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Machine tools - Milling machines - Part 1: Safety

Werkzeugmaschinen - Fräsmaschinen - Teil 1: Sicherheit

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Machine tools safety — Machining centres, Milling machines, Transfer machines —

Part 1: Safety requirements

*Machines-outils — Sécurité — Centres d'usinage, machines à fraiser, machines transfert —
Partie 1: Exigences de sécurité*

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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.



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Foreword

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

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16090-1 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 10, and by Technical Committee CEN/TC 143, *Machine tools safety* in collaboration.

- This first edition cancels and replaces:
- EN 12417:2001+A2:2009, Machine tools — Safety — Machining centres
- EN 12417:2001+A2:2009/AC:2010
- EN 13128:2001+A2:2009, Safety of machine tools — Milling machines (including boring machines)
- EN 13128:2001+A2:2009/AC:2010
- EN 14070:2003+A1:2009, Safety of machine tools — Transfer and special-purpose machines
- EN 14070:2003+A1:2009/AC:2010

ISO 16090 consists of the following parts, under the general title *Machine tools safety — Machining centres, Milling machines, Transfer machines*

- *Part 1: Safety requirements*
- *Part 2: Example applications for optional special mode [Technical Report]*
- *Part [n+1]*

This document is a draft international standard.

Introduction

This international standard is a type C standard as stated in ISO 12100:2010.

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.

Milling machines present a wide range of hazards, not least from their wide application as rotating tool, 'stationary' workpiece machine tool, for general purpose cutting of cold metal and other non-combustible, cold material, excluding wood and stone.

Protection of operators and other persons from contact with moving cutting tools, especially when being rapidly rotated in the spindle, or being swung from a tool magazine to the spindle during power-operated tool changing, or from contact with fast-moving workpieces, is of great importance.

When power-operated mechanisms are provided for workpiece transfer, they can also create hazardous situations during loading/unloading and workpiece alignment, clamping or releasing of the workpiece.

Total enclosure of the working zone using guards during cutting is practicable for smaller machines. The requirements for access to the working zone of large machines used for the processing of a wide range of workpiece configurations can require that operators are safeguarded by other means (e.g. perimeter fencing, protective devices around the hazardous area).

Movable control stations (cable connected or wireless) enable operators to move around the machine, especially large machines, and to view the working zone, the load/aligning, clamping, cutting, or unloading operations, carry the movable control station with them, as they move.

The significant hazards covered by this standard are those listed in clause 4. The safety requirements and/or protective measures to prevent or minimize those hazards identified in table 3 and procedures for verification of these requirements or measures are found in clause 5.

The figures in annex D are examples only and are not intended to illustrate the only interpretation of the text.

Machine tools safety — Machining centres, Milling machines, Transfer machines — Part 1: Safety requirements

1 Scope

This standard specifies the technical safety requirements and protective measures to be adopted by persons undertaking the design, construction and supply (including installation and dismantling, with arrangements for transport and maintenance) of stationary machines for working of cold metal and other non-combustible, cold, material, excluding wood and stone, with geometrically-defined cutting edge tools (milling).

This standard includes the following machines, capable of performing milling and boring operations but is not limited to these:

- a) Manually controlled boring and milling machines without numerical control (see 3.2.1, Group 1), e.g.
 - knee and column type milling machines (see figure C.1)
 - boring and milling machines (see figure C.2)
- b) Manually controlled boring and milling machines with limited numerical controlled capability (see 3.2.2, Group 2), e.g.
 - plano-milling machines (see figures C.3 and C.4)
 - profile and contouring milling machines
- c) Numerical controlled milling machines, milling- and machining centres (see 3.2.3, Group 3), e.g.
 - automatic milling machines and milling centres, e.g. multi-spindle milling machines, gear-milling machines (see figures C.5, C.6 and C.7)
 - machining centres
- d) Transfer and special purpose machines (see 3.2.4, Group 4), which are designed to process only a pre-specified metal or analogous material workpiece, or limited family of similar workpieces by means of a predetermined sequence of machining operations and process parameters (see figures C.8, C.9, C.10, C.11, C.12 and C.13).

This international standard takes account of intended use, including reasonably foreseeable misuse, maintenance, cleaning, and setting operations. It specifies access conditions to operators positions and manual load/unload stations. It presumes accessibility to the machine from all directions. It describes means to reduce risks to operators and other exposed persons.

This international standard also applies to workpiece transfer devices including transport devices for loading/unloading when they form an integral part of the machine.

This international standard deals with significant hazards relevant to milling machines when they are used as intended and under the conditions foreseen by the manufacturer (see 4).

Risk analysis of hazards arising from other metal working processes (e.g. grinding, turning, friction welding, forming, electro discharge, laser processing) are covered by other standards (see Bibliography). However if additional turning and grinding operation are provided hazard arising from additional clamping condition and ejection of parts shall be considered.

This international standard applies to machines which are manufactured after its date of publication.

prEN ISO 16090-1:2014 (E)**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.

