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Obdelovalni stroji - Varnost - Žage za hladne kovine

Machine tools - Safety - Sawing machines for cold metal

Werkzeugmaschinen - Sicherheit - Sägemaschinen für die Kaltbearbeitung von Metall

Machines-outils - Sécurité - Machines à scier les métaux à froid

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Sawing machines

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Kaltbearbeitung von Metall

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Foreword

This document (EN 13898:2003) 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of an identical text or by endorsement, at the latest by March 2004, and conflicting national standards shall be withdrawn at the latest by March 2004.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 requirements of EC Directive(s).

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

Annexes A and B are normative.

Annexes C and D 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.

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0 Introduction

This standard is a type 'C' standard (see introduction of EN 292–1:1991) which applies to sawing machines.

The extent to which significant hazards are covered by this standard is indicated in the scope of this standard. In addition, sawing machines should comply, as appropriate, with EN 292–1 and –2 for hazards which are not covered by this standard.

Complementary requirements and guidance are given in type A and type B standards to which reference is made in the text.

The figures are intended to be examples and not to give the only interpretation of the text.

1 Scope

1.1 This standard specifies the safety requirements and measures to be adopted by persons undertaking the design, construction and supply (including installation, setting-up, maintenance, and repair) of machines whose primary intended use is for sawing cold metal (ferrous and non-ferrous), or material partly of cold metal, by means of a saw blade.

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1.2 This standard takes into account the intended use, reasonably foreseeable misuse, machine setting and blade fitting, maintenance and cleaning, and their effects on the safety of operators and other exposed persons. It presumes access to the machine from all directions at floor level and addresses both normal operation and unexpected or unintended starting.

1.3 This standard applies to the ancillary devices which form an integral part of the machine. Where such devices are not an integral part of the machine, the designer, manufacturer or supplier of the installation should take into account their intended use, and should make provision for the safe linking of such devices with the machine.

1.4 This standard applies to (metal) sawing machines which are manufactured after the date of publication by CEN of this standard.

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/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 distance 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 414, *Safety of machinery – Rules for the drafting and presentation of safety standards.*

EN 418, *Safety of machinery – Emergency stop equipment, 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, *Safety of machinery – Safety distances to prevent danger zones being reached by the lower limbs.*

EN 842, *Safety of machinery - Visual danger signals - General requirements, design and testing.*

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, *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 1: General principles for design.*
- EN 981, *Safety of machinery - System of auditory and visual danger and information signals.*
- EN 982, *Safety of machinery – Safety requirements for fluid power systems and their components – Hydraulics.*
- EN 983, *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 – Part1: 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 1033, *Hand-arm vibration – Laboratory measurement of vibration at the grip surface of hand-guided machinery – General.*
- 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 1299, *Mechanical vibration and shock – Vibration isolation of machines – Information for the application of source isolation.*
- 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 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, modified).*

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EN 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards; Emission standard for industrial environments (IEC 61000-6-4:1997, modified).*

EN 61496-1:1997, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests (IEC 61496-1:1997).*

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 11546-1, *Acoustics - Determination of sound insulation performances of enclosures - Part 1: Measurements under laboratory conditions (for declaration purposes) (ISO 11546-1:1995).*

EN ISO 11546-2, *Acoustics - Determination of sound insulation performances of enclosures - Part 2: Measurements in situ (for acceptance and verification purposes) (ISO 11546-2:1995).*

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 ISO 11691, *Acoustics - Measurement of insertion loss of ducted silencers without flow - Laboratory survey method (ISO 11691:1995).*

EN ISO 11820, *Acoustics - Measurements on silencers in situ (ISO 11820:1996).*

EN ISO 11821, *Acoustics - Measurement of the in situ sound attenuation of a removable screen (ISO 11821:1997).*

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

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

ISO 683-1, *Heat-treatable steels, alloy steels and free-cutting steels – Part 1: Direct-hardening unalloyed and low alloyed wrought steel in form of different black products.*

IEC 61496-2:1997, *Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active optoelectronic protective devices (AOPDs).*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 292-1:1991 and EN 1070:1998 and the following.

