BS EN 15571:2014

BSI Standards Publication

Machines and plants for mining and tooling of natural stone — Safety — Requirements for surface finishing machines

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National foreword

This British Standard is the UK implementation of EN 15571:2014.

The UK participation in its preparation was entrusted to Technical Committee MCE/3/15, Machines for natural stone.

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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Maschinen und Anlagen zur Gewinnung und Bearbeitung von Naturstein - Sicherheit - Anforderungen an Flächenschleifmaschinen

This European Standard was approved by CEN on 13 September 2014.

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Foreword

This document (EN 15571:2014) has been prepared by Technical Committee CEN/TC 151 “Construction equipment and building material machines - Safety”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by May 2015 and conflicting national standards shall be withdrawn at the latest by May 2015.

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

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Introduction

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

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

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

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the 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 authorized representatives of surface finishing machines. It is also useful for designers.

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

1 Scope

This European Standard applies to stationary surface finishing machines, with stationary work piece (see 3.1) or with moving work piece (see 3.2), which are used to grind or polish horizontal surfaces of slabs, strips or tiles of natural stone and engineered stone (e.g. agglomerated stone) as defined by EN 14618:2009.

This European Standard deals with all significant hazards, hazardous situations and events relevant to surface finishing machines, when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Clause 4).

This European Standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards.

This European Standard deals with the foreseeable lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and scrapping.

This European Standard does not deal with:

— hand-held grinding machines;

— machines intended for operation in a potentially explosive atmosphere;

— operation in severe environmental conditions (e.g. extreme temperatures, corrosive environment);

— machines intended for outdoor operation.

This European Standard is not applicable to machinery which is manufactured before the date of publication of this document by CEN.

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 166:2001, *Personal eye-protection - Specifications*

EN 349:1993+A1:2008, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body*

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

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

EN 1005-4:2005+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 1837:1999+A1:2009, *Safety of machinery - Integral lighting of machines*

EN 14618:2009, *Agglomerated stone - Terminology and classification*

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

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

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

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

EN 61439-1:2011, *Low-voltage switchgear and controlgear assemblies - Part 1: General rules (IEC 61439-1:2011)*

EN 61496-1:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests (IEC 61496-1:2012)*

EN 82079-1:2012, *Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements (IEC 82079-1:2012)*

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

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

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

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

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

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

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

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

EN ISO 11200:2014, *Acoustics - Noise emitted by machinery and equipment - Guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions (ISO 11200:2014)*

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)*

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

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

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

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

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

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

EN ISO 13856-2:2013, *Safety of machinery - Pressure-sensitive protective devices - Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars (ISO 13856-2:2013)*

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

EN ISO 14119:2013, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2013)*

3 Terms and definitions

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

3.1
surface finishing machine with fixed table and mobile transversal bridge (track machines)
integrated fed machine, with stationary work piece table and a movable bridge, designed for grinding or polishing horizontal surfaces of stone slabs (see Figure 1 and Figure 2) by the use of grinding or polishing head water cooled during the working process having at least two squared axes which the working head moves over

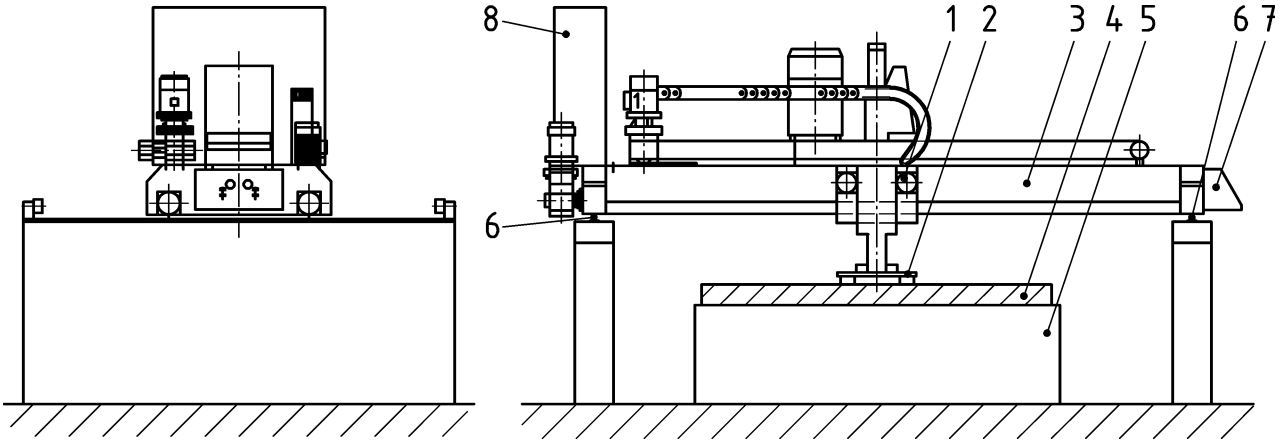
Note 1 to entry: This machine can be equipped with the following facilities:

a) automatic grinding or polishing head change system with tool – magazine;

b) grinding or polishing head change system with bayonet locking;

c) accessory units for calibrating;

d) accessory units for polishing.

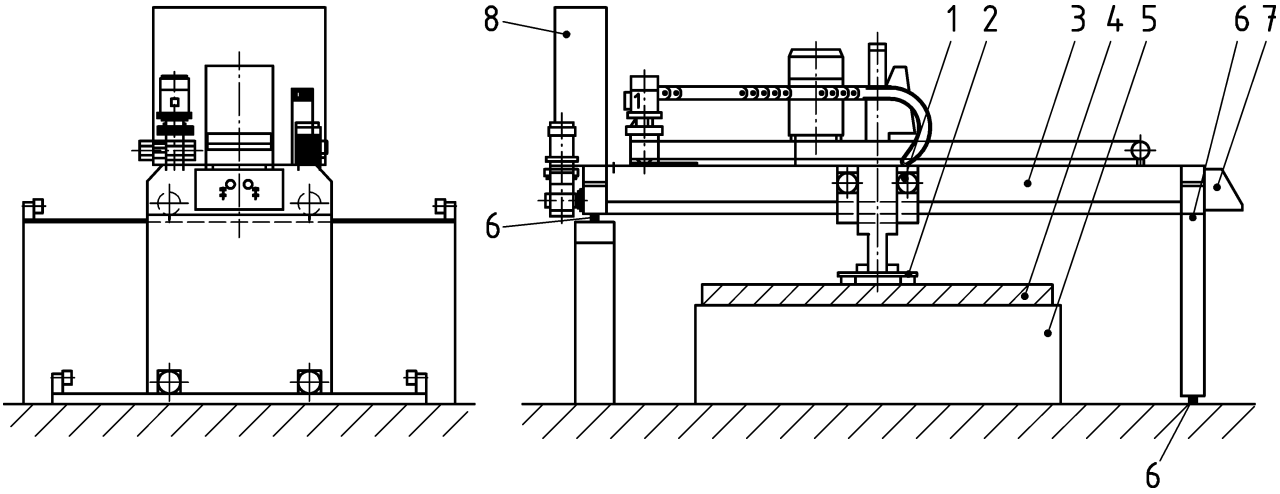


Safeguarding devices are not illustrated

Key

1	spindle	5	material support plan
2	tool	6	track
3	bridge	7	control panel
4	workpiece	8	electric panel

Figure 1 — Example of a surface finishing machine with fixed table and mobile transversal bridge "PORTAL"



Safeguarding devices are not illustrated

Key

1	spindle	5	material support plan
2	tool	6	track
3	bridge	7	control panel
4	workpiece	8	electric panel

Figure 2 — Example of a surface finishing machine with fixed table and mobile transversal bridge "SEMI-PORTAL"

