BS EN 60704-2-1:2015

BSI Standards Publication

Household and similar electrical appliances — Test code for the determination of airborne acoustical noise

Part 2-1: Particular requirements for vacuum cleaners

National foreword

This British Standard is the UK implementation of EN 60704-2-1:2015. It is identical to IEC 60704-2-1:2014. It supersedes BS EN 60704-2-1:2001 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee CPL/59, Performance of household electrical appliances, to Subcommittee CPL/59/6, Floor treatment appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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English Version

Household and similar electrical appliances - Test code for the determination of airborne acoustical noise - Part 2-1: Particular requirements for vacuum cleaners (IEC 60704-2-1:2014)

Appareils électrodomestiques et analogues - Code d'essai pour la détermination du bruit aérien - Partie 2-1: Exigences particulières pour les aspirateurs (IEC 60704-2-1:2014)

Elektrische Geräte für den Hausgebrauch und ähnliche Zwecke -Prüfvorschrift für die Bestimmung der Luftschallemission -Teil 2-1: Besondere Anforderungen an Staubsauger (IEC 60704-2-1:2014)

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Foreword

The text of document 59F/255/FDIS, future edition 3 of IEC 60704-2-1, prepared by SC 59F: "Floor treatment appliances" of IEC/TC 59: "Performance of household and similar electrical appliances." was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60704-2-1:2015.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-07-09
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-06-26

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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.

Endorsement notice

The text of the International Standard IEC 60704-2-1:2014 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)
Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Addition *to Annex ZA of EN 60704-1:2010:*

Publication	Year	Title	EN/HD	Year
IEC 60312-1 (mod)	2010	Vacuum cleaners for household use - Part 1: Dry vacuum cleaners - Methods for measuring the performance	EN 60312-1 +prA	2013

Annex ZZ
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission to provide reliable, accurate and reproducible procedures and methods of measuring airborne acoustical noise of household appliances, which take into account the recognised state-of-the-art measurement methods.

This European Standard in conjunction with Part 1 specifies the test code for the determination of airborne acoustical noise emission of vacuum cleaners for household and similar use. It shall be applied implementing:

– Commissions delegated Regulation (EU) No 665/2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of vacuum cleaners;

– Commission Regulation (EU) No 666/2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for vacuum cleaners.

For determining and verifying airborne acoustical noise emission values declared on a printed label as well as in a product fiche and in the technical documentation, see EN 60704-3.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

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INTRODUCTION

The measuring conditions specified in this part of IEC 60704 provide for sufficient accuracy in determining the noise emitted and comparing the results of measurements taken by different laboratories, whilst simulating as far as possible the practical use of vacuum cleaners.

It is recommended to consider the determination of noise levels as part of a comprehensive testing procedure covering many aspects of properties and performance of household vacuum cleaners.

NOTE As stated in the introduction to IEC 60704-1, this test code is concerned with airborne noise only.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – TEST CODE FOR THE DETERMINATION OF AIRBORNE ACOUSTICAL NOISE –

Part 2-1: Particular requirements for vacuum cleaners

1 Scope and object

This clause of Part 1 is applicable except as follows:

1.1 Scope

1.1.1 General

Replacement:

These particular requirements apply to electrical vacuum cleaners (including their accessories and their component parts) for household use in or under conditions similar to those in households.

This part of IEC 60704 applies as it is to electrical vacuum cleaners operating in dry conditions. Some additions and modifications for vacuum cleaners operating in wet conditions are under consideration. How to test robotic vacuum cleaners is under consideration for a future edition.

This part of IEC 60704 does not apply to vacuum cleaners for industrial or professional purposes.

1.1.2 Types of noise

Replacement:

The methods specified in ISO 3743-1, ISO 3743-2 and ISO 3744 can be used for measuring noise emitted by electric vacuum cleaners.

1.1.3 Size of the source

Replacement:

The method specified in ISO 3744 is applicable to noise sources of any size. When applying ISO 3743-1 and ISO 3743-2, care should be taken that the maximum size of the appliance under test fulfils the requirements specified in ISO 3743-1 and ISO 3743-2.

1.2 Object

Addition:

This part of IEC 60704 describes the determination of the noise emission of vacuum cleaners under normal operating conditions on carpet and hard floor according to 4.6 of IEC 60312-1:2010.

NOTE 101 For determining and verifying noise emission values declared in product specifications, see IEC 60704-3.

