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Machine tools — Safety — Turning machines

AMENDMENT 1

Machines-outils — Sécurité — Machines de tournage
AMENDEMENT 1

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Foreword

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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.

Amendment 1 to ISO 23125:2010 was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 10, *Safety*.

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Machine tools — Safety — Turning machines

AMENDMENT 1

Page v, Foreword

Replace the reference to ISO 12100-1 with ISO 12100.

Page vi, Introduction

Replace the reference to ISO 12100-1 with ISO 12100.

Replace the reference to ISO 12100-1 and ISO 12100-2 with ISO 12100.

Replace the fifth paragraph, beginning: "This International Standard replaces" with the following (which includes deletion of the footnote):

This International Standard makes reference to the "safety categories" in EN 954-1:1996 as resistance to faults and their subsequent behaviour in the fault condition together with the "performance level" defined in ISO 13849-1:2006 in terms of probability of dangerous failure per hour. It is the decision of the user of this International Standard to apply "safety categories" or "performance levels".

Page 1, Scope

Replace the reference to ISO 12100-1:2003, Figure 1, with ISO 12100:2010, Figure 2.

Pages 2 to 4, Normative references

Replace the references to ISO 3744, ISO 3746, ISO 4413, ISO 4414, ISO 10218-2, ISO 11202, ISO 11204, ISO 12100-1, ISO 12100-2, ISO 13855, ISO 14119, IEC 61000-6-4, EN 1005-1:2001+A1:2008, EN 1005-2:2003+A1:2008 and EN 1005-3:2002+A1:2008 with the following:

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 10218-2:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration*

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*

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

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

ISO 14119:—¹⁾, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

IEC 61000-6-4:2011, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments*

EN 1005-1:2009, *Safety of machinery — Human physical performance — Part 1: Terms and definitions*

EN 1005-2:2009, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1005-3:2009, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

Add the following references:

ISO 11161:2007+Amd.1:2010, *Safety of machinery — Integrated manufacturing systems — Basic requirements*

EN 954-1:1996, *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design*

Pages 2 to 4, *Normative references*

Delete footnotes 2 to 9.

Add the following footnote to correspond with ISO 14119:—¹⁾:

¹⁾ To be published. (Revision of ISO 14119:1998)

Delete the references to ISO 14121-1:2007, IEC 62061:2005, EN 982:1996 and EN 983:1996+A1:2008.

Page 5, Terms and definitions

Replace the introductory paragraph with the following:

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 13849-1:2006 and EN 954-1:1996 and the following apply.

Page 6, Terms and definitions

Add the following new term after 3.1.9:

3.1.10**category**

classification of safety-related parts of a control system in respect of its resistance to fault and its subsequent behaviour in the fault condition, and which is achieved by the structural arrangement of the parts and/or their reliability

[EN 954-1:1996, definition 3.2.]

Page 7, 3.3.1

Delete the Note.

Page 15, Clause 4

In the first paragraph, replace the reference to ISO 14121-1 with ISO 12100. Replace "ISO 14121-1:2007, Clause 6" with "ISO 12100:2010, 5.4".

In the first paragraph, replace "ISO 12100-1:2003, Clause 5" with "ISO 12100:2010, Clause 5"; in list item a), replace "(see ISO 12100-1:2003, 3.22 and 3.23)" with "(see ISO 12100:2010, 3.23 and 3.24)".

Pages 17 to 20, Table 3

Replace the table, thus modifying the following items, in particular:

- a) in the fourth and fifth column headings, replace "ISO 12100 ISO 12100-1:2003 ISO 12100-2:2003" with "ISO 12100:2010";
- b) in the first column, replace the numbers A.1 to A.4 with B.1 to B.4;
- c) in table footnote a, replace the reference "ISO 14121-1:2007, Annex A" with "ISO 12100:2010, Annex B";
- d) merge the fourth and fifth columns, and replace the references to the subclauses of ISO 12100-1:2003 and ISO 12100-2:2003 with references to the subclauses of ISO 12100:2010;
- e) in the sixth column entitled "Relevant type-B standard", replace EN 982 with ISO 4413, and EN 983 with ISO 4414;
- f) in the row for A.4 entitled "Failure of control system" (on page 18), insert "EN 954-1" after ISO 14118; delete IEC 62061, which follows IEC 60204.

