BRITISH STANDARD

BS EN 15094:2008

Safety of Machinery — Safety requirements for cold flat rolling mills

ICS 77.180

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 15094:2008.

The UK participation in its preparation was entrusted to Technical Committee MCE/23, Safety of metal producing mills.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Sicherheit von Machinen - Sicherheitsanforderungen an Kaltflachwalzwerke

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Foreword

This document (EN 15094:2008) 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of an identical text or by endorsement, at the latest by April 2009, and conflicting national standards shall be withdrawn at the latest by April 2009.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 document 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 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.

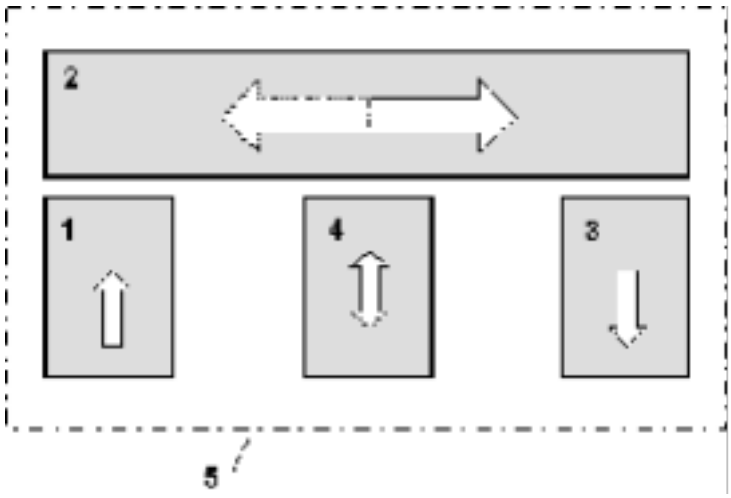
This European Standard assumes that the equipment is operated and maintained by trained personnel.

1 Scope

This European Standard specifies the safety requirements for cold rolling mills for flat products (coiled or as heavy plates) as defined in 3.1.

This European Standard deals with significant hazards, hazardous situations and events relevant to cold 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 cold rolled flat products from the material entry station (1), through the forming stations (2), to the exit (3) (see Figure 1).



Key
1 entry section
2 cold rolling mill
3 exit section
4 roll changing device
5 border of the plant

Figure 1 — Exemplary layout of a cold flat rolling mill

The following equipment is outside the scope of this European Standard:

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

— pickling plants according to EN 15061;

— strip processing lines according to EN 15061;

— abrasive blasting plants according to EN 1248;

— roll shop equipment;

— hook conveyors according to EN 619;

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

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

This European Standard is not applicable to cold 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 574, *Safety of machinery - Two-hand control devices - Functional aspects - Principles for design*

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) (IEC 60529:1989)*

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 document are also valid for this document.

3.1
machinery and equipment for cold rolling mills for flat products
machinery and equipment where metal is cold rolled to flat products

EXAMPLES coiled strip, heavy plates.

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

3.2
material
metal being cold 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 temporarily work place

3.5
large machinery/equipment
interconnected equipment (size > 15 m) of cold flat rolling mills in which several components of 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 cold flat rolling mills, or to perform certain actions in relation with the operation and/or maintenance of the equipment, because not having the required specific knowledge and skill and/or not being properly equipped in order 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 cold 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 cold flat rolling mill avoiding hazards or hazardous situations for, e. g., unauthorized access or having another line-related safety function (for explanations 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 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

Cold flat rolling mills conforming to this 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 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 surrounding (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 standard. To deal with this fact an individual risk assessment of the cold flat rolling mill in question shall be carried out (see 4) considering the safety requirements of this 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 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 cold flat rolling mills

Manufacturers of cold 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 cold 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 cold 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 cold 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 into 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 persons to cold 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 349 and EN ISO 13857.

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 1 400 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 of this standard)).

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.

5.1.8 Safety signs and warning devices

Safety signs and warning devices according to EN 61310-1 and EN 61310-2 shall be used.

Graphical symbols shall be in accordance with ISO 3864-1 and/or ISO 7000.

Danger signals shall be in accordance with EN ISO 7731 and/or EN 842 and/or EN 981.

Warning signs about non-ionising radiation for persons with implanted medical devices shall be fixed where applicable.

The manufacturer shall not rely upon warning devices alone to reduce hazards in case of significant risks.

5.1.9 Safe guarding

Any kind of safeguarding (see 3.20 of EN ISO 12100-1:2003) shall be accessible for inspection and maintenance and protected against damage under foreseeable conditions. In particular, it shall be sufficiently robust to operate reliably.

5.1.10 Personal protective equipment

The manufacturer shall give information in the information for use (see Clause 7) on the required attributes of any personal protective equipment (PPE, see Column 3 of Table 1) needed to protect personnel from any residual risks remaining after applying the safety requirements.

5.1.11 Electrical equipment

Electrical equipment shall conform to EN 60204-1 and withstand the hazards identified in the risk assessment required at the design stage and taking into account the requirement set out in Annex A.

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

5.1.12 Hydraulic, pneumatic, cooling and lubrication systems

Hydraulic, pneumatic, cooling and lubrication systems shall be designed to reduce risks from hazardous substances, fire, explosion, vibration and noise.

Sufficient ventilation and/or other means shall be provided for cooling/lubrication systems to minimize hazardous effects.

Hazards associated with pressure, temperature, ignition sources, and proximity to adjacent personnel shall be taken into account. In no case shall the system be designed to safety requirements lower than those described in EN 982 or EN 983 and shall take account of Table 1.

5.1.13 Fluid systems

Cold flat rolling mills using fluid systems carrying or containing fluids which are likely to solidify and/or have high or low viscosity which can increase temperature influences shall meet the following requirements.

Equipment and pipes containing hydraulic fluids shall be protected wherever the risk of temperature influences is involved. Instruction shall be given in the information for use about the correct fluid to be used and to ensure protection against high temperature influences and also hazardous situations.

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

5.1.14 Material to be discharged to drains

The manufacturer shall give information on the material to be discharged to drains. This information shall include connection means to waste discharge points and floor drains which form a part of the equipment. The information shall be included in the Information for use.

5.1.15 Surface temperatures and heat radiation

Where the risk of heat radiation is given, protection walls/shields with isolating material shall be provided. EN 12198-3 shall be considered.

Surfaces which are accessible and could be touched shall have temperatures not exceeding the burn threshold for contact time and material specified in EN ISO 13732-1. Where these limits can not be kept, additional technical measures shall be applied, e. g., isolation, distance guard. These measures shall be supplemented by warning instructions and wearing of PPE, if necessary.

5.1.16 Pulpits and control stands

The pulpits and control stands shall be designed taking into consideration 5.2.7.

5.1.17 Software manipulation

Software shall be protected against unauthorised access and manipulation, e. g. by keywords on different levels. For software safety requirements see 4.6 of EN ISO 13849-1:2006.

5.1.18 Fire protection

The necessity to install fire fighting systems at cold flat rolling mills (e. g., pulpit, hydraulic/electric rooms) shall be checked taking into account the processing conditions (e. g., use of lubricants). For detailed information see EN 12094-1, EN 13478, EN 15004-1 and Annex C.

5.1.19 Ergonomic principles

4.8 of EN ISO 12100-2:2003 and EN 13861 shall be used as a guideline for considering ergonomic aspects in the design of cold flat rolling mills. Particular consideration shall be given to EN 614-1, EN 614-2, EN 894-1, EN 894-2, EN 894-3, EN 60447 and EN ISO 11064-1.

Particular attention shall be paid to the following:

— dedicated lifting aids or anchoring points for common lifting devices shall be provided whenever frequent lifting or heavy tooling of machines is required;

— eyebolts or similar aids shall be fitted to heavy components to lift them; they shall also be fitted with handles, hand-holds or grips with a slip-resistant (e. g., knurled) surface;

— work areas used for manual handling of components shall be so designed that they are free of obstructions so that the operator is not hindered in his movements; the work area shall be sufficiently spacious to handle manual loads close to the body;

— slip-resistant surfaces, as defined in 5.1.4;

— vibration protection, as defined in 5.1.20;

— heat protection, as defined in 5.1.15;

— lighting of the working areas shall be in accordance with EN 1837.

The particular ergonomic requirements of 5.3.4 shall be taken into consideration (if applicable).

5.1.20 Vibrations

Vibrations shall be considered at the design stage, see EN 1299.

Harmful hand-arm vibration at cold flat rolling mills cannot be expected.

Where the risk of whole-body vibration is given, measurement according to EN 14253 shall be made.

5.1.21 Loss of energy

In case of loss of energy (hydraulic, pneumatic, electric) all components shall take a safe position.

Where applicable, an emergency power supply shall be provided which meets the requirements of EN 50171.

In case of re-supply of energy after interruption, any uncontrolled re-start shall be avoided, see EN 1037.

The control systems and devices shall meet the requirements of 9.4 of EN 60204-1:2006 and Tables 8 and 9 of EN ISO 13849-1:2006.

5.1.22 Linked Equipment

For the equipment linked to cold flat rolling mills, e. g.,

— exhausting systems,

— energy supply (e. g., compressed air, gases, steam),

— auxiliary equipment and systems.

Respective instructions and safety measures including monitor requirements for the take-over-points shall be given in the information for use.

5.2 List of significant hazards, hazardous situations, safety requirements and/or measures

Table 1 is developed to allow the designer and manufacturer of the equipment to apply a logical approach for checking the design against the list of significant hazards with respect to cold flat rolling mills.

Table 1 is structured as follows:

a) column 1 identifies the significant hazards;

b) column 2 describes the hazardous situations;

c) column 3 specifies the safety requirements and/or measures to avoid or minimize the hazards and hazardous situations; they are shown as combined measures or as options;

d) column 4 makes reference to the relevant clauses or standards defining the measures; all references shown are applicable to each of the measures except where this is otherwise indicated;

NOTE 1 When implementing safety requirements and/or measures it has to be considered that different hazards may appear at the same time.

NOTE 2 5.3 and 5.4 contain special safety requirements or measures.

e) column 5 identifies the verification methods to be used to demonstrate conformity; the abbreviations V, P, M and D are defined as follows:

1) **V:** Visual inspection verifies the required features of the components.

2) **P:** A test/check verifies that the features provided perform their function in such a way that the requirement is met.

