

SLOVENSKI STANDARD
SIST EN 14681:2007+A1:2010
01-junij-2010

Varnost strojev - Varnostne zahteve za stroje in opremo za proizvodnjo jekla z električnimi obločnimi pečmi

Safety of machinery - Safety requirements for machinery and equipment for production of steel by electric arc furnaces

Sicherheit von Maschinen - Sicherheitsanforderungen für Anlagen und Einrichtungen zur Erzeugung von Stahl mittels Elektrolichtbogenofen

Sécurité des machines - Exigences de sécurité pour les machines et les équipements pour la production d'acier par four à arc électrique

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Safety of machinery - Safety requirements for machinery and equipment for production of steel by electric arc furnaces

Sécurité des machines - Exigences de sécurité pour les machines et les équipements pour la production d'acier par four à arc électrique

Sicherheit von Maschinen - Sicherheitsanforderungen für Anlagen und Einrichtungen zur Erzeugung von Stahl mittels Elektrolichtbogenofen

This European Standard was approved by CEN on 26 June 2006 and includes Amendment 1 approved by CEN on 28 February 2010.

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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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EN 14681:2006+A1:2010 (E)**Foreword**

This document (EN 14681:2006+A1:2010) has been prepared by Technical Committee CEN/TC 322 "Equipments for making and shaping of metals - Safety requirements", 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of an identical text or by endorsement, at the latest by October 2010, and conflicting national standards shall be withdrawn at the latest by October 2010.

This document includes Amendment 1, approved by CEN on 2010-02-28.

This document supersedes EN 14681:2006.

The start and finish of text introduced or altered by amendment is indicated in the text by tags \square_{A1} \square_{A1} .

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 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 European Standard was elaborated by CEN/TC 322/WG1 comprising experts from the following countries: Austria, Germany, Italy and Sweden.

NOTE Initially it was planned to prepare this European Standard as a part of the standard series EN 746 "Industrial thermoprocessing equipment". As a result of the time gap between the elaboration of EN 746-1:1997 and this European Standard the goal could not be achieved because of a diverging technical level in both standards. For the next revision of both standards it is foreseen to reconsider the initial plan.

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, Croatia, 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.

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 situations 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 type C standard.

Where for clarity an example of a preventive measure is given in this European Standard, this should not be considered as the only possible solution. Any other solution leading to the same risk reduction is permissible if an equivalent level of safety is achieved.

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EN 14681:2006+A1:2010 (E)**1 Scope**

This European Standard specifies the general safety requirements for electric arc furnaces (EAF) to melt steel not containing radioactive material.

This European Standard deals with all significant hazards, hazardous situations and events pertinent to EAF, when used as intended and under conditions foreseen by the manufacturer, but also includes foreseeable faults and malfunctions in case of misuse.

This European Standard specifies also criteria for the plant and equipment integrated in the production process.

This European Standard specifies the requirements to ensure the safety of persons which are to be met during the design, assembly, transport, commissioning, operation, maintenance and decommissioning of the equipment.

This European Standard assumes that installations are operated and maintained by adequately trained and competent personnel. Manual intervention for setting, adjustment and maintenance is accepted as part of the normal use of the equipment.

This European Standard covers the following equipment (see Annex B):

- EAF with AC technology (alternating current);
- EAF with DC technology (direct current);
- scrap pre-heating technology;
- associated equipment/devices according Annex B.

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The following equipment is **not** covered by this European Standard:

- induction furnace;
- resistance-arc furnace;
- electron beam furnace;
- plasma furnace;
- other electrical furnaces used in secondary steelmaking.

This European Standard **does not** specify safety requirements for the following equipment, which can be an integral or complementary part of the equipment covered by the Scope:

- a) cranes;
- b) scrap basket;
- c) transport car for scrap basket;
- d) elephant house (furnace encasing for environmental reasons);
- e) separate scrap drying equipment.

