BS EN 691-1:2012

BSI Standards Publication

Safety of woodworking machines

Part 1: Common requirements

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National foreword

This British Standard is the UK implementation of EN 691-1:2012.

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

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

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

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Foreword

This document (EN 691-1:2012) 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of an identical text or by endorsement, at the latest by April 2013, and conflicting national standards shall be withdrawn at the latest by April 2013.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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document, EN 691-1, which concerns general requirements which are common to most woodworking machines, is intended to be used with the parts XX of EN 691, i.e.:

— EN 691-XX: Requirements for particular types of woodworking machines which either supplement or modify the requirements given in EN 691-1 to account for the particular hazards and characteristics of these specific machines.

Compliance with the relevant clauses of EN 691-1 together with a relevant EN 691-XX provides one means of conforming with the essential health and safety requirements of the Machinery Directive.

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

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

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

Introduction

This document is a type C standard as stated in EN ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and events 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 and B standards, the provisions of this 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 woodworking machines. They are also useful for designers and importers.

This document also includes examples which can be provided and information which shall be provided by the manufacturer to the user.

Requirements for milling tools, circular saw blades are given in EN 847-1:2005+A1:2007, for the shank of shank mounted milling tools in EN 847-2:2001, for clamping devices in EN 847-3:2004.

1 Scope

This European Standard is applicable to woodworking machines with cutting tools and/or sanding tools as defined in 3.2.1, when they are used as intended and under the conditions foreseen by the manufacturer.

This document deals with some but not all significant hazards, hazardous situations and events relevant to woodworking machines: those that are common to most of such machines and are listed in Clause 4.

When a relevant part EN 691-XX does not exist, EN 691-1 can help to establish the requirements for the machine, but will not by itself provide a means of conforming to the relevant essential health and safety requirements of the Machinery Directive. In this case a risk assessment should be performed.

NOTE 1 Reasonably foreseeable misuse of machines is dealt with in the relevant parts EN 691-XX.

This document is not applicable to:

— 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, having a mass not exceeding 25 kg; the bench can also be an integrated part of the machine if it consists of hinged legs which can be extended down;

NOTE 2 A relevant part EN 691-XX may define different criteria for delimiting the Scope.

NOTE 3 Transportable electrically driven machines excluded by the Scope of this document are covered by the requirements of EN 61029-1:2009 and parts of EN 61029-2-XX.

— hand held woodworking machines (hand held motor operated tools) or any adaptation permitting their use in a different mode, i.e. bench mounting.

NOTE 4 Driven hand held motor operated tools are covered by EN 60745-1:2009 and parts of EN 60745-2-XX.

NOTE 5 Machines for capturing and extracting dust are covered by EN 12779:2004+A1:2009.

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

NOTE 6 This document covers also woodworking machines which fulfil the criteria of the Machinery Directive, Annex IV.

2 Normative references

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

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

EN 847-2:2001[1)], *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*

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

1) This document is impacted by the corrigendum EN 847-2:2001/AC:2003.

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

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

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

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

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

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

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

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

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

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

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

EN 1760-3:2004+A1:2009, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive bumpers, plates, wires and similar devices*

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

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

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

EN 50525-2-21:2011, *Electric cables — Low voltage energy cables of rated voltages up to and including 450/750 V (Uo/U) — Part 2-21: Cables for general applications — Flexible cables with crosslinked elastomeric insulation*

EN 60204-1:2006[2)], *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60439-1:1999[3)], *Low-voltage switchgear and controlgear assemblies — Part 1: Type-tested and partially type-tested assemblies (IEC 60439-1:1999)*

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2) This document is impacted by EN 60204-1:2006/A1:2009.

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

EN 60529:1991[4)], *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

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

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

EN 61496-1:2004[5)], *Safety of machinery — Electro–sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)*

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

CLC/TS 61496-3:2008, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for active opto-electronic protective devices responsive to diffuse reflection (AOPDDR) (IEC 61496-3:2008)*

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

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

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

EN ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

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

EN ISO 3746:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:2010)*

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

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

EN ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning (ISO 9614-2:1996)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

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4) This document is impacted by EN 60529:1991/A1:2000.

5) This document is impacted by EN 61496-1:2004/A1:2008.

EN ISO 11202:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections (ISO 11202:2010)*

EN ISO 11204:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections (ISO 11204:2010)*

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

EN ISO 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)*

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

EN ISO 13849-1:2008[6)], *Safety of machinery — Safety-related parts of controls systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13849-2:2008, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation (ISO 13849-2:2003)*

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

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

3 Terms and definitions

3.1 General

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

3.2 Definitions

3.2.1
woodworking machine
machine designed to machine wood, material similar to wood, wood based materials and also these materials if they are covered with edgings and/or laminates made of plastic, light alloy, veneer, etc.

Note 1 to entry: Materials analogous to wood include, for example, chipboard, fibreboard, plywood (and also these materials when they are covered with plastic or light alloy laminates), cork, bone, rigid rubber or plastic.

3.2.2
machine actuator
power mechanism used to effect motion on the machine

3.2.3
run-up time
time elapsed from the actuation of the start control device until the spindle or machine part reaches the intended speed

6) This document is impacted by the corrigendum EN ISO 13849-1:2008/AC:2009.

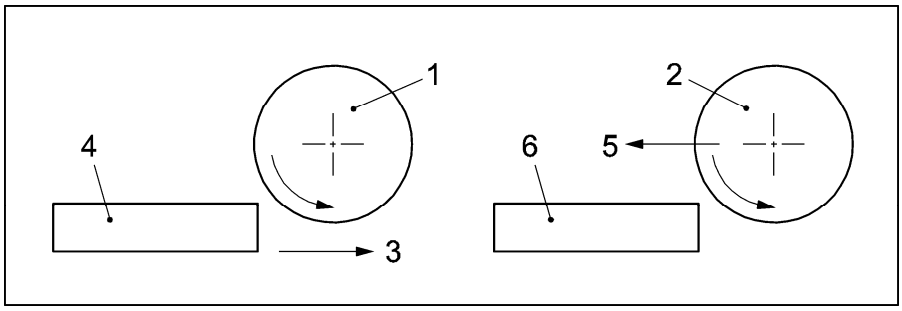
3.2.4
run-down time
time elapsed from the actuation of the stop control device up to spindle or machine part standstill

3.2.5
stationary machine
machine designed to be located on or fixed to the floor or other parts of the structure of the premises

3.2.6
displaceable machine
machine, stationary during use and equipped with a device, e.g. wheels, which allows it to be moved between locations

3.2.7
climb cutting
cutting where the projection of the movement of the cutting knife in direction of the feed movement shows in the same direction as the relative movement of the work-piece against the tool

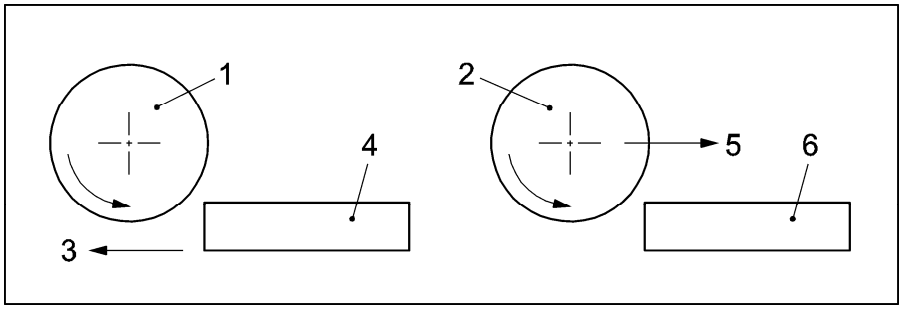
Note 1 to entry: See Figure 1a).



Key

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

a) Climb cutting



Key

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

b) Cutting against the feed

Figure 1 — Climb cutting and cutting against the feed

3.2.8
cutting against the feed
cutting where the projection of the movement of the cutting knife in direction of the feed movement shows in the opposite direction as the relative movement of the work-piece against the tool

Note 1 to entry: See Figure 1b).

3.2.9
information of the supplier
statements, sales literature, leaflets or other documents, in which a manufacturer (supplier) declares either the characteristics of e.g. a material or product or the conformity of the material or product to a relevant standard or specification

3.2.10
feed
relative movement between work-piece and tool(s) during machining

3.2.11
hand feed
manual holding and/or guiding of the work-piece or machine element with incorporated tool during machining; hand feed includes the use of a hand operated support on which the work-piece is placed manually or clamped and the use of a demountable power feed unit

3.2.12
integrated feed
mechanical feed
feed mechanism for the work-piece (or tool) which is integrated with the machine and where the work-piece (or machine element with incorporated tool) is held and controlled mechanically during the machining operation

3.2.13
kickback
particular form of ejection describing the unexpected movement of the work-piece or parts of it opposite to the direction of feed during processing

3.2.14
safety function
function of the machine whose failure can result in an immediate increase of the risk(s)

[SOURCE: EN ISO 12100-1:2010, 3.30]

3.2.15
safety-related part of a control system (SRP/CS)
part of a control system that responds to safety-related input signals and generates safety-related output signals

[SOURCE: EN ISO 13849-1:2008, 3.1.1]

Note 1 to entry: The combined safety-related parts of a control system start at the point where the safety-related input signals are initiated (including for example, the actuating cam and the roller of the position switch) and end at the output of the power control elements (including, for example, the main contacts of the contactor).

Note 2 to entry: If monitoring systems are used for diagnostics, they are also considered as SRP/CS.

