SLOVENSKI STANDARD
SIST EN 60312-1:2017

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Sesalniki za uporabo v gospodinjstvu - 1. del: Sesalniki za suho čiščenje - Metode za merjenje lastnosti

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

Staubsauger für den Hausgebrauch - Teil 1: Trockensauger - Prüfverfahren zur Bestimmung der Gebrauchseigenschaften

Aspirateurs de poussière à usage domestique - Partie 1: Aspirateurs a sec - Méthodes de mesure de l'aptitude à la fonction

Ta slovenski standard je istoveten z: **EN 60312-1:2017**

ICS:

97.080	Aparati za čiščenje	Cleaning appliances

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EUROPEAN STANDARD

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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)

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

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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

This document (EN 60312-1:2017*)* 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)	2018-01-02
•	latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2020-01-02

The common modifications of EN 60312-1:2013 still apply. They are partly modified.

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

This European Standard also specifies, as far as necessary, the test methods which shall be applied in accordance with the standardisation mandate M540 related to Council Directive 92/75 of the European Commission.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZA and ZZB, which are integral parts of this document.

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.Z4
cylinder vacuum cleaner
portable dry vacuum cleaner having a nozzle separated from the cleaner housing by a hose so that, in use, only the nozzle is guided over the surface area to be cleaned

Note 1 to entry: Cylinder vacuum cleaners are generally floor-supported.

Note 2 to entry: The cylinder vacuum cleaner may have detachable nozzles, attachments, and tubes for both floor and above the floor cleaning.

Note 3 to entry: The nozzle may employ a driven rotating brush to assist in cleaning.

3.Z5
water filter vacuum cleaner
dry vacuum cleaner that uses water as the main filter medium, whereby the suction air is forced through the water entrapping the removed dry material as it passes through

3.Z6
water filter system
removable water filter components which are in contact with the water"

2 Modification to 4.6

Delete entire subclause and replace with:

"4.6 Operation of the vacuum cleaner

4.6.1 General

The tube grip of cleaners with suction hose or the handle of other cleaners shall be held as for normal operation at a height of (800 ± 50) mm above the test floor.

During measurements where the agitation device of an active nozzle is not used as in normal operation, the agitation device shall be running but not in contact with any surface.

The following wording regarding declaration and compliance shall also apply to EN 60704-2-1, and EN 60335-2-2. For declaration and compliance purposes, related tests for a given cleaning task shall be conducted with the same dry vacuum cleaner setting configurations such as cleaning head and cleaning head setting.

NOTE 1: Related tests are all tests related to a given cleaning task. They include tests relevant to the Energy Labelling and Ecodesign requirements for cordless dry vacuum cleaners.

NOTE 2: Related tests are:

- tests measuring the dust removal from carpet, the energy consumption for cleaning a carpet and the noise level on carpet;
- tests measuring the dust removal from hard floor with crevices and the energy consumption for cleaning a hard floor with crevices and the noise level on hard floors (for noise measurement regarding Energy Label / Ecodesign refer to Regulations 665/2013 and 666/2013).

The dry vacuum cleaner setting configurations, such as cleaning head and cleaning head setting, shall be used and adjusted in accordance with the manufacturer's instructions for the surface to be cleaned (e.g. carpet or hard floor) for the test to be carried out. Any separate electrical specific vacuum motor settings shall be set for maximum continuous airflow and, unless the manufacturer’s instructions states otherwise, any manually operated air by-pass opening for reduction of the suction power shall be closed.

In the absence of unambiguous instructions within the user manual the product shall be tested with settings that are in accordance with any explicitly clear text, symbol or pictogram that is identifiable on the product.

If, after following the above order of checks, the tester believes the device under test to be in a configuration that is ambiguous, or that multiple configurations are possible with no way to clearly determine which is the most suitable for a given task, then the manufacturer shall be contacted for additional guidance.

Complete details of the settings used for each cleaning task are to be recorded in the test documentation.

Where a manufacturer publishes/declares values for the performance of its product, e.g. in the Technical Documentation, it shall provide accurate and unambiguous details of the settings that were used during the test procedure.

NOTE 3: Performance in other settings/combinations may differ from the results in the declaration settings, however the standard does not address those results.

4.6.2 Operation of water filter vacuum cleaner, additional requirements

4.6.2.1 Determining the water loss

Prior the preconditioning the water loss of the water filter vacuum cleaner shall be determined.

