BRITISH STANDARD

BS EN
848-2:2007
+A2:2012
Incorporating corrigendum January 2013

Safety of woodworking machines — One side moulding machines with rotating tool —

Part 2: Single spindle hand fed/integrated fed routing machines

ICS 79.120.10

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 848-2:2007+A2:2012. It supersedes BS EN 848-2:2007+A1:2009, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1⟩ ⟨A1].

The following changes were implemented by CEN correction notice 17 October 2012:

In the CEN Foreword, in 8th paragraph, replaced "Annexes ZA and ZB, which are integral parts" *with* "Annex ZA, which is an integral part".

In 5.4.2.2, in 7th paragraph, deleted "and EN ISO 11202:1995/AC:1997".

In 5.4.2.2, in 3), deleted "and EN ISO 11204:1995/AC:1997". *and* "and EN ISO 11202:1995/AC:1997".

In Annex A, replaced "Figure B.1" *with* "Figure A.1" (twice).

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.

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

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30 June 2010	Implementation of CEN amendment A1:2009
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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 848-2:2007+A2

September 2012

ICS 79.120.10

Supersedes EN 848-2:2007+A1:2009

English Version

Safety of woodworking machines - One side moulding machines with rotating tool - Part 2: Single spindle hand fed/integrated fed routing machines

Sécurité des machines pour le travail du bois - Machines à fraiser sur une face, à outil rotatif - Partie 2: Défonceuses monobroche à avance manuelle/mécanisée

Sicherheit von Holzbearbeitungsmaschinen - Fräsmaschinen für einseitige Bearbeitung mit drehendem Werkzeug - Teil 2: Einspindelige Oberfräsmaschinen mit Handvorschub/mechanischem Vorschub

This European Standard was approved by CEN on 13 January 2007 and includes Amendment 1 approved by CEN on 3 October 2009 and Amendment 2 approved by CEN on 13 August 2012.

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Foreword

This document (EN 848-2:2007+A2:2012) 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 March 2013, and conflicting national standards shall be withdrawn at the latest by March 2013.

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

This document includes Amendment 1, approved by CEN on 2009-10-03 and Amendment 2, approved by CEN on 2012-08-13.

This document supersedes [A2] EN 848-2:2007+A1:2009 [/A2].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [/A1] and [A2] [/A2].

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the [A1] Machinery Directives [/A1].

[A1] For relationship with EU Directive(s), see informative [A2] Annexe ZA, which is an integral part [/A2] of this document. [/A1]

Organisation contributing to the preparation of this document include the European Association of Manufacturer of Woodworking Machines "EUMABOIS".

The European Standards produced by CEN/TC 142 are particular to woodworking machines and compliment the relevant A and B standards on the subject of general safety (see introduction of [A2] EN ISO 12100:2010 [/A2] for a description of A, B and C standards).

[A1] EN 848 *Safety of woodworking machines — One side moulding machines with rotating tool* consists of the following parts:

Part 1: Single spindle vertical moulding machines

Part 2: Single spindle hand fed/integrated fed routing machines

Part 3: Numerically controlled (NC) boring and routing machines [/A1]

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

Introduction

This document has been prepared to be a harmonised standard to provide one means of conforming to the essential safety requirements of the Machinery Directive and associated EFTA Regulations.

This document is a type C standard as stated in ⟦A2⟩ EN ISO 12100:2010 ⟨A2⟧.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are 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 single spindle hand fed/integrated fed routing machines. It is also useful for designers.

This document also includes examples of information which are to be provided by the manufacturer to the user.

Common requirements for tooling are given in ⟦A2⟩ EN 847-1:2005+A1:2007 ⟨A2⟧, EN 847-2:2001 and EN 847-3:2004.

1 Scope

This document [A1] specifies all significant [A1] hazards, hazardous situations and events as listed in Clause 4 which are relevant to stationary and displaceable single spindle hand fed/integrated fed routing machines with fixed head but allowing only movement along the axis of the tool during machining hereinafter referred to as "machines" designed to cut solid wood, chip board, fibreboard, plywood and also these materials if they are covered with plastic laminate, edgings or veneer when they are used as intended and under the conditions foreseen by the manufacturer [A2] including reasonably foreseeable misuse [A2].

[A2] For the definition of stationary and displaceable machine see 3.2.17 and 3.2.18.

Machines which are designed to work wood based materials may also be used for working hardened plastic materials with similar physical characteristics as wood. [A2]

This document does not apply to:

a) inverted pin routers and radial arm routers (machines where the work piece is fixed and the tool head is manually moved);

b) NC boring machines and NC routing machines;

[A2] NC boring machines and NC routing machines are dealt with in EN 848-3:2007+A1:2009. [A2]

c) hand-held routers or any adaptation permitting their use in a different mode, e.g. bench mounting;

[A2] NOTE 1 [A2] Hand-held motor-operated electric tools are dealt with in [A2] EN 60745-1:2009 [A2] together with EN 60745-2-17:2003.

d) routing machines set up on a bench or a table similar to a bench, which are intended to carry out work in a stationary position, capable of being lifted by one person by hand. The bench can also be an integrated part of the machine if it consists of hinged legs which can be extended down.

[A2] NOTE 2 [A2] Transportable motor-operated electric tools are dealt with in EN 61029-1:2000 together with [A2] EN 61029-2-8:2010 [A2].

This document is not applicable to single spindle hand fed/integrated fed routing machines which are manufactured before the date of its publication as EN.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[A2] EN 847-1:2005+A1:2007 [A2], *Tools for woodworking — Safety requirements — Part 1: Milling tools, circular saw blades*

EN 847-2:2001, *Tools for woodworking — Safety requirements — Part 2: Requirements for the shank of shank mounted milling tools*

EN 847-3:2004, *Tools for woodworking — Safety requirements — Part 3: Clamping devices*

[A2] EN 894-1:1997+A1:2008 [A2], *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*

deleted text

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 1837:1999+A1:2008, *Safety of machinery — Integral lighting of machines*

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 enclosure (IP code) (IEC 60529:1989)*

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

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

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

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1) EN 60439-1:1999 is impacted by EN 60439-1:1999/A1:2004.

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

[A2] EN ISO 3744:2010 [A2], [A2] *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)* [A2]

[A2] EN ISO 3745:2009[3)] [A2], *Acoustics — Determination of sound power levels of noise sources using sound pressure — Precision methods for anechoic and semi-anechoic rooms (ISO 3745:2003)*

[A2] EN ISO 3746:2010 [A2], [A2] *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)* [A2]

[A2] 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)* [A2]

[A2] EN ISO 4871:2009 [A2], *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

[A2] EN ISO 9614-1:2009 [A2], *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurements at discrete points (ISO 9614-1:1993)*

[A2] EN ISO 11202:2010 [A2], [A2] *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)* [A2]

[A2] *deleted text* [A2]

[A2] EN ISO 11204:2010 [A2], [A2] *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)* [A2]

[A2] *deleted text* [A2]

[A2] EN ISO 11688-1:2009 [A2], *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

[A2] *deleted text* [A2]

[A2] EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)* [A2]

[A1] EN ISO 13849-1:2008 [A1], *Safety of machinery — Safety-related parts of controls systems — Part 1: General principles for design (ISO 13849-1:2006)*

[A2] EN ISO 13850:2008 [A2], *Safety of machinery — Emergency stop - Principles for design (ISO 13850:2006)*

ISO 7948:1987, *Woodworking machines — Routing machines — Nomenclature and acceptance conditions*

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

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3) EN ISO 3745:2009 is replaced by EN ISO 3745:2012.

HD 22.4 S4:2004[4)], *Cables of rated voltages up to and including 450/750 V and having crosslinked insulation — Part 4: Cords and flexible cables*

3 Terms and definitions

3.1 General

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

3.2 Definitions

3.2.1
routing machine
C-frame type machine for the moulding of workpieces by means of:

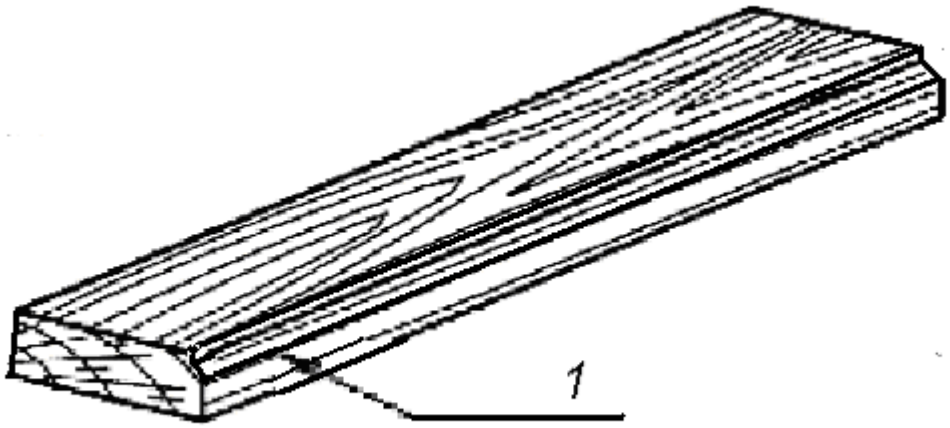
a) one tool spindle located above the table and running at speeds between 6 000 min^{-1} and generally 24 000 min^{-1}. The work head is tiltable or not and may be movable only along the direction of the axis of the tool during machining;

b) a table to support the workpiece or jig. The table is tiltable or not and/or movable in X, Y and Z directions and/or adjustable round the C axis;

c) the tool spindle/work head is either manually or power driven moved vertically during machining or moved by means of hydraulic or pneumatic devices. The workpiece is normally fed to the machine in a direction opposite to the direction of the tool spindle either manually or by means of an integrated feed system

3.2.2
straight work
shaping of a workpiece with one face in contact with the table and a second with the fence and where the work starts at one end of the workpiece and continues through to the other end (see Figure 1)

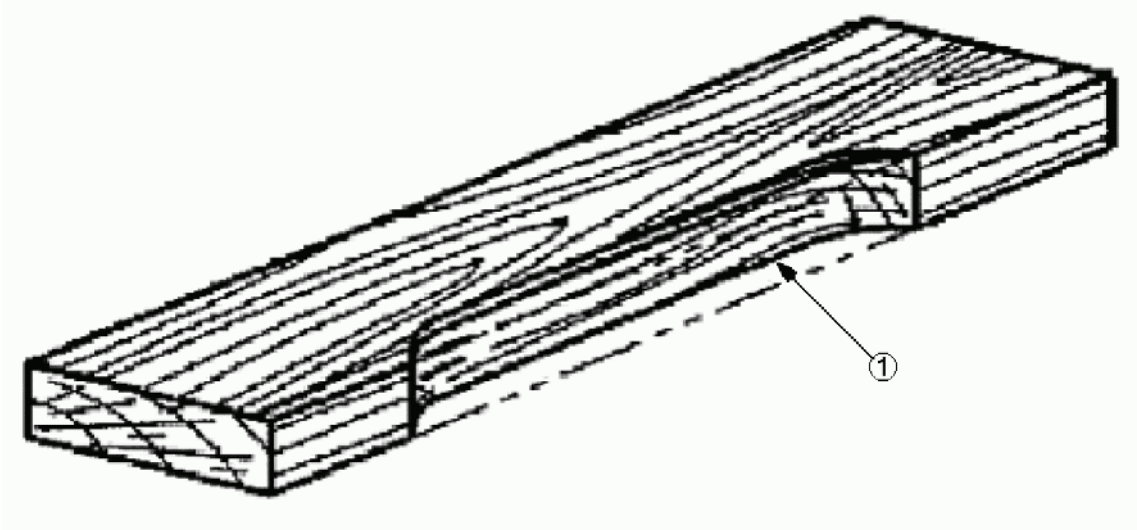
4) HD 22.4 S4:2004 is replaced by EN 50525-2-21:2011.



