

**Kuivatid ja ahjud, kuhu lastakse süttivaid aineid.
Ohutusnõuded**

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 1539:2010 sisaldab Euroopa standardi EN 1539:2009 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 31.01.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 18.11.2009.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 1539:2010 consists of the English text of the European standard EN 1539:2009.

This standard is ratified with the order of Estonian Centre for Standardisation dated 31.01.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 18.11.2009.

The standard is available from Estonian standardisation organisation.

ICS 25.180.01

Standardite reprodutseerimis- ja levitamiseõigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:
Aru 10 Tallinn 10317 Eesti; www.evs.ee; Telefon: 605 5050; E-post: info@evs.ee

Right to reproduce and distribute Estonian Standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without permission in writing from Estonian Centre for Standardisation.

If you have any questions about standards copyright, please contact Estonian Centre for Standardisation:
Aru str 10 Tallinn 10317 Estonia; www.evs.ee; Phone: +372 605 5050; E-mail: info@evs.ee

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.

CEN members are the national standards bodies of 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.



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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword.....	4
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and Definitions	8
4 Significant hazards	12
5 Safety requirements and/or protective measures	17
5.1 General.....	17
5.2 Safety requirements against mechanical hazards	18
5.2.1 Shearing, crushing, drawing-in	18
5.2.2 Means of escape	18
5.2.3 Safety requirements against slip and fall hazards	19
5.3 Safety requirements against electrical hazards	19
5.3.1 General.....	19
5.3.2 Electrical equipment.....	19
5.3.3 External influences on the electrical equipment	19
5.4 Safety requirements against thermal hazards	19
5.5 Safety requirements against hazards from noise	20
5.6 Safety requirements against hazards from radiation.....	20
5.7 Safety requirements against hazards generated from hazardous substances	21
5.8 Fire protection and prevention.....	21
5.8.1 General.....	21
5.9 Explosion protection and prevention requirements	22
5.9.1 Type A-dryers.....	22
5.9.2 Type B-dryers.....	29
5.10 Control systems.....	31
5.11 Failure of energy supply	31
6 Verification of the safety requirements and/or measures	31
7 Information for use	34
7.1 General.....	34
7.2 Instruction handbook	34
7.2.1 General.....	34
7.2.2 Information related to installation	35
7.2.3 Information related to operation	35
7.2.4 Information related to maintenance and inspection	36
7.3 Marking	37
Annex A (normative) Basis for air flow calculation of chamber dryers and continuous flow dryers	38
A.1 Chamber dryers	38
A.1.1 Calculation basis for chamber dryers	38
A.2 Continuous flow dryers.....	43
A.2.1 Calculation basis for continuous flow dryers.....	43
A.2.2 Calculation basis for continuous flow dryers for powder coatings	45
Annex B (informative) Examples of calculation	46
B.1 Chamber dryers	46
B.1.1 Example 1: Calculation of the required minimum exhaust flow (see 3.20).....	46
B.1.2 Example 2: Calculation of the maximum admissible amount of varnish.....	47
B.2 Continuous flow dryers.....	48

B.2.1	Examples for the calculation of the minimum exhaust flow rate	48
B.2.2	Example for the calculation of the maximum admissible throughput of flammable substances	50
Annex C	(normative) Concentration measurement in dryers	52
C.1	General	52
C.2	Requirements for concentration measuring systems	52
C.3	Calculation of the lower explosion limit at drying temperature	53
C.3.1	Influence of temperature on the indicated value of concentration (physical influence)	53
C.3.2	Influence of the temperature of mixture on the kinetics of reaction (chemical influence)	54
C.3.3	Consideration of chemical and physical influences	54
Annex D	(normative) Explosion reliefs	55
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive Machinery 98/37/EC	56
Annex ZB	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	57
Bibliography	58

Figures

Figure 1	— Maximum admissible concentration of flammable substances and admissible operating ranges for dryers with limited concentration	28
Figure A.1	— Dependency of γ versus τ	42

Tables

Table 1	— List of significant hazards	12
Table 2	— Requirements according to the operating ranges	27
Table 3	— Verification	32

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).

The following TCs participate in this joint-working group:

TC 186 "Industrial thermoprocessing - Safety";

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.

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 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.