NOTE 102 If a boost position is incorporated, this is not taken into account.

NOTE 103 A boost position is a setting of a control for occasional use which results in a higher temporary fan speed.

1.3 Measurement uncertainty

Replacement:

For vacuum cleaners designed for cleaning carpets the estimated values of standard deviations of sound power levels determined according to this part of IEC 60704 are provided in Table 101:

Table 101 – Standard deviations of sound power levels determined on carpets

Standard deviation (dB)	
σ_r (repeatability)	σ_R (reproducibility)
0,3	0,8

For vacuum cleaners designed for cleaning hard floors the estimated values of standard deviations of sound power levels determined according to this part of IEC 60704 are provided in Table 102:

Table 102 – Standard deviations of sound power levels determined on hard floors

Standard deviation (dB)	
σ_r (repeatability)	σ_R (reproducibility)
0,2	0,6

Addition:

1.101 Standard deviation for declaration and verification

For the purpose of determining and verifying declared noise emission values for vacuum cleaners designed for cleaning carpets according to IEC 60704-3, the following values provided in Table 103 apply:

Table 103 – Standard deviations for declaration and verification for vacuum cleaners for carpets

Standard deviation (dB)		
σ_P (production)	σ_t (total)	σ_M (reference)
0,5 to 1,0	0,9 to 1,3	1,5

For the purpose of determining and verifying declared noise emission values for vacuum cleaners designed for cleaning hard floors according to IEC 60704-3, the following values provided in Table 104 apply:

Table 104 – Standard deviations for declaration and verification hard floors

Standard deviation (dB)		
σ_P (production)	σ_t (total)	σ_M (reference)
0,5 to 1,0	0,8 to 1,2	1,5

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

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

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

Addition:

3.101
cleaning head
plain nozzle or a brush attached to a connecting tube, or a power nozzle, separate or part of the cleaner housing, and the part of a vacuum cleaner which is applied to the surface to be cleaned

[SOURCE: IEC 60312-1:2010, 3.3]

3.102
nozzle
active nozzle
cleaning head provided with a driven agitation device to assist dirt removal

Note 1 to entry: The agitation device may be driven by an incorporated electric motor (motorized nozzle), an incorporated turbine powered by the air flow (air turbine nozzle) or an incorporated friction or gear mechanism actuated by moving the cleaning head over the surface to be cleaned (mechanical nozzle).

[SOURCE: IEC 60312-1:2010, 3.4]

3.103
standard Wilton test carpet
Wilton type carpet according to the typical specification provided in Table 105 used for testing

Table 105 – Wilton type carpet specifications

Type	Wilton
Pile composition wool	8,6/2 x 2
Method of manufacturing	Wilton fabric
Colour	dark, one colour
Backing	jute and cotton with latex
Type	cut-pile
Total height	7,5 mm, see also tolerances
Pile height	6,4 mm, see also tolerances
Total weight/m^2	2 100 g/m^2, see also tolerances
Pile weight/m^2	1 500 g/m^2, see also tolerances
Number of knots/m^2	96 000 knots/m^2, see also tolerances
Reed	320 reed /m
Shots	300 shots/m
Standard width	400 cm
Tolerances	±5 %

Note 1 to entry: For acoustical reasons, the size of the carpet used is 1 m × 1 m.

Note 2 to entry: Carpets conforming to previous editions of this standard do not conform with this definition.

3.104
standard hard floor
part of the floor of at least 1 m by 1 m on which the vacuum cleaner and its nozzle is placed for the measurement, with a sound absorption coefficient lower than 0,1 and an areal density of at least 50 kg/m^2

Note 1 to entry: Scratches and other irregularities of the surface roughness shall be below 0,5 mm to prevent turbulence noise generated by these irregularities.

4 Measurement methods and acoustical environments

This clause of Part 1 is applicable except as follows:

4.2 Direct method

Addition:

If pure tone components are present in the noise emitted by the source, the estimated standard deviation of the measured sound pressure levels in the special reverberation room may increase. In such cases additional microphone positions or source positions may be necessary as specified in ISO 3743-2.

4.3 Comparison method

Addition:

If pure tone components are present in the noise emitted by the source, the estimated standard deviation of the measured sound pressure levels in the hard-walled test room or in the special reverberation room may increase. In such cases additional microphone positions or source positions may be necessary as specified in ISO 3743-1 or ISO 3743-2.

