BS EN 12750:2013

BSI Standards Publication

Safety of woodworking machines — Four sided moulding machines

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National foreword

This British Standard is the UK implementation of EN 12750:2013. It supersedes BS EN 12750:2001+A1:2009, which is withdrawn.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.

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Sécurité des machines pour le travail du bois - Machines à moulurer sur quatre faces

Sicherheit von Holzbearbeitungsmaschinen - Fräsmaschinen für vierseitige Bearbeitung

This European Standard was approved by CEN on 15 December 2012.

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Contents

Page

Foreword

This document (EN 12750:2013) has been prepared by Technical Committee CEN/TC 142 “Woodworking machines - 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of an identical text or by endorsement, at the latest by August 2013, and conflicting national standards shall be withdrawn at the latest by August 2013.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 12750:2001+A1:2009.

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 EU Directive(s).

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

The following most significant changes have been made in comparison with EN 12750:2001+A1:2009:

a) In Clause 1 Scope: The scope has been limited to machines having a maximum speed of the integrated work-piece feed of 200 m/min;

b) In 5.2.1 Safety and reliability of control systems: Application of EN ISO 13849, i.e. by requiring PL for the machine's safety functions;

c) In 5.2.7 Speed changing: concretion of requirements for different technologies;

d) In 5.2.9 Integrated feed: Additional requirements related to the powered adjustment of spindle position, height adjustment of the feed mechanism, fences, table height, chip breakers and pressure shoes;

e) In 5.3.4 Braking: concretion of requirements for different braking systems;

f) In 5.3.5.2 Out-feed end of the machine: Additional requirements to prevent ejection from the machine;

g) In 5.3.5.3 Use of glass bead cutting unit: Additional requirements for the glass bead cutting unit;

h) In 5.3.7 Prevention of access to moving parts and ejection of parts of tools: concretion of requirements related to the safeguarding of the tools and ejection of parts of tools;

i) In 5.4.2.1 Noise reduction at the design stage: Additional requirements related to integrated enclosures;

j) In 5.4.2.2 Noise emission measurement: Additional noise emission test for machines having a maximum feed speed > 40 m/min;

k) In 5.4.3 Emission of chips and dust: Additional requirements related to the emission of chips and dust;

l) In 6.3 Instruction handbook: The sermon to be provided by the manufacturer has been extended to a large extent.

Organisations contributing to the preparation of this European Standard include the European Manufacturers Association "EUMABOIS".

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 Health and 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.

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.

The requirements of this document are directed to manufacturers and their authorised representatives of four sided moulding machines. This document is also useful for designers.

This document also includes provisions and examples of 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 stationary four sided moulding machines with a maximum working width of 350 mm and a maximum speed of the integrated work-piece feed of 200 m/min, with electrical and/or electronic control system, hereafter referred to as "machines" designed to cut solid wood, chipboard, fibreboard, plywood and also these materials where these are covered with plastic laminate or edgings when they are used as intended and under the conditions foreseen by the manufacturer, including reasonably foreseeable misuse of the machine (see 6.3 c)).

For the definition of a stationary machine, see 3.22.

This European Standard deals also with hazards relating to the following optional work units:

— universal spindle;

— glass bead cutting unit.

This European Standard is not applicable to machines designed for machining logs which have not previously been machined.

This European Standard does not deal with any hazards relating to:

a) in-feed devices (magazines, hoppers, etc.);

NOTE For mechanical in-feed devices which also prevent access to the in-feed opening, see 5.3.7.2.

b) the combination of single machines with any other machine as part of a line;

c) out-feed devices (e.g. mechanical handling systems) except for hazards related to ejection from the machine due to climb cutting.

This European Standard is not applicable to four sided moulding machines which are manufactured before the date of its publication as 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 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 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

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 1760-2:2001+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 1837:1999+A1:2009, *Safety of machinery — Integral lighting of machines*

EN 50178:1997, *Electronic equipment for use in power installations*

EN 50370-1:2005, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 1: Emission*

EN 50370-2:2003, *Electromagnetic compatibility (EMC) — Product family standard for machine tools — Part 2: Immunity*

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

EN 60439-1:1999[1)], *Low-voltage switchgear and controlgear assemblies — Part 1: Type-tested and partially type-tested assemblies (IEC 60439-1:1999)*

EN 60529:1991[2)], *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

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

EN 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*

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

EN ISO 286-2:2010*, Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts (ISO 286-2:2010)*

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1) This document is impacted by the amendment EN 60439-1:1999/A1:2004.

2) This document is impacted by the amendment EN 60529:1991/A1:2000.

EN ISO 354:2003, *Acoustics — Measurement of sound absorption in a reverberation room (ISO 354:2003)*

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 3745:2012, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Precision methods for anechoic rooms and hemi-anechoic rooms (ISO 3745:2012)*

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)*

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 13732-1:2008, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of controls 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)*

EN ISO 15667:2000, *Acoustics — Guidelines for noise control by enclosures and cabins (ISO 15667:2000)*

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

3 Terms and definitions

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

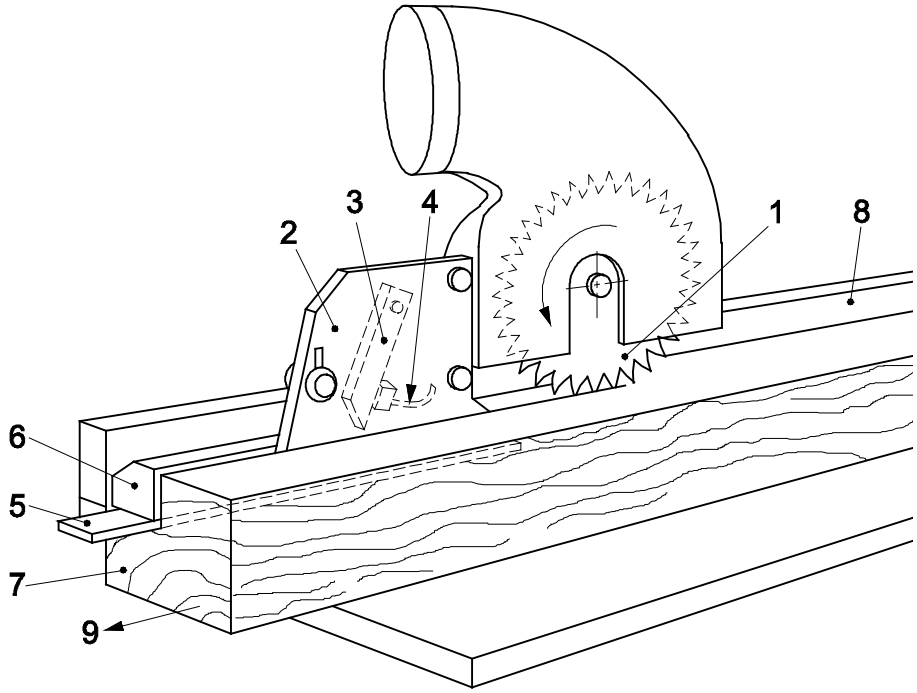
3.1
four sided moulding machine
machine where the work-piece, once loaded manually or by magazine, moves by an integrated feed mechanism; the machine has at least four work units with rotating planing or moulding tools, where one unit is located on each longitudinal side of the work-piece; the spindles have horizontal and/or vertical axes which can be adjusted manually or under power; the machine can be fitted with additional work units such as universal spindle(s) or glass bead cutting unit(s)

Note 1 to entry: Machines where the first feed roller is fitted after the first tool are, for the purpose of this document, integrated fed machines.

3.2
universal spindle
work unit, the position of which can be changed manually or under power so as to allow it to work at different positions around the work-piece

3.3
glass bead cutting unit
work unit fitted with a tool, usually a saw blade, with or without coaxial mounted milling tool, to cut out a glass bead from the machined profile of the work-piece

Note 1 to entry: See also Figure 1.



Key

1 glass bead saw-blade
2 bed ledge separator
3 anti-kickback finger
4 pressure device
5 guiding channel for glass bead ledge
6 glass bead ledge
7 work-piece
8 fence
9 feed direction

Figure 1 — Example of a glass bead cutting unit

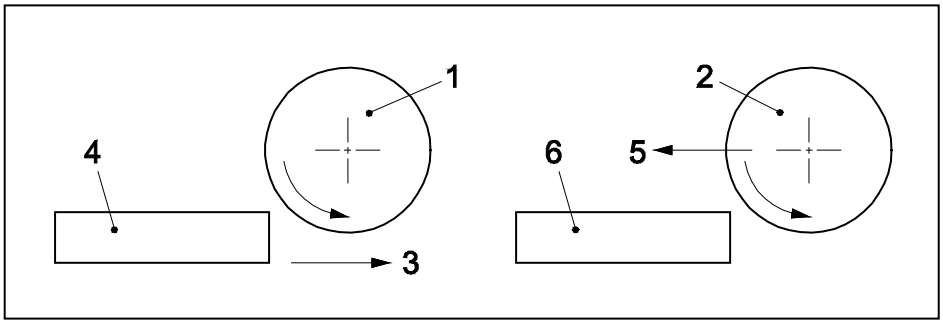
3.4
hydraulic tool fixing device
device for clamping the tool to the spindle using hydraulic pressure

3.5
integrated feed on four sided moulding machines
feed mechanism for the work-piece or tool which is integrated with the machine and where the work-piece or machine element with incorporated tool are held and controlled mechanically during the machining operation

3.6
loading of four sided moulding machines
manual or automatic placing of the work-piece on to a carriage, magazine, lift, hopper, movable bed, conveyor or the presentation of the work-piece to an integrated feed device

3.7
climb cutting
cutting where the projection of the movement of the cutting knife in direction of the feed movement shows in the same direction as the relative movement of the work-piece against the tool

Note 1 to entry: See also Figure 2.



Key

1 tool, fixed axis
2 tool, moving axis
3 feed direction (work piece)
4 work piece (moving)
5 feed direction (tool)
6 work piece (fixed)

Figure 2 — Climb cutting

3.8
cutting area of the tool
area where the tool can be involved in the cutting process

3.9
non-cutting area of the tool
area of the tool not involved in the cutting process

3.10
ejection
uncontrolled movement of the work-piece or parts of it or part of the tool from the machine during processing

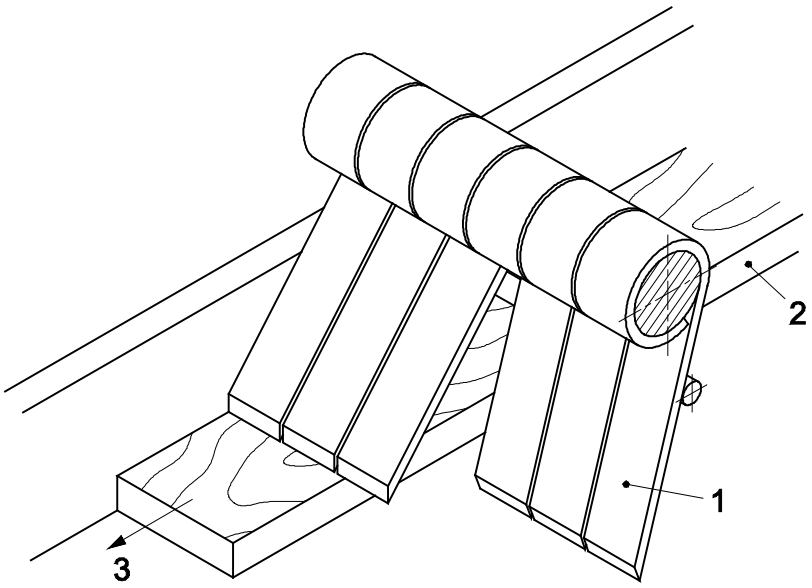
3.11
kickback
unexpected sudden movement of the work-piece or parts of it opposite to the direction of feed during processing

3.12
anti-kickback device
device which either reduces the possibility of kickback or arrests the motion of the work-piece or parts of it during kickback

Note 1 to entry: For example see Key 3 in Figure 1.

3.13
catching fingers device
device designed to prevent the ejection of divided work-pieces

Note 1 to entry: See also Figure 3.



Key

1 catching finger
2 work-piece
3 feed direction

Figure 3 — Example of a catching fingers device

3.14
speed range
range between the lowest and the highest rotational speed for which the spindle or tool is designed to operate

3.15
run-up time
time elapsed from the actuation of the start control device until the spindle reaches the intended speed

3.16
run-down time
time elapsed from the actuation of the stop control device up to spindle standstill

3.17
pressure sensitive protective equipment
PSPE
mechanically actuated assembly of devices and/or components working together for protective tripping or presence-sensing purposes comprising as a minimum:

— one or more pressure sensing elements;

— a control unit (where necessary);

— one or more output signal switching device(s)

Note 1 to entry: Safety-related control system associated with the PSPE or the PSPE itself can further include a secondary switching device, start interlock, re-start interlock, etc.

EXAMPLE Pressure sensitive bars.

3.18
complete enclosure
total machine enclosure primarily designed for noise attenuation and to permit the operator to move around freely within it and where all machine setting and adjustments are available inside it and access is normally through a door/opening

Note 1 to entry: The complete enclosure for a four-sided moulding machine usually contains openings for work-piece loading and unloading. The openings are usually equipped with sound-absorbing sections for noise attenuation.

