document is not intended for non-robotics cleaning appliances, high pressure cleaners or steam cleaners. This document is neither concerned with safety requirements nor with performance requirements.

NOTE Owing to the influence of environmental conditions, variations in time, origin of test materials and proficiency of the operator, most of the described test methods give more reliable results when applied to comparative testing of a number of appliances at the same time, in the same laboratory and by the same operator.

## 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 60734:2012, *Household electrical appliances - Performance - Water for testing*

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

IEC TS 62885-1:2020, *Surface cleaning appliances - Part 1: General requirements on test material and test equipment*

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

IEC 62885-6, *Surface cleaning appliances - Wet hard floor cleaning appliances for household or similar use - Methods for measuring the performance*

IEC 62885-7:2020, *Surface cleaning appliances - Dry-cleaning robots for household or similar use - Methods for measuring the performance*

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, IEC 62885-6, IEC 62885-7:2020, 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>

**3.1****wet cleaning robot**

cleaning robot with a function that is capable of removing wet or dry stains and soils (e.g., beverage and/or food stains, floor grime, etc.) from a surface to be cleaned by use of water alone, or a detergent solution mix. If the unit employs an air flow created by a vacuum within the unit, the removed material can be separated in the appliance, and the cleaned suction air returned to the ambient air

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.

Note 2 to entry: A wet cleaning robot can be a standalone cleaning robot dedicated for wet cleaning or a multi-purpose cleaning robot used in wet cleaning mode

**3.2****multi-purpose cleaning robot**

Multi-purpose cleaning robot means a cleaning robot which combines, in a single device, two or more functions, which could be wet cleaning function and/or dry-cleaning function and/or other functions

**3.3****wet hard floor cleaning robot**

wet cleaning robot intended to be used on a hard floor surface.

**3.4****wet cleaning head**

plain nozzle, mopping pad(s), roller(s) or brush(es) attached to a **wet cleaning robot** or to a multipurpose cleaning robot for its wet cleaning functionality, that is applied to a surface to be cleaned

**3.5****wet cleaning active nozzle**

wet cleaning head provided with a driven agitation device to assist stain or soil removal

**3.6****wet cleaning passive nozzle**

wet cleaning head without any driven agitation device

**3.7****track cleaning width**

maximum width of the wet cleaning head employed in the wet cleaning head of the wet hard floor cleaning robot, expressed in millimetres, as determined per [5.2.3](#)

Note 1 to entry: Extendable elements or functions e.g. for edge cleaning do not contribute to the value of  $W_T$ .

**3.8****docking station**

unit that provides functions such as manual or automatic battery charging facilities, dust removal from the robot, water management system, 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.

Note 2 to entry: The working group is working on a methodology to measure the energy consumption of the docking stations, which will lead to define them more precisely. The new definitions for the docking stations will be added when this work will be finalized.

**3.9****dust receptacle**

container inside of the cleaning robot used to hold the collected dust

**3.10****clean water receptacle**

container inside of the cleaning robot used to hold clean water

**3.11****test instance**

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

**3.12****trial**

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

**3.13****run**

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

**3.14****pass**

single 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.

**3.15****test area**

area where the stains or soils are distributed for the cleaning performance test

**3.16****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 any longer

**3.17****fully discharged**

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

**3.18****in-house wet hard floor reference cleaner**

electrically operated laboratory equipment designated for internal comparison within a laboratory

**4 General conditions for testing****4.1 General**

During the tests, any external interference that could affect the functions of the, sensors, processors or actuators of the cleaning robot 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).

- a) Temperature:  $(23 \pm 2) ^\circ\text{C}$
- b) Relative humidity:  $(50 \pm 5) \%$
- c) Air pressure: 91,3 kPa - 106,3 kPa

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

Air flows, and heat sources can have a high influence on the evaporation rate of the water. Care shall be taken to avoid opened windows, ventilators or punctual heat sources (e.g. sun light) in the test areas.

### 4.3 Lighting conditions

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

- a) Intensity:  $(200 \pm 50)$  lx
- b) Colour temperature: 2 000 K to 6 000 K

Measurements shall be made at floor level or, if the lighting conditions are similar to floor level, on elevated test setups.

NOTE Lighting conditions for autonomous navigation/coverage test ([Clause 7](#)) are different from the general lighting conditions, which are defined in [9.3](#).

### 4.4 Test equipment and materials

Unless otherwise specified, equipment and materials for measurements (devices, test surfaces, stains, soils, 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](#)).

If the [wet hard floor cleaning robot](#) is provided with a reusable pad(s) or brush that is removable without the aid of tools, it shall be cleaned and prepared according to the manufacturer's instructions prior to each run.