5 Instrumentation

This clause of Part 1 is applicable except as follows:

5.1 Instrumentation for measuring acoustical data

Addition:

The use of a windscreen is recommended. If necessary, the observed sound pressure level shall be corrected for changes in the microphone sensitivity, in accordance with the instructions accompanying the instrumentation.

6 Operation and location of appliances under test

This clause of Part 1 is applicable except as follows:

6.1 Equipping and pre-conditioning of appliances

6.1.1

Replacement:

The appliance is equipped with the ordinary cleaning head intended for dust removal from carpets or hard floors respectively and the necessary attachments, for example hoses and connecting tubes.

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. Height adjustment controls for the cleaning head shall be set as appropriate for the surface to be cleaned and the position noted.

NOTE 101 Additional measurements can be made for other settings (for instance: "boost" position, minimum speed). A boost position is a setting of a control for occasional use, which results in a higher temporary motor speed.

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

If the vacuum cleaner is designed to be used with disposable dust receptacles, it shall, prior to each measurement, be equipped with a new dust receptacle of the type recommended or supplied by the manufacturer of the vacuum cleaner.

If the vacuum cleaner is provided with a reusable dust receptacle (as the sole original dust receptacle or as an enclosure for disposable dust receptacles), the dust receptacle and any additional filters removable without the aid of tools shall, prior to each measurement, be cleaned according to manufacturer’s instructions until its weight is within 1 % or 2 g of its original weight whichever is lower.

6.1.3

Replacement:

Prior to the first test on a new vacuum cleaner it shall be kept running with unrestricted air flow for at least 2 h to ensure adequate running-in. For active nozzles, the agitation device shall be running but not be in contact with the floor.

Prior to the first test on a new battery operated vacuum cleaner it shall be kept running with unrestricted air flow for at least 3 full charge and discharge cycles to ensure adequate running-in. For active nozzles, the agitation device shall be running but not in contact with the floor.

Prior to conducting any series of tests, the age, condition, and history of the product shall be recorded.

6.1.4

Addition:

If the vacuum cleaner is unused and de-energized for more than 1 h, then the vacuum cleaner and attachments to be used shall be kept running for at least 10 min to allow them to stabilise.

For appliances supplied from batteries, this duration for stabilising is reduced to 2 min.

6.2 Supply of electric energy and of water or gas

6.2.2

Addition:

Rechargeable vacuum cleaners are measured with fully charged batteries and disconnected from the external power source.

6.4 Loading and operating of appliances during tests

6.4.2

Replacement:

Vacuum cleaners shall be operated either on standard Wilton test carpet or on standard hard floor depending on the function specified by the manufacturer. Vacuum cleaners designed for cleaning both carpets and hard floor shall be operated on standard Wilton carpet and on standard hard floor.

Any controls shall be set to the maximum position for normal operating. Unless the manufacturer’s instructions state otherwise, any bypass air openings for reducing the suction power shall be closed. If such openings are not controlled manually this shall be reported.

Before starting the measurement procedure, ensure that the cleaning head is adjusted correctly in accordance with the manufacturer's instructions for cleaning carpets and/or hard floors.

For operation of the appliance on carpets:

If the cleaning head is equipped with a device to put out brushes or other retractable parts for cleaning carpets, the cleaning head is adjusted so that the bristles of rotating brushes or other retractable parts go beyond the theoretical supporting plane of the cleaning head on a hard floor from $(2^{+0,2}_{0})$ mm or, if not possible, from at least 2 mm.

All parts intended for hard floor treatment only shall be removed or retracted.

With the appliance switched off, lift the cleaning head off the carpet, replace the cleaning head on the edge of the carpet and push along the pile direction into the measurement

position, taking care that no vertical force is exerted. To avoid any vertical force it is recommended to push the cleaning head directly by hand. Switch on the appliance.

Other conditions are specified in 6.1.1, 6.2 and 6.3.

If the appliance is delivered with an ordinary carpet nozzle and in addition with a power nozzle, measurements shall be carried out for both cleaning heads.

For operation of the appliance on hard floors:

All parts intended for carpet treatment only shall be removed or retracted.

With the appliance switched off, lift the cleaning head off the floor, replace the cleaning head approximately 30 cm before the measurement position and push along in a forward direction into the measurement position, taking care that no vertical force is exerted. Switch on the appliance.

Other conditions are specified in 6.1.1, 6.2 and 6.3.

