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Machine tools — Safety — Stationary grinding machines

Machines-outils — Sécurité — Machines à meuler fixes

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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.

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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.

ISO 16089 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 10, *Safety*.

((For EN ISO 16089 only))

Significant changes against EN 13218+A1/AC:2010-04 are as follows:

- a) Introduction of a subdivision of grinding machines into three groups, based on the degree of automation. Specific safety measures for safe design for each group of grinding machines
- b) Introduction of the operation mode called service mode with a separate selection device and specific safety measures.
- c) Instead of the categories of EN 954-1, the required performance level according to ISO 13849-1 is defined for relevant safety functions.
- d) The decrease in the impact resistance of unprotected polycarbonate depending on the duration of use, is shown in the form of an aging curve in Annex A.
- e) Measures for the use of flammable metalworking fluids are given in new Annex I.
- f) Examples for the integration of extraction and fire extinguishing systems when using flammable metalworking fluids are given in new Annex J.
- g) Example for rotational speed limit monitoring of the wheel spindle given in new Annex K.

Machine tools — Safety — Stationary grinding machines

1 Scope

This International Standard specifies the requirements and/or measures to eliminate the hazards or reduce the risks in the following groups of stationary grinding machines which are designed primarily to shape metal by grinding:

Group 1: Manually controlled grinding machines without power operated axes and without numerical control.

Group 2: Manually controlled grinding machines with power operated axes and limited numerically controlled capability, if applicable.

Group 3: Numerically controlled grinding machines.

NOTE 1 For detailed information on the groups of grinding machines, see the definitions in 3.1 and 3.4.

NOTE 2 Requirements in this International Standard are, in general, applicable to all groups of grinding machines. If requirements are applicable to some special group(s) of grinding machines only, then the special group(s) of grinding machine(s) is/are specified.

This International Standard covers the significant hazards listed in Clause 4 and applies to ancillary devices (e.g. for workpieces, tools and workpiece clamping devices, handling devices), which are integral to the machine.

This International Standard also applies to machines which are integrated into an automatic production line or grinding cell inasmuch as the hazards and risks arising are comparable to those of machines working separately.

This International Standard also includes in Clause 7 a minimum list of safety-relevant information which the manufacturer has to provide to the user. See also ISO 12100:2010, Figure 2, which illustrates the interaction of manufacturer's and user's responsibility for the operational safety.

The user's responsibility to identify specific hazards (e.g. fire and explosion) and reduce the associated risks can be critical (e.g. whether the central extraction system is working correctly).

Where additional metalworking processes (e.g. milling, turning, laser processing) are involved, this International Standard can be taken as a basis for safety requirements. For specific information on hazards arising from other metalworking processes, which are covered by other International Standards, see the Bibliography.

This International Standard applies to machines that are manufactured after the date of issue of this International Standard.

This International Standard does not apply to stationary honing, polishing and belt grinding machines and not to transportable motor-operated electric tools in accordance with IEC 61029-2-2 and IEC 61029-2-10.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 230-5:2006, *Test code for machine tools - Part 5: Determination of the noise emission*

ISO 447, *Machine tools — Direction of operation of controls*

ISO 1052, *Steels for general engineering purposes*

ISO 1083, *Spheroidal graphite cast irons — Classification*

ISO 2553, *Welded, brazed and soldered joints; symbolic representation on drawings*

ISO 3522, *Aluminium and aluminium alloys — Castings — Chemical composition and mechanical properties*

ISO 3574, *Cold-reduced carbon steel sheet of commercial and drawing qualities*

ISO 3744, *Acoustics — Determination of sound power level of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane*

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

ISO 3834-1, *Quality requirements for fusion welding of metallic materials — Part 1: Criteria for the selection of the appropriate level of quality requirements*

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, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 4997, *Cold-reduced carbon steel sheet of structural quality*

ISO 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

ISO 6316, *Hot-rolled steel strip of structural quality*

ISO 6361-2, *Wrought aluminium and aluminium alloys — Sheets, strips and plates — Part 2: Mechanical properties*

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

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

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

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

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

ISO 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

ISO 9606-2, *Qualification test of welders — Fusion welding - Part 2: Aluminium and aluminium alloys*

ISO 10218-1:2006, *Robots for industrial environments — Safety requirements — Part 1: Robots*

ISO 11161, *Safety of machinery — Integrated manufacturing systems — Basic requirements*

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

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

ISO 12100:2010, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

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

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

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

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

ISO 13855, *Safety of machinery — Positioning of protective equipment with respect to the approach speeds of parts of the human body*

ISO 13856-2, *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, *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, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels*

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

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

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

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

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

ISO 15607, *Specification and qualification of welding procedures for metallic materials — General rules*

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

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

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

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

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

IEC 62061, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 614-2, *Safety of machinery — Ergonomic design principles — Part 2: Interactions between the design of machinery and work tasks*

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

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

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

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

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

CR 1030-1, *Hand-arm vibration - Guidelines for vibration hazards reduction — Part 1: Engineering methods by design of machinery*

3 Terms and definitions

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

3.1 General terms

3.1.1

grinding machine

machine tool in which the principal movement is the rotation of the abrasive product against the workpiece

NOTE 1 to entry: The machine can combine different types of grinding methods, e. g. external cylindrical grinding and internal cylindrical grinding.

3.1.1.1

stationary grinding machine

grinding machine (3.1.1) fixed in position during operation

For types and groups of stationary grinding machines see 3.4.

NOTE 1 to entry In the following text of this International Standard, the term "grinding machines" will stand for "stationary grinding machines"

3.1.2

manual control

control where each movement of the machine is individually initiated and controlled by the operator

3.1.3

manually controlled grinding machine

grinding machine (3.1.1) for which all process steps for the machining are controlled or started by an operator without support by an NC-machining program

3.1.4

numerical control

NC

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

[SOURCE: ISO 2806:1994, 2.1.1]

3.1.5

computerized numerical control

CNC

realization of **NC** (3.1.4) using a computer to control the machine functions

[SOURCE: ISO 2806:1994, 2.1.2]

3.1.6

numerically controlled grinding machine

NC grinding machine

grinding machine that operates under **numerical control** (3.1.4) or **computerized numerical control** (3.1.4)

3.1.7

power operated axis

axis which is operated by a force other than muscular or gravity force.

3.1.8

abrasive product, grinding tool

rotary cutting tool of varied shapes with geometrically unspecified cutting edges made from abrasive grains and bond. There is a distinction between bonded abrasive products and superabrasive products, see EN 12413 and EN 13236

3.1.9

dressing tool

fixed or rotary tool for the generation or reproduction of the grinding capacity (sharpening) and/or the geometry (truing) of abrasive products

3.1.10

work zone

space where cutting is to take place

3.1.11

access to the hazard zone

entering or reaching the hazard zone either with individual parts of the body or with the whole body (whole body access)