
Vgrajena oprema za elektrostatični nanos gorljivih kosmičastih materialov - Varnostne zahteve

Stationary electrostatic application equipment for ignitable flock material - Safety requirements

Stationäre elektrostatische Beschichtungsanlagen für entzündbaren Flock - Sicherheitsanforderungen

Matériel fixe de projection électrostatique de flock ignitable - Exigences de sécurité

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**Stationary electrostatic application equipment
for ignitable flock material -
Safety requirements**

Matériel fixe de projection électrostatique
de flock ignitable -
Exigences de sécurité

Stationäre elektrostatische Flockanlagen
für entzündbaren Flock -
Sicherheitsanforderungen

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

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CENELEC

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

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Foreword

This European Standard was prepared by SC 31-8, Electrostatic painting and finishing equipment, of Technical Committee CENELEC TC 31, Electrical apparatus for potentially explosive atmospheres. It was submitted to the formal vote and was approved by CENELEC as EN 50223 on 2010-05-01.

This document supersedes EN 50223:2001.

The State of the Art is included in Annex ZY “*Significant changes between this European Standard and EN 50223:2001*”

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

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2011-05-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2013-05-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directives 2006/42/EC (see Annex ZZA) and 94/9/EC (see Annex ZZB).

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Introduction

In the process of electrostatic flock application, the flock is transported from a reservoir through an electrical field either by gravitational forces or an air stream or electrostatic forces. As the flock particles disperse due to the flock application device and/or the electric field, they are electrostatically charged by means of high voltage of some tens of kilovolts aligned and, in the form of a cloud, encased by and deposited on the grounded workpiece. They stick to those workpieces, which are covered with an adhesive layer. The adhesive is set at room temperature or by heating.

Flock particles not deposited on the workpiece (overspray) are upcast or removed by the exhaust ventilation system, by brushes or other devices into the flock recovery system.

1 Scope

1.1 This European Standard specifies requirements for automatic electrostatic flock application equipment which is designed for applying ignitable flock which may form explosive atmospheres in the flock application area. In this context a distinction is made between flock application devices which due to their type of construction comply with the requirements as laid down in EN 50050 as applicable, and those for which higher discharge energies are stipulated.

This European Standard also specifies the constructional requirements for a safe operation of the stationary equipment of flock application booths, including the electrical installations and the accessories.

This European Standard deals with all significant hazards, hazardous situations and events relevant to flock application booths, when they are used as intended and under conditions which are foreseeable as malfunction by the manufacturer (see Clause 4).

1.2 This European Standard considers four types of electrostatic flock systems. For more details, see Table 1.

1.3 This European Standard deals with those hazards occurring during stationary automatic electrostatic flocking. Among these hazards are, above all, ignition hazards of the generated explosive atmosphere and hazard to persons.

1.4 The stationary equipment dealt with in this European Standard is considered to be equipment of group II, category 3D for the use in areas with potential explosion hazards of zone 22.

1.5 In cases of hybrid mixtures, the stationary equipment dealt with in this European Standard is also considered as equipment of group II, category 3G for the use in areas with potential explosion hazard of zone 2.

1.6 This European Standard is not applicable for

- flock systems operated with AC voltage,
- the application system for liquid or pasty substances (e.g. adhesives, primer),
- the cleaning of flock application booths,
- the storage and handling of ignitable substances outside the coating plant.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50050:2006, *Electrical apparatus for potentially explosive atmospheres - Electrostatic hand-held spraying equipment*

EN 60079-0:2006 ¹⁾, *Electrical apparatus for explosive gas atmospheres - Part 0: General requirements* (IEC 60079-0:2004, mod.)