Key
1 machined edge

Figure 1 — Example of straight work

3.2.3
stopped straight work
machining of only a part of the workpiece length (see Figure 2)

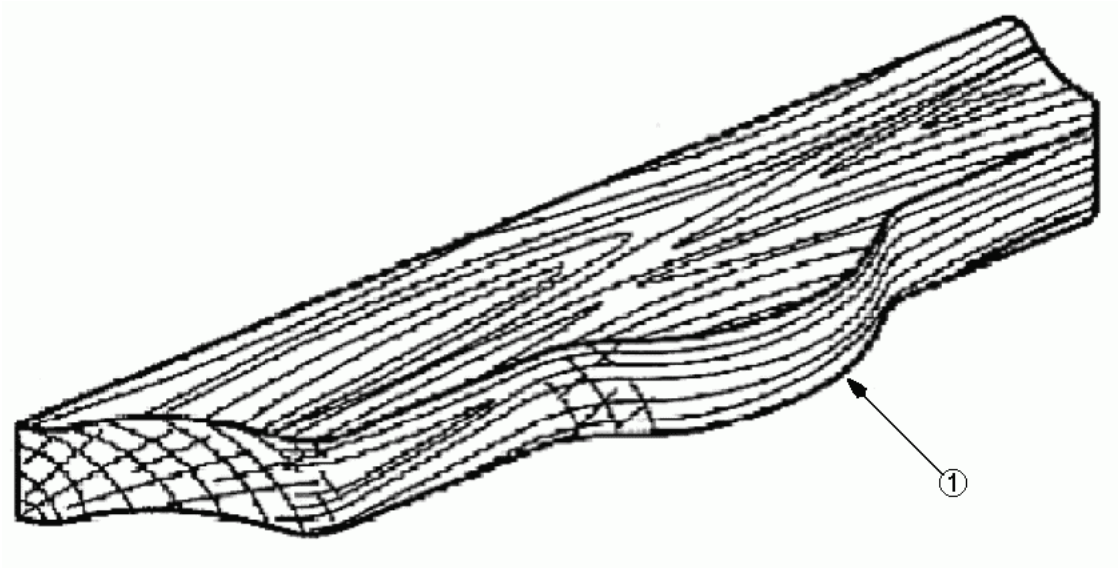


Key
1 machined edge

Figure 2 — Example of stopped straight work

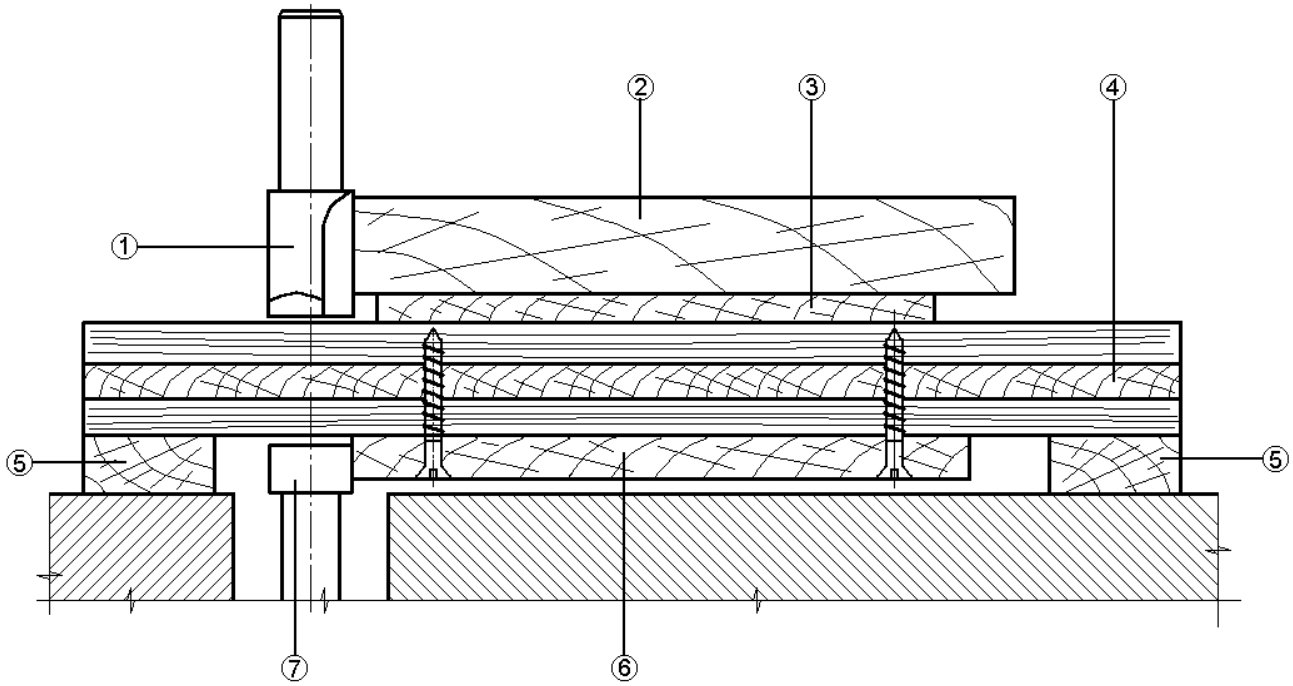
3.2.4
shaped work
machining of a curve at the edge or on the surface of a workpiece

NOTE 1 One of the techniques is attaching the workpiece to a jig. On the underside of the jig is a template which is in contact with a reference pin located in the centre of the table directly below the cutter. The jig is moved past the pin, but in contact with it, thereby reproducing the shape of the template on the workpiece (see Figures 3 and 4).



Key
1 machined edge

Figure 3 — Example of shaped work

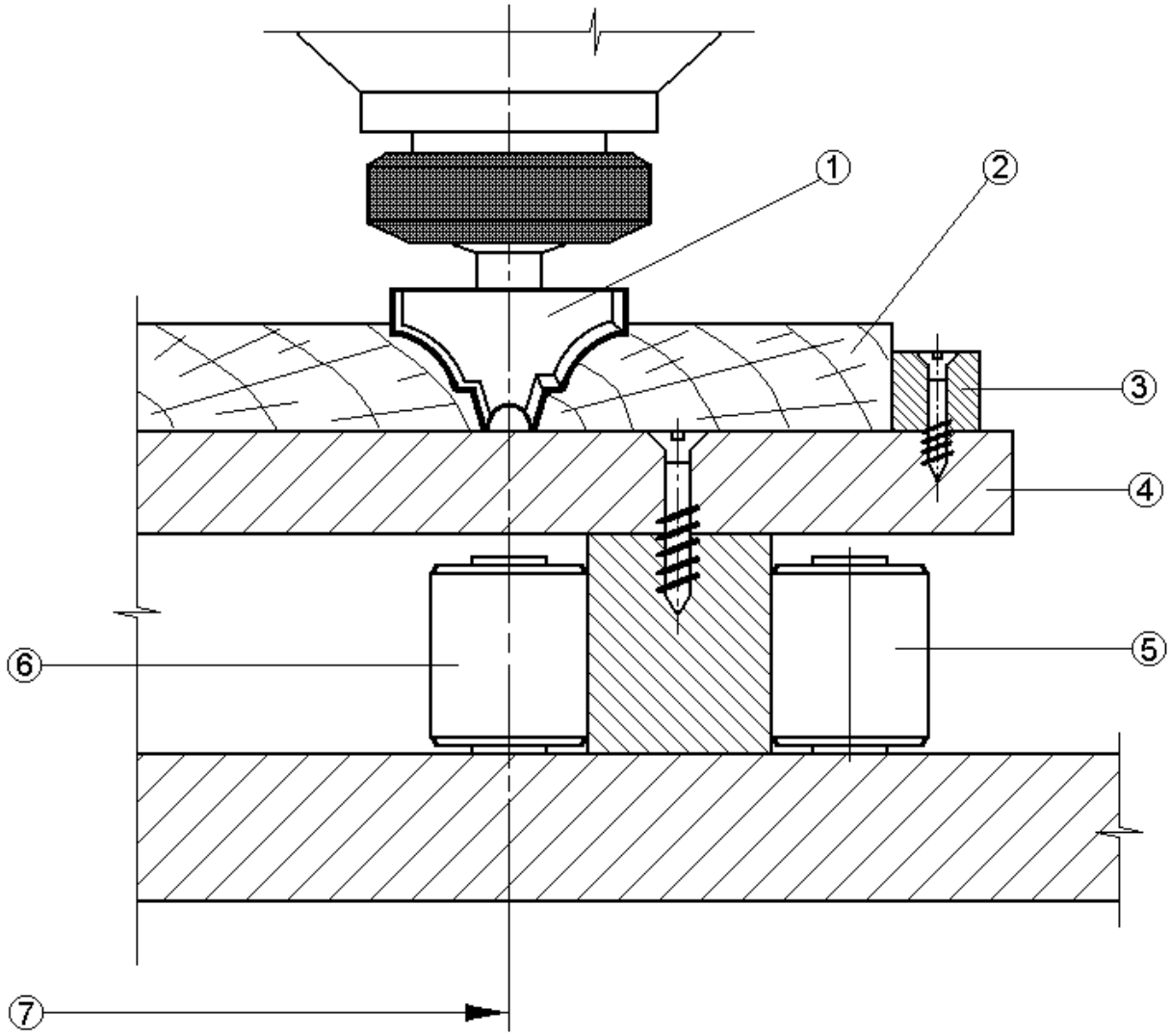


Key

1 tool
2 workpiece
3 plinth
4 jig
5 hard wood rail
6 template
7 guiding pin

Figure 4 — Example of shaped work on a hand fed machine using a template

NOTE 2 On machines fitted with an integrated workpiece feed system, the template-jig assembly is moved round by drive rollers (see Figure 5).



Key

1 tool
2 workpiece
3 stop
4 jig
5 moving roller
6 fixed roller
7 centre line

Figure 5 — Example of shaped work on an integrated feed machine

3.2.5
throat capacity
minimum distance between centre lines of the spindle and column

3.2.6
hand feed on single spindle hand fed routing machines
manual holding and/or guiding of the workpiece. Hand feed includes the use of a hand operated jig on which the workpiece is placed manually or clamped

3.2.7
integrated feed on single spindle integrated feed routing machines
feed mechanism for the workpiece or tool which is integrated with the machine and where the workpiece is held and controlled mechanically during the machining operation

3.2.8
loading the machine
manual placing of the workpiece on to a jig or the presentation of the workpiece to an integrated feed device

3.2.9
speed range
range between the lowest and the highest rotational speed for which the tool spindle or tool is designed to operate

3.2.10
kickback
particular form of ejection describing the uncontrolled movement of the workpiece, parts of it or parts of the machine opposite to the direction of feed during processing

3.2.11
anti-kickback device
device which either reduces the possibility of kickback or arrests the motion during kickback of the workpiece, parts of it or parts of the machine

3.2.12
run-down time
elapsed time from the actuation of the stop control device to complete spindle standstill

3.2.13
removable spindle
tool spindle capable of being changed without removing the main spindle bearings

3.2.14
machine actuator
power mechanism used to effect motion of the machine

3.2.15
information of the supplier
statement, sales literature, leaflets or other documents, in which a manufacturer (or supplier) declares either the characteristics of e.g. a material or product or the conformity of the material or product to a relevant standard

3.2.16
revolving stop
adjustment device located on the mobile part of the machining head to allow for cutting edge position setting with respect to the table for mass production machining

3.2.17
stationary machine
machine designed to be located on or fixed to the floor or other parts of the structure of the premises and to be stationary during machining

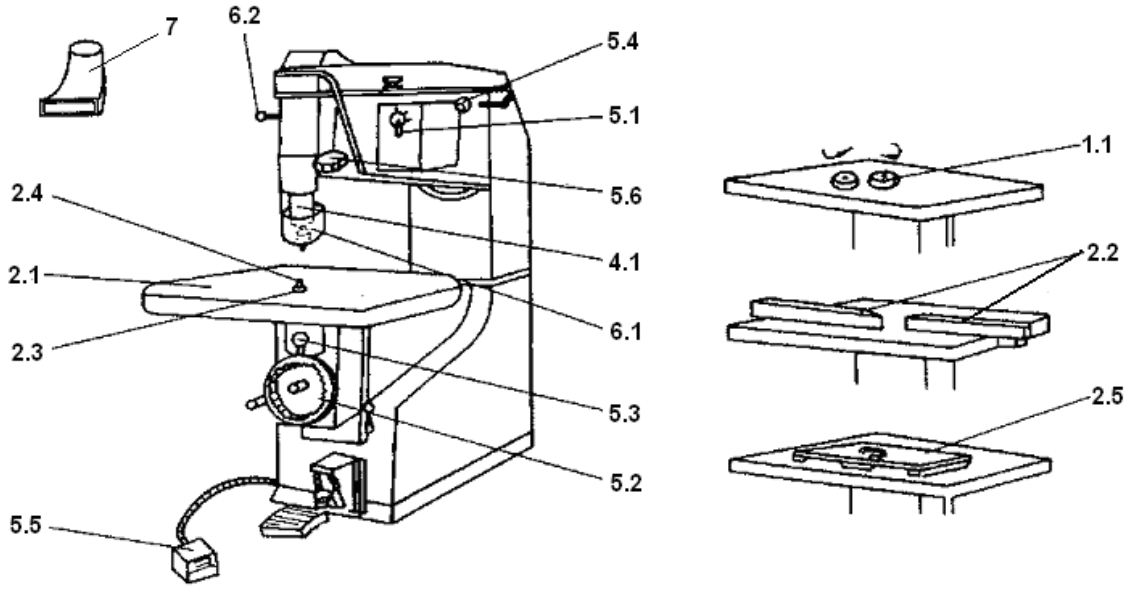
3.2.18
displaceable machine
machine which is located on the floor, stationary during use and equipped with a device, e.g. wheels, which allows it to be moved between locations

3.2.19
performance level PL
discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

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

3.3 Terms

The names of the main parts of the machine are shown in Figure 6.



