



**SLOVENSKI STANDARD**  
**SIST EN 12417:2002**

**01-januar-2002**

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**Machine tools - Safety - Machining centres**

Machine tools - Safety - Machining centres

Sicherheit von Werkzeugmaschinen - Bearbeitungszentren

Machines-outils - Sécurité - Centres d'usinage

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**ICS:**

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English version

## Machine tools - Safety - Machining centres

Machines-outils - Sécurité - Centres d'usinage

Werkzeugmaschinen - Sicherheit - Bearbeitungszentren

This European Standard was approved by CEN on 9 June 2001.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 143 "Machine tools - Safety", the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by January 2002, and conflicting national standards shall be withdrawn at the latest by January 2002.

Annex A is normative. Annexes B to D and ZA are informative.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EC-Directives, see informative annex ZA which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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## 0 Introduction

This European Standard is a type C standard as stated in EN 292–1.

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.

Machining centres present a wide range of hazards, not least from their wide application as rotating tool, 'stationary' workpiece machine tools, for general purpose cutting of cold metal work material.

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 or clamping.

Total enclosure of the work zone using guards during cutting is practicable for smaller machines. The requirements for access to the work 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 at the operating position).

Pendant controls enable operators to move around the machine, especially large machines, and to view the work zone, the load/aligning, clamping, cutting, or unloading operations, maneuvering the pendant control 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 1 and procedures for verification of these requirements or measures are found in clause 5.

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

## 1 Scope

**1.1** 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 machining centres (see 3.1).

**1.2** This standard takes account of intended use including reasonably foreseeable misuse, maintenance, cleaning, and setting operations. It presumes access to the machine from all directions. It describes means to reduce risks to operators and other exposed persons.

**1.3** This standard also applies to the workpiece transfer devices when they form an integral part of the machine.

**1.4** This standard deals with significant hazards relevant to machining centres when they are used as intended and under the conditions foreseen by the manufacturer (see clause 4).

**1.5** Hazards arising from other metal working processes (e.g. grinding, turning, forming, EDM, laser processing) are covered by other standards (see Bibliography).

**1.6** This standard applies to machines which are manufactured after (its date of publication).

## 2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

- |                                    |  |
|------------------------------------|--|
| EN 292-1:1991                      | Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology   |
| EN 292-2:1991 and EN 292-2/A1:1995 | Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications  |
| EN 294:1992                        | Safety of machinery – Safety distances to prevent danger zones being reached by the upper limbs  |
| EN 349:1993                        | Safety of machinery – Minimum gaps to avoid crushing of parts of the human body  |
| EN 547:1996                        | Safety of machinery – Human body measurements –<br>Part 1: Principles for determining the dimensions required for openings for whole body access into machinery<br>Part 2: Principles for determining the dimensions required for access openings<br>Part 3: Anthropometric data |
| EN 574:1996                        | Safety of machinery - Two hand control devices – Functional aspects – Principles for design  |

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- EN 614 Safety of machinery - Ergonomic design principles –  
Part 1: Terminology and general principles  
Part 2: Interaction between machinery design and work tasks
- EN 626-1:1994 Safety of machinery – Reduction of risks to health from hazardous substances emitted by machinery – Part 1: Principles and specifications for machinery manufacturers
- EN 894:1997 Safety of machinery – Ergonomics requirements and data for the design of displays and control actuators –  
Part 1: Human interactions  
Part 2: Displays
- EN 894-3:2000 Safety of machinery – Ergonomics requirements and data for the design of displays and control actuators – Part 3: Control actuators
- EN 953:1997 Safety of machinery – Guards – General requirements for the design and construction of fixed and movable guards
- EN 954-1:1996 Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
- EN 982:1996 Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics
- EN 983:1996 Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics
- EN 999:1998 Safety of machinery – The positioning of protective equipment in respect of approach speeds of parts of the human body
- prEN 1005:1998 Safety of machinery – Human physical performance –  
Part 1: Terms and definitions  
Part 2: Manual handling of machinery and component parts of machinery  
Part 3: Recommended force limits for machinery operation
- EN 1037:1995 Safety of machinery – Prevention of unexpected start-up
- EN 1050:1996 Safety of machinery - Principles for risk assessment
- EN 1088:1995 Safety of machinery - Interlocking devices associated with guards – Principles for design and selection
- EN 1127–1:1997 Explosive atmospheres - Explosion prevention and protection – Part 1: Basic concepts and methodology
- EN 1760–1:1997 Safety of machinery - Pressure sensitive protective devices – Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors
- EN 1837:1999 Safety of machinery – Integral lighting of machines
- EN 60529:1991 Specification for degrees of protection provided by enclosures (IP code)