3.19
sound-absorbing section
technical noise attenuation measure at the in-feed and/or out-feed opening designed to absorb airborne noise

3.20
integrated enclosure
safeguarding system consisting of a combination of fixed and moveable guards as integral part of the machine which provides a measure of sound attenuation and where certain setting adjustments may be available outside it

3.21
machine actuator
power mechanism used to effect motion on the machine

3.22
stationary machine
machine designed to be located on or fixed to the floor or other parts of the structure of the premises

3.23
safety function
function of the machine whose failure can result in an immediate increase of the risk(s)

[EN ISO 12100:2010, 3.30]

3.24
safety-related part of a control system
SRP/CS
part of a control system that responds to safety-related input signals and generates safety-related output signals

[EN ISO 13849-1:2008, 3.1.1]

3.25
safety-related PLC
programmable logic controller dedicated to safety-related application designed in the required PL according to EN ISO 13849-1:2008

3.26
safety-related electrical control system
SRECS
electrical part of a control system whose failure can result in a immediate increase of the risk(s)

[EN 62061:2005, 3.2.4]

3.27
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

[EN ISO 13849-1:2008, 3.1.23]

3.28
monitoring system
system with a safety function which ensures that a protective measure is initiated if the ability of a component or an element to perform its function is diminished or if the process conditions are changed in such a way that hazards are generated

[EN ISO 13849-1:2008, 3.1.21]

3.29
safety-related application software
SRASW
software specific to the application, that is implemented by the machine manufacturer, generally containing logic sequences, limits and expressions that control the appropriate inputs, outputs, calculations and decisions necessary to meet SRP/CS requirements

[EN ISO 13849-1:2008, 3.1.36]

3.30
safety-related embedded software
SRESW
firmware
system software
software that is part of the system supplied by the control manufacturer and is not accessible for modification by the user of the machine

[EN ISO 13849-1:2008, 3.1.37]

Note 1 to entry: Embedded software is usually written in FVL.

EXAMPLE The operating system of a speed monitoring device.

3.31
diagnostic coverage
DC
measure of the effectiveness of diagnostics, which may be determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures

[EN ISO 13849-1:2008, 3.1.26]

Note 1 to entry: Diagnostic coverage can exist for the whole or parts of a safety-related system. For example, diagnostic coverage could exist for sensors and/or logic system and/or final elements.

3.32
information from the supplier
statements, sales literature, leaflets or other documents where a manufacturer (supplier) declares either the characteristics of e.g. a material or product or the conformity of a material or a product to a relevant standard

4 List of significant hazards

This clause contains all the 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 reference to relevant standards.

These hazards are listed in Table 1.

Table 1 — List of significant hazards *(1 of 2)*

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clause(s) of this document
1	**Mechanical hazards** due to machine parts or work-pieces due to		
	a) shape;	6.2.2.1, 6.2.2.2, 6.3	5.3.3, 5.3.5, 5.3.6, 5.3.7, 5.3.8, Annex C
	b) relative location;		5.2.2, 5.2.3, 5.2.9, 5.3.3, 5.3.5
	c) mass and stability (potential energy of elements which may move under the effect of gravity);		5.2.9, 5.3.1, 5.3.6, 5.3.9
	d) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);		5.2.6, 5.2.7, 5.2.9
	e) mechanical strength.		5.3.3, 5.3.5, 5.3.6, 5.3.8, Annex C, Annex D
	- accumulation of energy inside the machinery by:		
	f) liquids and gases under pressure;	6.2.10, 6.3.5.4	5.4.7, 5.4.8
1.1	Crushing hazard		5.3.7.1, 5.3.7.2
1.2	Shearing hazard		5.3.7.1, 5.3.7.2
1.3	Cutting or severing hazard		5.3.7.1, 5.3.7.2
1.4	Entanglement hazard		5.3.7.1, 5.3.7.2, 5.3.7.3
1.5	Drawing-in or trapping hazard		5.3.7.1, 5.3.7.2, 5.3.7.3
1.6	Impact hazard		5.3.5
1.7	Stabbing or puncture hazard		5.3.7, 6.3
1.9	High pressure fluid injection or ejection hazard	6.2.10	5.4.9
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
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	6.2.9	5.4.4
3	**Thermal hazards**, resulting in:		
3.1	Burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiation of heat sources	6.2.8 c)	6.2, 6.3
4	**Hazards generated by noise**, resulting in:		
4.1	Hearing loss (deafness), other physiological disorders (loss of balance, loss or awareness)	6.2.2.2, 6.3	5.4.2
4.2	Interference with speech communication, acoustic signals		5.4.2

Table 1 — List of significant hazards *(2 of 2)*

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clause(s) 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	6.2.4	5.4.1, 5.4.10
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, 5.2.6
8.2	Hand-arm or foot-leg anatomy	6.2.8	5.4.5
8.4	Local lighting	6.2.8	6.3
8.6	Human error, human behaviour	6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4	5.2.6, 6.3
8.7	Design, location or identification of manual controls	6.2.8 f), 6.2.11.8	5.2.2, 5.2.6
8.8	Design or location of visual display units	6.2.8, 6.4.2	5.2.2
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	5.2.12
10.2	Restoration of energy supply after an interruption	6.2.11.4	5.2.12
10.3	External influences on electrical equipment	6.2.11.11	5.4.9
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	5.4.5, 5.4.11, 6.3
11	**Impossibility of stopping the machine in the best possible conditions**	6.2.11.1, 6.2.11.3, 6.3.5.2	5.2.4, 5.2.5
12	**Variations in the rotational speed of tools**	6.2.2.2, 6.2.3	5.2.7
13	**Failure of the power supply**	6.2.11.1, 6.2.11.4	5.2.12
14	**Failure of the control circuit**	6.2.11, 6.3.5.4	5.2.12
15	**Errors of fitting**	6.2.7, 6.4.5	5.4.12
16	**Break-up during operation**	6.2.3	5.3.2
17	**Falling or ejected objects or fluids**	6.2.3, 6.2.10	5.3.5
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).

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 safety-related parts of a control system (SRP/CS) start at the point where the safety-related input signals are initiated (including e.g. the actuating cam and the roller of the position switch) and end at the output of the power control elements (including, for example, the main contacts of a contactor). For the implementation of any safety-related function the appropriate requirements of EN ISO 13849-1:2008 shall apply.

Safety-related parts of the control system of the machine are those concerning the functions listed in Table 2.

The design of the safety-related control system shall be such as to achieve the machine safety functions required in this document.

NOTE If monitoring systems are used for diagnostics, they are also considered as SRP/CS.

5.2.1.2 Performance level (PL)

For the safety-related parts of the control system (SRP/CS) with the functions listed in column 1 of Table 2 the minimum performance level (see EN ISO 13849-1:2008, 4.5) shall be in accordance with column 2 of Table 2.

Table 2 — Safety functions, Performance Levels (PL)

Function	Performance level (PL)	Relevant Clause(s) of this document
starting	c	5.2.3
prevention of unexpected start-up	c	5.2.8, 5.2.12
normal stopping	c	5.2.4
emergency stop	c	5.2.5
interlocking of guards for drives	c	5.3.7.4
interlocking of guards for tools with or without guard locking	c	5.3.7.1
interlocking of functions	c	5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.8, 5.2.9, 5.2.10, 5.3.5, 5.3.7.1, 5.3.7.2
In setting mode: initiation of powered adjustment for positioning the spindles, spindle units, feed roller height, fences, table height, chip breaker and pressure-shoes	c	5.2.9, 5.2.10
powered adjustment for positioning the spindles, spindle units, feed roller height, fences, table height, chip breaker and pressure-shoes	b	5.2.9, 5.2.10
mode selection	c	5.2.6
hold-to-run control	c or b in conjunction with a movement initiation control device in PL=c	5.2.6, 5.2.9, 5.2.10
selection of direction of rotation of spindles	b	5.2.8
mechanical operated trip device	c	5.3.7.2
braking system	b or c	5.3.4
monitoring of tool speed if realized by use of frequency inverter	c	5.2.7.3

NOTE The average probability of a dangerous failure per hour for the different performance levels is described in EN ISO 13849-1:2008, Table 3.

If on machines designed for different modes of operation the same SRP/CS is used for all safety functions in the different modes the SRP/CS shall meet the requirements of the highest PL of the different modes.

Where a combination of SRP/CS is used the overall PL identified according 6.3 of EN ISO 13849-1:2008 shall comply at least with the PL required in Table 2.

SRP/CS for which a special standard exists shall fulfil all requirements of this document.

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

5.2.1.3 Fault detection and fault reaction for safety-related parts of the control system (SRP/CS)

Unless otherwise specified in the relevant clause of this document, fault detection and fault reaction functions shall be in accordance with the requirements in EN ISO 13849-1:2008, 6.2.4 to 6.2.7.

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

5.2.1.4 Environmental conditions

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

Unless safety-related electronic parts of the control system (SRP/CS) are part of a component for which a special standard exists they shall fulfil the environmental requirements according to EN 50178:1997, 6.1 and 6.2.

Unless SRP/CS dedicated to realise performance level b or c are part of a component for which a special standard exists, they shall fulfil the EMC requirements for type 2 in accordance with the requirements of EN 61496-1:2004.

See also 5.4.9 for the EMC requirements on the complete machine.

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

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

5.2.1.5 Protective devices

Protective devices shall be in accordance with the specific standards. In particular the requirements of the following relevant standards shall be applied:

a) magnetic/proximity switches shall be in accordance with the requirements of EN 1088:1995+A2:2008, 6.3 and the related control system shall be at least PL = c in accordance with the requirements in EN ISO 13849-1:2008;

b) pressure sensitive bars (trip bars) shall be in accordance with the requirements of EN 1760-2:2001+A1:2009;

c) time delay devices shall be of fail safe technique, e.g. of capacity type, and shall conform at least to 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 on the machine.

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

5.2.2 Position of controls

All hand-operated control devices shall be positioned ≥ 600 mm and ≤ 1 800 mm above the floor level.

The main electrical control devices that are those for starting (spindles and feed), normal stopping, emergency stop, speed changing (if fitted – see 5.2.7) and mode selection (if required – see 5.2.6) shall be located at the operator's position adjacent to the control display of the main control panel.

If controls are positioned on a movable pendant it shall be permanently connected to the machine by a cable.

The start control devices for the spindles shall be situated adjacent to the stop control devices for the spindles.

Emergency stop control devices shall be fitted at the following locations:

a) in close proximity to the in-feed end of the machine;

b) in close proximity to the out-feed end of the machine;

c) on each mobile pendant (if provided);

d) not more than 1,5 m from each fixed hold–to–run control device;

e) on the main control panel.

Mechanical control devices shall not be located at the rear side of the machine.

For the positioning of hold-to-run control device(s), see 5.2.6.

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

5.2.3 Starting

Before starting or restarting the machine all interlocked safeguards shall be in place and functional. This is achieved by the interlocking arrangements described in 5.3.7.

Start or restart shall only be possible by actuation of the start control device provided for that purpose and shall be protected against unintended actuation e.g. by shrouded control devices.

The starting sequence shall be achieved by the interlocking arrangements required by 5.2.9. Where a time delay device is used to satisfy the starting sequence requirements it shall be in accordance with the following requirements:

a) the time delay shall be at least equal to the run-up time. The time delay shall be fixed or the time delay device adjustment shall be sealed;

b) the time delay device shall be in accordance with 5.2.1.5 c).

The safety-related parts of the control system (see also 5.2.1) for starting and the interlocking arrangements (see 5.2.7, 5.3.6, 5.3.7) shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

For electrically operated machines see EN 60204-1:2006, 9.2.5.2, at which the exceptions described in EN 60204-1:2006, 9.2.5.2 are not relevant.

Closure of movable interlocked guards shall not lead to an automatic restart of hazardous movements. For each restart a deliberate action of the operator is required.

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

5.2.4 Normal stopping

The machine shall be fitted with a normal stop control system, which when actuated brings the machine – and, if fitted, in-feed devices – safely to a complete stop. The stopping action shall include disconnection from energy supply of all actuators.

The machine drives shall stop directly from each speed.

If the machine is fitted with spring operated mechanical brake(s) this stop control shall be of category 0 in accordance with the requirements of EN 60204-1:2006, 9.2.2.

If the machine is fitted with any other type of brake(s) e.g. electrical brake(s) this stop control shall be of category 1 in accordance with the requirements of EN 60204-1:2006, 9.2.2.

Where a category 1 stop control is fitted, the stopping sequence shall be:

a) cut power to all motors and machine actuators with exception of the braking system and retaining devices (see 5.3.9) and actuate the brake(s);

b) cut power to brake(s) (if electrical brake is fitted) after the spindle(s) has/have come to rest. The time delay device used for the time delay shall be in accordance with 5.2.1.5 c).

The design of the control system shall be such as to satisfy the normal stopping sequence. If a time delay device is used the time delay shall 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 (see also 5.2.1) for normal stopping shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

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

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

5.2.5 Emergency stop

The requirements of EN ISO 13850:2008 apply and in addition:

The machine shall be fitted with emergency stop control devices which are positioned in compliance with 5.2.2 and comply with the requirements of EN 60204-1:2006, 9.2.5.4.2 and 10.7. They shall be at any time of self-latching type.

If the machine is fitted with spring operated mechanical brake(s) this stop control shall be of category 0 in accordance with the requirements of EN 60204-1:2006, 9.2.2.

If the machine is fitted with any other type of brake(s) e.g. electrical brake(s) this stop control shall be of category 1 in accordance with the requirements of EN 60204-1:2006, 9.2.2 to allow the actuation of the electrical brake(s).

Where a category 1 stop control is fitted, the stopping sequence shall be:

a) cut power to all motors and machine actuators with exception of the braking system and retaining devices (see 5.3.9) and actuate the brake(s);

b) cut power to brake(s) (if electrical brake(s) is/are fitted) after the spindle(s) has/have come to rest. The time delay device used for the time delay shall be in accordance with 5.2.1.5 c).

The design of the control system shall be such as to satisfy the emergency stopping sequence. If a time delay device is used the time delay shall 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 (see also 5.2.1) for emergency stop shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

For emergency stop of PDS(SR) see 4.2.2.2 "safe torque off (STO)" and 4.2.2.3 "safe stop 1 (SS1)" of EN 61800-5-2:2007.

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

5.2.6 Mode selection

Mode selection control device(s) shall be provided:

a) where setting operations can only be carried out with the tools running while the movable guard(s) required in 5.3.7.1 are in the open position;

b) where the machine is capable of reverse feeding.