Key

1	feed of workpiece and/or tool	5	controls
1.1	automatic feed drive	5.1	speed select switch
2	workpiece support, clamp and guide	5.2	table rise and fall adjuster
2.1	table	5.3	guide pin raising lever
2.2	fence	5.4	head tilt lock
2.3	table ring	5.5	head control (pneumatic)
2.4	guide pin	5.6	depth stop turret
2.5	jig	6	safety devices (examples)
3	tool holders	6.1	cutter guide
4	work head and tool drive	6.2	spindle brake
4.1	spindle	7	exhaust outlet

Figure 6 — Example of routing machine

4 List of significant hazards

This clause contains [A1] all significant [A1] hazards, hazardous situations and events (see [A2] EN ISO 12100:2010 [A2]), [A2] deleted text [A2], 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.

[A2] These hazards are listed in Table 1: [A2]

[A2] Table 1 — List of significant hazards

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clauses of this document
1	Mechanical hazards related to: -machine parts or workpiece due to		
	a) shape	6.2.2.1, 6.2.2.2, 6.3	5.3.3, 5.3.6, 5.3.7, 5.4.10
	b) relative location		5.2.2, 5.3.5, 5.3.7, 5.3.9
	c) mass and stability (potential energy of elements which may move under the effect of gravity)		5.2.10, 5.3.1, 5.3.3, 5.3.5
	d) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)		5.2.5, 5.3.3
	e) mechanical strength		5.3.2, 5.3.3, 5.3.7, 5.3.8
	- accumulation of potential energy:		
	f) elastic elements (springs), or	6.2.10, 6.3.5.4	5.3.3, 5.3.6.2
	g) liquids or gases under pressure		5.4.6, 5.4.7

(*to be continued*)

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

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clauses of this document
1.1	Crushing hazard		5.3.7, 5.3.10
1.2	Shearing hazard		5.3.7, 5.3.10
1.3	Cutting or severing hazard		5.3.7
1.4	Entanglement hazard		5.3.7, 5.4.3
1.5	Drawing in or trapping hazard		5.3.7
1.6	Impact hazard		5.3.5
1.9	High pressure fluid injection or ejection hazard	6.2.10, 6.3.5.4	5.4.6, 5.4.7
2. Electrical hazards			
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
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
7. Hazards generated by materials and substances (and their constituent)processed, or used by the machinery:			
7.1	Hazards from contact or inhalation of harmful fluids and dusts	6.2.3, 6.2.4	5.4.3
7.2	Fire hazard	6.2.4	5.3.6.2, 5.4.1, 5.4.9

(*to be continued*)

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

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clauses of this document
8. Hazards generated by neglecting ergonomic principles in machine design			
8.1	Unhealthy postures or excessive efforts	6.2.7, 6.2.8, 6.2.11.12, 6.3.5.5, 6.3.5.6	5.2.2
8.2	Human hand/arm or foot/leg anatomy	6.2.8.3	5.2.2, 5.4.5
8.6	Human error, human behaviour	6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4	5.4.12, 6.3
8.7	Design, location or identification of manual controls	6.2.8.f, 6.2.11.8	5.2.2
8.8	Design or location of visual display units	6.2.8.8, 6.4.2	5.4.5, 5.4.11
9	Combination of hazards	6.3.2.1	5.2.3, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.2.10, 5.3.5, 5.4.10, 5.4.11
10. Unexpected start-up, unexpected overrun/overspeed (or any similar malfunction) from			
10.1	Failure/ disorder of the control system	6.2.11, 6.3.5.4	5.2.1, 5.2.7
10.2	Restoration of energy supply after an interruption	6.2.11.4	5.2.9
10.3	External influences on electrical equipment	6.2.11.11	5.2.1, 5.2.7, 5.2.11, 5.4.8
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, 5.2.6, 5.3.4
12	Variation in the rotational speed of tools	6.2.2.2, 6.2.3	5.2.6
13	Failure of the power supply	6.2.11.1, 6.2.11.4	5.2.6

(*to be continued*)

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

No	Hazards, hazardous situations and hazardous events	EN ISO 12100:2010	Relevant clauses of this document
14	Failure of the control circuit	6.2.11, 6.3.5.4	5.2.1
15	Errors of fitting	6.2.7, 6.4.5	5.4.10, 6.3
16	break-up during operation	6.2.3	5.3.2
17	Falling or ejected objects or fluids	6.2.3, 6.2.10	5.3.3, 5.3.5, 5.3.9
18	Overturn, unexpected loss of machine stability	6.3.2.6	5.3.1

〈A2〉.

5 Safety requirements and/or measures

5.1 General

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

〈A2〉 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. 〈A2〉

5.2 Controls

5.2.1 Safety and reliability of control systems

〈A2〉 *deleted text* 〈A2〉

For the purpose of this document, safety related part of a control system means the system from the initial actuator or position detector or sensor up to and including the power control element of the final machine actuator, e.g. motor or brake. 〈A2〉 Safety related parts of the control system of this machine comprise parts concerning the following functions and they shall fulfil at least the requirements of the PL given below in accordance with the requirements of EN ISO 13849-1:2008: 〈A2〉

— for starting: 〈A2〉 PL=c 〈A2〉 (see 5.2.3);

— for normal stopping: 〈A2〉 PL=c 〈A2〉 (see 5.2.4, 5.2.5);

— for emergency stopping): 〈A2〉 PL=c 〈A2〉 (see 5.2.6);

— for spindle adjustment if electrical: 〈A2〉 PL=c 〈A2〉 (see 5.3.3.2.1);

— spindle speed 〈A2〉 control 〈A2〉: 〈A2〉 PL=c 〈A2〉 (see 5.2.8);

— for feed speed control: [A2] PL=c [A2] (see 5.2.9);

— for holding the work head in the adjusted position: [A2] PL=c [A2] (see 5.3.3.2.1);

— for return movement of spindle to the safe position: [A2] PL=c [A2] (see 5.3.3.2.1);

— for interlocking: [A2] PL=c [A2] (see 5.3.4.1, 5.3.9);

— for monitoring clamping pressure: [A2] PL=c [A2] (see 5.3.9);

— for preventing of unexpected start-up in the event of power supply failure: [A2] PL=c [A2] (see 5.2.10);

— for mode selection: [A2] PL=c [A2] (see 5.2.7);

— for braking: [A2] PL=b or PL=c [A2] (see 5.3.4);

— for brake release: [A2] PL=c [A2] [A2] (see 5.3.4.2) [A2];

— for hold to run control: [A2] PL=c [A2] [A2] (see 5.2.7, 5.3.3.3.2) [A2].

[A2] *deleted text* [A2]

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

[A2] *deleted text* [A2]

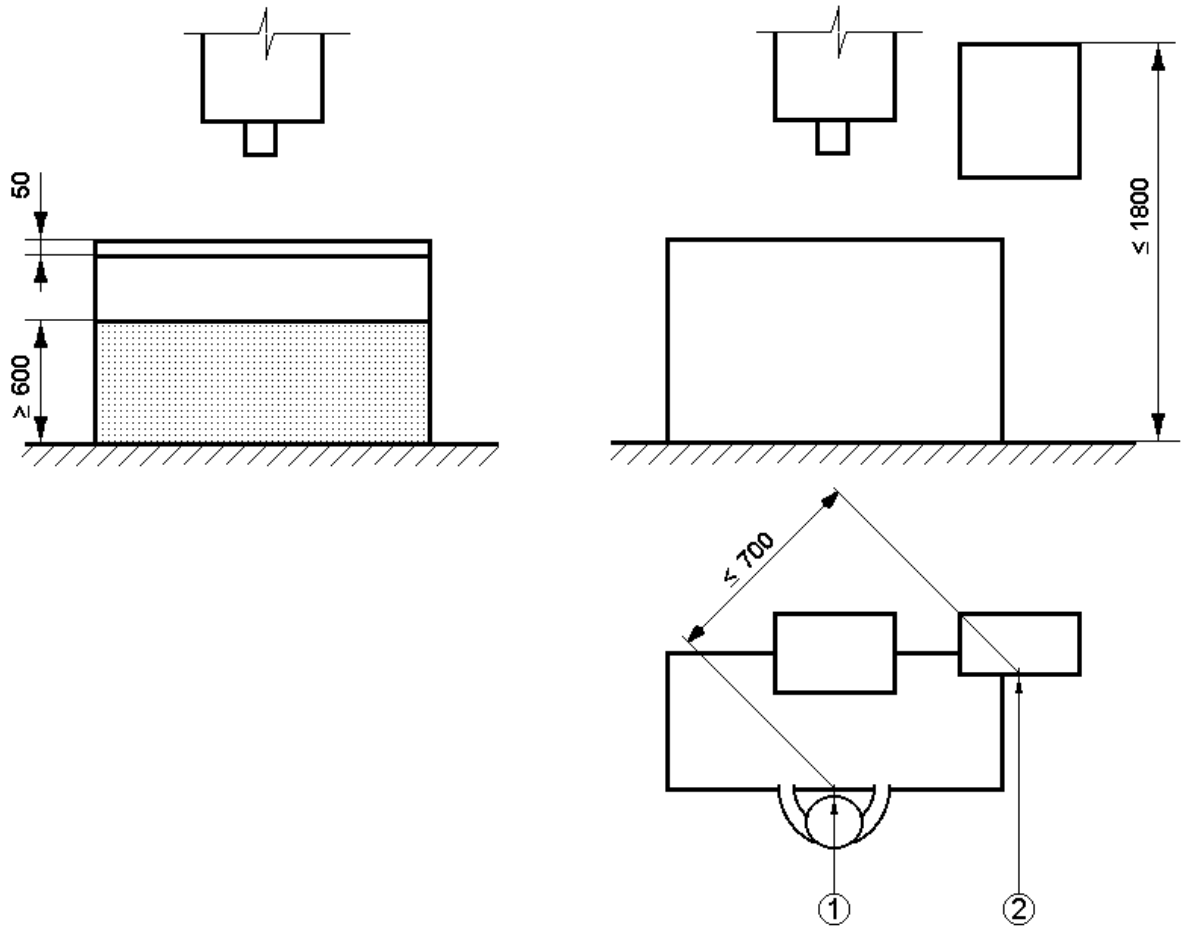
5.2.2 Position of controls

The main electrical control actuators, for starting, normal stopping, emergency stop (if required (see 5.2.6)), spindle adjustment, direction of rotation and mode selection (if required (see 5.2.7)) shall be located as follows:

a) 50 mm below the front edge of the table and at least 600 mm above the floor (see Figure 7), or

b) on the front side of a fixed pendant where it is permanently connected to the machine by a cable as shown in Figure 7.

