SLOVENSKI STANDARD
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Varnost obdelovalnih strojev - Stroji za prenos in posebne namene

Safety of machine tools - Transfer and special purpose machines

Sicherheit von Werkzeugmaschinen - Transfer- und Einzweck- oder Sondermaschinen

Sécurité des machines-outils - Machines transfert et machines spéciales

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25.080.01 Stroji na splošno Machine tools in general

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Sécurité des machines-outils - Machines transfert et machines spéciales

Sicherheit von Werkzeugmaschinen - Transfer- und Einzweck- oder Sondermaschinen

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 14070:2003) 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of an identical text or by endorsement, at the latest by April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential safety requirements of the Machinery Directive to determine safety for new transfer and special purpose machines.

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

Annexes A and D are normative. Annexes B and C are informative.

This document includes a Bibliography.

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, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

This European Standard is a type C standard as stated in 6.3.2 of EN 1070:1998.

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.

Transfer and special purpose machines present a wide range of hazards due to the variety of processes and configurations with possible obstructions to vision on these machines, in particular, those hazardous events which result from contact with:

— Moving tools especially when being rapidly rotated in spindles;

— Fast moving machine parts;

— Fast moving workpieces;

— Power operated mechanisms for workpiece handling, load or unload.

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

A list of standards related to EN 14070 is given in the bibliography.

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 information which must be provided for installation and dismantling, with arrangements for transport and maintenance) of transfer and special purpose machines (see 3.1). These machines 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.

1.2 This standard takes account of intended use, including reasonably foreseeable misuse, maintenance, cleaning, and setting operations. It specifies access arrangements to machining positions and manual load/unload stations (see 3.4). 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 transport devices for workpiece load/unload when they form an integral part of the machine.

1.4 This standard deals with significant hazards relevant to transfer and special purpose machines when they are used as intended and under the conditions foreseen by the manufacturer (see clause 4). The safety requirements and/or protective measures to prevent or minimise those hazards identified in Table 1 and procedures for verification of these requirements or measures are found in clause 5. Safety requirements and/or measures are not specified for: Fire and Explosion

1.5 Where machines employ processes which are covered by other standards (e.g. grinding, turning, forming, EDM, laser processing), the requirements of those standards should be applied (see Bibliography).

1.6 This standard applies to machines which are manufactured after publication of this standard by CEN.

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	*Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications.*
EN 292-2:1991/A1:1995	*Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications; Amendment A1.*
EN 294: 1992	*Safety of machinery – Safety distances to prevent danger zones being reached by the upper limbs.*
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	*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 811:1996	*Safety of machinery - Safety distances to prevent danger zones being reached by the lower limbs.*
EN 894-1	*Safety of machinery - Ergonomic 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 894-3:2000	*Safety of machinery – Ergonomics requirements 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	*Safety of machinery - Safety-related parts of control systems - Part l: 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	*Safety of machinery – The positioning of protective equipment in respect of approach speeds of parts of the human body.*
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 1037:1995	*Safety of machinery – Prevention of unexpected start-up.*
EN 1050:1996	*Safety of machinery - Principles for risk assessment.*
EN 1070:1998	*Safety of machinery – Terminology.*
EN 1088:1995	*Safety of machinery - Interlocking devices associated with guards – Principles for design and selection.*
EN 1760–1	*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	*Safety of machinery – Integral lighting of machines.*

EN ISO 3744	*Acoustics – Determination of sound power levels of noise sources using sound pressure – Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994).*
EN ISO 3746:1995	*Acoustics – Determination of sound power levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995).*
EN ISO 4871	*Acoustics – Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996).*
EN ISO 7250	*Basic human body measurements for technological design (ISO 7250:1996).*
EN ISO 9614-1	*Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points (ISO 9614-1:1993).*
EN ISO 11202:1995	*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 11204:1995	*Acoustics - Noise emitted by machinery and equipment - Measurement of emission sound pressure levels at a work station and at other specified positions - Method requiring environmental corrections (ISO 11204:1995).*
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 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).*
EN 60204-1:1997	*Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997).*
EN 60825-1:1994/A1	Safety of laser products - Part 1: Equipment classification, requirements and user's guide; Amendment A1 (IEC 60825-1:1993/A1:1997) / Note: Endorsement notice
EN 61000-6–2	*Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:1999, modified).*
EN 61000-6-4	*Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:1997, modified).*
EN 61310-3	*Safety of machinery – Indication, marking and actuation - Part 3: Requirements for the location and operation of actuators (IEC 613010-3:1999).*
EN 61496-1	*Safety of machinery – Electro-sensitive protective equipment - Part 1 - General requirements and tests (IEC 61496-1:1997).*
IEC 61496-2	*Safety of machinery – Electro-sensitive protective equipment – Part 2 – Particular requirements for equipment using active opto-electronic protective devices .*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1070 apply. Additional terms and definitions specifically needed for this document are added below.

3.1
transfer and special purpose machines
machine designed to process only a pre-specified workpiece or family of workpieces, by means of a pre-determined sequence of machining operations and process parameters (see Figures C.1 and C.2)

NOTE These machines can include one or more of the following elements:
- station(s) incorporating unit(s) (see 3.4 and 3.5 below);
- transport system(s) for the workpiece;
- clamping devices;
- metal working fluid system(s);
- swarf/chip removal system(s);
- measurement and test systems.

3.2
work zone
space within which the machine mechanisms are located and the process(es) are performed

3.3
machine working cycle
period of time between the start of process on one workpiece and the start of process on the next workpiece after a transfer

NOTE This is determined by the longest individual station time.