3) **M:** Measurement verifies that requirements are met to the specified limits.

4) **D:** Drawings and/or calculations verify that the design characteristics of the components provided meet the requirements.

Verification may involve more than one method.

Table 1 — Significant hazards, hazardous situations, safety requirements and/or measures

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verifi-cation**
5.2.1 General				
1 Combination of hazards	— Unexpected movement during maintenance	— Where equipment has to be held in a defined position and the risk of unexpected movement is given, mechanical restraining devices shall be provided	— 5.3.2	D, V
		— Operating/maintenance instructions	— 7.4	D
	— Damage of cables or hoses	— Provision of protecting devices (e. g., covers, power track, cable winding device, cable-holding trolley) for the cables and hoses supplying energy to the equipment	— 5.1.11 — 5.1.13	D, V
2 Noise	— Exposure to noise	— Noise reduction at workplaces	— 5.4	D, M, P
		— Operating/maintenance instructions	— 7.4.2	D
3 Vibration	— Exposure to hand-arm and whole-body vibration	— Vibration reduction at work stations	— 5.1.20	D, M, P
5.2.2 Hydraulics, pneumatics, emulsions and other pressurised fluid systems				
1 High pressure fluid ejection which may cause injury to persons	— Hose or pipe break due to:			
	— inadequate dimensions of hoses, pipes and fittings	— Use of adequately dimensioned hoses, pipes and fittings and	— 5.1.12 — 5.1.13	D
		— Selection of component material	— 5.1.12 — 5.1.13	D
	— vibration	— Vibration reduction at source or	— 5.1.12	D
		— Positioning equipment at a distance from vibration sources to eliminate vibration damage or	— 5.1.13	V, D
		— Provision of isolation/dampening measures and/or	— 5.1.13	V, D
		— Dimensioning taking into account the vibration load	— 5.1.12 — 5.1.13	D
	— reversed bending stress	— Selection of material and dimensioning, taking into account the fatigue strength of pipework and hoses	— 5.1.12 — 5.1.13	D
	— mechanical stress, kinking, damage	— Dimensioning taking into account mechanical stress and kinking pipework and hoses and	— 5.1.12 — 5.1.13	D
		— Protected location (e. g., by distance) or covering	— 5.1.13	D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verification**
	— chemical reaction	— Taking corrosion/chemical reactions into account when selecting materials and fluids and dimensioning wall thickness	— 5.1.12	D
		— Use of inhibitors in fluids	— 5.1.13	D, M
	— Mechanical damage by cobbling material or during scrap removal (e. g., welding or gas cutting)	— Protected location or	— 5.1.5.4	D
		— Protection against mechanical damage by covering or	— 5.1.5.4	V, D
		— Use of deflectors	— 5.1.5.4	V, D
	— Unexpected start-up	— Automatic pressure reduction in the pressure system (vessels) when the mill is switched off and	— 5.1.12 — 5.1.21 — EN ISO 13849-1	P, D
		— Measures to prevent start-up by third parties (e. g., key-operated switch) shall be implemented by providing trapped key interlocking of the pressure system where one of the locks is used to lock the venting system (or isolating device) in its open position and	— 5.1.12 — 5.1.17 — Annex A; A.2 — EN 1037 — EN 60204-1:2006; 5.4; 5.5; 5.6	P, D
		— Acoustic and visual warning device for restart	— 5.1.8	P, D
	— Dismantling and repair operations	— Attachment of measuring points with pressure relief facility and	— 5.1.5 — 5.1.12 — 7.4.3	V, D
		— Hoselines with quick disconnecting couplings which are not automatically shutting-off at both ends shall be disconnected only in the depressurised state and	— 5.1.12 — 7.4.3.2	V, D
		— Warning signs and	— 5.1.8	V, D
		— Operating/maintenance instructions	— 5.1.10 — 7.4.3 — 7.5	V, D
	— Measurement and operational checks	— Safe access for testing and inspection purposes	— 5.1.4 — 5.1.5 — Annex A; A.2	V, D
2 Burns, fire, explosion	— Combustion of fluids may cause: — release of substances hazardous to health — poisoning	— Use of low-toxicity and PCB-free fluids in the hydraulic equipment and/or	— 5.1.12 — 5.1.13 — EN 626-1	D
		— Consideration of low flammability fluids and/or	— 5.1.12	V, D

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
	caused by fumes	— Position at a distance from heat source so combustion of fluids does not occur or	— 5.1.13	D
		— Covering against thermal radiation by heat shields	— 5.1.13	V, D
	— Asphyxiation by CO_2	— Acoustic warning device and	— 5.1.8	P, D
		— Warning signs and	— 5.1.8	V, D
		— Facility to manually override the automatic CO_2 deployment and	— 5.1.18 — Annex C	D
		— Operating/maintenance instructions	— Annex C — 5.1.10 — 7.4 — 7.5	V, D
3 Release of stored energy	— Maintenance work on high pressure vessels	— Depressurising valve and	— 5.1.12 — 5.1.13	D
		— Warning signs	— 5.1.8	V, D
	— Maintenance work on pipes to the high pressure vessels	— Shut-off valve on high pressure vessel and	— 5.1.12 — 5.1.13	D
		— Warning signs	— 5.1.8	V, D
5.2.3 Bridges over roller tables and material guides				
1 Impact	— Cobbled material occurs in a manner likely to endanger persons using the bridge	— Solid deflectors or	— 5.1.2	V, D
		— Bridge constructed as protective cell or	— 5.1.2 — 5.1.4	V, D
		— Positioning of the bridges at a distance from the rolling stand where material cannot endanger persons using the bridge	— 5.1.3	V, D
2 Slip, trip, fall	— Fall from the bridge	— Railing/fencing and	— 5.1.7	V, D
		— Provision of safe access	— 5.1.5	V, D
	— Water, scale, lubricants or emulsion contaminate the bridge	— Slip-resistant flooring materials (e. g., grating, chequer plate) easy to maintain and clean and	— 5.1.4	D
		— Use of stairs with suitable handrails	— 5.1.4	V, D
	— Damage caused by vehicle, cranes or crane loads	— Bridge fixed in position (e. g., by welding or bolting) and	— 5.1.2 — 5.1.3	V, D
		— High visibility colouring	— 5.1.8	V, D

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
5.2.4 Handling, guiding and transfer equipment (general)				
1 Crushing, shearing, impact, drawing-in or trapping	— Operator intervention at boundary positions between handling equipment and parts of equipment	— Risk reduction by design avoiding accessible spaces and reducing operator intervention opportunities by filling in (e. g., space between roller table and mill stand) and/or	— 5.1.5 — 5.1.6	D
		— Provide fixed guards	— 5.1.6	V ,D
5.2.5 Roller tables and conveyors				
1 Crushing	— Material projecting over the end of the roller conveyor	— Fixed distance guard and end stops on roller tables, conveyors and pass lines	— 5.1.6	V, D
	— Reaching into chain and belt drives	— Fixed enclosing guard for chains, sprockets, belts and pulleys	— 5.3.3	V, D
2 Entanglement	— Access to rotating drive shafts	— Fixed enclosing guards	— 5.3.3	V, D
3 Drawing-in or trapping	— Access to rotating rollers — Access to product in motion (generally)	— Filling in of inrunning nips or		V, D
		— Fixed enclosing guards or distance guards	— 5.1.6 — 5.3.3	V, D
4 Impact	— Material cobbling	— Closing of gaps in roller tables and	— 5.1.2 — 5.1.6	V, D
		— Installation of guide tables and		V, D
		— Material guides and	— 5.1.2	V, D
		— Covers or protective cages or deflectors to ensure that the cobbled material is stored in/diverted to a non hazardous area and	— 5.1.6	V, D
		— Avoid access to the hazardous area during the running process and	— 5.1.3 — 5.1.4	V, D
		— Operating/maintenance instructions: no crossing or standing on/nearby roller tables during the running process	— 7.4.3 — 7.5	V, D
5 Slip, trip, fall	— Roller gaps — Contamination by grease, emulsion, rolling oil and water	— Prevent escape of grease, emulsion, rolling oil and water and	— 5.1.12 — 5.1.13	V, D
		— Slip resistant flooring materials (e. g., grating, chequer plate) easy to maintain and clean and	— 5.1.4	D
		— Use of stairs with handrails for access and	— 5.1.4 — 5.1.7	V, D
		— Operating/maintenance instructions: information on temporary walkways for emergency access	— 5.1.3 — 7.4.3.3	V, D