Dimensions in millimetres



Key

1 middle of the table

2 middle of the pendant face

Figure 7 — Position of controls

Mechanical controls shall not be located at the rear of the machine.

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

5.2.3 Starting

Before starting or restarting the machine all the safeguards shall be in place and functional. This is achieved by the interlocking arrangement described in 5.3.7 and 5.3.9. Start or restart shall only be possible by actuation of the start control device provided for that purpose (see 5.4.5).

Starting of machines requiring the use of an electrically controlled device to initiate a start shall be in accordance with 9.2.5.2 of EN 60204-1:2006.

Spindle start shall only be possible by voluntary action of a specific control device fitted for that purpose (e.g. push button) and when the machining head is in the rest position.

The safety related part of the control system for starting the rotation of the spindle (see also 5.2.1) shall [A2] conform at least to PL=c [A2] in accordance with the requirements of [A1] EN ISO 13849-1:2008 [A1]. Unintentional start-up shall be prevented e.g. by shrouded control devices.

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 stop control which, when actuated shall disconnect power from all the machine actuators [A2] except powered workpiece clamping and powered movement of the machining head [A2] and actuate the brake(s), if provided.

[A2] 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. [A2]

The normal stop control systems for machines fitted with spring operated mechanical brake shall comply with stop category 0 in accordance with the requirements in 9.2.2 of EN 60204-1:2006.

The normal stop control system for machines with other types of brake or electrical brake with or without integrated feed shall comply with stop category 1 in accordance with the requirements in 9.2.2 of EN 60204-1:2006.

Where a category 1 stop in accordance with the requirements in 9.2.2 of EN 60204-1:2006 is fitted, the normal stopping sequence shall be:

a) hold machining head stationary;

b) cut power to the integrated feed actuator (if fitted);

c) cut power to all machine actuators except workpiece clamping (if fitted) and apply the brake;

d) cut power to the brake(s) after braking sequence is complete (e.g. by a time relay of failsafe technique e.g. of capacity type or conforming to [A2] at least PL=c [A2] in accordance with [A1] EN ISO 13849-1:2008 [A1]).

The safety related part of the control system for normal stopping (see also 5.2.1) shall [A2] conform at least to PL=c [A2] in accordance with the requirements of [A1] EN ISO 13849-1:2008 [A1].

The design of the control [A2] system [A2] shall be such as to satisfy the normal stopping sequence. If a time delay device is used, time delay shall be at least equal to the maximum run-down time and either the time delay shall be fixed, or, the time delay adjustment device shall be sealed.

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

5.2.5 Additional stop

It shall be possible to stop separately spindle rotation and integrated feed (if provided) [A2] and the powered clamping [A2] through stop controls category 0 or 1 in accordance with the requirements of 9.2.2 of EN 60204-1:2006.

[A2] For additional stop 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. [A2]

Operation of the integrated feed stop control shall not cause movement of the machining head and stopping the spindle drive motor shall also stop the integrated feed drive.

The safety related part of the control system for additional stop (see also 5.2.1) shall [A2] conform at least to PL=c [A2] in accordance with the requirements of [A1] EN ISO 13849-1:2008 [A1].

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

5.2.6 Emergency stop

The requirements of [A2] EN ISO 13850:2008 [A2] apply and in addition:

Machines with more than one actuator (electrical, pneumatic, hydraulic or a combination of them) shall be fitted with an emergency stop control except machines with one electrical motor and only one (pneumatic or hydraulic) powered movement of the machining head positioning.

[A2] 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. [A2]

When operated the emergency stop control shall disconnect power from all machine actuators [A2] except powered workpiece clamping and powered movement of the machining head [A2] and actuate the brake (if provided) in accordance with 9.2.5.4.2 of EN 60204-1:2006.

If the machine is fitted with a mechanical brake the emergency stop control system shall conform to category 0 in accordance with the requirements of 4.1.4 of [A2] EN ISO 13850:2008 [A2] and shall comply with the requirements of 10.7 except 10.7.4 of EN 60204-1:2006. The emergency stop control device shall be at any time of self latching type.

If the machine is fitted with an electrical brake the emergency stop control system shall conform to category 1 in accordance with the requirements of 9.2.5.4.2 of EN 60204-1:2006 and to category 1 in accordance with the requirements of 4.1.4 of [A2] EN ISO 13850:2008 [A2].

For the position see 5.2.2.

The safety related part of the control system for emergency stop (see also 5.2.1) shall [A2] conform at least to PL=c [A2] in accordance with the requirements of [A1] EN ISO 13849-1:2008 [A1].

The emergency stop shall not cause the workpiece to become un-clamped unless all motors have come to rest.

The design of the control [A2] system [A2] shall be such as to satisfy the stopping sequence (see 5.2.4). If a time delay device is used, time delay shall be at least equal to the maximum run-down time and either the time delay shall be fixed, or, the time delay adjustment device shall be sealed.

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

5.2.7 Mode selection

The requirements of 9.2.3 of EN 60204-1:2006 apply and in addition:

[A2] Machines fitted with an integrated feed system shall be equipped with a mode selection switch in order to allow:

1) spindle rotation and

2) spindle rotation together with workpiece integrated feed,

3) setting. [A2]

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

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

b) it shall be lockable e.g. by a key-operated switch;

c) changing the mode shall only be possible after bringing the machine to a complete stop and restart shall be according to the requirements of 5.2.3;

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

In the setting mode it shall not be possible to start the spindle drive motor but the spindle shall be capable to rotate by hand for adjustment purposes. All movements except spindle rotation shall only be possible by hold to run control ⟦A2⟧ at least PL=c ⟨A2⟩ in accordance with the requirements of ⟦A1⟧ EN ISO 13849-1:2008 ⟨A1⟩.

⟦A2⟧ *deleted text* ⟨A2⟩

The safety related part of the control system for mode selection (see also 5.2.1) shall ⟦A2⟧ conform at least to PL=c ⟨A2⟩ in accordance with the requirements of ⟦A1⟧ EN ISO 13849-1:2008 ⟨A1⟩.

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

5.2.8 ⟦A2⟧ Spindle speed control ⟨A2⟩

On machines with more than one spindle speed, the selected spindle speed ⟦A1⟧ shall be visible or indicated ⟨A1⟩ at the work station.

⟦A2⟧ On machines without an automatic control device for infinitely varying the speed, the control system for speed changing e.g. a control system with change pole motor shall conform at least to PL=c in accordance with the requirements of EN ISO 13849-1:2008. ⟨A2⟩

On machines fitted with an automatic control device (e.g. frequency inverter) for infinitely varying (step-less) spindle speed, the device shall be such that the actual speed shall not exceed the selected speed by more than 10 % (e.g. by means of an auxiliary electrical circuit). If the actual speed exceeds the selected speed by more than 10 %, then the spindle shall automatically stop rotating. ⟦A2⟧ The safety related part of the control system for speed control shall conform at least to PL=c in accordance with the requirements of EN ISO 13849-1:2008. ⟨A2⟩ The actual speed of the spindle shall be compared with the selected speed continuously. The processor used for this purpose shall have an external watch dog function. The actual speed or exit frequency can be converted in a comparator e.g. by the electronic system and can there be compared with the selected value either by the inverter itself or by an external comparator. In addition the following measures against loss or falsification of data shall be taken:

a) Measures against loss of the data for tools and selected speed stored in the machine control ⟦A2⟧ if stored data result in an automatic selection of the intended tool spindle speed ⟨A2⟩:

1) the safety related data for the machine tools shall be stored either in 2 independent memory chips or stored twice in one single chip (one time inverse);

2) after input of the safety related data for the tools the data shall be confirmed by the operator;

3) the two data shall be compared automatically 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 signal shall be given;

4) ⟦A2⟧ for monitoring of failures the processor comparing the data shall have a watch dog function. ⟨A2⟩

b) Measures against falsification in data transfer between manual control, data stored in the machine control, display for the data and control of the inverter:

1) the selected spindle speed shall be stored in the control of the inverter [A2] or in the unit which monitors the actual speed [A2];

2) the selected speed transmitted to the control of the inverter shall be read back and monitored on the display for checking by the operator [A2] or in the unit which monitors the actual speed [A2].

[A2] The safety related part of the control circuits (also see 5.2.1) for the indication of the selected speed shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008. [A2]

[A2] *deleted text* [A2]

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

On machines equipped with workpiece integrated feed system, the feed system shall not operate unless the tool spindle is rotating. The spindle shall remain in the working position if the integrated feed of the workpiece is switched off.

[A2] The safety related part of the control circuits (also see 5.2.1) for the powered movement of the workpiece integrated feed system shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008 and the control circuits shall be hardwired. [A2]

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

5.2.10 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 paragraphs 1 to 3 of 7.5 of EN 60204-1:2006.

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

Machines with powered movement of the work-head shall be fitted with a device which holds the work-head in position in case of failure of the power supply.

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

5.2.11 Failure of the control circuits

The requirements of Clause 6 of [A2] EN 1037:1995+A1:2008 [A2] shall apply and in addition:

The control circuits shall be designed so that a break in any circuit (e.g. broken wire, ruptured pipe or hose) will not result in the loss of a safety function e.g. involuntary start of the machine, tool unclamping or loss of workpiece clamping (if fitted) in accordance with EN 60204-1:2006 and [A2] EN ISO 4414:2010 [A2].

Also see 5.2.1.

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

Machines and [A2] *deleted text* [A2] shall be equipped with the facilities to fix them to the floor, or other stable structure e.g. by providing holes in the machine frame.

Displaceable machines fitted with wheels shall have the facilities to make them stable during machining. Such facilities are e.g.:

a) brakes for the wheels, or

b) a combination of wheels and stabilisers, or

c) a device to retract the wheels from the floor.

See 6.3 for instruction on how to make the workpiece stable during machining.

Verification: By checking the relevant drawings, inspection of the machine and performing the test of Annex B.

5.3.2 Hazard of break up during operation

The principles of [A2] EN ISO 12100:2010, 6.2.3 [A2] shall be observed and in addition:

To reduce the probability of break up during operation the requirements of 5.3.3, 5.3.5, 5.3.6.2 and 5.3.8 apply.

To reduce the effect of break up during operation the requirements of 5.3.7 apply.

Verification: By checking the relevant drawings.

5.3.3 Tool holder and tool design

5.3.3.1 Tools

If the machine is fitted with tools these tools shall be in accordance with the requirements of [A2] EN 847-1:2005+A1:2007 [A2] and/or EN 847-2:2001 [A2] when their cutting circle diameter is greater than or equal to 16 mm [A2] (see also 6.3 g)).

Verification: By checking the relevant drawings.

5.3.3.2 Tool fixing

If the machine is designed for the use of shank mounted tool the clamping device shall be in accordance with the requirements of EN 847-3:2004 and the clamping unit shall provide a minimum clamping length in accordance with Table 2 of EN 847-2:2001.

If the tool spindle is fitted with a hydraulic tool fixing system axial movement of the tool in the case of a failure in the hydraulic system shall not be possible.

See 6.3 e), f), m).

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

5.3.3.3 Spindle

5.3.3.3.1 General

All spindles shall be manufactured in accordance with g 5 of ISO 7948:1987.

Verification: By checking the relevant drawings and measurement.

5.3.3.3.2 Height adjustment

As soon as the height adjustment control starts a rise of the tool spindle/work head, the tool spindle/work head shall go to the safe position and be mechanically locked there. Lowering of the tool spindle/work head shall only be possible by a voluntary action.

[A2] The safety related part of the control system (also see 5.2.1) for the tool spindle/work head adjustment shall conform at least to PL=c in accordance with the requirements of EN ISO 13849-1:2008. [A2]

The working position of the tool spindle/work head shall be capable of being set e.g. by moving down to revolving stops. The revolving stops shall be held in its selected position e.g. by a spring and ball mechanism.

The machine shall be equipped with an indicator to show incremental vertical movement of the tool spindle/work head.