3.2.16
application software
SRASW
software specific to the application, implemented by the machine manufacturer, and generally containing logic sequences, limits and expressions that control the appropriate inputs, outputs, calculations and decisions necessary to meet the SRP/CS requirements

[SOURCE: EN ISO 13849-1:2008, 3.1.36]

3.2.17
embedded software
firmware
system software
SRESW
software that is part of the system supplied by the control manufacturer and which is not accessible for modification by the user of the machinery

[SOURCE: EN ISO 13849-1:2008, 3.1.37]

3.2.18
performance level
PL
discrete level used to specify the ability of safety-related parts of control systems to perform a safety function under foreseeable conditions

[SOURCE: EN ISO 13849-1:2008, 3.1.23, 4.5.1]

3.2.19
operational stop
stop for operational reasons without cutting off the energy supply to the actuator(s) where the stop condition is monitored and maintained

3.2.20
start-up of a machine
starting
change from rest to motion of a machine or of one of its parts, e.g. tool spindle(s)

3.2.21
manual control
situation where each process movement is initiated by the operator

3.2.22
automatic machine
machine which after initiation of start-up by the operator is capable of autonomously repeating machining cycles; the work-piece may be manually loaded and/or unloaded

3.2.23
semi-automatic machine
machine which needs to be initiated by the operator for each cycle; the work-piece may be manually loaded and/or unloaded

3.2.24
cutting area
area where the tool(s) can be involved in the cutting process

3.2.25
non-cutting area
area where the tool(s) is(are) not involved in the cutting process

4 List of significant hazards

This clause contains the correlation between hazards common to woodworking machines as defined in the scope and the relevant clauses of this document. The extent to which all the significant hazards are covered is indicated in the relevant parts XX of this document.

These hazards are listed in Table 1.

Table 1 — List of significant hazards (1 of 3)

No.	Type or group	Examples of hazards		EN ISO 12100:2010	Relevant clause of this document
		Origin[a]	Potential consequences[b]		
1	**Mechanical hazards**	— Acceleration, deceleration (kinetic energy) — Angular parts — Approach of a moving element to a fixed part — Cutting parts — Elastic elements — Falling objects — Gravity (stored energy) — Height from the ground — High pressure — Machinery mobility — Moving elements — Rotating elements — Rough, slippery surface — Sharp edges — Stability — Vacuum	— Being thrown — Crushing — Cutting or severing — Drawing-in or trapping — Entanglement — Friction or abrasion — Impact — Injection — Shearing — Stabbing or puncture	6.2.2.1, 6.2.2.2, 6.2.10, 6.3, 6.3.5.4	5.2.1 5.3.1 5.3.2 5.3.3 5.3.4 5.3.5 5.3.6 5.3.7 5.3.8 5.3.9 5.3.10 5.4.8 5.4.12
2	**Electrical hazards**	— Arc — Electromagnetic phenomena — Electrostatic phenomena — Live parts — Not enough distance to live parts under high voltage — Overload — Parts which have become live under fault conditions — Short-circuit — Thermal radiation	— Burn — Chemical effects — Effects on medical implants — Electrocution — Falling, being thrown — Fire — Projection of molten particles — Shock	6.2.9, 6.3.5.4	5.4.4 5.4.11 5.4.12
3	**Thermal hazards**	— Explosion — Flame — Objects or materials with a high or low temperature — Radiation from heat sources	— Burn — Dehydration — Discomfort — Injuries by the radiation of heat sources — Scald		5.4.1, 5.4.3

Table 1 (2 of 3)

No.	Type or group	Examples of hazards		EN ISO 12100:2010	Relevant clause of this document
		Origin[a]	Potential consequences[b]		
4	**Noise hazards**	— Exhausting system — Gas leaking at high speed — Manufacturing process (stamping, cutting, etc.) — Moving parts — Scraping surfaces — Unbalanced rotating parts — Whistling pneumatics — Worn parts	— Discomfort — Loss of balance — Permanent hearing loss — Stress — Tinnitus — Tiredness — Any other (e.g. mechanical, electrical) as a consequence of an inter-ference with speech communication or with acoustic signals	6.2.2.2, 6.3	5.4.2
5	**Vibration hazards**	— Misalignment of moving parts — Mobile equipment — Scraping surfaces — Unbalanced rotating parts — Vibrating equipment — Worn parts	— Discomfort — Vascular disorder		
6	**Radiation hazards**	— Ionising radiation source — Low frequency electromagnetic radiation — Optical radiation (infrared, visible and ultraviolet), including laser — Radio frequency electromagnetic radiation	— Burn — Damage to eyes and skin — Effects on reproductive capability — Genetic mutation — Headache, insomnia, etc.		5.4.10
7	**Material/ substance hazards**	— Aerosol — Biological and microbiological (viral or bacterial) agent — Dust — Fibre — Flammable — Fluid — Fume — Oxidiser	— Breathing difficulties, suffocation — Cancer — Corrosion — Effects on reproductive capability — Fire — Infection — Mutation — Poisoning — Sensitisation	6.2.3, 6.2.4	5.4.3 5.4.8

Table 1 (3 of 3)

No.	Type or group	Examples of hazards		EN ISO 12100:2010	Relevant clause of this document
		Origin[a]	Potential consequences[b]		
8	**Ergo-nomic hazards**	• Access • Design or location of indicators and visual displays units • Design, location or identification of control devices • Effort • Flicker, dazzling, shadow, stroboscopic effect • Local lighting • Mental overload/underload • Posture • Repetitive activity • Visibility	• Discomfort • Fatigue • Musculoskeletal disorder • Stress • Any other (e.g. mechanical, electrical) as a consequence of human error	6.2.7, 6.2.8, 6.2.11.8, 6.2.11.12, 6.3.5.5, 6.3.5.6	5.2.2 5.4.5 5.4.6 5.4.13 6.3
9	**Hazards associated with environ-ment in which the machine is used**	— Dust — Electromagnetic disturbance — Lightning — Moisture — Pollution — Temperature — Water — Wind	— Burn — Slight disease — Slipping, falling — Suffocation — Any other as a consequence of the effect caused by the sources of the hazards on the machine or parts of the machine	6.2.11, 6.2.11.4, 6.2.11.7, 6.2.11.11, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.3.5.4, 6.4	5.4.9

[a] One origin of hazards can have several potential consequences.

[b] For each type or group of hazard, some potential consequences can be related with several origins of hazards.

5 Safety requirements and/or measures

5.1 General

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

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

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

5.2 Controls

5.2.1 Safety and reliability of control systems

5.2.1.1 General

For the implementation of any safety function, either realised in electric, pneumatic, hydraulic or mechanic technology, the appropriate requirements of EN ISO 13849-1:2008 shall apply. Safety related parts of the control system (SRP/CS) of machines dealt with in this document include those concerning the safety functions listed in Table 2.

Wherever in this document PL is mentioned the requirements for PL refer to EN ISO 13849-1:2008.

5.2.1.2 Performance level required

The required PL for the specific safety functions are listed in Table 2.

For machines where no specific part XX of this document exists and where the risk assessment results in a higher required PL than stated in Table 2 the higher one applies.

Table 2 — Safety functions and Performance Level (PL) required

Nr.	Safety function/devices	Performance level (PL) required	Clause of EN ISO 13849-1:2008	Clause of this document
1	starting, restarting, prevention of unexpected start-up	c	5.2.3	5.2.1.10 5.2.1.16
2	stop function (normal stopping, operational stop, emergency stop)	c	5.2.1	5.2.1.11
3	safety-related stop function initiated by protective devices or by interlocking of moveable guards	c	5.2.1	5.2.1.9.5 5.2.1.9.6 5.2.1.9.7
4	guard locking	c		5.2.1.9.7
5	interlocking of functions, e.g. adjustment of spindle with spindle rotation, feed drive with spindle rotation	b or c		5.2.1.10 5.2.1.12 5.3.4.2
6	mode selection	c		5.2.1.13
7	selection of local control function	c	5.2.4	5.2.1.18
8	hold-to-run function	c		5.2.1.9.2
9	enabling device function	c		5.2.1.9.3
10	braking function	b or c		5.2.1.12
11	adjusting, changing of tool speed or speed of machine parts	b or c	4.6.4 5.2.7	5.2.1.14
12	monitoring of parameterisation of safety-related input values	c	5.2.7	5.2.1.14
13	closing function of powered clamping devices (monitoring of closing speed, clamping force)	c		5.2.1.15
14	manual reset function	c	5.2.2	5.2.1.17
15	two hand control	c		5.2.1.9.4

In the parts XX of this document Table 2 may be supplemented by other safety functions.

The parts XX of this document may require a different PL depending on the risk assessment according to EN ISO 13849-1:2008.

5.2.1.3 Design of the safety functions

The design of the safety functions shall be according to EN ISO 13849-1:2008.

For SRP/CS as part of a safety component or protective device for which a specific standard exists, all requirements of the specific standard apply.

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

5.2.1.4 Safety-related embedded software (SRESW)

SRESW of the SRP/CS embedded software shall be in accordance with EN ISO 13849-1:2008, 4.6.1 and 4.6.2.

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

5.2.1.5 Safety-related application software (SRASW)

SRASW of the SRP/CS shall be in accordance with EN ISO 13849-1:2008, 4.6.1 and 4.6.3.

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

5.2.1.6 Verification that achieved PL meets required PL

Verification that PL achieves at least the required PL shall be according to EN ISO 13849-1:2008, 4.7.

Verification: By checking the relevant documentation.

5.2.1.7 Validation

SRP/CS shall be validated according to EN ISO 13849-1:2008, Clause 8 (see also EN ISO 13849-2:2008).

Verification: By checking the relevant documentation.

5.2.1.8 Environmental conditions

The environmental conditions SRP/CS are exposed to, e.g. dust, fumes and/or gases, shall be taken into account. The SRP/CS shall fulfil the environmental requirements of the specific standard, if available, otherwise EN 50178:1997 applies, also for electromechanical components.

The SRP/CS shall fulfil the EMC requirements of the specific standard, if available, otherwise the requirements of EN 50370-2:2003 apply.

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

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

NOTE For electrical components characteristics the information from the component manufacturer can be useful.

5.2.1.9 Safeguards

5.2.1.9.1 General

The control system of safeguards shall be in accordance with the specific standards for safeguards and shall be designed to achieve a PL as specified in 5.2.1.9.2 to 5.2.1.9.7.

