SLOVENSKI STANDARD
SIST EN 14677:2008

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Varnost strojev - Sekundarna metalurgija - Stroji in oprema za obdelavo tekočega jekla

Safety of machinery - Secondary steelmaking - Machinery and equipment for treatment of liquid steel

Sicherheit von Maschinen - Sekundärmetallurgie - Maschinen und Anlagen zur Behandlung von Flüssigstahl

Sécurité des machines - Métallurgie secondaire - Machines et équipements pour traitement d'acier liquide

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Safety of machinery - Secondary steelmaking - Machinery and equipment for treatment of liquid steel

Sécurité des machines - Métallurgie secondaire - Machines et équipements pour traitement d'acier liquide

Sicherheit von Maschinen- Sekundärmetallurgie - Maschinen und Anlagen zur Behandlung von Flüssigstahl

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Foreword

This document (EN 14677:2008) has been prepared by Technical Committee CEN/TC 322 “Equipment for making and shaping of metals”, 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of an identical text or by endorsement, at the latest by October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

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For relationship with EC Directive(s), see informative Annex ZA, ZB and ZC, which are an integral part 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, 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 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 European Standard.

When provision 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 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.

1 Scope

This European Standard specifies the general safety requirements for secondary steelmaking machinery and equipment (SSE) as defined in 3.1 to treat liquid steel.

This European Standard covers machinery and equipment involved in the treatment process of liquid steel under vacuum or atmospheric pressure.

This European Standard deals with all significant hazards, hazardous situations and events pertinent to SSE, 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 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 SSE 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.

NOTE 1 Annex B shows examples of SSE.

The following equipment is not covered by the scope of this European Standard:

— cranes;

— fork lift trucks or other transporting equipment;

— ladles;

— equipment for relining and preheating in the relining area;

— burners according to EN 746-2;

— dust and fume exhaust systems.

NOTE 2 Significant hazards and hazardous situations due to transporting/positioning of heavy components, e. g., by cranes (e. g., ladles, vessels, covers) are considered in this standard (see 5.2.3).

This European Standard is not applicable to SSE manufactured before the date of publication of this standard in the Official Journal.

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 294, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

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 620:2002, *Continuous handling equipment and systems — Safety and EMC requirements for fixed belt conveyors for bulk materials*

EN 746-2; *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems*

EN 811, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*

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

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 981, *Safety of machinery — Systems 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, *Safety of machinery — Prevention of unexpected start-up*

EN 1088, *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 1837, *Safety of machinery - Integral lighting of machines*

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 13463-1:2001, *Non-electrical equipment for 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 13478, *Safety of machinery — Fire prevention and protection*

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

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 60079-10[1)], *Electrical apparatus for explosive gas atmospheres — Part 10: Classification of hazardous areas (IEC 60079-10:2002)*

EN 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines) (IEC 60079-14:2002)*

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

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

EN 61241-10, *Electrical apparatus for use in the presence of combustible dust — Part 10: Classification of areas where combustible dust are or may be present (IEC 61241-10:2004)*

EN 61241-14, *Electrical apparatus for use in the presence of combustible dust — Part 14: Selection and installation (IEC 61241-14:2004)*

EN 61310-1, *Safety of machinery - Indication, marking and actuation - Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995)*

EN 61310-2, *Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (IEC 61310-2:1995)*

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

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, *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)*

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1) Will be replaced by prEN 60079-10-1 (2006-07).

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

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

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 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

3 Terms and definitions

For the purposes 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.

3.1
secondary steelmaking machinery and equipment (SSE)
machinery and equipment for treatment of liquid steel under vacuum or atmospheric pressure

NOTE Annex C shows examples of steelmaking processes.

