



SLOVENSKI STANDARD

SIST EN 16774:2016

01-junij-2016

Varnost strojev - Varnostne zahteve za peči za proizvodnjo jekla in pripadajočo opremo

Safety of machinery - Safety requirements for steel converter and associated equipment

Sicherheit von Maschinen - Sicherheitsanforderungen an Stahlkonverter und zugehörige Einrichtungen

Sécurité des machines - Prescriptions de sécurité pour les convertisseurs d'acier et les équipements associés

iTeh STANDARD PREVIEW

(standards.iteh.ai)

[SIST EN 16774:2016](https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016)

Ta slovenski standard je istoveten z: EN 16774:2016

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

ICS:

13.110	Varnost strojev	Safety of machinery
77.180	Oprema za metalurško industrijo	Equipment for the metallurgical industry

SIST EN 16774:2016

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 16774:2016

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

EUROPEAN STANDARD

EN 16774

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2016

ICS 77.180

English Version

Safety of machinery - Safety requirements for steel converter and associated equipment

Sécurité des machines - Prescriptions de sécurité pour les convertisseurs d'acier et les équipements associés

Sicherheit von Maschinen - Sicherheitsanforderungen an Stahlkonverter und zugehörige Einrichtungen

This European Standard was approved by CEN on 27 February 2016.

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-CENELEC 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-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>



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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	7
3 Terms and definitions	9
4 List of significant hazards	13
5 Safety requirements and/or measures	13
5.1 General.....	13
5.2 List of significant hazards, hazardous situations, safety requirements and/or measures	22
6 Verification of the safety requirements and/or measures	36
7 Information for use	36
7.1 General.....	36
7.2 Warning devices and safety signs	37
7.3 Accompanying documents.....	37
7.4 Minimum marking	42
7.5 Training of personnel.....	42
Annex A (normative) Safety requirements for electrical equipment and for safety related control systems.....	43
A.1 General.....	43
A.2 Special requirements for safety related control systems.....	43
A.3 Special requirements for shut-down equipment.....	43
Annex B (normative) Steel converter and its associated equipment for the oxygen steelmaking process.....	45
Annex C (normative) Noise test code	46
C.1 Introduction	46
C.2 Determination of sound power level	47
C.3 Determination of emission sound pressure levels	47
C.4 Measurement uncertainties	47
C.5 Operating conditions	48
C.6 Information to be recorded and reported	48
C.7 Declaration and verification of noise emission values.....	49
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC (Machinery Directive) aimed to be covered.....	52
Bibliography.....	53

Figures

Figure B.1 — Exemplary illustration of a steel converter and its associated equipment for the oxygen steelmaking process.....	45
Figure C.1 — Exemplary illustration of a BOF converter platform and lance cleaning platform.....	50

Tables

Table 1 — List of significant hazards, hazardous situations safety requirements and/or measures	23
Table 2 — Exemplary hazardous situations and proposals for references to the user.....	40
Table C.1 — Example of declared dual-number noise emission values for operating stations and specified points	51

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 16774:2016

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

EN 16774:2016 (E)**European foreword**

This document (EN 16774:2016) 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 2016, and conflicting national standards shall be withdrawn at the latest by October 2016.

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 Annex ZA, which is an integral part of this document.

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

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

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, 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 European Standard is a type C standard as stated in EN ISO 12100.

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

This document assumes that

- the converter plant is operated and maintained by adequately trained and competent personnel (see 7.5);
- manual intervention for setting, adjustment and maintenance is accepted as part of the intended use of the plant;
- the plant is used with adequate workplace lighting conforming to EN 12464-1.

This document assumes that the input materials do not contain the following hazardous components:

- radioactive scrap;
- explosives;
- entrapped water/ice;
- closed containers;
- oversized scrap which can lead to water leakage due to collision with lances (see 7.3.5).

The charging should be done to avoid/minimize risk of explosion.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

EN 16774:2016 (E)

1 Scope

This European Standard applies for steel converter and its associated equipment (hereinafter referred to as converter plant) used in the process of carbon or stainless steel making as defined in 3.1 and illustrated in Annex B.

This European Standard deals with significant hazards, hazardous situations and events relevant to the converter plant. It covers the intended use and foreseeable misuse.

This European Standard specifies the safety requirements to be met during transport, assembly, commissioning, operation, maintenance (as described in Clause 5) and decommissioning/disassembly of the equipment.