ISO 230-5:2000, *Test code for machine tools — Part 5: Determination of the noise emission*

ISO 1182:2010, *Reaction to fire tests for products — Non-combustibility test*

ISO 1940-1:2003, *Mechanical vibration — Balance quality requirements for rotors in a constant (rigid) state — Part 1: Specification and verification of balance tolerances*

ISO 1760:2010, *Reaction to fire tests for products — Determination of the gross heat of combustion (calorific value)*

ISO 2592:2000, *Determination of flash and fire points — Cleveland open cup method*

ISO 3448:1992, *Industrial liquid lubricants — ISO viscosity classification*

ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3746:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

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

ISO 6385:2004, *Ergonomic principles in the design of work systems*

ISO 8525:2008, *Airborne noise emitted by machine tools — Operating conditions for metal-cutting machines*

ISO 9241(all parts), *Ergonomics of human-system interaction*

ISO 9355-1:1999, *Ergonomic requirements for the design of displays and control actuators — Part 1: Human interactions with displays and control actuators*

ISO 9355-2:1999, *Ergonomic requirements for the design of displays and control actuators — Part 2: Displays*

ISO 9355-3:2006, *Ergonomic requirements for the design of displays and control actuators — Part 3: Control actuators*

ISO 11161:2007/Amd1:2010, *Safety of machinery — Integrated manufacturing systems — Basic requirements*

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

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ISO 11204:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections*

ISO 11228-1:2003, *Ergonomics — Manual handling — Part 1: Lifting and carrying*

ISO/TR 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

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

ISO 11925-2:2010, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame -- Part 2: Single-flame source test*

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

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

ISO 13849-2:2003, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

ISO 13850:2006,¹⁾ *Safety of machinery — Emergency stop — Principles for design*

ISO 13851:2002, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 13855:2010, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body*

ISO 13856-1:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*

ISO 13856-2:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for the design and testing of pressure-sensitive edges and pressure-sensitive bars*

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14118:2000, *Safety of machinery — Prevention of unexpected start-up*

ISO 14119:1998/Amd1:2007,²⁾ *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14120:2002, *Safety of machinery — Guards -- General requirements for the design and construction of fixed and movable guards*

ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels*

ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

1) May be replaced by a new version (ISO/CD 13858:2013-03)

2) May be replaced by a new version (ISO/FDIS 14119:2013-04)

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ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

ISO 14122-4:2004, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*

ISO 14159:2002, *Safety of machinery — Hygiene requirements for the design of machinery*

ISO 14738:2002/Cor 2:2005, *Safety of machinery — Anthropometric requirements for the design of workstations at machinery*

ISO 15534-1:2000, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*

ISO 15534-2:2000, *Ergonomic design for the safety of machinery — Part 1: Principles for determining the dimensions required for openings for whole-body access into machinery*

ISO 15641:2001, *Milling cutters for high speed machining — Safety requirements*

ISO/CD 16089:2013,³⁾ *Machine-tools safety — Safety — Stationary grinding machines*

ISO 16156:2004, *Machine-tools safety — Safety requirements for the design and construction of work holding chucks*

ISO 23125:2010/Amd 1:2012, *Machine-tools safety — Safety — Turning machines*

ISO 19353:2005, *Safety of machinery — Fire prevention and protection*

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

IEC 60529-Ed.2.1+CR2:2007, *Degrees of protection provided by enclosures (IP code); Corrigendum 2*

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

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments*

IEC 61000-6-3:2006, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4:2006, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments*

IEC 61496-1:2012, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

IEC 61496-2:2013, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

IEC 61800-5-2:2007, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional*

IEC 62061:2005+CR2:2008, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

3) May be replaced by the finished version.

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IEC/TR 62061-1:2010, *Guidance on the application of ISO 13849-1 and IEC 62061 in the design of safety-related control systems for machinery*

EN 1005-1+A1:2008, *Safety of machinery — Human physical performance — Part 1: Terms and definitions*

EN 1005-2+A1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1005-3+A1:2008, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

EN 1005-4+A1:2008, *Safety of machinery — Human physical performance — Part 4: Evaluation of working postures and movements in relation to machinery*

NOTE In this clause is defined whether a dated or an undated reference is made. Even if in the rest of this document the publication date is not repeated, the reference in this clause is obligatory.

3 Terms and definitions

For the purposes of this document, the definitions given in ISO 12100:2010, ISO 13849-1:2006 and the following apply.

3.1 General terms

3.1.1

milling machine

machine designed to shape cold metal and other non-combustible, cold metal, excluding wood and stone, by means of a rotating cutting tool

3.1.2

boring machine

machine designed to perform boring operations (see 3.1.4). Such machines are typically capable of milling operations

NOTE This definition does not include machines exclusively for drilling.

3.1.3

stationary machine

machine which is assembled, installed and intended to be used permanently at a predefined location

3.1.4

boring operation

the process of finishing to size pre-formed holes in cold metal and other non-combustible, cold material, excluding wood and stone, by the means of a rotating single-point tool using powered axial feed

3.1.5

numerical control ⁴⁾

NC

computer numerical control

CNC

automatic control of a process performed by a device that makes use of numeric data entered while the operation is in progress

NOTE Adapted from ISO 2806:1994, definition 2.1.1.

4) Numerical control and "NC" is the preferred term.