- EN 60825-1:1994 Safety of laser products – Equipment classification, requirements and user's guide
- EN ISO 3744:1995 Acoustics – Determination of sound power level of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane
- EN ISO 3746:1995 Acoustics – Determination of sound power level of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane
- EN ISO 4871:1997 Acoustics – Declaration and verification of noise emission values of machinery and equipment
- EN ISO 9614-1:1995 Acoustics – Determination of sound power level of noise sources using sound intensity – Part 1: Measurement at discrete points
- EN ISO 11202:1995 Acoustics – Noise emitted by machinery and equipment – Measurement method of emission sound power levels at the work station and at other specified positions – Survey method in situ
- EN ISO 11204:1996 Acoustics - Noise emitted by machinery and equipment – Method requiring environmental corrections
- prEN ISO 14122:1999 Permanent means of access to machines and industrial plants  
Part 2: Working platforms and gangways  
Part 3: Stairways, stepladders and guard-rails
- prEN 13478:1999 Safety of machinery – Fire prevention and protection
- EN ISO 11688-1:1998 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
- EN 50081-2:1993 Electromagnetic compatibility – Generic emission standard – Part 2: Industrial environment
- EN 60204-1:1997 Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997)
- EN 61000-6-2 Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:1999)
- EN 61496-1: 1997 Safety of machinery - Electrosensitive protective equipment - Part 1 - General requirements and tests (IEC 61496-1:1997)
- IEC 61496-2:1997 Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)

### 3 Terms and definitions

For the purposes of this standard, the following definitions apply. For other terms and definitions, see EN 292–1, EN 292–2+A1.

#### 3.1

##### **machining centre**

a numerically controlled machine tool, where the spindle orientation is usually either horizontal or vertical, capable of carrying out two or more machining processes (e.g. milling, drilling, boring) and having facilities to enable tools to be changed automatically from a magazine or similar storage unit in accordance with the machining program. Such machines may incorporate facilities for manual control in varying degrees

#### 3.2

##### **numerical control** (computer numerical control) (NC, CNC)

automatic control of a process performed by a device that makes use of numeric data introduced while the operation is in progress (ISO 2806:1994, 2.1.1)

#### 3.3

##### **work zone**

the space where the metal cutting process can take place

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#### 3.4

##### **workpiece transfer device**

a mechanism integrated with the machine as a means of supplying a previously loaded workpiece to a machine in exchange for a finished workpiece (e.g. pallet changing device – see annex C, Figures C.1, C.2, C.3, C.4)

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#### 3.5

##### **electronic handwheel**

a manually operated control device which initiates and maintains an axis movement by pulse generation input to the numerical control during its rotation

### 4 List of significant hazards

4.1 The list of hazards contained in Table 1 is the result of a hazard identification and risk assessment carried out as described by EN 1050 for machining centres covered by the scope of this standard. The safety requirements and/or protective measures and information for use contained in clauses 5 and 7 are based on the risk assessment and deal with the identified hazards by either eliminating them or reducing the effects of the risks they generate.

**4.2** The risk assessment assumes foreseeable access from all directions, as well as unexpected start-up. Risks to both the operators and other persons who can have access to the hazard zones are identified, taking into account hazards which can occur under various conditions (e.g. commissioning, set-up, production, maintenance, repair, decommissioning) during the life of the machine. The assessment includes an analysis of the effect of failure in the control system.

**4.3** In addition, the user of this standard (i.e. the designer, manufacturer, supplier) shall validate that the risk assessment is complete for the machine under consideration with particular attention to:

- the intended use of the machine including maintenance, setting and cleaning, and its reasonably foreseeable misuse;
- the identification of the significant hazards associated with the machine.

