



# SLOVENSKI STANDARD

## SIST EN 1539:2010

01-junij-2010

Nadomešča:  
SIST EN 1539:2002

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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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#### **ICS:**

25.180.01      Industrijske peči na splošno      Industrial furnaces in general

**SIST EN 1539:2010**

**en,fr,de**

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EUROPEAN STANDARD

**EN 1539**

NORME EUROPÉENNE

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November 2009

ICS 25.180.01

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English Version

## 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 17 October 2009.

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 CEN Management Centre 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 CEN Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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**EN 1539:2009 (E)****Foreword**

This document (EN 1539:2009) 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 May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

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.

This document supersedes EN 1539:2000.

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).

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

This 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).

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The following TCs participate in this joint-working group:

TC 186 "Industrial thermoprocessing - Safety"; [SIST EN 1539:2010  
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TC 198 "Printing and paper machinery - Safety";

TC 200 "Tannery machinery - Safety";

TC 202 "Foundry machinery".

NOTE 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.

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 the United Kingdom.

## Introduction

This European Standard is a type C standard as defined in EN ISO 12100 (all parts).

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

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**EN 1539:2009 (E)****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.

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).

This European Standard is not applicable to:

- 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;

NOTE 1 These machines are dealt with in EN 746-1 and EN 746-2.

- combined spraying and drying booths;

NOTE 2 EN 13355 deals with combined spraying and drying booths.

- ovens for hardening metals;

- sintering furnaces;

- enamelling plants;

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

- machinery for production of pharmaceutical products;

- machinery for production of food;

- 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 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 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 1037, *Safety of machinery — Prevention of unexpected start-up*
- EN 1127-1:2007, *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 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements*
- EN 13478, *Safety of machinery — Fire prevention and protection*
- EN 13501-1:2007+A1:2009, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*
- 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 50104, *Electrical apparatus for the detection and measurement of oxygen — Performance requirements and test methods*
- EN 60079-0:2006, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements (IEC 60079-0:2004, modified)*
- EN 60070-29-1, *Explosive atmospheres — Part 29-1: Gas detectors — Performance requirements of detectors for flammable gases*

**EN 1539:2009 (E)**

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2005)*

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 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

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)*

IEC 60405, *Nuclear instrumentation — Constructional requirements and classification of radiometric gauges*

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

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

### 3 Terms and Definitions

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

#### 3.1

##### **dryer**

machine in which flammable substances are released by evaporation and curing

#### 3.2

##### **chamber dryer**

enclosed dryer which are charged in batch quantities

NOTE These dryers are relatively simple to operate and maintain. Conditions and knowledge of solvent loading, temperatures, solvent vapour concentration and the degree of product dryness can vary considerably and thus increase the risk from hazards.

#### 3.3

##### **continuous flow dryer**

dryer with openings through which the materials being processed can be introduced and removed (conveyed) continuously

NOTE Continuous flow dryers can be divided into sections in order to influence individual steps of the drying process.

**3.4****accessible dryer**

dryer in which provision is made for the presence of persons inside the dryer during intended use

**3.5****type A-dryer**

dryer designed and built in such a way that the concentration of flammable substances in each part of the total space is below the limit values for the maximum concentration of flammable substances given in Figure 1

**3.6****type B-dryer**

dryer designed and built in such a way that 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 millimetres up to about 1 cm) compared with the drying of a surface coated part to be dried (range micrometres)

**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 (range some centimetres) compared with the drying of a surface coated part to be dried (range micrometres)

**3.8****curing**

transformation of a liquid or pasty printing or coating material or coating powders into a final solid film

NOTE This process is also known as gelling, through curing or through drying.

**3.9****flammable substances**

predominantly volatile organic compounds (VOC): Can include gases, vapours, liquids, solids, or mixtures of these, able to undergo an exothermic reaction with air when ignited

[EN 13237:2003, 3.48]

NOTE 1 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 Mixtures containing solvents can be printing and coating materials, e.g. inks, varnishes, lacquers.

NOTE 3 Solvents are also used as cleaning or washing agents, and could enter the dryer.

NOTE 4 The terms "flammable" and "combustible" are equivalent in this European Standard.

**3.10****released flammable substances**

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

**EN 1539:2009 (E)****3.11****coating material**

product, 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

[EN ISO 4618:2006]

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

NOTE 2 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.

**3.12****drying temperature**

higher temperature value of the heating medium (air or gas within the total space) at contact to the materials being processed or of the printing or coating material during drying

**3.13****ignition temperature (of a combustible gas or a combustible liquid)**

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

[EN 13237:2003, 3.66]

NOTE The terms "flammable" and "combustible" are equivalent in this European Standard.

**3.14****flammability temperature**

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

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NOTE Flammability temperature of a material is a safety parameter for which a continuous combustion could be stimulated under specified test conditions. It could 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)

NOTE See 6.4.2 of EN 1127-1:2007.

**3.16****lower explosion limit (LEL)**

lower limit of the explosion range

NOTE 1 "Explosion limit" and "ignition limit" are equivalent. In accordance with international usage only the term "explosion limit" is used in this standard. See 3.74 of EN 13237:2003.

NOTE 2 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 3.33 of EN 13237:2003.

**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 Explosive atmosphere is an explosive mixture under atmospheric conditions, see 3.37 and 3.38 of EN 13237:2003.

### 3.18

#### **hazardous explosive mixture**

explosive mixture which, if it explodes, causes damage

### 3.19

#### **normal operation**

situation when the dryer performs its intended function within its design parameters

NOTE Minor releases of flammable material may be part of normal operation. For example, releases from seals which rely on wetting by fluid which is being pumped are considered to be minor releases. Failures (such as breakdown of pump seals, flange gaskets or releases of substances caused by accidents) which involve repair or shut-down are not considered to be part of normal operation. See 3.70 of EN 13237:2003.