Table 3 — Overview of hazards and reference to type-B standards

No. ^a	Hazards, hazardous situations and hazardous events	Situations on turning machines	ISO 12100:2010	Relevant type-B standard	Relevant clause in this International Standard
B.1	1 Mechanical hazards				
—	Acceleration, deceleration (kinetic energy)				5.2.1.1 g) 5.2.3 a) 4) ii)
—	Angular parts				5.1.1, 5.2
—	Approach of a moving element to a fixed part				5.1.1 5.2
—	Cutting parts, sharp edges: crushing and shearing				5.1.1 5.2
—	Elastic elements High pressure: fluid injection or ejection Vacuum, Gravity (stored energy) High pressure Height from the ground	Dissipation of accumulated energy inside the machine	6.2.2.1 6.2.2.2 6.2.3 a) 6.2.3 b) 6.2.6 6.2.10 6.3.1 6.3.2 6.3.3	ISO 13851 ISO 13854 ISO 13855 ISO 13856-2 ISO 13856-3 ISO 13857 ISO 14118 ISO 14119	5.2.4.5 b) 1) iii) 5.2.2.4 a) 1) 5.2.2.4 c) 6) 5.2.4.4 b) 5.2.4.3 a) 3) 5.2.4.4.1 c) 5.2.4.5 a) 3) 5.8 e) 1) iv) 5.8 h) 4) 5.10 d)
—	Falling of objects	Falling of workpiece	6.3.5.2	ISO 14120	5.2.3
—	Moving elements: entanglement		6.3.5.4 6.3.5.5 6.3.5.6	ISO 14122-1 ISO 14122-2 ISO 14122-3	5.1.1 5.2
—	Rotating elements: entanglement		6.4.1 6.4.3 6.4.4 6.4.5	ISO 14122-4 ISO 16156 IEC 60204-1 EN 614-1	5.1.1 5.2
—	Rough, slippery surface: slipping, tripping and falling of persons (related to machinery)	Ejection or spillage of metal cutting fluid (metal removal fluid), lubricants or hydraulic fluid; fall of persons during access to/or at/from the work position on large machines during setting and machining mode			5.15
—	Sharp edges				5.1.1, 5.2
—	Stability	Loss of stability			5.14

Table 3 (continued)

No. ^a	Hazards, hazardous situations and hazardous events	Situations on turning machines	ISO 12100:2010	Relevant type-B standard	Relevant clause in this International Standard
B.3	Assembly and installation Error of fitting	During tool workpiece clamping change	5.5.2.2, 6.4.1.3 6.4.5.1		5.12 6.2.1 to 6.2.3 6.2.9
—	Operation	Restarting the machine after stopping/interruption	5.5.2.2 6.2.11.4 6.2.11.5	ISO 14118 IEC 60204-1 ISO 4413 ISO 4414	5.10
—	Fault finding and troubleshooting	Isolation and energy dissipation	6.2.10	ISO 4413 ISO 4414 ISO 14118 IEC 60204-1	5.8 h)
B.4	Falling or ejection of objects	At work clamping, during machining, at bar feed and coolant (workpiece, part of tool, swarf)	6.2.3, 6.2.5 6.2.10 to 6.2.12 6.3.2.1, 6.3.2.2, 6.3.2.7 6.3.3, 6.3.5.2, 6.3.5.4, 6.3.5.5, 6.4.4, 6.4.5	ISO 4413 ISO 4414 ISO 14120	5.13 Annex A Annex B Annex C
B.4	Failure of control system	<ul style="list-style-type: none"> — dropping or ejection of moving parts of the machine or of a workpiece clamped by the machine — failure to stop moving parts — uncontrolled movements (including speed change) — unintended/unexpected start-up — other hazardous events due to failure(s) or poor design of the control system — variation of speed of tools (during setting) 	5.5.2.2 6.2.2 6.2.3 6.2.5 6.2.11 to 6.2.13 6.3.5.2 to 6.3.5.4 6.4.3 to 6.4.5	ISO 4413 ISO 4414 ISO 13849-1 ISO 13849-2 ISO 14118 EN 954-1 IEC 60204-1	5.8 5.9 5.10 5.11
B.1	2 Electrical hazards				
—	Live parts (direct contact)	At electrical equipment during maintenance			5.3 a)
—	Parts which have become live under fault conditions (indirect contact)	At electrical equipment during setting, machining and maintenance	6.2.9 6.3.2 6.3.3.2 6.3.5.4 6.4.4 6.4.5	IEC 60204-1	5.3 b)
—	Short circuit	At any mode of operation, in case of penetration of conducting substances			5.3 c)