This European Standard applies to:

Steel converter and its associated equipment for the oxygen steelmaking process

- from hot metal/liquid steel and scrap charging;
- via oxygen refining and stirring;
- temperature measurement and sampling equipment;
- up to tapping including slag retaining device;
- cooling systems;
- maintenance devices (e.g. relining device, tap hole repair device);
- process related interfaces/interactions (e.g. according to design, controls) to
 - media,
 - primary and secondary gas cleaning plant,
 - material feeding systems and ladle alloying systems,
 - transfer cars for steel ladle and slag pot, and
 - charging/tapping equipment, e.g. crane, scrap chute, ladles and slag pots.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

This European Standard does not cover safety requirements for:

- usage of process media other than oxygen, nitrogen, argon and compressed air;
- primary and secondary gas cleaning plants;
- measuring devices with radioactive sources;
- material feeding systems and ladle alloying systems;
- transfer cars for steel ladle and slag pot;
- charging/tapping and de-slagging equipment, e.g. crane, scrap chutes, ladles and slag pots;
- auxiliary winches and hoists.

NOTE 1 For variations of converter process where other gases and media, e.g. hydrocarbons, fuels, steam, etc. are used, additional safety measures have to be considered which are not covered in this safety standard

This European Standard is not applicable to converter plant, manufactured before the date of publication of this standard in the Official Journal (OJ).

NOTE 2 In case of revamping, this European Standard can be used as a guideline for the specific parts to be revamped.

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 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

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

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

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

EN 12094-1, *Fixed firefighting systems — Components for gas extinguishing systems — Part 1: Requirements and test methods for electrical automatic control and delay devices*

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

EN 14253, *Mechanical vibration — Measurement and calculation of occupational exposure to whole-body vibration with reference to health — Practical guidance*

EN 15004-1, *Fixed firefighting systems — Gas extinguishing systems — Part 1: Design, installation and maintenance (ISO 14520-1:2006, modified)*

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

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

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

EN 61310-3, *Safety of machinery — Indication, marking and actuation — Part 3: Requirements for the location and operation of actuators (IEC 61310-3)*

EN 16774:2016 (E)

EN 62061:2005, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061:2005)*

EN ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413)*

EN ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs (ISO 7010)*

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

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

EN ISO 11202:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections (ISO 11202:2010)*

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

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

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 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13849-2:2012, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation (ISO 13849-2:2012)*

EN ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design (ISO 13850:2015)*

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

EN ISO 14119, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection (ISO 14119)*

EN ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards (ISO 14120)*

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)*

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)*

EN ISO 14123-1, *Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers (ISO 14123-1)*

EN ISO 14123-2, *Safety of machinery — Reduction of risks to health resulting from hazardous substances emitted by machinery — Part 2: Methodology leading to verification procedures (ISO 14123-2)*

EN ISO 19353, *Safety of machinery — Fire prevention and fire protection (ISO 19353)*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 3864-2, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 3864-3, *Graphical symbols — Safety colours and safety signs — Part 3: Design principles for graphical symbols for use in safety signs*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 16069, *Graphical symbols — Safety signs — Safety way guidance systems (SWGS)*

3 Terms and definitions

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

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

3.1

steel converter

tiltable unit for the production of carbon or stainless steel

Note 1 to entry: This tiltable unit is mainly consisting of a vessel with refractory lining, trunnion ring, vessel suspension system, tilting drive.

3.2

associated equipment

additional equipment for the production of carbon steel or stainless steel by means of a steel converter

Note 1 to entry: For associated equipment, e.g. lances, see Figure B.1.

3.3

refining

conversion of hot metal to carbon steel or stainless steel by elimination of (mainly) carbon (and other unwanted elements like silicon, phosphor) using oxygen supply

EN 16774:2016 (E)**3.4****refining processes**

the processes differ in oxygen supply from top and by injection or in a combination of both; optionally with gas stirring

3.5**production process**

all production-related activities between charging to tapping

3.6**maintenance devices**

devices to maintain the converter, e.g. relining device, tap hole repair device

3.7**control modes****3.7.1****manual control**

every single function/movement will be individually triggered by the operator

3.7.2**automatic control**

sequence of serial or parallel functions/movements triggered by the operator

3.8**special control modes**

dedicated modes activated by a specific device, to carry out operations like skull removal or slag splashing

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 16774:2016](https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016)

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

3.9**maintenance**

all activities carried out outside the production process

3.9.1**inspection**

basic checks (e.g. visual) of equipment

3.9.2**service**

periodic exchange of lances, cleaning (e.g. lance, converter mouth), lubrication, adjustment of limit switches

3.9.3**repair**

repair or exchange of damaged components accompanied with complete shutdown (i.e. isolation of energy)

3.9.4**relining**

all activities from shut down of converter for relining up to end of pre-heating (including converter vessel exchange or parts of it, refractory breakout)

3.9.5**skull removal**

special procedure for removing the skull inside the converter by using the blowing lance

3.10**ladle**

vessel with refractory lining to collect, treat, transport and charge/discharge hot metal/steel

3.11**slag pot**

vessel to collect, treat and transport slag

3.12**scrap chute**

scrap charging container used to charge scrap into the converter

3.13**work stations**

predefined locations for personnel used for production or maintenance activities

3.13.1**operating stations**

locations where operating personnel is required during the production process

3.13.1.1**converter control room**

main control room in which the control desk and monitoring facilities for a steel converter are located

Note 1 to entry: It is a location where operating personnel is required permanently during the production process.

