BS EN 1870-9:2012

BSI Standards Publication

Safety of woodworking machines — Circular sawing machines

Part 9: Double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 1870-9:2012. It supersedes BS EN 1870-9:2000+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MTE/23, Woodworking machines.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 72426 8

ICS 79.120.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 September 2012.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1870-9

September 2012

ICS 79.120.10

Supersedes EN 1870-9:2000+A1:2009

English Version

Safety of woodworking machines - Circular sawing machines - Part 9: Double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading

Sécurité des machines pour le travail du bois - Machines à scies circulaires - Partie 9: Machines à scier à deux lames de scie circulaires pour tronçonnage, à avance mécanisée et à chargement et/ou déchargement manuels

Sicherheit von Holzbearbeitungsmaschinen - Kreissägemaschinen - Teil 9: Doppelgehrungskreissägemaschinen mit mechanischem Vorschub und Handbeschickung und/oder Handentnahme

This European Standard was approved by CEN on 13 July 2012.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 1870-9:2012) has been prepared by Technical Committee CEN/TC 142 “Woodworking mchines - Safety”, the secretariat of which is held by UNI.

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 2013, and conflicting national standards shall be withdrawn at the latest by March 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1870-9:2000+A1:2009.

The main modifications to the previous version concern inclusion of performance levels (PL).

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 the Machinery Directive.

For relationship with EU Directive 2006/42/EC, see informative Annex ZA, which is an integral part of this document.

Organisations contributing to the preparation of this document include European Committee of Woodworking Machinery Manufacturers Association "EUMABOIS".

EN 1870, *Safety of woodworking machines — Circular sawing machines,* consists of the following parts:

— *Part 1: Circular saw benches (with and without sliding table), dimension saws and building site saws*

— *Part 3: Down cutting cross-cut saws and dual purpose down cutting cross-cut saws/circular saw benches*

— *Part 4: Multi-blade rip sawing machines with manual loading and/or unloading*

— *Part 5: Circular saw benches/up-cutting cross-cut sawing machines*

— *Part 6: Circular sawing machines for firewood and dual purpose circular sawing machines for firewood/circular saw benches, with manual loading and/or unloading*

— *Part 7: Single blade log sawing machines with integrated feed table and manual loading and/or unloading*

— *Part 8: Single blade edging circular rip sawing machines with power driven saw unit and manual loading and/or unloading*

— *Part 9: Double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading* (the present document)

— *Part 10: Single blade automatic and semi-automatic up-cutting cross-cut sawing machines*

— *Part 11: Semi-automatic and automatic horizontal cross-cut sawing machines with one saw unit (radial arm saws)*

— *Part 12: Pendulum cross-cut sawing machines*

— *Part 13: Horizontal beam panel sawing machines*

— *Part 14: Vertical panel sawing machines*

— *Part 15: Multi-blade cross-cut sawing machines with integrated feed of the workpiece and manual loading and/or unloading*

— *Part 16: Double mitre sawing machines for V-cutting*

— *Part 17: Manual horizontal cutting cross-cut sawing machines with one saw unit (manual radial arm saws)*

— *Part 18: Dimension saws*

— *Part 19: Circular saw benches (with and without sliding table) and building site saws*

The European Standards produced by CEN/TC 142 are particular to woodworking machines and complement the relevant A and B Standards on the subject of general safety (see introduction of EN ISO 12100:2010 for a description of A, B and C standards).

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document has been prepared to be a harmonised standard to provide one means of conforming to the essential safety requirements of the Machinery Directive, and associated EFTA regulations. This document is a type C standard as defined in EN ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered is indicated in the scope of this document.

The requirements of this document are directed to manufacturers and their authorised representatives of double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading. This document is also useful for designers and importers.

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 over the provisions of other standards, for machines that have been designed and built according to the provisions of this type C standard. This document also includes information to be provided by the manufacturer to the user.

Common requirements for tooling are given in EN 847-1:2005+A1:2007.

1 Scope

This European Standard deals with all significant hazards, hazardous situations and events as listed in Clause 4 which are relevant to double blade circular sawing machines for cross-cutting with integrated feed of the saw units and with manual loading and/or unloading, hereinafter referred to as 'machines'. These are machines designed to cut solid wood, chipboard, fibreboard and plywood, and also these materials when covered with plastic edging and/or plastic/light alloy laminate, when they are used as intended and under the conditions foreseen by the manufacturer including reasonably foreseeable misuse.

This document does not apply to:

— machines for cross cutting logs;

— double blade up-cutting cross-cut sawing machines.

This document is not applicable to machines which are manufactured before its date of publication as an EN.

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.

EN 574:1996+A1:2008, *Safety of machinery — Two hand control devices — Functional aspects — Principles for design*

EN 614-1:2006+A1:2009, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 847-1:2005+A1:2007, *Tools for woodworking — Safety requirements — Part 1: Milling tools*, *circular saw blades*

EN 894-1:1997+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2:1997+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3:2000+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 1005-1:2001+A1:2008, *Safety of machinery — Human physical performance — Part 1: Terms and definitions*

EN 1005-2:2003+A1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1005-3:2002+A1:2008, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

EN 1005-4:2005+A1:2008, *Safety of machinery — Human physical performance — Part 4: Evaluation of working postures and movements in relation to machinery*

EN 1037:1995+A1:2008, *Safety of machinery — Prevention of unexpected start-up*

EN 1088:1995+A2:2008, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1760-1:1997+A1:2009, *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 1760-2:2001+A1:2009, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989*[1)]

EN 60825-1:2007, *Safety of laser products — Part 1: Equipment classification and requirements (IEC 60825-1:2007)*

EN 61310-1:2008, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

CLC/TS 61496-2:2006, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs) (IEC 61496-2:2006)*

EN 61800-5-2:2007, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional (IEC 61800-5-2:2007)*

EN ISO 3743-1:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for small, movable sources in reverberant fields — Part 1: Comparison method for a hard-walled test room (ISO 3743-1:2010)*

EN ISO 3743-2:2009, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering methods for small, movable sources in reverberant fields — Part 2: Methods for special reverberation test rooms (ISO 3743-2:1994)*

EN 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 3744:2010)*

EN ISO 3745:2009, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for anechoic and hemi-anechoic rooms (ISO 3745:2003)*[2)]

EN 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 3746:2010)*

EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

1) EN 60529:1991 is impacted by EN 60529:1991/A1:2000.

2) EN ISO 3745:2009 has been replaced by EN ISO 3745:2012.

EN ISO 9614-1:2009, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points (ISO 9614-1:1993)*

EN ISO 11202:2010, *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 11202:2010)*

EN 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 11204:2010)*

EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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

EN ISO 13849-1:2008*, Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

ISO 7960:1995, *Airborne noise emitted by machine tools — Operating conditions for woodworking machines*

3 Terms and definitions

3.1 General

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

3.2 Definitions

3.2.1
cross-cutting
operation of cutting across the grain of a wooden workpiece

3.2.2
double blade circular sawing machine for cross-cutting with integrated feed and with manual loading and/or unloading
machine fitted with two sawing units for cross-cutting, which has integrated feed and the workpiece is manually loaded and/or unloaded and stationary during cutting

Note 1 to entry: The cutting stroke can be downwards or horizontal. One or both sawing units can be adjusted horizontally and may be canted and/or pivoted.

3.2.3
semi-automatic double blade circular sawing machine for cross-cutting
machine where the saw units have integrated feed which is initiated manually and the workpiece is positioned manually or by means of a positioning mechanism for cutting to length

Note 1 to entry: The cutting stroke can be downwards or horizontal.

3.2.4
automatic double blade circular sawing machine for cross-cutting
machine where the saw units have integrated feed which is initiated automatically and where the workpiece is manually loaded and/or unloaded and automatically positioned for cutting to pre-selected lengths

Note 1 to entry: The cutting stroke can be downwards or horizontal.

3.2.5
machine actuator
power mechanism used to effect motion of the machine

3.2.6
integrated feed
feed mechanism for the workpiece or tool which is integrated with the machine and where the workpiece or machine element with incorporated tool are held and controlled mechanically during machining operation

3.2.7
cutting area of the saw blade
area of the saw blade which can be involved in the cutting process

3.2.8
non-cutting area of the saw blade
area of the saw blade where the saw blade is not be involved in the cutting process

3.2.9
ejection
unexpected movement of the workpiece or parts of it or part of the machine from the machine during processing

3.2.10
run-down time
time elapsed from the actuation of the stop control device up to spindle standstill

3.2.11
run-up time
time elapsed from the actuation of the start control device until the spindle reaches the intended speed

3.2.12
manual loading of power fed machines
operation during which the workpiece is presented by the operator directly to the machine integrated feed, e.g. rotating feed rollers, travelling table or reciprocating carriage; i.e. for which there is no intermediate loading device to receive and transfer the workpiece from the operator to the integrated feed

3.2.13
manual unloading of power fed machines
operation during which the workpiece is removed by the operator directly from the machine outfeed; i.e. there is no intermediate unloading device to receive and transfer the workpiece from the machine outfeed to the operator

3.2.14
information from the supplier
statements, sales literature, leaflets or other, where a manufacturer (supplier) declares either the characteristics or the compliance of the material or product to a relevant standard

3.2.15
performance level (PL)
discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

[SOURCE: EN ISO 13849-1:2008, 3.1.23]

4 List of significant hazards

This clause contains all significant hazards, hazardous situations and events (see EN ISO 12100:2010), identified by risk assessment as significant for the machines as defined in the scope and which require action to eliminate or reduce the risk. This document deals with these significant hazards by defining safety requirements and/or measures or by making reference to relevant standards.