[wet hard floor cleaning robot](#) with receptacles to collect dirty liquids from cleaning the floor shall be cleaned and/or maintained in accordance with relevant clauses and carried out according to the manufacturer's instructions.

#### 4.4.1 Carpets for floor detection

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.

#### 4.4.2 Test floor tiles

Test floor tiles used in a laboratory for the determination of cleaning performance per [Clause 5](#) may, over time, change from their original condition due to surface wear and handling. Therefore, the [in-house wet hard floor reference cleaner](#) as defined in [in-house wet hard floor reference cleaner](#) shall be used to regularly check the floor tile conditions as a verification of the test results obtained and recorded.

### 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 test, the sample robot shall not be changed. Consumables and replacement parts necessarily changed shall be recorded in the test report.

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.

Tests carried out to simulate stresses that a [wet hard floor cleaning robot](#) can be exposed to during normal use, possibly causing impairment of the cleaner's performance, can require additional samples of replaceable parts which are listed by the manufacturer such as pads, filters, floor rollers, batteries... . Such tests shall be carried out at the end of the test program.

### 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 docking station once it is in operation to ensure full discharge unless the docking station integrates functionalities which prevent the robot from reaching full discharge state (e.g. water management system during operation).

NOTE It is understood that some robots do not allow discharge below a certain energy level for battery protection.

#### 4.7 Running-in of a new wet hard floor cleaning robot

Prior to the first test on a new cleaning robot (and following preparations in line with the manufacturer's instructions), the appliance shall be fully charged in accordance with 4.6. If the appliance employs a wet-cleaning pad, the wet-cleaning pad shall be removed. If the wet-cleaning pad cannot be removed for the running-in, it shall be changed before performing the performance tests.

If there is a docking station with a mop cleaning function, the station shall be run in by performing a mop cleaning cycle at least three times to ensure that the water level inside the pipelines of the docking station is in a normal operation condition.

The new cleaning robot shall then be kept operating while dispensing liquid etc. until fully discharged. The sequence shall be repeated one time for a total number of two, with a pause of at least 30 min after the first discharge. No operation shall be carried out during this waiting time

If the appliance employs a vacuum, the appliance shall be operated with unrestricted air flow during the running-in sequence.

Depletion of at least one tank of liquid is required during the running-in sequence.

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.

For declaration and compliance purposes, related tests conducted on a hard floor shall be conducted with the same [wet hard floor cleaning robot](#) setting configurations such as power, water flow, [wet cleaning head](#) and [wet cleaning head](#) setting.

The related tests are the tests measuring the stain and soil removal from hard floor, the energy consumption for cleaning a hard floor, the noise level on hard floor, the surface coverage, the straight-line cleaning speed.

Any safety-related device shall be able to operate.

#### 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:

- a) Resolution  $\leq 0,01$  g

b) Accuracy  $\leq 0,02$  g

Recommended position measurement by pose tracking system:

c) Position resolution  $\leq 1$  cm

d) Position accuracy  $\leq 1$  cm

e) Orientation resolution  $\leq 0.1^\circ$

f) Orientation accuracy  $\leq 3^\circ$

g) Acquisition rate  $\geq 30$  Hz

Time measurement:

– Resolution  $\leq 0,1$  s

– Accuracy  $\leq 0,2$  s

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

#### 4.10 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 Dimension**

| Nominal size range<br><i>mm</i>                            | Tolerance<br><i>mm</i> |
|------------------------------------------------------------|------------------------|
| 3 - 6                                                      | $\pm 0,5$              |
| 6 - 30                                                     | $\pm 1,0$              |
| 30 - 120                                                   | 1,5                    |
| 120 - 400                                                  | 2,5                    |
| 400 - 1000                                                 | 4,0                    |
| 1000 - 2000                                                | 6,0                    |
| 2000 - 5000                                                | 8,0                    |
| Values are taken from <a href="#">ISO 2768-1:1989 [13]</a> |                        |

## 5 Wet hard floor cleaning performance - Straight line

### 5.1 General

These tests are designed to isolate the wet cleaning performance of the 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 stains and soils. This facilitates direct comparison between cleaning robots.

### 5.2 Preparation of test

#### 5.2.1 Test conditions

The ambient temperature and humidity shall be recorded.

#### 5.2.2 Pre-treatment of cleaning robot

If the cleaning robot is multifunction wet and dry and 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 trial, be cleaned in accordance with the manufacturer's instructions.