3.2
additives
non metallic additions, e. g., lime, carbon

3.3
alloying material
ferrous and/or non-ferrous additions

3.4
chimney effect
hot exhaust gas stream to the top of steelmaking vessel

3.5
local control-stand
free standing local control desks which are usually situated adjacent to machine or equipment to control part of the process

3.6
local control box
box situated at each electrical drive and only used for maintenance purposes

3.7
pulpit
enclosed room in which the control desk and monitoring facilities for a machine or equipment are located and the whole operating process can be controlled

3.8
CO-Scrubber
equipment for CO-extraction from cooling water of vacuum pump systems

3.9
ignition sources
source of energy that initiates combustion

3.10
mode of operation

— manual
manual control of the operation of the equipment (e. g., starts/stops all movements)

— automatic
automatic mode of operation (all interlocks are active)

3.11
slack rope protection
protection device with prevent slack rope

3.12
material addition equipment
equipment for storage, conveying and adding material into liquid steel

3.13
blowing equipment
equipment for blowing gas and/or powder on top or into liquid steel, e. g., chemical heating and desulphurization

3.14
positioning equipment
equipment for positioning of components

3.15
stirring equipment
equipment for stirring liquid steel

3.16
vacuum pump
equipment to reduce pressure with respect to atmospheric conditions

3.17
vacuum vessel equipment
equipment to enable a treatment of liquid steel under vacuum conditions

3.18
media handling equipment
equipment to store, supply and return media

3.19
deslagging equipment
equipment to remove slag from the surface of liquid steel

3.20
heating equipment
equipment to provide thermal energy to liquid steel and/or vacuum vessels

3.21
temperature and sampling equipment
equipment for temperature measurement and samples of liquid steel

3.22
high voltage switch gear (furnace breaker)
device to connect and disconnect the ladle furnace to/from the electrical high voltage supply

3.23
take–over–points
interfaces at the border of the SSE to auxiliary equipment and for supply and discharge of, e. g., media, energy, material additions and auxiliary equipment

3.24
relining
exchange/repair of refractory material, including drying and preheating (usually made in the relining area outside SSE)

3.25
trained personnel
persons with the knowledge of systems, background, experience and ability to operate and/or maintain the intended use and proper operation of the equipment

3.26
unauthorised persons
person not permitted to enter certain areas or to perform certain actions in the area of the SSE in relation with the operation and/or maintenance equipment, because not having the required specific knowledge and skill, and/or not being properly equipped, in order to avoid the related hazards

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.

The list of significant hazards, hazardous situations and events are specified in 5.2, Table 1 together with the required safety requirements and measures.

In addition it is important that the manufacturer shall identify through their own risk assessment (see EN ISO 14121-1) which of the hazards listed in Table 1 are significant for equipment made to customers specifications.

The manufacturer shall establish at the contract stage all foreseeable hazards which may arise from the use of the SSE, and shall give the appropriate preventative measures.

Machines/equipment shall be manufactured in accordance with the principles listed in EN ISO 12100-2 to eliminate or reduce the foreseeable risk.

5 Safety requirements and/or measures

5.1 General design requirements

5.1.1 General

SSE conforming to this European Standard shall comply with the safety requirements and/or measures of this Clause 5 together with those set out in Clause 7 and Annex A.

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.

— machinery is used with adequate workplace lighting conforming to EN 12464-1 or to local regulations.

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

The following clauses show general design and special safety requirements or measures. Their relevance to the significant hazards and hazardous situations are shown in Table 1.

The manufacturer shall undertake and record design calculation of the structural assembly, e. g., parts and auxiliaries of the equipment under intended use.

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

5.1.2 Site inspection

The manufacturer shall undertake sufficient site inspection to ensure good placement and safe operation of the SSE with regard to

— accessibility,

— maintenance and clearance gaps for cleaning,

— movement of machinery and material,

— safe operation,

— prevention of emissions hazardous to health at the workplace,

— escape routes.

5.1.3 Linked equipment

For the equipment linked to the SSE, e. g.,

— alloying system (tanks/vessels, structures, discharge/conveyor devices, etc.),

— fume extraction,

— injection systems,

— energy supply (e. g., oxygen, heating gases, argon, nitrogen),

— temperature and sampling equipment,

— auxiliary equipment and systems,

respective instructions and safety measures for the take-over-points shall be given in the information for use.

5.1.4 Safety layout

A safety layout showing all plant-related safety devices and their position in the plant shall be provided by the manufacturer and shall describe:

— visual warning equipment (e. g., signal lights),

— emergency stops,

— escape routes (if necessary, e. g., for large plants),

— other safety-related devices (e. g., guards, doors, protective coverings, light barriers).