EN 60204-1:2006 + A1:2009, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements* (IEC 60204-1:2005 + A1:2008)

¹⁾ Superseded by EN 60079-0:2009 "Explosive atmospheres - Part 0: Equipment - General requirements" (IEC 60079-0:2007)

- EN 60529:1991 + A1:2000, *Degrees of protection provided by enclosures (IP code)* (IEC 60529:1989 + A1:1999)
- EN 61241-0:2006, *Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements* (IEC 61241-0:2004, mod. + corr. Nov. 2005)
- EN 61241-10:2004, *Electrical apparatus for use in the presence of combustible dust - Part 10: Classification of areas where combustible dust are or may be present* (IEC 61241-10:2004)
- EN 61340-4-1:2004, *Electrostatics - Part 4-1: Standard test methods for specific applications - Electrical resistance of floor coverings and installed floors* (IEC 61340-4-1:2003)
- EN 62061:2005, *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems* (IEC 62061:2005)
- EN 619, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of unit loads*
- EN 746-1:1997 + A1:2009, *Industrial thermoprocessing equipment - Part 1: Common safety requirements for industrial thermoprocessing equipment*
- EN 953, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards*
- EN 981, *Safety of machinery - System of auditory and visual danger and information signals*
- EN 1037, *Safety of machinery - Prevention of unexpected start-up*
- EN 1081:1998, *Resilient floor coverings - Determination of the electrical resistance*
- EN 1127-1:2007, *Explosive atmospheres - Explosion prevention and protection – Part 1: Basic concepts and methodology*
- EN 1149-5, *Protective clothing - Electrostatic properties - Part 5: Material performance and design requirements*
- EN 12445, *Industrial, commercial and garage doors and gates - Safety in use of power operated doors - Test methods*
- EN 12453, *Industrial, commercial and garage doors and gates - Safety in use of power operated doors – Requirements*
- EN 12635, *Industrial, commercial and garage doors and gates - Installation and use*
- EN 12978, *Industrial, commercial and garage doors and gates - Safety devices for power operated doors and gates - Requirements and test methods*
- EN 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements*
- EN 13478:2001 + A1:2008, *Safety of machinery - Fire prevention and protection*
- EN 13501-1 + A1, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*
- EN 14373, *Explosion suppression systems*
- EN 14460, *Explosion resistant equipment*
- EN 14462, *Surface treatment equipment - Noise test code for surface treatment equipment including its ancillary handling equipment - Accuracy grades 2 and 3*
- EN 14491, *Dust explosion venting protective systems*
- EN 14797, *Explosion venting devices*
- EN 14986, *Design of fans working in potentially explosive atmospheres*
- EN 15089, *Explosion isolation systems*
- EN ISO 12100-1:2003 + A1:2009, *Safety of machinery - Basic concepts, general principles for design – Part 1: Basic terminology, methodology* (ISO 12100-1:2003 + A1:2009)

EN ISO 12100-2:2003 + A1:2009, *Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles* (ISO 12100-2:2003 + A1:2009)

EN ISO 13849-1, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design* (ISO 13849-1)

EN ISO 13850, *Safety of machinery - Emergency stop - Principles for design* (ISO 13850)

EN ISO 14122-2; *Safety of machinery - Permanent means of access to machinery – Part 2: Working platforms and walkways* (ISO 14122-2)

EN ISO 14122-3; *Safety of machinery - Permanent means of access to machinery - Part 3: Stairs, stepladders and guard-rails* (ISO 14122-3)

EN ISO 14122-4; *Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders* (ISO 14122-4)

EN ISO 20344:2004 + A1:2007, *Personal protective equipment - Test methods for footwear; Amendment 1* (ISO 20344:2004 + A1:2007)

ISO 8421-3:1989; *Fire protection - Vocabulary – Part 3: fire detection and alarm*

3 Definitions

For the purposes of this document, the following terms and definitions apply.

3.1

stationary electrostatic application device for ignitable flock

flock application booths or flock application areas, in which the electrostatic application equipment is either fixed stationary (e.g. on supports) and is operated automatically or is guided by reciprocators (e.g. robots). In general, the equipment comprises the following units:

- flock application booth;
- flock application area;
- flock application system;
- flock recovery system
- fixtures for workpieces;
- conveyors;
- grounding devices;
- forced ventilation;
- fire prevention and protection equipment;
- explosion protection equipment

3.2

flock application system

devices for application of flock by means of electrostatic charge. In general, the flock application system comprises the following units:

- device for the transport of flock;
- high voltage electrode;
- high voltage supply system;
- dosing device

3.3

high voltage supply system

in general, the high voltage supply system comprises the following:

- low voltage section with devices for switching on and off the unit and for adjustment, control, regulation, limitation and monitoring of current and voltage, as well as the required connecting cables;
- high voltage generator;
- high voltage switching device;
- high voltage cable;
- high voltage plug-and-socket connector

