

# INTERNATIONAL STANDARD

**IEC**  
**60335-2-69**

Third edition  
2002-07

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## **Household and similar electrical appliances – Safety –**

### **Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use**

*Appareils électrodomestiques et analogues –  
Sécurité –*

*Partie 2-69:  
Règles particulières pour les aspirateurs fonctionnant  
en présence d'eau ou à sec, y compris les brosses  
motorisées, à usage industriel et commercial*



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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES –  
SAFETY –**
**Part 2-69: Particular requirements for wet and dry vacuum cleaners,  
including power brush, for industrial and commercial use**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by sub-committee 61J: Electrical motor-operated cleaning appliances for industrial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

This third edition cancels and replaces the second edition published in 1997 and its amendment 1 (2000). It constitutes a technical revision.

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

FDIS	Report on voting
61J/131/FDIS	61J/136/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 Part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

NOTE 1 When "Part 1" is mentioned in this standard, it refers to IEC 60335-1.

This Part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for electric wet and dry vacuum cleaners, including power brush, for industrial and commercial use.

When a particular subclause of part 1 is not mentioned in this Part 2, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
- additional annexes are lettered AA, BB, etc.

NOTE 3 The following print types are used:

- requirements: in roman type;
- *test specifications: in italic type;*
- notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

The committee has decided that the contents of this publication will remain unchanged until 2004. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

The following differences exist in the countries indicated below.

- 25.7: PVC-cords may not be suitable for operation outdoors at low temperatures (Finland, Sweden);
- 25.14: Flexing test is not conducted (U.S.A.)

A bilingual version of this publication may be issued at a later date.

## INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another Part 2 of IEC 60335, the relevant Part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.



## HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –

### Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for industrial and commercial use

#### 1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of electrical motor-operated vacuum cleaners and includes appliances and stationary equipment specifically designed for wet suction, dry suction, or wet and dry suction for industrial and commercial use with or without attachments, for example for suction to withdraw dust or the like from work benches and production machines, their **rated voltage** being not more than 250 V for single-phase appliances and 480 V for other appliances.

NOTE 101 Commercial uses are for example for use in hotels, schools, hospitals, factories, shops and offices for other than normal housekeeping purposes.

This standard also applies to machines handling hazardous dust, such as asbestos or liquids for which additional national requirements might apply.

It is also applicable to appliances making use of other forms of energy for the motor; but it is necessary that their influence is taken into consideration.

For battery operated appliances reference shall be made to IEC 60335-2-72.

NOTE 102 Attention is drawn to the fact that

- for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;
- in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

NOTE 103 This standard does not apply to

- appliances for household use to which IEC 60335-2-2 applies;
- centrally sited stationary vacuum cleaning systems;
- appliances intended to be used in locations where special conditions prevail, such as the presence of a corrosive or explosive atmosphere (vapour or gas);
- audio, video and similar electronic apparatus (IEC 60065);
- appliances for medical purposes (IEC 60601);
- hand-held motor-operated electric tools (IEC 60745);
- personal computers and similar equipment (IEC 60950);
- transportable motor-operated electric tools (IEC 61029).

## 2 Normative references

This clause of Part 1 is applicable except as follows.

*Addition:*

IEC 60312, *Vacuum cleaners for household use – Methods of measuring the performance*

IEC 60335-2-72, *Household and similar electrical appliances – Safety – Part 2-72: Particular requirements for automatic machines for floor treatment for commercial and industrial use*

## 3 Definitions

This clause of Part 1 is applicable except as follows.

### 3.1.9 Replacement:

#### normal operation

the normal operation  $P_m$  of the vacuum motor is obtained at the following power input:

$$P_m = 0,5 (P_f + P_i)$$

where

$P_f$  is the input, in watts, when the appliance has been operated for 3 min, fitted with the nozzle and hose supplied by the manufacturer giving the highest input;

$P_i$  is the input, in watts, when the appliance has been operated for 20 s with the nozzle sealed, immediately following the 3-minute-period with the nozzle open. Any valve or similar device used to ensure a flow of air to cool the motor in the event of a blockage of a main air inlet is rendered ineffective.

$P_f$  and  $P_i$  are measured with the supply voltage adjusted to **rated voltage**, or to a voltage equal to the mean value of the **rated voltage range** if the difference between the limits of the **rated voltage range** does not exceed 10 % of the mean value of the range. If the difference between the limits of the **rated voltage range** exceeds 10 % of the mean value, the tests are carried out with the supply voltage set to the upper limit of the range.

The measurements are made with the appliance fitted with a clean dust bag and filter and with the water container, if any, empty. If the appliance is intended for use only with a hose, detachable nozzles are removed and the hose is laid out straight. If the appliance is provided with a hose as an optional accessory, it is operated without the hose.

Electrically driven devices, if any, are in operation but are not in contact with the floor or any other surface or with the means used to seal the air inlet.

The normal load is equal to the mean load  $P_r$  for the electrically driven agitating device such as a motor driven brush determined in accordance with the following:

- the agitating device operates on a carpet as specified in IEC 60312;
- the mean load  $P_r$  is determined when using the device in the following way:

After setting the device according to the manufacturer's instructions the device should be moved twice over a distance of 5 m in the direction giving the highest load;

- the motor responsible for the airflow operates under the same conditions as determining  $P_f$ , i.e. no airflow restrictions, and measurements are taken after 3 min;

- the device is adjusted to the carpet pile height in accordance with the recommendations of the manufacturer;
- it is necessary to move the agitating device slowly across the carpet in the usual manner to avoid carpet damage.

### **3.1.9.101 Soiled water discharge pumps are normally operated as follows.**

The pump delivers a continuous flow of water without any soiled water discharge hose attached to the soiled water outlet of the machines unless the discharge hose is permanently attached to the machine. The vacuum motor shall work during the test, unless an interlock device is provided to prevent combined operation of both motors.

### **3.101**

#### **soiled water discharge pump**

pump for discharging the soiled water from the machine.

## **4 General requirement**

This clause of Part 1 is applicable.

## **5 General conditions for the tests**

This clause of Part 1 is applicable.

## **6 Classification**

This clause of Part 1 is applicable, except as follows.

### **6.1 Replacement:**

Vacuum cleaners and their attachments shall be of **class I, class II or class III** with respect to their protection against electric shock.

Appliances carried on the body during use shall be of **class II or class III**.

*Compliance is checked by inspection and by the relevant tests.*

### **6.2 Addition:**

Water suction appliances shall be so constructed that neither water nor foam from detergents can penetrate into the motor or come in contact with **live parts**.

Water suction appliances shall be at least IPX4.

## **7 Marking and instructions**

This clause of Part 1 is applicable, except as follows.

### **7.1 Addition:**

The maximum rated input of the electrically energized nozzle shall be marked near the receptacle.

Electrically energized nozzles for vacuum cleaners for wet use shall be marked: "Do not immerse."

**7.9 Addition:**

The operation of the motor is deemed to be an adequate indication of the switch position.

