

INTERNATIONAL
STANDARD
NORME
INTERNATIONALE

IEC
CEI

60312

Fourth edition
Quatrième édition
2007-04

**Vacuum cleaners for household use –
Methods of measuring the performance**

**Aspirateurs de poussière à usage domestique –
Méthodes de mesure de l'aptitude à la fonction**



Reference number
Numéro de référence
IEC/CEI 60312:2007



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2007 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 la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: 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.

- Catalogue of IEC publications: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

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

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) 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 CEI

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

- Catalogue des publications de la CEI: www.iec.ch/searchpub/cur_fut-f.htm

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: www.iec.ch/online_news/justpub

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Service Clients: www.iec.ch/webstore/custserv/custserv_entry-f.htm

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: csc@iec.ch
Tél.: +41 22 919 02 11
Fax: +41 22 919 03 00

INTERNATIONAL
STANDARD
NORME
INTERNATIONALE

IEC
CEI

60312

Fourth edition
Quatrième édition
2007-04

**Vacuum cleaners for household use –
Methods of measuring the performance**

**Aspirateurs de poussière à usage domestique –
Méthodes de mesure de l'aptitude à la fonction**



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE
CODE PRIX XC

*For price, see current catalogue
Pour prix, voir catalogue en vigueur*

CONTENTS

FOREWORD.....	7
---------------	---

Section 1: General

1.1	Scope.....	9
1.2	Normative references	9
1.3	Definitions	9
1.4	General conditions for testing	11
1.4.1	Atmospheric conditions	11
1.4.2	Test equipment and materials	12
1.4.3	Voltage and frequency	12
1.4.4	Running-in of vacuum cleaner and attachments	12
1.4.5	Equipment of the vacuum cleaner	12
1.4.6	Operation of the vacuum cleaner.....	13
1.4.7	Conditioning prior to tests	13
1.4.8	Initial application of dust	13
1.4.9	Mechanical operator	13
1.4.10	Number of samples.....	14
1.4.11	Reference cleaner system.....	14

Section 2: Dry vacuum cleaning tests

2.1	Dust removal from hard flat floors	14
2.1.1	Test equipment.....	14
2.1.2	Test area and stroke length	14
2.1.3	Distribution of test dust	14
2.1.4	Determination of track width and stroke width.....	14
2.1.5	Test method	15
2.1.6	Determination of dust removal ability.....	15
2.2	Dust removal from hard floors with crevices	16
2.2.1	Test equipment.....	16
2.2.2	Distribution of test dust	16
2.2.3	Determination of dust removal ability.....	16
2.3	Dust removal from carpets	16
2.3.1	Test carpet	16
2.3.2	Test area and stroke length	17
2.3.3	Cleaning cycle	17
2.3.4	Conditioning of test carpet	17
2.3.5	Distribution of test dust	18
2.3.6	Embedding of dust into carpet.....	18
2.3.7	Preconditioning of dust receptacle.....	18
2.3.8	Determination of dust removal ability.....	18
2.4	Dust removal along walls	19
2.4.1	Test equipment and materials	19
2.4.2	Distribution of test dust	19
2.4.3	Determination of dust removal ability along walls.....	19
2.5	Fibre removal from carpets and upholstery.....	19
2.5.1	Fibre removal from carpets	19
2.5.2	Fibre removal from upholstery.....	20

2.6	Thread removal from carpets	21
2.6.1	Test carpet	21
2.6.2	Distribution of threads	21
2.6.3	Determination of thread removal ability	21
2.7	Maximum usable volume of the dust receptacle	22
2.7.1	Conditions for measurement	22
2.7.2	Introduction of moulding granules.....	22
2.7.3	Determination of maximum usable volume of dust receptacle	22
2.8	Air data	22
2.8.1	Conditions for measurement	22
2.8.2	Test equipment.....	23
2.8.3	Determination of air data.....	23
2.9	Performance with loaded dust receptacle	23
2.9.1	General	23
2.9.2	Suction with loaded dust receptacle	23
2.9.3	Throttling to simulate loaded dust receptacle.....	24
2.9.4	Determination of performance with loaded dust receptacle	24
2.10	Dust emission of the vacuum cleaner	25
2.10.1	Test procedure	25
2.10.2	Pre-test	26
2.10.3	Dust test.....	26
2.10.4	Calculating emission	27
2.10.5	Record.....	28

Section 3: Wet vacuum cleaning tests

3.1	Object of the test	28
3.2	Wet cleaning effectiveness on carpet	29
3.2.1	Test carpet samples	29
3.2.2	Soiling of carpet sample.....	29
3.2.3	Cleaning procedure.....	29
3.2.4	Drying of the carpet sample	30
3.2.5	Determination of wet cleaning effectiveness	30
3.2.6	Colorimetric measurements	31
3.2.7	Visual assessment.....	31

Section 4: Miscellaneous tests

4.1	Motion resistance	31
4.1.1	Test carpet and test equipment	31
4.1.2	Determination of motion resistance	32
4.2	Cleaning under furniture	32
4.2.1	Distribution of test dust	32
4.2.2	Determination of free furniture height	32
4.3	Radius of operation	32
4.3.1	Conditions for measurement	33
4.3.2	Determination of radius of operation.....	33
4.4	Impact resistance	33
4.4.1	Test equipment.....	33
4.4.2	Determination of impact resistance	33
4.5	Deformation of hose and connecting tubes.....	33
4.5.1	Test equipment.....	33