Verification of PL for all safeguards devices, see 5.2.1.6.

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

5.2.1.9.2 Hold-to-run function

The hold-to-run function shall be designed to achieve at least PL=c.

Verification: By checking the relevant drawings and/or circuit diagrams, calculation

For electrical hold-to-run control devices, see EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.6.1.

NOTE For electrical components characteristics the information from component manufacturer can be useful.

5.2.1.9.3 Enabling device

The enabling device function shall be designed to achieve at least PL=c.

Verification: By checking the relevant drawings and/or circuit diagrams, calculation.

NOTE For electrical components characteristics the information from component manufacturer can be useful.

5.2.1.9.4 Two-hand control device

Two-hand control devices shall be as a minimum in accordance with type III A as defined in EN 574:1996+A1:2008 (see 5.3.5.2.2, 5.3.8). At least PL=c shall be achieved.

Verification: By checking the relevant drawings and/or circuit diagrams, calculation.

NOTE For electrical components characteristics the information from component manufacturer can be useful.

5.2.1.9.5 Pressure sensitive protective equipment

Pressure sensitive mats shall comply with requirements of EN 1760-1:1997+A1:2009.

Trip bars shall comply with requirements of EN 1760-2:2001+A1:2009.

Pressure sensitive bumpers, plates, wires and similar devices shall comply with requirements of EN 1760-3:2004+A1:2009.

At least PL=c shall be achieved.

NOTE 1 For this safety function usually category 3 of EN ISO 13849-1:2008 is applied.

Verification: By checking the relevant drawings and/or circuit diagrams, calculation.

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

5.2.1.9.6 Active opto-electronic protective device (AOPD)

Active opto-electronic protective devices (light barriers) shall be as minimum in accordance with type 2 as defined in CLC/TS 61496-2:2006 and at least PL=c shall be achieved (see Table 2).

Where the test procedure is not implemented in the AOPD component itself the test procedure shall be performed by the machine control system.

Where the AOPD is used for cyclic access (access in each machining cycle) and/or for elimination of faults, maintenance, at least PL=c shall be achieved (see Table 2).

NOTE 1 For this safety function usually category 2 or 3 of EN ISO 13849-1:2008 is applied.

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

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

5.2.1.9.7 Movable guards

Movable guards shall be interlocked to prevent the start of hazardous machinery functions until the guards are closed and they shall generate a stop command whenever the guards are no longer closed.

Where it is possible for an operator to reach the danger zone before the risk due to the hazardous machinery functions has ceased, the guards shall be additionally associated with a guard locking device that keeps the guards closed and locked until the risk of injury from the hazardous machinery functions has ceased.

Where the moveable guard prevents access to the tool(s) or other hazardous machines parts, for interlocking and interlocking with guard locking at least PL=c shall be achieved (see Table 2).

NOTE 1 For this safety functions usually category 1 of EN ISO 13849-1:2008 is applied if the control circuits are hardwired and category 3 of EN ISO 13849-1:2008 if the control circuits include electronic components.

See also 5.3.5.1.2.

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

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

5.2.1.10 Starting

Before starting or restarting of the machine all relevant safeguards shall be in place and functional. This is achieved by the arrangements described in 5.3.6.1. Start or restart shall only be possible by actuation of the start control device provided for that purpose. The control device shall be protected against unintended actuation e.g. by a shrouded control device.

Starting of power feed shall only be possible when the tool spindle(s) involved in machining is/are running at the intended speed(s).

This may be achieved by a time delay device having a time delay of at least the maximum run-up time and which achieves at least PL=c.

For the safety related part of the control system for start-up (starting) or restarting and for the interlocking arrangements at least PL=c shall be achieved according to 5.2.1.2, Table 2 (see 5.3.5, 5.3.6, 5.3.9). The safety functions shall be designed in accordance with the requirements of EN ISO 13849-1:2008.

NOTE For this safety functions usually category 1 of EN ISO 13849-1:2008 is applied if the control circuits are hardwired and category 3 of EN ISO 13849-1:2008 if the control circuits include electronic components.

For electrically operated machines see EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 7.5 and 9.2.5.2.

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

5.2.1.11 Stop function

5.2.1.11.1 General

The stop function for machine actuators may be realised in stop category 0, stop category 1 or stop category 2 according to EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.2.

The stop function shall be designed to achieve at least PL=c (see 5.2.1).

For machine actuators stopped in stop category 0, power shall be cut to these actuators except work-piece clamping (if fitted) unless STO according to EN 61800-5-2:2007 is used.

For machine actuators stopped in stop category 1, the stopping sequence shall be:

a) cut power to these machine actuators except work-piece clamping (if fitted) unless STO according to EN 61800-5-2:2007 is used and actuate the brake(s);

b) cut power to brake(s) (if electrical brake is fitted) after tool spindle has come to rest e.g. by using a time delay.

For machine actuators stopped in stop category 2 of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, see 5.2.1.11.3.

A stop category 0 according to EN 60204-1:2006 and EN 60204-1:2006/A1:2009 may include the use of a spring-actuated mechanical brake.

The design of the control system shall be such as to satisfy the normal stopping sequence. If a time delay device is used it shall at least conform to PL=c and the time delay shall be at least the maximum run-down time. Either the time delay shall be invariable or the time delay adjustment device shall be sealed.

NOTE For this safety function usually category 1 of EN ISO 13849-1:2008 is applied if the control circuits are hardwired and category 3 of EN ISO 13849-1:2008 if the control circuits include electronic components. For time delay function usually category 3 is applied.

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

5.2.1.11.2 Normal stopping

The machine shall be fitted with a stop control which, when activated, brings all machine actuators and – if fitted – a demountable power feed unit safely to a stop.

If the machine is fitted with a spring-actuated mechanical brake for the tool spindle(s) this stop function shall be of stop category 0 in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.2.

If the machine is fitted with any other type of brake e.g. an electrical brake for the tool spindle(s) this stop function shall be of stop category 1 in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.2.

NOTE Electrical braking also includes reducing spindle speed by a frequency inverter.

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

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

5.2.1.11.3 Operational stop

For operational stops the stopping sequence shall be:

a) stop the machine actuators, keep work-piece clamping effective (if fitted);

b) keep the stop condition monitored and maintained after stopping.

For operational stop of PDS(SR) the stop condition is usually monitored in category 3 according to EN ISO 13849-1:2008. See EN 61800-5-2:2007, 4.2.3.1 “safe operating stop” (SOS) and 4.2.2.4 “safe stop 2” (SS2)

For measures against access to danger zone(s) in operational stop mode see 5.3.5.

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

5.2.1.11.4 Emergency stop

Machines with more than one machine actuator or where provision is made for use with more than one machine actuator (e.g. with a socket for a demountable power feed) shall be fitted with an emergency stop control. Emergency stop control devices shall be at any time of self-latching type. Electrical emergency stop control systems shall comply with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.5.4.2 and 10.7.

The requirements regarding stop categories in 5.2.1.11.2 apply.

If an emergency stop control is fitted the requirements of EN ISO 13850:2008 apply and the control actuator shall be located in accordance with 5.2.2.

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

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

5.2.1.12 Braking function

For the safety related part of the control system for the braking function at least PL=c shall be achieved.

Where a spring operated mechanical brake or any other type of brake not using electronic components is fitted, the last paragraph of 9.3.4 of EN 60204-1:2006 and EN 60204-1:2006/A1:2009 does not apply.

As an exception where electric braking systems containing electronic components are used, the control system for braking shall at least fulfil the requirements of PL=b and be designed in 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 periodically, e.g. by monitoring braked run down time. The feed back shall come from either the encoder fitted to the spindle motor or from the measurement of the residual current in the wires powering the motor.

The test shall:

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

b) be independent from the intention of the operator;

c) be performed at each spindle stop.

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

NOTE 1 For this safety function usually category 2 of EN ISO 13849-1:2008 is applied.

The diagnostic coverage (DCavg) shall be at least 60 %.

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

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

NOTE 2 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 fulfill the requirements of category 1 of EN ISO 13849-1:2008.

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

For brake release see 5.3.4.2.

NOTE 3 Where the machine is designed with a mechanical brake for this safety function usually category 1 according to EN ISO 13849-1:2008 is applied.

NOTE 4 Where the machine is designed with an electrical brake for this safety function usually category 2 according to EN ISO 13849-1:2008 is applied.

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

5.2.1.13 Mode selection

If it is necessary to operate the machine with reduced safety measures, e.g. for setting or adjustment, the machine shall be fitted with a mode selector.

Mode selection shall be in accordance with the following requirements (see also EN ISO 12100:2010, 6.2.11.10):

a) the mode selected shall override all other control or operating modes, with the exception of the emergency stop;

b) the mode selector shall be lockable in any position e.g. by a key-operated switch;

c) changing the mode shall not initiate any movement of the machine;

d) when changing modes the machine shall be brought to a normal stop except when changing from a mode with lower safety measures (e.g. setting) into a mode with higher safety measures.

See also 6.3.

For the safety related part of the control system for mode selection at least PL=c shall be achieved.

NOTE For this safety function usually category 1 of EN ISO 13849-1:2008 is applied if the control circuits are hardwired and category 3 of EN ISO 13849-1:2008 if the control circuits include electronic components.

See also EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.3.

The parts XX of this document may provide additional requirements.

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

5.2.1.14 Spindle speed changing

5.2.1.14.1 General

Where a machine is designed to operate at more than one spindle speed, all relevant requirements in 5.2.1.14.2 to 5.2.1.14.4 shall be met. The selected spindle speed(s) shall be indicated or visible at the operator's position before starting the spindle motor(s).

See also EN 61310-1:2008.

5.2.1.14.2 Spindle speed changing by changing belts on the pulleys

On machines with varying speed by changing the belts positions on the pulleys the control system for speed indication (if fitted) shall be designed to achieve at least PL=b.