If the appliance is delivered with an ordinary hard floor nozzle and in addition with a power nozzle for hard floors, measurements shall be carried out for both cleaning heads.

6.5 Location and mounting of appliances

6.5.1 *Replacement:*

For measurement on carpet:

The vacuum cleaner is located on the standard test carpet Wilton (defined in 3.103) placed directly without any resilient means:

– either on the floor of the hard-walled test room or the special reverberation test room with a minimum distance of 1 m between any surface (including protruding parts) of the appliance and the nearest wall;,
– or on the reflecting plane of the free-field environment, taking into account the shape and the size of the specified measurement surface.

The vertical projection of the shape of the appliance under test and its cleaning head shall be at the centre of the carpet area (see Figures 101 and 102).

The axis of longitudinal travelling of the cleaning head shall be parallel with the direction of the pile of the carpet (*x*-axis). The angle α between the transverse axis of the cleaning head (parallel with *y*-axis) and the longitudinal axis of the appliance (or the tube, if any) shall be $\alpha = (90 \pm 5)°$ (see Figures 101 and 102).

For measurements on standard hard floor:

The vacuum cleaner is located on the standard hard floor (defined in 3.104) placed directly without any resilient means:

– either on the floor of the hard-walled test room or the special reverberation test room with a minimum distance of 1 m between any surface (including protruding parts) of the appliance and the nearest wall,
– or on the reflecting plane of the free-field environment, taking into account the shape and the size of the specified measurement surface.

Generally the floor in a hard-walled test room, a special reverberation test room or in a hemi-anechoic test room fulfils the requirements for a standard hard floor (3.104).

If the requirements for a standard hard floor are not met two plates made of marble or similar natural stone with a polished surface shall be used. The size of the plates shall be at least 0,5 m × 1,0 m; thickness shall be at least 0,02 m. Care is to be taken to prevent additional noise production between the plates and between plates and floor.

NOTE 101 To avoid additional noise production a resilient underlay with a thickness of 25 mm, mechanical loss factor 0,25 and a dynamic E-modulus less than 0,2 N/mm^2 shall be used. The foam Getzner Sylomer®[1] SR11 fulfils these requirements (www.getzner.com).

The vertical projection of the shape of the appliance under test and its cleaning head, shall be at the centre of the test area (see Figures 101 and 102).

If the cleaning head is connected by a hose and connecting tube(s) to the appliance, the cleaning head is placed close to the appliance on the carpet so that the projection of the axis of longitudinal travelling of the cleaning head and that of the longitudinal axis of the appliance are parallel, the projections of the appropriate transverse axis coincide and the clearance between the projection of the appliance and the projection of the cleaning head is (2 ± 1) cm.

In the case of a hard floor measurement, the placement of cleaning head, connecting hose, tubes and appliance is done as if it were placed on a 1 m × 1 m carpet, to ensure a sufficiently compact placement of the various elements. The hose and connecting tube(s) or the handles of hand-supported and upright vacuum cleaners are resiliently suspended or supported in normal position of use (middle of the handles at (80 ± 5) cm above the floor, if possible), the cleaning head being in full contact with the floor.

Telescopic connecting tubes should be adjusted in accordance with the owner's manual. If no instructions are given, then the length of the telescopic connecting tubes shall be adjusted so that the angle β between the telescopic connecting tubes and the floor shall be $\beta = (45\,^{+5}_{0})°$ or, if not possible, as near as possible to 45°.

If necessary the cleaning head is resiliently fastened to prevent self-propulsion.

Sound radiation due to possible vibrations of the test floor should be prevented.

The test floor is considered to be a part of the appliance to be tested and its possible influence on the acoustical characteristics of the test environment, for example of the hard reflecting plane, or on the absorption (reverberation time) of the reverberant test room or hard-walled room should not be taken into account.

6.5.2 to 6.5.5 *Not applicable*.

7 Measurement of sound pressure levels

This clause of Part 1 is applicable except as follows:

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[1] Getzner Sylomer® is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this product.

7.1.1 to **7.1.3** *Not applicable*.

7.1.5 and **7.1.6** *Not applicable*.

7.4 Measurements

7.4.1 *Addition:*

The A-weighted sound pressure level shall be time-averaged during at least 30 s.

8 Calculation of sound pressure and sound power levels

This clause of Part 1 is applicable.