The mode selection shall be in accordance with the following requirements:

c) its control system shall override all other control systems except the emergency stop;

d) it shall be lockable in each position e.g.

1) by a key-operated switch; or

2) via limited access to related numerically controlled functions by means of a password;

e) changing from a mode with higher safety measures into a mode with lower safety measures (setting or reverse mode feeding) shall only be possible after bringing the machine to a complete stop and restart shall be in accordance with the requirements of 5.2.3;

f) changing the mode shall not initiate any movement of the machine.

In reverse feed mode, the moveable guard required in 5.3.7.1 may be in an open or closed position if the following requirements are met in addition to 5.3.7.1:

g) the spindles shall not be capable of rotation;

h) the feed shall be controlled only by a hold–to–run control device;

i) movement of the feed shall stop within 100 mm after the hold–to–run control actuator is released.

The safety-related parts of the control system (see also 5.2.1) for mode selection and for hold-to-run control shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

As an exception to 5.2.3, in setting mode, tools starting may be in performance level b in accordance with the requirements in EN ISO 13849-1:2008 only if a rotation initiation control circuit at least in performance level c in accordance with the requirements in EN ISO 13849-1:2008 is provided.

See also EN 60204-1:2006, 9.2.3.

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

5.2.7 Speed changing

5.2.7.1 Speed changing by changing belts on the pulleys

On machines with varying the spindle speed by changing the position of the belts on the pulleys the control system for the spindle speed indication/detection shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008.

The selected spindle speed shall be indicated prior to the start control device for the spindle.

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

5.2.7.2 Speed changing by incremental speed change motor

On machines fitted with an incremental speed change motor, e.g. a change pole motor, the selected speed shall be indicated at the control actuator, the control system for the spindle speed indication/detection shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008.

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

5.2.7.3 Infinitely speed changing/monitoring by frequency inverter

5.2.7.3.1 General

On machines fitted with a control device for infinitely varying the speed (e.g. a frequency inverter) for the spindle drive motor, the device shall be such that the actual speed shall not exceed the selected speed by more than 10 %. The selected speed shall be indicated prior to spindle start at the control actuator.

The safety-related part of the control system (see also 5.2.1) for speed changing/monitoring shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008.

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

5.2.7.3.2 Control system

Where for spindle speed changing a control system in accordance with the requirements of EN ISO 13849-1:2008 is used, the following requirements shall be met.

The actual speed of the spindle shall be compared to the selected speed continuously. If the actual speed exceeds the selected speed by more than 10 % the spindle shall automatically stop rotating.

In addition the following measures against change or falsification of data shall be taken:

a) measures against loss of the data for tools and selected speed stored in the machine control:

   1) the safety-related data for the machine tools shall be stored either in two independent memory chips or stored two times in one single chip (one time inverse);

   2) after input of the safety-related data for the tools the data shall be redirected to the input unit and confirmed by the operator;

   3) the two data shall be compared at each switching on of the isolator, at each fetch of the data, at least once per shift. If the two data are not identical it shall be impossible to start the spindle motor or if running the spindle motor shall be stopped and a warning shall be given;

4) for monitoring of failures the processor comparing the data shall have an external watch dog function.

b) appropriate measures against falsification in data transfer between manual control, data stored in the machine control, display for the data and control of the inverter, e.g.:

1) the selected spindle speed shall be stored in the control of the inverter or in the unit which monitors the actual speed; and

2) the selected speed transmitted to the control of the inverter or to the unit which monitors the actual speed shall be read back and monitored on the display for checking by the operator.

As an exception b) does not apply if inverter(s) is/are used and the tool(s) can only be operated at a fixed speed.

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

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

5.2.8 Direction of rotation

5.2.8.1 Universal spindle

If the universal spindle is intended for climb cutting the requirements in 5.3.5.2 apply. To prevent unintended climb cutting the universal spindle shall be able to run in both directions and the following requirements shall be met:

a) a direction of rotation selection device shall be fitted at the main control, e.g. by means of a key;

b) the selected direction of rotation shall be indicated at the main control panel and at all other places where this spindle can be started, e.g. by a pictogram;

c) operation of the direction of rotation selection device shall not initiate spindle start up.

See also 6.3.

The safety-related part of the control system for selection of the direction of rotation (see also 5.2.1) shall have at least a PL = b in accordance with the requirements in EN ISO 13849-1:2008.

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

5.2.8.2 All other spindles

If one or both of the last two working spindles are designed to run in two directions of rotation the requirements in 5.3.5.2 apply.

Where any spindle is running in climb cutting mode, this shall be indicated at the main control panel.

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

5.2.9 Integrated feed

5.2.9.1 General

In automatic mode, start of the feed motor shall only be possible when the tool spindles motors are running at the intended speed or the tools of all spindles not involved in the current operation cannot come into contact with the work-piece (the tools are removed from the spindles or the non-rotating spindles are retracted to a non-cutting position). See 5.2.9.2 for the requirements.

The integrated feed shall fulfil the requirements specified in 5.2.9.3 with respect to the height adjustment of the feed mechanism.

The safety-related part of the control system (see also 5.2.1) for interlocking, where required, shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

While the movable guards required in 5.3.7.1 are in the open position, the following additional requirements shall be met:

a) the feed shall be controlled only by a hold–to–run control device, and it shall be possible for the operator to survey the dangerous movements while actuating the hold–to–run control;

b) movement of the feed shall stop within 100 mm after the hold–to–run control actuator is released.

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

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

5.2.9.2 Requirements with respect to spindles position

For spindle units that are adjusted manually (by hand wheel or power operated) see 6.3 n) 2).

For automatically adjusted spindle units under NC or CNC-control, the following requirements shall be fulfilled when not rotating tools are removed from the spindles or the spindles are retracted to a non-cutting position:

a) a limit control device, the control system of which shall have at least a PL = b in accordance with the requirements of EN ISO 13849-1:2008 shall be provided; or

b) a confirmation to the PLC that the tool has been removed or is retracted to a non-cutting position, which has to be given by the operator at each start-up of the integrated feed; or

c) the PLC shall ensure that no contact between tool and work-piece is possible, taking into account the tool diameter, the work-piece dimension and the spindle position.

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

5.2.9.3 Requirements with respect to height adjustment of the feed mechanism

For manual height adjustment of the feed mechanism by hand wheel see 6.3 hh).

For power operated non-automatic height adjustment of the feed mechanism (also under NC or CNC control) the following requirements shall be met:

a) this adjustment shall be via a hold-to-run control device, the control system of which shall have at least:

1) a PL = c in accordance with the requirements of EN ISO 13849-1:2008; or

2) a PL = b in accordance with the requirements in EN ISO 13849-1:2008, if the hold-to-run control is combined with a movement initiation control circuit at least in performance level c in accordance with the requirements in EN ISO 13849-1:2008;

b) upward movement of the feed mechanism while the tools are rotating shall only be possible:

1) in a way that the work-piece is retained safely by the pressure elements, which are under pressure as intended by design. The control system for safely retaining shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008; or

2) with the in-feed opening completely closed by specific movable guard(s) interlocked with the tool rotation and with the movable guards required in 5.3.7.1 and 5.3.7.2 closed. This guard / these guards shall be designed and constructed to retain any ejected work-piece and it shall extend to the whole opening area. Additionally a means of detecting that work-pieces which have entered the in-feed of the machine have passed the tools shall be provided. The control system for this detection system shall have at least a PL = b in accordance with the requirements of EN ISO 13849-1:2008; or

3) a means of detecting that work-pieces which have entered the in-feed of the machine have passed the tools, e.g. monitoring of powered roller position associated with time delay devices. The control system for this detection system shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008.

For automatic height adjustment of the feed mechanism under NC or CNC-control, the following requirements shall be met:

c) Automatic height adjustment shall only be possible with the movable guards required in 5.3.7.1 and 5.3.7.2 closed or if the height adjustment movements do not create new hazards and the tool spindles are not rotating.

d) upward movement of the feed mechanism while the tools are rotating shall only be possible:

1) in a way that the work-piece is retained safely by the pressure elements, which are under pressure as intended by design. The control system for safely retaining shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008; or

2) with in-feed opening completely closed by specific movable guard(s) interlocked with tools rotation and with the movable guards required in 5.3.7.1 and 5.3.7.2 closed. This guard shall be designed and constructed to retain any work-piece ejected and it shall extend to the whole opening area. Additionally a means of detecting that work-pieces which have entered the in-feed of the machine have passed the tools shall be provided. The control system for this detection system shall have at least a PL = b in accordance with the requirements of EN ISO 13849-1:2008; or

3) by means of detecting that work-pieces which have entered the in-feed of the machine have passed the tools, e.g. monitoring of powered roller position associated with time delay devices. The control system for this detection system shall have at least a 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 and relevant functional testing of the machine.

5.2.10 Adjustment of spindles, spindle units, fences, table height, chip breakers and pressure shoes

For manual adjustment, e.g. by hand wheels, of spindles, spindle units, fences, table height, chip breakers and pressure shoes, see 6.3.

For power operated non-automatic adjustment of spindles, spindle units, fences, table height, chip breakers and pressure shoes (also under NC or CNC control), while the movable guard(s) required in 5.3.7.1 are in the open position, the control device for this function shall be a hold-to-run control device, the control system of which shall have at least:

a) a PL = c in accordance with the requirements of EN ISO 13849-1:2008; or

b) a PL = b in accordance with the requirements in EN ISO 13849-1:2008, if the hold-to-run control is combined with a movement initiation control circuit at least in performance level c in accordance with the requirements in EN ISO 13849-1:2008.

The automatic adjustment of spindles, spindle units, fences, table height, chip breakers and pressure shoes under NC or CNC-control shall only be possible with the movable guards required in 5.3.7.1 and 5.3.7.2 closed or if the adjustment movements do not create hazards and the tool spindles are not rotating.

The safety-related parts of the control system (see also 5.2.1) for automatic adjustment for positioning the spindles, spindle units, fences, table height, chip breakers and pressure-shoes shall have at least a PL = b in accordance with the requirements in EN ISO 13849-1:2008.

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

5.2.11 Control duplication

Where the machine is fitted with more than one control for starting, these controls shall be in accordance with EN ISO 12100:2010, 6.2.11.8 e), where hazardous elements means the movement of any machine actuator.

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

5.2.12 Failure of the power supply

For electrically driven machines automatic restart in the case of a supply interruption, after the restoration of the supply voltage shall be prevented in accordance with the requirements of EN 60204-1:2006, 7.5, paragraphs 1 to 3.

The automatic restart of the machine shall be prevented after restoration of the pneumatic or hydraulic energy.

Where the positions of the spindles and/or pressure shoes and/or feed mechanism and/or feed rollers are adjustable, in the event of the failure of the power supply they shall remain in their adjusted position during machining. This can be realized by arranging, for example, that these components are:

a) held by a securing device (e.g. screw and nut etc.) where they are moved manually; or

b) held by means of a brake or self-locking transmission (e.g. a rack and pinion) where they are moved by an electric motor; or

c) held by means of a non-return valve directly connected to the air cylinder where they are moved by pneumatic power; or

d) held by means of the control system where they are under NC or CNC control.

NOTE In the context of this requirement “adjustment” does not include controlled movement during machining.

The safety-related parts of the control system (see also 5.2.1) for prevention of automatic restart and for maintaining adjusted position of spindles, pressure shoes, feed mechanism and feed rollers shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

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

5.3 Protection against mechanical hazards

5.3.1 Stability

It shall be possible to fix the machines and auxiliary equipment to a suitable stable horizontal structure e.g. floor. Facilities for fixing are e.g. fixing holes in the machine frame and auxiliary equipment frame (see also 6.3).

Dangerous movements of the machine or parts of it caused by gravity, pressure etc. shall be avoided e.g. by mechanical blocking devices capable of withstanding the maximum load for which the machine is designed.

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

5.3.2 Risk of break-up during operation

To reduce the probability of break up during operation the requirements of 5.3.3 and 5.3.6 apply. To reduce the effect of break up during operation the requirements of 5.3.7.1 apply.

Feed rollers and pressure shoes (if provided) shall be adjustable so that their contact with the tool is avoided. See also 6.3.

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

5.3.3 Tool holder and tool design

5.3.3.1 Spindles

5.3.3.1.1 Spindle strength and performance

The spindles shall be manufactured from steel with an ultimate tensile strength of at least 580 N mm^{-2}.

The tool holding part of the spindle shall have geometrical performance in accordance with the specifications given in Annex A and shall have a tolerance of g6 in accordance with the requirements of EN ISO 286-2:2010.

Verification: By checking the relevant drawings and measurement.

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

5.3.3.1.2 Spindle dimensions

With regard to the balancing requirements in EN 847-1:2005+A1:2007, 6.2.4, the manufacturer shall declare for each spindle the maximum speed, maximum mass and dimensions of the tools that can be used with it (see also 6.3).

Verification : By calculation or other method, e.g. tests.

5.3.3.1.3 Spindle rings

Where spindle rings are provided, their bores shall have a tolerance of at least H8 in accordance with the requirements of EN ISO 286-2:2010. The spindle ring clamping surfaces shall be parallel within $\pm$ 0,02 mm.

Spindle rings shall be manufactured in steel with an ultimate tensile strength of at least 350 N mm^{-2}.

For spindle rings with a bore size ≥ 30 mm the wall thickness shall be ≥ 9,5 mm. Where the bore size is < 30 mm the wall thickness shall be ≥ 4 mm.

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.

5.3.3.1.4 Spindle locking

If it is necessary to hold the spindle stationary e.g. for tool changing a spindle locking device shall be provided, e.g. a double spanner or a bar inserted through the spindle by the operator by a voluntary action. This bar may be integral or not with the machine. Locking bars or forks shall prevent the spindle from rotating if the spindle motor is inadvertently switched on. After starting the spindle drive motor with the locking device in place, the spindle shall stay stationary and the locking device shall not be deformed.

