



SLOVENSKI STANDARD

SIST EN 12981:2005+A1:2009

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Nadomešča:
SIST EN 12981:2005

Obrati za premaze in prevleke - Kabine za nanašanje organskih prahastih snovi - Varnostne zahteve

Coating plants - Spray booths for application of organic powder coating material - Safety requirements

Beschichtungsanlagen - Spritzkabinen für organische Pulverlacke - Sicherheitsanforderungen
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87.100	Oprema za nanašanje premazov	Paint coating equipment

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EUROPEAN STANDARD

EN 12981:2005+A1

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April 2009

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Coating plants - Spray booths for application of organic powder coating material - Safety requirements

Installations d'application - Cabines d'application par projection de produit de revêtement en poudre organique - Exigences de sécurité

Beschichtungsanlagen - Spritzkabinen für organische Pulverlacke - Sicherheitsanforderungen

This European Standard was approved by CEN on 21 March 2005 and includes Amendment 1 approved by CEN on 22 February 2009.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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COMITÉ EUROPÉEN DE NORMALISATION
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EN 12981:2005+A1:2009 (E)**Foreword**

This document (EN 12981:2005+A1:2009) has been prepared by Technical Committee CEN/TC 271 "Surface treatment equipment — Safety", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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

A1 For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. **A1**

This document includes Amendment 1, approved by CEN on 2009-02-22.

This document supersedes EN 12981:2005.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

NOTE Although a spray booth, as an integral whole, formally does not fall under the scope of the ATEX Directive 94/9/EC, the standard is based upon a fundamental risk analysis according to this directive.

This European Standard includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

0 Introduction

This European Standard is a Type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situation and events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this European Standard.

The specific requirements which manufacturers shall include in the information for use are given in Clause 7.

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EN 12981:2005+A1:2009 (E)**1 Scope**

1.1 This European Standard is applicable to spray booths for spray application of organic coating powder, called in this European Standard “powder spray booths”, i.e. machinery and related equipment for automated and/or manual powder coating application processes.

This European Standard covers powder spray booths consisting of the following equipment:

- forced ventilation system;
- air filtering and coating powder recovery system;
- coating powder recycling system;
- delivery and circulating systems for coating powder (for instance hopper or tank, preparation and transfer new powder feeding);
- air conditioning system;
- automatic cleaning system;
- monitoring and/or control systems;
- fire detection and interlocking system;
- explosion protection system;
- mechanical aspects of product handling systems and reciprocators inside the powder spray booth;
- electrical equipment;
- powered doors and gates

joined together within or at a partially or totally enclosed structure (limited by walls, called space) for the controlled processing of spray application of organic coating powder.

This European Standard deals with the significant hazards, hazardous situations and events relevant to powder spray booths when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4).

NOTE Powder spray booths are classified in Annex **A1** C **A1**.

In addition, it defines:

- the content of marking;
- the minimum requirements for use.

1.2 This European Standard does not cover:

- a) powder spray booths in which the coating is applied by immersion in a fluidised bed;
- b) powder spray booths for application of non combustible and inorganic coating powder and flock;
- c) spraying equipment as covered by EN 1953, EN 50050, EN 50177;

- d) machinery for the supply or circulation of coating material under pressure as covered by prEN 12621;
- e) all loading and unloading systems;
- f) automatic systems, e.g. robots as covered by EN 775 and control systems of powder spray booths influencing these systems (e.g. teaching of the spraying process);
- g) powder spray booths for application of coating powder for food-stuffs and pharmaceuticals;
- h) spraying areas characterized by an open space for application of organic powder coating material which is limited only by one side wall used for extraction of exhaust ventilation;
- i) limiting walls of powder spray booths if they are constituent parts of a building.

1.3 This European Standard is not applicable to powder spray booths which are manufactured before the date of publication of this European Standard by CEN.

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 179, *Building hardware — Emergency exit devices operated by a lever handle or push pad* ^(A1), for use on escape routes ^(A1) — Requirements and test methods

EN 294, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 418, *Safety of machinery — Emergency stop equipment, functional aspects — Principles for design*

EN 619, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of unit loads*

EN 775, *Manipulating industrial robots — Safety (ISO 10218:1992, modified)*

EN 811, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

CR 954-100, *Safety of machinery — Safety-related parts of control systems — Part 100: Guide on the use and application of EN 954-1:1996*

EN 971-1:1996, *Paints and varnishes — Terms and definitions for coating materials — Part 1: General terms*

EN 981, *Safety of machinery — System of auditory and visual danger and information signals*

EN 999, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*

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EN 1037, *Safety of machinery — Prevention of unexpected start-up*

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1127-1:1997, *Explosive atmospheres — Explosion prevention and protection — Basic concepts and methodology*