9 Information to be recorded

This clause of Part 1 is applicable except as follows:

9.12.5 *Not applicable.*

10 Information to be reported

This clause of Part 1 is applicable except as follows:

10.3.1 *Addition:*

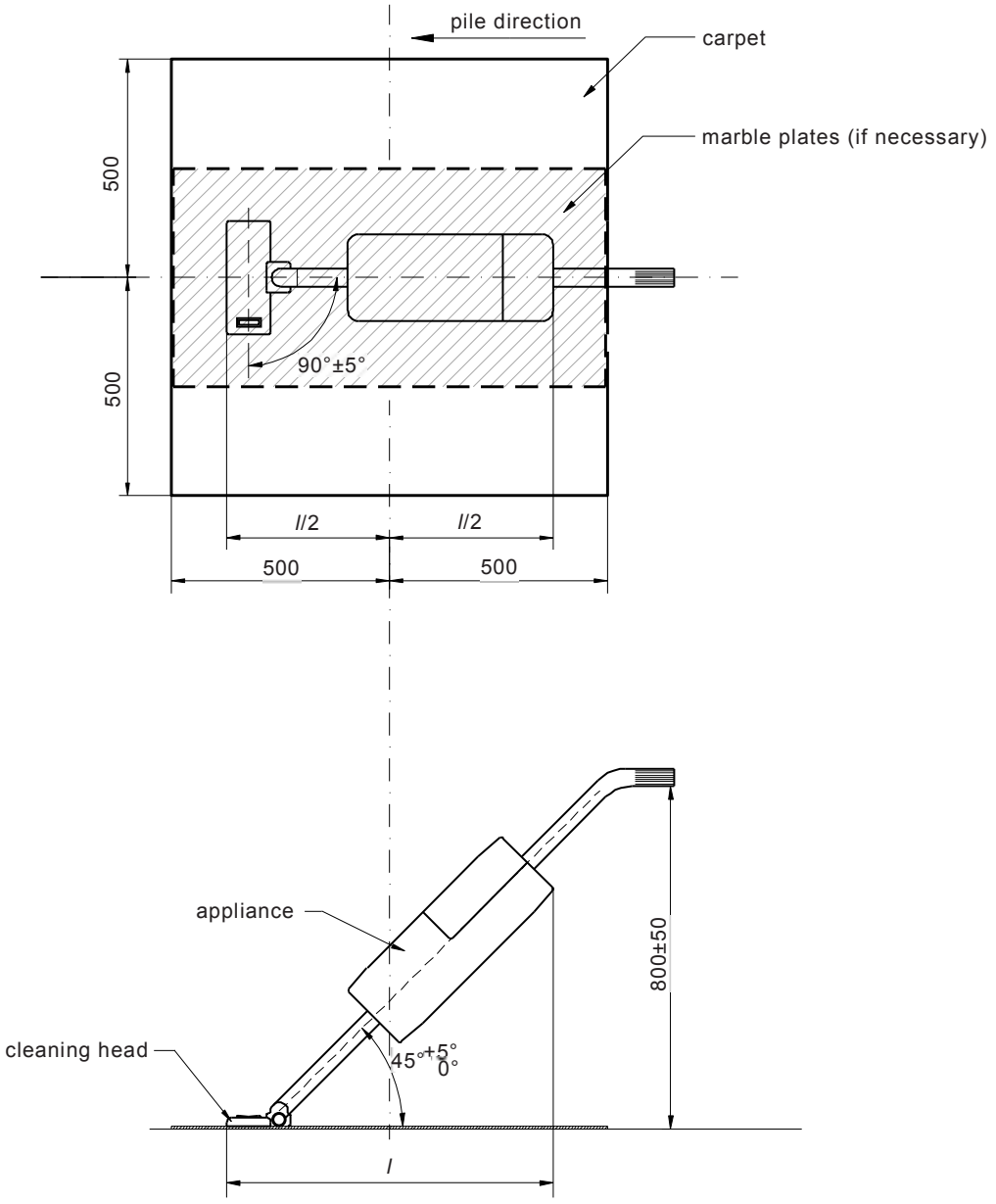
The state of openings for reduction of suction power shall be reported.

10.4.10 *Not applicable.*

10.4.12 *Addition:*

– L_{WA} values for both hard floor and carpet shall be reported for appliances designed for both floor types
– L_{WA} value for a single floor type shall be reported if the appliance is specifically designed for that floor type, meaning that the manufacturer discourages the use of the device on the alternative floor type.
– In all cases type of floor and measured value shall be clearly coupled.