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 (according to manufacturer's instruction or 24h if no indication in manufacturer's instruction) 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 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 cleaned or replaced with new ones according to manufacturer's instructions. Parts which are after the recommended cleaning process still dirty, or parts with visible traces of wear, or where non-visible wear, affecting the test results is assumed, shall be replaced.

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

In the case of a multi-purpose cleaning robot used in wet cleaning mode, the wet cleaning functionality shall be tested with all secondary functionalities, which are specified by the manufacturer for optimal wet cleaning abilities, and the functionalities that cannot be intentionally switched off and/or removed during a wet cleaning process by the user.

Follow the manufacturer's instructions for setup and detergent mix (if employed) for preparing the product for floor cleaning use. If the manufacturer does not instruct to use tap water, demineralized water shall be used, also for all detergent mixes. .

The water tank shall be fully filled according to manufacturer's instruction.

In the case a docking station is associated with the wet cleaning robot with an integrated functionality to fill the water tank, the water tank shall be filled with this functionality.

If a pad is specified to be used, a clean pad of this type shall be installed on the **cleaning head** which has been washed and thoroughly dried in accordance with the manufacturer's instructions.

In the case of the wet cleaning robot being associated with a base station with an integrated functionality to prepare or wash the wet cleaning head, this functionality shall be used to moisten the wet cleaning head (pad or brush roll) according to the manufacturer's instructions. No additional preparation is required.

In any other case, the following methodology shall be used:

For an appliance employing a wet cleaning material (e.g. pads, rollers, or similar) for surface cleaning, the manufacturer's instructions to clean/wash and dry the wet cleaning material shall be followed. This step is necessary to ensure no foreign substances on a new or used wet cleaning material will affect test results. A clean wet cleaning material is required for each test **run**.

To ensure the pad or any other wet cleaning material is properly moistened, the wet hard floor cleaning robot shall be placed on a large, clean, dry floor surface (separate from the test surface, at least 2mx1,15m as described in [9.2.1](#), with a floor type identical to that described

in 9.1.1), and the floor cleaning process shall be run for 2min. to apply cleaning liquid. If the wet hard floor cleaning robot does not start immediately the floor cleaning process to pre-moisten the wet cleaning material, the floor cleaning process shall run for 2min after the end of the pre-moistening process.

An appliance employing a fixed wet cleaning material is not required to repeat the drying and subsequent moistening process after the 1<sup>st</sup> test trial, but it shall be cleaned before each subsequent trial and returned to its properly moistened state.

### 5.2.3 Determining track cleaning width

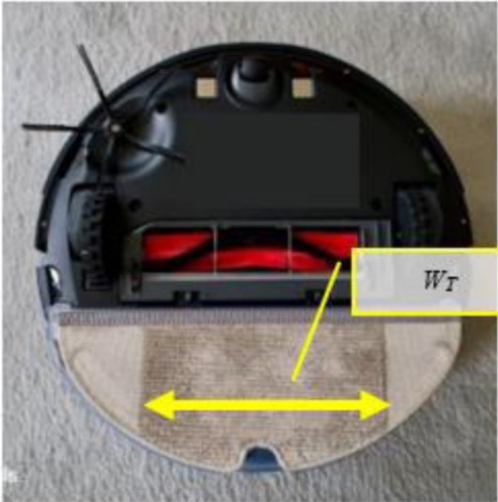
The [track cleaning width](#) of a wet hard floor cleaning robot shall be determined by measuring the width of the wet cleaning material installed on the cleaning head of the appliance. This dimension may be different from the measured outside housing width of the wet cleaning head or of the wet hard floor cleaning robot (see examples in below).

shall be measured at the largest possible extent of the active area of the pad or roller brush, perpendicular to the robot's longitudinal axis.

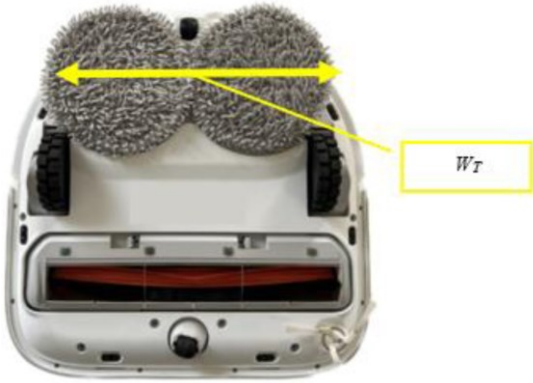
The active area shall be determined for the robot running in straight line in a free field condition (for example, specific robot behaviour like edges and corner modes, or any other specific mode shall not be taken into account).

The active area is the area directly involved in the cleaning action, e.g. the pad itself in contrast to a carrier structure extending the dimensions of pad (see [1 a](#)).