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 13463-5, *Non-electrical equipment intended for use in potentially explosive atmospheres — Part 5: Protection by constructional safety "c"*

EN 13478, *Safety of machinery — Fire prevention and protection*

EN 14462:2005, *Surface treatment equipment — Noise test code for surface treatment equipment including its ancillary handling equipment — Accuracy grades 2 and 3*

EN 14986, *Design of fans working in potentially explosive atmospheres*

EN 50015, *Electrical apparatus for potentially explosive atmospheres — Oil immersion "o"*

EN 50017, *Electrical apparatus for potentially explosive atmospheres — Powder filling "q"*

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i"*

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

EN 50177:1996, *Automatic electrostatic spraying installations for flammable coating powder*

EN 50281-1-2, *Electrical apparatus for use in the presence of combustible dust — Part 1-2: Electrical apparatus protected by enclosures — Selection, installation and maintenance*

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

EN 60079-1, *Electrical apparatus for potentially explosive atmospheres — Part 1: Flameproof enclosure "d" (IEC 60079-1:2003)*

EN 60079-7, *Electrical apparatus for explosive gas atmospheres — Part 7: Increased safety "e" (IEC 60079-7:2001)*

EN 60079-17, *Electrical apparatus for explosive gas atmospheres — Part 17: Inspection and maintenance of electrical installations in hazardous areas (other than mines) (IEC 60079-17:2002)*

EN 60079-18, *Electrical apparatus for explosive gas atmospheres — Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus (IEC 60079-18:2004)*

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997)*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 61000-6-1, *Electromagnetic compatibility (EMC) — Part 6-1: Generic standards — Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1:1997, modified)*

EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:1996, modified)*

EN 61000-6-4, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environment (IEC 61000-6-4:1997, modified)*

EN 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements (IEC 61010-1:2001)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)*

EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:1995)*

EN 61310-3, *Safety of machinery — Indication, marking and actuation — Part 3: Requirements for the location and operation of actuators (IEC 61310-3:1999)*

EN 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*

A1 deleted text A1

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

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

EN ISO 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

EN ISO 14122-2, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

IEC 61496-2, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 971-1:1996, EN ISO 12100-1:2003 and the following apply.

3.1

powder spray booth

assembly of linked components such as forced ventilation by one or more fans, air filtering and coating powder recovery system, coating powder recycling system, measuring and control devices (e.g. interlocking of forced ventilation and spraying device), fire detection and interlocking, explosion protection system, automatic cleaning system, air conditioning system, warning devices, electrical apparatus, joined together within or at a partially or totally enclosed structure (limited by walls, called space) for the controlled processing of spray application of organic coating powder

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NOTE Different kind of powder spray booth are described in Annex **A1** C **A1**, e.g.:

- powder spray booth with operator inside the booth (see Figure **A1** C.1 **A1** of Annex **A1** C **A1**);
- powder spray booth with operator outside the booth (see Figure **A1** C.2 **A1** of Annex **A1** C **A1**);
- powder spray booth without operator but with supports for automatic spraying device outside the booth (see **A1** C.3 **A1**);
- powder spray booth with operator and supports for automatic spraying device outside the booth (see Figure **A1** C.4 **A1**);
- powder spray booth with operator and automatic spraying device inside the booth (see Figure **A1** C.5 **A1** of Annex **A1** C **A1**).
- This kind of powder spray booth can also be designed as a multizone powder spray booth.

3.2
powder coating material; coating powder
 solvent-free coating material in powder form which, after fusing and possible curing, gives a continuous film (see 1.41 of EN 971-1:1996)

3.3
application
 action of depositing coating powder on a substrate so that it adheres to the surface to be coated

3.4
electrostatic process
 sprayed coating powder electrostatically charged, and attracted by the surface of the earthed unheated or preheated workpiece

3.5
flammable substance
 substance in form of gas, vapour, liquid, solid, or mixtures of these, able to undergo an exothermic reaction with air when ignited (see 3.1 of EN 1127-1:1997)

NOTE “Flammable substances” and “combustible material” are equivalently used terms in this European Standard.

3.6
forced ventilation system
 ensures the air exchange by fan(s) or by other powered means

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

3.7
supply air
 consists either totally of outside air or by energetic reasons of a mixture of outside air with recirculation air. The recirculation airflow may consist of exhaust air and/or recirculated clean air. Air introduced in the powder spray booth serves to replace the collection air, to reduce the concentration of air pollutants in the work region and to supply air for technological processes

3.8
explosive atmosphere
 mixture with air, under atmospheric conditions, of flammable substances in the form of gases, vapours, mists or dusts, in which, after ignition has occurred, combustion spreads to the entire unburned mixture (see 3.17 of EN 1127-1:1997)

NOTE In this European Standard, explosive atmosphere is only due to dust resulting from used coating powder.