**7.12 Addition:**

The substance of the following statement may be given in the instruction manual:

This machine is also suitable for commercial use, for example in hotels, schools, hospitals, factories, shops, offices, rental businesses and for other than normal house-keeping purposes.

The following warnings shall be included in the instructions if applicable:

- CAUTION: This machine is not suitable for picking up hazardous dust.
- CAUTION: This machine is for dry use only and shall not be used or stored outdoors in wet conditions.

Any limitation to the use of the socket outlet on the machine shall be clearly stated in the instructions.

For wet suction machines, the instructions shall clearly state the following:

CAUTION: If foam/liquid comes out, switch off immediately.

The instructions for the machine shall state that the water level limiting device is to be regularly cleaned and examined for signs of damage.

## **8 Protection against access to live parts**

This clause of Part 1 is applicable except as follows.

**8.1 Addition:**

NOTE 101 The soiled liquid picked up by the wet suction appliance is considered to be conductive.

**8.1.4 Addition:**

Isolated battery systems of 18 to 24 cells of either acid or alkaline electrochemistry, including gel batteries, shall be regarded as **Class III** provided that

- the maximum voltage per cell on charge does not exceed 2,7 V;
- there are no earthed parts (see Clause 27);
- conductive parts cannot fall on to and thereby bridge live parts of opposite polarity (see Clause 22).

## **9 Starting of motor-operated appliances**

This clause of Part 1 is not applicable.

## 10 Power input and current

This clause of Part 1 is applicable.

## 11 Heating

This clause of Part 1 is applicable except as follows.

### 11.3 Addition:

*If it is necessary to dismantle the appliance for fitting thermocouples or other wiring, the input shall be measured before and after fitting at the lowest possible load, for example, with closed suction openings, with brushes not in contact with the floor, with declutched drive, etc. to check that the assembling has been accomplished properly.*

11.4 Not applicable.

### 11.5 Addition:

*For the heating test the normal load  $P_r$  on the motor driving the moving brushes can be simulated by a brake or other means.*

11.6 Not applicable.

### 11.7 Addition:

*Appliances are operated until steady conditions are established.*

## 12 Void

## 13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable, except as follows.

### 13.2 Addition:

*For class I appliances where several motors operate at the same time, the leakage current shall not exceed 3,5 mA*

## 14 Transient overvoltages

This clause of Part 1 is applicable.

## 15 Moisture resistance

This clause of Part 1 is applicable except as follows.

### 15.1.2 Addition:

*Wet suction appliances shall be operated for 10 min on a level surface wetted by a detergent solution specified in 15.2.*

*In practice the pick-up consists largely of air such that there is no overloading of the suction motor; the input load should be observed to avoid overloading.*

## **15.2 Replacement:**

Appliances having a liquid container shall be so constructed that spillage of liquid due to overfilling and, for unstable appliances and **hand-held appliances**, overturning, does not affect their electrical insulation.

*Compliance is checked by the following tests:*

*Appliances having a liquid container and provided with an appliance inlet are fitted with an appropriate connector and flexible cable or cord; appliances having a liquid container and **type X attachment** are fitted with the lightest cross-sectional area specified in Table 11. Other appliances are tested as delivered.*

*The liquid container of the appliance is completely filled with water containing approximately 1 % NaCl and a further quantity, equal to 15 % of the capacity of the container or 0,25 l, whichever is the greater, is poured in steadily over a period of 1 min.*

***Hand-held appliances** and appliances which are unstable are then, with the container completely filled and with the cover or lid in place, overturned from the most unfavourable of the normal positions of use, and are left in that position for 5 min unless the appliance returns automatically to its normal position of use.*

NOTE 101 Appliances are considered to be unstable if they overturn when applying a force of 180 N at the top of the appliance in the most unfavourable horizontal direction while they are placed in the most unfavourable of the normal positions of use on a support inclined at an angle of 10° to the horizontal, the liquid container being filled to half the level indicated in the manufacturer's instructions.

*Appliances are then subjected to the following test:*

*The nozzle of the appliance is placed in a trough, the base of which is level with the surface supporting the appliance. The trough is filled with water containing detergent to a level of 5 mm above its bottom, this level being maintained throughout the test.*

*The detergent solution consists of 20 g of sodium chloride and 1 ml of a solution of 28 % by mass of dodecyl sodium sulphate in water for every 8 l of water.*

NOTE 102 The solution used for the spillage test on water suction cleaning appliances should be stored in a cool atmosphere, and should be used within 7 days after its preparation.

The chemical designation of dodecyl sodium sulphate is  $C_{12}H_{25}NaSO_4$ .

*The appliance is then operated under normal operation for 5 min after the liquid container has been filled completely.*

*Immediately after this treatment, the appliance shall withstand an electric strength test as specified in 16.3.*

*Inspection shall show that any liquid that may have entered the appliance does not impair compliance with this standard. In particular, there shall be no trace of liquid on insulation that could result in a reduction of **clearances** and **creepage distances** below the values specified in Clause 29.*

NOTE 103 The appliance is allowed to stand in normal test room atmosphere for 24 h before being subjected to the test of 15.3.

*If it is not possible to overfill the container for soiled liquid owing to the construction of the appliance, the test specified in 19.101 is considered to be adequate.*

**15.3 Modification:**

*The relative humidity shall be  $(93 \pm 6)$  %.*

**16 Leakage current and electric strength**

This clause of Part 1 is applicable.

**17 Overload protection of transformers and associated circuits**

This clause of Part 1 is applicable.

**18 Endurance**

This clause of Part 1 is not applicable.

**19 Abnormal operation**

This clause of Part 1 is applicable except as follows.

**19.1 Addition:**

*Appliances are also subjected to the test of 19.101.*

**19.2 Addition:**

*The appliance is tested without liquid in the container.*

NOTE 101 The term restricted heat dissipation means without liquid in the container.

**19.7 Addition:**

NOTE 101 Fan blades are not regarded as parts liable to be jammed.

*Vacuum cleaners with power brushes are tested with the brushes locked.*

**19.9** Not applicable.

**19.10 Addition:**

NOTE 101 For this test the lowest possible load for radial turbines is obtained with the air inlet sealed. Other turbine types may have different characteristics.

*In the case of cleaners driving a brush or agitator, the belt is removed.*

**19.101** *Appliances having containers that are provided with shut-off device(s) or valve(s) are again subjected to the test of 15.2.*

*Stop valves or other fluid shut-off devices are made inoperative. If two or more independent shut-off devices are provided, only one of them is made inoperative at a time, provided that they have passed the test of operating 3 000 times satisfactorily. Otherwise all devices that failed are made inoperative.*

NOTE Care should be taken to suck up an air-liquid mixture to prevent overloading of the motor of the suction unit. The input power should be observed to avoid overloading.

