SLOVENSKI STANDARD
SIST EN 15093:2008

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Varnost strojev - Varnostne zahteve za valjarne (vroļ e valjanje)

Safety of Machinery - Safety requirements for hot flat rolling mills

Sicherheit von Maschinen - Sicherheitsanforderungen an Warmflachwalzwerke

Sécurité des Machines - Prescriptions de sécurité relatives aux laminoirs a chaud pour produits plats

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Safety of Machinery - Safety requirements for hot flat rolling mills

Sécurité des machines - Prescriptions de sécurité relatives aux laminoirs à chaud pour produits plats

Sicherheit von Maschinen - Sicherheitsanforderungen an Warmflachwalzwerke

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Foreword

This document (EN 15093:2008) has been prepared by Technical Committee CEN/TC 322 “Equipment 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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by April 2009.

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 EC Directive(s).

For relationship with EC Directive(s), see informative Annex ZA and B, which is an integral part of this document.

This European Standard has been elaborated by CEN/TC 322/WG 3, comprising experts from: Denmark, Germany, Italy, Sweden and the United Kingdom.

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 12100:2003.

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 preventative measure is given in the text, 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.

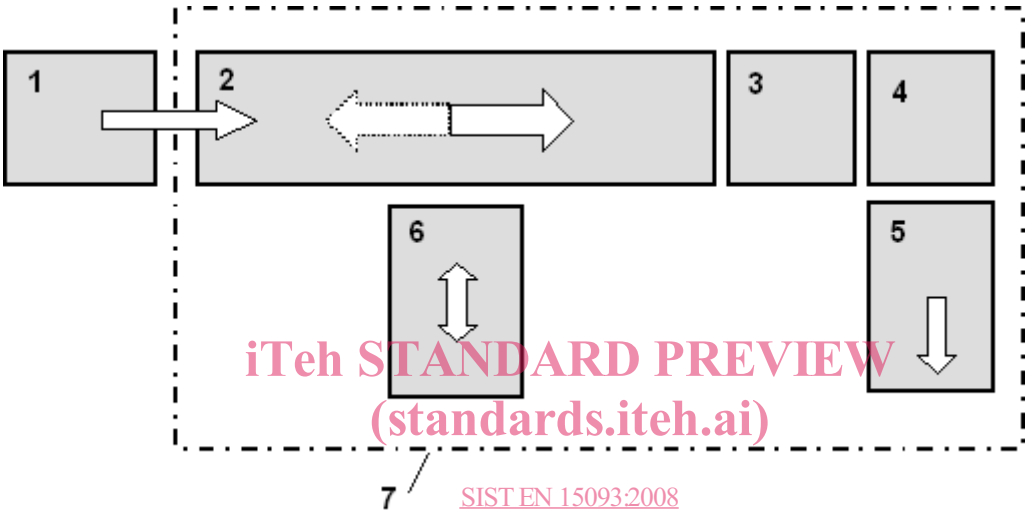
This European Standard assumes that the equipment is operated and maintained by trained personnel.

1 Scope

This European Standard defines the general safety requirements for hot rolling mills for flat products as defined in 3.1.

This European Standard deals with significant hazards, hazardous situations and events relevant to hot rolling mills for flat products. It deals not only with circumstances where the machinery is used as intended, but also includes other conditions foreseen by the manufacturer, such as foreseeable faults, malfunctions or misuse (see Clauses 4 and 5).

This European standard applies to: Machinery and equipment used for the manufacturing of metal hot rolled flat products from the material supply from (1), via the mill stands (2), to the exit (5) (see Figure 1).



Key

1 e. g., continuous casting machine (according to EN 14753) or furnace (according to EN 746-1)
2 mill stands
3 roller tables
4 coiler/cooling bed
5 coil or plate transport
6 roll changing device
7 border of the hot rolling mill

Figure 1 — Exemplary layout of a hot flat rolling mill

The following equipment is outside the scope of this standard:

— furnaces in accordance with EN 746-1, EN 746-2 and EN 746-3;

— continuous casting machines according to EN 14753;

— hook conveyors according to EN 619;

— roll shop equipment;

— storage equipment (e. g., high-bay warehouses);

— cranes, fork lifts, trucks and railway trucks and other vehicles.

This European standard is not applicable to hot rolling mills for flat products, manufactured before the date of publication of this standard by CEN.

