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Electrostatic hand-held spraying equipment - Safety requirements - Part 1: Hand-held spraying equipment for ignitable liquid coating materials

Elektrostatische Handsprüheinrichtungen - Sicherheitsanforderungen - Teil 1: Handsprüheinrichtungen für entzündbare flüssige Beschichtungsstoffe

Electrostatic hand-held spraying equipment - Safety requirements - Part 1: Hand-held spraying equipment for ignitable liquid coating materials

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Elektrostatische Handsprüheinrichtungen - Sicherheitsanforderungen - Teil 1: Handsprüheinrichtungen für entzündbare flüssige Beschichtungsstoffe

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CENELEC

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Foreword

This document (EN 50050-1:2013) has been prepared by SC 31-8, "Electrostatic painting and finishing equipment", of CLC/TC 31, "Electrical apparatus for potentially explosive atmospheres".

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-10-14
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2016-10-14

In combination with EN 50050-2:2013 and EN 50050-3:2013, this document supersedes EN 50050:2006.

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

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

0 Introduction

0.1 Process

During the electrostatic coating process the liquid coating material is transported to an applicator where it is atomised and converted to droplets by mechanical forces and by the influence of an electric field. During this atomising process the droplets are charged by high voltage of some 10 kV and a spray cloud is generated. The charged droplets are attracted by and applied to the earthed workpiece.

Droplets, which are not applied to the workpiece (overspray) are removed by a suction device or by other means.

After the coating process the coated workpieces are introduced into a dryer where the solvent is evaporated and a dry film of coating material is generated.

0.2 Explosion hazards

0.2.1 An explosion could occur, if

— the concentration of sprayed ignitable liquid coating material in air is within the explosion limits,

— an ignition source of appropriate energy for this explosive atmosphere is present.

Ignition sources could be, for instance, a hot surface, a naked flame, an electric arc or a spark.

An explosion could be prevented, if at least one condition is avoided. Because it is very difficult to exclude the possibility of ignitable discharges completely, the main focus should be the prevention of an explosive atmosphere.

0.2.2 An explosive atmosphere can only explode within a given range of concentration, but not, if the concentration is above or below this range.

NOTE If an explosive mixture of coating materials and air is trapped into a closed room, an explosion can lead to a fatal increase of pressure.

0.2.3 Particular attention should be paid to the prevention of electrostatic charges on different surfaces located in the vicinity of the spraying cloud. This could apply to e.g. workpieces during the coating process. Grounding is critical to the prevention of electrostatic charge to any conductive objects in the spray area.

0.3 Electric hazards

0.3.1 Electric shock (by direct or indirect contact) can be generated, for instance, by contact with

– live parts, which are not insulated for operational reasons,

– conductive parts, which are not connected to dangerous voltage during normal operation, but only in case of failure,

– insulated live parts with insufficient or damaged insulation due to external impact.

0.3.2 Inadequate earthing may occur, for instance, due to

– faulty connections to the protective earthing system,

– a too high resistance to earth (e. g. contamination by coating materials).

0.3.3 Hazards could occur, for instance, if hazardous malfunctions (e.g. shortcut of electronic safety circuits) occur due to interferences of the electrostatic high voltage equipment and the components of the control and safety systems.

0.3.4 Hazardous electrostatic discharges could be generated, for instance, by non-earthed conductive components or by large insulating surfaces, especially if they are backed with conductive material.

1 Scope

1.1 This European Standard specifies the requirements for hand-held or hand-operated electrostatic spraying equipment for ignitable liquid coating materials to be used in explosive atmospheres generated by their own spray cloud within a temperature range from 5 °C to 40 °C.

This European Standard deals with all hazards significant for the electrostatic spraying of liquid coating materials, which could also contain small quantities of added metal particles, if the work is carried out under conditions recommended by the manufacturer. In particular, this includes ignition hazards resulting from the generated explosive atmosphere.

This European Standard specifies the design-related and test requirements for electrostatic spraying equipment of type A-L according to Table 1 of EN 50176:2009.