*After this test, the appliance shall be subjected to the electrical strength test of 16.4. Inspection shall show that water has not entered the appliance to any dangerous extent. In particular, there shall be no trace of water on the electrical insulation that would result in the reduction of **clearance and creepage distances** below the limits specified in Clause 29.*

## **20 Stability and mechanical hazards**

This clause of Part 1 is applicable except as follows.

### **20.2 Addition:**

This requirement does not apply to rotating brushes and similar devices, or to moving parts exposed during the fitting of accessories that allow conversion from one application to another.

## **21 Mechanical strength**

This clause of Part 1 is applicable except as follows.

### *Modification:*

*The impact value is increased to 1,0 J ± 0,04 J.*

**21.101** Those parts of the machine which are subjected to impact in normal use are tested as follows:

*If failure of the part subject to impact would cause a failure to comply with this specification, any spot of the machine which may be exposed during normal cleaning function to impacts or blows shall be subjected to a single blow with an impact energy of 6,75 Nm. The impact stress on the free-standing machines shall be exerted by a steel sphere with a diameter of 50,8 mm and mass of 0,535 kg dropped from a height of 1,3 m or hanging on a string acting as a pendulum, falling from a height of 1,3 m.*

## **22 Construction**

This clause of Part 1 is applicable except as follows.

### **22.35 Modification:**

*Delete the note.*

### *Addition:*

These parts are subject to the hammer test of Clause 21. If this insulation does not meet the requirement of 29.3, these are subject to the following impact test.

*A sample of the covered part is conditioned at a temperature of 70 °C ± 2 °C for seven days (168 h). After conditioning, the sample is allowed to attain approximately room temperature.*

*Inspection shall show that the covering has not shrunk to such an extent that the required insulation is no longer given or that the covering has not peeled off, so that it may move longitudinally.*

*After this, the sample is maintained for 4 h at a temperature of –10 °C ± 2 °C.*



*While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 101. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm on to the chisel "B" of hardened steel, the edge of which is placed on the sample.*

*One impact is applied to each place where the insulation is likely to be weak or damaged in normal use, the distance between the points of impact being at least 10 mm.*

*After this test it shall show that the insulation has not peeled off, and an electric strength test as specified in 16.3 is made between metal parts and metal foil wrapped round the insulation in the area required to be insulated.*

**22.101** Appliances shall be constructed so as to prevent the penetration of objects from the floor, which may impair their safety.

Machines for wet use shall have no **live parts** at a distance of less than 30 mm from the floor where there is an opening which could admit liquid.

*Compliance is checked by inspection and measurements.*

**22.102** The addition of a power outlet shall not impair the safety of the appliance.

*Compliance is checked by the test of this standard taking the manufacturer's instructions into consideration.*

**22.103 Class I appliances or class II appliances** shall employ a mains isolating switch or switches having a contact separation in all poles that provide full disconnection under overvoltage category III conditions. Additional switches may be of single pole construction.

Components such as RFI suppressors, mains indicating lights and phase rotation indicators can be connected to the live side of the isolating switch, providing any failure does not constitute a failure to comply with the requirements of this standard.

*Compliance is checked by inspection.*

## **23 Internal wiring**

This clause of Part 1 is applicable.

## **24 Components**

This clause of Part 1 is applicable except as follows:

### **24.1.3 Addition:**

*The main switch in vacuum cleaners shall be tested for 50 000 cycles of operations.*

**24.101** Appliances shall be constructed so that, in normal use, there will be no electrical or mechanical failure that could impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as a result of such things as heating and vibration.

*Compliance is checked by the tests of this standard and for appliances with motors provided with **self-resetting thermal cut-outs** as follows.*

The appliance is supplied at a voltage equal to 1,1 times **rated voltage**, under locked rotor conditions so as to cause the **thermal cut-out** to operate within a few minutes, until the **thermal cut-out** has performed 200 cycles of operation.

After the test the appliance shall withstand the tests of Clause 16.

## 25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

### 25.1 Addition:

Appliances classified as IPX7 shall not be provided with an appliance inlet.

Appliances classified as IPX4, IPX5 or IPX6 shall not be provided with an appliance inlet, unless both inlet and connector have the same classification as the appliance when coupled or separated, or unless inlet and connector can only be separated by the use of a tool and have the same classification as the appliance when coupled.

Appliances provided with appliance inlets shall also be provided with an appropriate cord set.

### 25.7 Addition:

Power **supply cords** shall be not lighter than:

- if rubber insulated, ordinary tough rubber sheathed flexible cord (code designation 60245 IEC 53);
- if polyvinyl chloride insulated, ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53).

### 25.14 Addition:

For appliances incorporating a **type X attachment** or **type Y attachment** the number of flexings is 20 000.

### 25.15 Modification:

Replace Table 12 by the following:

**Table 12 – Pull force and torque**

<b>Mass of appliance</b> kg	<b>Pull force</b> N	<b>Torque</b> Nm
≤ 1	30	0,1
>1 and ≤4	60	0,25
> 4	125	0,40

### Addition:

The test is also applied to the cord in the cord set for appliances classified as IPX4 or higher that are provided with an appliance inlet. The cord set is fitted to the appliance inlet prior to the commencement of the test.

**26 Terminals for external conductors**

This clause of Part 1 is applicable.

**27 Provision for earthing**

This clause of Part 1 is applicable.

**28 Screws and connections**

This clause of Part 1 is applicable.

**29 Clearances, creepage distances and solid insulation**

This clause of Part 1 is applicable except as follows.

**29.2 Addition:**

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to normal use of the appliance.

**30 Resistance to heat and fire**

This clause of Part 1 is applicable.

**31 Resistance to rusting**

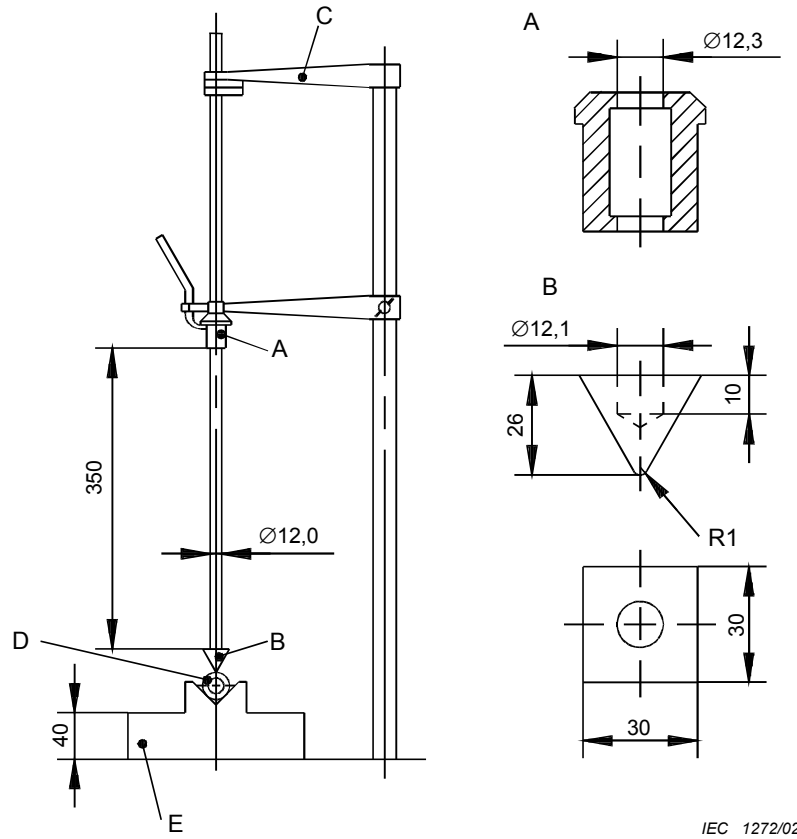
This clause of Part 1 is applicable.