3.1

saw blade

toothed cutting tool used with a circular-, band-, and hack-sawing machine

3.2

saw blade mounting position

area or zone of the machine where provision exists for operators to mount, adjust/align and dismount saws; access is not required during sawing, but access is a normal requirement for setting and maintenance

3.3

load/unload positions

areas or zones of the machine where provision exists for manual loading onto, or unloading work material(s) from the machine, frequent, but not continuous access, is required of operators during normal operation of the machine

3.4

manual sawing process

operation of the machine under manual control, all process steps in the machining sequence are controlled or started by the operator

3.5

semi-automatic or single-cycle machine

machine in which the power-operated elements perform a single cycle initiated by the operator

NOTE A typical cycle can be:

- clamp work material
- feed saw blade to work material
- sawing process
- saw blade retraction
- unclamp work material

3.6

automatic machine

machine in which the power-operated elements perform continuous or repeat cycles, the first cycle initiated by a control system start from the operator until either an automatically-determined condition is achieved, or a stop signal is given by the operator

NOTE A typical cycle can be:

- feeding of work material
- clamping of work material
- feeding of saw blade through work material
- saw blade retraction
- unclamping of work piece
- unloading of work piece
- unclamping of work material
- repeat above cycle until stop signal

3.7

back jaw feed (hitch feed)

power-operated work material feeding device having a carriage-mounted vice which grips the work material at any point along its length and traverses it to the sawing position, the required work material length is determined by the stroke of the feed carriage

EN 13898:2003 (E)**3.8****push feed**

power-operated work material feeding device pushing on the tail end of the work material to advance it to a position or length stop which determines the required work material length

3.9**roller feed**

power-operated work material feeding device in which the work material is fed by a roller or rollers, such devices can incorporate work piece gripping and length measuring systems

3.10 Kinds of sawing processes**3.10.1****profile and contour cutting**

work material is pushed either by hand or under power through the saw blade, following a path which is not parallel to the plane of the saw blade, profile and contour cutting uses a vertical band-sawing machine, fixed saw frame, contour cutting type

3.10.2**mitre-sawing**

work material is cut out of square to the longitudinal axis

3.11**work area**

danger zone through which the saw blade traverses to process the work material and includes the work material holding mechanism (where applicable)

3.12 Metalworking fluid systems**3.12.1****recirculating system**

metalworking fluid system with collection and pumped recirculation of the fluid

3.12.2**minimum quantity system**

system where a small volume of the fluid is supplied to the saw blade; no circulation of the fluid is required due to the small consumption

3.13**metalworking fluid**

fluid to cool and lubricate the sawing process (e.g. oil, oil mist, alcohol, mixture of oil and water)

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 sawing 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, 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

a	Hazard	Examples of hazardous situation/activity	Danger zone(s)
1	Mechanical hazards (for safety requirements, see 5.3, 5.4, 5.5)		
1.1	Crushing hazard	Power-operated work material clamping during loading/re-orientating/ unloading work material	Between clamps and work material
		Power-operated in feed during running, sawing, machine setting, saw blade changing, maintenance, repair	Between material and work support; between fixed and moving parts of the machine
1.2	Shearing hazard	Power-operated and manual work material feeding during loading, unloading, machine setting, saw blade fitting	Between saw blade and work support; work material and work support
1.3	Cutting or severing hazard	Moving saw blade during operation, machine setting, saw blade changing, maintenance, repair	At the saw blade
1.4	Entanglement hazard	Power-operated and manual saw blade feed during operation	At the saw blade and adjacent stationary parts of machine. Between saw blade cleaning device and saw blade
		Machine elements in powered motion (e.g. power transmission elements).	At moving machine elements
1.5	Drawing-in or trapping hazard	Power-operated and manual work material feeding or moving saw blade during operation	At work material and infeed mechanism and adjacent parts of machine
		Machine elements in powered motion (e.g. power transmission elements).	At load/unload and operating positions and near sawing zones.
1.6	Impact hazard	Power-operated work handling during operation, machine setting, saw blade fitting Gravity fall	Machine elements in powered motion (e.g. hack saw during operation) At work material and work handling mechanisms
1.7	Stabbing or puncture hazard	Handling saw blade(s)	At saw blade (especially during changing)
2	Electrical hazards (for safety requirements, see 5.6)		
2.1	Direct electrical contact	Contact with live parts during operation, machine setting, saw blade changing, and maintenance.	Control and other electrical equipment.
2.2	Contact of persons with parts which have become live under fault	During fault conditions.	Conductive parts of the machine
3	Thermal hazards (for safety requirements, see 5.7)		
3.1	Contact with hot surfaces	Ejection of hot swarf or work pieces during sawing	At and/or near machine, saw blade and cut surfaces of the work piece