3.4**flock application area**

area, closed or not, in which the flock is applied to the workpieces by the electrostatic flock application system

3.5**flock application booth**

assembly of linked parts and devices like e.g.:

- forced ventilation by one or several fan(s);
- ducts of the forced ventilation;
- transport device for the flock;
- air filter and flock recovery system;
- measuring and control devices (e.g. interlocking of forced ventilation and flock application system);
- fire detection system and interlocking devices;
- explosion protection system;
- automatic cleaning system;
- air conditioning system;
- warning devices; and
- electrical apparatus

joined together for application of flock within or at a partially or totally enclosed structure (limited by walls) for the controlled flock application

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3.6**multi-zone flock application booth**

flock application booth including a number of sections for manual and/or automatic application of flock and forced ventilation flash off space

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3.7**dangerous discharge**

a dangerous discharge is a discharge which generates the hazard of ignition of explosive mixtures or by electric shock

3.8**dosing device**

In general, the dosing device comprises the following parts:

- devices for dosing the flock;
- supply lines for the flock;
- devices for drive, control and monitoring the flock transport

3.9**flock recovery system**

the flock recovery system collects the overspray from the flock application process which has not been deposited on the workpiece, and, if necessary, recycles it.

In general, the flock recovery system is either connected directly to the flock application booth or via the ducts of the forced ventilation

3.10**workpiece**

part, which is coated with an adhesive film and applied with flock

3.11**ignitable flock**

dispersed flock which could be ignited by an effective ignition source, and which continues to burn after removal of the ignition source or may react in the form of an explosion

3.12**solvent**

liquid consisting of one or several components, volatile under specified drying/setting conditions, and in which the binder of the adhesive is soluble

NOTE Solvents are also contained in liquids used as cleaning or washing agents.

3.13**hybrid mixture**

mixture of ignitable substances and air, occurring in different states of aggregation

NOTE An example of a hybrid mixture is a mixture of solvent vapours of adhesives and flock in air.

3.14**explosive atmosphere**

mixture with air, under atmospheric conditions, of ignitable substances in the form of gases, vapours, mists, powder or flock in which combustion spreads to the entire unburned mixture after ignition has occurred

3.15**lower explosion limit (LEL)**

the concentration of ignitable gas, vapour, mist, powder or flock in air, below which an explosive atmosphere will not be generated

3.16**average concentration of ignitable flock in air**

mass of ignitable flock introduced into the flock application area, divided by the volume of air extracted by the forced ventilation system from the flock application area within the same period of time

3.17**hazardous areas**

areas where hazards due to explosive atmosphere may exist. The probability of occurrence of explosive atmosphere is classified in zones. (standards.iteh.ai)

Hazardous areas are given in Annex C

3.17.1**zone 0**

area in which an explosive atmosphere consisting of a mixture with air of ignitable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently

NOTE In general, these conditions, when they occur, arise inside containers, ducts and apparatus, etc.

3.17.2**zone 1**

area in which an explosive atmosphere consisting of a mixture with air of ignitable substances in the form of gas, vapour or mist is likely to occur occasionally during normal operation

3.17.3**zone 2**

area in which an explosive atmosphere consisting of a mixture with air of ignitable substances in the form of gas, vapour or mist is not likely to occur during normal operation. If it does occur, it will persist for a short period

3.17.4**zone 20**

area, in which an explosive atmosphere in the form of a cloud of combustible flock in air is present continuously, or for long periods or frequently

NOTE In general, these conditions, when they occur, arise inside containers, ducts and apparatus, etc.

3.17.5**zone 21**

area, in which an explosive atmosphere in the form of a cloud of combustible flock in air is likely to occur occasionally during normal operation

NOTE This zone can include, among others, areas in the immediate vicinity of e.g. flock filling and delivery positions and places where flock layers occur and, during normal operation, may give rise to an explosive concentration of combustible flock in mixture with air.

3.17.6**zone 22**

area in which an explosive atmosphere in the form of a cloud of combustible flock in air is not likely to occur during normal operation. If it does occur, it will persist for a short period

NOTE This zone can include, among others, areas in the vicinity of equipment containing combustible flock, from which flock can escape from leaks and form flock deposits.