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 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 614-2, *Safety of machinery — Ergonomic design principles — Part 2: Interactions between the design of machinery and work tasks*

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

EN 894-1, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

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

EN 982:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

EN 1037:1995, *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, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 1299, *Mechanical vibration and shock — Vibration isolation of machines — Information for the application of source isolation*

EN 1837, *Safety of machinery — Integral lighting of machines*

EN 12198-3, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 3: Reduction of radiation by attenuation or screening*

EN 12464-1, *Light and lighting — Lighting of work places — Part 1: Indoor work places*

EN 13463-1:2009, *Non-electrical equipment for use in 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 14253, *Mechanical vibration — Measurement and calculation of occupational exposure to whole-body vibration with reference to health — Practical guidance*

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EN 50171, *Central power supply systems*

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

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60204-11; *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV (IEC 60204-11:2000)*

EN 60447, *Basic and safety principles for man-machine interface — Marking and identification — Actuating principles (IEC 60447:2004)*

EN 60519-4:2006, *Safety in electroheat installations — Part 4: Particular requirements for arc furnace installations (IEC 60519-4:2006)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:2007)*

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

EN ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1996, including Amd 1:1989)*

EN ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731:2003)*

EN ISO 11064-1, *Ergonomic design of control centres — Part 1: Principles for the design of control centres (ISO 11064-1:2000)*

EN ISO 11202:1995, *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 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 14121-1, *Safety of machinery — Risk assessment — Part 1: Principles (ISO 14121-1:2007)*


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)*

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

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

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis* 

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

NOTE Definition used in EN and ISO standards referred to in this European Standard are also valid for this European Standard.

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3.1.1 charge material

material which is charged into the furnace, e.g. steel scrap

3.1.2 standard cycle

time period between two consecutive tappings with defined power-on and power-off time

3.1.3 hydraulic fluid

fluid used to transmit force via hydraulic pressure (see EN ISO 6743-4)

3.1.4 fire-resistant fluid

fluid with low flame propagation (see ISO 5598)

3.1.5 ladle

vessel to collect, transport and discharge molten steel

3.1.6 pulpit

room in which the control desk and monitoring facilities for a machine or equipment are located

3.1.7 control stand

free standing control desk to operate the equipment locally

EN 14681:2006+A1:2010 (E)**3.1.8****tilting**

movement of the furnace to discharge molten steel or slag from foreseen openings

3.1.9**blocking device**

device to block the equipment in the desired position

3.1.10**high voltage switch gear**

furnace breaker to connect and disconnect the EAF to/from electrical high voltage supply

3.1.11**reactor**

device to increase the reactance of the EAF system

3.1.12**furnace transformer**

device for the transformation of the high voltage electrical supply to arc voltage

3.1.13**alloying system**

device to store and feed any metallic and non-metallic materials to/into the EAF

3.1.14**electrode nipping system**

device, in which electrode strands can be stored or new electrode sections are added

3.1.15**dog house**

furnace enclosure serving as indirect fume extraction system and minimising noise propagation

3.1.16**fume extraction system**

equipment for the collection of created off-gas during operation (direct and/or indirect system)

3.1.17**bus bar system**

high-current connection-line between transformer and cable

3.1.18**linked equipment**

equipment which may be connected to an EAF

3.1.19**trained personnel**

persons with the knowledge of systems, background, experience and ability to operate and/or maintain the equipment in the way intended

3.2 Abbreviations

For the purpose of this document, the following abbreviations apply.

AC	Alternating Current;
DC	Direct Current;
EAF	Electric Arc Furnace.

4 List of significant hazards

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

- a) potentially hazardous situations having significant risks;
- b) the safety requirements and/or measures which shall be incorporated into the machinery/equipment;
- c) special instructions which shall be communicated to the user.

The significant hazards and hazardous situations identified are listed in columns 1 and 2 of 5.2, Table 1.

In addition it is important for the manufacturer to carry out a risk assessment according to **EN ISO 14121-1** to identify any other relevant hazard of the machine/equipment and take measures to eliminate or minimize the risk.

5 Safety requirements and/or measures

5.1 General

5.1.1 General design requirements

Electric arc furnace and equipment conforming to this European Standard shall comply with the safety requirements and/or measures of this clause.

This European Standard assumes that:

- machinery and equipment are operated and maintained by adequately trained and competent personnel. Manual intervention for setting, adjustment and maintenance is accepted as part of the normal use of the equipment;
- machinery is used with adequate workplace lighting conforming to EN 12464-1 or to local regulations.

The manufacturer shall undertake and record design calculations of the structural assembly, e.g. steel sections, auxiliaries and service as part of the equipment which shall be stable, suitable for function and intended use.

Safety devices shall be protected against damage. In particular, they shall be robust to withstand continuous operation in the respective area.

In particular the design shall include requirements and constructional details with respect to, e.g.:

- accessibility;
- guards and protection;
- maintenance openings and clearance gaps for cleaning;
- escape routes;
- movement of machinery and material;
- safety during operation;