[A2] In the case of powered movement the control circuits (also see 5.2.1) for change of position of the tool spindle work-head from the adjusted position shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008. The control system for the return movement to the safe position shall conform to at least PL=c in accordance with the requirements of EN ISO 13849-1:2008. Any powered adjustments of the spindle shall be initiated by means of a hold to run control device of at least PL=c in accordance with the requirements of EN ISO 13849-1:2008 with a stop control in the vicinity in accordance with 6.2.11.8 b) of EN ISO 12100:2010. [A2]

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

5.3.3.3.3 Inclination adjustment

Where the spindle is capable of being inclined, the machine shall be equipped with an indicator to show its degree of inclination with respect to the table. The adjustment device shall be self locking.

The tool spindle including its bearing system shall be so designed that the tool spindle remains stable in any position.

Verification: By checking the relevant drawings, inspection of the machine and performing the following test in at least vertical position: a force of 300 N shall be applied horizontally on the exposed end of the tool spindle. The inclination of the tool spindle shall not exceed 1°.

5.3.3.4 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 fork 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 shall not be deformed.

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

5.3.3.5 Direction of rotation

Tool spindles which are capable of rotating in only one direction shall always rotate in a clockwise direction when viewed from the top.

Tool spindles which are capable of rotating in both clockwise and anticlockwise direction of rotation shall fulfil the following requirements:

a) a direction of rotation selection device shall be fitted at the normal operating position of the machine. The movement of the control shall be consistent with its effect (see 6.2 e));

b) when anticlockwise direction of rotation is selected a visible warning device shall inform the machine operator that anticlockwise direction of rotation has been selected. The colour of the warning device shall be yellow. The visible warning device may be supplemented by an audible device;

c) as soon as the spindle stops anticlockwise rotation the direction of rotation selection device shall automatically return to:

   1) the clockwise position and then:

      i) the selection device shall be held in the clockwise direction of rotation position by a blocking device and

      ii) further selection of anticlockwise direction of rotation shall only be possible after manual override of the blocking device, or

   2) a neutral position with a blocking device effective and then further selection of any direction of rotation shall need manual override of the blocking device;

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

The spindle shall be so designed that neither the tool nor the removable spindle can loosen during starting, cutting and braking, regardless of the direction of rotation.

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

5.3.4 Braking

5.3.4.1 General

An automatic brake shall be provided for the tool spindle where the un-braked run-down time exceeds 10 s.

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

〚A2〛 A PL_r of at least c for the braking function shall be achieved. 〚A2〛

〚A2〛 Where a spring operated mechanical brake or any other type of brake not using electronic components is fitted the last paragraph of 9.3.4 of EN 60204-1:2006 does not apply. 〚A2〛

〚A2〛 As an exception where an electrical brake containing electronic components is fitted, its control system for braking shall fulfil at least the requirements of PL=b and be designed as minimum in accordance with the requirements of category 2 of EN ISO 13849-1:2008 with the exception that the test rate requirement in 4.5.4 of EN ISO 13849-1:2008 is not applicable. The safety related part of the control system for braking shall be tested automatically, periodically, e.g. by monitoring braked run down time. The feed back shall come from either the encoder fitted to the spindle motor or from the measurement of the residual current in the wires powering the motor. The test shall:

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

b) be independent from the intention of the operator;

c) be performed at each spindle stop. 〈A2〉

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

〈A2〉 The diagnostic coverage (DC_{avg}) shall be ≥ 60 %.

See Annex E of EN ISO 13849-1:2008 for DC estimation. 〈A2〉

〈A2〉 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 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.

For calculating the probability 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. 〈A2〉

For electrical brake only direct current injection or frequency inverter braking is permissible.

Where the machine is fitted with a frequency inverter for infinitely varying spindle speed and this device is also used to control the braking function, this function shall be guaranteed even in case of overload.

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

5.3.4.2 Brake release

Where a control to release the spindle brake is provided to enable rotation of the tool by hand in order to carry out adjustments, the release of the brake shall only be possible when the spindle has stopped turning (e.g. by time delay 〈A2〉 in at least PL=c in accordance with the requirements of EN ISO 13849-1:2008 〈A2〉 between stop control actuator and brake release).

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

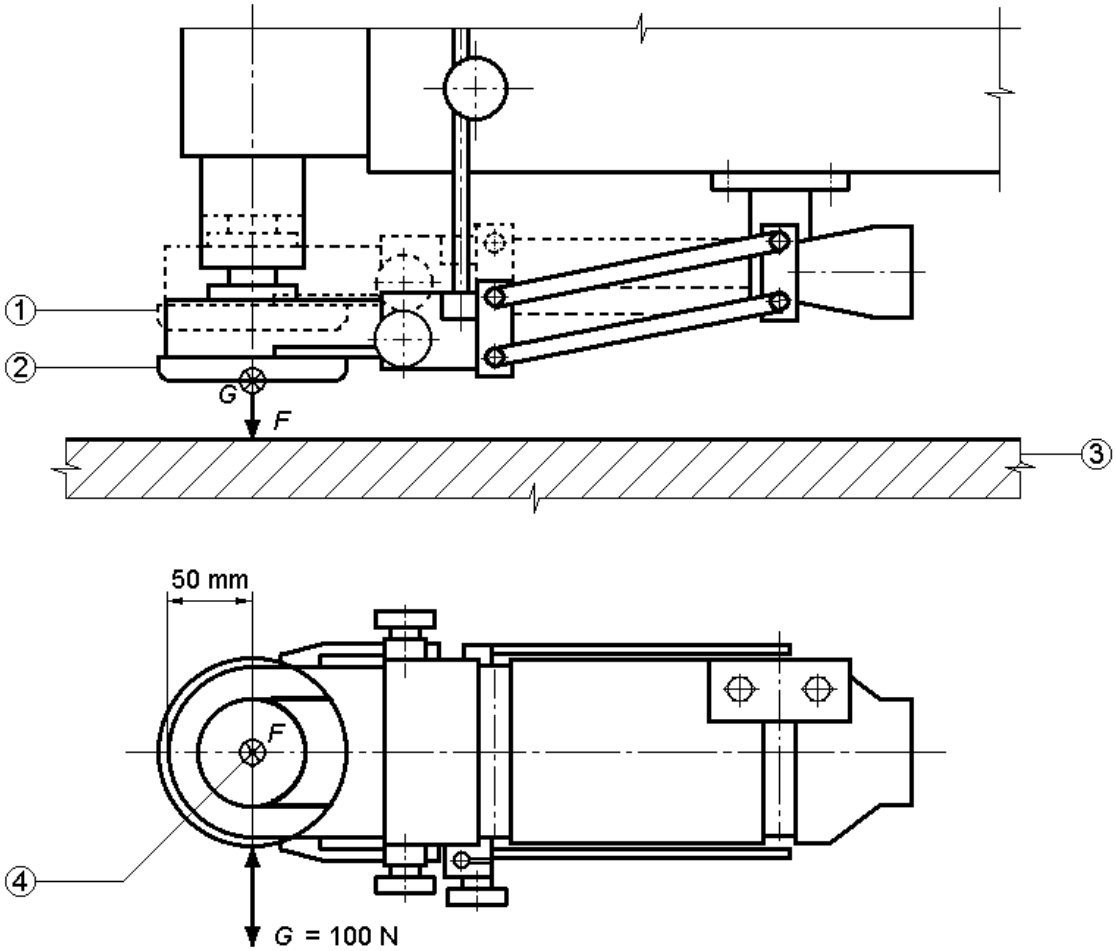
〈A2〉 The safety related part of the control circuits (also see 5.2.1) for the release of the spindle brake shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008. 〈A2〉

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

The ring guard required in 5.3.7.1 shall apply a force *F* of between 50 N and 150 N to the workpiece (see Figure 8).

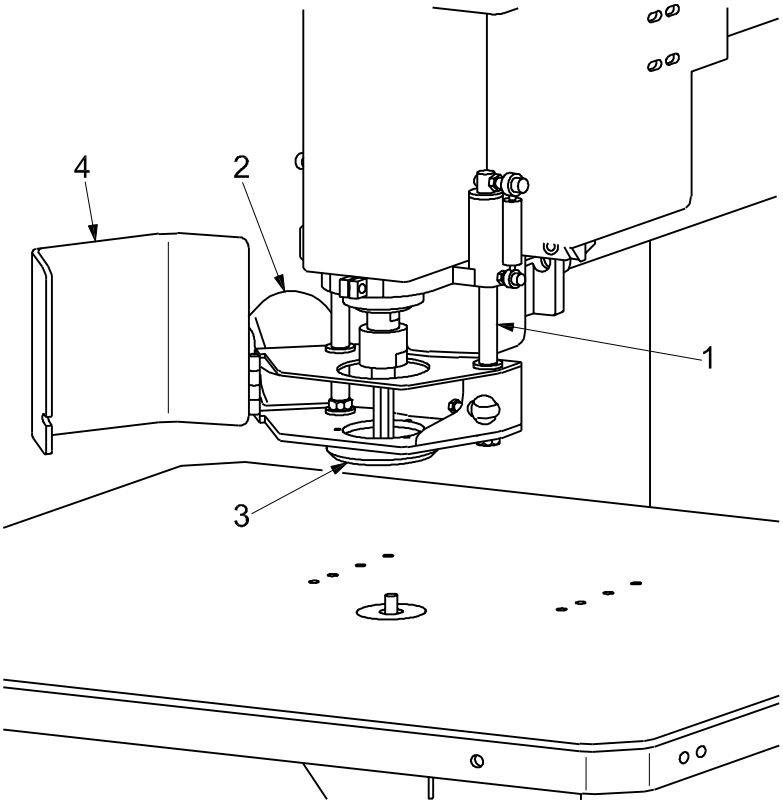
Dimensions in millimetres



Key

1 ring guard highest work position
2 ring guard lowest work position
3 table
4 measuring point for *F* (*F* measured with spring gauge square to the table)
5 force G for testing the stability of ring guard support (see 5.3.7.1.3 e))

Figure 8 — Ring guard force applied on the workpiece



Key

1 device for adjusting
2 dust exhaust outlet
3 pressure ring
4 guard (open)

Figure 9 — Example of tool guard

Where a fence is provided provisions shall be made for the fixing (e.g. fixing holes or "T" slots) of anti-kickback devices (e.g. adjustable end stops) to the fence plate (see 5.3.6.2).

T slots shall be parallel to the direction of feed and fixing holes shall not exceed 12 mm in diameter.

Verification: By checking the relevant drawings, measurement, inspection of the machine and relevant functional testing of the machine. When a static load of 300 N is applied to the anti-kickback device in the direction of kickback it shall not deflect more than 2 mm.

5.3.6 Workpiece supports and guides

5.3.6.1 General

The table shall extend at least 60 % of throat capacity on each side of spindle centre line if the spindle is set in the vertical position.

The table shall extend forward from the spindle centre line at least 50 % of the throat capacity or 300 mm which ever is the largest.

The machine table shall not be capable of being tilted beyond 45° from horizontal. Where a tiltable table is provided it shall be lockable in the adjusted position and the fence required in 5.3.6.2 shall be capable of being adjusted to that part of the table which is lowered during tilting and shall be adjustable towards and away from and parallel to the lowered edge.

The machine table shall have provisions for the fixing of extension tables at each side of the spindle centre line as seen from the working position (also see 6.3).

Machines designed to be equipped with integrated workpiece feed, and where the table bore diameter exceeds 20 mm shall be provided with a table fill in piece to fill the table aperture when integrated feed is not in use.

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

5.3.6.2 Workpiece guiding for straight work

The machine shall be equipped with means to fix a fence to the table (e.g. slots).