Table 3 (continued)

No. ^a	Hazards, hazardous situations and hazardous events	Situations on turning machines	ISO 12100:2010	Relevant type-B standard	Relevant clause in this International Standard
B.1	3 Thermal hazards				
—	Explosion or flame	Working with flammable metal working fluid or pyrophoric material		EN 13487	5.6 c) 6.2.1 c), n), o) 6.2.8 Annex E
—	Objects or materials with a high or low temperature	At hot tools, chips and workpiece		ISO 13732-1	6.2.2 c)
B.1	4 Noise hazards				
—	Manufacturing process (stamping, cutting, etc.) and/or — moving parts, — scraping surfaces, — unbalanced rotating parts, — whistling pneumatics, — exhausting system	At any mode of operation or in maintenance situation	6.2.2.2 6.2.2 c) 6.2.4 c) 6.2.8 6.3.1 6.3.3.2.1 6.3.4.2 6.4.3 6.4.5.1 c)	ISO 8525 ISO 230-5 ISO/TR 11688-1	5.4 6.2.6 6.2.8
B.1	6 Radiation hazards				
—	Low-frequency electromagnetic radiation Radio frequency electromagnetic radiation	At electrical equipment during setting mode or maintenance	6.2.2.2 6.2.3 c) 6.3.3.2.1 6.3.4.5 6.4.5.1 c)		5.5 a) 5.8 k)
—	Optical radiation (infrared, visible and ultraviolet), including laser	At laser equipment during setting mode or maintenance		IEC 60825-1	5.5 b) 6.2.1 g)
B.1	7 Material/substance hazards				
—	Biological and microbiological (viral or bacterial) agent	Contact with metal cutting fluids during loading/unloading maintenance, setting mode	6.2.2.2 6.2.3 b) 6.2.3 c) 6.2.4 a) 6.2.4 b) 6.3.1 6.3.3.2.1 6.3.4.4 6.4.5.1 c) 6.4.5.1 g)	ISO 14159	5.6 b) 5.6 d) 6.2
—	Explosive, flammable, combustible	At work zone during machining		EN 13478	5.6 c) 6.2
—	Fume, mist, dust	At delivery system of metal cutting fluid, during setting, machining, maintenance After extinguishing system has been activated			6.2.1 m), Annex F

Table 3 (continued)