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

EN 614-1:2006, *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 626-1, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

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

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

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

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

EN 999, *Safety of machinery — The positioning of protective equipment in respect of approach speeds of parts of the human body*

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up*

EN 1063, *Glass in building — Security glazing — Testing and classification of resistance against bullet attack*

EN 1088, *Safety of machinery — Interlocking devices associated with guards - Principles for design and selection*

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

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 12254, *Screens for laser working places — Safety requirements and testing*

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

EN 13478, *Safety of machinery — Fire prevention and protection*

EN 13861, *Safety of machinery — Guidance for the application of ergonomics standards in the design of machinery*

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 50171, *Central power supply systems*

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

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

EN 60529, *Degrees of protection provided by enclosures (IP code)*

EN 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements (IEC 60825- 1:2007)*

EN 60825-4, *Safety of laser products — Part 4: Laser guards (IEC 60825-4:2006)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory 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 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*

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)*

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 13849-1:2006, *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 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 14121-1:2007, *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 6183, *Fire protection equipment — Carbon dioxide extinguishing systems for use on premises — Design and installation*

ISO 7000, *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 12100-1:2003 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
machinery and equipment for hot rolling mills for flat products
machinery and equipment where metal is hot rolled to flat products

EXAMPLES hot strip, heavy plates.

NOTE Machines and equipment which are covered by this standard are listed in Annex E.

3.2
material
metal being hot rolled

3.3
pulpit
enclosed room in which the control desk and monitoring facilities for a machine or equipment are located, used as a permanent work place

3.4
control stand
free standing control desk (usually situated adjacent to the machine or equipment), used as a temporary work place

3.5
large machinery/equipment
interconnected equipment (size > 15 m) of hot flat rolling mills in which several components of the machinery or forming stages are linked by dedicated transport facilities (e. g., roller conveyors, cross-transfer systems)

3.6
cobbling
material leaving its intended path

3.7
trained personnel
persons 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

3.8
unauthorized person
person not permitted to enter certain areas of the hot flat rolling mills, or to perform certain actions in relation with the operation and/or maintenance of the equipment, because of not having the required specific knowledge and skill and not being properly equipped to avoid the related hazards

3.9
maintenance
service, inspection and repair

3.10
modes of operation
different modes of operation under which machinery and equipment of hot flat rolling mills (single machines or groups of interconnected parts) can function

a) **manual mode**
mode in which every single function of the equipment is controlled by an operator by means of a hold-to-run control or equivalent device (see 3.26 of EN ISO 12100-1:2003)

b) **semi-automatic mode**
mode of operation of the machinery consisting of a series of automatic sequences (summary of functions) into which the whole working cycle is subdivided and, at the end of each sequence, started by the operator and then controlled by a programmable electronic system (PES), the operation is automatically stopped, and a new command of the operator is needed to initiate the next sequence

c) **automatic mode**
process, e. g., a cycle of successive or parallel sequences, once initiated by the operator, which is totally controlled by a PES and in which the repetition of the working cycle of the machinery takes place (as long as the running conditions are met) without any operator intervention required

3.11
safety layout
description of line-related equipment with safety functions to ensure safe operation of the hot flat rolling mill avoiding hazards or hazardous situations for, e. g., unauthorized access or having another line-related safety function (see 5.1.3)

4 List of significant hazards

This clause contains all 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 requires action to eliminate or reduce the risk. The risk identification was determined as follows:

a) potentially hazardous situations having significant risks;

b) the safety requirements and/or measures which shall be incorporated into the machinery/equipment;

c) any special instructions which shall be communicated to the user.

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

In addition it is important for the manufacturer to carry out an individual risk assessment according to EN ISO 14121-1 to identify any other significant hazard of the machine/equipment. Significant hazards identified in this

individual risk assessment but not dealt with in this European Standard shall be reduced by applying the principles of EN ISO 12100-2:2003.

The risk assessment shall take into account the interfaces between the machinery and the environment (e. g., other machinery and/or buildings), see Annex G.

5 Safety requirements and/or measures

5.1 General requirements for design, planning and risk assessment

Hot flat rolling mills 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 and B and the information for use as defined in clause 7.

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;

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

In general, risks and associated hazards are production and plant-related. The main differences arising from the processing of different materials in different qualities and the surroundings (i. e. different combination of machines, different boundary conditions, see Annex G). The resulting variety of "different plants" could not be covered in all details in a European Standard. To deal with this fact, an individual risk assessment of the hot flat rolling mill in question shall be carried out (see 4) considering the safety requirements of this European Standard.

Where the means of reducing the risk is by the physical arrangement or positioning of the installed machines, the manufacturer shall include in the information for use a reference to the reduction means to be provided, and to any limiting value of the requirement, and, if appropriate, to the means of verification.

Where the means of reducing the risk is by a safe system of working the line, the manufacturer shall include in the Information for use details of the system and of the elements of information required by the operating personnel. This shall include protective measures used according to 4.11.9 and 4.11.10 of EN ISO 12100-2:2003 to run a machine for essential operating reasons or in special mode with safety devices suspended or temporarily modified.

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 requirements also apply to under floor areas of the plant.

5.1.1 Planning of hot flat rolling mills

Manufacturers of hot flat rolling mills are normally not involved in planning the entire plant (e. g., halls, civil works). But in any case they have to take into account the following aspects in order to ensure good placement and safe operation of the hot flat rolling mill:

— accessibility;

— clearance gaps for maintenance and cleaning;

— escape routes;

— movement of machinery and material;

— safe operation;

— health and safety at the workplace;

— prevention of emissions hazardous to health at the workplace.

