



SLOVENSKI STANDARD

SIST EN 13355:2005

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Premazne naprave - Kombinirane kabine za brizganje in sušenje – Varnostne zahteve

Coating plants - Combined booths - Safety requirements

Beschichtungsanlagen - Kombinierte Spritz- und Trocknungskabinen - Sicherheitsanforderungen

Installations d'application - Cabines mixtes d'application et de séchage - Prescriptions de sécurité

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| 87.100 | Oprema za nanašanje premazov | Paint coating equipment |
|--------|------------------------------|-------------------------|

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EUROPEAN STANDARD

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Coating plants - Combined booths - Safety requirements

Installations d'application - Cabines mixtes d'application et
de séchage - Prescriptions de sécurité

Beschichtungsanlagen - Kombinierte Spritz- und
Trocknungskabinen - Sicherheitsanforderungen

This European Standard was approved by CEN on 22 November 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

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Foreword

This document (EN 13355:2004) 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of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

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) 98/37/EC and 94/9/EC.

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

This document is part of a series of standards in the area of safety for development and construction of machines and plants for the coating of surfaces with organic substances (paints, varnishes and similar products).

This document is mainly based on EN 12215 and EN 1539.

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

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

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Introduction

This document is a C-type standard as stated in EN ISO 12100.

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

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 type C standard.

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1 Scope

This document is applicable to combined booths for the application of organic liquid coating materials by an operator with maximum drying temperature of 100 °C and deals with all hazards significant for combined booths, when they are used as intended and under the conditions foreseen by the manufacturer (see clause 4).

To the extent of this document, a combined booth is considered an assembly of the following equipment:

- forced ventilation by one or more fans,
- ventilation air heating system (e. g. heat exchanger or burner),
- power driven dampers, forced ventilation ducting,
- dry air filtering and/or wet air washing systems,
- automatic fire extinguishing equipment and additional specific electrical equipment,
- control and power circuits joined together for the spraying and drying process of liquid coating material in a space totally enclosed provided with forced ventilation.
- working pit, in special case.

This document does not cover:

- a) booths for automatic spraying, powder spray booths, open booths, and portable heaters.
- b) design of the building foundations upon which a booth is installed;
- c) the civil engineering and building design where a booth is constructed as, or to use part of, a new or existing building;
- d) spraying equipment (see EN 1953), automatic devices for spraying systems like robots (see EN 775) or reciprocators or similar systems, conveyors, lifts and continuous handling equipment and systems (see EN 619).

This document is not applicable to combined booths which are manufactured before the date of publication of this standard by CEN.

EN 13355:2004 (E)

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

EN 525, *Non-domestic direct gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW.*

EN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces.*

EN 746-1, *Industrial thermoprocessing equipment — Part 1: Common safety requirements for industrial thermoprocessing equipment.*

EN 746-2, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems.*

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

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 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics.*

EN 983, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics.*

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

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

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

EN 1539:2000; *Dryers and ovens, in which flammable substances are released — Safety requirements.*

EN 1953, *Atomising and spraying equipment for coating materials - Safety requirements*

prEN 12753; *Thermal cleaning systems for exhaust gas from surface treatment equipment — Safety requirements.*

EN 12433-1, *Industrial, commercial and garage doors and gates — Terminology — Part 1: Types of doors.*

EN 12433-2, *Industrial, commercial and garage doors and gates — Terminology — Part 2: Parts of doors.*

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 13463-1:2001; *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*.

prEN 14986, *Design of fans working in potentially explosive atmospheres*.

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

EN 60079-15, *Electrical apparatus for explosive gas atmospheres – Part 15: Type of protection "n" (IEC 60079-15:2001, modified)*.

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)*.

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 environments (IEC 61000-6-4:1997, modified)*.

EN ISO 3746, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

EN ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*.

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EN ISO 11202, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ (ISO 11202:1995)*.

EN ISO 12100-1, *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 14122-2, *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)*.

EN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2004)*.

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 12100-1:2003 and the following apply.

3.1

combined booth

assembly of linked components such as fan(s), ventilation air heating system (e. g. heat exchanger or burner), power driven dampers, forced ventilation ducting, dry air filtering and/or wet air washing systems, automatic fire extinguishing equipment and additional specific electrical equipment, control and power circuits joined together for the spraying and drying process of liquid coating material in a space totally enclosed provided with a forced ventilation

EN 13355:2004 (E)**3.2****working pit**

ground excavation, illuminated and ventilated in which the operator works while painting the underside of an item

3.3**organic liquid coating material**

organic product, in liquid form, that when applied to a substrate forms a film possessing protective, decorative and/or specific technical properties, e.g.: paints, varnishes, including their solvents and thinners (see EN 971-1)

3.4**solvent**

single liquid, or blends of liquid, volatile under specified drying conditions, and in which the binder is completely soluble (see 1.4.5 of EN 971-1:1996)

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

3.5**spraying**

application of coating material on an item within the combined booth by pneumatic, airless, electrostatic or combination of these spraying systems

3.6**drying**

evaporation of liquids from the materials being processed (see 3.5 of EN 1539:2000).