Additional figures:

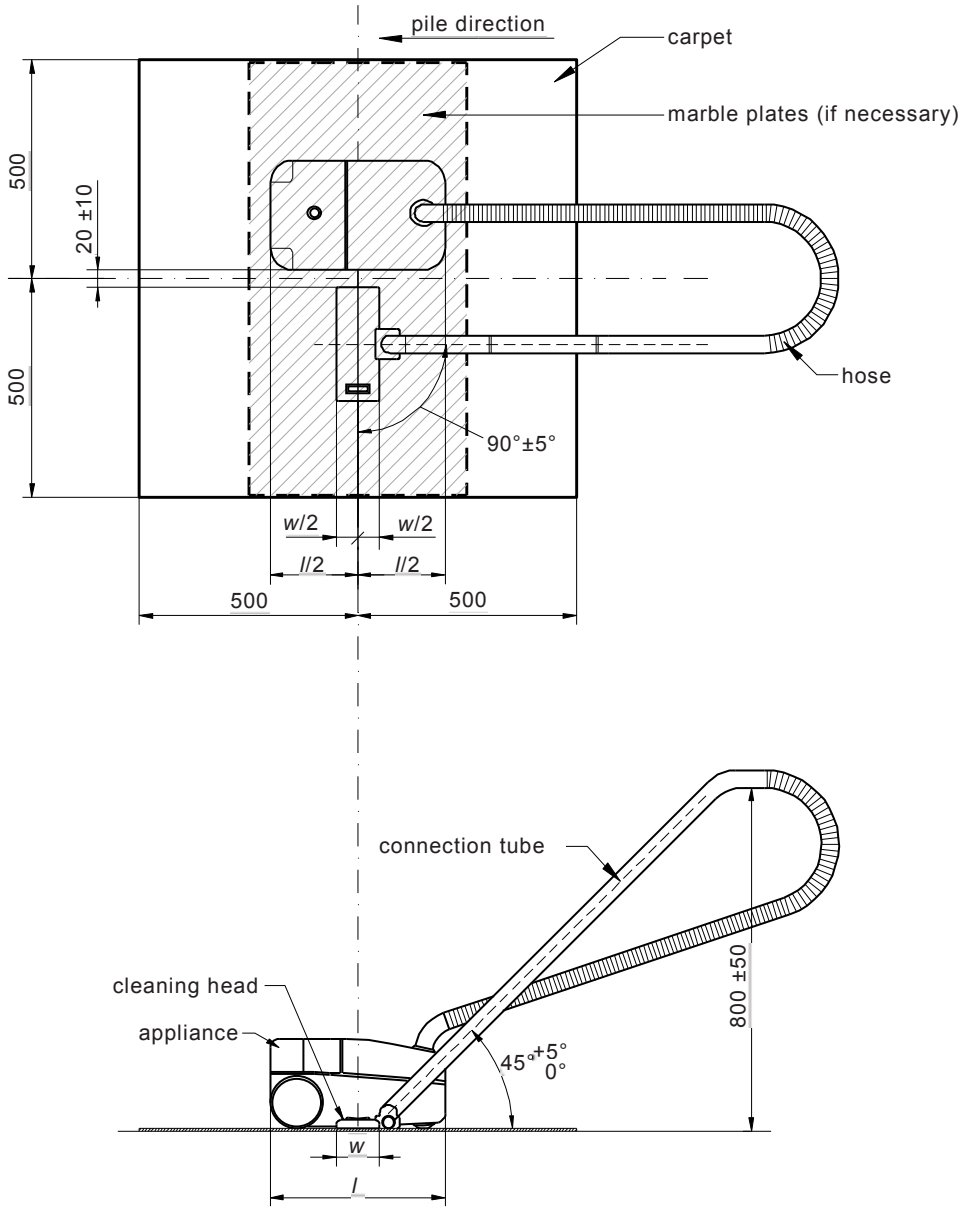


Dimensions in millimetres

Key

l length of the horizontal projection of the appliance

Figure 101 – Appliance with cleaning head connected directly



Dimensions in millimetres

Key

l length of the appliance

w depth of the cleaning head

Figure 102 – Appliance with the cleaning head connected by hose and connecting tube

Annexes

The annexes of Part 1 apply with the following exception:

Annex A
(normative)

Standard test table

This annex of Part 1 is not applicable.

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