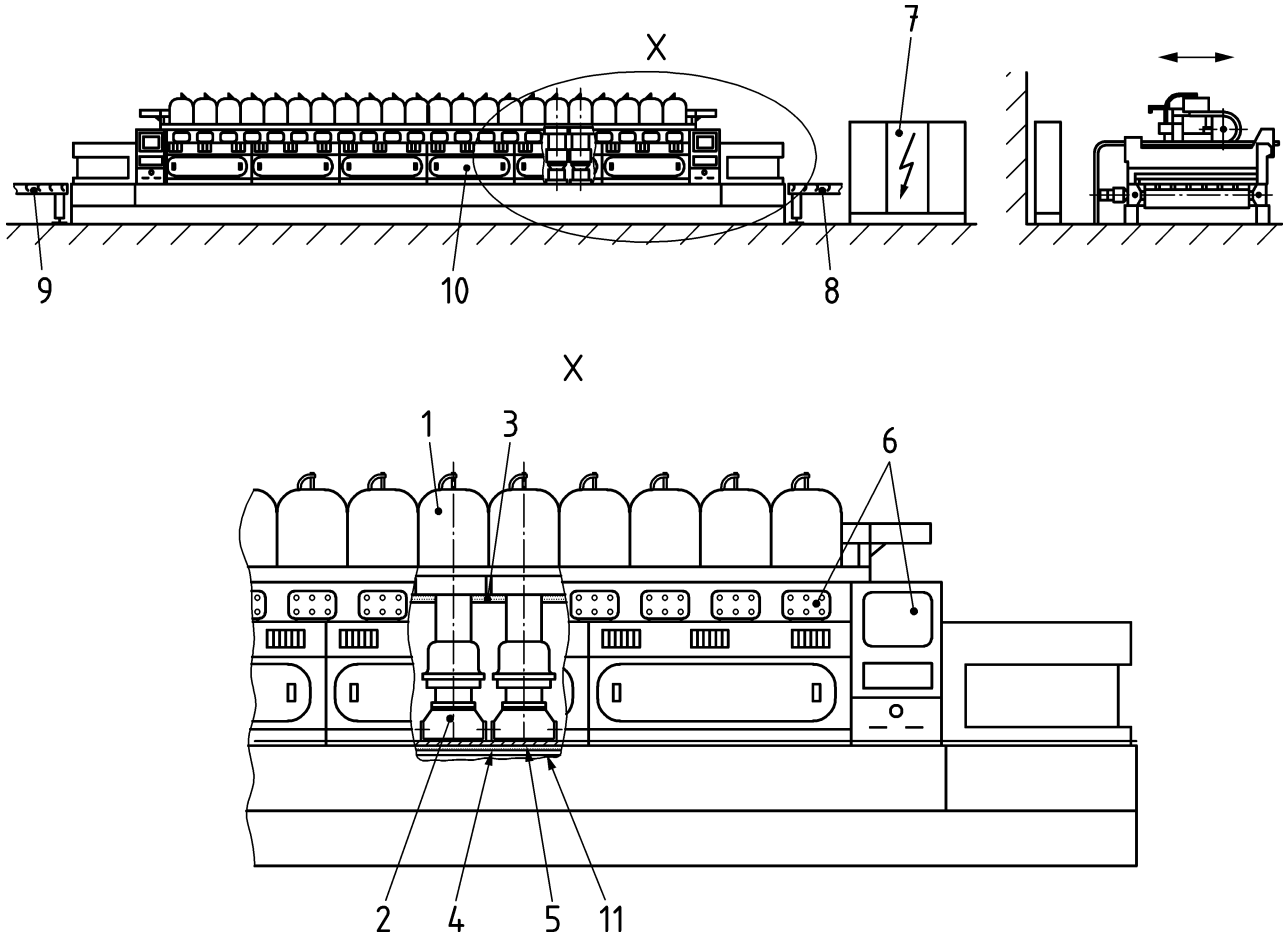
3.2
surface finishing machine with belt conveyor and fixed or mobile spindles-holding beam
integrated fed machine, with continuous operating belt and a spindles-holding beam, designed for grinding or polishing horizontal surfaces of stone slabs (see Figure 3) by the use of grinding or polishing head water cooled during the working process having at least two squared axes which the working head moves over

Note 1 to entry: This machine can be equipped with the following facilities:

a) grinding or polishing head change system with bayonet locking;

b) accessory units for calibrating;

c) accessory units for polishing.



Safeguarding devices are not illustrated

Key

1	spindle	5	workpiece	9	unloading roller track
2	grinding or polishing head	6	control panel	10	front cover (sliding door)
3	spindles-holding beam	7	electric board	11	work bench
4	belt Conveyor	8	loading roller track		

Figure 3 — Example of a surface finishing machine with belt conveyor and fixed or mobile spindles-holding beam

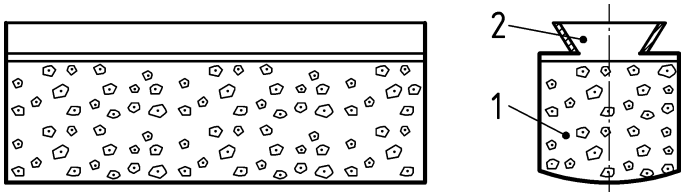
3.3
slab machines
machine described in 3.1 or 3.2, designed for polishing slabs normally roughly sawn with a processing width of more than 1 m

3.4
strip or tile machines
machine described in 3.1 or 3.2, designed for polishing processed workpieces and having a processing width of less than 1 m

3.5
running gear
guide element on the track and carries the bridge

3.6
grinding or polishing segment
removes the material of the workpiece to be processed

Note 1 to entry: During this process, they also undergo a wear.



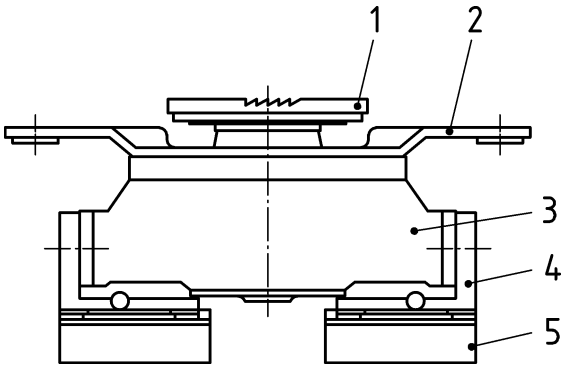
Key

1 grinding or polishing segment 2 holder saddle with dovetail

Figure 4 — Grinding or polishing segment

3.7
grinding or polishing head
different types of grinding or polishing heads are used to pick up the proper grinding or polishing segments

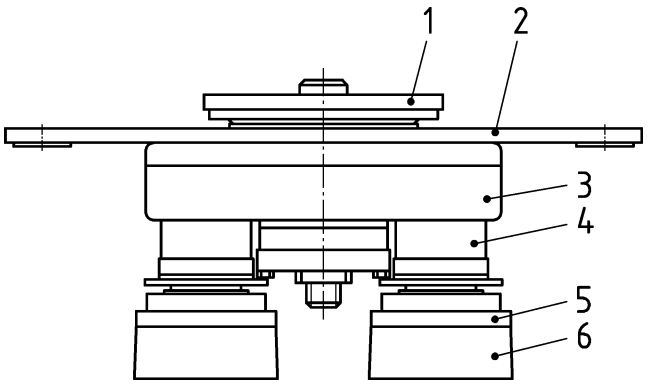
Note 1 to entry: These heads can be designed for different additional movements between grinding or polishing segment and workpiece (swing, planetary, …).