NOTE For this safety function usually category B of EN ISO 13849-1:2008 is applied.

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

5.2.1.14.3 Spindle speed changing by incremental speed change motor

On machines fitted with an incremental speed change motor, e.g. a change pole motor, the selected speed shall be indicated at the control actuator. Speed indication/selection shall be designed to achieve at least PL=c.

NOTE For this safety function usually category 1 of EN ISO 13849-1:2008 is applied.

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

5.2.1.14.4 Infinitely variable speed by frequency inverter

On machines fitted with a control device for infinitely variable speed (e.g. a frequency inverter) for the spindle drive motor, the device shall be such that the real speed shall not exceed the selected speed by more than 10 %. The selected speed shall be indicated prior to spindle start. The selected speed value shall be displayed to be read easily by the operator.

The safety related part of the control system for speed monitoring shall be designed to achieve at least PL=c.

NOTE For this safety function usually category 2 or 3 of EN ISO 13849-1:2008 is applied. See the informative Annex E.

For software requirements see EN ISO 13849-1:2008, 4.6.

See also EN 61800-5-2:2007, 4.2.3.4 (safely-limited speed (SLS)).

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

5.2.1.15 Powered clamping

Where powered clamping is provided and where preventing crushing or shearing hazard is dependent of the control system, its safety related part shall be designed to achieve at least PL=c.

See 5.3.8.

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

5.2.1.16 Failure of any power supply

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

For electric supply see EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 7.5 paragraphs 1 and 3.

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

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

The safety related part of the control system to prevent automatic restart shall be designed to achieve at least PL=c.

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

5.2.1.17 Manual reset function

The requirements of EN ISO 13849-1:2008, 5.2.2 apply with the exception that the manual reset function can restart the machine on condition that this does not lead to hazardous situations.

NOTE Exceptions are stated in the parts XX of this document.

For the safety related part of the control system for this safety function at least PL=c shall be achieved.

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

5.2.1.18 Local control function

See EN ISO 13849-1:2008, 5.2.4.

5.2.2 Position of control actuators

All hand-operated control actuators shall be positioned ≥ 600 mm and ≤ 1.800 mm above floor level and at a distance not exceeding 700 mm from the related operator's position measured in horizontal direction.

For electric control devices see also EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 10.1.2

NOTE Additional requirements regarding movable control panels, if any, are specified in the parts XX of this document.

A stop control device shall be placed near each start control device. See also 5.3.5.2.1.

The emergency stop control device required in 5.2.1.11.4 shall be situated adjacent to the start control device(s) initiating dangerous movements.

Reset actuators, if fitted, shall be situated outside the danger zone and in a safe position from which there is good visibility for checking that no person is within the danger zone. It shall be prevented to initiate the reset

function when standing inside a danger zone.

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

5.3 Protection against mechanical hazards

5.3.1 Stability

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

Displaceable machines shall have the facility to make them stable during machining (e.g. by providing brakes for the wheels or a device to retract the wheels from the floor). Machines provided with wheels shall have adequate stability during transportation. Such displaceable machines shall pass the test in Annex A.

Verification: By checking the relevant drawings, inspection of the machine and for displaceable machines performing the test in Annex A.

5.3.2 Risk of break-up during operation

To reduce the probability of break up during operation the requirements of 5.3.3 apply. To reduce the effect of break up during operation the requirements of 5.3.9 and 5.3.5.1 apply.

Unless the ejection of parts from the machines is prevented by enclosures, the design of work-piece feeding and guiding devices, e.g. feed roller(s), fences and pushers shall be such that their contact with the tool is prevented. If the possibility of contact between tool(s) and parts of the machine cannot be excluded by design, any part of the machine that can come in contact with the tool(s) shall be made of easily chip-able material, e.g. plastics or light alloy.

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

5.3.3 Tool holder and tool design

Tools and tool holders supplied by the machine manufacturer, if any, shall comply with the relevant standard(s).

NOTE Requirements for milling tools with cutting diameter over 16 mm, circular saw blades and milling tool holders are specified in EN 847-1:2005+A1:2007, EN 847-2:2001 and EN 847-3:2004.

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

5.3.4 Braking

5.3.4.1 Braking of tool spindle

An automatic brake shall be provided for tool spindles where the tool is accessible during run-down and the un-braked run-down time exceeds 10 s (braking sequence see 5.2.1.11).

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

See 5.2.1.12.

The braking torque shall not be applied directly to the tool itself or its flange(s), if any.

Verification: For the determination of the run-up time, braked and un-braked run-down time see the appropriate test given in Annex C.

5.3.4.2 Brake release

Where a control is provided to release the mechanical spindle brake in order to enable rotation by hand, release of the brake shall only be effective when the spindle has stopped turning, e.g. by a time delay between control actuation and brake release with a time delay device fulfilling at least PL=c.

The actuator of the brake release shall be interlocked with the spindle motor to prevent starting of the motor if the brake release function has not been reset.

The safety related part of the control system of the interlocking components and function shall be designed to achieve at least PL=c (see 5.2.1).

NOTE For this safety function usually category 1 of EN ISO 13849-1:2008 is applied.

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

5.3.5 Guards, protective devices; design, arrangement

5.3.5.1 Guards

5.3.5.1.1 Fixed guards

Fixed guards shall be designed in accordance with EN 953:1997+A1:2009, Clause 5.

Fixed guards that are to be demounted by the user, e.g. for maintenance and cleaning purposes, shall be fitted with fixing elements remaining attached to the machine or to the guard when the guard is removed, e.g. un-losable screws. See also 6.3.

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

5.3.5.1.2 Interlocked moveable guards with or without guard locking

Interlocked movable guards shall be designed in accordance with EN 953:1997+A1:2009, Clause 5.

Interlocking with guard locking is required where access to danger zone(s) is possible before the risk due to the hazardous machinery function has ceased.

See also 5.2.1.9.7.

NOTE 1 The parts XX of this document provide additional information.

Where interlocking with guard locking is required and the hazardous machinery functions have ceased in less than 10 s after initiation of the stop command, guard locking shall be at least by a manually operated delay device in accordance with EN 1088:1995+A2:2008, Annex N.

Where the run down time of the hazardous machinery functions is 10 s or more, guard locking shall be spring applied/power released in accordance with EN 1088:1995+A2:2008, Annex M.

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

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

5.3.5.2 Protective devices

5.3.5.2.1 Hold-to run control device

Where hazardous movements are controlled by a hold-to-run device, e.g. in setting mode, the following requirements shall be met:

a) the danger zone shall be completely visible from the place of the operator;

b) the stopping distance or the distance moved before the moving parts reverse shall be short enough to prevent any hazard.

See also 5.2.1.9.2.

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

5.3.5.2.2 Two-hand control devices

Where hazardous movements are controlled by a two-hand control device, e.g. clamping, feed of tool (cutting stroke), the following requirements shall be met:

a) the danger zone shall be completely visible from the place of the operator;

b) the push-buttons of the two-hand control device and their position shall be arranged in accordance with EN 574:1996+A1:2008.

See also 5.2.1.9.4.

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

5.3.5.2.3 Active opto-electronic protective device (AOPD)

Light curtains and light barriers shall be designed in accordance with EN 61496-1:2004, EN 61496-1:2004/A1:2008 and CLC/TS 61496-2:2006.

Laser scanners shall be designed in accordance with CLC/TS 61496-3:2008.

See also 5.2.1.9.6.

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

5.3.5.2.4 Sensitive protective equipment (SPE)

Sensitive protective equipment (SPE) shall be designed and arranged in compliance with:

a) EN 1760-1:1997+A1:2009 for pressure sensitive mats and pressure sensitive floors;

b) EN 1760-2:2001+A1:2009 for trip bars and pressure sensitive edges;

c) EN 1760-3:2004+A1:2009 for bumpers.

See also 5.2.1.9.5.

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

5.3.6 Prevention of access to moving parts

5.3.6.1 General

Access to hazardous moving parts shall be prevented by one or more of the following safeguards (see 5.3.5):

a) Guards (see 5.3.5.1); or

b) AOPD (see 5.3.5.2.3); or

c) Sensitive protective equipment (see 5.3.5.2.4).

5.3.6.2 Guarding of tools

Access to the tool(s) shall be prevented by an interlocked moveable guard with guard locking (see 5.3.5.1.2).

As an exception where access is required only for tool changing and is necessary less than once a month, access to the tool may be prevented by a fixed guard (see 5.3.5.1.1).

Where safeguarding of the part of the tool(s) involved in machining is not possible by a fixed guard or a moveable guard access shall be prevented as far as possible by one of the following means:

a) automatically adjustable guards; or

b) manually adjustable guards; or

c) impeding/deterring devices; or

d) AOPD; or

e) sensitive protective equipment; or

f) any combination of a) to e).

It shall not be possible to touch the tool(s) through any dust extraction outlet when the exhaust system is not connected.

See also EN ISO 12100:2010, 3.27.

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

NOTE Information from supplier from the material is useful.

5.3.6.3 Guarding of drives

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

a) fixed guard(s); or

b) moveable guard(s) interlocked with the drive mechanism(s), with or without guard locking (see 5.3.5.1.2).

Where frequent access, i.e. more than once per week, to the drive(s) is necessary for maintenance or adjustment purposes only b) applies.

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

5.3.6.4 Guarding of shearing and/or crushing zones

Access to shearing and/or crushing zones caused by moving machine parts in cyclic operation shall be prevented e.g. by

a) guards according to 5.3.5.1; or

b) protective devices according to 5.3.5.2.

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

5.3.7 Impact hazard

Where contact between whole body (trunk), chest and head with moving machine parts or moving work-pieces is not avoided by design of the machine or by the measures in 5.3.6, the speed of moving machine parts or work-piece shall not exceed 25 m/min; otherwise bumpers according to EN 1760-3:2004+A1:2009 shall be provided.