The water filter vacuum cleaner has to run according manufacturer's instructions for a period of 10 min with the suction nozzle lifted 20 mm off the floor at standard temperature and standard relative humidity. Before and after this running time of 10 min the weight of the water filter system shall be measured with an accuracy of at least 0,1 g. This test shall be repeated three times and an average of these 3 tests shall be noted.

The ambient condition have a big influence on the water loss. Temperature and air humidity will have impact on the results. Therefore the temperature and air humidity should be controlled carefully.

4.6.2.2 Filter conditions

4.6.2.2.1 For dust removal from hard flat floor (see 5.1) and from carpet (see 5.3)

If the value measured according to 4.6.1.1 is lower than 0,1 g/min the water filter vacuum cleaner shall be used according to manufacturer's instructions for the dust removal from hard flat floors and carpet.

NOTE: The mass of water which is lost during the measuring time is low and has no relevant influence on the test result.

Water Filter vacuum cleaners should not be moved to minimize the loss of water.

If the value measured according to 4.6.1.1 is equal or higher than 0,1 g/min and the water filter vacuum cleaner is equipped with a dust collection system which doesn't use water, this collecting system will be included to determine the dust removal from hard flat floors according to 5.1.6 and dust removal from carpets according to 5.3.

The air data according to 5.8.shall be measured with the water filter system used according to the manufacturer's instructions. Then, the vacuum cleaner shall be equipped with the dust collecting system without water and the maximum airflow shall be adjusted to ± 3 % of the measured values with the water filter system.

In all other cases the dust removal from hard flat floors and from carpet shall be performed using the dust collecting box (see 7.3.Z2 Dust collecting box) as a pre filter system. The vacuum cleaner shall be used according to manufacturer's instructions.

The dust collecting box is equipped with a filter bag. The filter bag from the reference vacuum cleaner system could be used. For measuring dust pick up the filter bag shall be handled in the same way as it is handled in the reference vacuum cleaner system

4.6.2.2.2 For all other tests with a water filter vacuum cleaner

The vacuum cleaner and its attachments shall be used and adjusted in accordance with the manufacturer's instructions for normal operation for the test to be carried out."

3 Modification to 5.1.5

Add note at the end:

"NOTE: For water filter vacuum cleaners consider 4.6.1"

4 Modification to 5.1.6

Add note at the end:

"NOTE: For water filter vacuum cleaners consider 4.6.1"

5 Modification to 5.2.1

Replace "removable insert with a crevice" with "removable aluminium insert with a crevice."

6 Modification to 5.3.1

Add note at the end:

"NOTE There are known issues with the reproducibility of this test. An extensive round robin test is underway to define the uncertainties within the procedure for future versions of the standard. Changes may be necessary to the way it is recommended the test is performed and results are corrected."

7 Modification to 5.3.3.3

Add note at the end:

"NOTE: For water filter vacuum cleaners consider 4.6.1"

8 Modification to 5.3.7

Add note at the end:

"NOTE: For water filter vacuum cleaners consider 4.6.1"

9 Modification to 5.7.2

Add after first paragraph:

"For water filter vacuum cleaner the visible maximum level mark has to be checked with vacuum cleaner off."

10 Modification to 5.7.3

Add after first paragraph:

"For water filter vacuum cleaner the water loss during the feeding time shall be taken into consideration. The ON duration during the feeding time has to be measured and multiplied with the water loss measured according to 4.6.1.1. This lost weight shall be added to the calculated usable volume.

NOTE 1: For water filter vacuum cleaners take into consideration that the density of the moulding granules could change due to the contact with water."

11 Modification to 5.11

Delete entire clause including heading and replace with:

“5.11 Filtration efficiency and dust re-emission of the vacuum cleaner

5.11.1 Purpose

The aim of this test is to determine the ability of a vacuum cleaner to retain dust, depending on particle size, from the intake aerosol containing a predefined concentration of test dust.

This test is not suitable for determining permeability of filters or filter materials.

5.11.2 Test conditions

NOTE A relative humidity of 45 % RH to 55 % RH is recommended for control of static.

Measuring equipment required for the test is specified in 7.3.8.

In preparation of the test, the vacuum cleaner should be equipped with a new or thoroughly cleaned dust receptacle and new filters according to specifications. It is to be set to operate at maximum airflow.