Key

1	toothed wheel	4	grinding or polishing segment holder
2	grinding or polishing head carrier	5	grinding or polishing segment
3	housing of grinding or polishing head		

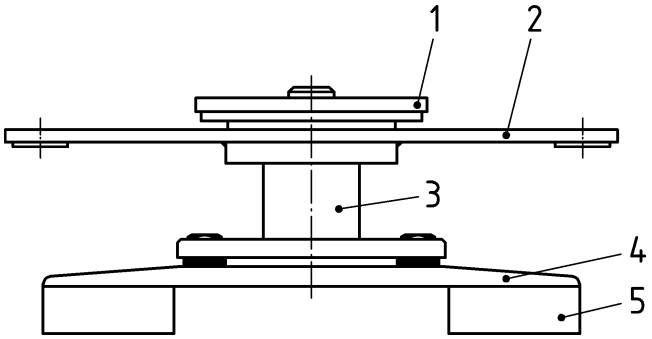
Figure 5 — Swing grinding or polishing head



Key

1	toothed wheel	4	flange bearing
2	grinding or polishing head carrier	5	grinding or polishing segment holder
3	housing of grinding or polishing head	6	grinding or polishing segment

Figure 6 — Planetary grinding or polishing head



Key

1	toothed wheel	4	grinding or polishing segment holder
2	grinding or polishing disk carrier	5	grinding or polishing segment
3	grinding or polishing disk flange		

Figure 7 — Disk grinding or polishing head

3.8
main drive
generates the tool moving

3.9
feed drive
drive of the adjusting axles (vertical adjustment, infeed, etc.)

3.10
spindle
special shaft, powered by a motor, which holds the grinding or polishing head in rotation

3.11
spindles-holding beam
beam that supports all the spindles and allows the alternative movement of translation

3.12
work bench
bench on which the conveyor belt drives the workpiece (slabs or strips)

3.13
machine actuator
power mechanism used to affect motion of the machine

3.14
machining mode of operation
automatic, programmed, sequential mode of operation of the machine with the facility for manual or automatic loading/unloading of the workpiece

3.15
machine setting mode of operation
setting, programming, fault finding, programme verification, testing mode of operation of the machine

3.16
operational stop
stop for operational reasons without cutting off the energy supply to the actuator(s) where the stop condition is monitored and maintained

3.17
safety related PLC
programmable logic controller dedicated to safety-related application

3.18
rated rotational speed
speed of the drive spindle without tool (no working process) in rotations per minute with the nominal operation values stated by the manufacturer

3.19
nominal mass
mass of the machine with all demountable parts, but without any tool

3.20
rotational speed range
range between the lowest and the highest rotational speed for which the tool spindle or tool is designed to operate

3.21
ejection
uncontrolled movement of the workpiece or parts of it or part of the tool from the machine during processing

3.22
redundancy
application of more than one device or system, or part of a device or a system, with the objective of ensuring that, in the event of one failing to perform its function, another is available to perform that function

Note 1 to entry: See EN 60204-1:2006, 3.44 and EN ISO 12100:2010, 6.2.12.4.

3.23
monitoring
safety function which ensures that a safety measure is initiated if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed in such a way that hazards are generated

3.24
unbraked run-down time
time elapsed from the actuation of the stop control, but not the braking device (if fitted) up to spindle standstill

3.25
braked run-down time
time elapsed from the actuation of the stop control and the brake device up to spindle standstill

3.26
information of the supplier
statements, sales literature, leaflets or other documents where a manufacturer (supplier) declares either the compliance of the characteristics of e.g. a material or a product or the conformity of a material or a product to a relevant standard

3.27
safety function
function of the machine whose failure can result in an immediate increase of the risk(s)

[SOURCE: EN ISO 12100:2010, 3.30]

3.28
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.

3.29
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]

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as indicated in EN ISO 12100:2010, Annex B, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

Table 1 — List of significant hazards

Type or group	Origin	Potential consequences	Subclause of this document
Mechanical hazards	Approach of a moving element to a fixed part	Crushing Impact	5.2.7, 5.2.8, 5.2.9, 5.3.3, 5.3.4, 5.3.5
	Cutting parts	Cutting and shearing	5.3.4, 5.3.5
	Elastic elements	Crushing Impact	5.4.10
	Gravity Falling objects	Impact	5.3.1, 5.3.2, 5.3.3, 5.4.8
	Instability	Crushing Impact Being run over	5.3.1, 5.3.2, 5.3.3, 5.4.8
	High pressure	Crushing Impact Being thrown	5.4.6
	Moving elements	Drawing-in Entanglement Being thrown	5.3.4, 5.3.5
	Rotating elements	Cutting, Abrasion Entanglement, Being thrown	5.3.4, 5.3.5

Type or group	Origin	Potential consequences	Subclause of this document
Electrical hazards	Electromagnetic phenomena	Effects on medical and other electro-mechanical implants	5.4.7
	Live parts	Electrical contact with live parts	5.2.8, 5.2.9, 5.4.3, 5.4.10
	Not enough distance to live parts under high voltage	Electrical contact with live parts	5.2.8, 5.2.9, 5.4.3, 5.4.10
	Parts which have become live under fault conditions	Electrical contact with live parts	5.2.8, 5.2.9, 5.4.3, 5.4.10
	Short-circuit	Electrical contact with live parts Shock Fire	5.2.8, 5.2.9, 5.4.1, 5.4.3, 5.4.10
Thermal hazards	Objects or materials with a high or low temperature	Scald or frostbite	5.4.1, 5.4.3
Noise Hazards	Manufacturing process	Interference with other acoustic signals Loss of awareness Stress Tinnitus	5.4.2
Material/ substance hazards	Biological and microbiological agent (cooling water)	Infection	5.4.9
	Dust	Respiratory diseases	5.4.9
Ergonomic hazards	Access (worktable height)	Discomfort Fatigue	5.4.4
	Location of indicators and control devices	Discomfort Fatigue Stress Impact	5.4.4
Hazards associated with the environment in which the machine is used	Electromagnetic phenomena Unexpected Start/Stop Break Command failure	Unexpected Start/Stop Break Command failure	5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.4.7
Hazards associated with unexpected start-up, unexpected overrun/ overspeed (or any similar malfunction)	Failure/ disorder of the control system	Unexpected Start/Stop Break Command failure Crushing Impact Cutting and shearing Being run over Being thrown Drawing-in Entanglement Abrasion	5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, 5.2.8, 5.2.9, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.4.3, 5.4.6, 5.4.7, 5.4.8, 5.4.9
	Uncontrolled restoration of energy supply after an interruption		

Type or group	Origin	Potential consequences	Subclause of this document
	Errors in the software		
	Impossibility of stopping the machine in the best possible conditions		
	Variations in the rotational speed of tools		
	Errors of fitting		
	Break-up during operation		
	Loss of stability/overturning of machinery		
	Slip, trip and fall of persons (related to machinery)		

5 Safety requirements and/or protective measures

5.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document.

5.2 Controls

5.2.1 Safety and reliability of control systems

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

— for starting: PL = c (see 5.2.3);

— for normal stop: PL = b (see 5.2.4);

— for emergency stop: PL = c (see 5.2.5);

— for operational stop: PL = c (see 5.2.6);

— for standstill monitoring: PL = c (see 5.2.6 and 5.2.8);

— for interlocking: PL = c (see 5.2.6 and 5.2.7);

— for mode selection: PL = c (see 5.2.7).

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

5.2.2 Position of controls

The main control devices, i.e. devices for starting, operational/normal stop, emergency stop, mode selection, shall be located at the operator's position adjacent to the control display (at the main control panel) at a distance of at least 1 200 mm and not exceeding 1 800 mm from the floor level.

The main interrupter control shall be located on the main electrical board.

Any safeguarding equipment reset control device shall be located outside the protected zone and shall not be reachable from inside the protected zone.

The emergency stop device shall be provided at each working station (see 6.3) and in particular:

a) at the main control panel;

b) at the mobile control panel, connected by cable or wireless system (if provided);

c) adjacent to all hold-to-run control;

d) adjacent to all limited movement control;

e) at a distance of maximum 1 500 mm for front to the workpiece loading and unloading area;

f) inside any peripheral enclosure fitted with access door (see 5.3.4).

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

5.2.3 Starting

For starting or restarting, the starting function of each head machining shall be at least PL = c, in accordance with the requirements of EN ISO 13849-1:2008.