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

5.3.8 Clamping devices

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

a) a two-hand control of type III A in accordance with EN 574:1996+A1:2008 to control the clamping stroke; or

b) 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

c) reduction of the gap between clamp and work-piece to 6 mm or less by a manually adjustable device and clamping stroke limitation to a maximum of 10 mm; or

d) guarding of the clamp by a guard fixed to the clamping device to reduce the gap between the work-piece and the guard to less than 6 mm; the maximum extension of the clamp outside the guard shall not exceed 6 mm; or

e) limitation of the clamp closing speed to 10 mm/s or less.

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

5.3.9 Devices to minimise the possibility or the effect of ejection

5.3.9.1 Guards materials

5.3.9.1.1 General

Where guards are used as capturing devices to prevent ejection of machine parts or work-piece parts they shall be designed to withstand the estimated forces.

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

NOTE Commonly used guards and their characteristics are classified in 5.3.9.1.2 and 5.3.9.1.3 with regard to their capability to withhold typical impacts. In the parts XX of this document reference to the required class of guards is made.

5.3.9.1.2 Characteristics of guards class A

Guards class A shall be manufactured from either:

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

b) light alloy with characteristics in accordance with the requirements of Table 3; or

Table 3 — Characteristics of guards class A made of light alloy

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

c) polycarbonate with a wall thickness of at least 5 mm; or

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

Guards passing the impact test in Annex B with the projectile specified in B.2.3.2 are considered to fulfil the requirements for guards classes A and B.

Verification: By checking the relevant drawings, tensile strength, measurement, performing for materials not conforming to the requirements in 5.3.9.1.2 the impact test given in Annex B with a projectile specified in B.2.3.2 and inspection of the machine.

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

5.3.9.1.3 Characteristics of guards class B

Guards class B shall be manufactured from either:

a) steel with an ultimate tensile strength of at least 350 N mm^{-2} and a wall thickness of at least 1.5 mm; or

b) light alloy with characteristics in accordance with the requirements of Table 4; or

Table 4 — Characteristics of guards class B made of light alloy

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

c) polycarbonate with a wall thickness of at least 3 mm; or

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

Guards passing the impact test in Annex B with the projectile specified in B.2.3.3 are considered to fulfil the requirements for guards class B.

Verification: By checking the relevant drawings, tensile strength, measurement, performing for materials not conforming to the requirements in 5.3.9.1.3 the impact test given in Annex B with a projectile specified in B.2.3.3 and inspection of the machine.

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

5.3.9.2 Measures against ejection

To minimise the risk of ejection machines shall be fitted with one or more of the following means or devices:

a) fixed guards or moveable guards (see 5.3.5.1); or

b) anti-kickback-device(s); or

c) clamping devices for the work-piece(s) (see 5.3.8).

NOTE The above list is not exhaustive.

For requirements against ejection of tool parts see 5.3.2, 5.3.5.

5.3.10 Work-piece supports and guides

Means for efficient support and guiding of the work-piece during machining shall be provided, e.g. tables, carriages, feed rollers, work-piece clamping devices, pressure devices, fences.

On machines with manual feed of the work-piece the flatness of the table(s) supporting the work-piece during machining should be in accordance with G.1 of ISO 7568:1986.

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

5.4 Protection against non-mechanical hazards

5.4.1 Fire

To minimise fire hazards, the requirement of 5.4.3 and 5.4.4 shall be met (see also 6.3).

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

5.4.2 Noise

5.4.2.1 Noise reduction at the design stage

When designing machinery, the information and technical measures to control noise at source given in EN ISO 11688-1:2009 and EN ISO 11688-2:2000 shall be taken into account. The most relevant noise source is/are the rotating tool(s).

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

5.4.2.2 Noise emission measurement

Operating conditions for noise measurement shall comply with ISO 7960:1995. For machines where no specific annex in ISO 7960:1995 exists the requirements of Annex D apply.

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.

Emission sound power levels shall be measured according to the enveloping surface measuring method EN ISO 3746:2010 with the following modifications:

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

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

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

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

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

f) the number of microphone positions shall be 9 in accordance with Annex D.

Alternatively, where the facilities exist and the measurement method applies to the machine type, emission sound power levels may also be measured according to a method with higher precision i.e. EN ISO 3743-1:2010, EN ISO 3743-2:2009, EN ISO 3744:2010 and EN ISO 3745:2012 without the preceding modifications.

For determination of sound power level by sound intensity method, use EN ISO 9614-1:2009, EN ISO 9614-2:1996 (subject to agreement between the supplier and the purchaser).

Emission sound pressure level at the workstation shall be measured according to EN ISO 11202:2010 with the following modifications:

1) the environmental indicator K_{2A} and 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 according to EN ISO 11202:2010, 6.4.1, accuracy grade 2 (Engineering);

3) the correction of the local environmental factor K_{3A} shall be calculated in accordance with EN ISO 11204:2010, A.2 with the reference restricted to EN ISO 3746:2010 instead of the method given in EN ISO 11202:2010, Annex A, or in accordance with EN ISO 3743-1:2010, EN ISO 3743-2:2009, EN ISO 3744:2010 or EN ISO 3745:2012 where one of these standards has been used as the measuring method.

Depending on which grade of measurement is used for the determination of the sound power level (engineering, survey, etc.) the corresponding grade of measurement shall be used to determine the sound pressure level at the operator's position, i.e. for EN ISO 3746:2010 (survey grade) of sound power, use EN ISO 11202:2010 for sound pressure. For EN ISO 3744:2010 (engineering grade) of sound power, use EN ISO 11201:2010 for sound pressure.

The declaration of noise emission shall be in accordance with 6.3 s).

Verification: By checking the relevant documents.

5.4.3 Emission of chips and dust

Except for boring tools, that part of the tool which is not involved in machining shall be enclosed by a capture device (exhaust hood, enclosure of the area of dust generation), which shall have an extraction outlet. The opening of the capture device should face the projection.

When the opening of the capture device cannot 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 risk of explosion usually does not exist on woodworking machines. If relevant, the risk is covered in a part XX of this document.

NOTE 2 The size of the opening of the capture device depends on the emission pattern and the distance between the emission source and the opening of the capture device.

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

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

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

The pressure drop between the inlet of all capture devices and the connection to the CADES should not exceed 1.500 Pa (at air velocity in the ducts of 20 m/s).

Verification: By checking of drawings, inspection of the machine 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 part XX of this document or ISO 7960:1995 respectively.

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

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

5.4.4 Electricity

With the exception of 6.3 the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009 apply unless stated otherwise in this document.

See EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 6.2 for the requirements regarding prevention of electric shock due to direct contact, and EN 60204-1:2006 and EN 60204-1:2006/A1:2009, Clause 7 for the requirements regarding protection against short circuits and overloading.

The protection against electric shock due to indirect contact should be 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, 6.3 w)).

The degree of protection of all electric components outside of 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.

Electrical enclosures shall not be exposed to risk from the ejection of tools and work-pieces. Live parts shall not be accessible in accordance with EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 6.2.2. Fire risk is not present where power circuits are protected against over current in accordance with EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 7.2.3.

The power supply cord of displaceable machines shall be of type H07 or better in accordance with the requirements of EN 50525-2-21:2011.

Displaceable machines with connection to 3 phases shall be fitted with a phase changer.

In accordance with EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 18.1 the test 1 for the continuity of the protective bonding circuit and with EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 18.6 the functional test apply.

Verification: By checking the relevant drawings and/or circuit diagrams, inspection of the machine and relevant tests (EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 18.2, test 1 and functional test according to EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 18.6).

NOTE For electrical components characteristics information from the electrical components suppliers can be useful.

5.4.5 Ergonomics and handling

The machine and its controls shall be designed according to ergonomic principles (see EN 1005-4:2005+A1:2008) 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 (see EN 894-1:1997+A1:2008, EN 894-2:1997+A1:2008, EN 894-3:2000+A1:2008 and EN 1005-1:2001+A1:2008, EN 1005-2:2003+A1:2008 and EN 1005-3:2002+A1:2008).

Where necessary on the machine, work stations and the zones in which control devices, guards and protective devices are located shall be illuminated sufficiently to ensure that all work equipment and materials can be properly seen, and that eye strain is also avoided (see EN 1837:1999+A1:2009).

Parts of the machine with a mass exceeding 25 kg and which are required to be lifted for normal use with a lifting device shall include the necessary attachments to accommodate the fitting of a lifting device or lugs positioned such as to avoid their overturn or fall or move in an uncontrolled way during transport, assembly, dismantling and scrapping.

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

NOTE Further guidance is given in EN 60204-1:2006 and EN 60204-1:2006/A1:2009, EN 614-1:2006+A1:2009 and EN 614-2:2000+A1:2008.

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

5.4.6 Lighting

Where lighting is required as determined by reference to EN 1837:1999+A1:2009, it shall be provided in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 15.2 (see also 6.3 i)).

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

5.4.7 Pneumatic

For machines fitted with pneumatic equipment the requirements of EN ISO 4414:2010 apply.

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

5.4.8 Hydraulic

For machines fitted with hydraulic equipment the requirements of EN ISO 4413:2010 apply.

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

5.4.9 Electromagnetic compatibility

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

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

5.4.10 Laser

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

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

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

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

For the laser characteristics a confirmation from the manufacturer of the laser may be useful.

5.4.11 Static electricity

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

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

5.4.12 Isolation

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

The electric power supply to the machine shall be controlled by a supply disconnecting device which is in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 5.3.2.

If the machine is fitted with a DC injection braking system, the electrical supply disconnecting device shall be:

a) equipped with a blocking device. It shall only be possible to switch off the electrical supply disconnecting device after manually overriding the blocking device; or

b) not situated on the same side of the machine as the stop control(s).

Hydraulic and pneumatic isolators shall have their function, location and operational position(s) 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 (also see 6.2).

Where pneumatic supply is only used for clamping, a quick action coupling (see EN ISO 4414:2010) without the means for locking is acceptable only when the isolated machine (or part of machine) is so easy to survey that the disconnected coupling can be at all times under the control of the person making an intervention on the machine.

