# KODUMAJAPIDAMISES KASUTATAVAD TOLMUIMEJAD. OSA 1: KUIVTOLMUIMEJAD. TOIMIVUSE MÕÕTEMEETODID

# Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance (IEC 60312-1:2010, modified + A1:2011, modified)

EESTI STANDARDIKESKUS
ESTONIAN CENTRE FOR STANDARDISATION

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

| | |
|---|---|
| See Eesti standard EVS-EN 60312-1:2013 sisaldab Euroopa standardi EN 60312-1:2013 ingliskeelset teksti. | This Estonian standard EVS-EN 60312-1:2013 consists of the English text of the European standard EN 60312-1:2013. |
| Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. | This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation. |
| Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 17.05.2013. | Date of Availability of the European standard is 17.05.2013. |
| Standard on kättesaadav Eesti Standardikeskusest. | The standard is available from the Estonian Centre for Standardisation. |



Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 97.080

EUROPEAN STANDARD

NORME EUROPÉENNE

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# EN 60312-1

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ICS 97.080

Supersedes EN 60312:2008 (partially)

English version

# Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance

(IEC 60312-1:2010, modified + A1:2011, modified)

Aspirateurs de poussière à usage domestique -
Partie 1: Aspirateurs a sec -
Méthodes de mesure de l'aptitude à la fonction
(CEI 60312-1:2010, modifiée + A1:2011, modifiée)

Staubsauger für den Hausgebrauch -
Teil 1: Trockensauger -
Prüfverfahren zur Bestimmung der Gebrauchseigenschaften
(IEC 60312-1:2010, modifiziert + A1:2011, modifiziert)



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CENELEC

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

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**



Ref. No. EN 60312-1:2013 E

CONTENTS

## Foreword

This document (EN 60312-1:2013) consists of the text of IEC 60312-1:2010+A1:2011 prepared by SC 59F, "Surface cleaning appliances", of IEC TC 59, "Performance of household and similar electrical appliances", together with the common modifications prepared by CLC/TC 59X, "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) | 2014-03-04 |
| • latest date by which the national standards conflicting with this document have to be withdrawn | (dow) | 2016-03-04 |

This document partly supersedes EN 60312:2008.

Clauses, subclauses, notes, tables and figures which are additional to those in IEC 60312-1:2010 are prefixed “Z”.

EN 60312 is divided into 3 parts:

- EN 60312-1, *Vacuum cleaners for household use – Part 1: Dry vacuum cleaners – Methods for measuring the performance*

- prEN 60312-2, *Vacuum cleaners for household use – Part 2: Wet cleaning appliances – Methods of measuring the performance*

- prEN 60312-3, *Vacuum cleaners for household use – Part 3: Cleaning robots for household use – Dry cleaning – Methods of measuring performance*

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This European Standard also specifies, as far as necessary, the test methods which shall be applied in accordance with the standardisation mandate M353 related to Council Directive 92/75 of the European Commission.

## Endorsement notice

The text of the International Standard IEC 60312-1:2010+A1:2011 was approved by CENELEC as a European Standard with agreed common modifications.

COMMON MODIFICATIONS

## 1 Modification to Clause 3

*Add:*

**"3.Z1**
**reference vacuum cleaner system**
electrically operated laboratory equipment used to measure the reference dust removal ability on carpets with given air flow and active brush bar related parameters to improve the reproducibility of test results

Note 1 to entry: reference vacuum cleaner system is not suitable for other tests than dust pick-up from carpets.

**3.Z2**
**hybrid vacuum cleaner**
vacuum cleaner that can be both mains and/or battery operated

**3.Z3**
**battery operated active nozzle**
cleaning head provided with an agitation device to assist dirt removal driven by a battery operated motor"

## 2 Modification to Clause 4

*In the Note, replace:*

"When not in use they should be preferably hanging free, or may be lying flat, pile upwards and uncovered but not rolled."

*with:*

"When not in use they should be hanging free."

## 3 Modification to 4.10

*Delete entire clause including heading and replace with:*

### "4.Z1 Reference vacuum cleaner system

Test carpets used in a laboratory for the determination of dust removal ability will, over time, change from their original conditions, for instance due to wearing or gradual filling with dust. It is therefore required that the reference vacuum cleaner system as defined in 3.17 be used to regularly check the carpet conditions as a verification of the test results obtained and being recorded.

The reference vacuum cleaner system is designed to obtain 75 % of dust removal after 5 double strokes, both with passive and active nozzle (only for carpet).

The reference vacuum cleaner system has to be tested on each carpet used prior to each sample testing and the test results shall be recorded, after correction according to 6.17.2.2 by using the calibrated dust removal ability $K_c$. The expected result should be near to the 75 % of dust removal ability after 5 double strokes, however a deviation of ± 5 % is allowed.

NOTE In case the deviation exceeds the ± 5 % limit, the test carpet can be replaced or the reference vacuum cleaner system can be calibrated by the manufacturer.

