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Industrial vacuum cleaners & dust extractors:
The EUnited Cleaning guide to choosing
the right machine based on the dust and
area to be collected

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Introduction

EUnited Cleaning represents the leading manufacturers of floor cleaning machines and high-pressure cleaners for commercial and industrial use. It represents the interests of its members in all economic and technical matters with politicians, legislators, customers, research and education, trade fair companies, the press and the public.

Members of EUnited Cleaning in support of this document are in alphabetical order:

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Types of vacuum cleaners

Vacuum cleaners and dust extractors are used in various applications and locations. There are 4 main types of vacuum cleaners per Figure 1.

Low Voltage Directive (IECEE/CB)	Machinery Directive (IECEE/CB)	Machinery Directive (IECEE/CB)	ATEX (IECEX)
			
Example of a household Vacuum Cleaner	Example of a commercial Vacuum Cleaner	Example of an industrial Vacuum Cleaner	Example of a Vacuum Cleaner for hazardous locations and explosive atmosphere

Figure 1: Examples of different types of vacuum cleaners.

A vacuum cleaner picks up deposited dust whereas a dust extractor is used to extract dust emissions from manual, electrical or pneumatic tools. In this document we will focus on

- industrial vacuum cleaners,
- dust extractors,
- and vacuum cleaners to be used in explosive atmospheres.



Example of a dust extractor application



Example of industrial vacuum cleaner application

Figure 2: Example of a dust extractor and an industrial vacuum cleaner

Additionally, an industrial vacuum cleaner differs from a dust extractor by following:

- the dust extractor has a warning signal which operates before the suction velocity becomes less than stated by the manufacturer or 20 m/s, whichever is greater, referring to the largest section in the hose.
- Alternatively, the dust source is shut off by a mechanism in the dust extractor.

Dust collection machines (industrial vacuum cleaners and dust extractors) are designed and constructed in accordance with IEC/EN 60335-2-69¹. Additionally, they shall be designed and constructed in accordance with the dust classes given in Annex AA of this standard and meet the values given in Table 1.

Table 1: Penetration limits

Dust class	Degree of penetration <i>D</i> %	Essential filter material test	Essential filter element test	Assembled machine test method
L (light hazard)	< 1	AA22.201.1	AA.22.201.2 may be applied alternatively to AA22.201.1	AA.22.201.3 if essential filter material test is not carried out
M (medium hazard)	< 0,1	AA.22.201.1	AA.22.201.2 may be applied alternatively to AA22.201.1	AA.22.201.3
H (high hazard)	< 0,005	Not required	AA.22.201.2	AA.22.201.3

For which task I use which type of industrial vacuum cleaner and dust extractor?

¹ HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use

Table 2 gives an overview of which profession uses industrial vacuum cleaners and dust extractors and what types of dust are typically to be expected.

Table 2: What type of dust is typically expected in which trades (not exhaustive list)?

Professions	Expected dusts
Carpenter Window manufacturers	Wood Paint particles Plastics Light metal chips
Modelmaking	Wood Paint particles Plastics Light metal chips Fiber glass materials Carbon fiber materials
Locksmith	Metal dust (iron, chromium, nickel, aluminum, etc.) Plastics Paint particles
Concrete builders and bricklayers	Quartz-containing mineral dust
Roofer	fibres of old mineral wool, Asbestos, mineral dust (slate, quartz, clay)
Electrician	Quartz-containing mineral dust Asbestos, gypsum
Painter	Paint dust containing lead/chromate Paint particles Filler
Asbestos remediation	Asbestos
Drywall construction	Mineral dust Plaster old mineral wool
Container builder	Fiber glass materials Carbon fiber materials Metal dust
Car mechanic/mechatronics engineer, coachbuilder	Soot particles, Abrasion of friction linings Filler and paint dusts Metal dusts
Chimney sweep	Soot, wood dust (e.g., of pellet heating systems)
Heating construction	Mineral dust, Asbestos

	Soot (domestic combustion systems only), Wood dust (e.g., for pellet heating systems)
Furnace construction	High-temperature wool mineral dust
Service technician for office equipment	Toner dust
Building cleaner (maintenance cleaning)	Household dust
Building cleaner (final cleaning)	Quartz-containing mineral dust
Industrial cleaning	Depending on the area of application
Baker	Flour dust Grain dust Sugar dust
Stonemason/ Stonemason	Quartz-containing mineral dust

Which dust class is suitable for me?

The correct choice of a dust class depends on the expected dust to have during the task given. It is part of the risk assessment conducted for the application the operator is tasked. In general, two stage of filtration is suggested to ensure a safe level of protection.¹ Below in Table 3 you can find a general guidance for different types of dusts.

Table 3: General suggested minimum "Dust class" of a vacuum cleaner according to IEC EN 60335-2-69 to collect a specific dust. **The risk assessment takes precedence over the table.**

Expected dust types	Dust class according EN 60335-2-69 (minimum)
Wood	M
Paint particles	M
Plastics	M
Light metal chips	M (additional requirements for wet pick up)
General metal dust	M
Chromium, nickel, cobalt	H
Quartz-containing mineral dust	M
Fibres of old mineral wool	M
Paint dust containing lead	M
Asbestos	H, with add. requirements for asbestos
Gypsum	L

¹ Fleece bag plus main filter is also considered a two-stage filtration.