The beginning of the piece working cycle (cycle start) shall be possible only when all safeguards described in 5.3.4 are in place and functional.

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

Machine starting shall conform to the requirements of EN 60204-1:2006, 9.2.5.2.

For each restart, a deliberate action of the operator is required. All protective devices shall not lead to an automatic restart.

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

5.2.4 Normal stop

A normal stop control system shall be provided for the machining and setting modes of operation, which when actuated shall fulfil the stopping sequences and shall disconnect power from all machine actuators.

The stop function shall be of a category 1 in accordance with the requirements of EN 60204-1:2006, 9.2.2 to allow the actuation of the electrical brake (if fitted). If an electrical brake is not fitted, the stop function may be 0.

The stopping sequence for normal stop shall be:

a) stop axes movements;

b) stop spindles rotation;

c) cut power to the machine actuators.

The normal stop function shall be at least PL = b in accordance with the requirements of EN ISO 13849-1:2008.

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

5.2.5 Emergency stop

The machine shall be fitted with an emergency stop control device which complies with the requirements of EN ISO 13850:2008 and additionally with the requirements of EN 60204-1:2006, 10.7. The emergency stop control device shall be at any time of self-latching type.

The emergency stop function shall comply with the requirements of EN 60204-1:2006, 9.2.5.4.2 and the emergency stop function shall be of a category 0 or 1 in accordance with the requirements of EN 60204-1:2006, 9.2.2, to allow the actuation of the brake until the braking sequence is complete.

When initiated, the emergency stop sequence shall:

a) stop axes movements;

b) stop spindle rotation;

c) cut power to the machine actuators.

The control circuit for emergency stop shall be at least PL = c in accordance with the requirements of EN ISO 13849-1:2008.

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

5.2.6 Operational stop

If an operational stop function is provided for the replacement of grinding or polishing segment while the main spindle-holding beam and conveyor belt systems remain under control, the following requirements shall apply.

The stop function provided (e.g. cycle stop) shall be at least of category 2 in accordance with the requirements of EN 60204-1:2006, 9.2.2, actuated in conjunction with standstill monitoring and the control system for standstill monitoring shall be at least PL = c in accordance with the requirements of EN ISO 13849-1:2008.

NOTE For example, the operational stop control system can be of dual channel type including the transducer, with diversity, where one channel controls the other at least at each cycle start.

When the operational stopping sequence is initiated it shall:

a) stop the axes movements;

b) stop spindle rotation.

As an exception, for strip or tile machines with belt conveyor and fixed or mobile spindles-holding beam, an operational stop function can be provided for each grinding or polishing head. In that case the movement of conveyor belt and the spindles-holding beam for replacing of the grinding or polishing segments can be possible with guards open. This kind of operation can only be performed if the following requirements shall be met:

c) the machine shall be equipped with fixed transverse guards (diaphragms) between the individual heads;

d) the stop function provided actuated in conjunction with the control system for head suspension function monitoring shall be at least PL = c in accordance with the requirements of EN ISO 13849-1:2008.

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

5.2.7 Mode selection switch

5.2.7.1 General

If the machine is designed to be operated during setting with the interlocking guards and/or protective devices disabled, a mode selection switch shall be provided to select between the machining and setting modes of operation and the following conditions shall be met:

a) the mode selection switch shall be lockable in each position (e.g. by key or password) and shall be located outside the hazards zone, e.g. on the main control panel (see 5.2.2 for location of control devices);

b) the control system for mode selection shall be at least PL = c in accordance with the requirements of EN ISO 13849-1:2008;

c) the mode selection switch shall not allow more than one mode to be active at any one time;

d) the safeguarding requirements given in 5.2.7.2 and 5.2.7.3 shall be effective in their respective mode of operation;

e) selecting any of the modes shall not initiate any movement of the machine;

f) it shall not be possible to change from one mode to another mode before the machine has been brought to a complete stop in accordance with 5.2.4.

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

5.2.7.2 Machining mode of operation

In machining mode, movement shall only be possible when the interlocking guards (for definition see EN ISO 14119:2013, 3.2 and 3.5) and/or protective devices are in place and functional.

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

5.2.7.3 Machine setting mode of operation

In machine setting mode of operation when the moveable guards are open and/or protective devices disabled, any hazardous movement shall only be possible when the following requirements are met:

a) tool rotation shall not be possible;

b) any single axis movement shall be controlled by a hold-to-run control. The movement shall be limited to 5 m/min speed or 10 mm increment. Both the hold-to-run control and speed/increment monitoring shall be PL = c in accordance with the requirements of EN ISO 13849-1:2008. If this is technically not possible, alternatively hold-to-run control and the speed/increment monitoring shall be provided in conjunction enabling device PL = c in accordance with the requirements of EN ISO 13849-1:2008;

c) hold-to-run control devices and enabling devices for tool or axes movements shall be located on the main control panel and/or on a mobile set of controls connected to the machine by a cable or wireless system (if provided);

d) automatic restart of the machine shall be prevented in accordance with the requirements of EN 1037:1995+A1:2008, 6.2.1 and 6.2.3.

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

5.2.8 Failure of electrical power supply

In case of any supply interruption, the automatic restart of the machine shall be prevented after the restoration of the supply.

In case of power supply failure, all tools shall remain in upper position or get it immediately.

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

The requirements of EN 1037:1995+A1:2008, Clause 6 apply.

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

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

5.2.9 Failure of the control circuits

See 5.2.1.

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

5.3 Protection against mechanical hazards

5.3.1 Transport and installation of machine

For the transport of the machine, appropriate provisions for the easy and safe handling shall be made in accordance with EN ISO 12100:2010, 6.3.5.5.

For the installation of the machine, appropriate provisions for the installation of the machine shall be made in accordance with EN ISO 12100:2010, 6.3.2.6.

Verification: By checking relevant drawings of relative provisions in the instruction handbook and inspection of the machine.

5.3.2 Stability

It shall be possible to fix the machines and auxiliary equipment to a suitable stable structure, e.g. floor. Facilities for fixing are e.g. fixing holes in the machine frame and auxiliary equipment frame.

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

5.3.3 Risk of break-up during the working process

Risk of break-up of the beam movement transmission device shall be minimized by mechanical stops provided at the ends of the beam railways.

Risk of break-up of the grinding or polishing segments or their holders shall be minimized as indicated in 5.3.4.1.

5.3.4 Prevention of access to moving parts and devices to minimize the effect of ejected parts of tools or workpieces

5.3.4.1 Guarding of tools

Access to the tools shall be prevented by enclosure consisting of fixed guards and moveable guards interlocked with guard locking for setting, tool changing, cleaning or loading/unloading. Guards shall be according to EN 953:1997+A1:2009.

The enclosure shall prevent hazards due to access to rotating parts or ejection of part of the tool or workpiece up to at least 1 000 mm from the level of the workbench and the distance from the top of the guard and the tool shall be not less than 200 mm. To enter the enclosure for setting, tool changing, cleaning or loading/unloading, a door shall be provided and be interlocked with guard locking to the drives.

The tools shall be fixed with central and self-locking screws with flanges having screw threads, or self-locking worm-lock devices to prevent dismantling from the work spindle. The guards shall be closed apart from the effective working area of the tool to prevent any hazard caused by ejection of material or workpieces. The tool covers shall prevent spurting of the cooling lubricant.

In the frontal zone of the bench (operator side) a vertical fixed guard with a minimum height of 150 mm from the working plane, realized in accordance with 5.3.4.5, shall be inserted.