3.18**equipment category**

equipment for potentially explosive atmospheres is divided into groups and categories. Group II: Equipment for areas with a potentially explosive atmosphere, other than mines susceptible to firedamp; this group comprises three categories depending to the level of safety provided

3.18.1**equipment group II category 1G**

equipment of this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are present continuously or for long periods or frequently

NOTE Equipment of category 1G is suitable for use in zones 0, 1 and 2.

3.18.2**equipment group II category 2G**

equipment of this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are likely to occur

NOTE Equipment of category 2G is suitable for use in zones 1 and 2.

3.18.3**equipment group II category 3G**

equipment of this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists are unlikely to occur, or, if they do occur, are likely to do so only infrequently and for a short period only

NOTE Equipment of category 3G is suitable for use in zone 2.

3.18.4**equipment group II category 1D**

equipment of this category is intended for use in areas in which explosive atmospheres caused by flock/air mixtures are present continuously or for long periods or frequently

NOTE Equipment of category 1D is suitable for use in zone 20, zone 21 and zone 22.

3.18.5**equipment group II category 2D**

equipment of this category is intended for use in areas in which explosive atmospheres caused by flock/air mixtures are likely to occur

NOTE Equipment of category 2D is suitable for use in zone 21 and 22.

3.18.6**equipment group II category 3D**

equipment of this category is intended for use in areas in which explosive atmospheres caused by flock/air mixtures are unlikely to occur, or, if they do occur, are likely to do so only infrequently and only for a short period

NOTE Equipment of category 3D is suitable for use in zone 22.

3.19**explosion relief**

protective measure by which an area of the wall panel of the enclosure (for example of the flock recovery system) is designed and constructed to release the excess pressure in the event of an explosion to prevent injury to persons and further damage to equipment

3.20**explosion suppression**

system which can detect and suppress an incipient explosion

3.21**explosion decoupling**

system preventing the propagation of flames and explosions from one unit to other parts of the installation by special devices, e.g. mechanical high-speed shut-off, rotary valves or flame suppression barriers

3.22**discharge energy**

energy discharged from a conductive part of the installation in the form of a spark which could cause both electric shock to a person and an ignition of an explosive atmosphere

3.23**antistatic footwear**

footwear that has a resistance to ground, via the sole, which is low enough to prevent the build-up of electrostatic charges capable of an incentive discharge. See EN ISO 20344

NOTE A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

3.24**antistatic clothes**

clothes that have a resistance to ground, which is low enough to prevent the build-up of electrostatic charges capable of an incentive discharge. See EN 1149-5

NOTE A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

3.25**antistatic floor**

floor that has a resistance to ground, which is low enough to prevent the build-up of electrostatic charges capable of an incentive discharge

3.26**forced ventilation system**

ensures the air exchange by one or several fans or by other powered equipment

NOTE Forced ventilation systems are using exhaust air units with devices for material separation and – optional – automatic cleaning, and in addition a supply air unit with devices for filtering, air conditioning and an automatic flock recovery system if applicable.

3.27**minimum air volume flow**

air volume flow of the forced ventilation which shall ensure to undercut the LEL under most unfavourable operating conditions and to prevent the emission of flock out of the flock application booth

3.28**recirculation air**

air, which is extracted from a volume and will be reintroduced into it

3.29**exposure limit values**

concentration limits of dangerous substances in the breathing air required by worker health legislation

NOTE Limits may differ from country to country.

3.30**accessories**

accessories are all devices, assemblies and other equipment, except of the flock application system and the high voltage supply system according to this standard

3.31**constant-voltage operation**

closed control circuit system with direct feedback of the actual value of the output high voltage. During the constant-voltage operation the adjusted output high voltage is maintained constant up to the capacity of the high voltage part via a control device, independent of the variable operational current

NOTE In this standard the symbol for this type of operation is U_k .

3.32**voltage-controlled operation**

open control circuit system, control without feedback of the output high voltage. During the voltage-controlled operation the output high voltage is adjusted generally to a defined operational current. The output high voltage, however, is not maintained constant by a control device, it varies depending on the operational current and the on-load behaviour of the high voltage device

NOTE In this standard the symbol for this type of operation is U_v .