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
	— Fall into pits	— Covering of those floor openings or	— 5.1.6	V, D
		— Guard-rails	— 5.1.7	V, D
5.2.6 Rolling mills, rolling mill stands				
1 Crushing, shearing, squeezing	— Automatically controlled movements of changing devices (rolls, guides, tools)	— Provide guards or	— 5.1.6	V, D
		— Trip devices	— 5.1.5 — 5.1.11	V, P, D
	— Semi-automatic controlled movement of changing devices (rolls, guides, tools)	— Clearance between changing devices and fixed structure (except the roll changing interface) or walls shall not be less than 500 mm and	— 5.1.1 — 5.1.5	P, D
		— Mechanical restraint to prevent overrun of carriage to within 500 mm of fixed structures and	— 5.3.2 — 5.3.3	M, D
		— Bringing the rolls into the changing position, the movement of the roll changing device shall be controlled by a hold-to-run control device with full view of the danger zone; if the final roll changing is done automatically it shall be started from a control stand with full overview of the danger zone; and	— 5.3.1	M, D
		— Visible and audible warning devices	— 5.1.8	P, D
	— Removal of workrolls	— Mechanical restraint devices to prevent unexpected movement and	— 5.3.2	V, D
		— Operating/maintenance instructions: mechanical restrained devices are to be used, PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
	— Spindle falling during roll changing	— Clamping device holding the spindle in a safe position and	— 5.3.2	V, P, D
		— Operating/maintenance instructions	— 7.4.3.3	V, D
	— Movement of parts, e. g., transfer tables, hold down rolls, entry guides, cobble deflectors during operation	— Provide guards and	— 5.1.5 — 5.1.6	V, D
		— Operating/maintenance instructions	— 7.4.3 — 7.5	V, D
	— Unexpected movement due to stored energy during maintenance and trouble shooting	— Risk reduction by design (e. g., counter weight to achieve stability, low centre of gravity) or	— 5.1.1 — 5.1.2 — 5.1.3 — A.3.1	D
		— Mechanical restraint device to prevent unexpected movement and	— 5.3.2 — EN 1037:1995; 5.3.2, 6.3	V, D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verifi-cation**
		— Warning signs and	— 5.1.8	
		— Operating/maintenance instructions: mechanical restraining devices are to be used	— 5.1.10 — 7.4.3 — 7.5	V, D
2 Cutting	— Touching moving material	— Provide guards and/or	— 5.1.5 — 5.1.6	V, D
		— Photoelectric safety system, if frequent access is necessary	— 5.1.5 — EN 61496-1	P, D
3 Entanglement, drawing-in or trapping	— Access to rotating drive shafts, couplings and rolls	— Provide covering or	— 5.3.3	V, D
		— Provide fixed guards (fence)	— 5.1.6	V, D
4 Impact	— Material cobbling	— Material guides and deflectors and/or	— 5.1.2	V, D
		— Fixed or movable guards between stands and	— 5.1.6	V; D
		— Normal operation speed shall only be achievable if guards are closed	— 5.1.5 — Annex A	P, D
		— Where there is a residual risk deterring/impeding device with additional safety marking and warning signs	— 5.1.7 — 5.1.8	V, D
5 Ejection of parts	— Rupture of product/ material or parts	— Provide fixed guards (e. g., covering)	— 5.1.6	V, D
	— Roll fracture, roll spalling	— Shut-down the mill and	— Annex A	D
		— Operating/maintenance instructions	— 7.4.3.4 — 7.5	V, D
	— Break of mechanical overload safety devices (e. g., breaker blocks. shear bolts)	— Covering capable of containing ejected parts	— 5.1.2 — 5.1.6	V, D
6 Slip, trip, fall	— Falling from machinery or into pits	— Platforms with guard-rails, access ways or ladders on and in rolling mill stands and	— 5.1.4	V, D
		— Covering of floor openings or	— 5.1.6	V, D
		— Deterring/impeding device (railing)	— 5.1.7	V, D
	— Slipping and falling due to lubricants, water, emulsion or rolling oil	— Slip resistant flooring, easy to maintain and clean and	— 5.1.4	V, D
		— Restriction of lubricants, water, emulsion, rolling oil or	— 5.1.13	V, D
		— Diversion into containers or to provided areas	— 5.1.14	V, D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verification**
7 Burns	— Contact with hot surfaces of machinery (rolls) and/or process materials	— Provide guards and	— 5.1.5 — 5.1.6	V, D
		— Warning signs and	— 5.1.8	V, D
		— Operating/maintenance instructions: PPE	— 5.1 10 — 5.1.15 — 7.4.3 — 7.5	V, D
	— Scrap removal	— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
8 Damage to skin, airways and lungs	— Inhalation of aerosol or vapours	— Exhaust system or other means and	— 5.1.12	V, D
		— Lubricants with lower toxic risk (where possible) and	— 5.1.12	V, D
		— Monitoring the function of the exhaust system and alarm in case of failure of the exhaust system and	— 5.1.8 — 5.1.22	V, D, M
		— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3.3	V, D
	— Contact with rolling emulsions or rolling oil	— Covering of roll stand and	— 5.1.6	V, D
		— Exhaust system and	— 5.1.22	V, D
		— Operating/maintenance instructions: handling and treatment of rolling emulsion/oil and use of PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
9 Asphyxiation	— Release of extinguishing gases, e. g., CO_2 by fire fighting system at mill stands and into areas below	— Selection of fire fighting systems and	— 5.1.18	V, D
		— Provide safety measures as defined in Annex C and	— Annex C	V, D
		— Safe access to cellars and	— 5.1.5	V, D
		— Access doors to under floor areas below stands shall be at mill-floor level and	— 5.1.5	V, D
		— Operating/maintenance instructions	— 7.4.3.3 — Annex C	V, D
5.2.7 Pulpits and control stands				
1 Slip, trip, fall	— Escape from pulpits and control stands in case of danger	— Safe escape and	— 5.1.1 — 5.1.3 — 5.1.5	V, D
		— Escape ways only built with stairs and	— 5.1.4	V, D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verifi-cation**
		— Slip resistant flooring material and	— 5.1.4	D
		— Marking of escape routes	— 5.1.8	V, D
2 Heat, cold, draught	— Hot or cold work environment at pulpits	— Thermal isolation and/or	— EN ISO 11064-1	M, D
		— Heat reflecting windows and/or	— EN ISO 11064-1	M, D
		— Air conditioning	— EN ISO 11064-1	D
	— Draught conditions at control stands	— Provide fixed or movable protection walls	— 5.1.6	V, D
3 Impact, ejection of parts	— Workpieces breaking away — Roll fracture — Break of material	— Location at a safe distance or	— 5.1.3	V, D
		— Impact resistant glass/adequate material and walls	— EN 1063	D
	— Impact by vehicles, cranes or travelling load	— Select a safe location and	— 5.1.1 — 5.1.2 — 5.1.3	V, D
		— Collision protection (e. g., by fencing, bollards) robustly fixed in position and	— 5.1.1 — 5.1.2 — 5.1.3	V, D
		— Firm fixture to the building structure and	— 5.1.2	V, D
		— Marking of areas to be protected and	— 5.1.3 — 5.1.8	V, D
		— Warning signs and	— 5.1.8	V, D
		— Operating/maintenance instructions: crane passage with load prohibited	— 7.4.3 — 7.5	V, D
4 Interference with, e. g., speech com-munication, acoustic signals in pulpits	— Wrong information — Operation error	— Sound insulated pulpits	— 5.4	M, D
		— Operating/maintenance instructions: wearing of special PPE at control stands	— 5.1.10 — 7.4.3 — 7.5	V, D
5 Vibration	— Transmission of vibrations	— Design and construction of the pulpit in such a way that it is dampened and disconnected from vibration sources	— 5.1.20 — EN 614-1:2006; 4.4 — EN 1299	D
6 Musculoskele-tal damage	— Bad design of work equipment	— Design taking into account ergonomic principles	— 5.1.19	V, D

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
7 Impaired vision	— Operator error caused by insufficient lighting or dazzle	— Provide sufficient lighting and — Positioning of the light sources to minimize dazzling and/or — Provide tinted glass/adequate material to prevent dazzle from outside	— 5.1.19 — EN 614-1:2006; 4.4	V, D
		— Non-dazzling lighting	— EN 1837	V, D
8 Mental overload, fatigue of the operator, decrease in concentration	— Overstressing caused by excessive number of screens and controlling instruments	— Automatic operation where possible and	— 5.1.11	D
		— All safety related information requiring action by the operator shall be indicated at the main monitor and	— EN 894 part 1 to 3	V, D
		— Information that have to be observed permanently by the operator shall be shown on only one or two monitors	— 5.1.19	V, D
5.2.8 Measuring devices and display units				
1 Burns from lasers	— Eye or skin contact (directly or by reflection)	— Reflections shall be avoided by design and	— EN 12254 — EN 60825-4	D
		— If possible, use of low energy lasers and a defined, controlled beam path or	— EN 60825-1	P, D
		— In case of high energy lasers, class 3 B or higher, interlocking guards or trip devices shall be provided to switch-off the laser or activate a beam trap and	— 5.1.6 — Annex A; A.2 — EN 60825-1	V, D, P
		— Optical warning device and	— 5.1.8	P, D
		— Screens for laser working places and	— EN 12254	V, D
		— Safety marking and	— 5.1.8 — EN 60825-1	V, D
		— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
2 Ionising radiation sources	— Radiation from — sealed radioactive sources, — x-ray generators	— Radiation protection:		V
		— Segregation of the ionising radiation beam by the use of interlocked guards (enclosures) designed to prevent access and	— 5.1.6 — 5.1.11	V, D
		— Mandatory enclosing of emitters (e. g., shutter mechanism)	— 5.1.6 — 5.1.11	D
		— When installing sources, consideration shall be given to:		

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verifi-cation**
		— Location and integrity of installation (physical damage to source housing location and installation shall be such that any radioactive source cannot be dislodged and consequently damaged by moving machinery/ product) and	— 5.1.9	D
		— Emission warning device (optical) and	— 5.1.8	P, D
		— Warning signs on outside of enclosure and	— 5.1.8	V, D
		— Operating/maintenance instructions: Written procedures for access and for work in or around the enclosure; in the maintenance and handling instructions of sealed radioactive sources give information on the action to be taken when replacing, removing and disposing of radioactive sources.	— 7.4.3 — 7.5	V, D
3 Crushing	— Touching of moving machine parts and/or moving equipment in automatic mode	— Provide guards	— 5.1.5 — 5.1.6	V, D
5.2.9 Cutting devices				
1 Crushing, shearing, drawing-in or trapping	— Movement of the cutting device, knife or blank holders during rolling process	— Provide guards	— 5.1.6	V, D
	— Movement of the cutting device, knife or blank holders during threading or sample/scrap cutting	— Trip device or	— 5.1.5	V, D
		— Two-hand control device	— EN 574	V, D
	— Closing movement of clamping devices, drive elements or rotating masses	— Use of guiding and/or deflecting devices (e. g., enclosure, catching device)	— 5.1.6	V, D
	— Movement of scrap collection buckets or cars	— Interlocking guard to prevent access to scrap chutes and pits	— 5.1.6	V, D
	— Changing or adjusting of knives during maintenance	— Hold-to-run control and reduced speed for movement of the knife and	— 5.1.5 — 5.1.6 — 5.3.1 — Annex A; A.2	V, D
		— Mechanical restraint device to prevent unexpected movement	— 5.3.2	V, D