Where a fence is provided it shall meet the following requirements:

a) it shall be capable of being fixed to the table without the aid of a tool;

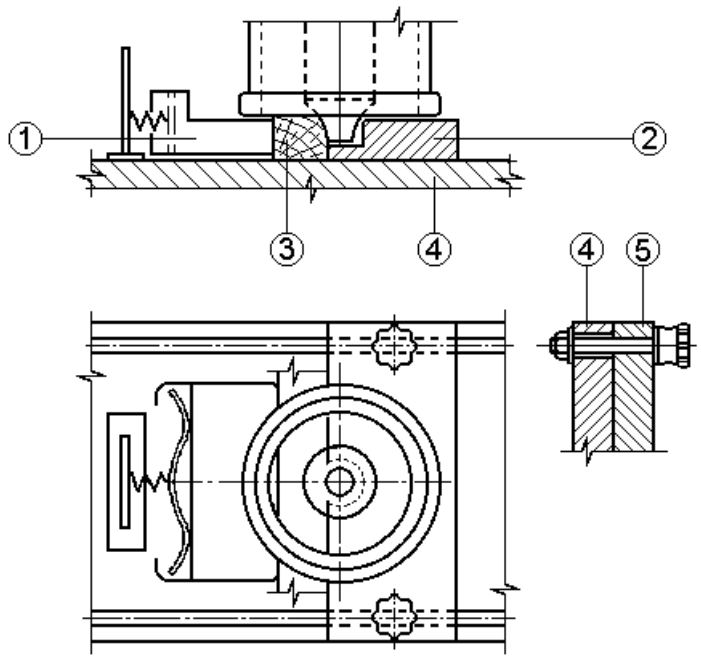
b) it shall be adjustable towards and away from the front edge of the table;

c) the part of the fence or of fence plate close to the tool shall be made from light alloy, plastic or wood such that any contact with the tool does not create a hazardous situation (e.g. tool breaking or sparks) and shall allow for the ring guard (see 5.3.7.1.2) to press the workpiece of a minimum height of 8 mm;

d) the length of the fence or of the fence plate shall be adequate to the capacity of the machine but not less than 500 mm and its height shall be at least of 65 mm. If the table is capable of being tilted the height of the fence shall be at least 110 mm except in the central part to allow for pressing thin workpieces.

When a fence is provided the machine shall be equipped with a lateral pressure device to press the workpiece against the fence (see Figure 10).

This device shall allow for fixing different sizes of pressure pads (e.g. see Figure 10).



Key

1 lateral pressure device
2 fence
3 workpiece
4 machine table
5 fence

Figure 10 — Fence and lateral pressure device

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

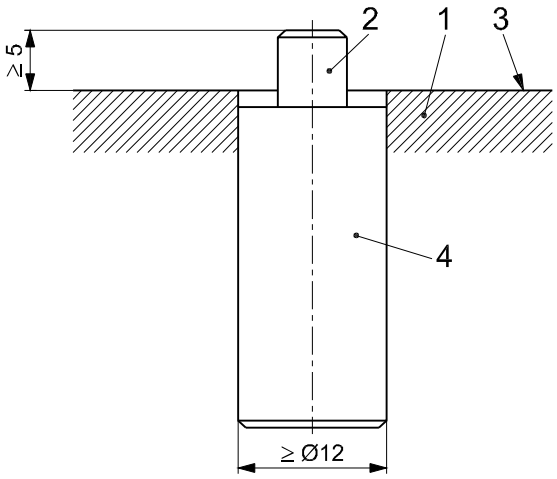
5.3.6.3 Workpiece guiding for shaped work

All machines shall be capable of accepting guide pins in the table.

The guide pin and its mounting arrangement shall comply with the requirements of Figure 11.

〈A2〉

Dimensions in millimetres



〈A2〉

Key

1 table
2 pin head
3 table surface
4 pin body

〈A2〉 Figure 11 〈A2〉 — Guide pin

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

5.3.7 Prevention of access to moving parts

5.3.7.1 Guarding of tools

5.3.7.1.1 General

An adjustable and self closing guard (ring guard) shall be provided. This guard shall prevent the access to the tool from above and from the sides in any horizontal direction in each position of the guard and shall rest on the workpiece during machining (see Figure 8).

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

5.3.7.1.2 Ring guard

The ring guard shall be in accordance with the following requirements:

a) the inside diameter of the ring guard shall allow for mounting the tool with the maximum diameter for which the machine is designed.

If the maximum diameter of the tool exceeds 80 mm, the machine shall be equipped with at least two ring guards with different internal diameters;

b) In each position the lower surface of the ring guard shall remain parallel to the table within a tolerance of 0,5 mm over a length of 100 mm;

c) [A2] the ring guard or a separate enveloping guard shall be connected to a dust exhaust outlet required in 5.4.3 which is located on a fixed part of the machine. The ring guard shall be a one piece ring guard (see Figure 8) or a pressure ring in combination with an enveloping guard (see Figure 9). This guard shall allow for tool changing e.g. by means of a non interlocked hinged cover which is capable of been locked manually in the closed position. [A2]

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

5.3.7.1.3 Ring guard support

The ring guard support shall:

a) be designed to allow the ring guard to move automatically with the spindle head;

b) be designed to allow the ring guard lower surface to be set parallel to the table which ever the position of the table;

c) be designed to allow for adjustments of the position of the ring guard to take account of the maximum length of the tool for which the machine is designed;

d) be capable of being adjusted without the aid of a tool;

e) be so designed that under a force *G* of 100 N applied as indicated in Figure 8 its displacement does not exceed 3 mm;

f) allow for tool change without dismounting other parts than the ring guard.

Verification: By checking the relevant drawings, measurements, strength test (see Figure 8), inspection of the machine and relevant functional testing of the machine.

5.3.7.1.4 Safeguarding for straight work

Provisions shall be made for the fixing of an additional device [A2] in front of the fence (when a fence is provided) which [A2] will ensure that the workpiece is held against the fence during machining and prevent horizontal access to the tool. Its height shall not exceed 8 mm and its length shall be at least 500 mm (see 5.3.6.2).

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

5.3.7.2 Guarding of drives

Access to the drive mechanism for the tool and integrated feed (if fitted) shall be prevented by a fixed guard. [A2] If such fixed guard is to be demounted by the user e.g. for maintenance, cleaning purposes the fixing systems shall remain attached to the guard or to the machine when the guard is removed e.g. fitted with unlosable screws (see 6.4 cc)). [A2]

Where frequent access to the drives is provided for maintenance or adjustment purposes, i.e. more than once per shift, access shall be via an interlocked movable guard interlocked with the spindle drive motor in accordance with the requirements of [A2] EN 1088:1995+A2:2008 [A2].

[A2] The safety related part of the control circuits (also see 5.2.1) for interlocking function shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008. [A2]

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

5.3.8 Characteristics of guards and safety devices

The tools guards shall be manufactured from one of the following materials:

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

b) light alloy with an ultimate tensile strength of at least 185 N mm^{-2} and a wall thickness of at least 3 mm;

c) ▌A2⟩ polycarbonate with a wall thickness of at least 3 mm or other plastic material passing the test given in Annex C; ⟨A2▐

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, measurements and inspection of the machine ▌A2⟩ and for plastic materials with characteristics other than those for polycarbonate given in c) above by performing the test in Annex C ⟨A2▐.

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

5.3.9 Clamping device

Where powered clamping is provided crushing hazards shall be prevented by:

a) two stage clamping with a maximum clamping force at the clamping device of 50 N for the first stage followed by full clamping force actuated by a manual control, or

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

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

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

▌A2⟩ The safety related part of the control systems for the supervision of the first stage clamping force (see 5.3.9 a)) and the limitation of the clamp closing speed (see 5.3.9 c)) shall be at least PL=c in accordance with the requirements of EN ISO 13849-1:2008 (see 5.2.1). ⟨A2▐

Where pneumatic or hydraulic clamping is provided the requirements of ▌A2⟩ EN ISO 4413:2010 ⟨A2▐ or ▌A2⟩ EN ISO 4414:2010 ⟨A2▐ respectively shall additionally be met.

In the case of machines incorporating powered clamping (pneumatic, hydraulic) of the workpiece, provisions shall be made to maintain clamping in the event of a failure of power supply e.g. by the use of non return valve fitted to the actuating cylinders in accordance with ▌A2⟩ EN ISO 4413:2010 ⟨A2▐ and ▌A2⟩ EN ISO 4414:2010 ⟨A2▐.

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

5.3.10 Safety appliances

A fixing point for push stick shall be provided for use on all machines equipped with a fence ▌A2⟩ for straight work ⟨A2▐.

Fixing points shall be provided for any additional safety appliances such as extension tables.

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

5.4 Protection against non mechanical hazards

5.4.1 Fire

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

Also see 5.3.6.2 for avoiding sparks as a result of contact between the tool and the fence.

Accumulation for chips and dust on hot parts (e.g. tool drive motor) shall be avoided.

Verification: By checking the relevant drawings, inspection of the machine and relevant functional testing 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 [A2] EN ISO 11688-1:2009 [A2] [A2] *deleted text* [A2] shall be taken into account. Also the information given in EN ISO 11688-2:2001 may be taken into account.

The most relevant noise sources are the rotating tool and clamping, i.e.:

a) pneumatic system (if provided);

b) hydraulic system (if provided).

5.4.2.2 Noise emission measurement

Operating conditions for noise measurement shall comply with the requirement of Annex L of ISO 7960:1995.

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

For machines where Annex L of ISO 7960:1995 is not applicable e.g. for spindle speed, tool diameter, the detailed operating conditions used shall be given in the test report.

Emission sound power levels shall be measured in accordance with the enveloping surface measuring method shown in [A2] EN ISO 3746:2010 [A2] 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. [A2] The correction formula for this difference is given in EN ISO 3746:2010, 8.3.3, Formula (12) [A2];

c) only the parallelepiped measurement surface shall be used at 1,0 m from the reference surface;

d) where the distance from the machine to an auxiliary unit is less than 2,0 m the auxiliary unit shall be included in the reference surface;

[A2] *deleted text* [A2]

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 Annex L of ISO 7960:1995.

Alternatively, where the facilities exist and the measurement method applies to the machine type, emission sound power levels may also be measured according to a method with higher precision i.e. [A2] EN ISO 3743-1:2010 [A2], [A2] EN ISO 3743-2:2009 [A2], [A2] EN ISO 3744:2010 [A2] and [A2] EN ISO 3745:2009 [A2] without the preceding modifications.

For determination of emission sound power level by sound intensity method, use [A2] EN ISO 4871:2009 [A2] (subject to agreement between the supplier and the purchaser).

Emission sound pressure level at the workstation shall be measured in accordance with the requirements of [A2] EN ISO 11202:2010 [A2] [A2] *deleted text* [A2] with the following modifications:

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

2) the difference between the background emission sound pressure level and the workstation sound pressure level shall be equal to or greater than 6 dB [A2] in accordance with EN ISO 11202:2010, 6.4.1, accuracy grade 2 (Engineering) [A2];

3) the correction of the local environmental correction K_{3A} shall be calculated in accordance with A.2 of [A2] EN ISO 11204:2010 [A2] [A2] *deleted text* [A2] with the reference restricted to [A2] EN ISO 3746:2010 [A2] instead of the method given in Annex A of [A2] EN ISO 11202:2010 [A2] [A2] *deleted text* [A2] or in accordance with [A2] EN ISO 3743-1:2010 [A2], [A2] EN ISO 3743-2:2009 [A2], [A2] EN ISO 3744:2010 [A2] or [A2] EN ISO 3745:2009 [A2] where one of these standards has been used as the measuring method.

For noise declaration 6.3 u) shall be met.

5.4.3 Emission of chips and dust

Provision shall be made for the extraction of dust and chips from the machine either by an integral extraction and collection system or by providing outlets to enable the machine to be connected to a separate dust extraction system.

Where machines have two directions of spindle rotation, the chip and dust extraction shall be so designed that it has the same efficiency irrespective of the direction of rotation.

It shall not be possible to reach the tool through any dust extraction outlet when the exhaust system is not connected.

[A2] When the opening of the capture device can not face the projection, the flow of chips and dust shall be guided efficiently to the opening of the capture device.

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. [A2]

To ensure that chips and dust extracted from the point of origin are conveyed to the collection system, the design of hoods, ducts, baffles etc. 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 (18 % or above moisture content).

[A2] 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). [/A2]

[A2] *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). [/A2]

5.4.4 Electricity

[A2] With the exception of 6.3, the requirements of EN 60204-1:2006 apply unless stated otherwise in this document.

See 6.2 of EN 60204-1:2006 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 bb)).

The degree of protection of all electric components out of the enclosure(s) and the enclosure(s) for electrical components itself/themselves shall be at least IP 54 in accordance with the requirements of EN 60529:1991 and EN 60529:1991/A1:2000. [/A2]

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 tools and workpieces. Live parts shall not be accessible in accordance with 6.2.2 of EN 60204-1:2006. Fire risk is not present where power circuit(s) is (are) protected against over current in accordance with 7.2.2 of EN 60204-1:2006.