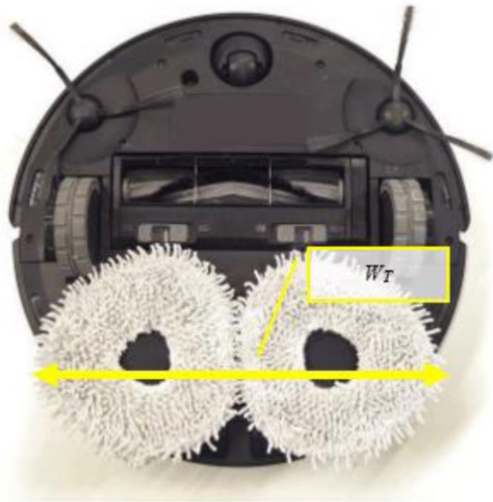
In the case of variable active area in shape or in orientation of its segments to each other, the shape or orientation that provides the highest value for the [track cleaning width](#) shall be used (see [1 c](#)).



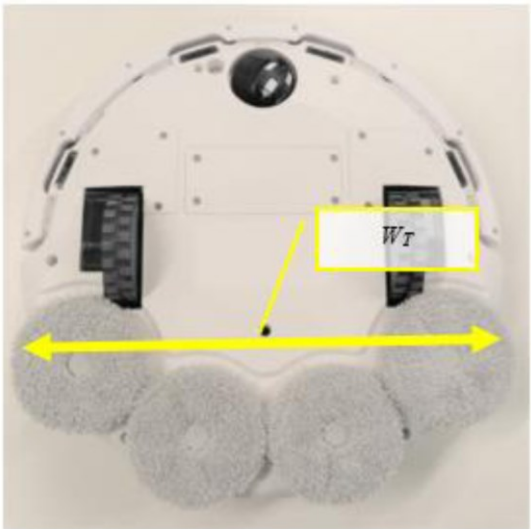
1 a)



1 b)



1 c)



1 d)

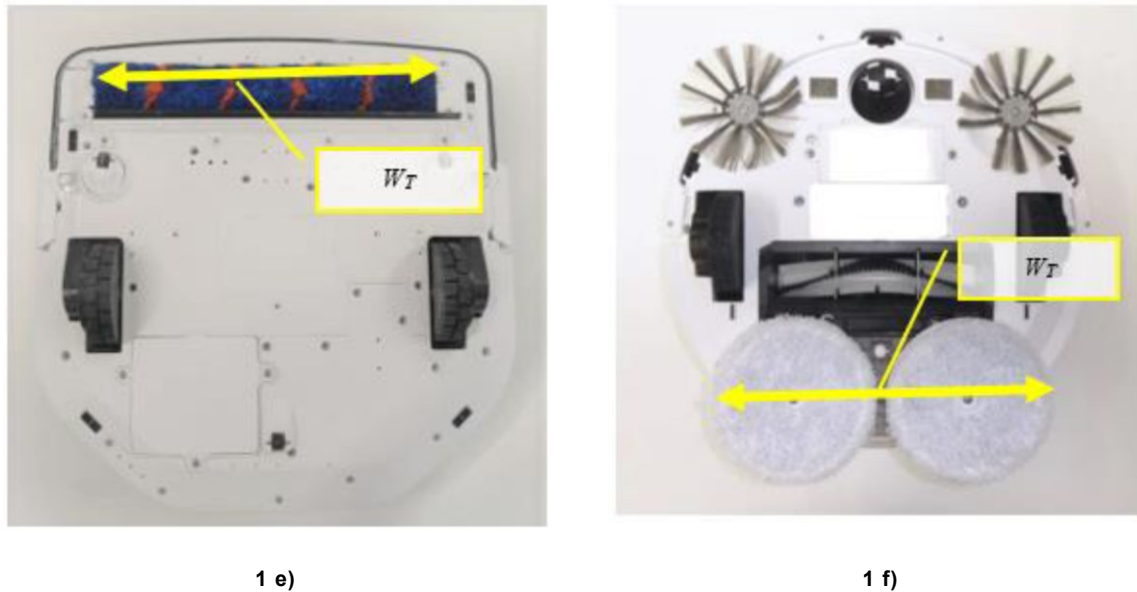


**Figure 1 – Examples of track cleaning width (WT) for different wet hard floor cleaning robots**

### 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. This behaviour shall be provided within a test mode, together with further functions decisive for the straight-line cleaning test.

This mode shall enable the robot to perform a repeatable test mode action in which it shall be prompted to drive 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, that fact shall be reported, and 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 the robot is 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 speed  $s_{avg\_hardwet}$ , either by a method available on the robot (such as a button press) or a remote means.  $s_{avg\_hardwet}$  shall be calculated following the method described in 8.3.