These hazards are listed in Table 1.

Table 1 — List of significant hazards

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant sub-clause of this document
1	**Mechanical hazards** related to: - machine parts or workpieces:		
	a) shape	6.2.2.1, 6.2.2.2, 6.3	5.3.3, 5.3.7, 5.3.8
	b) relative location		5.2.2, 5.2.3, 5.3.6, 5.3.7, 5.3.8
	d) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)		5.3.7
	e) mechanical strength		5.3.2, 5.3.3, 5.3.6
	- accumulation of energy inside the machinery:		
	g) liquids and gases under pressure	6.2.10, 6.3.5.4	5.4.7, 5.4.8
1.1	Crushing hazard		5.3.7, 5.3.8
1.2	Shearing hazard		5.3.7, 5.3.8
1.3	Cutting or severing hazard		5.3.2, 5.3.3, 5.3.7,
1.4	Entanglement hazard		5.3.7
1.5	Drawing-in or trapping hazard		5.3.7
1.9	High pressure fluid injection or ejection hazard	6.2.10	5.4.7, 5.4.8
2	**Electrical hazards** due to:		
2.1	Contact of persons with live parts (direct contact)	6.2.9, 6.3.5.4	5.4.4, 5.4.11, 5.4.12
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	6.2.9	5.4.4, 5.4.11, 5.4.12
4	**Hazards generated by noise**, resulting in:		
4.1	Hearing loss (deafness), other physiological disorders (loss of balance, loss of awareness)	6.2.2.2, 6.3	5.4.2
4.2	Interference with speech communication, acoustic signals.		5.4.2
6	**Hazards generated by radiation**		
6.5	Lasers	6.3.4.5	5.4.9

Table 1 *(2 of 2)*

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant sub-clause of this document
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 and dusts	6.2.3, 6.2.4	5.4.3
7.2	Fire hazard	6.2.4	5.4.1, 5.4.3
8	**Hazards generated by neglecting ergonomic principles in machinery design** related to:		
8.1	Unhealthy postures or excessive effort	6.2.7, 6.2.8, 6.2.11.12, 6.3.5.5, 6.3.5.6	5.2.2
8.2	Hand-arm or foot-leg anatomy	6.2.8.3	5.2.2
8.4	Local lighting	6.2.8.6	6.4
8.6	Human error, human behaviour	6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4	6.4
8.7	Design, location or identification of manual controls	6.2.8.7, 6.2.11.8	5.2.2
8.8	Design or location of visual display units	6.2.8.8, 6.4.2	5.2.2
9	**Combination of hazards**	6.3.2.1	5.2.6
10	**Unexpected start up, unexpected overrun/overspeed** (or any similar malfunction) from:		
10.1	Failure/disorder of the control system	6.2.11, 6.3.5.4	5.2.1
10.2	Restoration of energy supply after an interruption	6.2.11.4	5.2.7, 5.2.8, 5.4.7, 5.4.8
10.3	External influences on electrical equipment	6.2.11.11	5.2.1, 5.4.4
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4	5.2.1, 5.4.5, 6.4
11	**Impossibility of stopping the machine in the best possible conditions**	6.2.11.1, 6.2.11.3, 6.3.5.2	5.2.2, 5.2.4, 5.2.5
13	**Failure of the power supply**	6.2.11.1, 6.2.11.4	5.2.7
14	**Failure of the control system**	6.2.11, 6.3.5.4	5.2.1
15	**Errors of fitting**	6.2.7, 6.4.5	5.3.3
16	**Break-up during operation**	6.2.3	5.3.2
17	**Falling or ejected objects or fluids**	6.2.3, 6.2.10	5.3.2, 5.3.3, 5.3.5, 5.3.6, 5.3.8
18	**Loss of stability/overturning of machinery**	6.3.2.6	5.3.1

5 Safety requirements and/or measures

5.1 General

The machine shall comply with the safety requirements and/or protective measures of Clause 5.

In addition, the machine should be designed according to the principles of EN ISO 12100:2010 for hazards relevant but not significant, which are not dealt with by this document (e.g. sharp edges of the machine frame).

NOTE For guidance in connection with risk reduction by design see EN ISO 12100:2010, 6.2 and for safeguarding measures see EN ISO 12100:2010, 6.3.

5.2 Controls

5.2.1 Safety and reliability of control systems

5.2.1.1 General

For the purpose of this document, the safety-related part of a control system means the system from the initial device, e.g. push button or position detector or sensor, up to and including the power control element of the final machine actuator or element, e.g. motor or brake. Safety related parts of the control system of this machine comprise parts concerning the following functions and the required performance level according to EN ISO 13849-1:2008 shall be fulfilled for each function:

— starting and restarting: PL=c (see 5.2.3);

— normal stopping: PL=c (see 5.2.4);

— emergency stop: PL=c (see 5.2.5);

— interlocking; PL=c (see 5.2.3, 5.3.7.2, 5.3.7.6);

— interlocking with guard locking: PL=c (see 5.3.7.1, 5.3.7.2, 5.3.7.4, 5.3.7.6);

— clamping: PL=c (see 5.3.8);

— the braking system: PL=b or PL=c (see 5.3.4);

— two-hand control: PL=c (see 5.3.7.1);

— hold to run control: PL=c (see 5.3.7.3);

— control systems associated with interlocking of the positioning of the workpiece or of the integrated feed of the saw unit: PL=c (see 5.2.3, 5.2.4, 5.2.5);

— pressure sensitive mats: PL=c (see 5.2.3, 5.3.7.1, 5.3.7.2, 5.3.7.3, 5.3.7.4, 5.3.7.5);

— active opto-electronic protective devices: PL=c (see 5.2.3, 5.3.7.1, 5.3.7.2, 5.3.7.3, 5.3.7.4, 5.3.7.5);

— pressure sensitive edges (bumper) and pressure sensitive bars (trip bar): PL=c (see 5.3.7.3, 5.3.7.4).

For all components exposed to environmental conditions, e.g. dust, fumes and/or gases, these conditions shall be taken into account.

Verification: By checking the relevant drawings and/or circuit diagrams and inspection of the machine.

NOTE For components characteristics, the information from the component supplier can be useful.

5.2.1.2 Use of protective devices

Protective devices shall be in accordance with the specific standards. For the devices listed below, the following requirements apply:

a) magnetic/proximity switches shall be in accordance with the requirements of EN 1088:1995+A2:2008, 6.2 and the related control system shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008;

b) if a time delay is used it shall be of fail safe technique e.g. of capacity type conforming to the requirements of at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection of the machine, measurement and relevant functional testing of the machine.

NOTE For the components characteristics, a confirmation from the components' manufacturers can be useful.

5.2.2 Position of controls

Hand-operated control devices for start and stop of the motor for the saw spindles, emergency stop, integrated feed, reset controls and hold-to run shall be located in an area between 600 mm and 1700 mm above the floor level.

NOTE For electric control devices, see also EN 60204-1:2006, 10.1.1.

Where the machine is fitted with a two-hand control device, it shall be:

a) situated at the front of the machine;

b) below the workpiece support;

c) at a minimum height above floor level of 750 mm;

d) such that where the maximum distance between the saw units is ≥ 2,5 m it is capable of being located centrally between the saw units ± 300 mm for each adjusted position and not less than 300 mm from the closest position of a saw blade.

Where the control for the clamps is separate from the two hand control it shall be within 400 mm measured horizontally to the two hand control.

According to the size of machine, one or more emergency stops (see 5.2.5) shall be positioned:

1) within 1,0 m of the loading position;

2) within 1,0 m of the unloading position;

3) at the main control panel;

4) within 500 mm of the two hand control (where provided);

5) within 3,0 m of the saw unit.

Verification: By checking the relevant drawings, inspection, measurement and relevant functional testing on the machine.

5.2.3 Starting

The requirements of EN ISO 12100:2010, 6.2.11 and EN 60204-1:2006, 9.2.5.2 apply in addition to the following:

a) Before start-up (starting) or restarting of the machine all relevant safeguards shall be in place and functional.

NOTE For the purpose of this document "all the relevant safeguards in place and functional" is achieved by the interlocking arrangements described in 5.3.7 and 5.3.8 and "operation" means rotation and/or powered adjustment of any saw spindle and/or powered movement of any workpiece holding and feeding device and/or any machine element in which a saw blade is mounted.

b) Start or restart shall only be possible by actuation of the start control device provided for that purpose.

c) The closure of movable interlocked guards shall not lead to an automatic restart of hazardous movements.

d) The exceptions described in EN 60204-1:2006, 9.2.5.2 are not relevant.

e) For semi-automatic machines, the cutting stroke shall only be capable of being started with a manually operated control device after saw blade rotation and clamping have been initiated.

f) For all machines, the cutting stroke shall only be capable of being started after saw blade rotation and clamping have been initiated and when:

   1) all interlocked guards are in the closed position;

   2) no person is standing on pressure sensitive mats (where provided);

   3) no person is within the beams of an active opto-electronic protective device (where provided).

g) All start and/or reset controls shall be located outside protected areas and not reachable when standing inside a protected area.

h) The safety related part of the control systems (also see 5.2.1) for starting and the interlocking arrangements shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing of the machine.