3.7**curing**

Transformation of a liquid, paste or powder (coating material) into a finished solid material (see 3.8 of EN 1539:2000)

NOTE Also known as gelling, through curing or through drying.

3.8**forced ventilation**

air circulation achieved by one or several fans

3.9**recirculated air**

air extracted from the volume and reintroduced into it

3.10**air cleaning (filtering system)**

Filtering system used for introducing clean air into the booth and cleaning contaminated air extracted from the combined booth

3.11**flammable (combustible) substances**

substance in the 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 "Combustible materials" and "flammable substances" are equivalently used terms in this standard. Examples are paint aerosols and solvents.

3.12**explosive atmosphere**

mixture with air, under atmospheric conditions, of flammable substance(s) in the form of gas, vapour, mist or dust, in which after ignition has occurred, combustion spreads to the entire unburned mixture (see EN 1127-1)

3.13**lower explosion limit (LEL)**

lower limit of the range of concentration of a combustible in air over which an explosion can occur (3.8 and 3.13 of EN 1127-1:1997)

NOTE "Explosion limit" and "Ignition limit" are equivalent. In accordance with international usage, only the term "explosion limit" is used in this standard.

3.14

total space

net volume within the booth during spraying and drying processes which may contain released substances. It includes all sections of the combined booth recirculation system(s) and ends at the outlet connection to the external exhaust

NOTE It does not include any items loaded into the combined booth, supports, transport systems or thermal cleaning systems (see prEN 12753).

3.15

hazardous areas

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

3.15.1

zone 0

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently (see 6.3.2 of EN 1127-1:1997)

3.15.2

zone 1

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally (see 6.3.2 of EN 1127-1:1997)

3.15.3

zone 2

place in which an explosive atmosphere consisting of a mixture with air of flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only (see 6.3.2 of EN 1127-1:1997)

3.16

Equipment category

3.16.1

Equipment Group II Category 1

equipment in 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 for long periods or frequently (see 3.2.3 of EN 13463-1:2001)

NOTE Equipment of category 1 is suitable for use in zone 0.

3.16.2

Equipment Group II Category 2

equipment in 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 (see 3.2.4 of EN 13463-1:2001)

NOTE Equipment of category 2 is suitable for use in zone 1.

3.16.3

Equipment Group II Category 3

equipment in 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 in frequently and for a short period only (see 3.2.5 of EN 13463-1:2001)

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

EN 13355:2004 (E)**3.17****exposure limits**

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

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

3.18**maximum drying temperature**

upper limit of circulated air temperature within the working area for which the combined booth is designed

3.19**ventilation air heating system**

heat generating and air heat exchanger system direct or indirect, which may include burner, combustion chamber, heat exchanger, fan(s), inlet, exhaust and recirculation ducts, enclosures and ancillaries, measuring and control devices

4 List of significant hazards**4.1 General**

This clause contains all the significant hazards, hazardous situations and events as far as they are dealt with in this standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

All hazards generated by spraying equipment for liquid paint and varnish and their ancillary devices are covered by EN 1953.

NOTE Information on the method of risk analysis is given in EN 1050.

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4.2 Mechanical hazards

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4.2.1 Shearing, crushing and drawing in

These hazards are related to:

- unexpected actuation of conveyor (whilst loading the combined booth)
- fans (e.g. injuries caused by after-running of fan blades) and air change valves for the combined booth
- damper adjusters (power driven dampers),
- moving parts of combined booth (e.g. doors, gates and hoods).

4.2.2 Entrapment of operators

These hazards are related to:

- obstacles or obstructions which can impede evacuation from the combined booth including any working pit in case of mechanical accident or the occurrence of fire;
- accidental significant lowering of pressure inside the combined booth (i.e.: obstruction of air inlet) capable of
 - clamping the doors by mechanical deformation of the structure of the combined booth;
 - increasing the door opening effort beyond human capability.

4.2.3 Hazards resulting from the operator slipping or falling:

These hazards are related to:

- ladders, gangways, platform or stairs;
- floor gratings;
- slippery floors;

These hazards may be increased as a result of poor lighting.

4.3 Electrical hazards

4.3.1 Electrical shock (by direct or indirect contact)

These hazards are related to:

- electrically live parts that are non insulated for operational reasons (for instance in electrostatic devices);
- live parts when insulation is damaged by contact with solvents or by mechanical means.

4.3.2 External influence on electrical equipment

These hazards are related to:

- interaction of the electrostatic high voltage equipment elements of the control and safety systems which can cause dangerous malfunctions, e. g. short circuits on electronic safety circuits, entrance guards, alarm units.

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4.4 Thermal hazards

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These hazards are related to:

- contact with hot surfaces within easy reach.

4.5 Hazards generated by noise

These hazards are related to combined booths and can be present inside as well as outside the booth.

They can be generated by noises emitted for instance by:

- fans;
- excessive air velocity in ducts and accessories ;
- wet air washing systems;
- air operated equipment (nozzles of atomising and spraying equipment, pumps, valves...).

4.6 Hazards generated by radiation

These hazards are related to the use of infra-red radiation (IR) causing

- damage to the eyes,
- burning.