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

5.3.3.2 Spindle unit locking

Spindle units which are fixed in position during machining shall be held in this fixed position, e.g. by means of:

a) a securing device (e.g. screw and nut etc.) where setting adjustment is manual or power operated; or

b) a brake or self-locking transmission (e.g. a rack and pinion) where setting adjustment is by an electric motor; or

c) a non-return valve directly connected to the actuating cylinder where setting adjustment is by pneumatic power; or

d) a self-locking device.

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

5.3.3.3 Tool fixing device

5.3.3.3.1 Planing, moulding tools and saw blades

The spindles except those designed for hydrostatic tool fixing shall be provided with one of the following tool fixing devices:

a) a lock nut or a spindle screw and separate/integral spindle ring which ensures a positive connection between the ring and the spindle; or

b) a lock nut or a spindle screw which ensures positive connection between the tool and the spindle; or

c) a cone connection.

Hydrostatic tool fixing devices which are an integral part of the spindle or which are permanently connected with it shall have an additional mechanical device to prevent loosening of the tool in case of leakage in the hydrostatic system (see also 6.3).

Planing, moulding and saw blade spindle run-out shall not exceed 0,02 mm.

Tool release shall only be possible after the spindle has stopped and its restart is prevented. The control system for interlocking between tool release and spindle rotation shall have at least a PL = c in accordance

with the requirements of EN ISO 13849-1:2008 or consist of 2 independent systems having a PL = b in accordance with the requirements of EN ISO 13849-1:2008.

As an exception, the tool release function can have a PL = b in accordance with the requirements of EN ISO 13849-1:2008 if the spindles are equipped with an additional mechanical system which prevents tool release while the spindle rotates.

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

5.3.3.3.2 Glass bead cutting unit

Two saw flanges (or in the case of flush mounted saw blade, a single flange) shall be provided for the saw spindle.

The diameter of all flanges shall be at least D/6 (where *D* = the diameter of the largest saw blade for which the machine is designed).

For flanges other than those for flush mounted saw blade the clamping surface at the outside part of the flanges shall be flat over a width of at least 5 mm and be recessed to the centre. Both outside diameters shall be within a tolerance of ± 1 mm. In addition there shall be a positive connection either between the saw blade and the rear flange fixed to the saw spindle or between the front flange and the saw spindle, e.g. by a key.

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

5.3.3.4 Tools

If the machine is fitted with tools these tools shall be of round form complex cylindrical type in accordance with the requirements of EN 847-1:2005+A1:2007 (see also 6.3).

Verification: By checking the relevant drawings.

5.3.4 Braking

5.3.4.1 General

Automatic brakes shall be provided for spindles where the un-braked run-down time exceeds 10 s.

The braked run-down time shall be less than 10 s or where the run-up time exceeds 10 s the braked run-down time shall be less than the run-up time but in no case exceed 30 s.

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 the run-up time, the un-braked run-down time and the braked run-down time, if relevant, the appropriate tests given in Annex B apply.

5.3.4.2 Mechanical brake

Where a mechanical brake is fitted the last paragraph of EN 60204-1:2006, 9.3.4 does not apply and the following requirements shall be met:

a) control system for braking shall have at least a PL = c in accordance with the requirements of EN ISO 13849-1:2008;

b) the minimum life time (number of braking cycles) of the friction coating and method of replacement shall be given in the instruction handbook (see 6.3).

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

5.3.4.3 Electrical brake

Where an electrical brake with electronic components is fitted, at least a PL = b for the breaking function shall be achieved and be designed 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 feedback 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 work:

a) independently from the basic control system for braking or an internal watchdog function shall be provided in the control system for braking;

b) independently from the intention of the operator;

c) at least at each spindle stop.

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

The diagnostic coverage (DC_{avg}) shall be ≥ 60%.

See EN ISO 13849-1:2008, Annex E for DC estimation.

As an exception, 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 Table 5 of EN ISO 13849-1:2008 reaches a value of “high” (at least 30 years).

NOTE 1 Complex electronic components like e.g. 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.

NOTE 2 For calculating the probability of occurrence of a dangerous failure 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.

When the inverter for infinitely speed changing of spindle rotation (see 5.2.7.3) is also used to control the braking function this function shall be guaranteed even in case of overload or it shall not be possible to open the movable guards required in 5.3.7.1 until the spindle has come to a complete stop.

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

5.3.4.4 Brake release

Where a control is provided to release the spindle brake in order to enable rotation by hand and adjustment of the tool (moulding tool, saw blade), release of the brake shall only be possible when the spindle has stopped turning (e.g. by a time delay in accordance with 5.2.1.5 c) between control actuation and brake release).

It shall not be possible to start the machine before the control for the spindle brake has been reset. Reset of the control for brake shall not initiate a start-up of the spindle.

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

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

5.3.5 Devices to minimise the possibility or the effect of ejection

5.3.5.1 In-feed end of the machine

Where the machine is fitted with spindles designed to be used with tools for dividing the work-piece, e.g. saw units and multi-profiling units, a device shall be fitted to prevent ejection of divided parts and splinters of the work-piece, e.g. a catching finger device (example see Figure 4).

This device is not required for machines only fitted with a glass bead cutting unit (see 5.3.5.3).

Where a catching finger device is fitted it shall be designed in accordance with the following requirements:

a) it shall be effective over the whole working area of the in-feed opening;

b) it shall be located before the dividing spindle;

c) the catching fingers shall be manufactured from steel with an ultimate tensile strength of at least 350 N mm^{-2};

d) all catching fingers in a single row shall be of the same length;

e) in the fully closed position the catching fingers shall extend downwards to within 1 mm of the machine table;

f) the width of an individual catching finger shall be:

   1) between 6 and 10 mm for fingers with a length not exceeding 150 mm;

   2) between 8 and 10 mm for fingers with a length exceeding 150 mm;

g) the thickness of each finger shall not be less than 3 mm;

h) the space between the fingers shall be between 0,4 mm and 1 mm;

i) the fingers shall return automatically to their fully closed position after a work-piece has passed them;

j) end stops shall be provided to prevent the catching fingers rotating around the shaft except for an angular sector corresponding to the capacity of the dividing tools.

Dimensions in millimetres

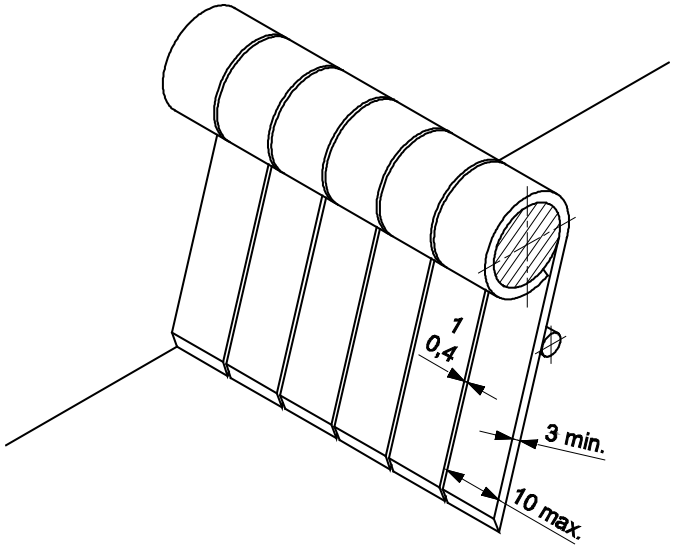


Figure 4 — Catching finger dimensions

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

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

5.3.5.2 Out-feed end of the machine

On machines designed for climb cutting on one or both of the last 2 working spindles a tunnel guard (see EN 953:1997+A1:2009, 3.2.2) shall be fitted at the out-feed end of the machine. The tunnel guard shall be in accordance with the following requirements:

a) it shall allow side or bottom off-loading;

b) its end shall be designed and constructed to retain any work-piece ejected by an end wall (impact wall), the area of which shall be at least equivalent to and in feed direction aligned with the out-feed opening (see Figure 5, key 7);

c) access to the danger zone in the discharge area (see Figure 5, keys 10 and 11) shall be prevented in accordance with the requirements in EN ISO 13857:2008, 4.5.1 for reaching through openings and in accordance with the requirements in EN ISO 13857:2008, 4.3.2.2 for access to the danger zone;

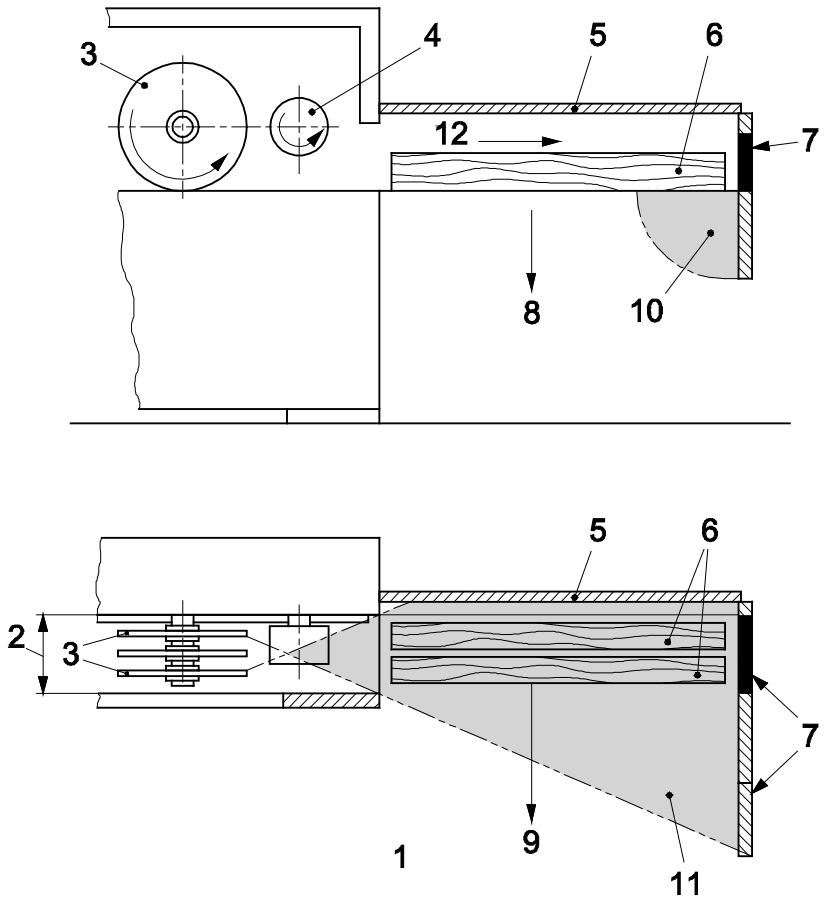
d) where frequent access (i.e. more than once per month) to dangerous points inside the tunnel is necessary, it shall be via a movable guard interlocked with guard locking with conditional unlocking in accordance with the requirements in EN 1088:1995+A2:2008, Table 2 and Annex M.

Other parts of the out-feed tunnel shall be manufactured from materials which are in accordance with the requirements of 5.3.8. Mesh shall not be used.

The above requirements do not apply to universal units unless they are intended for climb cutting.

The safety-related parts of control system for interlocking (see also 5.2.1) between direction of rotation for climb cutting of the last two working spindles or on spindles designed for use with tools for dividing the work-piece and the tunnel guard and movable guard section of the tunnel guard (if provided) shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

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



Key

1 plan view
2 width of the out-feed opening
3 tool for dividing the work-piece e.g. saw-blade
4 last feed roller
5 tunnel guard
6 work-piece
7 end wall
8 bottom off-loading of the work-piece
9 side off-loading of the work-piece
10 danger zone in the discharge area
11 danger zone in the discharge area
12 feed direction

Figure 5 — Safeguarding of the out-feed end of the machine (safeguarding of the machine not shown)

5.3.5.3 Use of a glass bead cutting unit

When fitted with a glass bead cutting unit (see Figure 1), the machine shall be equipped with:

a) a bead ledged separator (see Figure 1). It shall be manufactured from steel with an ultimate tensile strength of at least 580 N mm^{-2} or of a comparable material, have flat sides (within 0,1 mm per 100 mm) and shall have a thickness less than the width of cut (kerf) and at least 0,2 mm greater than the saw blade plate (see Figure 6);

b) a device to guide the bead ledge, for example a guiding channel (see Figure 7);

c) a device to avoid or minimise the risk of kick-back of the bead ledge, for example an anti-kickback finger (see Figure 7). If an anti-kickback finger is fitted it shall be designed in accordance with the following requirements:

   1) it shall be located after the glass bead cutting tool in the direction of the feed;

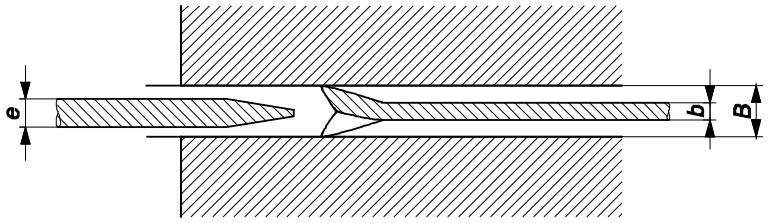
2) it shall be made from steel with an ultimate tensile strength of at least 350 N mm^{-2} or of a comparable material;

3) it shall have a lower tip with a maximum radius of 0,5 mm;

4) the angle of the tip shall be between 30° and 60° (see Figure 8);

5) it shall be effective over the full cutting height capacity of the glass bead cutting unit. "Effective operation" shall be between 85° and 55°, this angle being measured between a line from the tip to the axis of pivot of the fingers and the horizontal (see Figure 8);

6) a mechanical stop shall be provided to prevent the anti-kickback finger moving beyond the 85° point (see Figure 8).