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

5.4.13 Maintenance

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

For all maintenance operations intended to be carried out by the user the machine shall be supplied with all special equipment and accessories.

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

The exterior of the machine shall be designed with smooth surfaces in order to ease the daily cleaning for chips and dust with chips and dust extraction systems. Where cleaning for chips and dust is required with movable guards open, such guards shall be in accordance with 5.2.1.9.7.

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

6 Information for use

6.1 Warning devices

Optical signals shall be clearly visible from the operator(s) place(s).

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

6.2 Marking

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

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

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

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

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

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

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

d) serial or identification machine number, if any;

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

f) rating information (mandatory for electro-technical products: voltage, frequency, nominal current, in accordance with EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 16.4);

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

h) on machines where speed changing is achieved by changing the position of the drive belts on the drive pulleys, with a diagram in min^{-1} adjacent to the pulleys or on a door giving access to the belt drive mechanism showing the relevant speed in min^{-1} selected for each combination of pulleys;

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

j) if the machine is fitted with tools tool marking shall conform to the requirements of EN 847-1:2005+A1:2007.

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

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

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

6.3 Instruction handbook

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

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

b) intended use of the machine including reasonable foreseeable misuse (examples may be provided in the parts XX of this document);

c) warning regarding residual risks as:

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

      i) the correct choice of tools;

      ii) the correct speed selection;

      iii) the level of tools and machine maintenance;

      iv) the type of material being machined;

      v) the significance and use of any enclosure provided;

      vi) the proper use of ear protection.

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

      i) the level of tool and machine maintenance;

      ii) the type of material being machined;

      iii) the importance of local extraction (capture at source);

iv) the proper adjustment of hoods/baffles/chutes;

v) the machine connection to an external chip and dust extraction system which ensures parameters given in instruction for use.

d) instruction for safe use in accordance with EN ISO 12100:2010, 6.4.5.1, d). This includes:

1) the working area around the machine to be unobstructed;

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

3) the wear of suitable personal protective equipment when necessary. This may include:

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

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

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

4) to report faults or defects in the machine, including guards or tools, as soon as they are discovered;

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

6) when using milling tools with diameter ≥ 16 mm and circular saw-blades they shall conform to EN 847-1:2005+A1:2007 and EN 847-2:2001; tool holders shall conform to EN 847-3:2004;

7) to follow tool manufacturers instructions for use, adjustment and repair of tools;

8) to ensure that the maximum rotational speed marked on the tools is not exceeded;

9) work-piece to be adequately supported during machining/feeding using where necessary additional support e.g. for long work-pieces;

10) to refrain from removing any splinters or other part of the work-piece from the cutting area whilst the machine is running;

11) not to use the machine unless the guards and other safety devices necessary for machining are in position, in good working order and properly maintained;

12) information that operators are adequately trained in the use of guards and how to carry out regular examination of such guards and safety devices;

e) where necessary, requirements for the need to fix stationary machines to the floor and how this is to be done;

f) minimum and maximum work-piece sizes;

g) the range of tool dimensions which are suitable for the machine;

h) that only sharpened tools shall be used;

i) instruction that adequate general or localised lighting shall be provided;

j) that where the noise enclosure(s) (if provided) is/are not interlocked (see 5.3.6), the noise enclosure(s) shall remain in the closed position as long as possible to ensure the most efficient noise reduction;

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

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

   2) pressure drop at each dust extraction connection outlet at the recommended air velocity;

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

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

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

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

m) instruction that dust extraction equipment to be switched on before commencing machining;

n) information that the machine can create sources of ignition when in operation;

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

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

q) if fitted with a hydraulic or a pneumatic system the method for the safe dissipation of residual energy (see 5.4.12);

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

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

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

   3) interlocked guards with guard locking - by checking the impossibility to open each guard in turn until the machine is stopped and to start the machine as long as a guard is open;

   4) any AOPD and SPE devices - by functional testing;

   5) the brake(s) - by functional testing to check that the spindle(s) is/are braked within the specified time;

s) a declaration regarding airborne noise emissions from the machinery, either the actual value or a value established on the basis of measurements made on identical machinery, measured in accordance with the methods given in 5.4.2.2). The declaration shall be accompanied by a statement of the measuring method used and the operating conditions applied during the test and values for associated uncertainty *K* using the dual-number form of declaration in accordance with EN ISO 4871:2009 as follows:

   4 dB when using EN ISO 3746:2010 and EN ISO 11202:2010;
   2 dB when using EN ISO 3743-1:2010 or EN ISO 3743-2:2009 or EN ISO 3744:2010;
   1 dB when using EN ISO 3745:2012.

   For example, for a sound power level : L_{WA} = XX dB (measured value)
   Associated uncertainty *K* = 4 dB
   Measurement made in accordance with EN ISO 3746:2010.

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

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

The noise declaration shall be accompanied by the following statement:

"The figures quoted are emission levels and are not necessarily safe working levels. 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 workforce include the characteristics of the work room and the other sources of noise etc. i.e. the number of machines and other adjacent processes. Also the permissible exposure level can vary from country to country. This information, however, will enable the user of the machine to make a better evaluation of the hazard and risk."

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

t) 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;

u) 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;

v) 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);

w) information on how to provide protection against electric 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 (RCD);

x) if fitted with a laser,

   1) statement that no exchange with a different type of laser is permitted, that no additional optical equipment shall be used and that repair shall only be carried out by the laser manufacturer or authorised persons;

   2) repetition of the laser manufacturer instructions for setting and use of the laser (where appropriate);

y) 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).

Verification: By checking the information given in the instruction handbook and relevant drawings.

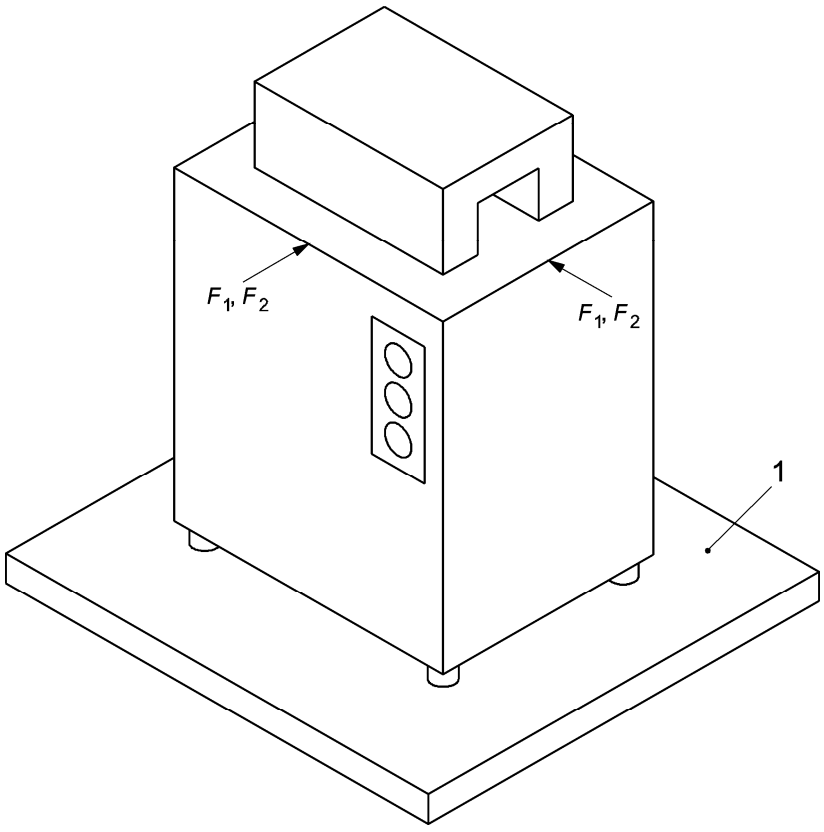
Annex A
(normative)

Stability test for displaceable machines

A.1 Test of stability during machining

The machine shall be set in its working position on a chipboard fixed on the floor and the brakes for the wheels applied (where fitted) or the wheels retracted from the floor (if a device for retracting them is fitted). A horizontal force F_1 = 100 N shall be applied in the plane of work-piece support and in the direction of feed in line with the machine tool. Subsequently a horizontal force F_1 = 100 N is applied in the same plane but in perpendicular direction in the middle of the machine. Under both conditions the machine shall not move.

The test is repeated with a horizontal force F_2 = 300 N. When the machine is moving, a fence shall be applied on the chipboard. Under both conditions the machine shall not tilt.



Key
1 chipboard

Figure A.1 — Stability test for displaceable machines

A.2 Test of stability during transportation

The machine is held in its normal transportation position on a plane inclined at an angle of 10° to the horizontal, the cable or cord wrapped up and stored.

While the machine is rotated slowly through 360°, it shall not tip over.

Annex B
(normative)

Impact test method for guards

B.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 (see 5.3.9).

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

B.2 Test method

B.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.

B.2.2 Testing equipment

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

B.2.3 Projectile for impact tests

B.2.3.1 General

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

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

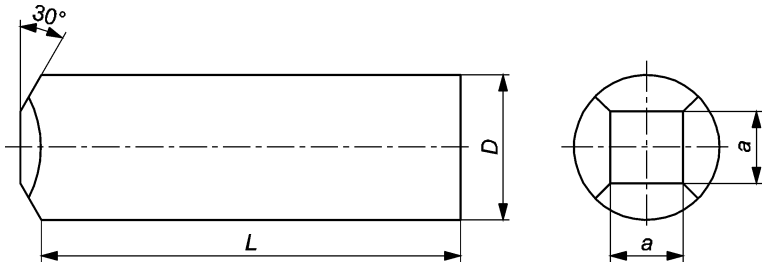
b) yield strength: R 0,2 ≥ 330 N mm^{-2};

c) elongation at rupture: A ≥ 20 %;

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

B.2.3.2 Projectile for guards class A tests

For tests of guards class A the shape, the mass and the dimensions of the projectile are given in Figure B.1.