3.4
station
term applied to the fixed positions within a machine at which workpieces are located during the processing portion of the machine working cycle

NOTE Stations are normally identified by sequential numbering e.g.:
- Station 1 – Load station
- Station 2 – Machining station
- Station 3 – Gauging station
- Station 4 – Idle station
- Station XX – Unload station

The term station also covers the fixtures, units, heads and other mechanisms associated with the process performed at a particular station (see Figures C.3, C.4 and C.5).

3.5
unit
single axis or multi-axis module located at a station to carry the tooling, device or mechanism which performs the process on the workpiece (see Figure C.6)

3.6
workpiece load/unload device
mechanism that delivers workpieces to, or removes them from, the machine

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 transfer and special purpose machines 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 or 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.

Table 1 — List of significant hazards and major sources of these hazards associated with transfer and special purpose machines

a	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
1.	**Mechanical hazards** due to:				
1.1	Crushing	workpiece clamping	loading/reorienting/ unloading	between clamps and workpiece	1.2
		transfer mechanism	maintenance	within pits	1.5
		movement of workpiece handling devices, transfer mechanism or unit heads	operating cycle of machine, process control, manual tool change, maintenance	at machine	1.1, 1.2
1.2	Shearing	movement of axes, workpiece handling devices or transfer mechanism	operating cycle of machine, manual tool change, maintenance	at machine	1.1 to 1.1.5, 1.2, 1.3, 1.4
1.3	Cutting or severing	spindle or tool running or cutting	spindle running	at spindle or tool	1.1 to 1.1.5
1.4	Entanglement	rotating tools	spindle running	at spindle or tool	1.1 to 1.1.5
		removal of swarf/chips	power–operated swarf/chip removal	swarf/chip collection and discharge zones	1.3
1.5	Drawing–in or trapping	movement of workpiece handling, transfer mechanism or unit head	power–operated motion of workpiece or tool in spindle	envelope of movement of workpiece or at unit head	1.1 to 1.1.5, 1.2, 1.3, 1.4
		rotating power transmission mechanisms	maintenance	in or around machine	1.4
1.6	Impact	moving/rotating tool	spindle running	at spindle or tool	1.1 to 1.1.6.4
		workpiece transfer	power-operated workpiece transfer	envelope of motion of workpiece and workpiece transfer mechanisms	1.2

a	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
1.7	Stabbing or puncture	moving tool (especially eccentric tools)	process control	at tool in spindle	1.1 to 1.1.6.4
		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)
1.9	High pressure fluid ejection	Pipes or hoses carrying high pressure fluids	machine operating, maintenance	at or near machine	13, 17
2	**Electrical hazards** due to:				
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	
2.2	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	
3	**Thermal hazards resulting in:**				
3.1	Burns or scalds by a possible contact of persons	ejection of swarf	during cutting	at or near machine	1.1.1, 1.1.2, 17
		handling of hot work material	during unloading	at unload position	7.2.f
		contact with hot tooling	during tool change, process control, maintenance	at unit heads	7.2.f
4	**Hazards generated by noise** resulting in:				
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 fixture/pallet locations	during operating cycle of machine	near machine	4
6	**Hazards generated by radiation**				

a	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
6.5	Lasers	direct or reflected visual exposure to laser radiation	maintenance of laser positional feedback system	within machine	6.5
7	**Hazards generated by materials and substances** (and their constituent elements) processed or used by the machinery				
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	**Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:**				
8.1	Unhealthy postures or excessive effort (repetitive strain)	lifting and reaching while handling workpiece, tooling or 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 or positioning of workpiece or tooling	during loading /unloading, process control, handling of tooling	at load/unload, tool mounting positions	8.4
8.6	Human errors, human behaviour	reasonably foreseeable misuse, inadvertent operation of controls, incorrect work material or cutter handling/setting	during loading/ unloading, process control, tool handling	at load/unload, tool mounting positions	8.6
8.7	Inadequate design, location or identification of manual controls	inadvertent operation of controls	during operating cycle of machine, setting, maintenance	at or near machine	8.7

a	Description	Example(s) of related hazardous situation(s)	Associated activity	Related danger zone	Clause 5 Reference (Table 2)
8.8	Inadequate design or location of visual display units	misinterpretation of displayed information	during operating cycle of machine, setting, maintenance	at or near machine	8.8
10	**Unexpected start-up, unexpected overrun/ over speed** (or any similar malfunction) from:				
10.1	Failure/disorder of the control system	mechanical hazards associated with selected machine movement	during setting, cleaning	at machine	10.1
10.2	Restoration of energy supply after an interruption	unexpected movements of machine	during setting, cleaning or maintenance	at or near machine	10.2
10.3	External influences on the electrical equipment	unpredictable behaviour of electronic controls due to electromagnetic interference	during setting or operating cycle of the machine	at or near machine	10.3
13	**Failure of the power supply**	malfunctions of the control with consequent misapplication of stored energy or power. Power work holding fails, motor over speed. Part breakage causes machine elements to move under residual forces (inertia, gravity, spring/ energy storage means) causing external elements to move unexpectedly	during operation, process control, maintenance	at machine where machine elements retained in a safe condition by the application of power or fluid pressure.	13
14	**Failure of the control circuit**	Unexpected movements of machine	during setting, cleaning or maintenance	at or near machine	14
15	**Errors of fitting**	machine elements fail or move unexpectedly	during process control, tool mounting, maintenance	at machine	15
17	**Falling or ejected objects or fluids**	ejection of machine parts, workpiece or tools caused by clamping device, control system failures or collision due to data errors	during the operating cycle of the machine	at or near machine	17