4.5.2	Determination of permanent deformation.....	33
4.6	Bump test.....	34
4.6.1	Test equipment.....	34
4.6.2	Test cycle	34
4.6.3	Test procedure	34
4.7	Flexibility of the hose	35
4.7.1	Preparation of test object.....	35
4.7.2	Determination of the flexibility of the hose	35
4.8	Repeated bending of the hose	35
4.8.1	Test equipment.....	35
4.8.2	Test method	35
4.9	Operation with partly filled dust receptacle	36
4.10	Mass	36
4.11	Specific cleaning time	36
4.12	Dimensions	37
4.13	Noise level.....	37
4.14	Energy consumption	37
4.14.1	Energy consumption with vacuuming of carpets.....	37
4.14.2	Energy consumption with vacuuming of hard floors with crevices.....	39
Section 5: Test material and equipment		
5.1	Material for measurements	39
5.1.1	Test carpets	39
5.1.2	Standard test dust.....	41
5.1.3	Fibre material	43
5.1.4	Thread material	43
5.1.5	Moulding granules.....	43
5.1.6	Test cushion	43
5.2	Equipment for measurements	44
5.2.1	Floor test plate.....	44
5.2.2	Test plate with crevice	44
5.2.3	Carpet-beating machine	44
5.2.4	Carpet hold-downs and guides	44
5.2.5	Dust spreader.....	44
5.2.6	Rollers for embedding.....	44
5.2.7	Void.....	45
5.2.8	Equipment for air data measurement.....	45
5.2.9	Equipment for dust emission measurement	47
5.2.10	Device for motion resistance test	49
5.2.11	Device for impact test	49
5.2.12	Device for determination of deformation of hoses and connecting tubes	49
5.2.13	Mechanical operator	49
5.2.14	Weighing machine	49
5.2.15	Testing surface for wet cleaning tests	50
5.2.16	Spectrophotometer	50
5.2.17	Test soil mixer	50
Annex A (informative) Information on materials.....		73
Bibliography		76

Table 1 – Values for the upper confidence value of a Poisson distribution for the 95 % confidence level	28
Table 2 – Classes for sizes 0,4 – 25 µm	48
Figure 1 – Zig-zag pattern	51
Figure 2 – Stroke length in measurements of dust removal from hard floors and of thread removal from carpets.....	51
Figure 3 – Grain size diagram for test dust	52
Figure 4 – Devices for distribution of mineral dust.....	53
Figure 5 – Test plate with crevice	53
Figure 6 – Carpet-beating machine.....	54
Figure 7a – Carpet hold-downs and guides	54
Figure 7b – Stroke length in the measurement of dust removal from carpets	55
Figure 7c – Dust spreader and roller for embedding dust into carpets	55
Figure 7d – Mechanical operator for the measurement of dust removal from carpets and of motion resistance	56
Figure 8 – Right-angled T	57
Figure 9 – Arrangement of threads in the thread removal test	57
Figure 10a – Stencil for distribution of fibres on test carpets	58
Figure 10b – Frame for test cushion	58
Figure 10c – Stencil for distribution of fibres on upholstery	59
Figure 11 – Nozzle adaptor for upright cleaners	59
Figure 12 – Air data curves	60
Figure 13a – Alternative A equipment for air data measurements.....	60
Figure 13b – Measuring box for alternative A.....	61
Figure 13c – Alternative B equipment for air data measurements	62
Figure 14a – Testing hood for measurement of dust emission.....	63
Figure 14b – Placing of upright cleaners in the testing hood.....	63
Figure 14c – Dust dispenser.....	64
Figure 15 – Insertion depth.....	65
Figure 16 – Drum for impact test	65
Figure 17a – Device for testing deformation of hoses and connecting tubes	66
Figure 17b – Position of test object and cross-section for measurement of deformation	66
Figure 18 – Preparation of hoses for testing flexibility	67
Figure 19 – Equipment for repeated bending of hoses	67
Figure 20a – Profile of threshold.....	68
Figure 20b – Arrangements for bump test.....	68
Figure 21 – Clamping arrangement for carpet sample.....	69
Figure 22a – Cleaning pattern for appliances with cleaning head used in forward and backward strokes	69
Figure 22b – Cleaning pattern for appliances with cleaning head only used in backward strokes.....	70
Figure 23a – Connecting tube openings.....	71

Figure 23b – Dust spread uniformly on surface	71
Figure 24 – Test dust for loading dust receptacle.....	72

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**VACUUM CLEANERS FOR HOUSEHOLD USE –
METHODS OF 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.
- 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 60312 has been prepared by subcommittee 59F: Floor treatment appliances, of IEC technical committee 59: Performance of household electrical appliances.

This fourth edition cancels and replaces the third edition published in 1998, amendment 1 (2000) and amendment 2 (2004). The following subclauses have been updated:

- 2.9 on performance with partly filled receptacle;
- 2.10 on determination of dust emission of the vacuum cleaners;
- 4.14 on energy consumption.

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

FDIS	Report on voting
59F/163/FDIS	59F/164/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.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.