The vacuum cleaner is placed centrally under the test hood in its normal operation condition.

Dust will be fed

- to vacuum cleaners with a suction hose, through this hose,
- to vacuum cleaners without a suction hose (for instance Uprights) through a suitable auxiliary hose which is connected and sealed tightly to the suction nozzle by use of a nozzle adaptor.

For water filter vacuum cleaner distilled water shall be used for measuring the filtration efficiency. The amount of water shall be taken from the manufacturer’s instructions. In order not to measure water droplets a diffusion dryer shall be added to the inlet of the particle counter.

5.11.3 Determining the test dust quantity

For the entire duration of dust, according to 7.2.2.5 being fed, the dust concentration c shall be 0,1 g/m^3 in the intake aerosol channel. Therefore, the maximum airflow q for the vacuum cleaner with the given filter equipment shall be determined.

The quantity m of dust to be fed for duration t_{DUST} is calculated consequently as

$$m = c \times t_{DUST} \times q$$

5.11.4 void

5.11.5 void

5.11.6 Test procedure

5.11.6.1 General

A test run can be conducted either by using two particle counters which read intake and exhaust values simultaneously or by using a single particle counter which is switched for reading intake and exhaust values, respectively.

Particle registration is by particle analysing system (see 7.3.8.5) which can be operated with a suitable aerosol dilution system to adapt count rate capacity and the particle concentration of aerosol intake and of exhaust channel, respectively. The results of any single trial shall be recorded as follows:

- counter events / class; i.e. the number of events recorded by the particle counter, separately for each range of particle size as well as for aerosol intake channel and exhaust channel;
- sample air volumes, VA_{Ex} (exhaust) and VA_{In} (intake); i.e. the volumes of the aerosol samples analysed by the particle counter combined in the course of the trial;
- applicable dilution factors k_{VA} (intake or exhaust) of the particle analysis system; i.e. the ratio between the volume of the air sample extracted from the channel and the sample air volume analysed by the particle counter.

The following test procedure for a single trial may be repeated with several dry vacuum cleaners of identical type. Then the final result of the test run has to be averaged arithmetically.

NOTE 1 Proper dilution ratio needs to be verified. Prove not over-concentrated by serial dilution and prove not over-diluted on the exhaust by lessening the dilution serially, see 7.3.8.5.

NOTE 2 There are known issues with the particle transport within this test. Measures are under development to ensure and verify a proper particle transport. Changes may be necessary to the measuring equipment or to the way the test is performed.

5.11.6.2 Single particle counter procedure

A single trial proceeds as follows:

- the dry vacuum cleaner is operated without dust being fed until acceptable and stable conditions are achieved (minimum 10 min, maximum 30 min). This method stability is ± 10 % for particle counts over 100 for 30 s or less than 100 particle counts per 30 s over at least 10 min.
- conditioning: dust is fed for 10 min while the particle concentration in the aerosol intake channel is monitored (quantity of test dust according to 5.11.3),
- sampling: feeding of dust is continued for approximately 10 min during which 5 test cycles are carried out, each consisting of:
  - particle registration from aerosol intake channel for 30 s (intake measurement),
  - flushing of particle analysing system with the applicable sample stream for ≥ 10 s,
  - particle registration from exhaust channel for 30 s (exhaust measurement),
  - flushing of particle analysing system with the applicable sample stream for ≥ 10 s.

5.11.6.3 Dual particle counter procedure

If two particle counters are used, they need to be verified to match in calibration and count rate. Their particle counts have to be within 10 % in each range of particle size for particle counts over 100 for 30 s.

A single trial proceeds as follows:

- the dry vacuum cleaner is operated without dust being fed until acceptable and stable conditions are achieved (minimum 10 min, maximum 30 min). This method stability is ± 10 % for particle counts over 100 for 30 s or less than 100 particle counts per 30 s over at least 10 min.
- conditioning: dust is fed for 10 min while the particle concentration in the aerosol intake channel is monitored (quantity of test dust according to 5.11.3),
- sampling: feeding of dust is continued for 150 s during which 5 test cycles are carried out, each consisting of continuous particle registration from both aerosol intake channel (intake measurement) and exhaust channel (exhaust measurement) for 30 s.