The power supply cord of displaceable machines shall be of type H0 7 in accordance with the requirements of HD 22.4 S4:2004.

[A1] In accordance with 18.2 of EN 60204-1:2006 the test 1 for the continuity of the protective bonding circuit and functional tests in 18.6 of EN 60204-1:2006 apply. [/A1]

Verification: By checking the relevant drawings, circuit diagrams, inspection of the machine and relevant tests [A1] (specified in 18.2, test 1 and 18.6 of EN 60204-1:2006) [A1].

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

5.4.5 Ergonomics and handling

The requirements of 5.2.2, 6.3, EN 614-1:2006, [A2] EN 1005-3:2002+A1:2008 [A2] apply and in addition:

The height of the workpiece support shall be between 750 mm and 900 mm above the floor level.

The machine and its controls shall be designed according to ergonomic principles in accordance with [A2] EN 1005-4:2005+A1:2008 [A2] for work posture which is not fatiguing.

The positioning, labelling and illumination (if necessary) of control devices, and facilities for materials and tool set handling shall be in accordance with ergonomic principles in accordance with [A2] EN 894-1:1997+A1:2008 [A2], [A2] EN 894-2:1997+A1:2008 [A2], [A2] EN 894-3:2000+A1:2008 [A2] and [A2] EN 1005-1:2001+A1:2008 [A2], [A2] EN 1005-2:2003+A1:2008 [A2], [A2] EN 1005-3:2002+A1:2008 [A2].

Where necessary on the machine, work stations and the zones in which control devices, guards and protective devices are located shall be lit sufficiently to ensure that all work equipment and materials can be properly seen and that eye strain is also avoided in accordance with the requirements of [A2] EN 1837:1999+A1:2008 [A2].

Parts of the machine which weight more than 25 kg and require to be lifted with a lifting device shall include necessary means for attaching lifting accessories e.g. threaded holes in accordance with [A2] EN 1005-2:2003+A1:2008 [A2]. [A1] These attachments shall be positioned such as to avoid machine or components overturn or fall or move in an uncontrolled way during transport, assembly, dismantling, disabling and scrapping. [A1]

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.

[A2] Further guidance is given in EN 60204-1:2006, EN 614-1:2006+A1:2009 and EN 614-2:2002+A1:2009. [A2]

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

5.4.6 Pneumatics

The requirements of [A2] EN ISO 4414:2010 [A2] apply.

See also 5.2.1, 5.2.10, 5.2.11, 5.3.9, 5.4.10, 6.1 and 6.2.

5.4.7 Hydraulics

The requirements of [A2] EN ISO 4413:2010 [A2] apply.

See also 5.2.1, 5.2.10, 5.2.11, 5.3.9, 5.4.10, 6.1 and 6.2.

5.4.8 Electromagnetic compatibility

The machine shall have sufficient immunity to electromagnetic disturbances to enable it to operate correctly in accordance with [A2] EN 60439-1:1999 and EN 60439-1:1999/A1:2004 [A2], 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 manufacturers 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.

5.4.9 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.

5.4.10 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.

Also see 6.3 f).

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

5.4.11 Supply disconnecting devices

The requirements of Clause 5 of ⟦A2⟩ EN 1037:1995+A1:2008 ⟨A2⟧ shall apply and in addition:

The principles of ⟦A2⟩ EN ISO 12100:2010, 6.2.10 and 6.3.5.4 ⟨A2⟧ shall be observed.

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

The electrical isolation shall be in accordance with 5.3 of EN 60204-1:2006.

If the machine is fitted with a DC injection braking system to avoid unintentional switch off, the isolator shall not be on the same side of the machine or of the panel as the start and stop controls.

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 clamping the isolation of the pneumatic clamping device can be achieved through disconnecting a quick action coupling in accordance with ⟦A2⟩ EN ISO 4414:2010 ⟨A2⟧ and does not need to be locked.

When the machine is fitted with hydraulic or pneumatic equipment the electric isolator can also isolate the drive motor of the hydraulic or pneumatic unit (if fitted) and dump any residual hydraulic pressure from an accumulator if fitted.

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/or circuit diagrams, inspection of the machine and relevant functional testing of the machine.

5.4.12 Maintenance

The principles of ⟦A2⟩ EN ISO 12100:2010, 6.2.15 ⟨A2⟧ shall be observed and in addition:

At least the information for maintenance listed in ⟦A2⟩ EN ISO 12100:2010, 6.4.5.1 e) ⟨A2⟧ shall be provided.

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

Where residual energy is stored, e.g. in a reservoir or pipe, means for dumping residual pressure shall be provided for example using a valve.

Dumping of residual pressure shall not be achieved by disconnection of a pipe or union.

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

6 Information for use

6.1 Warning devices

The principles of [A2] EN ISO 12100:2010, 6.4.3 [A2] shall be observed, the requirements of 5.3.3.4 d) apply and in addition:

If the machine is equipped with a pneumatic/hydraulic supply and isolation of the pneumatic/hydraulic 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/hydraulic supply is not isolated by isolation of the electrical supply.

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

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

6.2 Marking

The principles of [A2] EN ISO 12100:2010, 6.4.4 [A2] 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) [A1] business name and address of the machine manufacturer and, where applicable, of his authorised representative; [A1]

b) [A1] year of construction, which is the year in which the manufacturing process is completed; [A1]

c) [A1] designation of the machinery and designation of series or type; [A1]

d) serial or identification machine number, if any;

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

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

g) if the machine without generator for pneumatic or hydraulic energy is equipped with a connection for pneumatic/hydraulic supply and the pneumatic/hydraulic supply is not switched off by the main electrical isolator (e.g. by an electro valve) the permanent warning label shall be placed in proximity to the electrical supply disconnecting device warning that the pneumatic/hydraulic supply is not isolated. If the machine is

connected to a separate pneumatic/hydraulic supply the means for connection e.g. electro valve shall be interlocked with the electrical disconnecting device;

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

i) where fitted with hydraulic and/or pneumatic isolators they shall have their function, location and operational position(s) clearly identified e.g. by a label or a pictogram (see 5.4.10);

[A2] *deleted text* [A2]

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 isolator on the machine.

The hydraulic isolator shall have its function, location and operational position clearly identified e.g. by a label or a pictogram. The label or pictogram shall be fitted in a position in close proximity to the installed location of the isolator on the machine.

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

Also see 5.2.7.

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

6.3 Instruction handbook

The principles of [A2] EN ISO 12100:2010, 6.4.5 [A2] shall be observed and 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 [A2] including reasonably foreseeable misuse e.g. feeding workpieces in the same direction as the running tool [A2];

c) the maximum length, width and thickness of the workpiece;

d) a warning regarding residual risks as:

   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; and

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

   5) not to try removing chips whilst the tool is running and the machining head is not in the rest position;

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

e) instruction for safe use in accordance with [A2] EN ISO 12100:2010, 6.4.5.1 d) [A2]. This shall include as a minimum precautions for machining as:

   1) use of the fence for straight work in order to provide adequate guidance of the workpiece;

2) use of a false fence to minimise the gap between the cutter(s) and the fence plate;

3) use of a power feed device wherever possible;

4) use a push stick for straight work to aid feeding in conjunction with the guard;

5) the tooling to be fitted to the machine to operate in the correct direction of rotation and the workpiece to be fed to the tools whenever possible against the direction of spindle rotation;

6) use of extension tables to support long workpieces;

7) the use of the safeguarding required in 5.3.7.1 and its adjustment according to the typical machining in order to prevent access to the tool;

8) the use of a pressure device with same pad height as the workpiece and for straight work of a push stick in conjunction with the fence in order to prevent access to the tool;

9) the use of a special jig in addition to the guide pin to ensure firm support of the workpiece in order to prevent access to the tool;

10) to avoid climb cutting wherever possible to avoid the risk of ejection;

11) to use extension tables to provide adequate support for large jigs and workpieces and integrated or de-mountable feed mechanism wherever possible;

f) a description of the range, type and dimensions of tools which are suitable for the machine including necessary fixing length, necessary balancing etc.;

g) [A2] that only milling tools with cutting circle diameter below 16 mm and milling tools [A2] marked MAN in accordance with [A2] EN 847-1:2005+A1:2007 [A2] shall be used. This shall include such precautions for machining such as:

1) that the tools used are sharp, correctly selected, maintained and adjusted in accordance with the tool manufacturers recommendation;

2) use of a guide pin head diameter coherent with the tool diameter;

3) use of special equipment where practicable e.g. gauges for setting;

4) Warning the select rotational speed and feeding to be appropriate for the tooling being used;

h) that the cutting speed should always exceed 40 m s^{-1} in order to reduce the risk of kickback but shall not exceed 70 m s^{-1} in order to reduce the risk of tool damage [A2] except for tools with cutting circle diameter below or equal to 50 mm [A2];

i) where necessary on stationary machines requirements for the need to fix the machine to the floor and how this is to be done;

j) on displaceable machines information how transportation shall be handled and how to make the machine stable during machining;

k) information that allows operators to be adequately trained in the use, adjustment and operation of the machine including the correct use;

l) a recommendation to provide adequate general or localised lighting;

m) for machines equipped with hydrostatic tool fixing facilities, that only tool fixing devices with additional mechanical device against loosening of tool in case of leakage in the hydrostatic system shall be used;

n) guidance for use including type of wood and minimum workpiece size recommendations;

o) if equipped with different sized ring guards the choice of the appropriate size and use of the ring guard;

p) the method for adjustment of the lateral pressure device and the method for fixing pressure pads;

q) the method how to fix anti-kickback device (e.g. end stops) to the table or to the fence;

r) the fixing method for the extension tables;

s) information about safe cleaning;

t) that the design of the jig will be determined by the work to be done. The essential factors to be taken into consideration to ensure safe working are accurate location of the workpiece, secure method of workpiece clamping and secure hand-holds (on hand-fed jigs). Followers for jigs being of adequate strength and construction for the purpose envisaged;

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

A-weighted emission sound pressure levels at workstations

A-weighted sound power level emitted by the machinery

The noise declaration shall be accompanied by a statement of the measuring method used and the operating conditions applied during the test, and value of associated uncertainty *K* using the dual-number form of declaration in accordance with [A2] EN ISO 4871:2009 [A2] as follows:

4 dB when using [A2] EN ISO 3746:2010 [A2] and [A2] EN ISO 11202:2010 [A2]

2 dB when using [A2] EN ISO 3743-1:2010 [A2] or [A2] EN ISO 3743-2:2009 [A2] or [A2] EN ISO 3744:2010 [A2]

1 dB when using [A2] EN ISO 3745:2009 [A2].

For example, for a sound power level [A2] L_{WA} = xx dB [A2] (measured value)

Associated uncertainty *K* = 4 dB

Measurement made in accordance with the requirements of [A2] EN ISO 3746:2010 [A2]

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 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".