5.2.4 Normal stopping

Machines shall be fitted with a stop control system which, when actuated, shall disconnect power from all the machine actuators unless STO according to EN 61800-5-2:2007 is used, and actuate the brake (if provided).

For normal stopping of PDS(SR) (power drive system, safety related) see EN 61800-5-2:2007, 4.2.2.2 "safe torque off (STO)" and 4.2.2.3 "safe stop 1 (SS1)".

When initiated, the stopping sequence shall be:

a) initiate the return stroke of the saw unit(s);

b) cut power to saw spindle drive motors and initiate the brakes (if provided);

c) when braking sequence is complete, cut power to the brakes (if electrical brake is provided);

d) remove power to the workpiece clamping device.

The stopping sequence shall be satisfied at the level of the control system. If a time delay device is used, time delay shall conform to 5.2.1.2 b) and be at least the maximum run-down time. Either the time delay shall be fixed, or, the time delay adjustment device shall be sealed.

The safety related part of the control system (also see 5.2.1) for normal stopping shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing on the machine.

5.2.5 Emergency stop

The requirements of EN ISO 13850:2008 apply in addition to the following:

a) The machine shall be fitted with emergency stop control devices, which when actuated shall stop all machine actuators. The emergency stop control device shall be at any time of self latching type. On electric driven machines, the emergency stop control system shall conform to EN 60204-1:2006, 9.2.5.4 and 10.7. EN 60204-1:2006, 10.7.4 however does not apply. When actuated, the emergency stop shall include disconnection from energy supply to all actuators unless STO according to EN 61800-5-2:2007 is used and shall actuate the brake (if provided).For emergency stop of PDS(SR) see EN 61800-5-2:2007, 4.2.2.2 "safe torque off (STO)" and 4.2.2.3 "safe stop 1 (SS1)".

b) When initiated the stopping sequence shall be according to 5.2.4.

c) The safety-related part of the control system (see also 5.2.1) for the emergency stop and interlocking arrangement shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing on the machine.

5.2.6 Failure of the power supply

In the case of supply interruption automatic restart of the machine shall be prevented and parameters affecting safety functions of the machine shall not change in an uncontrolled way after restoration of the supply wherever this may result in a hazard.

For electric supply, see EN 60204-1:2006, 7.5, paragraphs one and three.

The requirements of EN 1037:1995+A1:2008, Clause 6 apply in addition to the following:

a) In the event of loss of pneumatic or hydraulic pressure, clamping of the work piece shall be maintained until the return stroke of the saw blade(s) is initiated. Where non-return valves are used to meet this requirement, they shall be fitted directly to the actuating cylinders.

b) Where the machine is fitted with pneumatic and/or hydraulic actuators, the restoration of the energy supply shall not result in a restart of any machine actuator.

c) The control system to prevent automatic restart shall be designed to achieve at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing on the machine.

5.3 Protection against mechanical hazards

5.3.1 Stability

Machines shall be equipped with the facility to fix the machine to the floor or other stable structure, e.g. by providing holes in the machine frame.

Verification: By checking the relevant drawings and inspection of the machine.

5.3.2 Risk of break-up during operation

The guards for the saw blades shall be manufactured from either:

a) steel, having an ultimate tensile strength of at least 350 N mm^{-2} and a wall thickness of at least 1,5 mm; or

b) light alloy with characteristics in accordance with the requirements of Table 2; or

Table 2 — Characteristics of light alloy saw blade guards

Ultimate tensile strength N mm^{-2}	Minimum thickness mm
180	5
240	4
300	3

c) polycarbonate with a wall thickness of at least 3 mm or other plastic material passing the test in Annex C; or

d) cast iron with an ultimate tensile strength of at least 200 N mm^{-2} and a wall thickness of at least 5 mm.

Verification: By checking the relevant drawings, measurement, for materials with characteristics other than those given for polycarbonate in c) above, by performing the test in Annex C and inspection on the machine.

NOTE For the ultimate tensile strength, a confirmation from the manufacturer of the material can be useful.

5.3.3 Tool holder and tool design

5.3.3.1 Saw spindle design

Saw spindles shall be manufactured in accordance with the tolerances given in Annex A.

The saw blade spindle shall be manufactured from steel with a minimum ultimate tensile strength of 580 N mm^{-2}.

Verification: By checking the relevant drawings, inspection, measurement and relevant functional testing of the machine.

NOTE For the ultimate tensile strength, a confirmation from the manufacturer of the material can be useful.

5.3.3.2 Spindle locking

When it is necessary to hold a spindle stationary for saw blade changing, a spindle holding device shall be provided. This may for example be a double spanner arrangement, or an integral locking bar to each saw unit

to be inserted through the spindles. These bars shall have a minimum diameter of 8 mm and be made from steel with an ultimate tensile strength of at least 350 N mm^{-2}.

Locking bars shall prevent spindles from rotating if a spindle drive motor is inadvertently switched on.

Verification: By checking the relevant drawings, inspection, measurement and relevant functional testing of the machine. Alternatively on machines with locking bars, by the following test: after starting the spindle drive motor and with the locking bar in place, the spindle shall remain stationary.

NOTE For the ultimate tensile strength, a confirmation from the manufacturer of the material can be useful.

5.3.3.3 Saw blade fixing device

Saw flanges (or in the case of flush mounted saw blades - a flange) shall be provided.

For saw blades up to 450 mm diameter, the diameter of both flanges (or flange for flush mounting) shall be at least *D*/4 (where *D* = the diameter of the largest saw blade for which the machine is designed).

For saw blades with a diameter greater than 450 mm, the diameter of the flanges (or flange for flush mounting) shall be at least *D*/6, but not less than 115 mm.

For flanges other than those for flush mounted saw blades, the clamping surface at the outside part of flange shall be at least 5 mm in width and recessed to the centre (see Figure 1).

Where two flanges for each saw spindle are provided, both outside diameters shall be within a tolerance of ± 1 mm.

Precautions shall be taken to ensure that the saw blades do not come loose during start-up, running, run-down or braking, e.g. by using a positive connection between the spindle and the saw blade, or by using a positive connection between the front flange and the saw spindle.

The flanges shall be manufactured from steel with an ultimate tensile strength of 350 N mm^{-2}.

Verification: By checking the relevant drawings, measurement and inspection of the machine.

NOTE For the ultimate tensile strength, a confirmation from the manufacturer of the material can be useful.

Dimensions in millimetres

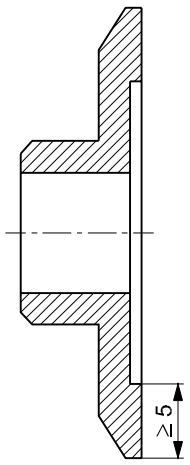


Figure 1 — Saw flange detail at the clamping surface

5.3.4 Braking

An automatic brake shall be provided for the saw spindles.

The braked run-down time shall be less than 10 s.

On electrical brakes in the case of failure of electrical power supply, this run-down time may be exceeded.

The braking torque shall not be applied directly to the saw blade itself or to the saw blade flange(s).

A PL of at least c for the braking function shall be achieved.

Where a spring operated mechanical brake or any other type of brake not using electronic components is fitted, the last paragraph of EN 60204-1:2006, 9.3.4 does not apply (see 6.4 w)).

Reverse current electrical braking shall not be used.

The following exception applies. Where an electrical brake with electronic control system is fitted, its control system shall be designed

— as a minimum in PL=b in accordance with the requirements of EN ISO 13849-1:2008, and

— in category 2 in accordance with the requirements of EN ISO 13849-1:2008,

with the exception that the test rate requirement in EN ISO 13849-1:2008, 4.5.4 is not applicable. The safety related part of the control system for braking shall be tested periodically, e.g. by monitoring braked run down time. The feed back shall come from either the encoder fitted to the spindle motor or from the measurement of the residual current in the wires powering the motor.

The test shall:

a) be independent from the basic control system for braking or an internal watch dog shall be provided in the control system for braking;

b) be independent from the intention of the operator;

c) be performed at each spindle stop.

Where the test result is negative more than three times in succession, it shall not be possible to operate the machine. A negative test result shall be indicated.

The diagnostic coverage (DC_{avg}) shall be ≥ 60 %. See EN ISO 13849-1:2008, Annex E.

The following exception applies. A simple electronic brake (using simple electronic parts like rectifiers, transistors, triacs, diodes, resistors, thyristors) may be PL=b and designed in category 1 in accordance with the requirements of EN ISO 13849-1:2008 if the “mean time to a dangerous failure” (MTTFd) according to EN ISO 13849-1:2008, Table 5 reaches a value of “high” (at least 30 years).

NOTE Complex electronic components such as microprocessors or PLCs cannot be considered as well tried under the scope of EN ISO 13849-1:2008 and do therefore not fulfil the requirements of category 1.

For calculating the probability of a dangerous failure (PFH) for a simple electronic brake component with no fault detection (no DC) and no testing capability (category 1), the procedure described in EN ISO 13849-1:2008, Annex D can be used.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection of the machine and relevant functional testing of the machine. For the determination of un-braked run-down time and braked run-down time, if relevant, the appropriate tests given in Annex B apply.