As an exception, the surface finishing machine with fixed table and mobile transversal bridge may be provided with light beams or pressure-sensitive edge or bar if the following requirements shall be fulfilled:

a) in the frontal zone of the bench (operator side) a vertical fixed guard with a minimum height of 250 mm from the working plane, realized in accordance with 5.3.4.5, shall be inserted;

b) any electronic light barrier shall be of at least Type 2 in accordance with EN 61496-1:2013 and its associated safety-related control systems shall be at least PL = c in accordance with EN ISO 13849-1:2008;

c) light barriers shall consist of at least three opto-electronic elements, the lower elements shall be situated at a height of 300 mm, 700 mm, 1 100 mm above the floor level;

d) the light barriers shall be positioned at a minimum of 850 mm from any rotating tool;

e) the reset control device shall be outside the protected zone and not reachable from inside this zone. The operator shall have a good view on the protected zone;

f) accessible supporting parts shall be designed and situated in a way that they do not cause injury or create a tripping hazard;

g) pressure-sensitive edges or bars shall be in accordance with the requirements of EN ISO 13856-2:2013 for category 1.

For the surface finishing machine with belt conveyor and fixed or mobile spindles-holding beam the following additional requirements shall be fulfilled:

h) the movement of the belt and the additional relative movement as defined in 3.2, shall be stopped;

i) the safety-related parts of the control system shall present a performance level of at least PL = c, defined in accordance with EN ISO 13849-1:2008;

j) fixed guarding shall prevent access to the adjacent heads or the adjacent heads shall be stopped at the same time as the head to which access is required.

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

5.3.4.2 Guarding of drives

Access to drive mechanisms (which include tool spindles, feed, etc.) shall be prevented either by fixed guards or movable guards interlocked with the corresponding motor drives in accordance with the requirements of EN ISO 14119:2013.

Guards shall be according to EN 953:1997+A1:2009.

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. unlosable screws. See also 6.3.3 l).

Where frequent access to the drives is provided for maintenance or adjustment purposes i.e. more than once per day, access shall be via an interlocked movable guard with guard locking.

Guard locking shall be spring applied/power released in accordance with EN ISO 14119:2013, Annex F.

As an exception, 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 may be by a manually operated delay device in accordance with EN ISO 14119:2013, Annex F.

The control circuit for interlocking with guard locking shall be at least PL = c in accordance with the requirements of EN ISO 13849-1:2008

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

5.3.4.3 Transmission parts

Access to the elements of the transmission parts like gear-wheels, shafts, joints, belts shall be prevented by fixed guards.

The 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. Guards shall be according to EN 953:1997+A1:2009.

No guard is necessary if the transmission parts are beyond the safety distances due to their location and are therefore out of reach (EN ISO 13857:2008, 4.2.1).

Guard locking shall be spring applied/power released in accordance with EN ISO 14119:2013, Annex F.

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

5.3.4.4 Spindles-holding beam

For finishing machines with mobile spindles-holding beam the protective measures against the risks due to the continuous alternative movement of the spindles-holding beam shall be provided by fixed and moveable guards with guard locking.

Fixed and moveable guards shall prevent hazards due to impact between the upper limb of the operator and the spindles-holding beam. The distance from the top of the guard and any part of the spindles-holding beam shall be at least 200 mm.

If the use of a raised floor surface or platform is allowed, the safety distances indicated in 5.3.4.1 and 5.3.4.4 shall be recalculated adding the maximum allowed height of the raised floor surface or platform indicated in the instruction handbook (see 6.3.2 point bb) 8).

As an exception, for strip or tile machines with belt conveyor and mobile spindles-holding beam, for the replacing of the grinding or polishing segments on the stopped head (see 5.2.6), supplementary fixed guards shall be fitted internally at the moveable guards.

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

5.3.4.5 Requirements for guard materials

Where guards are used as capturing devices to minimize the effect of ejection of machine parts or workpiece parts they shall be:

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

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

Table 2 — Light alloy guard thickness and tensile strength

Minimum ultimate tensile strength [N/mm^2]	Minimum wall thickness [mm]
180	5
240	4
300	3

c) polymeric materials (e.g. ABS or similar) single or double wall of at least 5 mm total thickness;

d) fibreglass single or double wall of at least 5 mm total thickness;

e) concrete wall (for machine described in 3.1) minimum thickness 100 mm .

Verification: By checking the relevant drawings, calculations, tensile strength, measurement, inspection of the machine.

5.3.5 Specific requirements for surface finishing machine with fixed table and mobile transversal bridge (track machines)

5.3.5.1 Bridge infeed

Guide rolls and drive elements such as pinions shall be covered with a fixed guard according to EN 953:1997+A1:2009. The necessary gap between guide (rail) and under-carriage shall not exceed 5 mm.

In case that an access onto the machine table is necessary for the change of the workpiece, a protection system with proximity reaction shall be provided, which stops the bridge travel movement in case of contact fast enough for preventing crushing of parts of the body.

Acceptable protective devices are:

— pressure-sensitive edge or bar in accordance with the requirements of EN ISO 13856-2:2013 for category 1;

— light barrier in accordance with EN 61496-1:2013, type 2.

The related parts of the control system shall present a performance level of at least c in accordance with EN ISO 13849-1:2008.

Provisions shall be made to prevent the machine from overrunning the end of the rails. These provisions shall consist of a limit switch with positive opening of the contacts in accordance with EN ISO 14119:2013, 8.3.2, and a mechanical restraint device.

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

5.3.5.2 Transverse infeed

Unless access to the danger zones is prevented by guarding in accordance with 5.3.4.1, the transverse infeed movement shall not induce any risk of crushing at the end of the movement. For this reason, sufficient safety distances to other fixed or moving parts shall be ensured in accordance with EN 349:1993+A1:2008 or safety devices shall be provided. Appropriate safety devices are:

— pressure-sensitive edge or bar in accordance with the requirements of EN ISO 13856-2:2013 for category 1;

— light barrier in accordance with EN 61496-1:2013, type 2.

The related parts of the control system shall present a performance level of at least c, defined in accordance with EN ISO 13849-1:2008.

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

5.3.5.3 Automatic tool change

The installation of an appropriate safety device shall prevent the crushing hazard between tool spindle and tool.

Appropriate safety devices are:

— pressure-sensitive edge or bar in accordance with the requirements of EN ISO 13856-2:2013 for category 1;

— light barrier in accordance with EN 61496-1:2013, type 2.

The related parts of the control system shall present a performance level of at least c, defined in accordance with EN ISO 13849-1:2008.

As far as machines are equipped with automatic grinding or polishing head change systems where the grinding or polishing head is held by energy support, the grinding or polishing head shall be secured against breakdown of energy (pneumatic/electricity) (e.g. by a tool holding device).

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

5.4 Protections against no mechanical hazards

5.4.1 Fire

To minimize the risk from fire, the requirements of 5.4.3 shall be fulfilled.

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

5.4.2 Noise

5.4.2.1 Noise reduction at the design stage

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

The main noise sources are:

a) tools;

b) tool spindles drives;

c) axes drives;

d) pneumatic system (if provided);

e) hydraulic system (if provided).

Also the information given in EN ISO 11688-2:2000 may be taken into account.

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

5.4.2.2 Noise emission measurement

A standardized noise test code is required for the determination, declaration and verification of noise emission values of the machines covered by this European Standard.

The noise test code specifies the noise measurement methods and operating and mounting conditions for the test, as described in Annex A.

Verification: By checking test reports.

5.4.3 Electrical hazards

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

See EN 60204-1:2006, 6.2 for the requirements regarding prevention of electric shock due to direct contact and EN 60204-1:2006, Clause 7 for the requirements regarding protection against short circuits (feeder circuit excluded) and overloading.

The protection against electric shock due to indirect contact shall be ensured by the user, e.g. by automatic isolation of the electrical power supply of the machine by the operation of a protective device installed in the

line powering the machine (see the information provided by the manufacturer in the instruction handbook, 6.3.2 s)).

The protection against short circuits of the feeder circuit shall be ensured by the user (see the information provided by the manufacturer in the instruction handbook, 6.3.2 t)).

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.