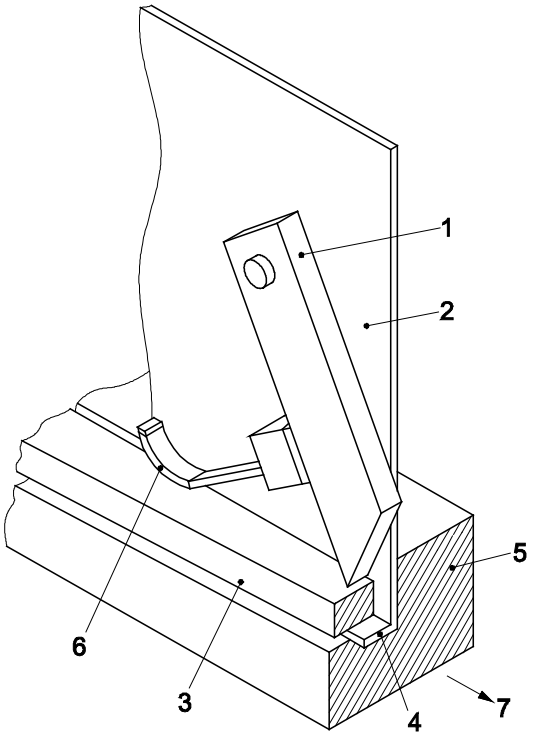
Key

e bead ledge separator

B width of cut

b width of saw blade

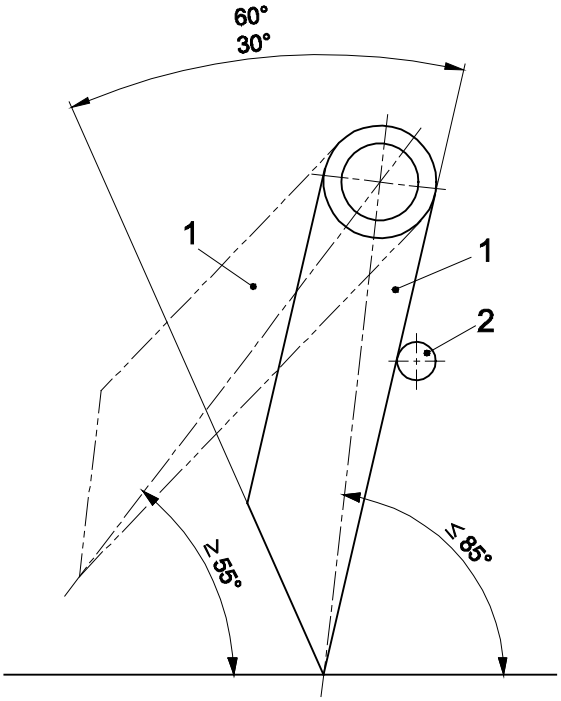
Figure 6 — Bead ledge separator thickness in relation to saw-blade dimensions



Key

1 anti-kickback finger after the glass bead cutting tool
2 bead ledge separator
3 bead ledge
4 guiding channel for bead ledge
5 work-piece
6 pressure pad
7 feed direction

Figure 7 — Example of anti-kickback finger and guiding channel



Key

1 anti-kickback finger

2 mechanical end stop

Figure 8 — Example of anti-kickback finger

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

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

5.3.6 Work-piece supports and guides

The machine table shall be provided with a fixed or adjustable fence prior to the first vertical spindle side.

If an adjustable fence is provided it shall be capable of being locked in position and it shall not be able to come into contact in any position with the spindle.

Adjustable side guides and/or pressure pads capable of being locked in position for proper work-piece guiding shall be provided.

If the machine is designed so that it can be used in such a way that the first powered feed roller is after the first horizontal spindle, then the table lips near to this spindle shall be in accordance with the following requirements:

a) they shall have a resilience of at least 3,5 daJ cm^{-2} and an ultimate tensile strength of at least 350 N mm^2;

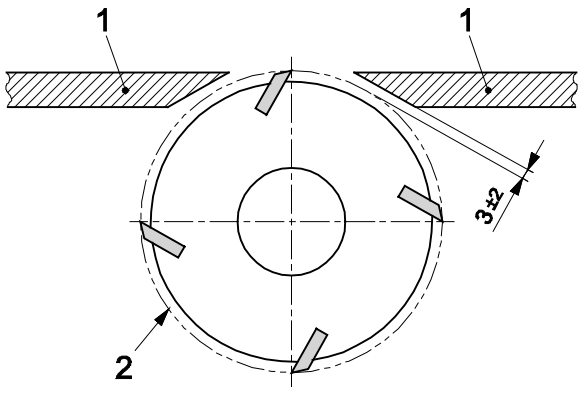
b) the distance between each table lip and the cutting flight diameter of the tool shall be 3 mm ± 2 mm whatever the relative positions of the tables and the tool is (see Figure 9);

c) where the table or table lips are slotted (for the purpose of noise reduction), the slots shall not exceed 6 mm in width and leave a tooth width of at least 6 mm; the minimum tooth thickness shall be 1,5 mm at the tip (see Figure 10);

d) where the table or table lips are slotted (for the purpose of noise reduction), the slots shall not exceed 30 mm in length (see Figure 10);

e) where the table or table lips are drilled (for the purpose of noise reduction), the bores shall not allow for the passage of a 6 mm in diameter cylindrical pin.

Dimensions in millimetres



Key

1 table lips

2 cutting flight diameter

Figure 9 — Distance between table lip and cutting flight diameter

Dimensions in millimetres

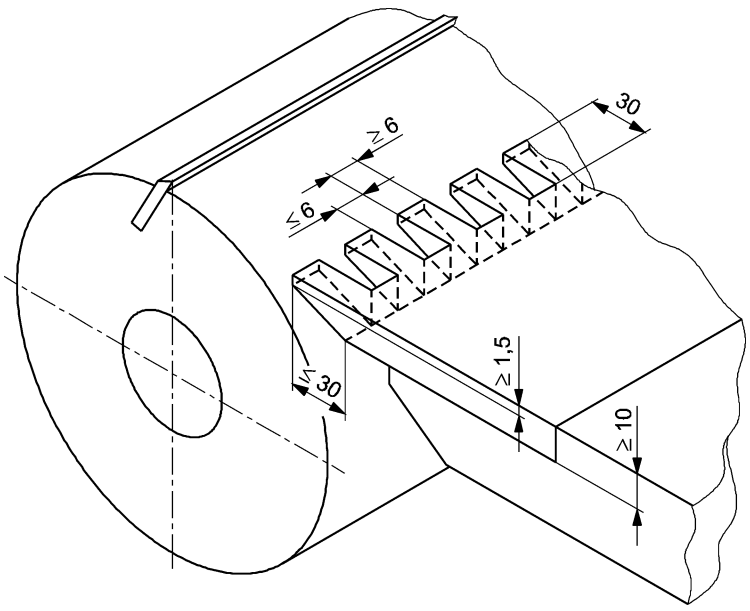


Figure 10 — Dimensions of slotted table lips

When the requirements a) and d) are not fulfilled, the test described in Annex C shall be performed and passed.

Verification: By checking relevant drawings, inspection of the machine, measurement and relevant functional testing on the machine, performing the test in Annex C if required.

NOTE For the resilience and ultimate tensile strength a confirmation from the material manufacturer can be useful.

5.3.7 Prevention of access to moving parts and ejection of parts of tools

5.3.7.1 Safeguarding of the tools

Access to the rotating tools and ejection of parts of tools shall be prevented by a combination of fixed and movable guards which make up an integrated enclosure (see also 5.4.2), other than through the in-feed and out-feed opening.

The integrated enclosure shall be so designed that it is not possible for a person to stand inside it with the access doors closed.

For machines which are set up in complete enclosure the above requirements shall be fulfilled, except the requirements of 5.4.2.

Where it is necessary that parts of the integrated enclosure must be opened, e.g. for tool changing, setting, adjustment or cleaning, these parts shall be interlocked with all directly accessible cutting and feeding movements of the machine by means of interlocking devices with guard locking, except for movements in the setting mode described in 5.2.6.

For the interlocking device with guard locking at least an interlocking device with spring applied/power released guard locking device in accordance with the requirements of EN 1088:1995+A2:2008, Table 1 and Annex M shall be used for that particular section(s) of the integrated enclosure.

Where spindles can operate with the movable guard opened, e.g. in setting mode, in addition to 5.2.6 the following requirements shall be met:

a) access to the tools shall be prevented by fixed guards with the exception of the maximum cutting area of the tool. This requirement can be met e.g. by the use of the extraction hood and chip breaker system;

b) a deterring/impeding device and/or parts of the machine, e.g. pressure rollers, shall minimise the direct horizontal access to the vertical tools;

c) access to all bottom horizontal tools shall be prevented by an adjustable guard. This adjustable guard shall satisfy the following requirements:

   1) it shall be adjustable to every working position without the aid of a tool;

   2) it shall be capable of being adjusted manually or automatically so as to cover the exposed length of the tool on the operator's side of the work-piece;

   3) if there is the possibility of contact with the tool, the adjustable guard shall be manufactured from a material such that neither the adjustable guard nor the tool will disintegrate, e.g. wood or light alloy;

   4) at rest and over the whole range of adjustment, the adjustable guard shall totally cover the area between the two vertical planes tangent to the table lips when they are set to the maximum width apart.

d) the openings necessary for changing tools shall be closed by movable guards which are held in place by means of a positive connection.

The distance L_{min} between the first tool and the in-feed opening of the enclosure shall be (see Figure 11):

e) $L_{min} \geq 200$mm for in-feed opening heights $X \leq 160$ mm;

f) $L_{min} \geq 1.25 \times X$ for in-feed opening heights $X > 160$ mm.

X has to be calculated – measured when cutting depth is 3 mm.

At the out-feed end of the machine access shall be prevented by:

g) a fixed distance guard (e.g. tunnel). The distance between the out-feed end of the tunnel and the nearest dangerous point inside of the machine shall be at least 550 mm; or

h) a single direction rigid pendulum flap system installed at the in-feed end of a tunnel guard (see Figure 12). The length *L* of the tunnel guard beyond the flap system position shall be more or equal to flap system height *H*. The width *W* of each flap shall be not exceed 20 mm.

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

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

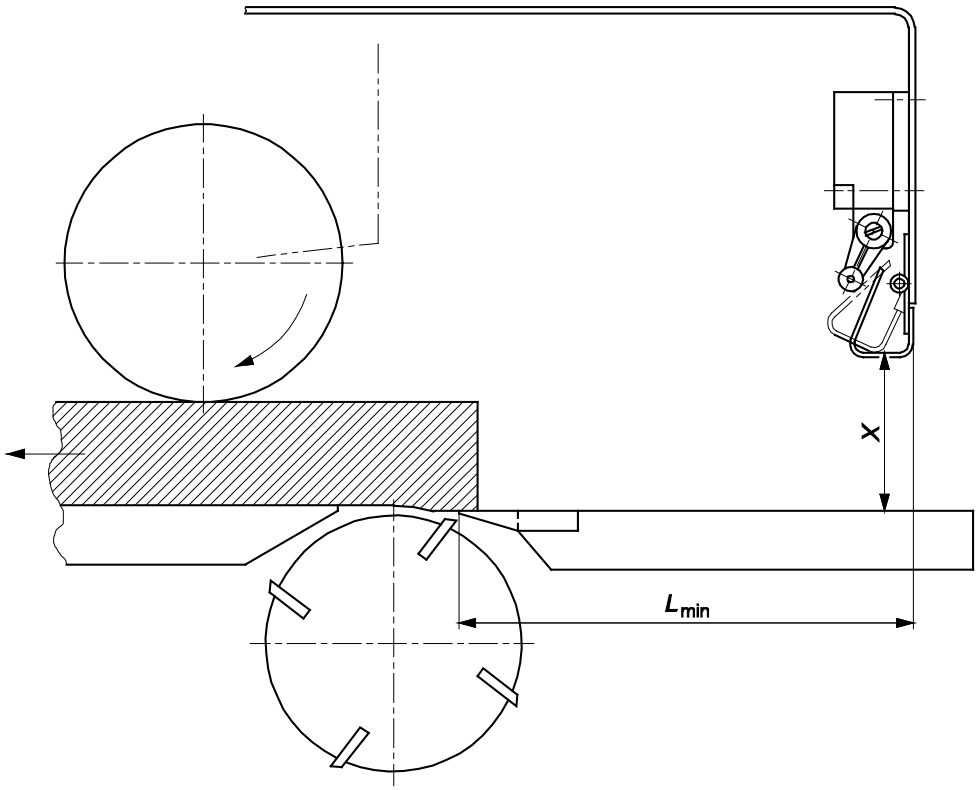
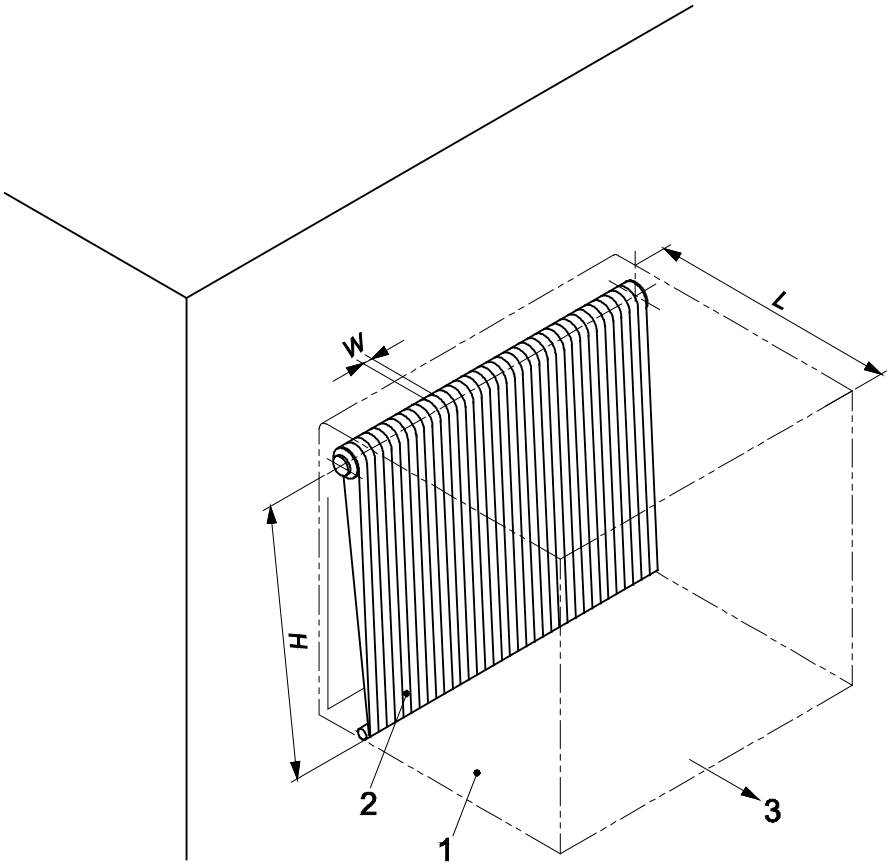


Figure 11 — In-feed opening - minimum distance to first tool



Key

1 tunnel guard
2 flaps
3 feed direction
H height of the flap system
L length of the tunnel guard
W width of a flap

Figure 12 — Tunnel guard at the out-feed opening

5.3.7.2 Safeguarding of feed and retaining mechanism

Access to feed rollers and retaining devices shall be prevented by the integrated enclosure required by 5.3.7.1.