**32 Radiation, toxicity and similar hazards**

This clause of Part 1 is applicable, except as follows.

**Addition:**

NOTE 101 For machines intended to pick up hazardous dust, additional requirements are specified in Annex AA to this standard.



*Dimensions in millimeters*

**Key**

- A = Weight
- B = Chisel
- C = Fixing arm
- D = Sample
- E = Base having mass of 10 kg

**Figure 101 – Impact test apparatus**

## Annexes

The annexes of Part 1 are applicable except as follows.

### Annex AA (normative)

#### Particular requirements for vacuum cleaners, suction sweeping machines and dust extractors for the collection of dusts hazardous to health

The following modifications to the relevant clauses in this Part 2 are applicable to vacuum cleaners, suction sweeping appliances and dust extractors specifically designed for wet and/or dry suction for industrial and commercial use and specify the requirements for collecting non-explodable dusts hazardous to health.

NOTE 1 When sources other than electricity are used as the motive power (e.g. compressed air, internal combustion engine etc.) or a negative pressure unit is employed, the requirements for filtration of dust quoted in this standard can still apply.

NOTE 2 In this annex, subclauses that are numbered starting from 201 are additional to those in this Part 2.

### 3 Definitions

This clause of of this Part 2 is applicable except as follows.

#### 3.201

##### **explosive atmosphere (dust)**

an atmosphere where the dust will explode when simultaneously subjected to the following conditions:

- a) the dust must be combustible;
- b) the dust must be in suspension in the atmosphere which must contain sufficient oxygen to support combustion;
- c) the dust must have a particle size distribution that will propagate flame;
- d) the dust concentration in the suspension must be within the explosible range;
- e) the dust suspension must be in contact with an ignition source of sufficient energy. Reference can then be made to Annex BB if necessary.

#### 3.202

##### **hazardous dust**

non-radioactive and non-explosive dust which is hazardous to health if inhaled, ingested or in contact with the skin

Examples: Any dust which is:

- a) listed in the ECD 79/831/EEC<sup>1)</sup> amending 67/548/EEC for which the general indication of nature of risk is specified as very toxic, harmful, corrosive or irritant;
- b) a dust for which an exposure limit has been established in the country of use;
- c) a micro-organism which creates a hazard to the health of any person;

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<sup>1)</sup> European Council Directive 79/831/EEC of 18 September 1979 amending for the sixth time Directive 67/548/EEC on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances

- d) if the appliance is used for collecting radioactive dust, additional precautions for handling and final disposal should be taken in accordance with the appropriate codes and regulations which are outside the scope of this standard.

### 3.203

#### penetration *D*

degree of penetration of a filter as regards the ratio between the mean mass dust concentration in fresh air behind the filter and the mean mass dust concentration in the dust-laden air in front of the filter, averaged over the test time

### 3.204

#### mean velocity

$\bar{V}$

$\bar{V}$  is calculated as follows:

$$\bar{V} = \frac{V_2}{F}$$

where

$V_2$  is the air flow rate (m<sup>3</sup>/h);

$F$  is the **essential filter** plane (m<sup>2</sup>).

### 3.205

#### air change rate *L*

The number of hourly fresh air changes, calculated as follows:

$$L = \frac{V_2}{V_1}$$

where

$V_1$  is the room air volume (m<sup>3</sup>).

### 3.206

#### safe change filter

filter which can be changed without atmospheric or operator contamination, such as by means of handling the filter from the exterior of an impervious membrane and by the use of a double sealing method of withdrawal, removal and replacement without exposing the interior of the filter housing

### 3.207

#### dust extractor

suction appliance with filtration which can be fitted to a machine tool or be placed adjacent to an operation where dust is being generated

### 3.208

#### essential filter

principal filter in a system which may use multiple filters and is a filter which ensures that the penetration limits of Table AA.1 are met

### 3.209

#### dust collection means

container having means of safe dust disposal to be undertaken when handled in accordance with the manufacturer's instructions

### 3.210

#### negative pressure unit

extraction unit used to ensure that the pressure within a working enclosure is below atmospheric

## 6 Classification

This clause of this Part 2 is applicable except as follows.

**6.201** The appliances are classified according to dust classes:

- **L** (light hazard) suitable for separating dust with a limit value<sup>1)</sup> of occupational exposure of greater than 1 mg/m<sup>3</sup>;
- **M** (medium hazard) for separating dust with a limit value of occupational exposure of greater than 0,1 mg/m<sup>3</sup>;
- **H** (high hazard) for separating all dusts with all limit values of occupational exposure, including carcinogenic and pathogenic dusts.

## 7 Marking and instructions

This clause of this Part 2 is applicable except as follows.

### 7.1 Addition:

The manufacturer's model or type reference marked on the appliance shall include the dust class letter. The part number shall be marked on spare parts relating to safety, such as filters, **dust collection means** and disposable devices (e.g. rigid containers or plastic bags) when provided.

### 7.12 Addition:

The instructions shall contain the following information:

- information about the most important operational data of the appliance as specified in 3.1.9 of this Part 2, its dust class, its intended use and, if applicable, any limitations of use;
- an exact designation of spare parts relating to safety, such as filters and **dust collection means**, and information of where they may be obtained;

The instructions shall also advise the user to refer to any applicable safety regulations appropriate to the materials being handled, and shall include the substance of the following:

- before use, operators should be provided with information, instruction and training for the use of the appliance and the substances for which it is to be used, including the safe method of removal and disposal of the material collected;
- for user servicing, the appliance must be dismantled, cleaned and serviced, as far as is reasonably practicable, without causing risk to the maintenance staff and others. Suitable precautions include, decontamination before dismantling, provision for local filtered exhaust ventilation where the appliance is dismantled, cleaning of the maintenance area and suitable personal protection;
- in the case of class **H** and **M** appliances the outside of the appliance should be decontaminated by vacuum cleaning methods and wiped clean or treated with sealant before being taken out of a hazardous area. All the appliance parts shall be regarded as contaminated when removed from the hazardous area and appropriate action taken to prevent dust dispersal.

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1) Reference should be made to national regulations existing in some countries about the prevention of dust dispersal.