Due to the fact that dust pick-up ability may differ between carpets used for active or passive nozzles, the result from tests between active and passive nozzles shall not be compared.

Test carpets designated for testing of passive nozzles shall only be cleaned with a passive nozzle on the face. Test carpets designated for testing active nozzles shall only be cleaned with an active nozzle on the face."

## 4 Modification to 5.2.2

*Add at end:*

"The linear density of the dust inside the crevice shall be between 0,0340 g/mm and 0,0290 g/mm crevice length. Otherwise, the filling has to be repeated.

NOTE The inserts are emptied from dust after the last measurement of each cleaning cycle."

## 5 Modification to 5.2.3

*At the end of the second paragraph add the following before the first formula:*

"The mean value of dust removal ability for 2 cleaning cycles is calculated as follows:

$$K_{cr}(2) = (k_{cr}(1) + k_{cr}(2))/2$$

$$k_{cr} = \frac{m_L - m_r}{m_L} \cdot \frac{L}{B} \cos 45^\circ \times 100$$ "

*Replace the description of $k_{cr}$ with:*

*"*$k_{cr}$ is the dust removal ability for a single cleaning cycle, in per cent;"

## 6 Modification to 5.3.4

*In the second paragraph, change the formula to read:*

"The amount of test dust to be used is calculated from the formula
(*B-0,02) m* × 0,7 m × 125 g/m$^2$,"

*In the second paragraph, replace the entire second sentence with the following:*

"For uniform distribution of the test dust over the test area minus 10 mm on each side, it is recommended that a dust spreader as described in 7.3.5 be used."

## 7 Modification to 5.11.2

*Delete* "Note 2" *and renumber* "Note 1" *to* "Note".

## 8 Modification to 5.11.3

*Delete the last sentence.*

## 9 Modification to 5.11.4

*Delete entire clause.*

## 10 Modification to 5.11.5

*Delete entire clause.*

## 11 Modification to 5.11.6

*Replace the first sentence "With the vacuum cleaner prepared according to 5.11.3, and the challenge agent neutralized per 5.11.4 the test proceeds as follows:" with:*

"The test proceeds as follows:"

## 12 Modification to 6.15

*Replace* "IEC 60704-1" *with* "EN 60704-1."

*Replace* "IEC 60704-2-1" *with* "EN 60704-2-1."

## 13 Modification to 6.16.2.4

*Delete the following text:*

"With $P_{eff}$ measured in accordance with 6.16.1.3 and the energy consumption per 10 $m^2$, $E$(10 $m^2$) with 5 double stokes is calculated as follows:

$$E(10\ m^2) = P_{eff} \times 200/B$$

The results shall record whether the surface was solid, i.e. hard floor, or with crevice, i.e. hard floor with crevice."

*Add*: "Same procedure as described in 6.16.1.4."

*Add:*

### "6.16.2.Z1 Energy consumption of battery powered nozzles

The energy consumption of battery powered nozzles is defined as a difference of energy between the discharge of the fully charged battery pack and the same battery pack after its use for the test of dpu on carpet and/or hard floor.

$$E_{pbn} = E_{pbn}(0) - E_{pbn}(1)\ (Wh)$$

$E_{pbn}$ : Energy consumption of powered battery nozzle
$E_{pbn}(0)$: Energy consumption of powered battery nozzle with fully charged battery pack
$E_{pbn}(1)$ : Energy consumption of powered battery pack after use

### 6.16.2.Z2 Energy consumption of powered battery pack fully charged

The energy consumption of a powered battery pack fully charged is defined as follows:

Charge the battery pack following the Instruction For Use (IFU) manual. When the battery pack is fully charged, discharge the pack while monitoring the voltage and the time.

The discharge current is linked to the declared capacity of the battery C and equal to C/10. The discharge runs until 1 V / cell for NiCd or NiMH batteries and similar. For Li-Ion-batteries the discharge current is 0,2 C. Discharge is terminated at 2,5 V.

Then the energy used $E_{pbn}(0)$ can be calculated in Wh.

### 6.16.2.Z3 Energy consumption of powered battery pack after its use

The energy consumption of a powered battery pack after its use is defined as follows:

Charge the battery pack following the Instruction For Use (IFU) manual. When the battery pack is fully charged, you can perform dust pick up measurement.

When the dust pick-up measurement is done, discharge the pack while monitoring the voltage and the time.

Discharge current and termination of discharge are the same as in 6.16.3.1.

Then the energy used $E_{pbn}(1)$ can be calculated in Wh.

## 6.Z1 Determination of energy efficiency

### 6.Z1.1 General

This subclause refers to mains powered dry vacuum cleaners only; hybrid vacuum cleaners have to be tested with the battery removed or disconnected.

Since “energy consumption” alone is not linked to a certain cleaning result “energy consumption” and “dust removal ability” have to be measured and brought into a defined relationship called “energy efficiency”.

“Energy efficiency” is calculated from the figures of “energy consumption” and “dust removal ability”.