3.9**explosion range**

range of the concentration of a flammable substance in air, within which an explosion can occur (see 3.13 of EN 1127-1:1997)

3.10**lower explosion limit (LEL)**

lower limit of the explosion range (see 3.8 of EN 1127-1:1997)

3.11**average concentration of coating powder**

mass of coating powder introduced into the powder spray booth divided by the volume of air extracted by the forced ventilation system during the same period of time

3.12**exposure limits**

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

NOTE Limits are different according to the countries (see Annex A_1 E A_1).

3.13**reciprocator**

alternating moving device holding guns

3.14**powder recovery system**

system which collects overspray from the powder coating process which has not been deposited on the workpiece

3.15**enclosed recovery system**

separate enclosed coating powder collector (e.g. filter and/or cyclone) which is connected through ductwork to the powder spray booth

3.16**open recovery system**

coating powder collector usually fitted with filters integrated to the powder spray booth in open arrangement

3.17**explosion relief venting**

protective measure at which an area of the panelwork of the enclosure (for example of the coating powder collection unit) 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

3.18**explosion suppression**

system which can detect and suppress an explosion in the incipient growth stage

3.19**explosion decoupling**

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

3.20**fire detection system**

fire alarm system comprising components for automatically detecting a fire, initiating an alarm of fire and initiating other action as appropriate (see 3.1.3 of ISO 8421-3:1989)

EN 12981:2005+A1:2009 (E)**3.21****hazardous areas**

areas where hazards due to explosive atmosphere may exist. The probability of occurrence of explosive atmosphere is classified in zones.

Limits of hazardous zones are given in Annex A

NOTE For this European Standard, only the zones 20 and 22 (as defined in 3.22 and 3.24) are suitable.

3.22**zone 20**

area, in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently (see 6.3.3 of EN 1127-1:1997 and 6.2 of EN 50281-3:2002)

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

3.23**zone 21**

area, in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally (see 6.3.3 of EN 1127-1:1997 and 6.2 of EN 50281-3:2002)

NOTE This zone can include, among others, areas in the immediate vicinity of e.g. coating powder filling and emptying points and places where dust layers occur and are likely in normal operation to give rise to an explosive concentration of combustible dust in mixture with air.

3.24**zone 22**

area in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but if it does occur, it will persist for a short period only (see 6.3.3 of EN 1127-1:1997 and 6.2 of EN 50281-3:2002)

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

3.25**Equipment category**

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

3.25.1**Equipment Group II Category 1D**

equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are present continuously for long periods or frequently (see 3.2.3 of EN 13463-1:2001)

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

3.25.2**Equipment Group II Category 2D**

equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are likely to occur (see 3.2.4 of EN 13463-1:2001)

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

3.25.3**Equipment Group II Category 3D**

equipment in this category is intended for use in areas in which explosive atmospheres caused by air/dust mixtures are unlikely to occur, or, if they do occur, are likely to do so only in frequently and for a short period only (see 3.2.5 of EN 13463-1:2001)

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

3.26**multi-zone powder spray booth**

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

NOTE In flash off space no spraying takes place.

3.27**danger points**

for the extent of this European Standard danger points are defined locations in the danger zone of machines where persons can be injured by movements of

- parts of machinery
- workpieces or parts of workpieces

NOTE Danger points can exist, for example, on gear, chain drives, V-belt, flat belt, pulling and supporting elements on continuous conveyors, spoke wheels, shafts and shaft ends, slides, push rods and similar parts, tools and clamping devices.

Particular points of danger are:

- crushing and shearing points; [SIST EN 12981:2005+A1:2009](https://standards.iteh.ai/catalog/standards/sist/3f5bb5ff-5ffe-4527-8310-d1d5515f9950/sist-en-12981-2005a1-2009)
- trapping points; <https://standards.iteh.ai/catalog/standards/sist/3f5bb5ff-5ffe-4527-8310-d1d5515f9950/sist-en-12981-2005a1-2009>
- inrunning nips;
- cutting, punching and impact points.

3.28**accessible danger zone**

"accessible danger zones" are areas where, for example, area guards or ESPDs allow whole-body access. The objective is to prevent anyone starting the machine while persons are within the danger zone

3.29**hold-to-run control device**

control device where the actuator automatically returns to the start position when released and where machine operation is started and maintained only as long as the actuator is hold depressed

3.30**integrated feeding system**

feed mechanism for the workpiece which is integrated with the powder spray booth and where the workpiece is held and controlled mechanically during the processing

3.31**loading / unloading**

operation where the workpiece is put on / taken from the integrated feeding system