5.3.5 Devices to minimise the possibility or the effect of ejection

See 5.3.6.1, 5.3.6.2, 5.3.7.1 and 5.3.8.

5.3.6 Workpiece supports and guides

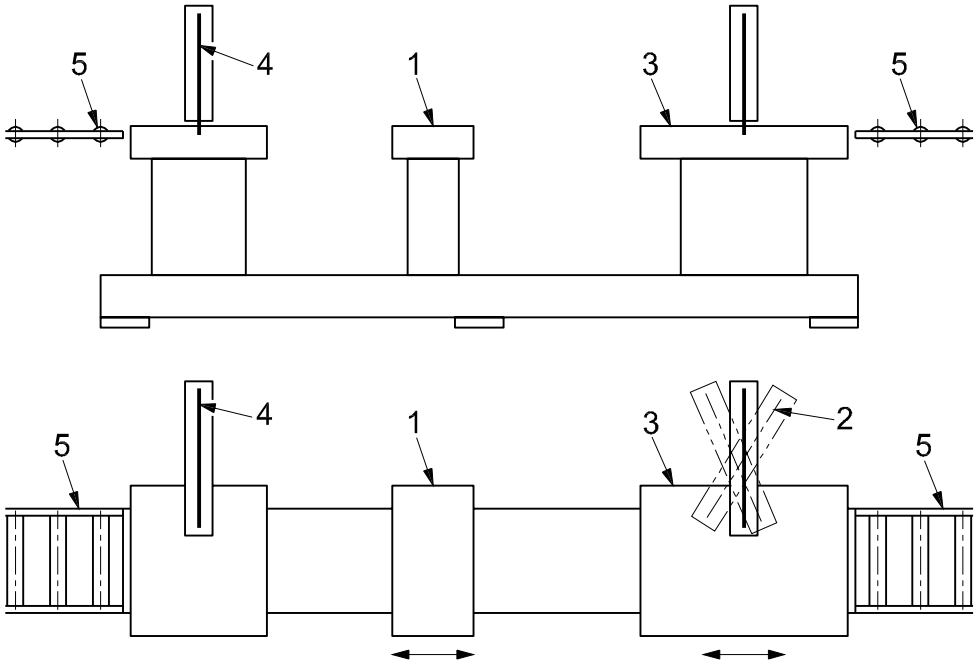
5.3.6.1 Workpiece supports

Each saw unit shall be fitted with a workpiece support on each side of the cutting line taking into account the ability of the saw unit to cant or pivot for angled cutting (see Figure 2).

An additional centre workpiece support between the two saw units shall be fitted where the maximum distance between the workpiece supports of the saw units exceeds 2 m (see Figure 2).

If there is a possibility of contact between a workpiece support and a saw blade, this part of the workpiece support shall be made of wood, wood-based material, light alloy or plastic.

Verification: By checking the relevant drawings, inspection, measurement and relevant functional testing on the machine.



Key

1 adjustable centre support
2 pivoting adjustment (when provided)
3 adjustable saw unit
4 saw blade
5 roller table (option)

Figure 2 — Workpiece supports

5.3.6.2 Workpiece guides

Each saw unit shall be provided with a fence on both sides of each saw line.

If there is a possibility of contact between the fence and the saw blade, this part of the fence shall be made of wood, wood-based material, light alloy or plastic.

Verification: By checking the relevant drawings, measurement, inspection and relevant functional testing on the machine.

5.3.7 Prevention of access to moving parts

5.3.7.1 Guarding of the saw blades on down-cutting machines

The non-cutting area of the saw blades shall be guarded with a fixed guard to the lowest point on the periphery of the saw flange.

If the fixed guards are to be demounted by the user e.g. for maintenance or cleaning purposes, their fixing systems shall remain attached to the guards or to the machinery when the guards are removed, e.g. with un-losable screws (see 6.4 p)).

Where access is required for saw blade changing, the access component shall either be a fixed guard or a movable interlocked guard interlocked with the spindle drive motor. Otherwise a fixed guard shall be provided which shall only be capable of opening with the aid of a tool and shall remain integral with the machine when open, e.g. hinged. The guard shall not remain in place without its fixing.

Access to the saw blades in the cutting area shall be prevented by either:

a) a self-closing guard on both sides of the saw teeth which extends beyond the periphery of the saw blade (see Figure 3a)) in accordance with the dimensions given in Figure 4a) and which opens when it makes contact with the workpiece or the fence. The guard shall lie on the workpiece or the fence during cutting to afford maximum protection; or

b) a self-closing guard which covers at least the periphery of the saw blade and both sides of the saw teeth (see Figures 3a) and 3b)) in accordance with the dimensions in Figure 4b). This guard shall be completely closed in the rest position and shall progressively open and be fully open when the saw blade is at its lowest position for which the machine is designed.

Both types of guard shall be locked in the fully closed position when the saw unit is in the rest position and shall permit the changing of the saw blade without removing the guard from the machine.

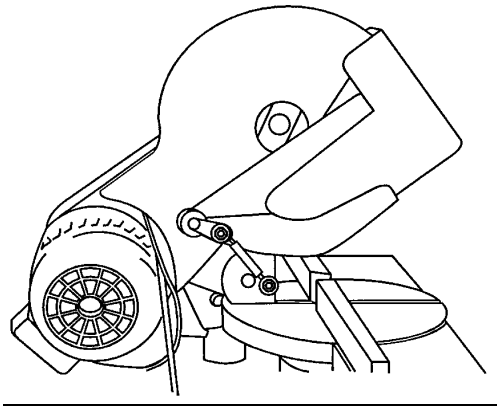


Figure 3 a) — Self closing guard in accordance with the requirements of 5.3.7.1a)

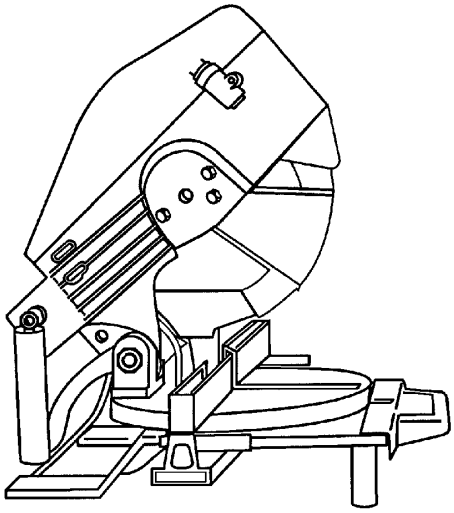


Figure 3 b) — Self closing guard in accordance with the requirements of 5.3.7.1b)

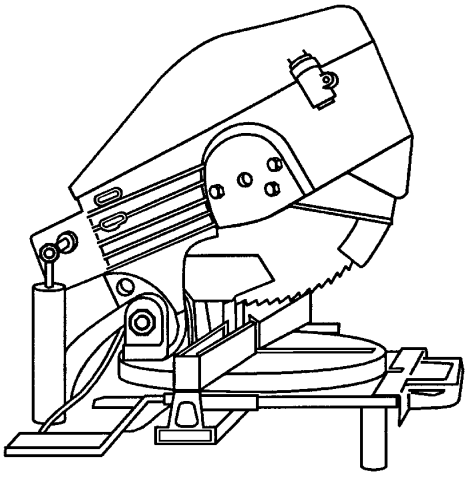
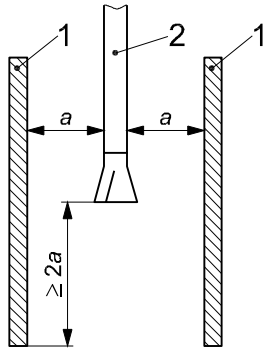


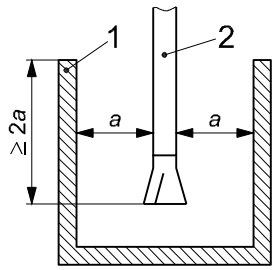
Figure 3 c) — Guard lowered and partially open

Figure 3 — Guarding the cutting area of the saw blade



a)

Figure 4 a) — Guard in accordance with the requirements of 5.3.7.1 a)



b)

Figure 4 b) — Guard in accordance with the requirements of 5.3.7.1 b)

Key

1 guard

2 saw blade

Figure 4 — Dimensions of self-closing guards

In addition, on automatic machines, access to the saw blades during the cutting stroke shall be prevented either:

1) with fixed guards, any openings in which shall be so designed that the safety distances of EN ISO 13857:2008, Table 4 are fulfilled. Any access door shall be interlocked with guard locking in at least unconditional unlocking in accordance with EN 1088:1995+A2:2008, and the door shall remain closed until the saw blades have returned to the rest position; or

2) by the provision of pressure sensitive mats in accordance with the requirements of at least type 2 of EN 1760-1+A1:2009 which shall be operative over a distance of at least 1,3 m measured horizontally to the nearest position of the saw blades. The return of the saw blades to the rest position shall be within 1 s after the activation of the pressure sensitive mats; or

3) by the provision of an active opto-electronic protective device (light beam) in accordance with the requirements of at least type 2 of CLC/TS 61496-2:2006, positioned at a distance of at least 1,3 m measured horizontally to the nearest position of the saw blades. It shall have two horizontal beams, one at 400 mm from the floor level and one at 900 mm from the floor level. The return of the saw blades to the rest position shall be within 1 s after the activation of the light beams; or

4) by a combination of any of these measures.