1.2 With regard to explosion protection and prevention measures, this European Standard also applies to ionisators with high voltage corona charging. Ionisators in conformity with EN 50050-1 provide equipment category 2G. Parts of ionisators, which are intended to be used or installed in Zone 2, provide equipment category 3G in conformity with EN 50050-1:2013, see Annex D.

1.3 Electrostatic applicators are considered to be equipment of group II, category 2G for use in potentially explosive areas of zone 1 or 2, which have been generated by the equipment itself. All other parts of hand-held electrostatic spraying equipment are considered to be equipment of category 3G if they are installed or used in potentially explosive areas of zone 2.

1.4 All other significant hazards relevant for applicators (e.g. ejection of fluids, mechanical strength, electrical hazards (apart from the electrostatic hazards), noise, explosion, contact with or inhalation of dangerous substances, ergonomics) are covered by EN 1953.

1.5 This European Standard also gives details regarding quality assurance systems for electrostatic spraying equipment, see Annex C.

1.6 Additional requirements may be applicable to equipment designed for use in food and pharmaceutical industry.

1.7 This European Standard does not apply to

- zone classification of the areas in and around spray booths [see EN 12215],
- zone classification of other areas with potentially explosive atmosphere [see EN 60079-10-1],
- selection, erection and application of other electrical and non-electrical equipment in areas with explosion hazard [see EN 60079-14 and EN 12215],
- cleaning of spraying areas, see instruction manual of the spray booth,
- fire prevention and protection, for instance fire hazards due to other sources [see EN 12215],
- requirements for machinery for the supply and recirculation of coating material under pressure [see EN 12621].

1.8 When processing coating materials having specific electrical properties (conductivity, resistivity) the function of the hand-held spraying equipment to charge coating materials electrostatically may be affected as a result of a voltage drop at the charging electrode.

2 Normative references

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

EN 1149-5	*Protective clothing – Electrostatic properties – Part 5: Material performance and design requirements*
EN 1953	*Atomising and spraying equipment for coating materials – Safety requirements*
EN 12215	*Coating plants – Spray booths for application of organic liquid coating materials – Safety requirements*
prEN 50059:2011	*Electrostatic hand-held spraying equipment – Safety requirements – Hand-held spraying equipment for non-ignitable coating materials*
EN 50176:2009	*Stationary electrostatic application equipment for ignitable liquid coating material – Safety requirements*
EN 60079-0	*Explosive atmospheres – Part 0: Equipment - General requirements (IEC 60079-0)*
EN 60079-7:2007	*Explosive atmospheres – Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2006)*
EN 60204-1	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements (IEC 60204-1)*
EN 60529	*Degrees of protection provided by enclosures (IP code) (IEC 60529)*
EN 61340-4-1	*Electrostatics – Part 4-1: Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors (IEC 61340-4-1)*
EN 62061	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061)*
EN ISO 12100	*Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100)*
EN ISO 13849-1	*Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design (ISO 13849-1)*
EN ISO 20344	*Personal protective equipment – Test methods for footwear (ISO 20344)*

3 Terms and definitions

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

3.1
hand-held spraying equipment
hand-held or hand-operated equipment for electrostatic coating with ignitable liquid coating materials, generally comprising the following parts:

— applicator;

— coating material supply system;

— control device;

— high voltage supply system, if applicable (can be an integral part of the applicator);

— connecting cable

3.2
connecting cable
electric cable to the applicator

3.3
earthing device
device for earthing the electrostatic hand-held spraying equipment permanently

3.4
spraying device
outlet opening for the coating materials

3.5
high voltage electrode
conductive part of the applicator which is at high voltage and serves to charge the coating materials directly or indirectly

3.6
control device
device generally having the following functions:

— control of, for instance, the coating material supply system and the control air

Note 1 to entry: A combination of the control device and the high voltage supply according to 3.8 is possible.