Electrical enclosures shall not be exposed to risk from the ejection of tools or workpieces. Live parts shall not be accessible in accordance with EN 60204-1:2006, 6.2.2. Fire risk is not present where power circuits are protected against overcurrent in accordance with EN 60204-1:2006, 7.2.3.

In accordance with EN 60204-1:2006, 18.1 the test 1 for the continuity of the protective bonding circuit and with EN 60204-1:2006, 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, 18.2, test 1 and functional test according to EN 60204-1:2006, 18.6).

5.4.4 Ergonomics and handling

For the transport of the machine, appropriate provisions for the easy and safe handling shall be made in accordance with EN ISO 12100:2010, 6.3.5.5.

Machines parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear.

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

The machine and its controls shall be designed according to ergonomic principles in accordance with EN 1005-4:2005+A1:2008.

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

5.4.5 Lighting

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

Where lighting is required as determined by reference to EN 1837:1999+A1:2009 it shall be provided in accordance with EN 60204-1:2006, 16.2.

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

5.4.6 Hydraulic and pneumatic components

The hydraulic and pneumatic systems shall comply with the requirements of EN ISO 4413:2010 and EN ISO 4414:2010.

When compressed air comes from a compressor outside the machine, the input point shall be fitted with a gate valve which makes it possible to close the air supply.

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

5.4.7 Electromagnetic compatibility

The machine shall have a low electromagnetic emission level and sufficient immunity to electromagnetic disturbances to enable it to operate correctly in accordance with EN 61439-1:2011, EN 50370-1:2005 and EN 50370-2:2003.

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

If only one of the above-mentioned requirements is not fulfilled, additional testing in accordance with EN 50370-1:2005 and EN 50370-2:2003 is required.

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

5.4.8 Unintended movements

Any hazardous movement by gravity shall be prevented, e.g. by means of fall arresters capable to withstand the stresses to which they are subjected.

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

5.4.9 Isolation

The principles of EN ISO 12100:2010, 6.2.10 and 6.3.5.4, shall be observed and in addition:

Electrical isolators shall be in accordance with EN 60204-1:2006, 5.3, except that the isolator shall not be type d) in EN 60204-1:2006, 5.3.2.

If pneumatic energy is also used for other purposes, it shall be possible to isolate the pneumatic supply by a manually operated lockable mechanical valve. The device shall include means permitting it only to be locked in the off position (e.g. by a padlock). Dumping pneumatic pressure shall not be by disconnection of a pipe.

The machine shall have means to isolate hydraulic power (if provided) according to EN ISO 4413:2010.

Where the machine has a hydraulic system that is powered by an integral electrically operated hydraulic pump, isolation of the hydraulic power is allowed by disconnecting the electrical supply. Where hydraulic energy is stored, e.g. in a reservoir or pipe, safe means for dumping of residual pressure shall be provided. Safe means can include a valve but does not include disconnection of any pipe.

The electric isolator shall have its function, location and operational position clearly identified, e.g. by a label or a pictogram. The label or pictogram shall be fitted in a position clearly visible in close proximity to the isolator on the machine (also see 6.2).

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

5.4.10 Maintenance

The principles of EN ISO 12100:2010, 6.2.15, shall be observed.

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

6 Information for use

6.1 Signals and warning devices

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

If the machine is equipped with a pneumatic supply, 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.

Safety signs shall be placed on the machine in order to allow the maintenance operator to climb on the conveyor belt only if the machine is turned off and the main switch is padlocked (see 6.3.3 h).

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

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

6.2 Marking

Following minimum markings shall be permanently marked on the machine:

a) the business name and full address of the manufacturer and, where applicable, his authorized representative;

b) designation of the machinery;

c) mandatory required marking;

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

e) declaration of the series or type;

f) machine serial number if existing;

g) power designation (compulsory for electrical products: voltage, frequency, power, nominal current, etc.);

h) the marking of their mass on machine parts that shall be handled with mechanical means;

i) the nominal (maximum) speed of tool spindles (see 6.3.2);

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

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

6.3 Instruction handbook

6.3.1 General

An instruction handbook shall be drawn up in accordance with EN ISO 12100:2010, 6.4.5.

The use and maintenance manuals shall be in accordance with EN 82079-1:2012.

It shall contain the following specific information.

6.3.2 Operator's manual

At least the following user information shall be included:

a) the business name and full address of the manufacturer and of his authorized representative;

b) repetition of the markings, pictograms and other instructions on the machine as described in 6.1 and 6.2;

c) intended use of the machine;

d) foreseeable misuse;

e) the maximum and minimum length, width and thickness of the workpiece;

f) information on the existing residual risks; a warning regarding residual risk with the instruction:

   1) to wear ear protection to prevent hearing loss; and

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

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

g) the hazards associated with the operation of the machine;

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

i) the correct procedures for manual mounting and fixing of tools;

j) the instruction for the selection of the bridge or spindles-holding beam speed;

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

l) instruction on those devices which shall be verified, how frequently the verification shall be carried out and by what method. This shall include at least the following:

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

   2) interlocked guards with guard locking - by proving an inability to open the guard as long the tool is rotating;

m) indication that the given rotating direction shall be checked;

n) indication that every contact with the rotating tool shall be avoided;

o) information on the operator's controls, especially on the on/off and on the emergency stop installation;

p) information on the choice of the appropriate tools and their application regarding the task to be performed;

q) indication that no tools shall be used whose maximum rotational speed is lower than the selected speed of the machine;

r) information about the safety measures for interventions including disconnection of the energy supply or supplies, measures against reconnection, neutralization of residual energies, testing of safe state. If for frequent interventions such complete disconnection is not possible, the manufacturer shall indicate appropriate procedures for carrying out safely the intervention;

s) 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);

t) information on how to provide protection against short circuits of the feeder circuit;

u) information on the handling method of the tool changing;

v) instructions on the detection of defects, the trouble-shooting and the reoperation after intervention;

w) indication that the correct mounting of guards shall be checked;

x) indication for avoiding the risk of stumbling in the working area of the machine, e.g. prevention of risk of slipping due to moisture and mud; covering open parts of guide rails at the floor;

y) indication that, for safety reasons, every damaged (broken) tool shall be replaced;

z) advice that apart from the operator nobody shall be within the working area;

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

bb) information on installation, the manufacturer shall always indicate:

1) machine overall dimensions and weight;

2) workspace;

3) the mounting unit on the ground and the vertical force at supporting foot or machine anchoring points;

4) inlet and outlet electrical main power supply;

5) the fixing of the machine and/or the rails;

6) that the user shall consider the compatibility with the additional upstream and downstream conveying elements and possible hazards, if such elements are not used;

7) indications on the connection on the power supply and water supply;

8) the maximum allowed height from the floor of any raised floor surface or platform;

9) specify the proper use of cooling lubricant supply process, usually water, while on line or recovery system;

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

1) that during setting it shall be verified that no contact exists between non rotating tools and any machine element;

2) the adjustment method for the pressure devices and the method for fixing auxiliaries;

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

4) the instruction for the use of special equipment, e.g. gauges for setting the tool when the machine is at a standstill;

dd) the instructions to minimize noise levels including:

1) the condition of the tools;

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

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

ee) a declaration regarding airborne noise emissions from the machinery, shall be in accordance with A.6.