### 6.Z1.2 Determination of energy efficiency on carpets

#### 6.Z1.2.1 Determination of energy consumption

The energy consumption on carpets is determined according to 6.16.1

#### 6.Z1.2.2 Reference level

The reference level is fixed to a dust removal ability of 65 % on a Wilton test carpet according to 7.2.1.3.2. To consider the reproducibility on different test carpets and the deviations from a test carpet's original conditions the reference vacuum cleaner system as described in 4.10 is used to measure and normalise the reference level $K_{calc}$ according to the specific conditions of the test carpet used for the determination of energy efficiency.

To determine the normalised reference level of the carpet used for energy efficiency measurement, the dust removal ability of the test carpet is measured according to 5.3. The dust removal ability in per cent is then normalised by applying the calibration value, which is given with the reference cleaner system using the following formula:

$$K_{calc} = K_{ref} / K_c \times 65\%$$

$K_{ref}$: Measured dust removal ability of the reference vacuum cleaner system on the test carpet used for the determination of energy efficiency

$K_c$: Calibrated dust removal ability of the reference vacuum cleaner system used for the test. This value, expressed in percent, is communicated by the manufacturer.

$K_{calc}$: normalised reference level

According to the vacuum cleaner under test, the reference cleaning system has to be equipped with an active or passive nozzle. A separate carpet has to be used for measurements with active nozzles

#### 6.Z1.2.3 Dust removal ability

The dust removal ability from carpets shall be examined according to 5.3. Different to 5.3.7, the measurements have to be done and recorded not only after five double strokes but after each double stroke until the reference level is reached. The fifth double stroke is necessary for the calculation of the Cleaning Performance index 6.Z1.2.5.

If the normalized reference level is not reached after 10 DS the measurement should be stopped. In this case the dpu curve has to be extrapolated. If extrapolation does not reach an intersection with the normalized reference level $K_{calc}$, the curve is to be continued by a fix slope of 1 % by 50 DS The intersection of the extrapolated curve or of the fix slope line with the normalized reference level $K_{calc}$ is the number of DS for the efficiency calculation.

Three separate measurements shall be carried out. Prior to each measurement, the sequence of preparations outlined in 5.3.3 to 5.3.6 shall be performed in total.

After each double stroke, the cleaning head shall be lifted at least 50 mm clear of the carpet, and the hose and tubes of the vacuum cleaner shall be agitated before the vacuum cleaner is

switched off. The dust receptacle shall not be removed before the motor has completely stopped.

Once the cleaner has completely stopped, the receptacle(s) and removable filters are carefully removed and reweighed. Due to effects of possible static charge build up during the time the vacuum cleaner is picking up dust, it is necessary to ensure that the receptacle has completely stabilised prior to recording the weight.

The dust removal ability is calculated as the ratio of the weight increase of the dust receptacle and removable filters as defined in 4.5 during the single double strokes to the weight of the test dust distributed on the test area.

The dust removal ability, in per cent, for each double stroke has to be calculated separately as the mean value from the three measurements according to the following procedure:

for n=1 to 10 and m=1 to 3: $D_r(m,n) = W_f(m,n) - W_i(m)$

$K_{ct}(m,n) = D_r(m,n) / D_d(m) \times 100$

$K_{ct}(n) = (K_{ct}(1,n) + K_{ct}(2,n) + K_{ct}(3,n)) / 3$

With:

| | |
|---|---|
| $W_i(m)$ | is the weight of the initially empty dust receptacle for each measurement, in grams; |
| $W_f(m,n)$ | is the weight of the dust receptacle after each double stroke in every measurement in grams; |
| $D_r(m,n)$ | is the amount of dust removed from the carpet after each double stroke in every measurement, in grams; |
| $D_d(m)$ | is the amount of dust distributed on the carpet for each measurement, in grams; |
| $K_{ct}(m,n)$ | is the dust removal ability after each double stroke and each measurement, in per cent; |
| $K_{ct}(n)$ | is the mean dust removal from three measurements for each double stroke, in per cent. |
| n | number of double strokes |
| m | number of measurements |

If the range of results for each a single double stroke n is greater than three percentage units, 2 extra measurements shall be made and the mean dust removal ability has to be calculated as $K_{ct}(n) = (K_{ct}(1,n) + K_{ct}(2,n) + K_{ct}(3,n) + K_{ct}(4,n) + K_{ct}(5,n)) / 5$

### 6.Z1.2.4 Calculation of energy efficiency

Energy efficiency is defined as the energy consumption necessary to reach the normalised reference level $K_{calc}$.

NOTE Annex D provides the method for the calculation of the number of double strokes $X_{calc}$ to reach the normalised reference level $K_{calc}$.

First the number of double strokes necessary to reach the reference level shall be calculated ($X_{calc}$).

Then the calculated energy consumption for 10 m² and 5 double strokes according to 6.16.1 shall be applied to $\boldsymbol{X_{calc}}$ according to the formula below:

$$\mathbf{W_c = X_{calc} \times E / 5 \text{ in Ws}}$$

where