3.13.1.2**local control stands**

control units usually situated adjacent to the equipment

Note 1 to entry: It is a location where operating personnel is required temporarily during the production process, e.g. during charging or tapping.

3.13.1.3**portable control box**

mobile control units connected to the control system

Note 1 to entry: For example, to position equipment more precisely.

3.13.2**maintenance points**

locations where personnel is required during maintenance

Note 1 to entry: All above-mentioned stations can also be used for maintenance.

3.14**trained personnel**

person with the knowledge of systems, background, experience and ability to operate and/or maintain the equipment in the intended use and proper operation of the machinery/equipment

EN 16774:2016 (E)

3.15**authorized personnel**

trained person who is instructed by the user to perform a specific task on a specific equipment

3.16**doghouse**

enclosure around the converter vessel consisting of sidewalls, ceiling and movable doors (see 5.1.4.4)

Note 1 to entry: The primary purpose is to contain noise and dust during process.

3.17**platforms**

areas on different operating levels

Note 1 to entry: For example, for equipment placement and access (see Figure C.1).

3.18**skirt**

movable water cooled part of the gas cleaning system

Note 1 to entry: Located above the converter mouth

3.19**protection platform**

(re-)movable platform above the converter

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Note 1 to entry: Protecting lower areas from falling material.

3.20**protected area**

area where persons find protection

[SIST EN 16774:2016](https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016)

<https://standards.iteh.ai/catalog/standards/sist/f089c023-436b-471d-b535-aa9c06d9a3cf/sist-en-16774-2016>

3.21**danger zone****hazard zone**

any space within and/or around machinery in which a person can be exposed to a hazard

3.22**safety layout**

graphical description of plant-related equipment with regard to safety

3.23**warning system**

visible, audible warning devices or a combination of both

3.24**blowing-lance**

water cooled vertical lance used for blowing technical gases, mainly oxygen

3.25**sub-lance**

water cooled vertical lance used for temperature measurement and sampling during blowing

3.26**relining machinery/device**

machine for manual or automatic installation of refractory lining inside the converter

Note 1 to entry: Associated lifting, lowering and travelling devices for material transport and access to the workplace are included.

Note 2 to entry: For the associated lifting devices of relining machinery the Directive 95/16/EC on lifts is not applicable (see also Article 24, Point 3, 9th indent of Machinery Directive 2006/42/EC).

4 List of significant hazards

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 are listed in columns 1 and 2 of 5.2, Table 1.

In addition, the manufacturer shall carry out a plant-related risk assessment, including interfaces to auxiliary equipment, according to EN ISO 12100:2010, Clause 4 to identify any other significant hazard of the machine/equipment. Significant hazards identified in this plant-related risk assessment but not dealt with in this standard shall be reduced by applying the principles of EN ISO 12100.

5 Safety requirements and/or measures**5.1 General****5.1.1 Introduction**

Converter plants conforming to this European Standard shall comply with the safety requirements and/or measures set out in Clause 5 together with those set out in Annexes A, B and C and the information for use as defined in Clause 7.

Special consideration shall be given to CO emission due to process transients and/or equipment failure.

In general, risks and associated hazards are production and plant-related. The variety of different plants (i.e. different combinations of machines, different boundary conditions) could not be covered in all details in a European Standard. To deal with this fact, an individual risk assessment of the equipment in question shall be carried out (see Clause 4) considering the safety requirements of this European Standard.

The manufacturer shall include in the information for use all details required for a safe operating process under normal operating conditions. He shall also describe the specific safety measures in case of special conditions, e.g. maintenance and adjustment work.

If in addition to the technical measures further measures for risk reduction by organizational precautions according to EN ISO 12100:2010, Clause 5 are necessary, the manufacturer shall include in the Information for use details of this measures and the necessary information considering the residual risks.

5.1.2 Planning phase

The manufacturer shall undertake during planning phase together with the user a layout-check to ensure good placement and safe operation of the converter plant, in particular with regard to:

- position of physical emergency systems;
- accessibility;
- maintenance and cleaning;