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
2 Cutting	— Contact with sharp edges (e. g., sheets, blades or knives)	— Provide guards and	— 5.1.6	V, D
		— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
	— Contact with scrap and/or samples	— Mechanical restraint device to prevent unexpected movement and	— 5.3.2	V, D
		— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
	— Dropping pieces of scrap	— Provide guards and	— 5.1.6	V, D
		— Protect accesses to scrap chutes and pits in operation and	— 5.1.5 — 5.1.6	V, D
		— Use of guiding and/or deflecting equipment (guard, safety catch)	— 5.1.6 — 5.3.2	V, D
3 Fall	— Falling into scrap pits/cellars	— Covering of floor openings or	— 5.1.6	V, D
		— Deterring/impeding device (railing)	— 5.1.7	V, D
4 Cutting, musculoskeletal damage	— Lifting of heavy loads when removing samples and sheets	— Use of mechanical handling devices (e. g., crane, hoist)	— 5.1.19	V, D
	— Contact with strip edges	— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
5.2.10 Coiling/de-coiling equipment				
5.2.10.1 Coilers/de-coilers				
1 Crushing, shearing squeezing, drawing-in	— Movements during automatic operations of blank holders, belt wrappers, mandrel supports, transfer tables and guides — Closing of gripping devices of mandrels, double head coilers, driving units or bridles	— Interlocking guard with guard locking and	— 5.1.5 — 5.1.6	V, D, P
		— Provide guards for mandrel thrust bearings, drives and trailing cable devices where access is possible (e. g., underfloor areas) and	— 5.1.5 — 5.1.6	V, D, P
		— additionally, if manual threading is necessary (e. g., for foil rolling mills): hold-to-run control with full view of danger zone and only creep-speed-mode or cadence-speed mode if guards are open	— 5.1.11 — 5.3.1 — EN ISO 13849-1 — EN 60204-1:2006; 9.2.5.6	V, D, P
	— For coilers only:			

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verifi-cation**
	— Reaching into in-running nips during placing/ removing visual information markers (e. g., record cards indicating strip faults etc.)	— Alternative means of information communication (e. g., tracking/ monitoring systems) shall be used which do not require marking the coil at the in-running nip		V, D
		— Automatic marking systems, e. g., labeling with robots		V, D
	— Reaching into in-running nips during insertion, attaching or removing of intermediate layers of material (e. g., paper)	— Provide guards and	— 5.1.5 — 5.1.6	V, D
		— automatic insertion devices for intermediate layers (e. g., electrostatic devices) or		D
		— coiling from underside and gravity feeding inserted layer from safe position above in-running nip or		D
		— pneumatic devices for removing intermediate layers or		D
		— Provide guards and	— 5.1.5 — 5.1.6	V, D
		— hold-to-run control with full view of danger zone and	— 5.1.11 — 5.3.1 — EN ISO 13849-1 — EN 60204-1:2006; 9.2.5.6	V, P
		— only creep-speed-mode (max. 15 m/min) or cadence-speed mode possible when guard is open and emergency stops in reachable distance	— 5.1.6 — 5.1.11 — Annex A; A.3.4	V, P
	— For de-coilers with paper coilers only:			
	— falling of metal strip end caused by backward movement of de-coiler when loading paper coiler	— Prevent backward movement of metal de-coiler	— Annex A; A.2	V, D
	— Threading and fixing of aluminium foil at spool or coil	— only creep-speed mode (max. 15 m/min) or cadence-speed mode when guard is open and	— 5.1.5 — Annex A; A.2	V, D
	— Marking after strip break	— emergency stops in reachable distance	— Annex A; A.3	V, D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4	Column 5
Significant hazard	**Hazardous situation**	**Safety requirements and/or measures**	**Reference**	**Verifi-cation**
2 Impact, ejection of parts	— Turning over of strip ends — Rupture of material	— Provide guards or	— 5.1.6	V, D
		— Protective walls or cages and automatic shut-down	— 5.1.2 — 5.1.3 — 5.1.6 — Annex A; A.3	V, D
	— Inadmissible high speed of empty mandrels	— Speed limitation and	— Annex A; A.2	D, P
		— Operating/maintenance instructions: Fixation of the segments during commissioning/maintenance	— 5.1.10 — 7.4.3 — 7.5	V, D
3 Slip, trip, fall	— Fall into pits	— Provide guards or	— 5.1.6	V, D
		— Guard rails and	— 5.1.7	V, D
		— Safe design of the floor, easy to maintain and to clean	— 5.1.4	V, D
	— Grease, water, emulsion or oil	— Limitation of grease, water, oil or emulsion and	— 5.1.12 — 5.1.13 — 5.1.14	V, D
		— Anti-slip flooring (e. g., grating)	— 5.1.4	V, D
4 Cutting, burns	— Manual handling of material (e. g., touching of edges, handling of samples, scrap removal)	— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
5 Contact with or inhalation of harmful fumes	— Fuming coils after rolling due to rolling emulsion or rolling oil	— Fume extraction system	— 5.1.22	V, D
5.2.10.2 Devices for tilting, guiding and transporting of coils or sleeves to or from coilers/de-coilers				
1 Crushing, drawing-in, impact	— Contact with moving parts of equipment and/or with the handled coils during automatic operation	— Provide guards	— 5.1.5 — 5.1.6	D, V
	— Rotating turntable	— If this area is accessible: safety distance of at least 0.5 m with or without load (e. g., largest coil) to working equipment, structure and safety devices (guards)	— 5.1.5	V, D
2 Crushing, impact	— Fall of a coil from transport equipment due to stored potential or kinetic energy	— Design of V-type saddles capable to retain every foreseen size of coil and		D, V
		— Provision of devices (e. g., proximity switches, position transducers, detectors of coil presence) enabling the automation system to control the movements of coil handling equipment and	— Annex A	D, T

Table 1 *(continued)*

Column 1 **Significant hazard**	Column 2 **Hazardous situation**	Column 3 **Safety requirements and/or measures**	Column 4 **Reference**	Column 5 **Verification**
		— Smooth acceleration and deceleration movements of transport equipment (including emergency stop conditions)	— Annex A	D, T
3 Slip, trip, fall	— Falling into floor openings due to the movement of coil cars running in pits > 500 mm below surrounding floor level:			
	— in case of access required during normal operation	— Permanent closing of the pits/trenches by passable sliding floor plates attached to the coil car; sliding floor plates shall be placed at surrounding floor level or at max 500 mm below surrounding floor level and	— 5.1.2	V, D
		— Operating/maintenance instructions	— 7.4.3 — 7.5	V, D
	— in case of access during maintenance and repair	— Marking of hazardous area and	— 5.1.8	V, D
		— Provision of removable covers and	— 5.1.2	V, D
		— Operating/maintenance instructions	— 7.4.3 — 7.5	V, D
4 Burns	— Touching of rolled coils	— Provide guards and	— 5.1.6	V, D
		— Warning signs and	— 5.1.8	V, D
		— Operating/maintenance instructions: PPE	— 5.1.10 — 7.4.3 — 7.5	V, D
5.2.11 Coil banding machines and marking machines				
1 Trapping, crushing, shearing, drawing-in, cutting, impact	— Access to parts in automatic motion (e. g., strap change during normal operation)	— Provide guards and doors with guard locking	— 5.1.5 — 5.1.6	V, D
		— Control stand outside guard	— 5.1.1 — 5.1.3	V, D
2 Burns	— Contact with hot surfaces	— Locate working area and regular access remote from heat sources (e. g., work areas, control and maintenance points, passage ways)	— 5.1.4 — 5.1.5	V, D

5.3 Additional safety requirements or measures

5.3.1 Hold-to-run control device

Where a hold-to-run control device is required in Table 1, it shall meet the following requirements:

— placing in an area that does not endanger the operator during the dangerous movements;

— the operator shall have full overview over the danger zone directly or by the help of visual aids (e. g., mirror, closed circuit television);

— release of a hold-to-run control device shall stop the movement immediately.

5.3.2 Mechanical restraint devices

Mechanical restraint devices shall be selected to hold the equipment/tool in a safe position during operation or maintenance. Those devices can be, e. g., safety bolts, latches, scotches and brakes.

Where automatically operated safety bolts are used, e. g., operated by hydraulic cylinders, they shall be monitored in their end position and any further operation shall only be possible if the correct position is confirmed.

Where safety bolts or latches are set by hand they shall be clearly identifiable (e. g., different shapes) and installed directly on the equipment to be protected (e. g., with a chain).

Safety bolts shall be sufficiently dimensioned to withstand the expected loads.

Where brake systems are used they shall be mechanically applied in the holding position.

The mechanical restraint devices shall be kept in safe position in case of loss of power supply.

5.3.3 Accessible rotating/moving parts

Accessible drive shafts, couplings belts, chains, pulleys and sprockets shall be guarded in accordance with EN 953, if the safety distances according to EN ISO 13857 cannot be achieved.

Rotating shafts shall be marked so that it is visually evident when the shafts are in motion.

5.3.4 Particular ergonomic requirements

5.3.4.1 Ergonomic requirements during installation

Supporting structures provided to enable machinery parts to be assembled on site shall be designed and fabricated to ensure stability, and thereby minimise manual handling.

Machine parts, such as electric motors, should be located on top of structural supports and shelves rather than suspended. This removes the need for manually supporting the item whilst it is secured in position.

The positioning of electric junctions, fluid power and electrical connections and similar, can adversely affect a workers posture during installation. The location of such items should ideally be between 400 mm and 1 600 mm above the workers standing level.

5.3.4.2 Ergonomic requirements during maintenance

Dedicated lifting aids, or anchoring points to allow common lifting devices, shall be provided wherever the frequent lifting of heavy tooling or machine parts is required.

Eyebolts or similar aids shall be fitted to heavy machinery and tooling to enable lifting, then they shall be fitted with handles, hand-holds or grips with a slip-resistant (e. g., knurled) surface.

Work areas used for manual handling of such parts shall be designed to be free from obstructions so as to permit unencumbered movement of the worker. The work area should allow the handled load to be held close to the body without unnecessary reaching.

The ideal placement for handwheels, levers, valves etc. to minimise physical effort is between 700 mm and 1 600 mm above the workers standing level.

Where components require periodic maintenance, the steps and work platforms shall be provided with slip-resistant surfaces.

5.3.4.3 Ergonomic requirements during normal operation

Foot pedals can place an asymmetrical strain on the operator's back, and other controls are preferable. Where a seated operator shall use foot pedals and hand levers, the seats and the levers shall be individually adjustable to ensure good posture.

EN ISO 6682 can be used as a guidance for placement of foot and hand operated controls.

