SLOVENSKI STANDARD
SIST EN 1539:2016

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Sušilniki in peči, v katerih se sproščajo vnetljive snovi - Varnostne zahteve

Dryers and ovens, in which flammable substances are released - Safety requirements

Trockner und Öfen, in denen brennbare Stoffe freigesetzt werden - Sicherheitsanforderungen

Séchoirs et fours dans lesquels se dégagent des substances inflammables - Prescriptions de sécurité

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EUROPEAN STANDARD

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Dryers and ovens, in which flammable substances are released - Safety requirements

Séchoirs et fours dans lesquels se dégagent des substances inflammables - Prescriptions de sécurité

Trockner und Öfen, in denen brennbare Stoffe freigesetzt werden - Sicherheitsanforderungen

This European Standard was approved by CEN on 27 June 2015.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (EN 1539:2015) 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of an identical text or by endorsement, at the latest by April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

This document supersedes EN 1539:2009.

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 the EU Directive 2006/42/EC.

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

This European Standard 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, lacquers and similar products).

This European Standard was prepared with contribution of the following TCs:

— TC 186 "Industrial thermoprocessing - Safety";

— TC 198 "Printing and paper machinery - Safety";

— TC 200 "Tannery machinery - Safety";

— TC 202 "Foundry machinery".

NOTE 1 Although a dryer as a whole is not subject to the ATEX Directive 94/9/EC in a formal way, this document is based on a fundamental risk assessment according to this Directive.

NOTE 2 This European Standard is based on an explosion protection concept which does not define zones for areas with potentially explosive atmosphere.

In relation to the previous version of the standard, the following main modifications have been made

— the scope has been adjusted to meet the fields of application of the standard;

— the requirements for safety related controls have been modified for clarification;

— guidance for implementation of safety related control systems has been included;

— requirements for monitoring of heating system have been implemented;

— requirements for type B dryers have been detailed;

— requirements for minimization of energy usage and environmental impact have been included.

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

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

Introduction

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

This document is of relevance in particular for the following stakeholder group representing the market players with regard to machinery safety:

— machinery manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance).

The machinery concerned and the extent to which hazards, hazardous situations and hazardous 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 type C standard.

1 Scope

This European Standard deals with all significant hazards, hazardous situations and hazardous events relevant to ovens and dryers in which flammable substances are released by evaporation from and curing of coating materials.

The specific significant risks related to the use of this machinery with foodstuff and pharmaceutical products are not dealt with in this European Standard.

This European Standard is only applicable to machines which are used as intended and under the conditions which are foreseeable as malfunction by the manufacturer (see Clause 4).

For ovens and dryers in which flammable substances are released by evaporation from and curing of coating materials, in which the concentration of these flammable substances shall not, under no circumstances, exceed 3 % of the LEL, EN 746-1 and EN 746-2 may be applied instead of this European Standard.

This European Standard is not applicable to:

— ovens for hardening metals;

— enamelling plants;

— portable heating systems for drying (for instance infrared radiant heaters, hot-air blowers, blow-dryers);

— solvent recovery plants;

— distillation and/or refraction plants;

— textile dry-cleaning systems.

This European Standard is not applicable to machinery manufactured before the date of its publication as EN.

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 547-1, *Safety of machinery — Human body measurements — Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

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

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

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

EN 12198-1:2000+A1:2008, *Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 1: General principles*

EN 12198-2, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 2: Radiation emission measurement procedure*

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 13023, *Noise measurement methods for printing, paper converting, paper making machines and auxiliary equipment — Accuracy grades 2 and 3*

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

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

EN 14994, *Gas explosion venting protective systems*

EN 15061, *Safety of machinery — safety requirements for strip processing line machinery and equipment*

EN 50104, *Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods*

EN 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0)*

EN 60079-29-1, *Explosive atmospheres - Part 29-1: Gas detectors - Performance requirements of detectors for flammable gases (IEC 60079-29-1)*

EN 60079-29-4, *Explosive atmospheres - Part 29-4: Gas detectors - Performance requirements of open path detectors for flammable gases (IEC 60079-29-4)*

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

EN 61000-6-2, *Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2)*

EN 60405, *Nuclear instrumentation - Constructional requirements and classification of radiometric gauges (IEC 60405)*

EN 60519-1, *Safety in electroheat installations — Part 1: General requirements (IEC 60519-1)*

EN 60519-6, *Safety in electroheat installations - Part 6: Specifications for safety in industrial microwave heating equipment (IEC 60519-6)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 10218-1, *Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots (ISO 10218-1)*

EN ISO 10218-2, *Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration (ISO 10218-2)*

EN ISO 13732-1, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1)*

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

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)*

ISO 19353, *Safety of machinery — Fire prevention and protection*

3 Terms and definitions

For the purposes of this document the terms and definitions given in EN ISO 12100 and the following apply.

3.1
dryer
oven
machine in which, by a drying process, flammable substances are released by evaporation and curing

Note 1 to entry: See 3.7 for the definition of drying process.

3.2
chamber dryer
dryer in which the temperature of workpieces and the concentration of flammable substances are a function of time

Note 1 to entry: Uniform temperature distribution is intended in the effective volume. This dryer is typically loaded in batches.

3.3
continuous flow dryer
dryer in which the temperature of workpieces and the concentration of flammable substances are a function of location

Note 1 to entry: This dryer may be subdivided into several sections with specific temperature and forced ventilation. Uniform temperature distribution is intended in the effective volume of sections. This dryer is typically loaded continuously or quasi continuously.