Access to the trapping points at the in-feed opening of the machine shall be prevented by a mechanically actuated trip device (see Figure 13) which shall meet the following requirements:

a) the width of the trip device sensor shall be at least equal to the width of the in-feed opening;

b) in the rest position, the bottom of the trip device shall have a vertical distance *H* to the base of the first in-feed roller of ≤ 30 mm, measured at the lowest level of the roller with no work-piece in the machine (see Figure 13);

c) the tripping force shall be ≤ 50 N;

d) the distance L_{min} between the trip device activation position and the drawing in point shall be at least 125 mm (see Figure 13). Where the vertical distance *H* does not exceed 25 mm, a minimum distance L_{min} of 100 mm is acceptable;

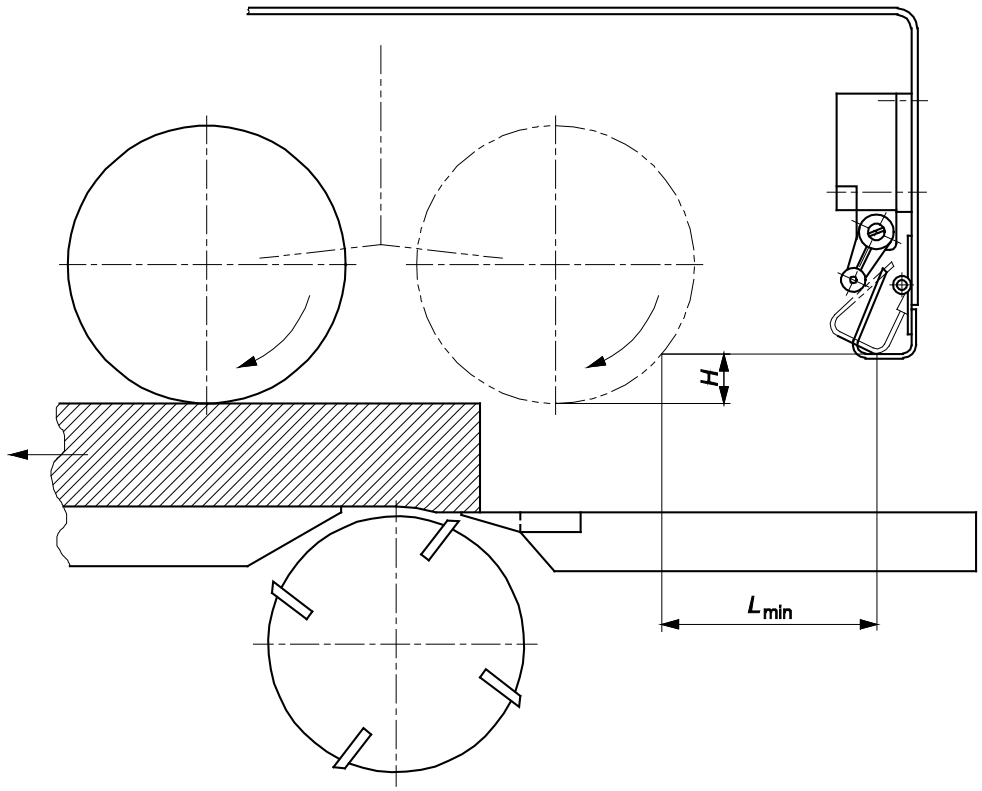
e) having regard to the gap between the trip sensor and the work-piece, the horizontal distance from the trip sensor to the trapping point, the response time of the trip device and the stopping time of the feed, the trip sensor shall be designed and positioned so that at the maximum feed speed a hand resting on the work-piece shall be prevented from being drawn into the trapping point;

f) the trip sensor shall not in itself create a trapping hazard.

Where a removable mechanical in-feed device (e.g. magazine, hopper) is fitted to the machine which prevents access to the in-feed opening, it shall be interlocked with the trip device so that if the trip device is deactivated when the in-feed device is fitted, then when the in-feed device is removed, the machine shall not be capable of being operated until the trip device is reactivated.

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

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



L_{min} = 125 mm for 25 mm < $H \leq$ 30 mm
L_{min} = 100 mm for $H \leq$ 25 mm

Figure 13 — Trip device - Positioning

5.3.7.3 Roller table

On machines fitted with a roller table at the out-feed end, the gaps between the rollers shall be closed by fixed guards. The gaps between the rollers and the fixed guards and between the first roller and the end of the machine shall be ≤ 4 mm (see Figure 14).

The fixed guards between the rollers shall have a maximum depth below the top of the rollers of 15 mm (see Figure 14).

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

Dimensions in millimetres

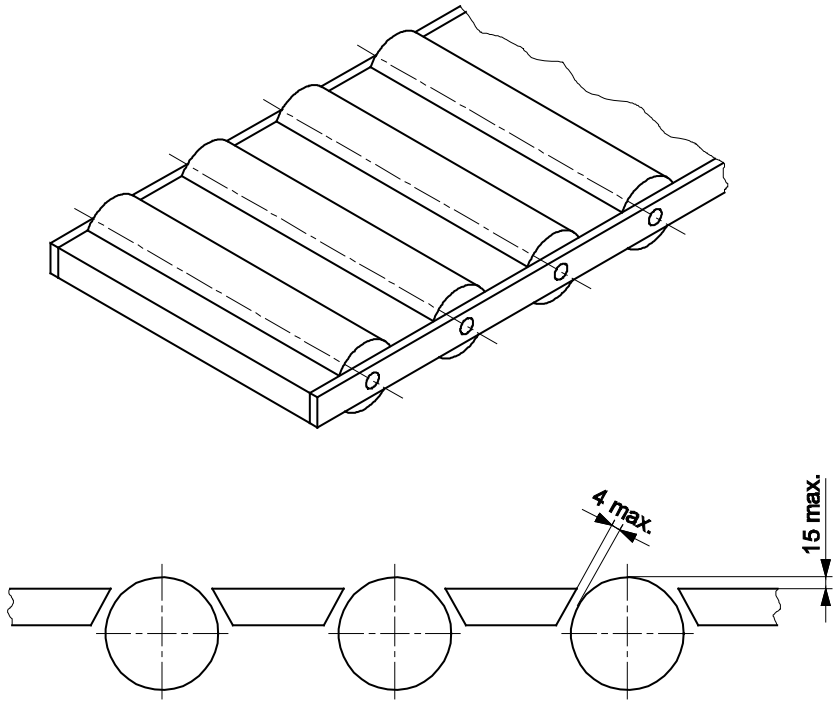


Figure 14 — Roller table - safeguarding of gaps between the rollers

5.3.7.4 Guarding of drives

Access to all drive mechanisms (e.g. for the tool and work-piece feed) shall be prevented by

a) fixed guard(s), fitted with a fixing system which remains attached to the guard or to the machine e.g. unlosable screws if they are demountable by the user e.g. for maintenance, cleaning purposes, see 6.3 kk); or

b) a moveable guard interlocked with the drive mechanism(s) where frequent access to the drive is provided for maintenance or adjustment purposes, i.e. more than once per shift. Where access to the tools is also possible, the movable guard shall be interlocked with guard locking in accordance with the requirements of 5.3.7.1.

NOTE The requirement b) also applies to doors at the rear side of the machine (if provided)..

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

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

5.3.8 Required characteristics of tool guards

The guards preventing ejection of parts of tools shall be manufactured from materials with at least the following properties:

a) steel with an ultimate breaking strength of at least 350 N mm^{-2} and a wall thickness of at least 2 mm;

b) light alloy with the characteristics shown in Table 3;

Table 3 — Light alloy tool guard thickness and tensile strength

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

c) polycarbonate with a wall thickness of at least 5 mm or other material passing the test in Annex D;

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 and/or circuit diagrams, inspection of the machine and relevant functional testing of the machine. For other materials by performing the impact test given in Annex D.

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

5.3.9 Retaining devices

The work-piece shall be held during its passage through the machine by means of retaining device(s), e.g. pressure provided by belt/rollers etc. These retaining device(s) shall be designed so that the work-piece remains held in case of a failure of the power supply and during braking.

The safety-related part of control system (see also 5.2.1) for interlocking between work-piece holding and power supply shall have at least a PL = c in accordance with the requirements in EN ISO 13849-1:2008.

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

5.4 Protection against non-mechanical hazards

5.4.1 Fire

To avoid fire risks the requirements in 5.4.3 and 5.4.4 shall be met (see also 6.3).

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. Also the information given in EN ISO 11688-2:2000 and EN ISO 14163:1998 may be taken into account. The most relevant noise sources are the rotating tools.

The machine shall preferably be equipped with an integrated enclosure according to EN ISO 15667:2000 for noise attenuation. The integrated enclosure shall completely cover the full length of the machine except for the openings necessary for the passing of the work-pieces.

The enclosure wall should have a surface-related mass of approx. 5 to 20 kg/m², depending on the frequency spectrum of the noise emitted, which is equivalent to a steel plate of 1 to 2,5 mm in thickness.

The enclosure shall incorporate sound absorbing linings to cover at least 70 % of the internal surface area. The lining material shall have a noise absorbing factor “alpha” (in accordance with EN ISO 354:2003) of at least 0,77 at 1 kHz. The in-feed and out-feed openings shall not be bigger than necessary: they must allow the passing of a maximum size work-piece in accordance with the maximum allowable work-piece dimensions defined by the manufacturer.

Machines equipped with a complete enclosure, the in-feed and out-feed openings of the enclosure shall be equipped with sound absorbing sections.

For machines without complete enclosure, wherever possible, and particularly if the machine is part of a line, sound absorbing sections should be used for noise attenuation.

Where noise attenuation is achieved through sound-absorbing sections, the passing work-pieces shall be enclosed by means of channels or tunnel guards. These shall incorporate sound absorbing linings – except for the guiding surfaces. The lining material shall have a noise absorbing factor “alpha” of at least 0,5 in octave bands between 1 and 4 kHz.

The necessary length of the sound-absorbing sections essentially depends on the cross-sectional area of the opening. The bigger the cross-sectional area of the opening, the longer the sound-absorbing sections should be designed. Details concerning the design of silencers are described in EN ISO 14163:1998.

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

NOTE For the characteristics of sound absorbing material a confirmation from the manufacturer of the material can be useful.

5.4.2.2 Noise emission measurement

The operating conditions for noise emission measurement shall comply with Annex H of ISO 7960:1995.

For machines having a maximum feed speed > 40 m min^{-1} an additional measurement at 80 % of the maximum feed speed or 96 m min^{-1}, whichever is lower, shall be performed, where the test material and other mounting and operating conditions of the machine remain unchanged.

NOTE Noise emission measurement on machines having a maximum feed speed higher than 120 m min^{-1} require integration into a production line and cannot be tested in a laboratory using the conditions stated in ISO 7960:1995, Annex H. For the evaluation of the noise emission of these machines additional measurements at the customer’s site can be useful.

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.

Sound power levels shall be measured according to the enveloping surface measuring method 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 surface;

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

f) the number of microphone positions shall be 9 in accordance with ISO 7960:1995, Annex H.

Alternatively, where the facilities exist and the measurement method applies to the machine type, 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 3745:2012 without the preceding modifications.

For determination of 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 level at the workstation shall be measured in accordance with EN ISO 11202:2010 with the following modifications:

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

h) the difference between the background emission sound pressure level and the workstation sound pressure level shall be equal to or greater than 6 dB according to EN ISO 11202:2009, 6.4.1 accuracy grade 2 (engineering);

i) the correction of the local environmental factor K_{3A} shall be calculated in accordance with the requirements of 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 in accordance with EN ISO 3743-1:2010, EN ISO 3743-2:2010, EN ISO 3744:2010 or EN ISO 3745:2012 where one of these standards has been used as the measuring method.

For noise declaration 6.3 dd) shall be met.

5.4.3 Emission of chips and dust

The non-cutting area of the tool shall be enclosed by a capture device (exhaust hood, enclosure of the area of dust generation), which shall have an extraction outlet. The opening of the capture device should preferably face the direction of the flow of the chips and dust.

When the opening of the capture device cannot face the direction of the flow of the chips and dust, the flow shall be guided to the opening of the capture device, e.g. by baffles.

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 chip 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).

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 2 For 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 Hot surfaces

See 6.2 k)

5.4.5 Electricity

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

See EN 60204-1:2006, 6.2 for the prevention of electric shock due to direct contacts and EN 60204-1:2006, Clause 7 for protection against short circuits and overloading.