5.1.5 Access

5.1.5.1 General

To ensure safe access to SSE the following requirements shall be considered:

5.1.5.2 Unintentional access to danger zones (see also 5.1.14) shall not be possible; they shall be protected by physical barriers meeting the requirements of EN 953.

5.1.5.3 Warning signs shall be installed so that they are visible from outside the danger zone.

5.1.5.4 Access to control desks, pulpits, underground areas, inspection and service floors shall be in accordance with EN 294, EN 811 and EN ISO 14122-1, EN ISO 14122-2, EN ISO 14122-3 and EN ISO 14122-4. Where required, they shall be protected against heat radiation and designed to withstand moving material, tools and jets of high pressure fluids or gases.

5.1.5.5 Railings shall not be used as the sole measure for guarding hazardous areas except for slips, trips and falls. They may be used in conjunction with other means to exclude unauthorised persons from hazardous areas.

5.1.5.6 Surfaces for walking or standing shall be so designed, that risks of slipping caused by scale, oil and/or lubricant are avoided or minimised.

5.1.5.7 Guards shall be provided to prevent access to a danger zone. They shall be selected as appropriate for the degree and frequency of access to be permitted, e. g., an enclosing guard or distance guard, fixed or movable with interlock. This selection shall be made according to EN 953. Interlock systems shall meet the requirements of EN 1088. The requirements of the guards shall conform with Clause 5 of EN 953:1997 and to EN 294, EN 349, EN 811.

5.1.5.8 Access to danger zones shall be permitted only after the operation of the equipment has been stopped and the related risks (e. g., stored energy, temperature, radiation) have been isolated according to EN ISO 13849-1 and EN 1037. Appropriate safety measures and/or intervention procedures shall be applied. Therefore, safety conditions shall be considered, in particular:

— conditions for access (e. g., switching to manual control mode);

— conditions for staying/working (e. g., hold-to-run-control with full overview of the danger zone); and

— conditions for re-start.

5.1.5.9 The manufacturer shall specify in the information for use the conditions under which access to the danger zones shall be permitted (7.2.6), including details about safe systems of working, as well as adoption of precautions like PPE, use of handling tools, etc..

5.1.5.10 The relevant Performance Level PL of safety systems for access to equipment shall be selected according to the specific risk assessment and shall consider the requirements of EN 1088 and EN ISO 13849-1.

5.1.6 Safety control system

Safety control systems shall be selected in accordance with the severity of the risk assessment made and as described in EN ISO 13849-1. The function of each safety control shall be considered in combination with other elements of the safety control system and shall not reduce the safety level of any other element of the system.

For the significant hazards listed in Table 1 where an electrical control system is involved a risk assessment shall be carried out according to EN ISO 13849-1.

5.1.7 Electrical power supply

The electrical power supply, comprising of the high voltage switch gear, reactor (if applicable), furnace transformer, interconnecting bus bar systems and cables, shall meet the requirements as defined in EN 60204-1.

5.1.8 Electrical low voltage supply

The electrical low voltage supply, comprising of low voltage switch gear, control system and low voltage cables, shall meet the requirements of EN 60204-1 and/or EN ISO 13849-1.

5.1.9 Fluid systems carrying or containing fluids

The manufacturer of the SSE using fluid systems carrying or containing fluids which are likely to solidify and/or have high or low viscosity shall provide protection for all fluid components against temperature influence and fire.

Where the risk of spilling of fluids in case of leakage is given at permanent workplaces, coverings of flanges, fittings and hoses shall be provided.

Equipment which has to be discharged in special sumps shall be specified. Instructions for discharge shall be given in the information for use.

Shut-off devices shall be

— installed outside the danger zone,

— easily accessible and

— the shut-off position shall be clearly indicated.

5.1.10 Hydraulic, pneumatic, gas, cooling and lubrication systems

Hydraulic, pneumatic, gas, cooling and lubrication systems shall be designed to reduce risks from toxic effects, fire, explosion and noise.