The safety related part of the control system (see also 5.2.1) for the interlocking with guard locking function shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

In addition, on semi-automatic machines, access to the saw blades during the cutting stroke shall be prevented either as for automatic machines (see above) or by the provision of a two-hand control device of type 3B in accordance with the requirements of EN 574:1996+A1:2008.

Where a two-hand control device is provided, the saw blades shall return to the rest position within 1 s after the release of the two-hand control device (position of two-hand control according to 5.2.2).

The safety related part of the control system (also see 5.2.1) for the two-hand control shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking relevant drawings and/or circuit diagrams, inspection, measurement and relevant functional testing of the machine.

5.3.7.2 Guarding of the saw blades on horizontal cutting machines

In the rest position, access to the saw blades shall be prevented by fixed guards. Openings in these guards shall be accordance with the requirements of EN ISO 13857:2008, Table 4.

If the fixed guards are to be demounted by the user e.g. for maintenance or cleaning purposes, their fixing systems shall remain attached to the guards or to the machinery when the guards are removed, e.g. with un-losable screws (see 6.4 p)).

During the cutting stroke, access to the saw blades on automatic machines shall be prevented either:

a) with fixed guards, any openings in which shall be so designed that the safety distances of EN ISO 13857:2008, Table 4 are fulfilled. Any access door shall be interlocked with guard locking and at least unconditional unlocking in accordance with EN 1088:1995+A2:2008, Annex N. The door shall remain closed until the saw blades have returned to the rest position; or

b) by the provision of pressure sensitive mats in accordance with the requirements of at least type 2 of EN 1760-1+A1:2009 which shall be operative over a distance of at least 1,3 m measured horizontally to the nearest position of the saw blades. The saw blades shall return to their rest position within 1 s after the activation of the pressure sensitive mats; or

c) by the provision of an active opto-electronic protective device (light beam) in accordance with the requirements of at least type 2 of CLC/TS 61496-2:2006 positioned at a distance of at least 1,3 m measured horizontally to the nearest position of the saw blades. It shall have at least two horizontal beams, one at 400 mm from the floor level and one at 900 mm from the floor level. The saw blades shall return to their rest position within 1 s after the activation of the active light beams; or

d) by a combination of any of these measures.

The safety related part of the control system (see also 5.2.1) for the interlocking with guard locking function shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

During the cutting stroke, access to the saw blades on semi-automatic machines shall be prevented either as for automatic machines (see above) or by the provision of a two-hand control device of type 3B in accordance with the requirements of EN 574:1996+A1:2008.

Where a two-hand control device is provided, the saw blades shall return to the rest position within 1 s after the release of the two-hand control device (position of two-hand control according to 5.2.2).

The safety related part of the control system (see also 5.2.1) for the two hand control shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking relevant drawings and/or circuit diagrams, inspection, measurement and relevant functional testing of the machine.

5.3.7.3 Guarding of saw unit positioning

Access to crushing and impact points shall be prevented by either:

a) one of the guarding systems described in 5.3.7.1 or 5.3.7.2 where the distance, and the time to reach a safe position, shall refer to the relevant moving parts; or

b) where it is possible that the moving saw unit can come closer than 500 mm to another part of the machine, the maximum speed of the moving saw unit shall be 25 m min^{-1} and it shall be controlled by a hold to run control device. The hold-to-run control device shall be positioned such that the operator can see the crushing point and the stopping distance after release of the control shall not exceed 10 mm; or

c) by the use of a pressure sensitive device (bumper bar) in accordance with the requirements of at least type 2 of EN 1760-2+A1:2009 and limiting the maximum speed of the moving saw unit(s) to 25m min^{-1}; or

d) a combination of any of these measures.

The safety related part of the control system (see also 5.2.1) for the hold-to-run control, the limitation of the positioning speed of the saw units and the pressure sensitive device shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, measurement, inspection and relevant functional testing of the machine.

5.3.7.4 Guarding of workpiece positioning mechanisms

Where access to the workpiece positioning mechanism is not prevented by the measures described in 5.3.7.1 or 5.3.7.2, it shall be prevented by the provision of either:

a) fixed guards, any openings in which shall be so designed that the safety distances of EN ISO 13857:2008, Table 4 are fulfilled; or

b) pressure sensitive mats in accordance with the requirements of at least type 2 of EN 1760-1:1997+A1:2009 which shall be operative over a distance of at least 1,3 m measured horizontally to the nearest dangerous part of the workpiece positioning mechanism; or

c) an active opto-electronic protective device (light beam) in accordance with the requirements of CLC/TS 61496-2:2006 positioned at a distance of at least 1,3 m measured horizontally to the nearest dangerous part of the workpiece positioning mechanism. It shall have at least two horizontal beams, one at 400 mm from the floor level and one at 900 mm from the floor level; or

d) a combination of any of these measures.

Access to the dangerous parts at the infeed opening of the workpiece positioning mechanism may be prevented by the measures in a) to d) or shall be prevented by using a trip bar in accordance with the requirements of EN 1760-2:2001+A1:2009.

Where a trip bar is used, it shall be located above the infeed opening, and shall meet the following requirements:

1) when operated the trip bar shall stop the positioning before a hand moving on the workpiece at the maximum positioning speed for which the machine is designed can reach the drawing-in or shearing point;

2) the width of the trip bar shall be at least equal to the width of the infeed opening;

3) the bottom edge of the trip bar shall be no more than 25 mm above the surface of any workpiece for which the machine is designed and be automatically or manually adjusted to the height of each workpiece;

4) the trip bar shall not in itself create a trapping hazard.

The safety related part of the control system (see also 5.2.1) for the trip bar, pressure sensitive mats and light beam shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: by checking the relevant drawings and/or circuit diagrams, measurement, inspection and relevant functional testing of the machine.

5.3.7.5 Guarding of powered roller tables

Where powered roller tables are fitted at the machine infeed and/or out-feed, access to the drawing-in points between the rollers shall be prevented either by:

a) filling-in the drawing-in points in accordance with the dimensions shown in Figure 5; or

b) an active opto-electronic protective device (light beams) in accordance with the requirements of at least type 2 of CLC/TS 61496-2:2006 which is interlocked with the dangerous movement and positioned at a distance of at least 1,3 m measured horizontally to the nearest drawing in point of the powered roller table. It shall have at least two horizontal beams, one at 400 mm from the floor level and one at 900 mm from the floor level; or

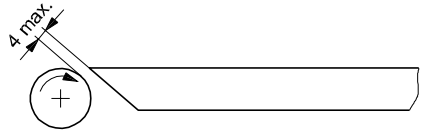
c) pressure sensitive mats in accordance with the requirements of at least type 2 of EN 1760-1+A1:2009 which is interlocked with the dangerous movement and operative over a distance of at least 1,3 m measured horizontally to the nearest drawing in point; or

d) a combination of any of these measures.

The safety related part of the control system (see also 5.2.1) for the pressure sensitive mats and light beam shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

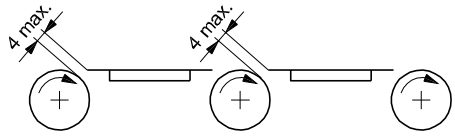
Verification: by checking the relevant drawings and/or circuit diagrams, measurement, inspection and relevant functional testing of the machine.

Dimensions in millimetres



a)

Figure 5 a) — Infeed or outfeed driven rollers



b)

Figure 5 b) — Powered roller table

Figure 5 — Example of powered roller guarding

5.3.7.6 Guarding of drives

Access to the saw blade drive and any other drive mechanisms shall be prevented either by fixed guards, or moveable interlocked guards which are interlocked with the drive mechanism(s).

If the fixed guards are to be demounted by the user e.g. for maintenance or cleaning purposes, their fixing systems shall remain attached to the guards or to the machinery when the guards are removed, e.g. with un-losable screws (see 6.4 p)).

If fitted with moveable interlocked guards and where it is possible to gain access to the revolving saw blade teeth or other dangerous points during the run-down time of the saw blades after having switched off the saw blades drive motors, these guards shall be fitted with guard locking, in accordance with at least unconditional unlocking in accordance with the requirements of EN 1088:1995+A2:2008, Annex N.

The safety related part of the control system (see also 5.2.1) for the interlocking and interlocking with guard locking function shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing of the machine.

5.3.8 Clamping devices

Each saw unit shall be equipped with either a power operated vertical clamping device and a power operated horizontal clamping device or a clamping device which can operate in the horizontal and vertical directions. The device shall be positioned at a distance of between 20 mm as a minimum and 300 mm as a maximum from each cutting line.

Where crushing hazards are not avoided by any of the means described in 5.3.7 above they shall be prevented by, for example:

a) two stage clamping with a clamping force not exceeding 50 N for 1 s, followed by full clamping pressure initiated by a manual control device; or

b) reduction of the clamp/workpiece gap to 6 mm or less by a manually adjustable device; and stroke limitation to a maximum of 10 mm; or

c) limitation of the clamp closing speed to 10 mm s^{-1} or less; or

d) guarding of the clamp by a guard fixed to the clamping device to reduce the gap between the workpiece and the guard to 6 mm or less. The maximum extension of the clamp outside the guard shall not be more than 6 mm.