Fiber glass materials	H
Carbon fiber materials	M
Soot particles (of domestic furnaces)	M
High-temperature wool/ mineral dust	M
Toner dust	H
Organic substances (moulds, oak processionary moths)	H
Abrasion of friction linings (except asbestos)	H
Flour dust	H
Grain dust	L
Sugar dust	L

Suction/extraction of combustible dusts outside explosive atmospheres

If the occurrence of an explosive atmosphere (hazardous location, zone classification according to the ATEX Directive 2014/34/EU) can be ruled out at the place of use and during the period of use, the vacuuming of combustible dusts is also permitted with vacuum cleaners/dust extractors whose dust-laden area is free of internal ignition sources. This is achieved by industrial vacuum cleaners / dust extractors fulfilling IEC/EN 60335-2-69, Annex AA for **ACD**. If conductive dust is picked up, then **ACD** IP54 is required. For infrequent pick up of small amounts of conductive dust and the rest **ACD**: IPX4 is sufficient.



Figure 3: Example of an ACD vacuum cleaner

Requirements for **ACD**:

- surface temperature in contact with **combustible dust**: $T_4 \leq 135 \text{ }^{\circ}\text{C}$;
- pick-up of conductive dust: IP54;
- small amounts of conductive dust & non-conductive: IPX4;

- classified as dust class L, M, or H;
- **flow-through motors** are not permitted;
- indicator for dust removal and air velocity control;
- air speed of dust exhaust
- essential filter durability test;
- designed for easy cleaning;
- suction fan on clean air side;
- testing to ensure essential filter not damaged picking up sharp objects
- requirements on alloys used to avoid spark generation
- when liquid reservoir incorporated: additional requirements per Annex AA, such as:
 - o venting, preventing hydrogen gas going to electrical compartments, correct liquid for dust to be collected, et al.

Suction/extraction of combustible dusts inside explosive atmospheres

If the occurrence of an explosive atmosphere (hazardous location, zone classification according to the ATEX Directive 2014/34/EU) cannot be ruled out at the place of use and during the period of use, the vacuuming of combustible dusts is only permitted with vacuum cleaners/dust extractors whose dust-laden area is free of internal ignition sources and additional properties on conductivity of the outer surface and special tools (nozzles and other accessories collected to the machine). This is achieved by industrial vacuum cleaners / dust extractors fulfilling IEC/EN 62784, the only IECEx standard for vacuum cleaners applied in a classified area.



Figure 4: Example of an IECEx vacuum cleaner

What are the general principles of explosion protection I need to take care of for electrical equipment & components:

electric arcs, sparks & hot surfaces possible ignition sources, e.g.

- when electric circuits are opened and closed;
- by loose connections;
- by overload or insufficient cooling;
- by faults such as short circuits;

- by electrostatic discharges;
- by heat generated by the equipment including heating devices.

So, what does my vacuum cleaners/dust extractors **need to fulfil**:

Comply to IEC EN 62784 which requires next to others following:

- Filter according to L/M/H classification per EN 60335-2-69.
- Surface temperature limitation to $t = 135\text{ °C}$ (T4).
- Suction air through hose filtered prior to contacting impeller of motor.
- Flow-through & universal motors **not** permitted.
- motor, switch, cord and plug comply to EN 60079-31 for equipment category 3D.
- following parts of the vacuum cleaner **conductive** / **electrostatic dissipative**, bonded and connected to the earth terminal of the connection facility:
 - o impeller;
 - o tools;
 - o non-metal parts of the machine;
 - o hose.
- Isolated metal parts coming into contact with dust not permitted.
 - o All metal parts bonded & connected to earth terminal of connection facility.
- Only electrical components of category 1D can be located inside of the dust collection containment.

As mentioned, IEC 62784 is the only **IECEx** standard for vacuum cleaners. **IECEx** is the global system for certification of equipment, service facilities and personnel for **explosive atmospheres**.

So how does IEC 62784 work? What testing is done? Figure 5 gives an answer.