5.4 Noise reduction as a safety requirement

5.4.1 Noise reduction at source by design

When designing a machine, technical measures for reducing noise at source at the design stage shall be considered, see EN ISO 11688-1. Examples for general measures which should be considered are:

— reduce impact energy (e. g., by reducing the height of fall);

— reduce power of impact (e. g., by damped impact);

— reduce noise of gas flow (e. g., low-noise nozzles, sound absorbers);

— use internal damping (e. g., cast instead of steel plate structures, sandwich plate);

— dampening of structure-borne noise (e. g., by coating or sandwich plate);

— insulation of structure-borne noise (e. g., by installation of masses), vibration isolated mounting (e. g., by spring elements and dampers);

— acoustic short circuit (e. g., perforated plate/lattice boxes).

The criterion for assessing the efficacy of measures to reduce noise at source are the actual noise emission values from the machine in relation to other machines of the same family and not the nature of the measures themselves.

NOTE EN ISO 11688-2 gives useful information on noise generation mechanisms.

5.4.2 Noise reduction by protective measures

The secondary noise control can be achieved e. g., by the increase of noise dampening and insulation, physical separation for noise source and receiver, sound-insulated control rooms, separate rooms/cellars for hydraulic pumps and water distribution systems. Examples are reductions by using:

— total or partial enclosures;

— shields;

— silencers;

— increased distance between source and operator.

NOTE The efficacy of such protective measures can be estimated, e. g., by using EN ISO 11546 (all parts) (for enclosures), EN ISO 11691 and EN ISO 11820 (for silencers) and EN ISO 11821 (for shields).

5.4.3 Noise reduction by information

If noise reduction at source and/or by protective measures is not sufficient, further protection of the operator is necessary. For recommendations to the user see 7.4.2, list item e).

5.4.4 Noise sources and examples of noise reduction measures

Table 2 shows the main noise sources of cold flat rolling mills and exemplary design or protective measures. This table is not exhaustive, alternative technical measures for noise reduction with identical or greater efficacy can be used.

Table 2 — Main noise sources of cold flat rolling mills equipment and exemplary noise reduction measures

Noise source	Examples of noise reduction measures
1 Cold rolling mills for flat products, e. g., — Tandem mills — Multiroll rolling mills — Temper mills — Single stand mills	— Automate process to reduce exposure to noise (e. g., remote diagnostics, measuring, controls) — Permanent places of work as far away from major sources of noise as possible — Accommodate operating staff in central sound-insulated control rooms with video monitoring of the plant — Avoid large, smooth surfaces, or use sandwich plates or foam — Build low-noise main drives or enclose them
2 Hydraulics	— Use low-noise drives — Use low-noise control elements — Degassing of hydraulic oil — Install drives in sound-insulated rooms (cellar, sound-absorbing cabins)
3 — Pneumatics (e. g., blow-off system)	— Pressure reduction — Provide air outlets with sound absorbers — Use low-noise nozzles (multi-tube nozzles) — Enclose or mount compressors in sound-insulated rooms away from workplaces
4 Electrical equipment	— Insulating of frequency converters (e. g. separate rooms)
5 — Roller tables	— Provide low-noise drives (e. g., industrial gear box, chains) — End stopper with dampening material — Minimise distance between rollers — Increase diameter of rollers
6 Exhaust system	— Low-noise fans — Install drives in sound-insulated rooms
7 Scrap chopper and shears	— Low-noise choppers — Scrap box in cellar — Scrap-openings as small as possible — Design openings as sound absorbers
8 Spool handling systems	— Use of spool conveyors instead of spool ramps

6 Verification of the safety requirements and/or measures

It is necessary to verify that all requirements of this standard have been incorporated in the design and manufacturing of cold flat rolling mills.

The verification required is defined in Table 1. Verification of electrical safety shall be made according to EN 60204-1 and for the noise according to the noise test code given in Annex B.

Verification should take place after completion of commissioning.

If partial disassembly is necessary, e. g., to gain access, it shall not affect the function being verified. Safety devices put out of operation for verification shall be restored before verification is completed.

7 Information for use

7.1 General

The essential safety requirements for the instruction handbook are listed in Clause 6 of EN ISO 12100-2:2003.

7.2 Warning devices and safety signs

Warning devices and safety signs shall be in accordance with 5.1.8.

7.3 Minimum marking

The following information shall be attached clearly and durably to cold flat rolling mills (e. g., in the pulpit):

— name and address of manufacturer and where applicable the name and address of the authorized representative;

— designation of series or type, if any;

— mandatory marking[1)];

— serial number/machine number, if any;

— year in which the manufacturing process is completed.

In accordance with EN 60204-1, the auxiliary electrical equipment shall be fitted with durable plates containing data, including casing protection grade.

7.4 Accompanying documents

7.4.1 Instruction handbook

An instruction handbook for each machinery/equipment shall be provided by the manufacturer. In this manual, the characteristics and measures to the specific machine/equipment shall be designated. The following items describe exemplary the structure and content of an instruction handbook and shall be completed or extended in consideration of the specific equipment.

7.4.2 Machine/equipment declaration

If applicable, the following information shall be given:

a) manufacturer, type of machinery, year of manufacturing, serial number (if any);

b) technical documents (circuit diagrams, data sheets, information/reference for spare parts);

c) for intended use, details to interfaces of additional/optional machinery;

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1) For machines and their related products intended to be put on the market in EEA, CE marking as defined in the European applicable directive(s), e. g., Machinery, Low Voltage, Explosive Atmosphere, Gas appliances.

d) for non-intended use (e. g., forbidden use of specific auxiliary equipment, prohibition of specific materials);

e) information about noise emission determined according to Annex B of this standard, where necessary recommendation to, e. g.,

   1) implement enclosures, screens by the user,

   2) use of cabins for the personnel,

   3) wear hearing protection,

   4) visual sign posting of noisy areas;

   NOTE Noise information should also be provided at the sales literature.

f) description of auxiliary equipment and the installation of the control system of these (e. g., emergency stop, effect of the safety devices).

7.4.3 Detailed information/instructions

7.4.3.1 Safety layout

According to 5.1.3.

7.4.3.2 Instruction for transportation and assembly of the equipment

Transport, setting up/installation, especially:

— instructions for safe lifting (e. g., transport rig, ring bolt, centre of gravity);

— transportation weight;

— transport safety devices and removal of these before commissioning;

— instructions for correct connection of take-over-points;

— prohibition of unauthorised reconstruction and modification;

— plant layout/installation conditions (e. g., foundation plan, requirements of the building);

— reference to installation/assembly of the machinery or single parts of the machine particularly where machine position or adjacent elements of the building provide safeguards or risk reduction;

— details on the fume and dust emission and arrangements provided for connection to extraction system.

7.4.3.3 Information about commissioning and dismantling of the equipment

Detailed information shall be given concerning associated significant risks and necessary remedial measures. In particular, it shall include the following details:

— energy supplies (electric, hydraulic, pneumatic);

— filling amounts;

— specification of fluids;

— fitting of special devices;

— safe starting, operation and shut-down;

— inspection and proofing of safety devices before commissioning;

— unauthorised reconstruction and modification;

— residual risks in areas surrounded by guards and guard-rails;

— reference for de-commissioning (e. g., disposal of high pressure fluids, emptying instructions, handling of radioactive materials);

— reference to qualification of operation personnel;

— instruction for flooding in case of leakage;

— information concerning the need of PPE and use.

7.4.3.4 Operation instructions concerning the equipment

The following operation instructions concerning the equipment shall be given:

a) available safety devices;

b) instruction on safety devices;

c) regular inspection of safety devices;

d) characteristic hazards (e. g., current, hydraulic, especially references to setting up and re-commissioning after setting up);

e) processing materials which generate, fume or dust hazardous to human health including cleaning requirements;

f) description of safety related control systems;

g) references about the qualification level of operators;

h) instruction and training to be given to the operator how to operate the machine;

i) action in the event of faults or irregularities and abnormal operation;

j) references to residual hazards for example:

   1) vibration;

   2) radiation;

   3) hot surfaces in the working area;

   4) ejection of material;

   5) ejection of parts of the machine, e. g., parts of the rolls;

   6) roll spalling, for recommendations; see Annex F;

   7) ejection of fluids;

   8) areas surrounded by guards and guard-rails;

k) references to particular hazards in case of access on special occasions (e. g., maintenance, trouble-shooting) shall be pointed out in the instruction handbook and on the machine by markings/symbols referring to the nature of hazard (see EN 61310-1); if the protective devices are not operational during this action, the necessary actions shall be indicated;

l) references to hazards due to:

   1) non-relieved pressures;

   2) malfunction of programmable electronic systems;

   3) temperature;

   4) fire;

   5) noise.

7.5 Maintenance manual

The maintenance manual shall contain instructions for:

a) the testing to be carried out;

b) maintenance work;

c) criteria for repair work;

d) isolation, elimination or reduction to a non-hazardous level of energy sources;

e) protective measures against hazardous situations;

f) those maintenance activities that require special knowledge or qualification;

g) a periodical inspection programme of the safety devices and the frequency of these inspections that shall be defined at the design stage according to the reliability, nature and importance of the device;

h) preventive measures (e. g. replacement of wear parts, lubrication, etc.);

i) error messages of the control system and the actions resulting from this;

j) which parts of the system(s) shall be switched off during repair work;

k) instructions on existing residual energy (hydraulic reservoir, etc.) and its reduction, where necessary

l) electrical isolation and grounding required during maintenance and repair;

m) warning in case of hot surfaces;

n) references to residual hazards for example:

   1) radiation,

   2) hot surfaces in the working area,

   3) stored energy,

   4) ejection of material,

5) ejection of parts of the machine,

6) roll spalling, for recommendations see Annex F,

7) ejection of fluids,

8) access to hazardous areas after removal of guards and guard-rails.

The maintenance manual shall contain:

o) the safety layout;

p) lists of spare parts with reference to drawings or circuit diagrams;

q) fault lists indicating causes of trouble and measures to be taken.

For further examples of safety instructions given by the manufacturer for maintenance works see Annex D.

Annex A
(normative)

Safety requirements and/or measures for electrical equipment and control systems at cold rolling mills

A.1 General

General and specific requirements and additional measures for electrical equipment, safety related control systems and shut down equipment to be selected are described below. The special conditions for complex installations are to be taken into account by the manufacturer.

The manufacturer shall identify through an individual risk assessment (EN ISO 14121-1) which electrical hazards are significant for equipment as defined in clause 4 of EN 60204-1:2006 and the quoted effects of Table A.1.