The safety-related part of the control circuits (see also 5.2.1) for supervision of the first stage clamping force (see 5.3.8 a)) and the limitation of the clamp closing speed (see 5.3.8 c)) shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008.

Where pneumatic clamping is provided and there is a failure of the pneumatic supply, clamping of the workpiece shall be maintained until the return stroke of the saw blade is initiated. Where non-return valves are used to meet this requirement, they shall be fitted to the actuating cylinders in accordance with EN ISO 4414:2010.

Verification: By checking the relevant drawings and/or circuit diagrams, measurement, inspection and relevant functional testing of the machine.

5.4 Protection against non-mechanical hazards

5.4.1 Fire

To minimise fire and explosion hazards the requirements in 5.4.3 and 5.4.4 shall be met.

Fire risk is not present where electrical power circuits are protected against over current in accordance with EN 60204-1:2006, 7.2.2.

Verification: By checking the relevant drawings and inspection of the machine.

5.4.2 Noise

5.4.2.1 Noise reduction at the design stage

When designing machinery, the information and technical measures to control noise at source given in EN ISO 11688-1:2009 shall be taken into account.

5.4.2.2 Noise emission measurement

Operating conditions for noise measurement shall comply with ISO 7960:1995, Annex T.

Mounting and operating conditions of the machine shall be identical for the determination of emission sound pressure levels at the work station and sound power levels.

For machines where ISO 7960:1995, Annex T is not applicable, e.g. for different spindle speeds and saw blade diameters, the detailed operating conditions used shall be given in the test report.

Sound power levels shall be measured in accordance with the enveloping surface measuring method shown in EN ISO 3746:2010 with the following modifications:

a) the environmental indicator K_{2A} shall be equal to or less than 4 dB;

b) the difference between the background sound pressure level and the machine sound pressure level at each measuring point shall be equal to or greater than 6 dB. The correction formula for this difference is given in EN ISO 3746: 2010, 8.3.3, Formula 12;

c) only the parallelepiped measurement surface shall be used at 1 m from the reference surface;

d) where the distance from the machine to an auxiliary unit is less than 2 m, the auxiliary unit shall be included in the reference box;

e) the accuracy of the test method shall be better than 3 dB;

f) the number of microphone positions shall be nine in accordance with ISO 7960:1995, Annex T.

Alternatively, where the facilities exist and the measurement method applies to the machine type emission sound power levels may also be measured according to a method with higher precision i.e. EN ISO 3743-1:2010, EN ISO 3743-2:2009, EN ISO 3744:2010 and EN ISO 3745:2009 without the preceding modifications.

For determination of emission sound power level by the sound intensity method, use EN ISO 9614-1:2009 (subject to agreement between the supplier and the purchaser).

Emission sound pressure levels at the workstation shall be measured in accordance with EN ISO 11202:2010 with the following modifications:

1) the environmental indicator K_{2A} and the local environmental factor K_{3A} shall be equal to or less than 4 dB;

2) the difference between the background emission sound pressure level and the workstation sound pressure level shall be equal to or greater than 6 dB in accordance with EN ISO 11202:2010, 6.4.1, accuracy grade 2 (Engineering);

3) the correction of the local environmental factor K_{3A} shall be calculated:

   i. in accordance with EN ISO 11204:2010, A.2 with the reference restricted to EN ISO 3746:2010 instead of the method given in EN ISO 11202:2010, Annex A, or

   ii. in accordance with EN ISO 3743-1:2010, or EN ISO 3743-2:2009, EN ISO 3744:2010 or EN ISO 3745:2009 where one of these standards has been used as the measuring method.

For noise declaration 6.4 k) shall be met.

5.4.3 Emission of chips and dust

Provision shall be made for the extraction of chips and dust from the machine, by providing outlet(s) to enable the machine to be connected to a separate chip and dust collection system.

The opening of the capture device shall be large enough to capture the chips and dust projected.

NOTE 1 The size of the opening of the capture device depends on the emission pattern and the distance between the emission source and the opening of the capture device.

The capture device shall be designed in order to minimise pressure drop and material build up e.g. by avoiding abrupt change of direction of extracted chips and dust, sharp angles and obstacles causing a risk for hanging of chips and dust.

The conveying of chips and dust between the capture device and the machine connection to the CADES (chip and dust extraction system), especially flexible connections of moving units, shall follow the requirements to minimise pressure drop and material build up.

To ensure that the chips and dust extracted from the point of origin are conveyed to the collection system, the design of the hoods, ducts and baffles should be based on a conveying velocity of extracted air in the duct of 20 m s^{-1} for dry chips and 28 m s^{-1} for wet chips (moisture content 18 % or above).

The pressure drop between the inlet of all capture devices and the connection to the CADES should be maximum 1 500 Pa (for the nominal air flow rate).

NOTE 2 A low dust emission can be expected if the air flow rate ≥1000 m^3 h^{-1} is ensured.

Verification: By checking of drawings, visual inspection and the following procedure:

— Measure the pressure drop at the chosen air flow rate by measurement under the condition given for noise measurement in the relevant C-standard or ISO 7960:1995.

— Run the machine (without processing a work piece) under the conditions for noise measurement in the relevant C-standard or ISO 7960:1995. The CADES shall be disconnected. Check if the machine creates an air flow from the inlet(s) of the capture device(s) to the connection outlet(s) to the CADES by use of smoke at the connection outlet(s).

NOTE 3 For the measurement of chip and dust extraction system performance, two standardised methods are useful: concentration method (EN 1093-9:1998+A1:2008) and index method (EN 1093-11:2001+A1:2008).

5.4.4 Electricity

With the exception of 6.3 the requirements of EN 60204-1:2006 apply unless otherwise stated in this document.

In particular see EN 60204-1:2006, 6.2 for the requirements regarding prevention of electric shock due to direct contact and EN 60204-1:2006, Clause 7 for the requirements regarding protection against short circuits and overloading.

The protection of people against electrical shock due to indirect contacts is normally ensured by automatic isolation of the electrical power supply of the machine by the operation of a protective device installed by the user in the line powering the machine. See the information provided by the manufacturer in the instruction handbook (see 6.4 o)).

The degree of protection of all electric components out of the enclosure(s) and the enclosure(s) for electrical components itself/themselves shall be at least IP 54 in accordance with the requirements of EN 60529:1991 and 60529:1991/A1:2000 with the following exceptions:

a) for three phase motors the degree of protection shall be at least IP 5X in accordance with EN 60529:1991 and EN 60529:1991/A1:2000;

b) the last sentence of EN 60204-1:2006, 11.3 does not apply.

In accordance with EN 60204-1:2006, 18.2 and 18.6, the test 1 for the continuity of the protective bonding circuit and functional tests apply.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection of the machine and relevant tests (specified in test 1 of EN 60204-1:2006, 18.2 and 18.6).

NOTE 2 For electrical components, characteristics the information from the electrical component supplier can be useful.

5.4.5 Ergonomics and Handling

The requirements of EN 614-1:2006+A1:2009 shall apply in addition to the following:

a) The machine and its controls shall be designed according to ergonomic principles in accordance with EN 1005-4:2005+A1:2008 for work posture which is not fatiguing.

b) The positioning, marking and illumination (if necessary) of control devices, and facilities for materials and tool set handling shall be in accordance with ergonomic principles in accordance with EN 894-1:1997+A1:2008, EN 894-2:1997+A1:2008, EN 894-3:2000+A1:2008, EN 1005-1:2001+A1:2008, EN 1005-2:2003+A1:2008 and EN 1005-3:2002+A1:2008.

c) Tanks containing compressed air drainers and oilers shall be placed or oriented in such a way that the filler and drain pipes can be easily reached.

d) Machine components with a mass exceeding 25 kg shall include necessary attachments to accommodate the fitting of a lifting device e.g. lugs positioned such as to avoid their overturn or fall or move in an uncontrolled way during transport, assembly, dismantling, disabling and scrapping.

e) If the machine is fitted with a movable control panel, the requirements of EN 894-2:1997+A1:2008 shall apply, and this panel shall be fitted with a facility to move it in the desired position.

f) If graphical symbols related to the operation of actuators are used, they shall be in accordance with EN 61310-1:2008, Table A.1.

NOTE Further guidance is given in EN 60204-1:2006, EN 614-1:2006+A1:2009 and EN 614-2+A1:2009.

See also 5.2.2 for position of controls, 6.4, EN 894-3:2000+A1:2008 and EN 1005-3:2002+A1:2008.

Verification: By checking the relevant drawings, inspection of the machine, measurement and relevant functional testing of the machine.

5.4.6 Lighting

Where lighting is provided it shall be provided in accordance with EN 60204-1:2006, 16.2 and with EN 1837:1999+A1:2009.

See also 6.4 d).

Verification: By checking the relevant drawings and/or circuit diagrams and inspection of the machine.

5.4.7 Pneumatic

If the machine is fitted with pneumatic system, the requirements of EN ISO 4414:2010 shall apply.

See also 5.2.1, 5.4.11 of this document and EN ISO 12100:2010, 6.2.10.

Verification: By checking the relevant drawings and/or circuit diagrams and inspection on the machine.

