

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Cleaning robots for household use – Dry-cleaning: Methods of measuring performance

Robots de nettoyage à usage domestique – Nettoyage à sec: Méthodes de mesure de l'aptitude à la fonction

This is a preview. [Click here to purchase the full publication.](#)



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 55 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

Plus de 55 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Cleaning robots for household use – Dry-cleaning: Methods of measuring performance

Robots de nettoyage à usage domestique – Nettoyage à sec: Méthodes de mesure de l'aptitude à la fonction

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XA

ICS 97.080

ISBN 978-2-8322-1685-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	8
4 General conditions for testing	10
4.1 Atmospheric conditions	10
4.2 Lighting conditions	10
4.3 Test equipment and materials	10
4.4 Number of samples	10
4.5 Running-in of a new cleaning robot	10
4.6 Preparation of battery	11
4.7 Operation of the cleaning robot	11
4.8 Measurement of dust receptacle weight	11
4.9 Measurement resolution and accuracy	11
4.10 Tolerance of dimensions	12
5 Dust removal test – Box.....	12
5.1 General.....	12
5.2 Dust removal from hard flat floors	12
5.2.1 Test bed	12
5.2.2 Preparation of test	13
5.2.3 Test method	15
5.2.4 Determination of dust removal ability and operation time	16
5.3 Dust removal from carpets	17
5.3.1 Test bed	17
5.3.2 Preparation of test	18
5.3.3 Test method	19
5.3.4 Determination of dust removal ability and operation time	20
6 Dust removal – Straight line.....	20
6.1 General.....	20
6.2 Test Mode.....	20
6.2.1 General	20
6.2.2 Access to test mode	20
6.2.3 Test mode action	21
6.2.4 Test mode speed verification	21
6.3 Dust removal from hard floor.....	21
6.3.1 Test bed	21
6.3.2 Preparation of test	22
6.3.3 Test method	23
6.3.4 Determination of dust removal ability	24
6.4 Dust removal from carpet.....	26
6.4.1 Test bed	26
6.4.2 Preparation of test	26
6.4.3 Test method	27
6.4.4 Determination of dust removal ability	27
7 Autonomous navigation/coverage test	27

7.1	General.....	27
7.2	Test bed	27
7.2.1	Test conditions	27
7.2.2	Floor configuration.....	27
7.2.3	Wall and ceiling configuration	33
7.2.4	General conditions.....	38
7.3	Preparation of test	39
7.4	Test method.....	40
7.5	Performance measurement	41
8	Average robot speed	43
8.1	Test bed	43
8.2	Preparation	44
8.2.1	Preconditioning of test floor	44
8.2.2	Pre-treatment of cleaning robot	44
8.2.3	Visual tracking system (VTS).....	44
8.3	Test method.....	44
8.4	Determination of average speed	45
9	Instructions for use	46
Annex A (informative)	Calculation of coverage.....	47
A.1	Robot metrics	47
A.2	Calculating robot coverage	47
Annex B (informative)	Comprehensive cleaning performance metric	50
Bibliography.....		51
Figure 1	Dust removal from hard flat floor test bed configuration.....	14
Figure 2	Dust distribution devices	14
Figure 3	Starting positions and orientations	15
Figure 4	Dust removal (box test) from carpet floor test bed configuration	18
Figure 5	Description of test mode action	22
Figure 6	Straight line dust removal from hard floor test bed configuration	22
Figure 7	Straight line dust removal from carpet floor test bed configuration.....	26
Figure 8	Navigation/Coverage test bed configuration	28
Figure 9	Details of obstacles around table	29
Figure 10	Illustration of metal transition installation.....	31
Figure 11	Illustration of wood transition Installation.....	31
Figure 12	Detail view of checker board and transitions.....	32
Figure 13	Configuration of four walls and ceiling	33
Figure 14	Illustration of four-panel door	36
Figure 15	Illustration of window.....	36
Figure 16	Illustration of baseboard.....	37
Figure 17	Illustration of pendant light	37
Figure 18	Illustration of clock	38
Figure 19	Illustration of mirror	39
Figure 20	Illustration of picture.....	39
Figure 21	Illustration of curtains	39

Figure 22 – Starting positions for navigation test.....	41
Figure 23 – Exemplary graph of coverage test result.....	43
Figure 24 – Location of average speed test area within coverage test environment.....	44
Figure A.1 – Robot coordinate frame	47
Figure A.2 – The first coverage step	48
Figure A.3 – Incremental coverage step	48
Table 1 – Tolerance of dimensions	12
Table 2 – Dimensions of furniture and obstacles	30
Table 3 – Wall and ceiling furniture	34

INTERNATIONAL ELECTROTECHNICAL COMMISSION

CLEANING ROBOTS FOR HOUSEHOLD USE –
DRY-CLEANING: METHODS OF MEASURING 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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.

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

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.

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.

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

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

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.