All necessary measures shall be taken in order to preclude electrical hazards at the machines. The relevant clauses of EN 60204-1 shall be complied with.

The risk assessment shall determine the IP class according EN 60529 of any electrical equipment to be used according EN 60204-1:2006; 10.1.3; 11.3.

NOTE The IP-code classification only takes into account the ingress of water and not of other fluids.

Where access to a danger zone is required for any reason during normal operation the safety related control system of the equipment shall be in accordance with the appropriate performance level PL/category given in EN ISO 13849-1. The selection of the appropriate performance level PL/category shall be based on the individual risk assessment and in compliance with 6.2 and Table 10 of EN ISO 13849-1:2006. If the access is required for the operations described as examples in Annex A of EN 1037:1995, the measures defined in EN 1037 shall be employed (EN 60204-1:2006; 5.4; 5.5; 5.6).

A.2 Special requirements for controls

When designing the control system the cycle time of the programmable logic control (PLC) system shall be taken into account because it takes some time for the PLC to scan input, process data and set output. Depending on where the PLC “looks” at the time of the signal input the delay caused by the PLC will randomly vary from approximately 5 msec to 100 msec. Often such a variation can cause additional hazards. It is advisable to use an interrupt function to get constant quick response from the PLC for functions that can cause hazards, e. g., by hold-to-run control.

Controls of cold rolling mills frequently include safety functions; in which case they are classified under the general term "safety-related parts of controls" according to the categories given in EN ISO 13849-1. The following shall be applied to the design of such controls:

— safety-related controls shall at least be designed corresponding to performance level PL=c/category 1;

— where access to a danger zone is required during operation the protective devices and signal processing equipment shall correspond at least to performance level PL=d/category 3.

A.3 Special requirements for shut-down equipment

A.3.1 Stop functions/emergency stop functions

In conformity with the requirements of EN ISO 13850 and EN 60204-1:2006; 10.7; 10.8 as well as EN 1037, the stop and emergency stop functions in clause A.3.5 of this Annex shall be applied.

Furthermore, the following shall be applicable to stop and emergency-stop functions:

With interlinked plant forming a production line, it shall be ensured that both the upstream and downstream equipment is shut down. Where stored energies can be a source of danger, they shall be eliminated, isolated or reduced to a level, which does not cause a risk. Where required, power shall remain available for certain purposes:

— to preserve the effectiveness of safety devices or equipment with a safety-related function according to 4.1.2 of EN ISO 13850:2006;

— to preserve the integrity of facilities provided for rescuing stranded personnel from the danger zone according 4.1.1 of EN ISO 13850:2006;

— to carry out mechanical movements of machinery for releasing trapped personnel or rescuing injured persons.

Design of the control actuator for the shutdown functions shall be such as to ensure that:

— there can be no confusion (e. g., by colour and marking, EN 60204-1:2006; 10.2.1);

— inadvertent actuation is eliminated/avoided;

— the control actuators are at all times outstanding as well as readily and safely accessible according to 4.4.1 of EN ISO 13850:2006;

— reactivation shall only be possible by a reset order.

High accumulated energy exists within the production process because the movement of material, handling equipment, other machinery used and the tools themselves all involve the high speed movement of substantial masses. As a result, it can take a substantial amount of time for the movement of machinery and material to come to a halt. Consequently, material, tools etc. can have moved a considerable distance before motion is arrested.

Because of the wide range of different types of cold rolling mills, differences in drive power and control systems, a range of different control systems are needed to bring the plant to a standstill. As indicated above, there remains a risk even when drive power to the plant is switched off because of the high masses and speeds involved. For precautions see 5.1.5.2.

A.3.2 Selection of stop functions

An uncontrolled stop of the cold flat rolling mill may lead to severe mechanical damage to the plant, strip break and dangerous uncontrolled ejection of material and parts of machinery as well as fire. For this reason, it may be necessary for alternative means of shutdown to be provided, (e. g., quick-stop) in addition to an emergency stop. This alternative means provided may be in the form of one or more manual operations to shut down the separate items of a plant. The selection of stop functions shall be in accordance with Table A.1.

A.3.3 Emergency stop areas

When designing a plant, it shall be determined how the plant shall be subdivided into individual emergency stop areas. The decisions made will be dependent on what parts of the plant machinery can be operated

separately and what risks can arise from shutting down independent parts of the plant when other parts are left running.

According to 4.1.1 of EN ISO 13850:2006, any emergency stop system shall be designed in a manner clearly showing which Emergency-stop controls are assigned to what area.

The size of such plants and their complexity make special demands on protective measures during partial shutdown and restarting.

Therefore, time-delayed visible and audible warning devices according to EN ISO 7731 and/or EN 842 are to be provided for the re-start of large installations. Key-operated switches should be provided for the personal safety of maintenance staff for defined plant sections.

A.3.4 Stop functions

Table A.1 shows a compilation of different kind of applicable stop functions. On the basis of the assessment of electrical risk the manufacturer shall select the stop-categories according to EN 60204-1 regarding the given examples and the quoted effects in Table A.1.

Table A.1 — Stop functions

Function	**Stop-Category** according to EN 60204-1	**Setting**	**Location (examples)**	**Effect**
Emergency stop	Category 1	— Red mush-room push-button before yellow back-ground and with reclosing lockout (lock) — Main switch — Mechanical device against unintended use on control panels necessary	— Main control desk — Auxiliary control panel — Separated devices of category 1 emergency stops for different parts of the equipment might be necessary (e. g., for the hydraulic system)	— Shut-down of main drives by electric braking (current limit) and/or mechanical braking — Shut-down of auxiliary drives while maintaining operation with self-resetting control. Energy supply is maintained up to the standstill, then power-off — Mechanical damage possible — Potentially, rescue of persons by moving units into an open position might not be possible (see A.3.1) — Cobbling material possible — Ejection of pieces of the rolled material possible — Reactivation shall only be possible by a reset-order
Normal stop	Category 1		— Main control desk — Auxiliary control panel	— Stopping of the complete installation: — 1st step: production stop — 2nd step: interruption of energy supply

Table A.1 *(continued)*

Function	**Stop-Category** according to EN 60204-1	**Setting**	**Location (examples)**	**Effect**
Emergency off	Category 0	— Red mush-room push-button before yellow back-ground and with reclosing lockout (lock) — Main switch — Mechanical device against unintended use might be necessary	— Transformer room — Computer room — Rectifier room — Switch cabinet feeder panel — Not adjacent to oper-ational control desks with category 1 emergency stop (EN ISO 13850)	— Immediate Power-off — Uncontrolled shut-down — All accumulators which might cause self-starting are relieved — Shut-down of all drives — Application of mechanical brakes — Potentially, rescue of persons by moving units into an open position might not be possible — Cobbling material possible — Ejection of pieces of the rolled material possible — Reactivation shall only be possible by a reset-order
Quick stop	Category 2 This does not meet the re-quirements of an emergency stop or normal stop	— Push-button (colour according EN 60204-1: 2006; 10.2.1)	— where required	— Maximum possible negative acceleration during shut-down — All operating conditions are maintained — Energy supply remains on during standstill — Possibly automatic standstill monitoring
Production stop	Category 2 This does not meet the re-quirements of an emergency stop or normal stop	— Push-button (colour according EN 60204-1: 2006; 10.2.1)	— Main control desk and every auxiliary control panel — Usually combined with category 1 emergency stop (s. above)	— Stop function for normal operating conditions — All operating conditions are maintained — Energy supply remains on during standstill — Possibly automatic standstill monitoring

Annex B
(normative)

Noise test code

B.1 Introduction

Cold flat rolling mills are not standard machines and are tailored to customers' specifications.

The noise emission of a cold flat rolling mill depends on many parameters, in particular

— dimension and material of the product,

— number of mill stands,

— mode of operation,

— number, size and operating pressures of hydraulic and water pumps and

— cutting system.

These parameters cannot be standardised as they differ from one cold flat rolling mill to another.

In order that the test can be repeated, the precise operation procedures of the cold flat rolling mill have to be known. This is why this noise test code requires these procedures to be recorded, reported and declared in detail.

Cold flat rolling mills never operate at the manufacturers place. Noise emission measurement can only be carried out after commissioning is completed.

This noise test code specifies all the information necessary to carry out efficiently and under standardised conditions the determination, declaration and verification of noise emission characteristics for cold flat rolling mills.

The noise emission of a machine in general is described by two quantities: the A-weighted emission sound pressure level at work stations and the A-weighted sound power level that are used by the manufacturer to declare the noise emitted. However, due to the size and complexity of a cold flat rolling mill, the noise emission of a cold flat rolling mill is described by the A-weighted emission sound pressure level at work stations and specified measuring points. The determination of these quantities is necessary for:

— manufacturers to declare the noise emitted;

— purposes of noise control at the source at the design stage.

NOTE Emission sound pressure levels in frequency bands may also be determined.

B.2 Determination of A-weighted sound power level

There would be a need to determine the sound power level of a cold flat rolling mill because the A-weighted emission sound pressure level at some work stations is higher than 80 dB. However limited access for safety reasons in the vicinity of a cold flat rolling mill in operation make it impossible to determine the sound power

level. Instead and because cold flat rolling mills are very large machines, A-weighted emission sound pressure levels at specified measuring points shall be determined in accordance with B.3.1.

Furthermore, for large machines/plants such as cold rolling mills, it is permissible to determine and report the emission sound pressure level at specified measuring points instead of the sound power level.

B.3 Determination of A-weighted emission sound pressure levels

B.3.1 Determination of the emission sound pressure level at specified measuring points

The measuring points shall be specified along a path around the machine at a height of 1,6 m above the floor or access level and at a distance of 1 m from the machine surface. They shall be spaced so that the difference in A-weighted emission sound pressure levels between adjacent measuring points does not exceed 5 dB. The number of measuring points will depend on the characteristic of the noise emission. For even distribution of sound pressure levels a low number of measuring points may be required. There should, however, be at least one measuring point at each side of the main components of the cold flat rolling mill. The measurement positions shall be recorded and reported.

The A-weighted emission sound pressure levels shall be determined in accordance with EN ISO 11202 (grade3).

B.3.2 Determination of emission sound pressure level at work stations

The A-weighted emission sound pressure level shall be determined at all work stations (permanent or temporary).

The A-weighted emission sound pressure levels shall be determined in accordance with EN ISO 11202 (grade3).