No. ^a	Hazards, hazardous situations and hazardous events	Situations on turning machines	ISO 12100:2010	Relevant type-B standard	Relevant clause in this International Standard
B.1 8 Ergonomic hazards					
—	Design or location of indicators and visual displays units	At operator's position		EN 547-1 EN 547-2	5.7 a) 5.7 b) 5.7 g)
—	Design, location or identification of control devices	At operator's position		EN 894-1 EN 894-2 EN 894-3	5.7 a) 5.7 b) 5.7 d) 5.7 f)
—	Posture, effort	At control devices and during handling of workpiece tools and machine parts	6.2.2.1 6.2.7 6.2.8 6.2.11.8	EN 894-1 EN 849-2 EN 849-3 EN 1005-1 EN 1005-2 EN 1005-3	5.7 c)
—	Repetitive activity	Inadequate consideration of hand-arm or foot-leg anatomy at workpiece or tool exchange	6.3.2.1 6.3.3.2.1	EN 614-1 EN 614-2 EN 894-1 EN 894-2 EN 894-3 EN 1005-1 EN 1005-2 EN 1005-3	5.7 d)
—	Visibility, local lighting	At cutting process, during setting, handling/positioning of workpiece		EN 1837	5.7 e)
B.1 9 Hazards associated with environment in which the machine is used					
—	Electromagnetic disturbances	At NC control equipment during all modes of operation and maintenance	5.5.2.2 6.2.12.2 6.4.5.1 b)		5.8 k)
B.4	Human errors, human behaviour	Workstation and/or work process design Inadequate consideration of hand-arm or foot-leg anatomy	6.2.2.1 6.2.7 6.2.8 6.2.11.8 6.2.11.10 6.3.5.5 6.4.3 to 6.4.6	EN 894-1 EN 894-2 EN 894-3	5.7 g) 5.7 f) 6.1 c) 6.2.4
^a The numbers in this column refer to table numbers in ISO 12100:2010, Annex B.					

Page 21, 5.1

In the first paragraph, replace "ISO 12100-1:2003, Clause 5" with "ISO 12100:2010, Clause 5".

In the second paragraph, replace "ISO 12100-2:2003, Clause 4" with "ISO 12100:2010, Clause 6"; replace "ISO 12100-2:2003, Clause 5" with "ISO 12100:2010, 6.3".

Replace the third and fourth paragraphs with the following:

The designer shall take into account hazards which can occur during the life of the machine to both operator and other persons who have access to the hazard zone(s) for conditions of intended use, including reasonably foreseeable misuse of the machine (see ISO 12100:2010, 3.23 and 3.24). The hazards for both machining operation and/or operations requiring intervention by the operator and/or other persons (e.g. setting, cleaning, maintenance and repair) shall be considered. An analysis of the failure of machine components, including failure in the control system(s), is part of the risk assessment and guidance on this subject and is given in ISO 13849-1 or in EN 954-1. Therefore, reliability requirements for safety functions are defined as performance level (PL), in accordance with ISO 13849-1, or as category, in accordance with EN 954-1:1996. [see 5.11 b)].

Each machine shall be designed and safeguarded in accordance with the specific requirements and/or protective measures listed in Clause 5. For some of the requirements, this International Standard offers the choice between two performance levels or two categories [see 5.11 b)]. In cases not specified in 5.11 b), categories according to EN 954-1 or performance levels according to ISO 13849-1 shall be determined based on an appropriate risk assessment.

Page 21, 5.1.1.2 a)

Replace with the following:

- a) In terms of height and position, where guards are floor-mounted (e.g. perimeter fencing), they shall be fixed securely and have a minimum height of 1,4 m and a distance from the hazard zone in accordance with ISO 13857:2008, Table 2. Any opening between the bottom of the guard and the floor shall be in accordance with ISO 13857:2008, Table 7 (≤ 180 mm).

Page 21, 5.1.1.2 c) 1)

Replace "ISO 14119:1998, Clause 7" with "ISO 14119:—¹), Clause 6".

Page 23, 5.2.2.2 a) 1)

Replace "(see ISO 14119:1998, Clauses 5 and 7)" with "(see ISO 14119:—¹), Clauses 6 and 7)".

Page 23, 5.2.2.1, 5.2.2.2 b)

In 5.2.2.1, replace "ISO 12100-2:2003, Table 1" with "ISO 12100:2010, Figure 4".

In 5.2.2.2 b), replace "ISO 12100-2:2003, 5.3.2.6" with "ISO 12100:2010, 6.3.3.2.6".

Replace "ISO 12100-2:2003, 5.3.2.5" with "ISO 12100:2010, 6.3.3.2.5".

Replace "ISO 12100-2:2003, 3.25" with "ISO 12100:2010, 3.27".

Page 27, 5.2.4.1 b) 1)

Replace "ISO 12100-2:2003, 4.11.10" with "ISO 12100:2010, 6.2.11.10".