5.11.7 Evaluation

5.11.7.1 General

Based on the particle counts obtained in the 5 measurement cycles, for aerosol intake channel and exhaust channel, the evaluation can be done either for

- fractional filtration efficiency (for each class of particle size) or
- filtration efficiency for the entire range of particle size (i.e. from 0,3 µm to 10 µm).

Filtration efficiency E for the entire range of particle size is 1 minus the ratio of number of particles exhaust and number of particles intake.

Dust re-emission R for the respective range of particle size is defined as 1 minus E which is the ratio of number of particles exhaust and number of particles intake.

The basic formulae are:

$$E = 1 - R$$

$$R = 1 - E$$

The detailed determination of E and R for a range of particle size including consideration of the 95 % confidence level is shown below.

5.11.7.2 Evaluation of fractional filtration efficiency

Based on the particle counts obtained in the 5 measurement cycles, for aerosol intake channel and exhaust channel, the fractional filtration efficiency is derived for each particle class.

The individual measurements are considered to be samples of a full distribution, and a statistical analysis is performed accordingly.

Given the particle counts $z(k,l)_U$ of the aerosol intake channel for particle class *k* obtained from each individual measurement cycle *l*, the corresponding lower limits of the 95 % -confidence range, $\underline{Z(k)}_U$, are obtained as follows:

– summation of particle counts obtained for particle class *k* in 5 individual measurements intake

$$Z(k)_U = \sum_{l=1}^{5} z(k,l)_U$$

where

k is the index of particle class;

l is the running index of individual measurement cycles;

$(k,l)_U$ is the particle count intake in class *k* from individual measurement cycle *l*;

$Z(k)_U$ is the particle sum intake in class *k* from all measurement cycles;

– determination of the 95 % lower - confidence limits $\underline{Z(k)}_{U\_95}$ for the particle sums $Z(k)_U$:

If $Z(k)_U > 50$: $\underline{Z(k)}_{U\_0,95} = Z(k)_U - 1{,}96 \times \left(Z(k)_U\right)^{\frac{1}{2}}$

If $Z(k)_U \leq 50$: $\underline{Z(k)}_{U\_0,95}$ from Table 1.

Given the particle counts $z(k,l)_D$ of the exhaust channel for particle class *k* obtained from each individual measurement cycle *l*, the corresponding upper limits of the 95 % - confidence range, $\overline{Z(k)}_{D\_0,95}$ are similarly derived by

– summation of particle counts obtained for particle class *l* in 5 individual measurements exhaust:

$$Z(k)_D = \sum_{l=1}^{5} z(k,l)_D$$

where

k is the index of particle class;

l is the running index of individual measurement cycles;

$z(k,l)_D$ is the particle count exhaust in class *k* from individual measurement cycle *l*;

$Z(k)_D$ is the particle sum exhaust in class *k* from all 5 measurement cycles;

– determination of corresponding upper limits of the 95 % - confidence range $\overline{Z(k)}_{D\_0,95}$ from particle sums $Z(k)_D$:

If $Z(k)_D > 50$: $\overline{Z(k)}_{D\_0,95} = Z(k)_D + 1{,}96 \times (Z(k)_D)^{\frac{1}{2}}$

If $Z(k)_D \leq 50$: $\overline{Z(k)}_{D\_0,95}$ from Table 1.

From the statistical limits calculated above, the lower limit of the 95 % - confidence range of the fractional filtration efficiency, $\underline{E(k)}_{0,95}$, is obtained for each particle class k :

$$\underline{E(k)}_{0,95} = 1 - \left(\frac{\overline{Z(k)}_{D\_0,95} \times k_{VA\_D} \times \left(\frac{VA_U}{VA_D} \right)}{\underline{Z(k)}_{U\_0,95} \times k_{VA\_U}} \right)$$

where

k	is the index of particle class;
$E(k)_{0,95}$	is the lower limit of confidence for filtration efficiency of particle class k;
k_{VA_D}	is the exhaust dilution factor of particle analysis system;
k_{VA_U}	is the intake dilution factor of particle analysis system;
VA_D	is the exhaust sample air volume analysed;
VA_U	is the intake sample air volume analysed;
$Z(k)_{D\_0,95}$	is the upper limit of confidence for partial sum class k from exhaust measurements;
$Z(k)_{U\ 0,95}$	is the lower limit of confidence for particle sum class k from intake measurements.