4	Hazards generated by noise (for safety requirements, see 5.8)		
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	– Saw blade and work material vibration, – Aerodynamic noise from saw blade, – Work material handling, – The power generation and transmission elements,	At and/or near machine.
4.2	Interference with speech communication, acoustical signals	During running or sawing.	
5	Hazards generated by vibration (for safety requirements, see 5.9)		
5.1	Contact of persons with vibrating machine manual controls or work material	Work material or handle held by operator. (feeding or damping vibration) during running or sawing.	At work material. At machine manual controls
7	Hazards generated by materials and substances processed, used or exhausted (for safety requirements, see 5.10)		
7.1	Hazards from contact,	Skin contact with harmful materials	At and/or near machine
	inhalation, or ingestion of harmful substances	Inhalation and ingestion of substances (e.g. metalworking fluid) used or generated during operation.	At and/or near machine
	(fluids, mists, gases, fumes, dust)	Ejection of dust, mist and fumes during operation.	At and/or near machine
7.2	Fire or explosion hazard	– Flammable work material (e.g. magnesium). – Loss of cooling fluid supply to sawing.	At and/or near machine
7.3	Biological and microbiological (viral or bacterial) hazard	Contact with contaminated fluids or work material.	At and/or near machine
8	Hazards generated by neglecting ergonomic principles (for safety requirements, see 5.11)		
8.1	Unhealthy postures or excessive effort (repetitive strain)	Feeding work material by hand into saw blade during running, sawing.	At the saw blade
	Excessive efforts, and/or repetitive strain.	Lifting and reaching while handling work material, saw blades and/or machine parts.	At load/unload and saw blade mounting positions and maintenance action points
8.2	Inadequate consideration of hand–arm anatomy	Operating manual machines.	At operating position while working
8.3	Neglected use of personal protection equipment	Handling of work material, saw blades, machine assemblies during loading, unloading, sawing, machine fitting, maintenance, repair.	At machine, saw blade(s) and metalworking fluid

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8.4	Inadequate local lighting.	Judgement and accuracy of manual actions impaired during handling/positioning of work material and saw blades. During loading and unloading, during machine setting, saw blade changing, and maintenance.	At load/unload and saw blade mounting positions
8.6	Human errors, human behaviour	Reasonably foreseeable misuse. Inadvertent operation of controls. Incorrect work material and saw blade handling and setting. During loading, unloading, sawing, machine setting, saw blade changing, maintenance	At machine.
8.7	Hazards caused by inadequate design, location, or identification of manual controls	Unsuitable location and selection of manual controls (e.g. starting, stopping, cooling fluid control devices) during operation, machine setting, saw blade changing, maintenance.	At machine.
8.8	Inadequate design, location of visual display units	Misinterpretation of displayed information	At machine
10	Unexpected start-up, unexpected overrun/ overspeed (for safety requirements, see 5.12)		
10.1	Failure/disorder of the control system	during setting, cleaning	At machine
10.2	Restoration of energy supply after an interruption	during setting, cleaning or maintenance	At or near machine
10.3	External influences on the electrical equipment	during setting or operating cycle of the machine	At or near machine
11	Impossibility of stopping the machine in the best possible conditions (for safety requirements, see 5.3.3.4)	Failure of malfunction of control system during setting or operating cycle of the machine	At or near machine
15	Errors of fitting (for safety requirements, see 5.13)	Saw blade or part of saw blade ejected during running.	At and/or near machine
17	Falling or ejected objects or fluids (for safety requirements, see 5.14)	Ejection or fall of parts of work material and swarf. during running, sawing, machine setting, saw blade changing, maintenance	At and/or near sawing zone and work material
		Saw blade break or saw blade teeth stripping and ejection. Pressurised fluid system line ruptures. Ejected broken machine part(s).	At and/or near machine
18	Loss of stability (for safety requirements, see 5.15)	Unrestrained machine or machine part falls or overturns.	At machine

19	Slip, trip and fall hazards (for safety requirements, see 5.16)	Ejection or spillage of metalworking fluid, lubricants and hydraulic fluid. Swarf and detritus entrained in spilled fluids. Inadequate railing (edge protection) or other restraint means particularly where there is a risk of falling from one level to another	Floor and stepping areas on and around machine and work material
^a The numbers in the left hand column above correspond with the table in annex A of EN 1050:1996 and the methods of safeguarding for the danger zones identified are given in clause 5.			

5 Safety requirements and/or protective measures

5.1 General

Sawing machines shall comply with the safety requirements and/or protective measures of this clause.

In addition, sawing machines shall be designed according to the principles of EN 292 for hazards relevant but not significant which are not dealt with by this standard. For guidance on risk reduction by design see clause 3 of EN 292-2:1991, and for safeguarding measures see clause 4 of EN 292-2:1991.

5.2 Machine type-specific clauses

Since this standard addresses various types of sawing machines, Tables 2, 3, 4 and 5 provide the relationship between these types of machines and the specific safety clauses to be implemented for mechanical hazards (see 5.3 - 5.5). Risk reduction requirements for non mechanical hazards shall also be applied to all machines (5.6 to 5.16). The requirements of Table 2 shall be applied to all machines.

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