Page 31, 5.2.5.2 a)

Replace "requirements shall be fulfilled:" with "requirements shall be fulfilled (see ISO 10218-2 and ISO 11161):

Pages 32 to 33, 5.2.5.4 b) and c)

Replace the title "Swarf collection and removal" with "Chip collection and removal".

Replace b) and c) with the following:

- b) When these interlocked movable guards are open, movement of the chip collection and removal system shall be prevented. Where access to dangerous parts of the chip collection system (e.g. belt or screws) is possible from the operator's position, movements of these parts shall be prevented when the work zone guards are opened. Where movement of the chip collection and removal system is required with the movable guard opened (e.g. for cleaning), this shall be possible only under hold-to-run control [see 5.11 b) 2)] and an emergency stop device shall be provided in the vicinity.
- c) The hazards in the chip discharge area shall be safeguarded by guarding or perimeter fencing preventing access to crushing and entanglement and permanently mounted labels warning of any residual risk, as defined in ISO 12100. Where movable guards are used, they shall be interlocked with the chip conveyor system [see 5.2.2.2 a)].

Page 33, 5.2.5.5 a)

Replace "ISO 14119:1998, 7.1" with "ISO 14119:—¹⁾, 6.1".

Page 35, 5.6 c) 4)

Replace the Note with the following:

NOTE Risks arising from fire and explosion depend on the actual conditions of use of the machine and/or the use of flammable fluids and are considered individually (see EN 13478).

Page 35, 5.7 a)

Replace "ISO 12100-1:2003, 4.9" with "ISO 12100:2010, Table B.1, No. 8".

Replace "ISO 12100-2:2003, 4.6, 4.8 and 5.5.6" with "ISO 12100:2010, 6.2.6, 6.2.8 and 6.3.5.6".

Page 36, 5.7 c) 5)

Replace "ISO 12100-2:2003, 4.2.2" with "ISO 12100:2010, 6.2.2.2".

Page 37, 5.8 b) 1)

Replace with the following:

- 1) control systems shall be designed in accordance with ISO 4413, ISO 4414, IEC 60204-1 and with ISO 13849-1 or EN 954-1. Unexpected machine movements (e.g. spindle rotation, axis movement, tool release from the spindle) shall be prevented (see ISO 14118);

Page 38, 5.8 h) 1) and 2)

Replace the reference "ISO 12100-2:2003, 4.10 and 5.5.4" with "ISO 12100:2010, 6.2.10 and 6.3.5.4".

Replace the reference "ISO 4413:—" with "ISO 4413:2010".

Replace the reference "ISO 4414:—" with "ISO 4414:2010".

Page 38, 5.8 i) and j)

Replace the references "EN 982" with "ISO 4413" and "EN 983" with "ISO 4414", respectively.

Page 39, 5.10 c)

Replace "ISO 12100-2:2003, 4.11.4)" with "ISO 12100:2010, 6.2.11.4)".

Page 39, 5.10 e) and f)

Replace the references "EN 982" with "ISO 4413" and "EN 983" with "ISO 4414", respectively.

Replace the references "EN 982:1996, 5.1.5" with "ISO 4413:2010, 5.3.2.2" and "EN 983:1996, 5.1.6" with "ISO 4414:2010, 5.28", respectively.

Pages 39 to 40, 5.11 a) and b)

Replace with the following:

- a) Regarding safety-related hardware and software, for the purposes of this International Standard, safety-related parts of a control system include the entire system from the initial actuator (control device) or position detector to the point of input to the final actuator or element, e.g. motor. Safety functions of control systems shall be implemented using safety-related parts designed, constructed and applied in accordance with ISO 13849-1 or EN 954-1.
- b) The safety functions shall fulfil the accordant requirements given in this subclause. The manufacturer has the choice between two reference standards, a combination of both is not foreseen:

If ISO 13849-1 is applied, the required performance level (PL_r) shall be fulfilled.

If EN 954-1 is applied, the required category shall be fulfilled.

NOTE For the determination of the performance level, see also example calculation in Annex F.