5.4.8 Hydraulic

If the machine is fitted with hydraulic system, the requirements of EN ISO 4413:2010 shall apply.

See also 5.2.1, 5.4.12 of this document and EN ISO 12100:2010, 6.2.10.

Verification: By checking the relevant drawings and/or circuit diagrams and inspection on the machine.

5.4.9 Laser

If the machine is fitted with a laser to indicate the cutting line, the laser shall be of category 2, 2M or a lower risk category in accordance with the requirements of EN 60825-1:2007.

The laser shall be fitted to the machine so that warnings on the laser itself remain visible.

All provisions from the laser manufacturer associated to the installation and the use of the laser shall be fulfilled. The instruction for use of the laser shall be repeated in the instruction manual. Warning label(s) and advice on use of eye protection, if any, shall be provided on the machine near the operator's position.

Verification: By checking the relevant drawings and inspection of the machine.

NOTE For the laser characteristics, the information from the manufacturer of the laser can be useful.

5.4.10 Errors of fitting

The machine shall be designed so that it is not possible to mount saw blades with dimensions larger than those for which it has been designed.

See also 6.2 and 6.3.

Verification: By checking the relevant drawings and inspection of the machine.

5.4.11 Isolation

The requirements of EN 1037:1995+A1:2008, Clause 5 apply in addition to the following:

a) Electrical isolators shall be in accordance with EN 60204-1:2006, 5.3.

b) When fitted with a plug to connect the machine to a three-phase electrical supply, this plug may incorporate a phase inverter.

c) If the machine is fitted with a Direct Current (DC) injection braking system, the electrical isolator shall be either

   1) not located on the same side of the machine or on the same side of the panel as the start and stop controls; or

   2) equipped with a blocking device. It shall only be possible to switch-off the mains after manually actuating a de-blocking device. In this case, the supply disconnection device shall not be equipped as emergency stopping device.

d) Where the pneumatic supply is used only for clamping, a quick action coupling in accordance with EN ISO 4414:2010 without the means for locking shall be acceptable when the disconnected coupling can all the time easily be under the control of the person making some intervention on the disconnected machine in accordance with EN 1037+A1:2008, 5.2.

e) Where hydraulic energy is used, hydraulic isolation shall be achieved by isolation of the electrical supply to the hydraulic motor.

f) Where residual energy is stored, e.g. in a reservoir or pipe, means for dumping residual pressure shall be provided, for example using a valve. Dumping pressure shall not be by disconnection of a pipe.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection and relevant functional testing of the machine.

5.4.12 Maintenance

The basic principles of EN ISO 12100:2010, 6.2.15 shall be observed and, in addition, at least the information for maintenance listed in EN ISO 12100:2010, 6.4.5.1 e) shall be provided.

Where lubrication points are provided, they shall be located outside of danger zones and accessible by the operator when standing on the floor.

The machine shall be so designed that maintenance and cleaning can be, if possible, undertaken after disconnection of the machine from all energy sources (see also 6.4).

Provision shall be made for storing the tools necessary for changing the saw blade.

Verification: By checking the relevant drawings and the instruction handbook, inspection of the machine and relevant functional testing of the machine.

6 Information for use

6.1 General

The basic principles of EN ISO 12100:2010, 6.2.15 shall be observed and - if fitted with saw blades - the requirements of EN 847-1:2005+ A1:2007, Clause 8 apply and in addition.

6.2 Warnings and warning devices

If the machine is equipped with a pneumatic/hydraulic supply and isolation of the pneumatic/hydraulic energy is not achieved by the electrical isolation, the machine shall be permanently marked with a warning label

placed in proximity to the electrical supply disconnection device, warning that the pneumatic/hydraulic supply is not isolated by isolation of the electrical supply.

Permanently marked means, for example, engraving, etching, embossing or stamping or using a sticker.

The warnings shall either be in the language of the country in which the machine is to be used or wherever possible by using pictograms.

Where an electrical brake with a complex electronic control system is fitted, the machine shall be equipped with a warning device e.g. a red warning lamp, indicating a negative test result of braking system.

Verification: By checking the relevant drawings, inspection and functional testing on the machine.

6.3 Marking of the machine

The basic principles of EN ISO 12100:2010, 6.4.4 shall be observed in addition to the following:

a) The following information shall be marked legibly and indelibly throughout the expected life of the machine either directly on the machine e.g. by engraving, etching or by using labels or stickers or a plate permanently affixed to the machine e.g. by riveting:

   1) business name and address of the machine manufacturer and, where applicable, of his authorised representative;

   2) year of construction, that is the year in which the manufacturing process is completed;

   3) designation of the machinery and designation of series or type;

   4) machine identification or serial number (if any);

   5) rating information (mandatory for electro-technical products: voltage, frequency, power);

   6) where the machine is fitted with a pneumatic system the nominal pressure for the pneumatic system;

   7) where the machine is fitted with a pneumatic isolator its function, location and operational position(s) e.g. by a label or a pictogram.

b) The maximum and minimum saw blade diameters and the bore diameter of the saw blade for which the machine has been designed shall be permanently marked on the machine or on a plate which is permanently fixed to the machine.

c) The labels or pictograms for marking the nominal pressure and the isolators shall be fitted in a position in close proximity to the installed location of the isolators on the machine.

d) The markings shall either be in the language of the country in which the machine is to be used or wherever possible by using pictograms.

e) If the machine is equipped with scales, the requirements of EN 894-2:1997+A1:2008 shall apply.

Verification: By checking relevant drawings and inspection of the machine.

6.4 Instruction handbook

The principles of EN ISO 12100:2010, 6.4.5 shall be observed and, in addition, the instruction handbook shall include at least:

a) repetition of the markings, pictograms and other instructions on the machine and, if necessary, information about their meaning as required in 6.2 and 6.3;

b) intended use of the machine including reasonably foreseeable misuse;

c) warning regarding residual risks as:

1) Instructions on factors that influence exposure to noise. This includes:

i) the use of saw blades designed to reduce the emitted noise;

ii) optimum speed selection;

iii) saw blade and machine maintenance;

2) information on factors that influence exposure to dust. This includes:

i) type of material being machined;

ii) importance of local extraction (capture at source);

iii) proper adjustment of hoods/baffles/chutes;

iv) dust extraction equipment to be switched on before commencing machining.

3) information that during indoor use the machine shall be connected to an external chip and dust extraction system;

NOTE 1 External chip and dust extraction equipment with fixed installations are dealt with in EN 12779:2004+A1:2009.

d) instructions for safe use in accordance with EN ISO 12100:2010, 6.4.5.1 d). This includes instructions on how the following points can be satisfied:

1) the floor area around the machine to be level, well maintained and free from loose material e.g. chips and off-cuts;

2) adequate general or localised lighting to be provided;

3) stock and finished workpieces to be located close to the operators normal working position.

4) the wear of suitable personal protective equipment when necessary; this may include

i) hearing protection to reduce the risk of induced hearing loss;

ii) respiratory protection to reduce the risk of inhalation of harmful dust;

iii) gloves for handling saw blades (saw blades should be carried in a holder wherever practicable);

5) stopping the machine running whilst unattended;

6) reporting faults in the machine, including guards or saw blades, as soon as they are discovered;

7) adopting safe procedures for cleaning, maintenance and remove chips and dust regularly to avoid the risk of fire;

8) following manufacturers instructions for use, adjustment and repair of saw blades;

9) observing the maximum speed marked on the saw blades;

10) using correctly sharpened saw blades;

11) ensuring that flanges used are suitable for the purpose as stated by the manufacturer (see 5.3.3.2);

12) refraining from removing any off-cut or other part of the workpiece from the cutting area while the machine is running except by using adequate safety appliances, e.g; a push stick;

13) ensuring that guards and other safety devices necessary for machine operation are in position, in good working order and properly maintained.

e) information that operators are adequately trained in the use, adjustment and operation of the machine;

f) installation and maintenance requirements including a list of those devices e.g. braking which shall be verified, how frequently the verification shall be carried out and by what method;

g) the range of saw blade diameters and thicknesses for which the machine is designed;

h) a statement that only tools made in conformity to EN 847-1:2005+A1:2007 shall be used on the machine;

i) information regarding the dust extraction equipment fitted to the machine as follows:

1) required airflow in $m^3\ h^{-1}$;

2) pressure drop at each dust extraction connection outlet;

3) recommended conveying air velocity in the duct in $m\ s^{-1}$;

4) cross section dimensions and details of each connection outlet.

j) if fitted with a laser, a statement that no exchange with a different type of laser is permitted, that no additional optical equipment shall be used and that repair shall only be carried out by the laser manufacturer or authorised persons together with a repetition of the laser manufacturer instructions for setting and use of the laser (where appropriate);

k) a declaration concerning airborne noise emissions by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery, measured in accordance with the methods given in 5.4.2.2.

1) A-weighted emission sound pressure levels at workstations;

2) A-weighted sound power level emitted by the machinery;

The declaration shall be accompanied by a statement of the measuring method used and the operating conditions applied during the test and values for associated uncertainty *K* using the dual-number form of declaration in accordance with EN ISO 4871:2009 as follows:

— 4 dB when using EN ISO 3746:2010;

— 2 dB when using EN ISO 3743-1:2010, EN ISO 3743-2:2009 or EN ISO 3744:2010;

— 1 dB when using EN ISO 3745:2009.