5.1.2 Structural assembly

The manufacturer shall undertake and record design calculations to show that the structural assembly, e. g., steel sections, auxiliaries, and services, which form part of the equipment are adequate for safety functions under intended use.

5.1.3 Safety layout

The manufacturer shall prepare a safety layout document of the whole hot flat rolling mill. The aim of the safety layout is to give information (normally by means of one or more drawings) about the physical position along the hot flat rolling mill of safety related elements like, e. g.,

— segregating devices (guards, fences, trip devices, etc.) intended to prevent access to danger areas of the plant;

— doors and other points of access (where required with related locking and/or interlocking devices) to the plant;

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

— emergency stop buttons;

— warning devices and safety signs (warning signs for, e. g., forbidden access, X-rays).

The safety layout shall be included in the manufacturer's instructions for use.

5.1.4 Access to operating points

All parts of the equipment such as control stands, pulpits, underground areas, inspection and service floors, to which personnel is required to have access, shall be easily and safely accessible.

Means of access, such as stairways, walkways, platforms, etc. shall be provided in accordance with 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. Surfaces for walking or standing shall be selected so that the risks of slips, trips and falls caused by scale, oil, emulsion and/or lubricant are avoided or minimized.

5.1.5 Access to danger zones

5.1.5.1 Access of unauthorized personnel to hot flat rolling mills is not permitted. In the information for use (e. g., safety layout), the manufacturer shall inform the user about those areas to be considered.

5.1.5.2 In general access to danger zones shall be avoided by guards. Access to danger zones is only permitted 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. An exception is only possible taking into account the requirements of 5.1.5.3.

Where possible remote monitoring (e. g., cameras, mirrors, probes, etc.) shall be used to prevent the need for personnel access.

The relevant category for control devices covering safety functions in relation with access of persons to danger zones during operation or maintenance, shall be selected according to Annex A.

5.1.5.3 For inspection purposes appropriate safety measures and/or intervention procedures shall be applied to allow authorized personnel access to danger zones under operational conditions, e. g., it might be necessary to

enter the danger zone at mill stands or drives for inspection. For these specific actions safety measures shall be considered, in particular:

— conditions for access: at least operation at reduced speed and other measures like indication to the main pulpit, switching to manual control mode, switching off the X-ray measuring device;

— conditions for staying/working, e. g., switching off the fire extinguishing system, hold-to-run control with full overview of the danger zone, operation at reduced speed;

— conditions for re-start: access doors shall be closed (taking care that no person is inside the danger zone) and reset-button has been pushed (or similar action).

Normal operation speed shall only be achievable if interlocking guards are in protective position.

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

5.1.5.4 Physical barriers (e. g., guards, see 5.1.6) shall be in general provided to safeguard the danger zones; also safety devices (e. g., trip devices), alone or in combination with guards can be used to achieve the required level of safety (see 5.3.3 of EN ISO 12100-2:2003). If a trip device is used, EN 999 shall be considered.

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

5.1.6 Guards

Guards used to prevent access to danger zones 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 Clause 5 of EN ISO 12100-2:2003 and EN 953. Interlock systems shall meet the requirements of EN 1088. The requirements of the guards shall conform to EN 953, EN ISO 13857 and EN 349.

There is no necessity for fixing (e. g., by screws) guards or guarding (e. g., covers) which could be removed only by auxiliary devices (e. g., cranes) due to the heavy weight.

With regard to the safety distances described in EN ISO 13857, the minimum height of distance guards (e. g., perimeter fences, protective structures) shall be at least 1400 mm.

5.1.7 Guard-rails

Guard-rails are to be considered as means to deter or impede access to hazardous areas, i. e., a physical obstacle which only reduces the probability of access (but not totally prevents it), offering an obstruction to free access (see 3.27 of EN ISO 12100-1:2003).

Therefore, guard-rails are not permitted as the sole measure of safeguarding hazardous areas in case of significant risks (e. g., from moving machinery or processed material). Guard-rails shall be used for cases where the hazards of slips, trips and falls are involved.

Guard-rails can be used as a measure to prevent unintentional access of unauthorised persons to zones where residual risks exist after more effective risk reduction measures have been used (e. g., zones where equipment with potentially dangerous movements can be operated only in manual mode by means of hold-to-run devices from control stands with full overview of the driven elements (see 5.3.1)).

The evaluation of the degree of risk associated to a specific hazardous situation shall be performed during individual risk assessment by the manufacturer in compliance with Clause 8 of EN ISO 14121-1:2007. However, guard-rails are not to be considered as sufficient measures of safeguarding to address hazardous situations included in Table 1, where only significant hazards are dealt with.

Guard-rails shall conform to EN ISO 14122-3. In addition, the manufacturer shall give information in the instructions for use (see Clause 7) about the foreseen restrictions for access to the areas surrounded by the guard-rails and about the nature of the existing residual risks.