The regular work stations (permanent or temporary), shall be determined by the manufacturer with consultation of the user of the equipment but in all cases shall include the

— pulpits

— local control stands

— sampling point

— product inspection station/place

— shear and

— and banding machine.

B.4 Measurement uncertainty

Total measurement uncertainty of A-weighted noise emission values is that given in EN ISO 11202.

B.5 Operating conditions

Measurements shall be made under defined representative operating conditions for the main part of the production with regard to the material to be processed, such as, e. g.,

— material and dimensions

— rolling speed

— operating pressures of fluid or pneumatic systems.

The installation and mounting conditions shall be those recommended by the manufacturer.

The operating conditions shall be recorded and reported.

B.6 Information to be recorded and reported

The information recorded when carrying out the test and the test report shall at least contain the following information:

a) manufacturer, kind of machine/plant, boundary and technical data and sizes;

b) operating conditions under which noise is measured (see B.5);

c) measurement results:

   1) A-weighted emission sound pressure level at each work station (accompanied by a drawing showing the position of each work station on the cold flat rolling mill),

   2) A-weighted emission sound pressure level at each specified measuring point (accompanied by a drawing showing these points on the cold flat rolling mill),

   3) possible deviations to this noise test code or to EN ISO 11202, with the justification for them;

d) precise position of work stations, specified measurement points and duration of measurement;

e) place and date of measurement, identifying information of the responsible person/body.

B.7 Declaration and verification of noise emission values

For cold flat rolling mills only estimated values can be given as noise emission values before commissioning. The noise emission shall then be measured under the specific operating conditions and declared after commissioning.

The following noise emission values shall be declared:

— A-weighted emission sound pressure level at each work station (accompanied by a drawing showing the position of each work station on the cold flat rolling mill);

— A-weighted emission sound pressure level at each specified measuring point (accompanied by a drawing showing these points on the cold flat rolling mill).

The noise declaration shall give detailed information on the operating conditions and parameters of the cold flat rolling mill during noise measurement and at least those indicated in B.5.

The declaration shall be made as dual-number noise emission values (measured value and associated uncertainty given separately). The noise declaration shall be made in such a way that the values can be verified according to 6.2 of EN ISO 4871:1996.

The noise declaration shall explicitly mention the fact that the noise emission values have been obtained according to the specifications of this noise test code and make reference to EN ISO 11202. If this statement does not apply, the noise declaration shall indicate clearly what the deviations are from these specifications and/or from the basic standard.

In case of verification of the declared noise emission values this shall be done using this noise test code and under the same operating conditions as those used for declaration.

Table B.1 shows an example of a dual-number noise declaration.

Table B.1 — Example of declared dual-number noise emission values for work stations and specified measuring points

Plant Name	
Job Number	
Machine Type	
Date of readings	
Dimension of the product	
Nominal rolling speed (m/min)	
Productivity (ton/h)	
...	
...	

DECLARED DUAL-NUMBER NOISE EMISSION VALUES

A-weighted emission sound pressure level at work stations A to ...			
Measurement at work stations		**Measured value** L_{pA} [dB] (re 20 µPa)	**Uncertainty** K_{pA} [dB]
A	description of the work station		
B	description of the work station		
C	description of the work station		
...			

A-weighted emission sound pressure level at measuring points around the cold flat rolling mill			
Specified measuring points		**Measured value** L_{pA} [dB] (re 20 µPa)	**Uncertainty** K_{pA} [dB]
1	specification/position of measuring point 1		
2	specification/position of measuring point 2		
...	...		
Values determined according to noise test code Annex B of EN 15094:2008 and measurement standard EN ISO 11202			

NOTE The sum of a measured noise emission value and its associated uncertainty represents an upper bound of the range of values which can occur in measurements.

Annex C
(normative)

Protection of persons in case of using asphyxiant gases in fire fighting systems

NOTE National regulations and the requirements of the insurance companies for protection of machinery should be considered and could differ from the requirements for protection of persons given in this Annex.

C.1 General

When designing a cold flat rolling mill, selecting and installing a fire fighting system using asphyxiant gases, the risk of asphyxiation shall be taken into account.

Areas which can be influenced by asphyxiant gases shall be indicated in the safety layout.

A critical concentration for asphyxiation occurs if the ratio of the used volume of the extinguishing gas to the volume of the working or operation area, where the object to be protected is located,

— exceeds the critical limit of the extinguishing gases concentration or

— remains under that of the oxygen concentration,

so that persons are endangered.

NOTE When using CO_2, this is the case, e. g., when the CO_2 concentration exceeds 5 vol.-% or the oxygen concentration is under 15 vol.-%.

C.2 Warning devices

For the warning of persons, fire fighting areas shall be equipped with acoustic and optic warning devices. Warning devices shall ensure the warning of persons entering or staying in the danger zone influenced by asphyxiant gases.

The sound of acoustic warning devices shall significantly differ from operational noise and exceed the environmental noise level according to 5.1.8. Optical warning devices shall give significant signals by interrupted light up.

The fire fighting alarm of fire fighting equipment which can endanger persons during its use shall not be cut off before it is ensured that flooded areas cannot be accessed by non-authorised persons. This can be achieved by warning lamps or signal devices at the accesses to endangered areas or by closing of the accesses. These measures shall be kept until the flooded areas are aired and can be accessed without danger.

At fire fighting equipment which can endanger persons during its use, acoustic fire fighting alarm shall be given by at least two independent warning devices with

— separate energy sources;

— separately installed cables and;

— separate alarm means.

Electric and pneumatic warning devices can be used.

There are two kinds of electric warning devices: protected or non-protected warning devices. Protected electric warning devices in combination with a pneumatic warning device shall be preferably used and shall be equipped with a protected electric supply and a protected feed line.

NOTE 1 Requirements for protected electric supply are given in 3.9 of DIN VDE 0833-1:2003. Protected feed lines can be achieved by constructing them as primary lines according to 3.4 of DIN VDE 0833-1.

Energy supply for non-protected electric warning devices shall only be effected by low-voltage energy supply (220 – 240 volt net). It shall only be possible to cut off the feed line at the main distribution panel with a separate marked safety circuit.

The energy reserve for an alarm shall be sufficient for at least 30 minutes.

Pneumatic warning devices shall be equipped with a monitored energy reserve.

For CO_2 low-pressure fire fighting equipment, separate energy sources are not necessary if two pneumatic warning devices are used which are supplied by the extinguisher reservoir. For high-pressure fire fighting equipment with pneumatic alarm only, two separate reservoirs shall be installed.

For fire fighting equipment with pneumatic or mechanic fire detection and actuation, acoustic fire fighting alarm can be given by two electric warning devices. At least one of these warning devices shall be designed as protected warning device.

For fire fighting equipment reaching critical concentrations (see C.1) the functions of the warning and restraint devices shall be ensured even in case of interfering effects.

NOTE 2 Interfering effects are, e. g., over-voltage or electromagnetic influences leading to destruction or malfunction of electric/electronic devices in warning or triggering equipment and consequently to an unintended release of extinguishers.

C.3 Restraint devices

Fire fighting equipment causing risks to persons by flooding shall be equipped with restraint devices.

Restraint devices shall ensure that flooding is impossible unless the warning devices are actuated and a preliminary warning time has expired.

C.4 Preliminary warning time

For room protecting equipment a preliminary warning time shall be actuated at each automatic or manual actuation of the fire fighting equipment.

The preliminary warning time shall be as long that dangerous areas can be left from each point without haste. It shall be at least 10 s.

The release of the fire fighting system does not require a preliminary warning time, if the critical concentration as defined in C.1 will not be reached, e. g., for a shot to the roll bite.

For plant protecting equipment, or small fire fighting equipment, e. g., according to ISO 6183, a preliminary warning time shall be actuated, if the ratio of the used volume of extinguishing gas to the volume of the working or operation area where the object to be protected is located, exceeds the critical concentration.

This is also valid if several equipment of such kind is installed in one room and their actuating systems react together at the same event or are actuated by flooding.

This can be avoided by, e. g., locking the actuating system of equipment in the vicinity after first actuation. If during a second or consecutive actuation the critical limit of extinguishing gases which endangers persons is exceeded or the oxygen concentration remains under the limit, restraint or warning devices shall be actuated.

C.5 Interrupt device for extinguishing gas

In special cases it could be useful to install interrupt devices (push buttons) if it ensures the saving of persons before flooding is started. The position of the interrupt devices shall be placed in a safe area and shall be shown in the safety layout.

The actuation of the interrupt device shall be indicated at a permanent staffed place from which help can be organised. The indication shall stay until it is released.

After the release of the actuated interrupt device the flooding shall not start before the preliminary warning time has expired. If the interrupt device is actuated for a period longer than the preliminary warning time, the flooding starts directly after the release of the interrupt device.

A flooding once started cannot be stopped by repeated actuation of the interrupt device.

Malfunctions in the supply of interrupt devices shall not start the fire extinguishing process. Such malfunctions shall be indicated in acoustic and optic manner.

Warning devices shall rest in function during actuation of the interrupt device.

C.6 Blocking devices

It shall be possible to block the actuation of fire extinguishing equipment during maintenance. Blocking shall be done mechanically in such a way, that the release of fire extinguishing means is prevented.

The actuation of the blocking devices shall be clearly indicated, e. g., optically.

C.7 Pipes

Pipes shall be electrical earthed.

C.8 Rooms and adjacent areas

Rooms to be protected by fire extinguishing equipment shall be designed to avoid the unintended escape of fire extinguishing agents to such an extent which endangers persons in adjacent rooms or areas.

Generally, the tightness of such rooms shall be checked, especially after reconstruction, new installations or change of installations.

If it is not possible to safeguard that escaping fire extinguishing agents also reach adjacent rooms or areas, these rooms or areas have to be integrated into the alarm system.

C.9 Escape routes

Rooms with the risk of fire shall have escape routes which shall be indicated in the safety layout.

C.10 Doors

Doors shall be self-locking, to be opened in the direction of escape and the opening from inside shall always be easily possible and without the use of auxiliary devices.

If due to operational reasons self-locking doors are kept open, these have to be equipped with locking devices which ensure automatic closing if the fire extinguishing equipment is actuated.