The protection of people against electrical shock due to indirect contacts should be 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 6.3, ll)).

The degree of protection of all electric components shall a minimum of IP 54 in accordance with EN 60529:1991.

In particular the following clause requirements of EN 60204-1:2006 shall be fulfilled:

a) Clause 7 for protection of equipment;

b) Clause 8 for equipotential bonding;

c) Clause 12 for conductors and cables;

d) Clause 13 for wiring practices;

e) Clause 14 for electrical motors and associated equipment.

Electrical enclosures shall not be exposed to risk from the ejection of parts of tools and work-pieces. Live parts shall not be accessible in accordance with EN 60204-1:2006, 6.2.2. Fire risk is not present where power circuit(s) is (are) protected against over current in accordance with EN 60204-1:2006, 7.2.2.

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

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

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

5.4.6 Ergonomics and handling

The requirements of EN 614-1:2006+A1:2009 apply and in addition:

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.

On machines designed for manual loading and/or unloading the height of the work-piece support shall be between 750 mm and 900 mm above the floor level.

On manually loaded machines the feed roller before the first bottom spindle shall be visible from the operator's position when feeding a work-piece with a length of 500 mm or shorter.

Parts of the machine with a mass of more than 25 kg (e.g. detachable units or fences) and that need to be replaced/removed, shall be equipped with means for safe handling or enable safe lifting, such as attachments to accommodate the fitting of a lifting device in accordance with EN 1005-2:2003+A1:2008, e.g. screw holes or lugs positioned such as to avoid their overturn or fall or move in an uncontrolled way during transport, assembly, dismantling, disabling and scrapping.

The integrated enclosure described in 5.3.7 shall allow viewing of the working area. This requirement is met if there is a window of at least 6×10^4 mm² every 1 m along the front length of the machine.

The positioning and labelling of control devices shall be in accordance with the ergonomic principles of 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.

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

NOTE Useful information on ergonomics can also be found in EN 60204-1:2006, EN 614-1:2006+A1:2009, EN 614-2:2000+A1:2008 and EN 1005-3:2002+A1:2008.

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

5.4.7 Lighting

Lighting shall be provided inside the machine enclosures and shall be in accordance with the requirements of EN 1837:1999+A1:2009 and of EN 60204-1:2006, 15.2 (see also 6.3).

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

5.4.8 Pneumatics

Pneumatic power systems and their components shall comply with EN ISO 4414:2010.

See also 5.2.1.

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

5.4.9 Hydraulics

For machines fitted with hydraulic power systems and components the requirements of EN ISO 4413:2010 shall apply.

See also 5.2.1.

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

5.4.10 Electromagnetic immunity

The machine shall have sufficient immunity to electromagnetic disturbances to enable it to operate correctly in accordance with EN 60439-1:1999, EN 50370-1:2005 and EN 50370-2:2003.

NOTE Machines which incorporate CE-marked electrical components and where such components and cabling are installed in accordance with their respective manufacturer's instructions, are generally considered to be protected against external electromagnetic interference.

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

5.4.11 Static electricity

If the machine is fitted with flexible hoses for chip and dust extraction, the hoses shall be able to lead charge to earth potential.

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

5.4.12 Supply disconnection (isolation)

The requirements of EN 1037:1995+A1:2008, Clause 5 shall apply and in addition:

Means for isolation from all energy sources (e.g. electrical, pneumatic or hydraulic) shall be provided.

For isolation from the electric energy source an electrical isolator shall be fitted which is in accordance with EN 60204-1:2006, 5.3, except that the isolator shall not be of type d) in EN 60204-1:2006, 5.3.2.

Pneumatic isolators shall be provided with a device for locking the isolator in the isolated condition e.g. by a padlock. Where the pneumatic supply is used only for retaining the work-piece and no crushing or shearing hazards exist isolation from the pneumatic energy can be achieved through disconnecting a quick action coupling in accordance with EN ISO 4414:2010 which does not need to be locked.

If the machine is fitted with hydraulic or pneumatic equipment the electric isolator shall also isolate the drive motor of the hydraulic or pneumatic unit (if fitted) and any residual hydraulic/pneumatic pressure from an accumulator (if fitted) shall be dumped.

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

5.4.13 Errors of fitting

It shall not be possible to fit a tool of greater diameter than the largest tool for which the machine is designed.

See also 6.3.

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

5.4.14 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.

The machine shall be designed so that maintenance and cleaning can be wherever possible undertaken after disconnection of the machine from all energy sources (see also 6.3).

Where the machine is equipped with mechanical brake(s), instructions for brake maintenance shall be given in the instruction handbook.

Where lubrication points are provided they shall be located outside of the tool guarding and easily accessible by the operator when standing on the floor.

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

If dumping residual hydraulic or pneumatic pressure allows movement of any machine component, then pressure shall be maintained in the system to prevent such movement and dumping of this pressure shall be by voluntary action on a separate control.

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 Warning devices

The basic principles of EN ISO 12100:2010, 6.4 shall be observed and in addition:

Information on a negative test result of the braking system shall be displayed.

On machines fitted with a complete enclosure and access door an audible or visual warning (e.g. a yellow light) of impending start up shall be provided.

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

6.2 Marking

The principles of EN ISO 12100:2010, 6.4.4 shall be observed and in addition:

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 plates permanently fixed to the machine e.g. by riveting or stickers:

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

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

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

d) serial or identification machine number, if any;

e) an arrow for spindles rotating in one direction of rotation and double arrow for spindles which can rotate in both directions of rotation;

f) where fitted with a glass bead cutting unit with the maximum diameter of the glass bead cutting tool;

g) rating information (mandatory for electro-technical products: voltage, frequency, nominal current, in accordance with 16.4 of EN 60204-1:2006);

h) if the machine is equipped with a pneumatic supply and isolation of the pneumatic energy is not achieved by the electrical isolation a permanent warning label shall be placed in proximity to the electrical supply disconnection device, warning that the pneumatic supply is not isolated by isolation of the electrical supply;

i) on machines where speed changing is achieved by changing the position of the drive belts on the drive pulleys, with a diagram adjacent to the pulleys or on a door giving access to the belt drive mechanism showing the relevant speed in rpm selected for each combination of pulleys;

j) where fitted with a hydraulic and/or pneumatic system with nominal pressure for the hydraulic and/or pneumatic circuits;

k) parts of the machine which may heat up during operation exceeding a temperature of 70 °C (see EN ISO 13732-1:2008, Figure 2), with a warning label placed in proximity to all potentially hot parts, warning of hot surfaces.

NOTE The machine table temperature largely depends on the quality of the table surface, the working conditions and the work-piece material. Particularly, machining of certain species of tropical hardwood is known to result in high machine table temperatures.

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 relevant isolator on the machine.

All written information presented on the machine, including warnings, shall be in the language of the country in which the machine is to be used.

Wherever possible it is recommended to use pictograms.

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

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

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

6.3 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) a repetition of the markings, pictograms and other instructions on the machine as required in 6.1 and 6.2 and, if necessary, information about their meaning;

b) intended use of the machine;

c) reasonably foreseeable misuse of the machine. This includes simultaneous machining of multiple work-pieces side by side (in parallel), planning or thicknessing, operating climb cutting in machines where it is not allowed (e.g. universal spindle), but does not include demounting of safety equipment;

d) the maximum length of the work-piece which can be machined together with installation drawing(s) insuring at least 500 mm clearance at the out-feed end of the machine in order to avoid body crushing;

e) a warning regarding residual risks. This includes:

1) to take precautions to reduce the hazard of inhalation of harmful dusts (e.g. wearing a dust mask);

2) to wear eye protection;

3) to wear ear protection to prevent hearing loss;

4) to wear gloves against the hazard of cutting when handling tools, feeding wood into the machine or doing maintenance;

5) not to try using the machine unless all guards and other safety devices necessary for machining are in good working order;

f) where necessary instruction for installation to ensure that the machine is stable and securely fixed to the floor or a stable structure and how this is to be done;

g) information regarding the need to ensure that the location of the machine is such that no impact risk and additional crushing risk is created between the moving work-piece at the out-feed of the machine and any other adjacent machine, part of the building, stocks of material, etc.

h) the specification of milling tools and saw blades including tools for dividing the work-piece (see 5.3.5.1) for which the machine is designed;

i) a warning that only milling tools and saw blades manufactured in accordance with EN 847-1:2005+A1:2007 shall be used;

j) a warning that saw blades made of High Speed Steel (HSS) shall not be used;

k) a warning that only the fixing device for the tool provided by the manufacturer shall be used;

l) the minimum/maximum length, width and thickness of the work-piece for which the machine is designed;

m) a warning that for machines where the maximum feed speed exceeds 120 m min^{-1} that the fence and the table may be heat up during operation;

n) the instruction for setting the machine. This includes the precautions during setting as:

1) a warning that before setting the machine it is necessary, to ensure that the tools used are sharpened, selected, maintained and adjusted in accordance with the tool manufacturer's instructions, to use special equipment for setting (e.g. gauges) where practicable and to take care when handling tools;

2) that during setting it shall be verified that no contact exists between non rotating tools and any retaining device or other machine element;

3) the instructions for retaining device mounting, setting and use;

4) the method for choosing the spindle speed taking into account the work to be done and the tool used;

o) instruction for safe use in accordance with EN ISO 12100:2010, 6.4.5.1 d) including indication of work station(s), necessary information for operators to be adequately trained in the adjustment and operation of the machine including the correct use. This includes taking precautions during machining such as:

1) the hazards associated with the setup and operation of the machine;

2) the principles of machine operation, correct use and adjustment of the guards;

3) the correct selection of tools for each operation;

4) how to minimise the noise levels by:

i) the choice of the condition of the tools;

ii) the guards positioning so as to reduce noise levels;

iii) the choice of the tooling speed to reduce the noise levels;

p) instruction for the selection of spindle speed taking into account the tool being used in order that the maximum permissible speed of the tool is not exceeded;

q) recommendation on care to be taken when handling tools and on use of tool carriers wherever practicable;

r) the use of personal protective equipment e.g. for noise, inhalation of harmful dust and eye protection;

s) mechanical device to protect against loosening of the tool in case of leakage in the hydrostatic system shall be used;

t) that where the complete enclosure is not interlocked (see 5.3.7), the enclosure(s) shall remain in the closed position as long as possible to ensure the most efficient noise reduction;

u) information that adequate general or localised lighting shall be provided;

v) information regarding the chip and dust equipment fitted to the machine as follows:

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

2) pressure drop at each dust extraction connection outlet at 20 m s^{-1} of air velocity;

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

4) cross section dimensions and details of each connection.

w) information that the machine shall be connected to an external chip and dust extraction system;

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

x) instruction that dust extraction equipment shall be switched on before commencing machining;

y) information that before changing any tool, the spindles shall be stopped, to wait for standstill of all tools and that the unexpected start-up shall be prevented;

z) information that whenever possible maintenance shall be only done if the machine is isolated from all energy sources and involuntary restart is prevented;

aa) information about safe cleaning;

bb) if fitted with a hydraulic or a pneumatic system the method for the safe dissipation of residual energy (see 5.4.13);

cc) those safety devices which shall be tested, how frequently the tests shall be carried out and the test method. This shall include at least the following:

1) emergency stop(s) – by functional testing;

2) interlocked guards – by opening each guard in turn to stop the machine and by proving the inability to start the machine with each guard in the open position;

3) interlocked guards with guard locking – by proving an inability to open the guards as long the tools are rotating*;*

4) any trip device – by functional testing;

5) catching fingers – by inspection to check that the catching fingers are in the fully closed position when no work-piece is present;

6) the brake(s) – by functional testing to check that the machine is braked within the specified time;

7) indication of the selected speed – by functional testing;

8) mode selection – by functional testing;

dd) a declaration of airborne noise emission 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. 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:

1) 4 dB when using EN ISO 3746:2010 and EN ISO 11202:2010;

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

3) 1 dB when using EN ISO 3745:2012.

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

Associated uncertainty *K* = 4 dB

Measured in accordance with EN ISO 3746:2010

In the case of very large machinery (i.e. machines with at least one dimension exceeding 7 m, instead of the sound power level, the emission sound pressure levels at specified positions around the machinery may be indicated.

If a verification of the declared noise emission values is required, it shall be conducted by using the same mounting, installation and operating conditions as those used for the initial determination of noise emission values.

The noise declaration in the instruction handbook shall be accompanied by the following statement:

"The figures quoted are emission levels and are not necessarily safe working levels. Whilst 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 work-force include the characteristics of the work room, the other sources of noise etc., i.e. the number of machines and other adjacent processes. Also the permissible exposure level can 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.

If noise emission tests on machines with a maximum feed speed greater than 120 m/min are carried out at the customer's site, the report should state the measuring points, the sound pressure level (not corrected) at the measuring points, information regarding the measuring method used and the operating conditions, particularly the feed speed. In addition, the accuracy of the measuring equipment according to EN 61672-1:2003 should be given.

ee) 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;

ff) 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;

gg) 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);

hh) a warning that manually adjusted spindles which are not in use shall be removed to a non-cutting area before starting the integrated feed;

ii) a warning that parts of the machine may heat up during operation and a drawing of the machine showing all parts which may exceed 70°C, e.g. machine table;

jj) if fitted, the minimum life time of mechanical brakes (number of braking cycles) of the friction coating and method of replacement.

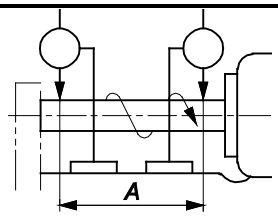
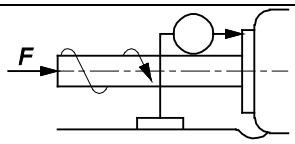
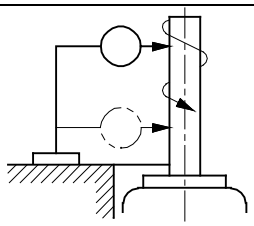
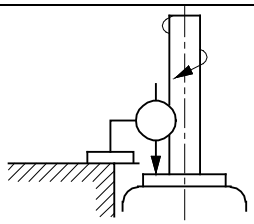
kk) description of fixed guards which have to be removed by the user for maintenance and cleaning purposes. (guards to be dismounted only by the manufacturer or personal charged by the manufacturer are excluded);

ll) 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.