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

6.3.3 Maintenance manual

At least the following user information shall be included:

a) information on the existing residual risks; a warning regarding residual risk with the instruction:

1) to wear eye protection;

2) to wear gloves against the hazard of cutting when handling tools, or doing maintenance;

b) indication that every contact with the rotating tool shall be avoided;

c) information about the safety measures for interventions including disconnection of the energy supply or supplies, measures against reconnection, neutralization of residual energies, testing of safe state. If for frequent interventions such complete disconnection is not possible, the manufacturer shall indicate appropriate procedures for carrying out safely the intervention;

d) list of tasks (e.g. adjustment, maintenance, lubrication, cleaning and service activities) that shall be carried out only when the machine is down and the main drive is off;

e) details and frequency of inspections;

f) instruction of maintenance activities which can be carried out by the operator (including indications on safe appliances and facilities to be used);

g) list of maintenance activities which can only be carried out by qualified maintenance personnel – as they require special technical knowledge – including indications on safe appliances and facilities to be used;

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

i) information about safe cleaning;

j) if fitted with a pneumatic and/or hydraulic system, the method for the safe dissipation of residual energy;

k) 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 personnel hired by the manufacturer are excluded);

l) description of fixed guards which shall be removed by the user for maintenance and cleaning purposes (guards to be dismounted only by the manufacturer or personnel hired by the manufacturer are excluded);

m) information that process water shall be filtered and checked regularly to avoid the presence of pollutants that can be dangerous to the operator;

n) information that when the guard is open, if there are moving parts or pipes under pressure, air or water, the use of safety glasses according to EN 166:2001 is required.

Verification: By checking the maintenance manual and the relevant drawings.

Annex A
(normative)

Noise emission measurement

A.1 Introduction

This noise test code specifies all the information necessary to carry out efficiently and under standardized conditions the determination, declaration and verification of the airborne noise emission values of surface finishing machines.

The determination of these quantities is necessary for:

— manufacturers to declare the noise emitted;

— comparing the noise emitted by machines in the family concerned;

— purposes of noise control at source at the design stage.

This noise test code specifies the noise measurement methods and operating and mounting conditions for the test.

The use of this noise test code ensures the reproducibility of the measurements and the comparability of the airborne noise emission values within specified limits determined by the grade of accuracy of the basic measurement method used.

A.2 Measurement of the A-weighted emission sound pressure level at the operator positions or other specified positions

A.2.1 Basic standards

The determination of the A-weighted emission sound pressure level shall be carried out using a method with an accuracy grade of 2 (engineering) or 3 (survey). One of the following standards shall be applied: EN ISO 11201:2010 or EN ISO 11202:2010 or EN ISO 11204:2010.

NOTE Grade 2 of accuracy can be reached only with class 1 measuring instruments. Class 2 instruments are allowed when using EN ISO 11202:2010, but grade 3 of accuracy results are obtained with, consequently, a higher uncertainty.

A.2.2 Measurement procedure and positions

If the emission sound pressure level at the workstation shall be measured according to EN ISO 11202:2010, the following modifications shall be applied:

a) the environmental indicator K2A and local environmental factor K3A shall be equal to or less than 4 dB;

b) 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);

c) the correction of the local environmental factor K3A 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.

Alternatively, where the facilities exist and the measurement method applies to the machine type, emission sound pressure levels may also be measured according to a method with higher precision, i.e. EN ISO 11201:2010 or EN ISO 11204:2010 without the preceding modifications.

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.

Measurements shall be carried out at each microphone position during at least one test cycle of the machine as defined in see A.4.

The microphone shall be located at all operator positions designated by the manufacturer in the instruction handbook. The A-weighted emission sound pressure level at each of these operator positions shall be recorded, reported and declared together with the associated measurement uncertainty.

The microphone used to measure the emitted noise at the position of the operator (see Figure A.1) shall be situated as follows:

— 1,60 m above floor level or platform, and

— 0,5 m in front of the main control panel.

A.2.3 Measurement uncertainty

If a grade 2 (engineering) method is used, the standard-deviation of reproducibility for A-weighted emission sound pressure levels at workstations is:

σ_{RA} = 1,5 dB, resulting in a measurement uncertainty of 3 dB if operating conditions of the machine are stable, which is normally the case for the machines covered by this standard.

If the emission sound pressure level at the workstation is measured according to EN ISO 11202:2010, uncertainty K, using the dual-number form of declaration in accordance with EN ISO 4871:2009, shall be of 4 dB.

NOTE Detailed information about uncertainty is given in EN ISO 11201:2010, Clause 11, EN ISO 11202:2010, Clause 12 and EN ISO 11204:2010, Clause 11. See also EN ISO 4871:2009.

A.3 Determination of sound power level

A.3.1 Measurement procedure and positions

Emission sound power level shall be measured in accordance with the enveloping surface measuring method ISO 3746:2010 with the following modifications:

a) the environmental indicator K2A 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 as described in Figure A1.

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.

If the A-weighted emission sound pressure level at any of the measurement positions considered in A.2 exceeds 80 dB, the A-weighted sound power level should normally be determined. However, machines covered by the present standard that have at least a largest dimension (L1 or L2 or L3 in Figure A.2) that exceeds 7 m, are considered as very large machines. Therefore, instead of the A-weighted sound power level, the A-weighted emission sound pressure levels at positions located on a path at 1 m from the enveloping surface of the machine and at a height of 1,60 m from the floor shall be detected with reference to EN ISO 11200. Microphone positions on the path shall be separated by not more than 2 m (see Figure A.2) and measurements shall be carried out as specified in A.2. Values shall be recorded, reported and declared together with the associated measurement uncertainty. These specified positions are identical to those used for machines with no workstation designated by the manufacturer (see A.2.2).

A.3.2 Measurement uncertainty

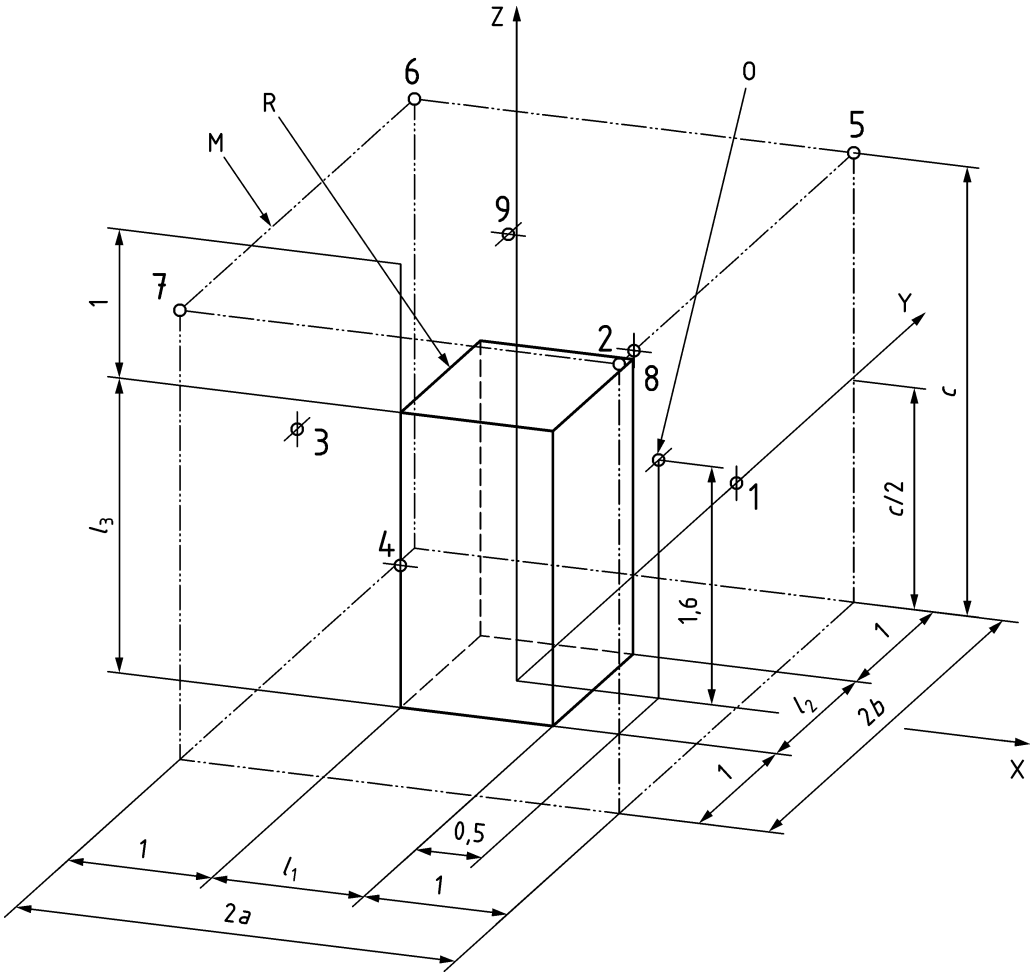
Uncertainty K, using the dual-number form of declaration in accordance with EN ISO 4871:2009, shall be as follows:

— 4dB when using EN ISO 3746:2010,

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

— 1dB when using EN ISO 3745:2012.