### 3.20

#### **required exhaust flow rate**

controllable exhaust flow rate maintaining the concentration of released flammable substances within the total space at any time below the maximum admissible concentration

### 3.21

#### **minimum exhaust flow rate**

constant air flow rate maintaining the maximum concentration of released substances within the total space below the maximum admissible concentration

### 3.22

#### **maximum admissible quantity of released flammable substances**

maximum quantity of flammable substances which may be released within the chamber dryer per charge, corresponding to the minimum forced ventilation flow rate with consideration of the drying temperature corrections

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### 3.23

#### **maximum admissible throughput of flammable substances**

maximum quantity of flammable substances per unit time which may be released within a continuous flow dryer corresponding to the minimum forced ventilation flow rate with consideration of the drying temperature corrections

### 3.24

#### **maximum admissible concentration of flammable substances**

concentration of flammable substances within the total space of the dryer, which shall not be exceeded

### 3.25

#### **total space**

net volume within the dryer which could contain flammable substances

NOTE 1 The total space includes ventilation of all section(s) (either single or multiple) and the recirculation systems of the dryer and ends at the outlet connection of the dryer housing to the external exhaust.

NOTE 2 The total space does not include any charged materials, supports, transport systems, thermal cleaning systems, chimneys or other ducts between sections or equipment.

### 3.26

#### **effective space**

part of the total space in which the material to be dried is charged or moved

### 3.27

#### **main vaporization time**

period of time during which the major quantity of flammable substances has been released

**EN 1539:2009 (E)**

NOTE See A.1.1.2.

**3.28****charged quantity of flammable substances**

total amount of flammable substances introduced into a chamber dryer per charge during the drying process

NOTE It can be determined by the applied quantity of coating materials and the content of flammable substances; deviations are only allowed for the pre-drying loss.

**3.29****pre-drying loss**

reduction in the amount of releasable flammable substances due to drying by air before the coated material is charged into the dryer

NOTE See A.1.1.2.

**3.30****peak release rate**

maximum release of flammable substances per unit time within the dryer

**4 Significant hazards****Table 1 — List of significant hazards**

Hazard factors	Location or situation of the hazard <a href="https://standards.iteh.ai/catalog/standards/sist/b33d73d7-c028-4170-995d-43723088a1b5/sist-en-1539-2010">SIST EN 1539:2010</a>	Specific requirements Applicable clauses of this standard	General requirements Applicable clauses of	
			EN ISO 12100-1:2003	EN ISO 12100-2:2003
4.1 General	This clause contains all hazards, hazardous situations and events as far as they are dealt with in this document, identified by risk assessment significant for this type of machinery and which require action to eliminate or reduce the risk.  NOTE EN ISO 14121-1 contains information for the procedure of risk assessment.	5.1	4.1	4, 5, 6
4.2 Mechanical hazards		5.2, 7.2	4.2	4.1, 4.2, 4.6, 4.8, 4.10, 4.14, 5.1, 5.2, 5.3

Table 1 (continued)

Hazard factors	Location or situation of the hazard	Specific requirements Applicable clauses of this standard	General requirements Applicable clauses of	
			EN ISO 12100-1:2003	EN ISO 12100-2:2003
4.2.1 Shearing, crushing and drawing-in hazards by unprotected moving parts of the machine, parts with hazardous surfaces and parts moving in an uncontrolled way	a) actuators, hoisting devices and automatic handling systems (e.g. robots) during charging and discharging of dryers; b) charging assistances and conveying systems for continuous flow dryers; c) fans (e. g. injuries caused by rundown of fan wheel) and air inlets; d) damper adjuster; e) moving parts of dryers (e.g. doors, gates, hoods, top and bottom boxes of continuous flow dryers).	5.2.1, 7.2.1, 7.2.2	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 Missing means of escape for operators in dryers which could be entered	a) when obstacles or obstructions can impede a quick evacuation by the operator(s) from the dryer in case of mechanical accident or fire; b) in case of an accidental significant lowering of pressure inside a dryer (e. g. obstruction of air inlet) capable: 1) of clamping the doors by mechanical deformation of the structure of the dryer; and/or 2) of increasing the door opening effort beyond human capability.	5.2.2, 7.2.1		5.5.3
4.2.3 Personnel's slip, trip, twist and fall hazards	a) on ladders, gangways, platforms or stairs; b) on gratings at floor level; c) on non-slip resistant floors; d) due to insufficient lighting.	5.2.3	4.10	4.2.1, 5.5.6
4.3 Electrical hazards	Shock currents (by direct or indirect contact) caused by e.g.: a) electrically live parts that are not insulated for operational reasons (e.g. on IR-radiators); b) electrically live parts when the insulation is damaged by contact with solvents or by mechanical effects.	5.3	4.3	
4.4 Thermal hazards	Burns and scalds, caused by contact with hot media, for instance: a) contact with hot surfaces of the dryer; b) radiation of heat sources; c) flame, electric arcs or explosions, see also 4.8.	5.4, 7.2.1	4.4	
4.5 Hazards generated by noise	Noise exposure, hearing loss and/or physiological impacts caused by noise emissions from e.g.: a) fans; b) high air velocities in ducts and equipment; c) drives and conveyors; d) resonant vibrations; e) burners.	5.5, 7.1, 7.2.1	4.5	4.2.2, 4.3, 5.4.2