C.11 Marking

At all accesses to dangerous areas a warning sign in accordance with EN 61310-1 and an additional sign with the following inscription shall be fixed:

— "Gas fire fighting equipment. In the case of fire alarm or release of extinguishing gas[2)] leave the room immediately".

C.12 Instruction handbook

The manufacturer shall include an instruction handbook for fire extinguishing equipment with all information for safe operation. In particular the instruction handbook shall include:

— commissioning,

— behaviour in case of actuation,

— maintenance and testing,

— behaviour in case of trouble,

— behaviour during decommissioning.

2) Specification of the extinguishing gas used

Annex D
(informative)

Example for manufacturer's safety instructions for maintenance at cold flat rolling mills

D.1 Precautions to reduce hazards caused by

D.1.1 Lack of instructions

Examples:

— "The instructions in this technical documentation of the machinery and/or plant, in particular the “safety section", shall be observed and put into practice by the user";

— "Internal company instructions are to be prepared taking into account the qualifications, experience, knowledge and abilities of the personnel entrusted with the work";

— "In addition to the instructions in this technical documentation, generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection are to be observed and instructed";

— "Maintenance work on/with the machine/plant may only be performed by personnel that have received adequate training and have proved competent";

— "Only maintenance personnel with special qualifications in this field shall be allowed to work on electrical, hydraulic, pneumatic and supply-related equipment".

D.1.2 Visual or audible checks at machinery in motion

Examples:

— "Visual or audible checks in automatic mode are only permissible for maintenance personnel for the areas and/or activities hereafter: ...";

— "This work shall only be carried out by personnel with written approval by the responsible user";

— "It may be necessary that an additional person should be assigned to supervise work progress and to assist these dangerous activities".

D.1.3 Unintentional movements during maintenance

Examples:

a) "The following measures may help to avoid hazardous situations caused by movements

   1) firstly, stopping the dangerous movement by control devices provided for that purpose until the movement has come to a standstill,

   2) secondly, interruption of power supply for actuator and control elements of the area for maintenance";

b) "Preventing unauthorised, erroneous and unexpected start-up through:

1) locking the main control equipment,

2) removing the key from the main control desk,

3) separating plug-in connections,

4) securing parts that may change their position, e. g., by means of a brake, backstop, safety bolts, supports, scotches or check valve";

c) "Preventing the start of hazardous motions as a result of stored energy through depressurising, shutting off, relaxing and lowering (e. g., of flywheel masses)".

D.1.4 Work during standstill with safeguards disabled

Examples: “Permit-to-work” system

— "A permit-to-work system shall be adopted for maintenance activities during plant shutdown. A written permit shall be issued by the plant manager to the person responsible for leading the maintenance activity, who shall examine the permit for important information and instructions and countersign the permit, thereby indicating that the contents have been read and understood";

— "Repair work requiring removal or deactivation of safeguards shall only be performed on the above conditions";

— "All safeguards that have been removed shall be replaced after completion of the work. Work completion and safeguard replacement shall be verified, and confirmed by signature of the permit-to-work, before the plant is accepted back and start-up commenced".

D.1.5 Work with hazardous substances

The operating instructions should list any hazardous substances used, the risk they pose and the precautions/ preventions to be taken. Maintenance staff have to be informed about this.

Examples:

— "The identity of the substances shall be checked before being used";

— "With regard to the substances being used neutralising agents, absorbents etc. shall be provided ready for use";

— "All personnel protective equipment required shall be kept ready and be used";

— "Instruction of action required in case of a leakage shall be provided at the machine, at the pulpit and to the emergency staff of the plant".

D.1.6 Plant re-start

Examples:

— "All safeguards and safety devices removed for maintenance shall be put back into place (see also D.1.4)";

— "The working and traffic areas shall be cleared and restored to a clean state";

— "All securing parts (e. g., safety bolts) shall be recovered in the plant-in-working-position";

— "Re-start shall only be possible by a reset-order from the authorized personnel".

Annex E
(informative)

Machines and/or equipment covered by this standard

E.1 Machines and/or equipment covered by this standard but are not limited to

E.1.1 Plants

— Cold strip mills;

— Tandem mill (2, 3, 4, 5 or 6 stands);

— Reversing mill (1 or 2 stands);

— DCR (double cold reduction) mill (2 stands);

— Skin-pass mill (1 or 2 stands);

— Single stands;

— Foil mills.

E.1.2 Equipment

— Rolling mill stands incl. drive;

— Tension and payoff reels;

— Roll changing equipment (e. g., roll changing car);

— Coil/spool/material handling equipment;

— Coil preparation (e. g., cutting devices, levelling/straightening rolls);

— Coil inspection (e. g., cutting devices, inspection reel);

— Entry equipment (e. g., strip side guides levelling unit and bridle roll unit);

— Exit equipment (e. g., belt wrapper, shears, pinch roll unit);

— Fluid systems.

Annex F
(informative)

Roll spalling

F.1 Hazard

Rolls, e. g., work rolls, bearing rolls can occasionally "spall" (violently ejected metal chips). Spalling can endanger employees and cause substantial damage to plant and equipment.

F.2 Causes

Flaws in the roll can be caused by:

— Incorrect operation – which can lead to local thermal overload, and subsequent spalling. Examples include strip breaks, laps and laminations, incorrect setting (e. g., excessive roll force), stopping the roll under screw-down pressure;

— Incorrect grinding – grinding errors can cause localised overheating of a roll, cracks and subsequent spalling;

— Corrosion – the cooling water in rolls with internal cooling can cause corrosion scars. Under compressive loading during rolling, these can result in fatigue fractures and subsequent spalling.

F.3 Safety measures

F.3.1 Recognition

Personnel should be adequately trained to recognise the circumstances that can give the potential for spalling.

F.3.2 Handling

F.3.2.1 Scrap removal

After a strip break, entangled scrap may need to be removed to enable the rolls to be removed from the stand. Special personal protective equipment can be used in order to protect the body and vital organs.

F.3.2.2 Isolation of suspect rolls

Personnel should be maintained at a safe distance from the rolls during removal and transportation (e. g., carried out by crane).

As soon as possible, the suspect roll should be covered (e. g., by a safety box or "blanketing material") so as to ensure capture of ejected metal chips in the event of spalling.

The roll should be isolated in a safe place and left in a safe condition at least until the roll has cooled to ambient temperature.

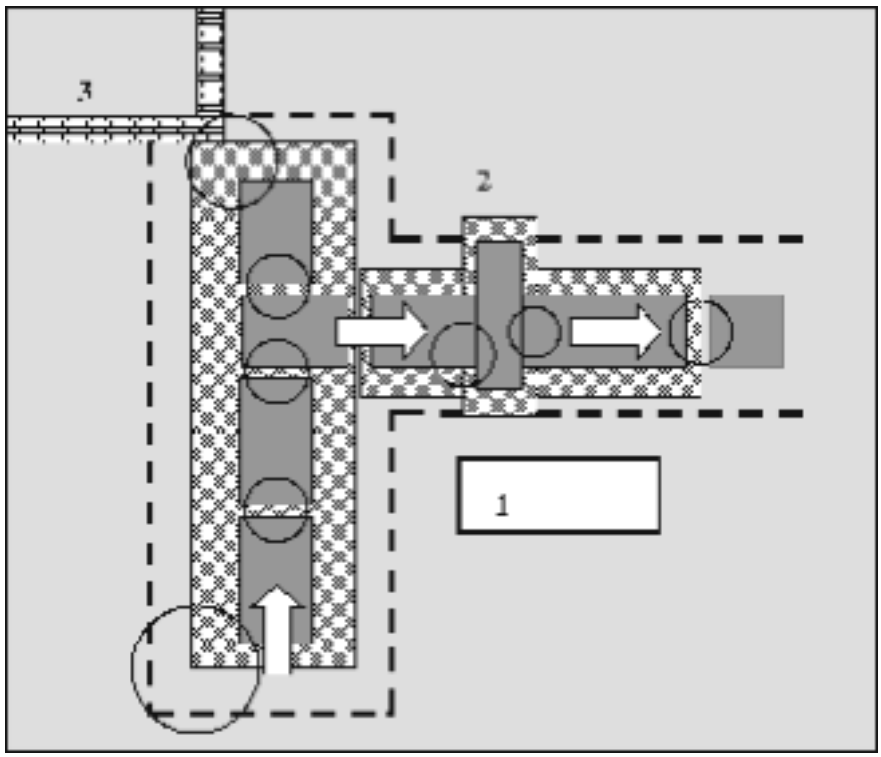
F.3.3 Records

It is recommended that a log is kept of the history of each roll in the mill so that common causes of roll spalling incidents can be determined.

Annex G
(informative)

Example for the risk analysis due to interfaces

According to the scope of this standard, hazards existing at the interfaces between single machines of a plant and/or adjoining parts of the building or other machines or plants near the border to the plant are not covered.



Key

1 main pulpit
2 driveside
3 building

machinery/equipment
function area
guard
interface
material flow

Figure G.1 — Diagram of a hypothetical plant indicating potentially hazardous interfaces

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 98/37/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive Machinery 98/37/EC, amended by 98/79/EC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Annex ZB
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING: Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 619, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of unit loads*

[2] EN 746-1, *Industrial thermoprocessing equipment — Part 1: Common safety requirements for industrial thermoprocessing equipment*

[3] EN 746-2, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems*

[4] EN 746-3, *Industrial thermoprocessing equipment — Part 3: Safety requirements for the generation and use of atmosphere gases*

[5] EN 1248, *Foundry machinery — Safety requirements for abrasive blasting equipment*

[6] EN 15061, *Safety of Machinery — Safety requirements for strip processing line machinery and equipment*

[7] EN ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls (ISO 6682:1986 including Amendment 1:1989)*

[8] EN ISO 11546 ,(all parts), *Acoustics — Determination of sound insulation performances of enclosures*

[9] EN ISO 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)*

[10] EN ISO 11691, *Acoustics — Measurement of insertion loss of ducted silencers without flow — Laboratory survey method (ISO 11691:1995)*

[11] EN ISO 11820, *Acoustics — Measurements on silencers in situ (ISO 11820:1996)*

[12] EN ISO 11821, *Acoustics — Measurement of the in situ sound attenuation of a removable screen (ISO 11821:1997)*

[13] DIN VDE 0833-1:2003, *Alarm systems for fire, intrusion and hold-up — Part 1: General requirements*

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