- the manufacturer, or an instructed person, shall perform a technical inspection at least annually, consisting of, for example, inspection of filters for damage, air tightness of the appliance and proper function of the control mechanism. On class **H** appliances the appliance filtration efficiency should be tested at least annually;
- when carrying out service or repair operations, all contaminated items which cannot be satisfactorily cleaned, are to be disposed of; such items shall be disposed of in impervious bags in accordance with any current regulation for the disposal of such waste.

The method by which covers of non-dust proof compartments should be removed for cleaning should also be included in the instructions.

For **dust extractors** the substance of the following shall be included:

It is necessary to provide for an adequate **air change rate L** in the room if the exhaust air is returned to the room. Reference to National Regulations is necessary.

#### 7.14 Addition:

Class **L**, **M** and **H** appliances shall be fitted with a label having a surrounding border 30 mm ± 0,5 mm wide. The label shall be marked with red diagonal stripes 10 mm ± 0,5 mm wide, spaced 20 mm ± 0,5 mm apart on a white background. The letter L, M or H shall also be incorporated (see Figure AA.201).

The following warning shall be given on the label and in the operating instructions:

**WARNING:** This appliance contains dust hazardous to health. Emptying and maintenance operations, including removal of the **dust collecting means**, must only be carried out by authorised personnel wearing suitable personal protection. Do not operate without the full filtration system fitted.

Covers and guards which do not require tools for removal shall be fitted with an additional label worded: REMOVE FOR CLEANING.

#### 7.15 Addition :

Lettering in warning notices on the appliance shall have a minimum height of 3 mm.

The warning notices shall be so positioned that they can easily be seen by the operator when switching the appliance on or off.

## 19 Abnormal operation

This clause of this Part 2 is applicable except as follows.

**19.201** The **essential filter** shall be of adequate strength to withstand the severest conditions created by the suction system when the **essential filter** is clogged and subject to pulsing air flow.

*Compliance is checked by inspection and the following test:*

*Use a clogging medium (e.g. French chalk) to give 90 % of the maximum differential pressure, obtained by the method used when measuring  $P_i$  in 2.2.9, and a pulsing effect achieved by covering the inlet to the appliance for 5 s followed by opening for 1 s.*

**NOTE** Any parts, with the exception of the essential filter itself, may be dried to facilitate the flow of the clogging medium. The pulsing test should be repeated 30 times over a period of 3 min.



*Fracture or break-down of the **essential filter** system shall not occur. If a safety switch is fitted to protect the motor and filter system, it is rendered inoperable.*

## 22 Construction

This clause of this Part 2 is applicable except as follows.

**22.201** Dust collecting appliances shall be built in accordance with the dust classes given in 6.201 and meet the values given in Table AA.1:

**Table AA.1 – Appliance penetration limits**

Dust class	Suitability for hazardous dust with limit values for occupational exposure mg x m <sup>-3</sup>	Degree of penetration <i>D</i> %	Mean velocity $\bar{V}$ through the filter plane, at the max. airflow of the appliance or measured under the conditions of $P_f$ according to IEC 60335-2-69, whichever is greater* m <sup>3</sup> x m <sup>-2</sup> x h <sup>-1</sup>
<b>L</b> (light hazard)	>1	<5	≤500
<b>M</b> (medium hazard)	>0,1	<0,5	≤200
<b>H</b> (high hazard)	All small particle dusts including carcinogens and pathogens	<0,005	≤200
* If a manufacturer can show evidence of maintenance of filtration efficiency after 50 cleaning cycles, in accordance with the manufacturer's instructions, then the <b>mean velocity</b> $\bar{V}$ through the filter plane can be exceeded by agreement when type tests are undertaken.			
NOTE 1 Maintenance of filtration efficiency can be demonstrated either by examination of service records, or the test cycles specified in AA.22.203.			
NOTE 2 For type approval, appliances using an identical construction of essential filter mounting and with an identical airflow velocity can be approved by testing one model in the range.			

As a minimum requirement for dust class **L** and **M** appliances the degree of **penetration** of the filter material shall be determined.

*Test methods for compliance are under consideration.*

**22.202** All dust removal appliances shall be capable of achieving an adequate removal of dust, and an indication shall be given as follows:

- vacuum cleaners of dust classes **M** and **H** shall be provided with an indicator which operates before the air velocity, through the largest hose (or tube) supplied by the manufacturer, falls below 20 m/s, referring to the largest section in the hose or to the vacuum cleaner inlet, whichever is the greatest;
- for suction-sweeping appliances, the indicator shall operate before the reduction of pressure in the suction region of the brush area becomes less than 50 N/m<sup>2</sup>. This also applies to the side brush area;
- for **dust extractors** (excluding negative pressure units) the indicator shall operate before the suction velocity becomes less than as stated by the manufacturer or 20 m/s, referring to the largest section in the hose (or tube), whichever is the greater, or the dust source is shut off by a mechanism in the dust collector. If the dust source cannot be shut off (e.g. when there is a conveyor belt system in a production process), then a warning signal shall be given;

- d) an acoustic warning signal, if used, shall work within an audio-frequency between 500 Hz and 3 000 Hz and a pulse time between 0,5 s and 5 s. The A-weighted sound pressure level shall be between 15 dB and 30 dB higher than the 1 m-surface sound pressure level of the appliance;
- e) if a visual warning signal is used it shall work with a pulse time between 0,5 s and 5 s, emitting yellow light. The bulbs in warning lights shall have a minimum power input of 45 W. The warning lights shall be visible from all sides of the appliance;
- f) a pair of voltage-free contacts and installation instructions for their use as a warning signal switching device;
- g) if airflow indicator adjustments are necessary, they shall be adjustable without **tools**.

*Compliance is checked by inspection and the following test:*

*Operate the mechanism and, if necessary compare the actual values with the specified values. No leaking of dust should occur.*

**22.203** Class **M** and **H** appliances may be provided with a **safe change filter** if a dust free filter exchange cannot be guaranteed. Class **H** appliances shall be fitted with a non-reusable **essential filter**. If Class **M** and **H** appliances are provided with a built-in filter cleaning mechanism for the **essential filter**, the action shall not be detrimental to the filtration efficiency.

*Compliance is determined by the filtration tests of AA.22.201 or AA.22.207 after conducting 50 cleaning cycles.*

*A cleaning cycle shall comprise collecting a suitable dust so that the airflow velocity is reduced below 20 m/s and then cleaned according to the manufacturer's instructions. The appliance is then emptied and the test is repeated.*

**22.204** If the appliance is provided with a built-in cleaning mechanism, it shall restore the required suction performance.

A cleaning mechanism conforms with the requirements when, after the cleaning:

- for suction-sweeping appliances the reduction of pressure in the brush area is 50 N/m<sup>2</sup>;
- for other appliances the suction air-flow is 20 % greater than the minimum air-flow volume as specified in AA.22.202.