Key

D 20 mm

a 10 mm

Mass 100 g

Figure B.1 — Projectile for guard class A tests

B.2.3.3 Projectile for guards class B tests

For tests of guards class B the projectile shall be a ball of 8 mm diameter.

B.2.4 Sampling

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

B.2.5 Test procedure

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

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

B.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.

B.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 B.3.

B.5 Test report

The test report shall give at least the following information:

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

b) projectile mass, dimensions, speed;

c) applicant identification;

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

e) clamping or fixing of the test object;

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

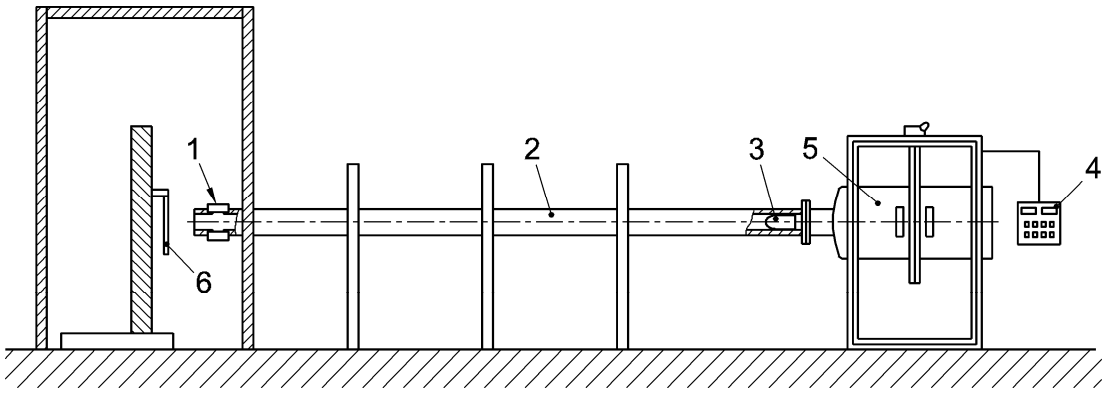
g) test result.

B.6 Test equipment for impact test

The propulsion device consists of a compressed air vessel with flanged gun barrel (see Figure B.2). The compressed air may be released by a valve to accelerate the projectile toward the test object.

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

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



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

Figure B.2 — Example of equipment for impact test

Annex C
(normative)

Test for braking function

C.1 Conditions for all tests

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

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

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

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

C.2 Un-braked run-down time

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

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

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

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

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

C.3 Braked run down time

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

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

b) initiate the normal stopping sequence and measure the braked run-down time;

c) allow the spindle to rest for not more than $(\frac{P}{c})^2$ min, (where *P* is the motor power (rated input) in kW and factor c = 7.5 kW). The re-start interval shall not be less than 1 min;

d) re-start the spindle drive motor and run at no-load for not more than $(\frac{P}{c})^2$ min, (where *P* is the motor power (rated input) in kW and factor c = 7.5 kW). The idle running time shall not be less than 1 min;

The test is repeated 9 times.

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

C.4 Run-up time

The run-up time shall be measured as follows:

a) start the tool spindle drive motor and measure the run-up time (see 3.2.3);

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

The test is repeated 2 times.

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

Annex D
(normative)

Operating conditions for noise emission measurement for machines not included in ISO 7960:1995

D.1 General

This annex shall be used in connection with the measurement of noise from woodworking machines.

Operating conditions shall be according to ISO 7960:1995. Microphone positions are specified in order to allow the measurement of sound pressure level at the work station and for determining the sound power level of a machine of this type.

These standard conditions shall be complied with as closely as possible. If, in a specific situation, it is necessary to deviate from the standard conditions, the actual condition applied for the test shall be recorded where a blank space in the "Condition chosen within permitted range or conditions deviating from the standard“ allows for such a situation.

All mandatory and standard safety attachments shall be mounted and in use during the tests.

The general data sheet included in this annex may also be used to record operating condition information.

D.2 Noise measurements

D.2.1 Test conditions

The machine shall be tested under conditions according to D.3.

The use of integrating sound level meters is recommended but not mandatory.

D.2.2 Microphone positions

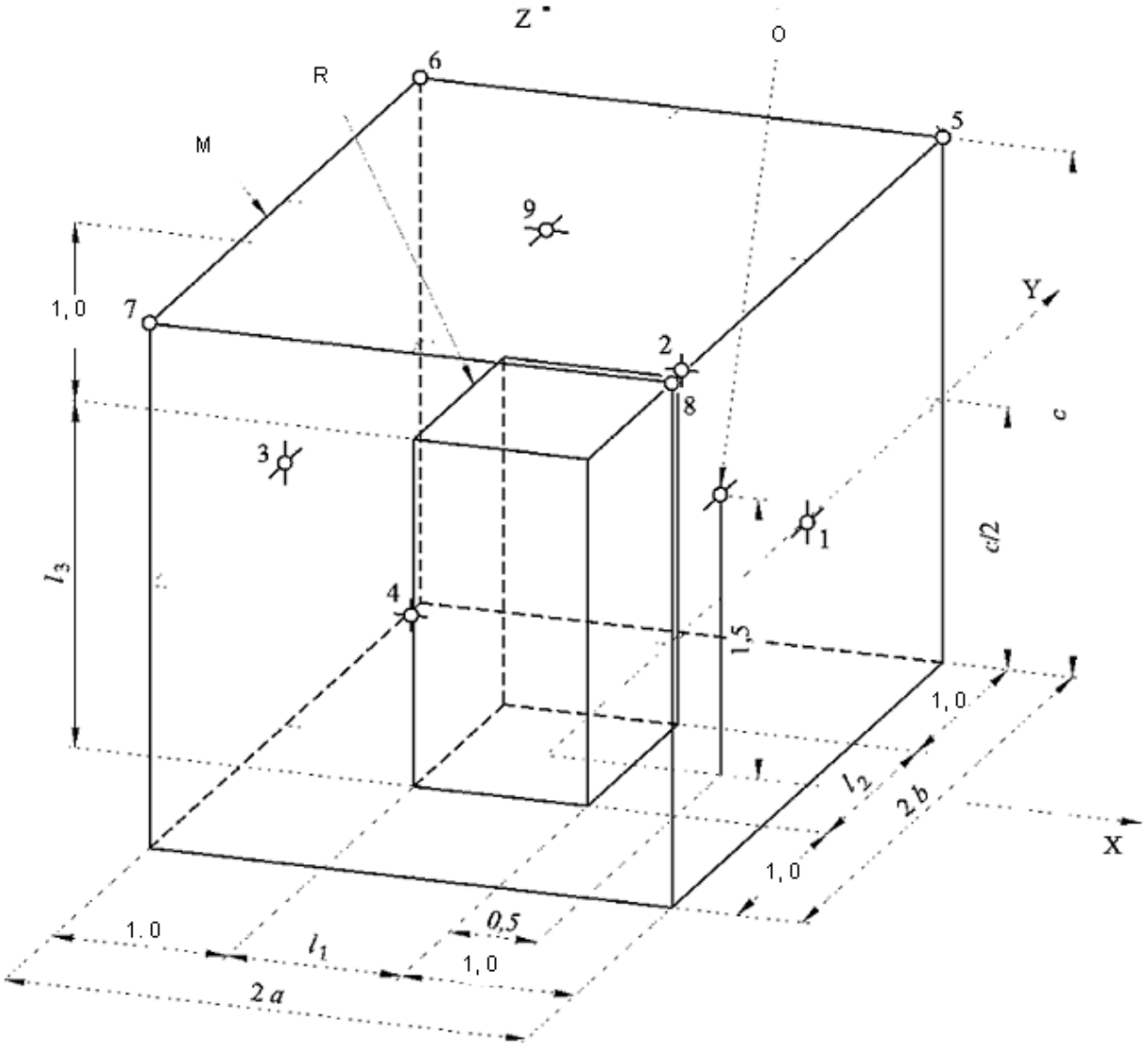
D.2.2.1 Operator's positions

The noise immission at the operator's position(s) shall be measured at typical workplace position(s) of the machine. The distance between the noise measuring position(s) and the machine shall not exceed 1 m and the measuring position(s) shall be indicated in the test report.

D.2.2.2 Other microphone positions

The microphones used for the measurement of the sound power level emitted by the machine shall be situated as shown in Figure D.1.

Dimensions in metres



Key

M = Measurement surface

R = Reference box

O = Operator position microphone location

1-9 = Measuring microphone positions

Figure D.1 — Measurement surface and microphone positions

D.2.2.3 General data sheet

Machine data	Manufacturer : ..... Model : ..... Year of manufacture : ..... Serial n^{o} : ..... Overall dimensions of machine [a] Length l_1 : ..... mm Width l_2 : ..... mm Height l_3 : ..... mm		
	Maximum feed rate: .....m min^{-1} ☐ Attached frequency converter ☐ Separate frequency converter		
Machine installation			Remarks/description
	Machine installed according to manufacturer's recommendations	yes ☐ no ☐	....
	Machine installed with dust extraction according to manufacturer's specifications	yes ☐ no ☐	....
	Machine mounted on vibration damping/isolation material	yes ☐ no ☐	....
	Machine set up in a separate noise enclosure	yes ☐ no ☐	....
	Machine equipped with integral noise enclosure	yes ☐ no ☐	....
	Machine equipped with noise reducing hood	yes ☐ no ☐	....
	Other noise control measures	yes ☐ no ☐	....

[a] Those elements which protrude from the machine and which are not likely to contribute to the noise emission (e.g. hand-wheels, levers) may be disregarded.

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General Data sheet *(continued)*

Tool and cutting Data – to be completed for each cutting tool or cutting medium, employed on the machine during test **Tool(s)/Cutting Medium – Describe and give details**						
No	Description [b]	Dia mm	Length/Height mm	Spindle speed mm	Cutting speed mm	Other details
1						
2						
3						
4						
5						
6						
[b] Description of any special or peculiar equipment or feature of the tooling.						