Once the test mode action has been completed, 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,  $s_{avg\_hardwet}$  shall be maintained through the test area and the pass-through area (equal to the longitudinal length of the robot), refer to Figure 2 - Test mode action. 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 (i.e., if the robot misses fully or partially the soil or stains spots on the centre tile), 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.

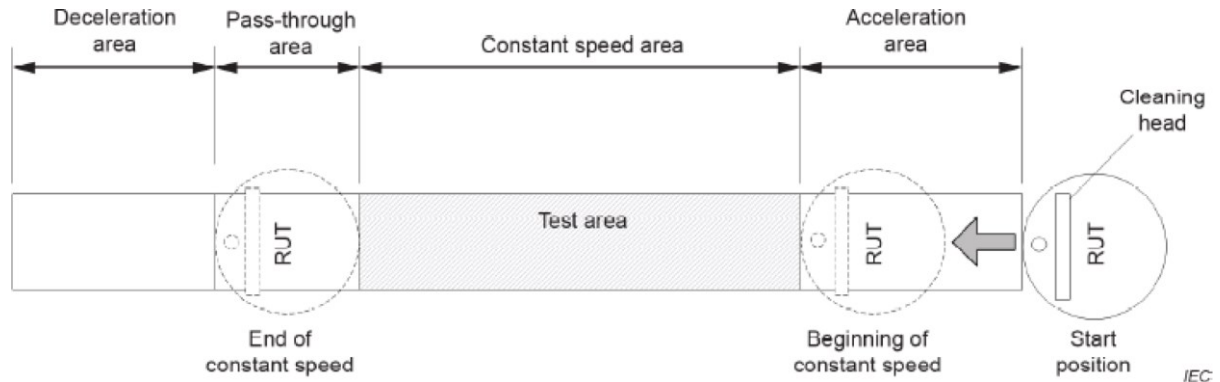


Figure 2 – Test mode action

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  $s_{avg\_wet\_hf} \pm 10\%$ , where  $s_{avg\_wet\_hf}$  is the straight line cleaning speed, as measured in 8.3.

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.

#### **5.4 Stain cleaning efficiency of hard flat floors**

The purpose of this test is to measure how many passes the robot needs to remove dried stains (as described in [9.4.1.1](#) to [9.4.1.4](#) and in [Table 6](#)) of certain soils from ceramic or porcelain tiles. Tiles are to be stained with representative soils that are typically found in household kitchens. After a drying period, the tiles are to be cleaned with the appliance in a defined way until the stains are not visible. The measured value is the number of necessary passes to remove each stain.

##### **5.4.1 General**

###### **5.4.1.1 Test bed**

The test bed is identical to that described in [9.1.1](#).

###### **5.4.1.2 Apparatus**

Spirit Level: a liquid level used to ensure adjacent tiles are located horizontal and level to each other prior to executing a test trial.

Adjustable pipette: 100 to 1 000 µl range for applying liquid stains (see [9.4.3.1](#)).

Stain application template (type A, see [9.4.3.2.1](#)): soil stain templates to mark the points on the tiles that are to be stained with liquid or pasty soils in accordance with [9.4.3.2](#).

Spoon and spatula: for spreading the pasty soils (see [9.4.3.5](#))

Digital video camera (optional): to take photographs of the stained tiles before and after the cleaning test, and to video record the cleaning procedure for confirming number of passes required to remove stains and soils.

Electronic scale: for weighing tiles, having a minimum measurement range of 4000 g (see [9.4.3.6](#)).

Tile drying rack: large enough to hold 20 to 50 tiles at a time is recommended. The drying rack shelves should be flat and level to prevent flowing of the liquid stains while drying (see [9.4.3.7](#)).

Food strainer: to remove solids from tartar sauce (see [9.4.3.8](#))

Magnetic stirring device: a magnetic stirring device that employs a rotating magnetic field to cause a stir bar immersed in a liquid to spin. An example of this device is provided in [9.4.3.3](#).

Soil mixing jars: glass jars with sealed lids for mixing the ingredients for the soil grime. An example of a suitable mixing jar is provided in [9.4.3.4](#).

###### **5.4.1.3 Materials**

Test soils: food soils in accordance with [9.4.1](#).

Dish detergent and cotton cloths: for cleaning floor tiles after each test run.

Demineralized water: demineralized water in accordance with [9.4.1.1](#) shall be used in all [wet hard floor cleaning robot](#) for mixing cleaning solution. The use of local tap water of unknown quality and hardness is not recommended.