*Compliance is determined by comparing the suction air-flow with the desired value after operating the cleaning device according to the manufacturer's instructions. The cleaning operation shall be performed when the minimum suction air-flow has been reached.*

**22.205** Class **H** appliances shall be so constructed that outside decontamination shall be as simple as is practicable and shall be fitted with tightly sealed containers which can withstand the stresses of transportation.

For class **M** appliances removal of the collection bag with minimum dust release, in accordance with the manufacturer's instructions, shall be possible.

*Compliance is checked by inspection.*

**22.206** Class **M** (except suction sweeping appliances) and **H** appliances shall be fitted with a disposable collection means.

*Compliance is checked by inspection.*

**22.207** Class **M** and **H** appliances shall be so constructed that the **essential filter** will not be damaged when collecting sharp objects such as broken glass or nails which may be sucked up.

*Compliance is checked by operating the appliance normally to collect 1 kg/(kW input), with a maximum of 1 kg, of upholstery tacks, 13 mm long, and no tack shall damage the essential filter. This test should be conducted before the test of AA.22.201 or AA.22.208.*

**22.208** In class **H** appliances when new, the filtration penetration of the assembled appliance shall be less than 0,005 %.

In class **M** appliances, if the appliance is suitable for wood according to the instructions for use, the filtration penetration of the assembled appliance shall be less than 0,5 %.

*Test methods for compliance with the penetration limits are "under consideration".*

**22.209** In dust class **H** appliances the **essential filter** shall only be removable by the use of a **tool**.

*Compliance is checked by inspection.*

**22.210** In class **M** and **H** appliances the air exhaust shall not unduly disturb dust lying on the floor.

*Compliance is checked by the following test:*

*The working hose shall be fitted to the inlet and the intake end shall be positioned in an upward direction at a minimum height of 2 m above floor level. The exhaust velocity shall not exceed 1 m/s at a height of 50 mm above floor level. The appliance shall be at least 2 m from any wall or vertical surface. The humidity of the air in the test area shall not exceed 60 % and the test shall be carried out in still air conditions.*

**22.211** In dust class **H** appliances the **essential filter** shall be at less than atmospheric pressure.

For class **L** and **M** appliances, if the **essential filter** is on the positive side, then the penetration tests of AA.22.201 are conducted to ensure compliance with the requirements of Table AA.1.

*Compliance is checked by inspection and the appropriate tests.*

**22.212** In dust class **H** appliances replacement **essential filters** shall have durable integral seals if they affect the requirements specified in AA.22.205.

NOTE **Essential filters** constructed for use with seals having one side to atmospheric pressure and tested by the manufacturer in this state, do not affect the requirement of AA.22.205 and do not require integral seals, although the provision of integral seals is recommended. Suitable materials are listed in Table AA.2

**Table AA.2 – Materials having a low susceptibility to ageing**

Abbreviation	Chemical name	Common name
NBR	Acrylonitrile-butadiene rubbers	Nitrile
NBR/PVC	Blend of acrylonitrile-butadiene rubber and polyvinyl chloride	
CO	Polychloromethyloxiran	Epichlorhydrin
ACM	Copolymer of ethyl acrylate (or other acrylates) and a small amount of a monomer which facilitates vulcanisation	Polyacrylate
CR	Chloroprene rubber	Neoprene
IRR	Isobutene-isoprene rubber	Butyl
XNBR	Carboxylic-acrylonitrile-butadiene rubbers	Carboxylic nitrile
BIIR	Bromo-isobutene-isoprene rubbers	Bromobutyl
CIIR	Chloro-isobutene-isoprene rubbers	Chlorobutyl
PDM	Polydimethylsiloxane	Silicone rubber

**22.213** Dust class **H** appliances shall be fitted with **essential filters** of the type for which the likelihood of damage to the filter medium during storage or fitting is a minimum.

NOTE Provision of a protective mesh screen as an enclosure for the filter media is considered acceptable.

*Compliance is checked by inspection.*

**22.214** Dust class **H** appliances shall not be fitted with filters with a limited shelf life of less than five years.

*Compliance is checked by inspection.*

**22.215** Class **M** and **H** appliances shall be constructed so as to guard against accidental entry and the release of **hazardous dust** from any part of the appliance when not in use.

*Compliance is checked by inspection and the use of test probe B of IEC 61032.*

**22.216** Class **H** appliances not to the requirements of IP6X and class **M** appliances not to the requirements of IP5X shall conform to the following:

- a) covers and guards not in accordance with IP65 and not protecting against both mechanical and electrical hazards shall not require **tools** for their removal;
- b) covers and guards not in accordance with IP6X but protecting against mechanical and electrical hazards shall have electrical interlocks which disconnect the mains supply on removal, or require the use of **tools** for removal. Covers and guards fitted with electrical interlocks shall not require **tools** for their removal. The interlock shall be double pole if protecting against electrical hazard, and double or single pole if protecting against mechanical hazard;
- c) if an **essential filter** is used to ensure there is no entry of dust into the compartment, then that filter shall require **tools** for its removal.

*Compliance is checked by inspection.*

## **32 Radiation, toxicity and similar hazards**

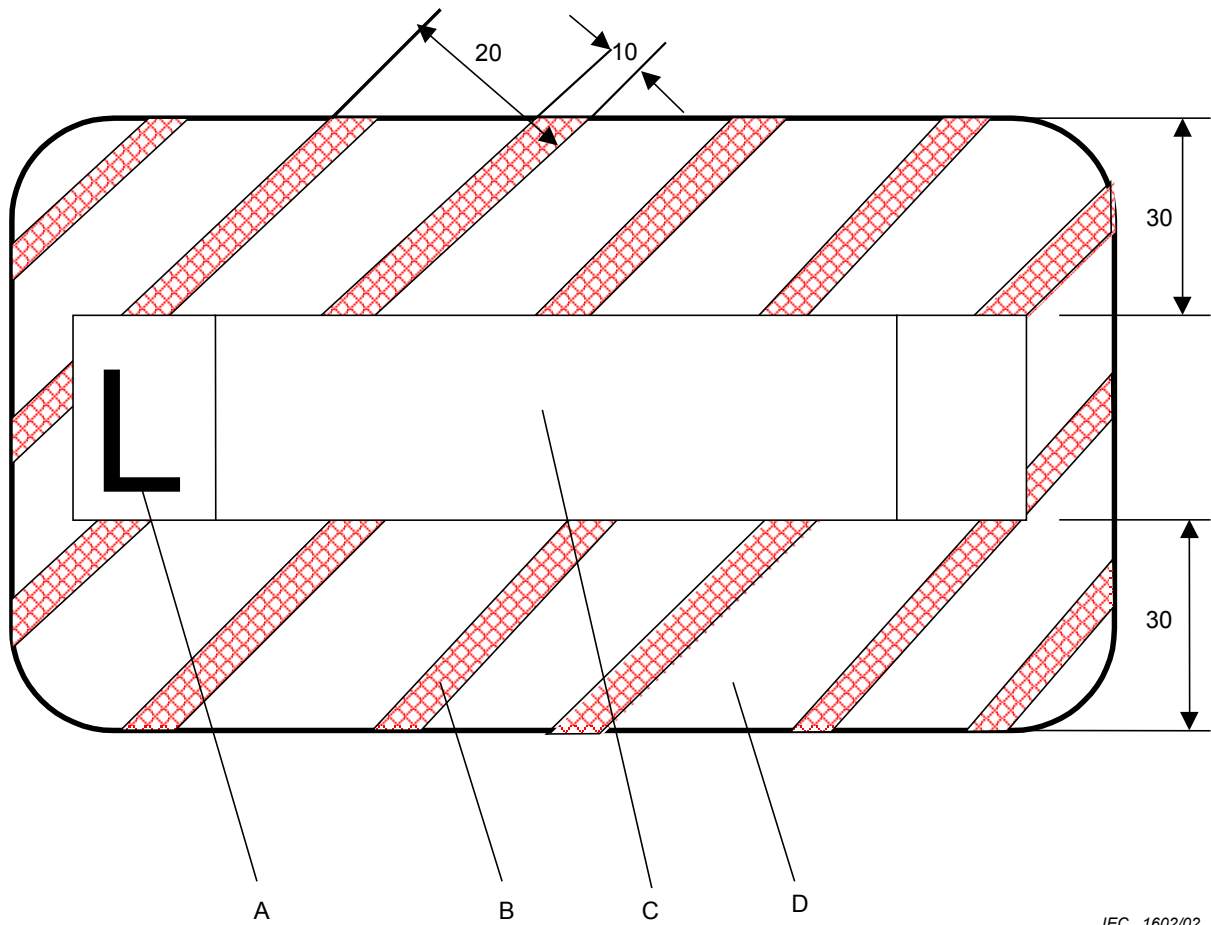
This clause of this Part 2 is applicable except as follows.

