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Industrial furnaces and associated processing equipment — Safety requirements for steel converter and associated equipment

Fours industriels et équipements associés — Prescriptions de sécurité pour les convertisseurs et équipements associés

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 244, *Industrial furnaces and associated processing equipment*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

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

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

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 document, this should not have been 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.

This document assumes that

— the steel converter is operated and maintained by adequately trained personnel (see 3.13 and 7.5);

— manual intervention for setting, adjustment and maintenance is accepted as part of the intended use of the steel converter;

— the steel converter is used with adequate workplace lighting conforming to e.g. ISO 8995-1.

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.

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.

Industrial furnaces and associated processing equipment — Safety requirements for steel converter and associated equipment

1 Scope

This document applies for new 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 document deals with significant hazards, hazardous situations and events relevant to the converter plant. It covers the intended use and foreseeable misuse.

This document specifies the safety requirements to be met during design, pre-assembly, transport, site-assembly, commissioning, operation, maintenance (as described in Clause 5) and decommissioning/dis-assembly of the equipment.

Assembly does not include erection because national regulations, e.g. national civil engineering laws and regulations or occupational health and safety regulations contain such information.

This document applies to:

Steel converter and its associated equipment (see Annex B, Figure B.1 for the oxygen steelmaking process

— from charging hot metal/liquid steel and scrap;

— 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, device for cleaning the converter mouth);

— process related interfaces/interactions (e.g. according to design, controls) to

  — process 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.

This document 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.

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

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

This document is not applicable to steel converter and associated equipment manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 3864-1:2011, *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 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

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

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

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

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

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

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

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 11428, *Ergonomics — Visual danger signals — General requirements, design and testing*

ISO 11429, *Ergonomics — System of auditory and visual danger and information signals*

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

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

ISO 13574, *Industrial furnaces and associated processing equipment — Vocabulary*

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

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

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

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

ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

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

ISO 14118, *Safety of machinery — Prevention of unexpected start-up*

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

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

ISO 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*

ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

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

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

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

IEC 60204-1:2006, *Edition 5.1:2009, Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

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

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

IEC 61511-1, *Functional safety — Safety instrumented systems for the process industry sector — Part 1: Framework, definitions, system, hardware and software requirements*

IEC 62061:2005, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems (Note: To be replaced by IEC 44/788/CD (2017-02))*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989/ AMD2:2013/ COR1:2019)*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 12100, ISO 13574 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/