3.7
applicator
equipment for application of coating materials

Note 1 to entry: In general, the applicator comprises the following parts:

- high voltage electrode;
- high voltage supply, if applicable, can be an integral part of the applicator;
- housing;
- spraying device;
- exchangeable attachment parts (e.g. nozzles, extensions, angular pieces, etc.);
- if applicable, battery unit (integrated fixedly, or attached).

3.8
high voltage supply for applicators
in general, high voltage supply comprising the following parts:

— low voltage section with devices for switching on and off the hand-held spraying equipment and for adjustment, control, regulation, limitation and monitoring of current and voltage, as well as the required connecting cables;

— high voltage generator

3.9
spraying area
area, closed or not, in which the coating material is applied to the workpiece by the hand-held spraying equipment

3.10
dangerous discharge
discharge which generates the hazard of ignition of explosive mixtures or of electric shock

3.11
coating material supply system
in general, coating material supply system comprising the following:

— reservoir for coating materials;

— dosing and mixing devices for coating materials;

— supply lines for coating materials;

— devices for drive, control and monitoring of coating materials

3.12
workpiece
article to which the coating material is applied

3.13
ignitable liquid coating materials (coating material)
sprayed materials, especially varnishes, which could be ignited by an effective ignition source and which continue to burn after the ignition source has been removed or may react in the form of an explosion

Note 1 to entry: A formula for the estimation of ignitability on the basis of the composition of the coating material is given in Annex E.

3.14
explosive atmosphere
mixture of air, under atmospheric conditions, and of ignitable substances in the form of gas, vapour, mist, powder or flock, in such proportions that it can be ignited by effective ignition sources, such as excessive temperature, arcs or sparks

Note 1 to entry: See EN 1127-1.

3.15
lower explosion limit
LEL
concentration of ignitable gas, vapour, mist, powder or flock in air below which an explosive atmosphere will not be formed

3.16
discharge energy
energy discharged from a conductive part of the installation in form of a spark which could cause both electric shock to a person and an ignition of an explosive atmosphere

3.17
antistatic footwear
footwear that has a resistance to earth via its sole, which is low enough to prevent the build-up of electrostatic charges capable to produce an incendive discharge

Note 1 to entry: See EN ISO 20344.

Note 2 to entry: A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

3.18
antistatic clothes
clothes that have a resistance to earth, which is low enough to prevent the build-up of electrostatic charges capable of an incendive discharge

Note 1 to entry: See EN 1149-5.

Note 2 to entry: A required electric insulating resistance to prevent electric shocks is not contradictory to this definition.

3.19
antistatic floor
floor that has a resistance to earth, which is low enough to prevent the build-up of electrostatic charges capable to produce an incendive discharge

3.20
accessories
devices, components and other equipment, except for 3.7 of this standard

3.21
U_{max}
maximum output voltage of the high-voltage generator

3.22
I_{max}
maximum output current of the high-voltage generator

3.23
repeated test
test of the hand-held spraying equipment, including all accessories, to be carried out at regular intervals

3.24
ionisator
an ionisator is a device to discharge electrostatic charge e.g. from workpieces

3.25
contact surface area
part of the handle connected to earth to discharge the charge of a person

4 Requirements for hand-held spraying equipment for ignitable liquid coating materials

4.1 General requirements

4.1.1 Hand-held spraying equipment shall be designed and constructed to prevent exceeding the maximum transferred charge of single sparks of 60 nC, or the maximum discharge energy of 0,24 mJ.

4.1.2 All conductive parts of the hand-held spraying equipment which are not at high voltage shall be earthed. Earthing of conductive parts inside the hand-held spraying equipment can be neglected if hazardous discharges have been prevented by design. Conductive parts connected to measuring and control circuits shall be earthed with a resistance of ≤ 100 MΩ. Parts which are at high voltage for operational reasons shall be bonded to each other in a conductive way.

4.1.3 A device shall be present connecting the liquid coating material at or inside the applicator with a resistance of ≤ 10 kΩ to earth.