### **32.201**

NOTE 1 None of the classes covered by this standard is suitable for collecting radioactive dust unless expert advice with regard to protection of operator and appliance is obtained from a relevant authority.

NOTE 2 Information on the explosion risk of certain dusts is given in Annex BB.

**32.202** Hazards relating to toxicity are covered for certain classes of appliances in Clause 22 of this annex.



IEC 1602/02

All dimensions in millimetres

**Key**

- A = This letter is either L, M or H with a minimum line thickness of 4 mm
- B = The infill is coloured red
- C = This area is for the WARNING as described in 7.14
- D = The background is coloured white

**Figure AA.1 – Warning label**

## Annex BB (informative)

### List of dusts which are an explosion risk when subject to ignition conditions

The values of explosion parameters are included as a guide for those concerned with the design and operation of dust-handling appliances. The dust samples are not necessarily in the most hazardous form that could arise in industry. In addition, the design of the appliance, the quantity of material and the methods of handling should all be taken into account when considering explosion hazards.

Dust	Minimum ignition temperature  °C	Minimum explosible concentration  kg/m <sup>3</sup>	Minimum ignition energy  mJ
Acetamide	560	-	-
Acetoparaphenetidine	-	-	11,5
Acetyl-p-nitro-o-toludine	450	-	-
Acetyl salicylic acid (Aspirin)	550	0,015	16
Acrylonitrile-butadiene-styrene copolymer	400	-	-
Acrylonitrile-vinylidene chloride copolymer	-	0,05	70
Alkyd powder coatings	360	0,028	22
Aluminium, 6 µm	-	0,03	13
Aluminium, <1400 µm	420	-	-
Aluminium, cuttings and buffings	480	-	-
Aluminium, fibres	610	-	-
Aluminium, linishings	600	-	-
Aluminium, polishings	460	-	-
Aluminium, swarf	590	-	-
Aluminium octoate	460	-	-
Animal feed stuff	450	-	-
Anthracene	-	-	7
Anthraquinone	670	-	-
Asbestos, resinated	480	-	-
Azodicarbonamide	-	0,6	130
Barley, milled	370	-	-
Battery case dust	400	-	-
Benzoic acid	600	0,011	12
Benzoyl peroxide	-	-	31
Benzoyl peroxide 44 %, gypsum 56 %	-	-	12
Bleach powder, 60/100 µm	580	-	-
Bone flour, steamed	540	-	-
Boron carbide	640	-	-
Bread	450	-	-
Bronze	440	-	-
Brunswick green	360	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m <sup>3</sup>	Minimum ignition energy mJ
Cadmium sulphide	700	-	-
Cadmium sulphoselenide	710	-	-
Cadmium yellow	390	-	-
Cadmium zinc sulphide	660	-	-
Calcium citrate	470	-	-
Calcium gluconate	550	-	-
Calcium pantothenate	430	-	-
Calcium propionate	530	-	-
Calcium silicide	-	-	< 4,6
Calcium stearate	450	-	24
Caprolactam	430	0,07	60
Carbon, 13 % volatile	590	-	45
Casein	460	-	-
Casein meal, steamed	460	-	-
Cellulose, bleached	410	-	-
Cellulose acetate	340	-	-
Cellulose acetate, fibres	430	-	-
Cellulose acetate butyrate	380	-	-
Cellulose triacetate	390	-	-
Charcoal, wood	470	-	-
Chicken manure	680	-	-
Chloro-amino-toluene sulphonic acid	650	-	-
p-Chloro o-toluidine hydrochloride	650	-	-
Coal, 30 % volatile	530	-	-
Coal, 36 % volatile	490	-	-
Coal, anthracite < 63 µm	530	-	-
Coal, Pittsburgh < 74 µm	530	0,03	-
Coal, pulverized < 150 µm	550	-	-
Coal, silkstone	490	-	-
Cocoa, bean husk	400	-	-
Coconut shell	490	-	-
Coffee	360	-	-
Coffee 55 %, chicory 45 %	370	0,1	140
Cork	400	-	-
Cornflour	390	-	-
Cornstarch	380	0,15	-
Cyclohexanone peroxide	-	-	21
Detergent, high non-ionic	410	-	-
Detergent, low non-ionic	560	-	-
Detergent, standard ABS	520	-	-
Dextrine	440	-	-



Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m <sup>3</sup>	Minimum ignition energy mJ
Dextrose monohydrate	350	-	-
Diamino stilbene disulphonic acid	450	-	-
Dibutyl tin maleate	600	-	-
Dibutyl tin oxide	530	0,012	7
Dihydro streptomycin sulphate	670	-	-
Dimethyl acridan	540	-	-
Dimethyl diphenyl urea	490	-	-
Dinitroaniline	470	-	-
Dinitrobenzoyl chloride	380	-	-
Dinitro stilbene disulphonic acid	450	-	-
Diphenyl guanidine + 1,5 % de-dusting powder	540	-	28
Diphenyl propane	-	0,012	11
Epoxide resin	-	-	9
Epoxy powder, semi-gloss coating	-	0,013	-
Epoxy resin	490	0,012	12
Esparto grass	-	-	-
Face powder	440	-	-
Farina starch, 20 % H <sub>2</sub> O	-	-	-
Ferrochrome	600	-	-
Fish meal	520	-	-
Flour, English 13 % H <sub>2</sub> O	-	-	-
Flour, wheat	390	-	100
Grain, distillers dried solubles	420	0,06	128
Grain, dried brewers	440	0,009	-
Grass	380	-	-
Gum, arabic, 250/1400 µm	550	-	-
Hoof and horn, hydrolysed	460	-	-
Hops, ground	340	-	-
Hydroxy ethyl cellulose	420	-	-
Hydroxy ethyl methyl cellulose	410	-	-
Irish moss	540	-	-
Isinglass	520	-	-
Jaborandi leaf	470	-	-
Lauryl peroxide	-	-	12
Lead stearate, dibasic	-	-	12
Leather, < 420 µm	520	-	-
Liquorice root	-	0,2	-
Magnesium swarf	610	-	-
Maize gluten meal	430	-	-
Maize husk	430	-	-
Male fern, crushed	510	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m <sup>3</sup>	Minimum ignition energy mJ
Malt, coarse	390	-	-
Manganese ethylene bis-dithio carbamate	270	0,07	35
Manioc flour	430	-	-
Meat meal	500	-	-
Meat and bone meal	440	-	-
Melamine formaldehyde resin	410	0,02	68
Methyl cellulose	480	-	-
2,2 Methylene bis-4-ethyl-6-tertiary butyl phenol	310	-	-
Methyl methacrylate	-	-	13
Milk powder	440	-	-
Milk powder, skimmed	-	-	-
Monochloroacetic acid	620	-	-
Monosodium salt of tri-chloroethyl phosphate	540	-	-
β-Naphthol	670	-	-
Nigrosine hydrochloride	630	-	-
p-Nitro o-anisidene	400	-	-
Nitrocellulose	-	-	30
Nitrodiphenylamine	480	-	-
Nitrofurfural semi-carbazone	240	-	-
m-Nitro p-toluidine	470	-	-
p-Nitro o-toluidine	470	-	-
Nylon, ground flock	450	-	-
Nylon 11	-	0,005	32
Paper	400	0,03	-
Paper tissue, < 1400 μm	-	-	39
Peat	450	-	-
Peat, dried	-	0,1	-
Pectin, powdered	390	-	-
Penicillin, N-ethyl, piperidine salt of	310	-	-
Phenol formaldehyde	520	-	-
Phenol formaldehyde resin	450	0,015	-
Phenothiazine	590	-	-
Polyester resin < 1400 μm	400	-	-
Polyethylene	390	0,02	38
Polyethylene, commercial	-	-	57
Polyethylene, ground	400	-	-
Polyethylene glycol	320	-	-
Polyethylene high density < 90 μm	-	-	17
Polypropylene	380	-	43
Polyurethane	460	-	-
Polyvinyl acetate	450	-	-

Dust	Minimum ignition temperature °C	Minimum explosible concentration kg/m <sup>3</sup>	Minimum ignition energy mJ
Polyvinyl acetate, beads	-	-	70
Polyvinyl chloride	510	-	-
Polyvinyl chloride, dispersion resin	550	-	-
Polyvinylidene chloride	670	-	-
Poppy flower	410	0,4	600
Potato, dried, < 200 µm	450	-	-
Propyl iodine	470	-	-
Protein	480	-	-
Protein, groundnuts	460	-	-
Protein concentrate	390	-	-
Provender	370	-	-
Quillaia bark	450	-	-
Rag, < 1400 µm	470	-	-
Rayon, viscose	420	-	-
Rayon flock	-	0,03	-
Rayon flock, 8 denier, 1,5 mm	425	0,15	-
Resin, rubber	400	-	-
Resin, synthetic	400	-	-
Rubber	380	-	-
Rubber, latex	450	-	-
Rubber, synthetic	410	-	-
Rubber accelerator	310	-	-
Rubber crumb	440	-	-
Sawdust	430	-	-
Senna	440	0,01	105
Silicon	900	-	-
Soap	570	0,02	25
Sodium acetate	560	0,15	-
Sodium carboxy methyl cellulose	320	1,1	440
Sodium salt of 2,2 dichloropropionic acid	520	-	-
Sodium salt of 2,2 dihydroxy naphthalene disulphonic acid	510	-	-
Sodium glucaspaldrate	600	-	-
Sodium glucoheptonate, dried	600	-	-
Sodium monochloracetate	550	-	-
Sodium propionate	470	-	-
Sodium toluene sulphonate	530	-	-
Sodium xylene sulphonate	490	-	-
Sorbic acid	440	-	-
Soya bean	390	0,23	370
Soya meal	410	0,18	330

<b>Dust</b>	<b>Minimum ignition temperature</b> °C	<b>Minimum explosible concentration</b> kg/m <sup>3</sup>	<b>Minimum ignition energy</b> mJ
Starch	470	-	-
Starch, cold water	490	-	-
Starch, maize 10 % H <sub>2</sub> O	-	0,15	-
Stearic acid	330	-	-
Steel	450	-	-
Streptomycin sulphate	700	-	-
Sugar	330	0,015	48
Sulphur	220	0,02	-
Tallow, hydrogenated	620	-	-
Tartaric acid	350	-	-
Tea	500	-	-
Tobacco, dried	320	-	-
Urea	900	-	-
Urea formaldehyde moulding powder	450	0,04	-
Urea formaldehyde moulding powder, paper filled	430	0,07	49
Wax, paraffin	340	-	-
Whey flour	480	-	-
Wood	360	-	-
Wood, flour	380	0,06	100
Wood, flour, < 1400 µm	410	-	100
Wood, ground fluffed	450	-	-
Wood, shavings	400	0,1	-
Wood pulp, dehydrated	450	-	-
Wood pulp, flock	470	-	-
Zinc stearate	420	-	14

## **Bibliography**

The bibliography of Part 1 is applicable except as follows.

*Addition:*

IEC 60335-2-2, *Household and similar electrical appliances – Safety – Part 2-2: Particular requirements for vacuum cleaners and water suction cleaning appliances*

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Standards Survey

The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!

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- purchasing agent
- librarian
- researcher
- design engineer
- safety engineer
- testing engineer
- marketing specialist
- other.....

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- consultant
- government
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- public utility
- education
- military
- other.....

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- not at all
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- fairly well
- exactly

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- standard is too superficial
- title is misleading
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- (3) average,
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- (5) exceptional,
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- logic of arrangement of contents .....
- tables, charts, graphs, figures.....
- other .....

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- both English and French texts

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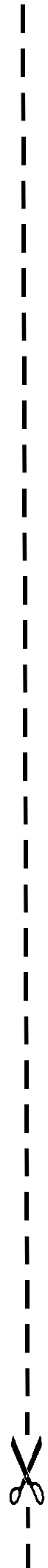
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