For example, for a sound power level L_{WA} = xx dB (measured value)

Uncertainty K (accompanied uncertainty) = 4 dB

Measured in accordance with EN ISO 3746:2010.

NOTE 2 If the accuracy of the declared emission values is to be checked, measurements will be made using the same method and the same operating conditions as those declared.

The noise declaration shall be accompanied by the following statement:

“The Figures quoted are emission levels and are not necessarily safe working levels. While there is a correlation between the emission and exposure levels, this cannot be used reliably to determine whether or not further precautions are required. Factors that influence the actual level of exposure of the workforce include the characteristics of the work room, the other sources of noise etc. i.e. the number of machines and other adjacent processes., The permissible exposure level can also vary from country to country. This information, however, will enable the user of the machine to make a better evaluation of the hazard and risk.”

Information on noise emission shall also be provided in the sales literature when performance data are provided.

l) information on conditions necessary to ensure that throughout the foreseeable lifetime the machine including its components cannot overturn or fall or move in an uncontrolled way during transport, assembly, dismantling, disabling and scrapping;

m) the operating method to be followed in the event of accident or breakdown; if a blockage is likely to occur, the operating method to be followed so as to enable the equipment to be safely unblocked;

n) the identification data of the spare parts to be changed by the user, when these affect the health and safety of operators (parts to be changed only by the manufacturer or personal charged by the manufacturer are excluded);

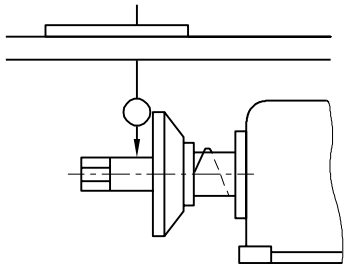
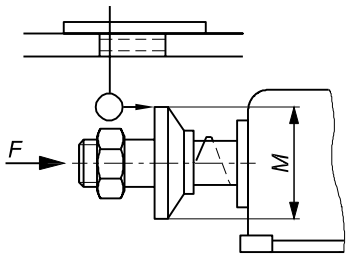
o) information on how to provide protection of people against electrical shock due to indirect contact in the machine by a device for automatic disconnection of the power supply to be installed by the user in the line powering the machine;

p) description of fixed guards which need to be removed by the user for maintenance and cleaning purposes. (guards to be dismounted only by the manufacturer or personal charged by the manufacturer are excluded).

Verification: By checking the instruction handbook and relevant drawings.

Annex A
(normative)

Dimensional tolerances of saw spindles

Diagram	Object	Permissible deviation (mm)	Measuring instrument
 Measurement mode as close as possible to the saw blade flange	Measuring run-out of saw spindle	0,03	Dial gauge
 Apply axial pressure F as recommended by manufacturer	Measuring camming of the saw flange	0,03 for M ≤ 100 0,04 for M > 100	Dial gauge

Annex B
(normative)

Braking tests

B.1 Conditions for all tests

a) The spindle units shall be set in accordance with the manufacturer's instructions (e.g. belt tension).

b) When selecting the speed and the saw blades, conditions shall be chosen which create the greatest kinetic energy for which the machine is designed.

c) Warm up the spindle units for at least 15 min by running the machine under no load before beginning the test.

d) Verify that the actual spindle speed is within 10 % of the intended speed.

e) The speed measuring equipment shall have an accuracy of at least ± 1 % of full scale.

B.2 Tests

B.2.1 Un-braked run-down time

The un-braked run-down time shall be measured as follows:

a) cut the power to the saw spindle drive motor and measure the un-braked run-down time;

b) restart the saw spindle drive motor and allow it to reach the intended speed;

c) repeat steps a) and b) twice more.

The un-braked run-down time of the saw spindle is the average of the three measurements taken.

B.2.2 Braked run-down time

The braked run-down time shall be measured as follows:

a) cut the power to the saw spindle drive motor and measure the braked run-down time;

b) allow the spindle to remain stationary for 1 min;

c) restart the saw spindle drive motor and run at no load for 1 min;

d) repeat steps a) to c) nine times.

The braked run-down time of the saw spindle is the average of the ten measurements taken.

Annex C
(normative)

Impact test method for guards

C.1 General

This annex defines tests for guards used in order to minimise risks of ejection of parts of saw blade or of work pieces out of the working zone.

This annex applies to guards as well as on samples of guards' materials.

C.2 Test method

C.2.1 Preliminary remarks

This test method reproduces the hazard of the ejection of saw blade parts or of work pieces. The test allows estimation of the resistance/strength of guards and/or samples of guard materials against penetration and dislodgement from the machine by ejected parts from machine or work piece.

C.2.2 Testing equipment

The testing equipment comprises a propulsion device, a projectile, a support for the test object and a system that allows to measure or record the impact speed with an accuracy of ± 5 %.

C.2.3 Projectile for guards

The projectile shall be a ball of 8 mm diameter made from steel with the following properties:

a) tensile strength: R_m = 560 N mm^{-2} to 690 N mm^{-2};

b) yield strength: $R_{0,2} \geq 330$ N mm^{-2};

c) elongation at rupture: $A \geq 20$ %;

d) hardened to 56^{+4}_{0} HRC over depth of at least 0,5 mm.

C.2.4 Sampling

The test is carried out with the guard and/or a sample of the guard material. The guard support shall be equivalent to the guard mounting on the machine. For testing guard materials, samples may be used, fixed on a frame with an inner opening of 450 mm × 450 mm. The frame shall be sufficiently rigid. The mounting of the sample shall be by non-positive clamping.

C.2.5 Test procedure

The impact test shall be executed with a projectile indicated in C.2.3 and an impact speed of 70 m s^{-1} ± 5 %.

Impact shall be as square to the material sample surface or the guard surface as possible. The targets for the projectiles shall be the weakest and most unfavourable spot on the guard or the centre of material sample.

C.3 Results

After the test, the impact damages found on the guard or material shall be assessed as follows:

a) buckling/bulging (permanent deformation without crack);

b) incipient crack (visible only on one surface);

c) through crack (crack visible from one surface to the other);

d) penetration (projectile penetrating the test object);

e) guard window loosened from its fixing;

f) guard loosened from guard support.

C.4 Assessment

The test is passed if there is no through crack or penetration of the test object and if there are no damages e) and f) in accordance with the requirements of C.3.

C.5 Test report

The test report shall give the following minimum information:

a) date, place of the test and name of the testing institute;

b) projectile mass, dimensions, speed;

c) applicant identification;

d) design, material and dimensions of the test object;

e) clamping or fixing of the test object;

f) direction of shock, point of impact of the projectile;

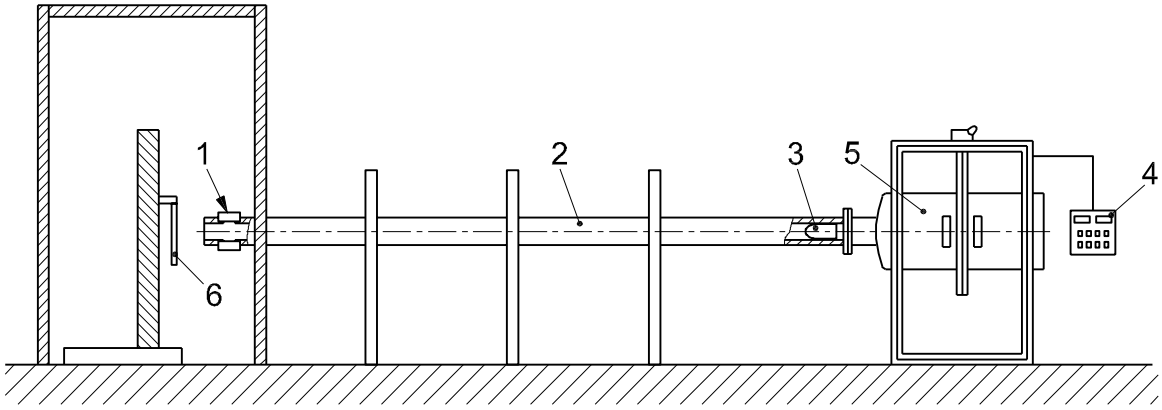
g) test result.

C.6 Test equipment for impact test

The propulsion device consists of a compressed air vessel with flanged gun barrel (see Figure C.1). The compressed air may be released by a valve to accelerate the projectile toward the test object.

The air gun is fed by an air compressor. The speed of the projectile may be controlled by the pressure of the air.

The projectile speed is measured near the nozzle of the gun barrel by a suitable speedometer e.g. by proximity sensor or photocell.



Key

1 speedometer
2 gun barrel
3 projectile
4 control panel
5 compressed-air vessel
6 test object

Figure C.1 — Example of equipment for impact test

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conforming to Essential Requirements of the New Approach Machinery Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that, compliance with the normative clauses of this standard, confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING - Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 614-2:2000+A1:2008, *Safety of machinery — Ergonomic design principles — Part 2: Interactions between the design of machinery and work tasks*

[2] EN 1093-9:2008, *Safety of machinery — Evaluation of emission of airborne hazardous substances — Part 9: Pollutant concentration parameter, room method*

[3] EN 1093-11:2008, *Safety of machinery — Evaluation of emission of airborne hazardous substances — Part 11: Decontamination index*

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™