Verification: By checking the instruction handbook and the relevant drawings.

Annex A
(normative)

Spindles dimensional tolerances

Diagram	Object	Permissible deviation	Measuring instruments
	Measuring of run–out of horizontal spindles	0,02 mm for $A \leq 150$ mm 0,03 mm for $150 \text{ mm} < A \leq 250$ mm	Dial gauge
	Measuring of camming of shoulders of horizontal spindles	0,01 mm	Dial gauge
	Measuring of run–out of vertical spindle	0,02 mm for a spindle length of 150 mm	Dial gauge
	Measuring of camming of shoulders of vertical spindles	0,01 mm	Dial gauge

Annex B
(normative)

Braking tests

B.1 Conditions for all tests

a) The spindle unit shall be set in accordance with the intended use of the machine (as stated in the instruction handbook (see 6.3);

b) when selecting the speed and the tool(s) for the tests, conditions shall be chosen which create the greatest kinetic energy for which the machine is designed;

c) before beginning the braking tests the spindle unit shall be run for at least 15 min at idle speed;

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

B.2 Un-braked run-down time

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

a) start the spindle drive motor and run at the intended speed (no load) for 1 min;

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

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

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

B.3 Braked run-down time

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

a) start the spindle drive motor and run at the intended speed (no load) for 1 min;

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

c) allow the spindle to remain stationary for no more than $(\frac{P}{c})^2$ min, (where *P* is the motor power (rated input) in kW and factor c = 7,5 kW). The re-start interval shall not be less than 1 min;

d) re-start the spindle drive motor and run at no-load for no more than $(\frac{P}{c})^2$ min, (where *P* is the motor power (rated input) in kW and factor c = 7,5 kW). The idle running time shall not be less than 1 min;

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

The braked run-down time is the average of the 10 measurements taken. The standard deviation of the 10 measurements shall not exceed 10 % of this average.

B.4 Run-up time

The run-up time shall be measured as follows:

a) start the spindle drive motor and measure the run-up time (see 3.15);

b) cut power to the spindle drive motor and allow the spindle to come to a complete stop;

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

The run-up time is the average of the three measurements taken.

Annex C
(normative)

Table lip resistance test

C.1 General

The test consists of the planing a special work-piece to reproduce the ejection of timber hitched during machining and to verify that lips or teeth are not damaged or distorted.

C.2 Test probe

The test probe consists of an assembly of a support and 10 inserts (see Figure C.2).

Support:

— softwood first choice;

— moisture content 8 to 14 %;

— dimensions L x l x h = 800 mm x 90 mm x 90 mm (see Figure C.2);

— the support is machined on four faces.

Insert (see Figure C.1):

— beech wood corrugated 10 mm diameter pin;

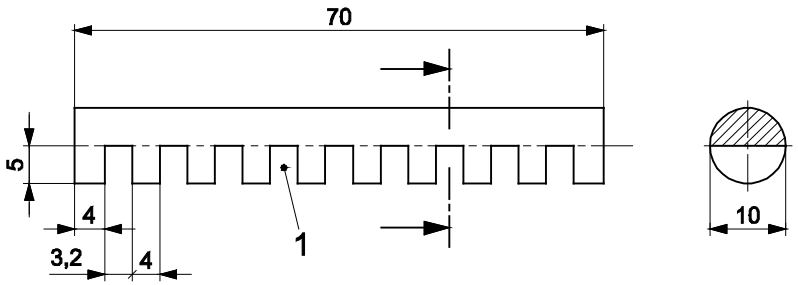
— length 70 mm;

— hafted in blind holes of support;

— grooved square to the axis on 5 mm depth with a standard saw blade with hard metal tips of 3,2 mm thick;

— the pins shall be completely inserted (see Figure C.2).

Dimensions in millimetres

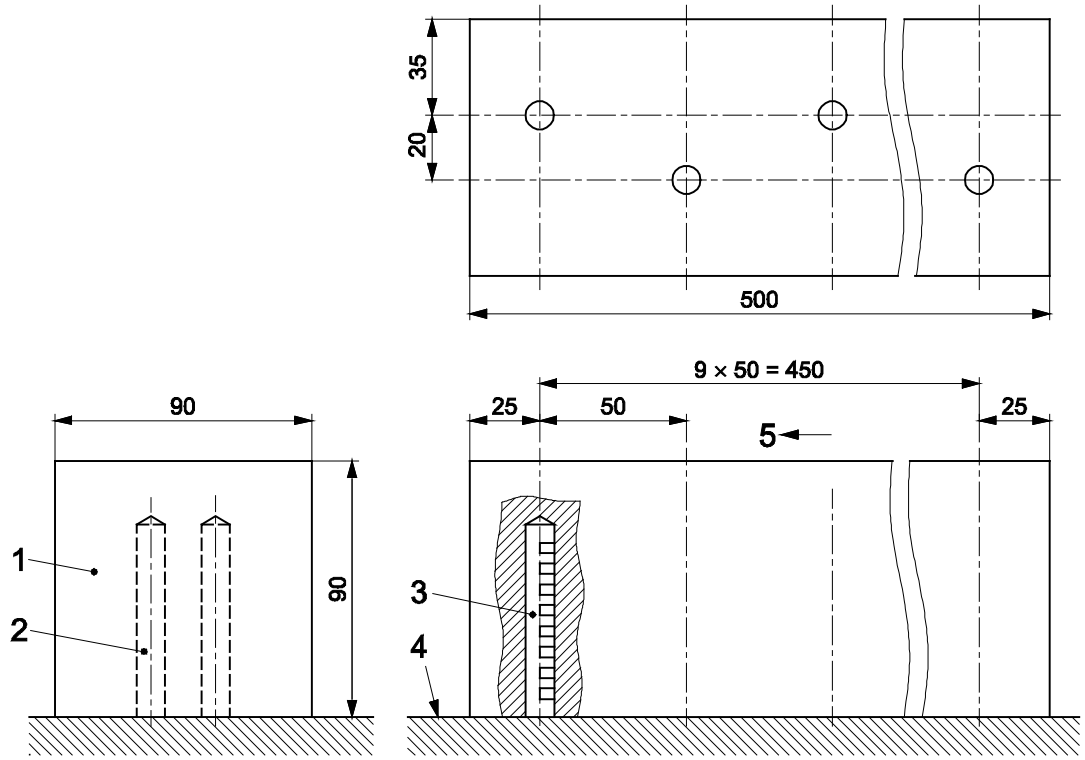


Key

1 9 slots of 3,2 mm width, 4 mm apart

Figure C.1 — Insert type

Dimensions in millimetres



Key

1 support
2 blind holes
3 insert
4 machine table
5 feed direction

Figure C.2 — Assembly and feed direction

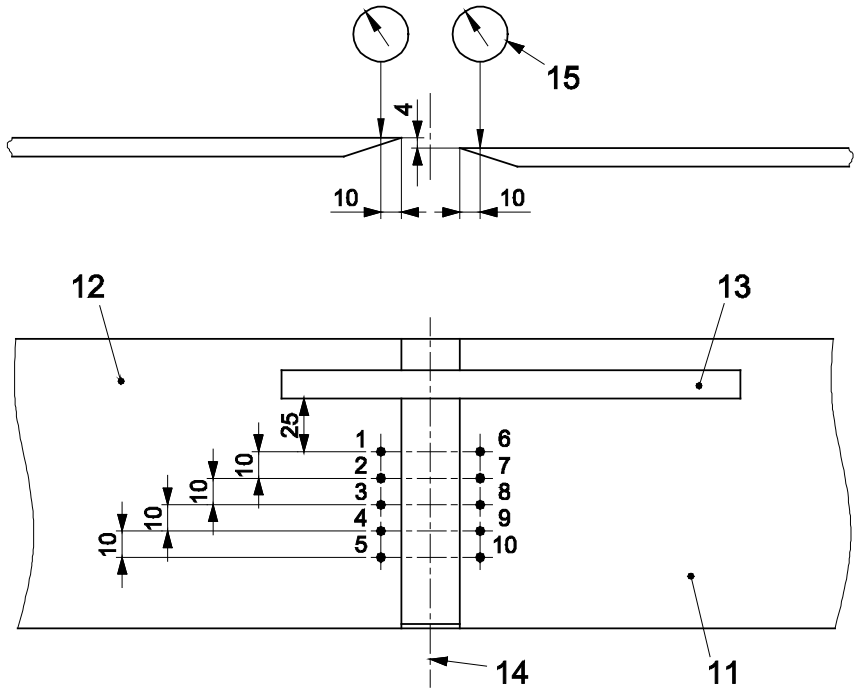
C.3 Measurements

Each measuring point on the in-feed and out-feed table lip is shown in Figure C.3.

A dial gauge with an accuracy of at least 0,01 mm shall be used to measure at each point.

Where lips have teeth the dial gauge point is located at the centre of each tooth.

Dimensions in millimetres



Key

1 to 10	measuring points
11	in-feed table
12	out-feed table
13	fence
14	axis of cutterblock
15	dial gauge

Figure C.3 — Measuring points

C.4 Tests

Perform the test as follows:

a) fix the fence in position and measure the table lip position at each point as indicated in Figure C.3;

b) set the in-feed table to perform a depth of cut of 4 mm (or to the maximum depth of cut);

c) set the machine to have a feed speed of 6 m min^{-1} $\pm$ 2 m min^{-1};

d) set the test probe on the machine table such that the planing operation can be performed on the face where the inserts are visible with their groves are aligned with the cutterblock rotational axis;

e) perform 10 planing operations in these conditions;

f) then measure the table lips at the same points as shown in Figure C.3.

C.5 Result

The test is passed if there is no distortion greater than 0,2 mm and no visual damage has occurred.

C.6 Test report

The test report shall, at least, include the following information:

a) test date;

b) machine manufacturer;

c) type of machine;

d) machine serial number;

e) machine working width (mm);

f) maximum depth of cut (mm);

g) the measurement results in a form as shown in Table C.1.

Table C.1 — Table lip deflection test results

	Outfeed table lips					**Infeed table lips**				
Measuring point	1	2	3	4	5	6	7	8	9	10
Measurement before test										
Measurement after test										

Annex D
(normative)

Impact test method for guards

D.1 General

This Annex defines tests for guards used in order to minimise risks of ejection of parts of tools or of work-pieces out of the working zone.

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

D.2 Test method

D.2.1 Preliminary remarks

This test method reproduces the hazard of the ejection of tools parts or of work-pieces. The test allows to estimate 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.

D.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 at least ± 5 %.

D.2.3 Projectile for guards

The shape, the mass and the dimensions of the projectile are given in Figure D.1.

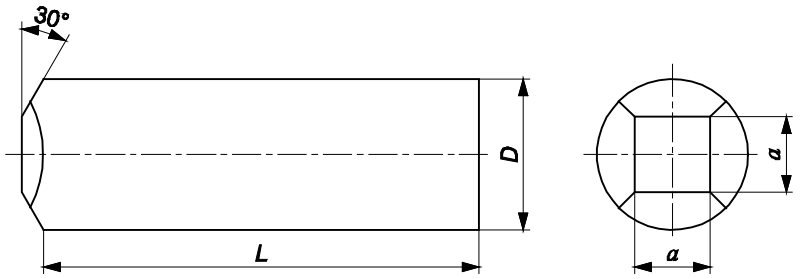
The projectile shall be made from steel with the following properties:

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

b) yield strength: R 0,2 ≥ 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.



Key

D	20 mm
a	10 mm
Mass	100 g

Figure D.1 — Projectile for guard test

D.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 x 450 mm. The frame shall be sufficiently rigid. The mounting of the sample shall be by non positive clamping.

D.2.5 Test procedure

The impact test shall be executed with projectile indicated in D.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 on the material sample.

D.3 Results

After 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.

D.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 D.3.

D.5 Test report

The test report shall give at least the following 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;

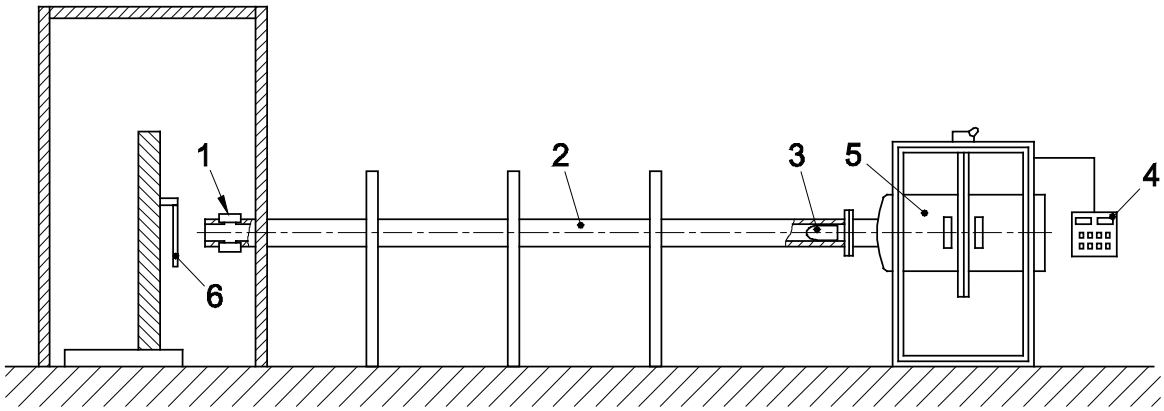
g) test result.

D.6 Test equipment for impact test

The propulsion device consists of a compressed air vessel with flanged gun barrel (see Figure D.2). 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 D.2 — 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 Directive, 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.

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