This evaluation shall be carried out in every test.

5.11.7.3 Evaluation of filtration efficiency and dust re-emission for the entire range of particle size

The individual measurements are considered to be samples of a full distribution, and a statistical analysis is performed accordingly.

Given the particle counts $z(k,l)_U$ of the aerosol intake channel for particle class k obtained from each individual measurement cycle l, the corresponding lower limits of the 95 % - confidence range, $\underline{Z(k)}_U$, are obtained as follows:

– summation of particle counts obtained for the entire range of particle size between 0,3 µm and 10 µm in 5 individual measurements intake

$$Z(k)_U = \sum_{l=1}^{5} z(k,l)_U$$

where

k	is the index of particle class;
l	is the running index of individual measurement cycles;
$(k,l)_U$	is the particle count intake in class k from individual measurement cycle l;

$Z_{0,3\text{-}10U}(l)$ is the intake sum of particles between 0,3 µm and 10 µm from individual measurement cycle l.

– summation of particle counts for 5 measurement cycles

$$Z_{0,3-10U} = \sum_{l=1}^{5} Z_{0,3-10U}(l)$$

Where

l is the running index of individual measurement cycles;

k0,3 is the particle class with the lower limit of 0,3 µm;

k10 is the particle class with the upper limit of 10 µm;

$Z_{0,3\text{-}10U}$ is the intake sum of particles between 0,3 µm and 10 µm.

– determination of the 95 % lower - confidence limits $\underline{Z_{0,3-10}}_{U\_0,95}$ for the particle sums $Z_{0,3-10U}$:

If $Z_{0,3-10U} > 50$: $\underline{Z_{0,3-10}}_{U\_0,95} = Z_{0,3-10U} - 1,96 \times (Z_{0,3-10U})^{\frac{1}{2}}$

If $Z_{0,3-10U} \leq 50$: $\underline{Z_{0,3-10}}_{U\_0,95}$ from Table 1.

Given the particle counts $z(k,l)_D$ of the exhaust channel for particle class *k* obtained from each individual measurement cycle *l*, the corresponding upper limits of the 95 % - confidence range, $\overline{Z(k)}_{D\_0,95}$ are similarly derived by

– summation of particle counts obtained for the entire range of particle size between 0,3 µm and 10 µm in 5 individual measurements exhaust:

$$Z_{0,3-10D}(l) = \sum_{k=k0,3}^{k10} Z(k,l)_D$$

where

k is the index of particle class;

l is the running index of individual measurement cycles;

$z(k,l)_D$ is the particle count exhaust in class *k* from individual measurement cycle *l*;

$Z_{0,3\text{-}10D}(l)$ is the exhaust sum of particles between 0,3 µm and 10 µm from individual measurement cycle *l*;

– summation of particle counts for 5 measurement cycles:

$$Z_{0,3-10D} = \sum_{l=1}^{5} Z_{0,3-10D}(l)$$

Where

l is the running index of individual measurement cycles;

k0,3 is the class with the lower limit of 0,3 µm

k10 is the particle class with the upper limit of 10 µm

$Z(k)_D$ is the particle sum exhaust in class *k* from all 5 measurement cycles;

$Z_{0,3\text{-}10D}$ is the exhaust sum of particles between 0,3 µm and 10 µm

– determination of corresponding upper limits of the 95 % - confidence range $\overline{Z_{0,3-10_{D\_0,95}}}$ from particle sums $Z_{0,3-10D}$:

If $Z_{0,3-10D} > 50$: $\overline{Z_{0,3-10_{D\_0,95}}} = Z_{0,3-10D} + 1{,}96 \times (Z_{0,3-10D})^{\frac{1}{2}}$

If $Z_{0,3-10D} \leq 50$: $\overline{Z_{0,3-10_{D\_0,95}}}$ from Table 1.