General Data sheet *(continued)*

Testing material	Material: _____ Moisture content: _____ Material length: _____ Material height: _____ Material width: _____ Previous processing: _____
Photo or detailed illustration of the machine tested	
Testing laboratory	Firm/Institution: ..... Address: ..... Telephone: ..... Date: ..... Signature: ..... Test carried out: Place: ..... Date: .....

D.3 Machine operating conditions

The following requirements for the operating conditions for the measurement of airborne noise emitted by machines shall be met for machines not included in ISO 7960:1995:

1) ISO 7960:1995, Clauses 0 to 4 apply, and the general data sheet provided in this annex shall be observed and completed.

2) For complex installations, the test shall include a complete cycle of operations and the equivalent continuous noise emission values for that cycle shall be declared.

3) All integrated auxiliary units, e.g. power feed, pneumatic clamping, shall be in operation during testing.

4) All relevant guards, safety devices, integral sound enclosures, etc. shall be in position during testing.

5) The CADES (chips and dust extraction system) shall be “on” during testing in the working condition but the influence of the noise of the CADES shall be excluded or reduced as far as possible, e.g. by the use of baffles, or taking into account e.g. background noise correction.

6) Where one or more dimensions of the machine exceed 7.0 m, instead of the sound power level the equivalent continuous sound pressure level at specified positions around the machine shall be declared, at a distance of 1.0 m from the surface of the machine, and at a height of 1.6 m from the floor, or access platform.

Annex E
(informative)

Spindle overspeed detection

E.1 General

This informative annex explains with examples how to achieve PL=c for spindle overspeed detection.

E.2 Spindle overspeed detection

E.2.1 General

To achieve PL=c usually category 2 or 3 of EN ISO 13849-1:2008 is applied.

For safety function Safely Limited Speed (SLS), see also EN 61800-5-2:2007.

E.2.2 Design of control circuits in category 2

A system in category 2 of EN ISO 13849-1:2008 may be achieved with following measures:

The real speed of the spindle is compared to the selected speed continuously. If the real speed exceeds the selected speed by more than 10 % the spindle performs a stop in category 1 in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.2. If a stop in category 1 is not possible the spindle performs a stop in category 0 in accordance with the requirements of EN 60204-1:2006 and EN 60204-1:2006/A1:2009, 9.2.2.

Especially the following measures to achieve PL=c apply:

a) measures against loss of the data for tools and selected speed stored in the machine control if stored data result in an automatic selection of the intended tool speed:

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

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

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

   4) the processor comparing the data has a watch dog function or other independent logical component (e.g. a PLC). Monitoring of the processor may be achieved by simple temporal time monitoring of the logic where trigger points are within the program of the logic.

b) to avoid falsification in data transfer between manual control, data stored in the machine control, display for the data and control of the inverter the selected tool speed is stored in the control of the inverter or in the unit which monitors the actual speed and read back and monitored on the display for checking by the operator.

   For detailed information about software-based parameterisation see EN 13849-1:2008, 4.6.4.

E.2.3 Design of control circuits in category 3

A system in category 3 of EN ISO 13849-1:2008 may be achieved with following measures:

The real speed of the spindle is compared to the selected speed continuously by using a dual channel system. If the actual speed exceeds the selected speed by more than 10 % the spindle automatically stops rotating.

Especially the following measures to achieve PL=c apply:

a) the data for tools and selected speed is stored in each of the two channels of the machine control;

b) after input and storing of the safety related data for the tools the data is redirected to the input unit and confirmed by the operator;

c) cyclic cross monitoring of the data in both channels. If the two data are not identical it is impossible to start the spindle motor or if running the spindle motor is stopped and a warning is given;

d) to avoid falsification in data transfer between manual control, data stored in the machine control, display for the data and control of the inverter the selected speed transmitted to the control of the inverter or to the unit which monitors the actual speed is read back and monitored on the display for checking by the operator.

   For detailed information about software-based parameterisation see EN 13849-1:2008, 4.6.4.

Annex F
(informative)

Recommended airflow rates for woodworking machines

Table F.1 contains in column 3 the recommended air flow rates for woodworking machines falling into the scope of CEN/TC 142. Additional information is provided in column 4.

Table F.1 — Recommended airflow rates *(1 of 3)*

Machine type	Standard	Recommended airflow rate	Comment
Handfed surface planing machines	EN 859	Cutter block length < 400 mm : ≥ 800 m^3/h 400 … 600 mm : ≥ 1100 m^3/h ≥ 600 mm : ≥ 1400 m^3/h	No significant dust emission because of the principle of work. The air flow rate stated is needed for chips and dust extraction.
One side thickness planing machines	EN 860	Cutter block length < 400 mm : ≥ 800 m^3/h 400 … 600 mm: ≥ 1100 m^3/h ≥ 600 mm : ≥ 1400 m^3/h	No significant dust emission because of the principle of work. The air flow rate stated is needed for chips and dust extraction.
Surface planing and thicknessing machines	EN 861	Cutter block length < 400 mm : ≥ 800 m^3/h 400 … 600 mm : ≥ 1100 m^3/h ≥ 600 mm : ≥ 1400 m^3/h	No significant dust emission because of the principle of work. The air flow rate stated is needed for chips and dust extraction.
Band sawing machines – Part 1: Table band saws and band re-saws	EN 1807-1	Wheel diameter ≤ 500 mm : ≥ 450 m^3/h > 500 mm : ≥700 m^3/h	Only applicable for table band sawing machines
Band sawing machines – Part 2: Log sawing machines	EN 1807-2		
Circular sawing machines – Part 3: Down cutting crosscut saws and dual purpose down cutting cross-cut saws/circular saw benches	EN 1870-3	≥ 350 m^3/h	
Circular sawing machines – Part 4: Multiblade rip sawing machines with manual loading and/or unloading	EN 1870-4	≥ 2500 m^3/h	
Circular sawing machines – Part 5: Circular sawbenches/upcutting cross-cut sawing machines	EN 1870-5	≥ 350 m^3/h	
Circular sawing machines – Part 6: Circular sawing machines for firewood and dual purpose circular sawing machines for firewood/circular saw benches, with manual loading and/or unloading	EN 1870-6	≥ 1 500 m^3/h	

Table F.1 *(2 of 3)*

Circular sawing machines – Part 7: Single blade log sawing machines with integrated feed table and manual loading and/or unloading	EN 1870-7	≥ 1 500 m^3/h	
Circular sawing machines – Part 8: Single blade edging circular rip sawing machines with power driven saw unit and manual loading and/or unloading	EN 1870-8	≥ 1 800 m^3/h	
Circular sawing machines – Part 9: Double blade circular sawing machines for cross-cutting with integrated feed and with manual loading and/or unloading	EN 1870-9	≥ 1 000 m^3/h	
Circular sawing machines – Part 10: Single blade automatic and semiautomatic upcutting cross-cut sawing machines	EN 1870-10	≥ 800 m^3/h	
Circular sawing machines – Part 11: Semi-automatic and automatic horizontal cross-cut sawing machines with one saw unit (radial arm saws)	EN 1870-11	≥ 800 m^3/h	
Circular sawing machines – Part 12: Pendulum cross-cut sawing machines	EN 1870-12	≥ 800 m^3/h	
Circular sawing machines – Part 13: Horizontal beam panel sawing machines	EN 1870-13	≥ 2 500 m^3/h	
Circular sawing machines – Part 14: Vertical panel sawing machines	EN 1870-14	≥ 1 500 m^3/h	
Circular sawing machines – Part 15: Multiblade cross-cut sawing machines with integrated feed of the workpiece and manual loading and/or unloading	EN 1870-15	≥ 800 m^3/h per unit	
Circular sawing machines – Part 16: Double mitre sawing machines for V-cutting	EN 1870-16	≥ 800 m^3/h	
Circular sawing machines – Part 17: Manual horizontal cutting cross-cut sawing machines with one saw unit (manual radial arm saws)	EN 1870-17	≥ 800 m^3/h	
Circular sawing machines – Part 18: Dimension saws	EN 1870-18	Saw blade diameter ≤ 315 mm : ≥ 50 m^3/h 315 mm … 400 mm : ≥ 1100 m^3/h ≥ 400 mm : 1400 m^3/h	

Table F.1 *(3 of 3)*

Circular sawing machines – Part 19: Circular saw benches (with and without sliding table), dimension saws and building site saws	EN 1870-19	Saw blade diameter ≤ 315 mm : ≥ 50 m^3/h 315 mm … 400 mm : ≥ 1100 m^3/h ≥ 400 mm : 1400 m^3/h	
One side moulding machines with rotating tool – Part 1: Single spindle vertical moulding machines	EN 848-1	≥1 100 m^3/h for straight work ≥2 000 m^3/h for curved work ≥1 400 m^3/h for tenoning	
One side moulding machines with rotating tool – Part 2: Single spindle handfed/integrated fed routing machines	EN 848-2		
One side moulding machines with rotating tool – Part 3: Numerical control (NC) boring machines and routing machines	EN 848-3		
Combined woodworking machines	EN 940	See single machine type for recommended air flow	
Tenoning machines – Part 1: Single end tenoning machines with sliding table	EN 1218-1	≥ 3 000 m^3/h	
Tenoning machines – Part 2: Double end tenoning and/or profiling machines fed by chain or chains	EN 1218-2		
Tenoning machines – Part 3: Hand fed tenoning machines with sliding table for cutting structural timbers	EN 1218-3	≥ 3 500 m^3/h	
Tenoning machines – Part 4: Edge banding machines fed by chain(s)	EN 1218-4	≥ 350 m^3/h for each unit that generates chips and dust	
Tenoning machines – Part 5: One side profiling machines with fixed table and feed rollers or fed by chain	EN 1218-5	≥ 500 m^3/h for each unit	
Four-sided moulding machines	EN 12750		

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