[A2] Information on noise emission shall also be provided in the sales literature when performance data are provided. [A2]

v) an information concerning the extraction equipment fitted to the machine as follows:

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

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

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

4) the cross section dimensions and details of each dust extraction outlet;

w) information that during [A1] *deleted text* [A1] use the machine [A1] *deleted text* [A1] shall be connected to an external chip and dust extraction system;

[A2] External chip and dust extraction equipment with fixed installations are dealt with in EN 12779:2004+A1:2009. [A2]

x) installation and maintenance requirement including life time and data for mechanical brake and a list of those devices (in particular mechanical brakes) which shall be verified how frequently the verification shall be carried out and by what method:

1) emergency stop(s) - by functional test;

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) the brake - by functional testing to check that the machine is braked within the specified time;

[A1]

y) 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; [A1]

[A1]

z) 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; [A1]

[A2]

aa) 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); [A2]

[A2]

bb) 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; [A2]

[A2]

cc) 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). [A2]

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

[A2⟩ *deleted text* ⟨A2]

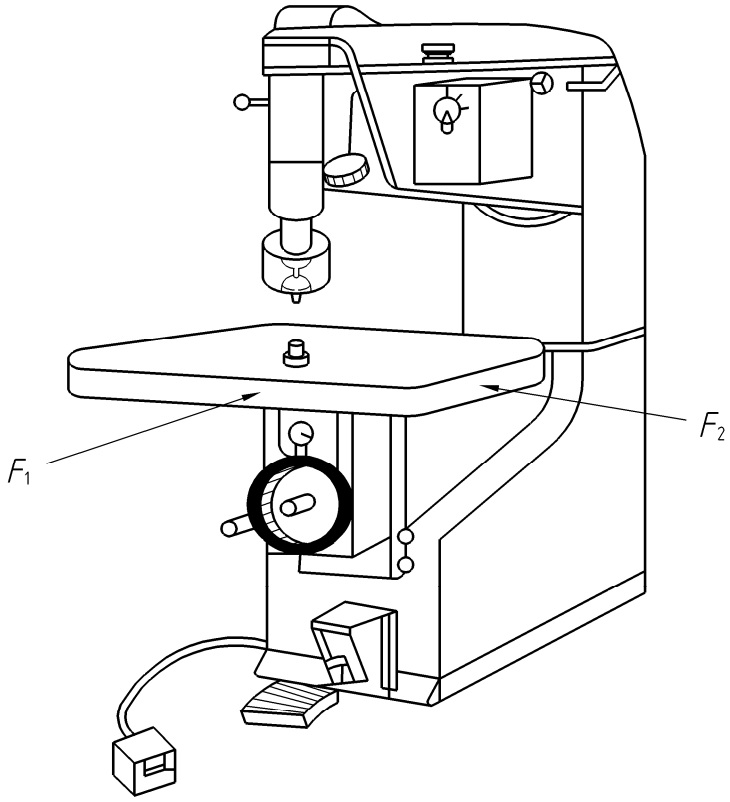
Annex A
(normative)

Stability test for displaceable machines

The machine shall be set in its working position placed on chipboard fixed on the floor and the brakes for the wheels applied (where fitted). A horizontal force F_1 = 500 N shall be applied in the middle of the front face of the table in the direction as shown in [A2] Figure A.1 [A2].

Subsequently a horizontal force F_2 = 500 N shall be applied at the middle of the lateral face of the table in the direction as shown in [A2] Figure A.1 [A2].

In both cases the machine shall not move or tilt.



[A2] Figure A.1 [A2] — Stability test for displaceable machines

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 according to the manufacturers instructions (e.g. belt tension) (also see 6.3);

b) when selecting the speed and the tools, conditions shall be chosen which create the greatest kinetic energy for which the machine is designed (taking into account tool sizes, types, spindle speed etc.);

c) before beginning the test the spindle unit shall be running for at least 15 min at no load (idle speed);

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

e) the speed measuring equipment shall have an accuracy ≤ 1 % of full scale;

f) the time measuring equipment shall have an accuracy ≤ 0,1 s.

B.2 Tests

B.2.1 Un-braked run-down time

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

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

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

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

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

B.2.2 Braked run-down time

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

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

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

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

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

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

Annex C
(normative)

A2 Impact test method for guards

C.1 General

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

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

C.2 Test method

C.2.1 Preliminary remarks

This test method reproduces the hazard of the ejection of 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.

C.2.2 Testing equipment

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

C.2.3 Projectile for guards

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

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

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

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

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

C.2.4 Sampling

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

C.2.5 Test procedure

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

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

C.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.

C.4 Assessment

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

C.5 Test report

The test report shall give the following minimum information:

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

b) projectile mass, dimensions, speed;

c) applicant identification;

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

e) clamping or fixing of the test object;

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

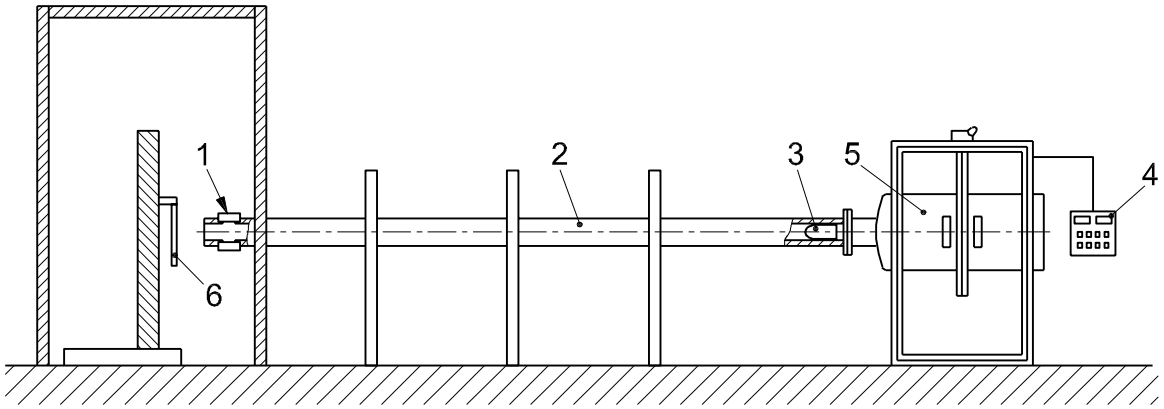
g) test result.

C.6 Test equipment for impact test

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

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

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



Key

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

Figure C.1 — Example of equipment for impact test A2

[A2⟩ *deleted text* ⟨A2]

Annex ZA
(informative)

[A1] 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 [A2] *deleted text* [A2] 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 [A2] *deleted text* [A2] of that Directive and associated EFTA regulations.

[A2] Table ZA.1 [A2] — Correspondence between this European Standard and Directive 2006/42/EC

Clause(s)/sub-clause(s) of this EN	Essential Requirements (ERs) of Directive 2006/42/EC
	1.1.2 Principles of safety integration
5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.4.12, 6.3	a) fitted for its function
Clause 5, 6	b) eliminate or reduce the risks, give measures, inform
Clause 5, 6	c) intended use and reasonably foreseeable misuse
5.4.5, 6.3	d) constraints in use
5.3.1, 5.3.3, 5.3.10, 6.3	e) equipment
5.3.2, 5.3.8, 5.4.3	1.1.3 Materials and products
6.3	1.1.4 Lighting
5.2.2, 5.3.7, 5.4.5	1.1.5 Design of machinery to facilitate its handling
5.4.5	1.1.6 Ergonomics

Table ZA.1 — *(continued)*

5.4.3, 6.3	1.1.7 Operating position
5.2.1, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.11, 5.4.4, 5.4.12	1.2.1 Safety and reliability of control systems
5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 6.3	1.2.2 Control devices
5.2.2, 5.2.3, 5.2.7, 5.2.9	1.2.3 Starting
5.2.2, 5.2.4, 5.2.5, 5.2.6	1.2.4 Stopping
5.2.4	1.2.4.1 Normal stop
5.2.5	1.2.4.2 Operational stop
5.2.6	1.2.4.3 Emergency stop
5.2.7, 5.3.3.5, 6.3	1.2.5 Selection of control or operating mode
5.2.7, 5.2.8, 5.2.10, 5.4.4, 5.4.11	1.2.6 Failure of the power supply
5.3.1, 6.3	1.3.1 Risk of loss of stability
5.3.2, 6.3	1.3.2 Risk of break-up during operation
5.3.2, 5.3.3, 5.3.5	1.3.3 Risks due to falling or ejected objects
5.1	1.3.4 Risk due to surfaces, edges or angles
5.2.7, 5.2.8, 5.2.9, 5.3.9, 6.3	1.3.6 Risks relating to variations in the operating conditions
5.2.11, 5.3.7	1.3.7 Risks related to moving parts
5.3.7	1.3.8 Choice of protection against risks related to moving parts
5.3.7.2	1.3.8.1 Moving transmission parts
5.3.7.1	1.3.8.2 Moving parts involved in the process
5.2.5, 5.3.5, 5.3.6, 5.3.7	1.3.9 Risk of uncontrolled movements

[A2] Table ZA.1 〈A2〉 — *(continued)*

5.3.5, 5.3.6, 5.3.7, 5.3.9	1.4.1 Required characteristics of guards and protective devices - General requirements
5.3.6, 5.3.7	1.4.2.1 Fixed guards
5.3.7	1.4.2.2 Interlocking movable guards
5.3.5, 5.3.9	1.4.2.3 Adjustable guards restricting access
5.2.10, 5.4.4, 5.4.11	1.5.1 Electricity supply
5.4.9	1.5.2 Static electricity
5.2.10, 5.4.6, 5.4.7, 5.4.11	1.5.3 Energy supply other than electricity
5.4.10, 6.3	1.5.4 Errors of fitting
5.4.1	1.5.6 Fire
5.4.2	1.5.8 Noise
5.4.8	1.5.11 External radiation
5.4.3	1.5.13 Emission of hazardous materials and substances
5.4.12	1.6.1 Machinery maintenance
5.2.2, 5.3.7, 5.4.12	1.6.2 Access to operating position and servicing points
5.4.11	1.6.3 Isolation of energy sources
5.2.2, 5.3.7, 5.4.5, 5.4.12, 6.3	1.6.4 Operator intervention
5.4.3, 6.3	1.6.5 Cleaning of internal parts
5.2.1, 5.3.3, 5.4.5, 6.3	1.7.1 Information and warnings on the machinery
6.1	1.7.2 Warning devices
6.2	1.7.3 Marking of machinery

Table ZA.1 — *(continued)*

6.3	1.7.4 Instructions
	2.3 Machinery for working wood and analogous materials
5.3.6, 5.3.7	a) guiding
5.3.5, 5.3.9	b) ejection
5.3.4	c) brake
5.3.5, 5.3.6, 5.3.7, 5.3.10	d) accidental tool contact

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

Bibliography

[A1] *deleted text* [A1]

[1] EN 614-1:2006, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

[2] EN 614-2:2000, *Safety of machinery — Ergonomic design principles — Part 2: Interaction between the design of machinery and work tasks*

[3] [A1] EN 848-3:2007 [A1], *Safety of woodworking machines — One side moulding machines with rotating tool — Part 3: Numerically controlled (NC) boring and routing machines*

[A2] *deleted text* [A2]

[A2]

[4] EN 1093-9:1998+A1:2008, *Safety of machinery — Evaluation of the emission of airborne hazardous substances — Part 9: Pollutant concentration parameter, room method*

[5] EN 1093-11:2001+A1:2008, *Safety of machinery — Evaluation of the emission of airborne hazardous substances — Part 11: Decontamination index* [A2]

[6] [A2] EN 12779:2004+A1:2009 [A2], *Safety of woodworking machines — Chip and dust extraction systems with fixed installation — Safety related performances and safety requirements*

[7] [A2] EN 60745-1:2009 [A2], *Hand-held motor-operated electric tools — Safety — Part 1: General requirements (ICE 60745-1:2006, modified)*

[8] EN 60745-2-17:2003, *Hand-held motor-operated electric tools — Safety — Part 2-17: Particular requirements for routers and trimmers (IEC 60745-2-17:2003, modified)*

[9] EN 60947-4-1:2001, *Low-voltage switchgear and controlgear — Part 4-1: Contactors and motor starters — Electromechanical contactors and motor starters (IEC 60947-4-1:2000)*

[10] EN 60947-5-1:2004, *Low-voltage switchgear and controlgear — Part 5-1: Control circuits devices and switching elements — Electromechanical control circuit devices (ICE 60947-5-1:2003)*

[A1]

[11] EN 61029-1:2000, *Safety of transportable motor-operated electric tools — Part 1: General requirements (IEC 61029-1:1990, modified)*

[12] [A2] EN 61029-2-8:2010 [A2], *Safety of transportable motor-operated electric tools — Part 2: Particular requirements for single spindle vertical moulders (IEC 61029-2-8 1995 + A1:1999 + A2:2001 modified)* [A1]

[13] [A1] EN 61310-1:2008 [A1], *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals* [A1] *(IEC 61310-1:2007)* [A1]

[14] EN 62061:2005, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061:2005)*

[15] EN ISO 11688-2:2000, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low noise design (ISO/TR 11688-2:1998)*

[16] ▌A1⟩ EN ISO 13849-2:2008 ⟨A1▐, *Safety of machinery — Safety-related parts of controls systems — Part 2: Validation (ISO 13849-2:2003)*

▌A1⟩

[17] EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)* ⟨A1▐

▌A2⟩ *deleted text* ⟨A2▐

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