From the statistical limits calculated above, the lower limit of the 95 % - confidence range of the filtration efficiency, $\underline{E}_{0,3-10\_0,95}$, is obtained :

$$\underline{E}_{0,3-10\_0,95} = 1 - \left(\frac{\overline{Z_{0,3-10_{D\_0,95}}} \times k_{VA\_D} \times \left(\frac{VA_U}{VA_D} \right)}{\underline{Z_{0,3-10}}_{U\_0,95} \times k_{VA\_U}} \right)$$

$$\overline{R}_{0,3-10\_0,95} = 1 - \underline{E}_{0,3-10\_0,95}$$

where

$\underline{E}_{0,3-10\_0,95}$	is the lower limit of confidence for filtration efficiency of particles between 0,3 µm and 10 µm;
$\overline{R}_{0,3-10\_0,95}$	is the upper limit of confidence for dust re-emission of particles between 0,3 µm and 10 µm;
k_{VA_D}	is the exhaust dilution factor of particle analysis system;
k_{VA_U}	is the intake dilution factor of particle analysis system;
VA_D	is the exhaust sample air volume analysed;
VA_U	is the intake sample air volume analysed;
$\overline{Z_{0,3-10_{D\_0,95}}}$	is the upper limit of confidence for particle sum of particles between 0,3 µm and 10 µm from exhaust measurements;
$\underline{Z_{0,3-10}}_{U\_0,95}$	is the lower limit of confidence for particle sum of particles between 0,3 µm and 10 µm from intake measurements.

This evaluation shall be carried out in every test.

Table 1 – Confidence limits of a Poisson distribution for 95 % - confidence range

z	$\underline{z}_{0,95}$	$\overline{z}_{0,95}$	z	$\underline{z}_{0,95}$	$\overline{z}_{0,95}$	z	$\underline{z}_{0,95}$	$\overline{z}_{0,95}$	z	$\underline{z}_{0,95}$	$\overline{z}_{0,95}$	z	$\underline{z}_{0,95}$	$\overline{z}_{0,95}$
0	0,0	3,7	10	4,7	18,4	20	12,2	30,8	30	20,2	42,8	40	28,6	54,5
1	0,1	5,6	11	5,4	19,7	21	13,0	32,0	31	21,0	44,0	41	29,4	55,6
2	0,2	7,2	12	6,2	21,0	22	13,8	33,2	32	21,8	45,1	42	30,3	56,8
3	0,6	8,8	13	6,9	22,3	23	14,6	34,4	33	22,7	46,3	43	31,1	57,9
4	1,0	10,2	14	7,7	23,5	24	15,4	35,6	34	23,5	47,5	44	32,0	59,0
5	1,6	11,7	15	8,4	24,8	25	16,2	36,8	35	24,3	48,7	45	32,8	60,2
6	2,2	13,1	16	9,2	26,0	26	17,0	38,0	36	25,1	49,8	46	33,6	61,3
7	2,8	14,4	17	9,9	27,2	27	17,8	39,2	37	26,0	51,0	47	34,5	62,5
8	3,4	15,8	18	10,7	28,4	28	18,6	40,4	38	26,8	52,2	48	35,3	63,6
9	4,0	17,1	19	11,5	29,6	29	19,4	41,6	39	27,7	53,3	49	36,1	64,8
10	4,7	18,4	20	12,2	30,8	30	20,2	42,8	40	28,6	54,5	50	37,0	65,9

5.11.8 Particle concentration and dilution

For flawless particle registration and analysis it has to be monitored and maintained that the particle concentration at the counter is within its specified range of proper operation and that each individual particle count z_{SAMPLE} is well below the maximum count $z_{COUNTER\_MAX}$, such that

$z_{SAMPLE} < 0{,}2\ z_{COUNTER\_MAX}$.

To verify not over-concentrated, increase the dilution a known amount, and verify that the counts are decreased by the same ratio.

To verify not over-diluted, decrease the dilution and verify that the counts increase by this same change in dilution ratio.

5.11.9 Record keeping

A record with the following information shall be kept for each test of filtration efficiency and filtration efficiency and dust re-emission for the entire range of particle size:

- electrical and air-technical data of the type of at least 3 devices being tested;
- information on its dust receptacle and filter system;
- quantity of test dust being fed in the procedure;
- information on the particle analysis system:
  - particle counter and size ranges of analysed particle classes
  - dilution factors intake and exhaust
- for each particle count:
  - dilution factor
  - sample air volume analysed in the particle counter
  - particle counts in each class registered by the particle counter
- filtration efficiency (lower limit of 95 % - confidence range) of each particle class;
- filtration efficiency (lower limit of 95 % - confidence range) for entire range of particle size;
- dust re-emission for entire range of particle size;
- sheath air if applicable;
- vacuum cleaner air flow rate."