3.4
accessible dryer
dryer in which provision is made for the presence of persons inside the dryer during normal operation

3.5
type A-dryer
dryer in which by design, the concentration of flammable substances in the total volume is limited below values of maximum concentration of flammable substances given in Figure 1

3.6
type B-dryer
dryer in which by design the formation of hazardous explosive mixtures is prevented in any part of the dryer by limitation of the oxygen concentration

3.7
drying
process of evaporation or volatilisation of components of the printing or coating material and the products to be dried, as well as the curing of the printing or coating material

3.7.1
mould varnish drying
process of drying of mould varnishes for casting moulds and foundry cores, in which volatile components have a longer travel to the surface (range from some mm up to about 1 cm) compared with the drying of a surface coated part to be dried (µm range)

3.7.2
resin varnish drying
process of drying of products impregnated with resin products (impregnating resin or resin varnish), in which volatile components have a longer travel to the surface (cm range) compared with the drying of a surface coated part to be dried (µm range)

3.7.3
rapid evaporation
evaporation for which the concentration maximum of released flammable substances is reached relatively quick, in average in 180s

Note 1 to entry: For coating thickness ≤ 1 mm, the warming of the coating material is typically significantly faster than the warming of the coated substrate. The release of flammable substances is constricted only little by the thin coating, over the progressing drying process.

Note 2 to entry: The time at which the concentration maximum of released flammable substances is reached, is practically not influenced by the warming of the workpiece or the ventilation number.

3.7.4
slow evaporation
evaporation for which the concentration maximum of released flammable substances is reached significantly later, than for surface coated workpieces, in average around 30 min

Note 1 to entry: For very thick coatings or for coatings which deeply penetrate the workpiece ($\gg$1 mm) the evaporation rate of the released flammable substances is driven by the warming of the workpiece and the progress of curing of the coating material (e.g. for mould or resin varnish drying).

3.8
curing
transformation of a liquid or pasty printing or coating material or powder coating into a solid film of dried coating material

Note 1 to entry: This process is also known as gelling, through curing or through drying.

3.9
flammable substances
predominantly volatile organic compounds (VOC) which can be present as gases, vapours, liquids, solids, or mixtures of these, and which are able to undergo an exothermic reaction with air when ignited

Note 1 to entry: Flammable substances can be solvents which are flammable or slow burning; e. g. aldehydes, alcohols, hydrocarbons, esters, ketones, mineral oils, as well as mixtures containing these substances.

Note 2 to entry: Mixtures containing solvents can be printing and coating materials, e.g. inks, varnishes, lacquers.

Note 3 to entry: Solvents are also used as cleaning or washing agents, and could enter the dryer.

Note 4 to entry: The terms "flammable" and "combustible" are equivalent in this European Standard.

[SOURCE: EN 13237:2013, 3.36]

3.10
released flammable substances
gases and vapours released during drying which could form an explosive mixture with air

3.11
coating materials
products, in liquid or in paste or powder form, that when applied to a substrate forms a film possessing protective, decorative and/or other specific properties

Note 1 to entry: In general coating materials consist of binders, pigments, dyestuff, fillers and other additives. Moreover, liquid coating materials can contain solvents.

Note 2 to entry: Coating materials are, for instance, paints, lacquers, varnishes, impregnating resin varnishes, paste fillers, filling materials, impregnating agents, anti-noise agents, fire resisting agents, stains, burnishes, flock, adhesives, sealing compounds, as well as coating powders.

[SOURCE: EN ISO 4618]

3.12
drying temperature
higher temperature value of respectively

— the heating medium (air or gas within the total volume) at contact to the materials being processed or

— of the printing or coating material during drying

3.13
ignition temperature
lowest temperature of a heated wall as determined under specified test conditions, at which ignition of a combustible gas or liquid, in the form of gas or vapour mixture with air, will occur

Note 1 to entry: The terms "flammable" and "combustible" are equivalent in this European Standard.

[SOURCE: EN 13237:2013, 3.45]

3.14
flammability temperature
lowest temperature at which symptoms of combustion can be found on the coated or uncoated material

Note 1 to entry: Flammability temperature of a material is a safety parameter for which a continuous combustion could be stimulated under specified test conditions. It can be determined for combustible solid substances such as paper or similar base stock and their coating. Signs of combustion are flames, glowing or pyrogenic symptoms.

3.15
limiting temperature
corresponds to the lower of the following values:

— the flammability temperature (see 3.14); or

— 0,8 times the ignition temperature (see 3.13)

3.16
lower explosion limit
LEL
lower limit of the explosion range

Note 1 to entry: "Explosion limit" and "ignition limit" are equivalent. In accordance with international usage only the term "explosion limit" is used in this European Standard. See 3.19.1 of EN 13237:2013.

Note 2 to entry: Explosion limits are the limits of the explosion range. Explosion range is the range of concentration of a flammable substance within air, in which an explosion can occur. See 3.22 of EN 13237:2013.

3.17
explosive mixture
mixture with air and combustible substances in the form of gases, vapours, mist or dust, in which after ignition has occurred, combustion spreads to the entire unburned mixture

Note 1 to entry: Explosive atmosphere is an explosive mixture under atmospheric conditions, see 3.28 of EN 13237:2013.