3.33**constant current operation**

closed control circuit system with direct feedback of the actual value of the high voltage current to a control device. In doing so, the operational current is maintained constant, and the output high voltage varies load-dependently between a minimum and a maximum value defined by the process

NOTE In this standard the symbol for this type of operation is I_k .

3.34**operational current**

current which flows within the high voltage circuit during failure-free operation

NOTE In this standard the symbol for the operational current is I_b .

3.35**overcurrent**

current occurring during a malfunction, exceeding the operational current of the high voltage circuit and giving rise to expect that in voltage-controlled and constant voltage operation hazardous discharges or flashovers between high voltage parts and grounded parts of the installation can occur in case the safety distance drops below the permissible limit

NOTE In this standard the symbol for overcurrent in the high voltage circuit is I_0 .

3.36**minimum voltage**

voltage of the high voltage circuit giving rise to expect that in constant current operation hazardous discharges or flashovers can occur between high voltage parts and grounded parts of the installation in case the safety distance drops below the permissible limit

NOTE In this standard the symbol for minimum voltage in the high voltage circuit is U_{\min} .

3.37**disconnection threshold**

disconnection threshold is either the overcurrent value I_0 or the minimum voltage value U_{\min} . When the value of I_0 is exceeded or the value of U_{\min} falls below, a cutting off of the high voltage supply is released

3.38**fire alarm system**

fire alarm system comprising components for automatic detection of a fire, initiation of a fire alarm and initiation of other appropriate action (see ISO 8421-3:1989, 3.1.3)

3.39**locally acting fire extinguishing system**

a locally acting fire extinguishing system protects the highly hazardous area between the flock application system and the workpiece. This fire extinguishing system meets the special conditions during electrostatic application of flock

3.40**skilled person**

person who due to technical training, experience and recent occupational activities, has sufficient knowledge in the field of electrostatic coating with stationary equipment, is familiar with the relevant and generally accepted technical rules, and thus is able to test and evaluate the occupationally safe state of coating plants

3.41**repeated tests**

inspection of the entire electrical equipment, systems and plants to be carried out at regular intervals

4 List of significant hazards		Safety requirements and/or measures		
Hazardous factors	Location or situation of the hazard	Specific requirements Corresponding clauses of this standard	General requirements Corresponding clauses of	
			EN ISO 12100-1:2003	EN ISO 12100-2:2003
4.1 General	This clause contains all significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for stationary electrostatic application equipment for ignitable flock included in the scope and which require action to eliminate or reduce the risk. NOTE For information on procedures of risk analysis, see EN ISO 14121-1.		4.1	4, 5, 6
4.2 Mechanical hazards		5.5.1.1, 5.5.1.2, 5.5.1.3	4.2	4.1, 4.2, 4.6, 4.8, 4.10, 4.14, 5.1, 5.2, 5.3
4.2.1 Hazards by shearing, crushing and drawing in	<ul style="list-style-type: none"> – drives, conveyors and automatic handling systems (e.g. robots) during charging or discharging flock application booths – auxiliary charging equipment and conveyors inside or adjacent to the application booths – fans (e.g. injuries due to after-running fan wheel) and air inlet openings – damper adjuster – movable parts of flock application booths (e.g. doors, gates, hoods). 	5.5.1.1	4.2.1, 4.2.2	4.1, 4.2.1, 4.6, 4.8, 4.10, 4.14, 5.1, 5.2, 5.3, 5.5.5
4.2.2 Entrapment hazard	<ul style="list-style-type: none"> – obstacles or obstructions can impede a quick evacuation of the operator(s) from the flock application booth in case of mechanical accident or fire – significant accidental lowering of pressure inside a flock application booth (i.e. obstruction of air inlet), <ul style="list-style-type: none"> – resulting in jammed doors due to mechanical deformation of the flock application booth and/or – increasing the door opening effort beyond human capability. 	5.5.1.2		5.5.3
4.2.3 Slip, trip and fall hazards for persons	<ul style="list-style-type: none"> – on ladders, gangways, platforms and stairs – on gratings at floor level – on slippery ground – as a result of poor lighting. 	5.5.1.3	4.10	4.2.1, 5.5.6