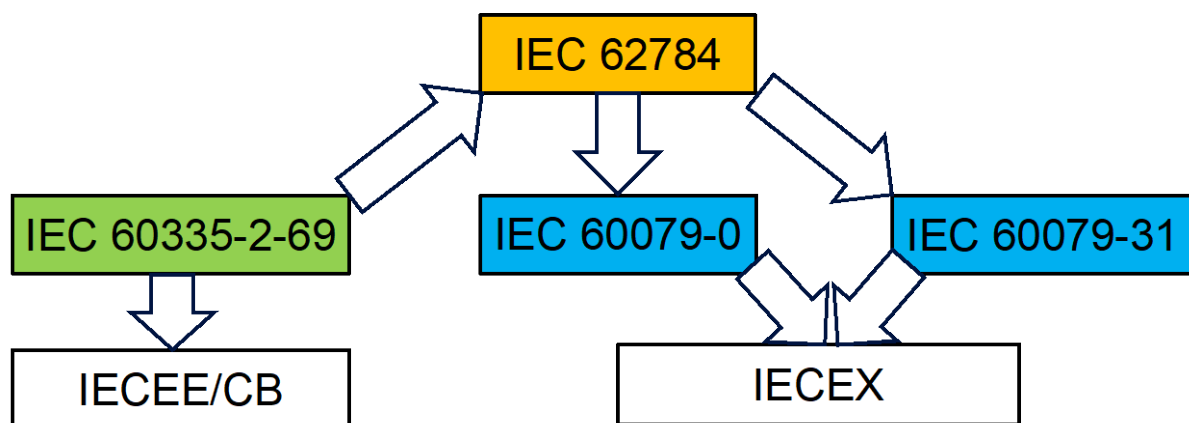


Figure 5: Interaction of the standards to reach compliance with the standard and the applicable safety Directive(s).

- IEC 60335-2-69: Household and similar electrical appliances – Safety – Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush, for commercial use
- IEC 60079-0:EXPLOSIVE ATMOSPHERES – Part 0: Equipment – General requirements
- IEC 60079-31: EXPLOSIVE ATMOSPHERES – Part 31: Equipment dust ignition protection by enclosure "t"

Summary of standards vs industrial vacuum cleaners and dust extractors

The right choice of industrial vacuum cleaner and dust extractor derives from the right risk assessment conducted taking into account clauses 1-5 of this document. Figure 5 shows which standard needs to be applied for which application/area.

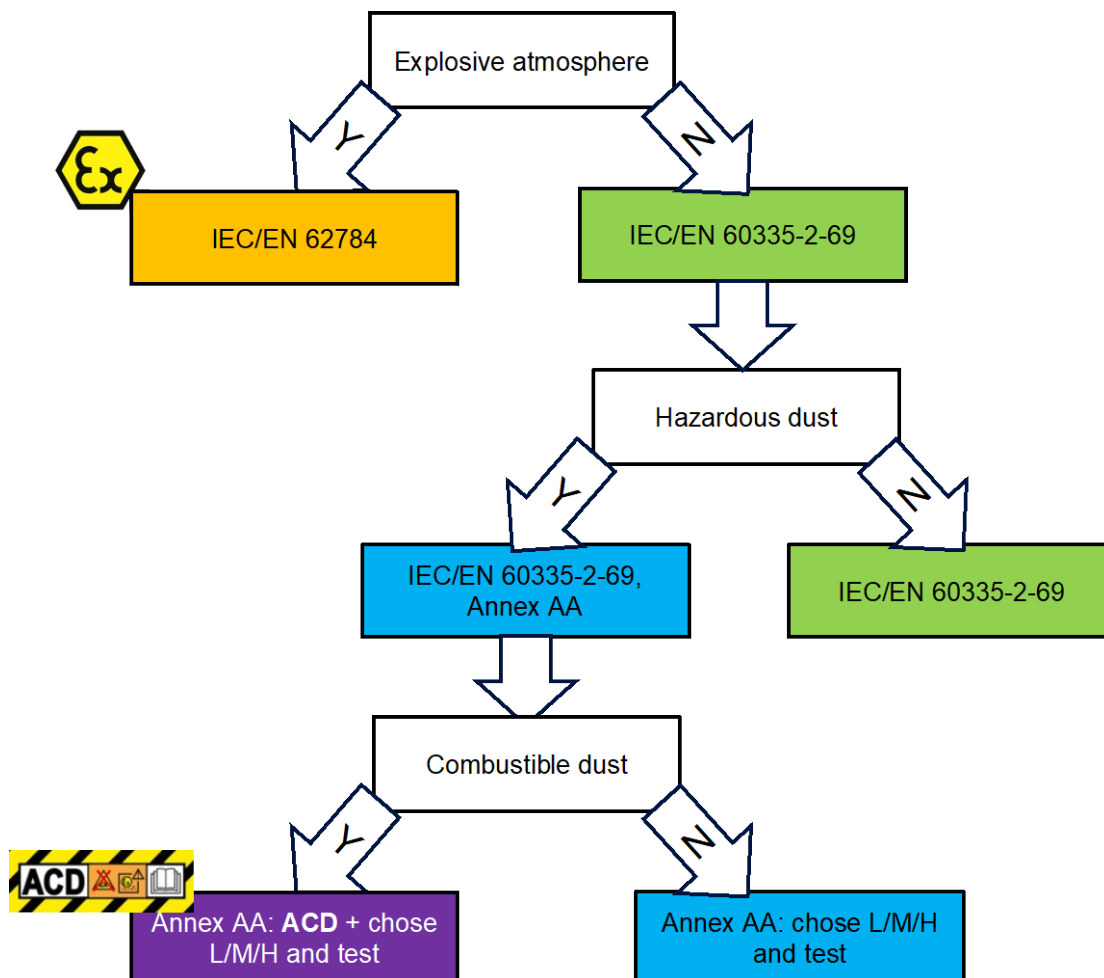


Figure 6: Applicable safety standard for industrial vacuum cleaner or dust extractor