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**Table 1 – List of significant hazards and major sources of these hazards associated with machining centres**

•	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
1.	<b>Mechanical hazards</b>				
1.1	Crushing	workpiece clamping	loading/reorienting/unloading	between clamps and workpiece	1.4
		movements associated with automatic tool changing	power-operated tool change	envelope of tool-changer motion between spindle and tool store	1.3
		moving axes	maintenance	within pits	1.7
		movement of operating platforms	normal operation, maintenance	at or near machine	1.8
1.2	Shearing	moving axes	manual operation/tool change	between tool/ spindle and table/ workpiece	1.1.6.3 1.1.6.4 1.2.1.3
1.3	Cutting or severing	spindle or tool running or cutting	spindle running	at spindle or tool	1.1 to 1.1.6.4
1.4	Entanglement	movements associated with automatic tool changing	power-operated tool-change	envelope of tool-changer motion between spindle and tool store	1.3
		removal of swarf/chips	power-operated swarf/chip removal	swarf/chip collection and discharge zones	1.5
1.5	Drawing-in or trapping	rapid travel of table or spindle head	power-operated motion of workpiece on table or tool in spindle	envelope of movement of workpiece on table axes; envelope of movement of tool in spindle head	1.1
		rotating power transmission mechanisms	maintenance	in or around machine	1.6
1.6	Impact	moving/rotating tool	spindle running	at spindle or tool	1.1 to 1.1.6.4
		automatic tool changing	power-operated tool change	envelope of tool change motion	1.3
		automatic workpiece transfer (e.g. pallet loading system)	power-operated workpiece transfer	envelope of motion of workpiece and workpiece transfer mechanisms	1.4
1.7	Stabbing or puncture	moving/rotating tool (especially eccentric tools)	process control	at tool in spindle	1.1 to 1.1.6.4
		movements associated with automatic tool changing	power-operated tool change	envelope of tool changer motion (especially tool grippers)	1.3
		handling tools	during manual tool change or replenishing tool magazine	at sharp cutter faces	(see clause 7)
		handling swarf/chips	during loading/unloading and cleaning	at workpiece, table, and swarf /chip collecting and discharge zones	(see clause 7)

•	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
2	<b>Electrical hazards</b>				
2.1	Contact of persons with live parts (direct contact)	contact with live parts or connections	during commissioning, maintenance, trouble shooting	electrical cabinet, terminal boxes, control panels at machine	2.1
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	contact with live parts or connections	during operation, inspection and maintenance of machine	at machine or faulty part	2.2
4	<b>Hazards generated by noise</b>				
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	motion of power transmission elements, cutting processes and fluid power systems	during operating cycle of machine	near machine	4
4.2	Interference with speech communication, acoustical signals	air blast used for cleaning of tool or pallet locations	during operating cycle of machine	near machine	4
6	<b>Hazards generated by radiation</b>				
6.5	Lasers	direct or reflected visual exposure to laser radiation	maintenance of laser positional feedback system	within machine	6.5
7	<b>Hazards generated by materials and substances</b>				
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts	conditions near machine caused by ejection of particles of work material, fluid droplets or mist from metal working fluids	during operating cycle of the machine	at or near machine	7.1
7.2	Fire or explosion	flammable work material, flammable (low flash point) metal working fluids	during operating cycle of the machine	at or near machine	7.2
7.3	Biological or micro-biological (viral or bacterial) hazards	contact with hydraulic or metal working fluid as liquid or mist containing detritus and bacteria	during operation, process control, and maintenance	at or near machine	7.3
8	<b>Hazards generated by neglecting ergonomic principles in the design process</b>				
8.1	Unhealthy postures or excessive effort (repetitive strain)	lifting and reaching while handling workpiece, tools, and machine parts	during loading/unloading, process control, and maintenance	at load/unload and tool mounting positions, maintenance action points	8.1
8.2	Inadequate consideration of hand-arm or foot-leg anatomy	inappropriate location of controls	during loading/unloading, process control, and maintenance	at load/unload and tool mounting positions, maintenance action points	8.2
8.4	Inadequate local lighting	judgement and accuracy of manual actions impaired during handling/ positioning of work materials and cutters	during loading /unloading, process control, tool handling	at load/unload, tool mounting positions	8.4