Dimensions in metres

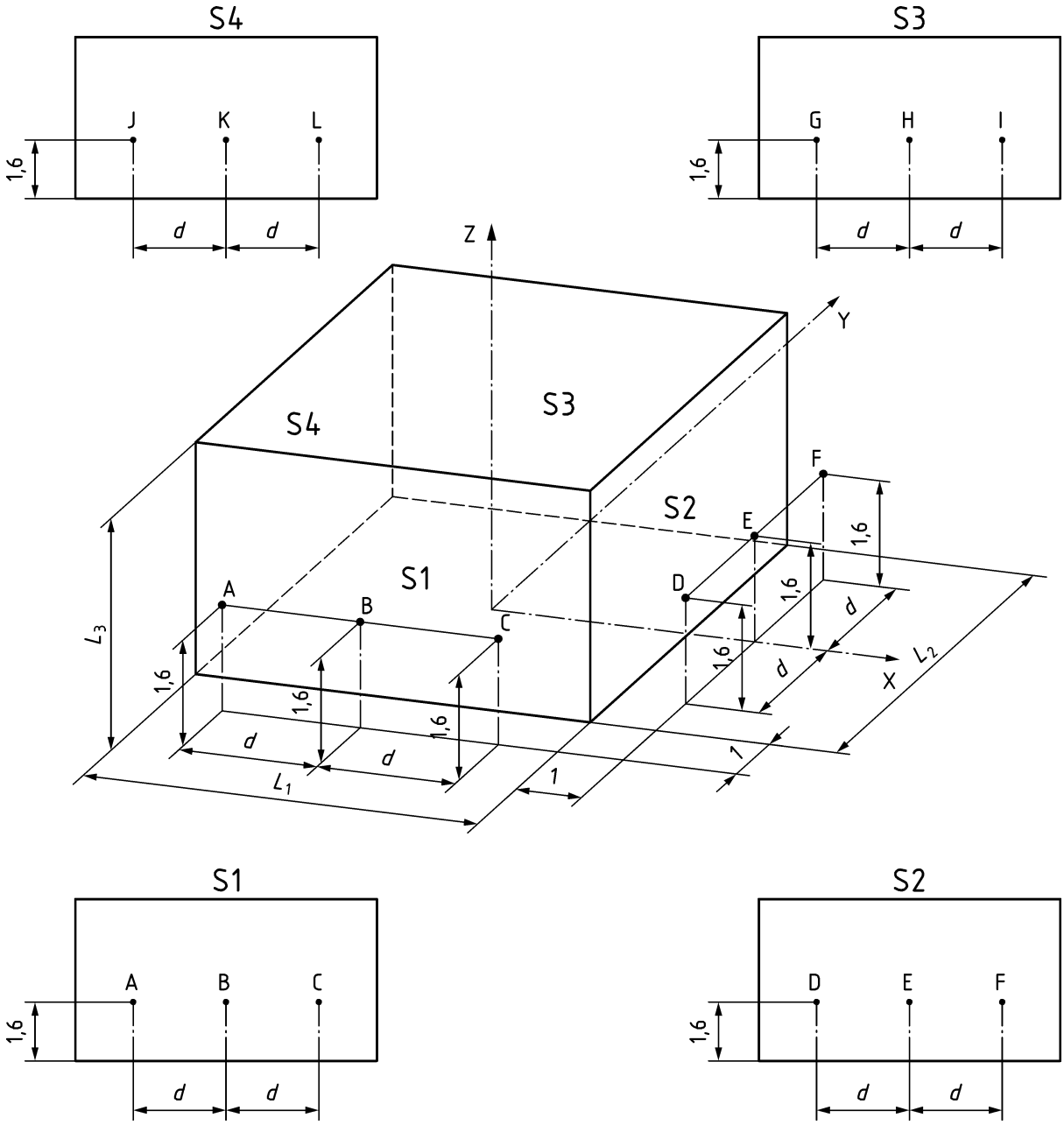


Key

M	measurement surface
R	reference box
0	operator position microphone location (sound pressure level measurement)
1 to 9	measuring microphone positions
l_1	length of the reference box
l_2	width of the reference box
l_3	height of the reference box

Figure A.1 — Measurement surface and microphone positions

Dimensions in metres



Key

A-L measuring microphone positions

L 1 length of the enveloping surface

L 2 width of the enveloping surface

L 3 height of the enveloping surface

d distance between two adjacent microphones (no more than 2 m)

Figure A.2 — Example of microphone positions when the A-weighted emission sound pressure level at the operator position exceeds 80 dB and at least a dimension (L1 or L2 or L3) exceeds 7 m

A.4 Installation, mounting and operating conditions for noise emission measurement

During the noise test the machine shall be installed, mounted and operated as specified/recommended by the manufacturer in the instruction handbook.

Installation, mounting and operating conditions of the machine shall be identical for the determination of emission sound pressure levels at the workstation and sound power levels.

For the noise tests the following requirements shall be fulfilled:

a) all integrated auxiliary units, relevant noise sources in the normal cycle and for the measurement, e.g. power feed polishing heads, shall be in function during testing;

b) all relevant guards, safety devices, integral sound enclosures, etc. shall be in position during testing;

c) in accordance with the dimensional requirements of the machine manufacturer, conventional tools normally available on the market shall be used;

d) tools shall be properly installed according to the instructions of their manufacturer;

e) the processed material shall be slabs of marble or granite;

f) slab dimensions, tools characteristics, cutting data and testing operation shall be in accordance with Table A1.

A.5 Information to be recorded and reported

The information to be recorded and reported shall include all the data required by the basic measurement standard(s) used, i.e. precise identification of the machine under test, acoustic environment, instrumentation, presence and position(s) of the operator(s), if any.

The operating conditions of the machine during measurement and the method that has been used for the measurement shall be indicated by reference to this noise test code with indication of possible deviations with justification of them.

At least the data specified in Table A1 shall be recorded and reported. If in a specific situation it is necessary to deviate from them, the actual condition applied for the test shall be recorded and reported in the column “Conditions chosen within permitted range or conditions deviating from standard” of Table A1.

The form in Table A1 may be copied, modified and distributed free of charge.

Table A.1 — Noise test code - General Data Sheet

Machine data	Manufacturer: …….. Model: …… Year of manufacture:…….. Serial n°:…… Overall dimensions of machine [a] Length l_1:…… mm Width l_2:……mm Height l_3:…… mm

[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.

Machine installation			**Remarks/description**
	Machine installed according to manufacturer's recommendations	yes ☐	……
		no ☐	……
	Machine set up in a separate noise enclosure	yes ☐	……
		no ☐	……
	Machine equipped with peripheral noise enclosure	yes ☐	……
		no ☐	……
	Other noise control measures	yes ☐	……
		no ☐	……

Testing operating arrangement	Standard conditions	Conditions chosen within permitted range or conditions deviating from standard
☐ **Test 1 – Surface finishing machine with belt conveyor - Polishing of marble slabs with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the machine belt conveyor. *Position of the workpiece*: in the middle of the machine belt conveyor.		
☐ **Test 2 – Surface finishing machine with belt conveyor - Polishing of granite slabs with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the machine belt conveyor. *Position of the workpiece*: in the middle of the machine belt conveyor.		
☐ **Test 3 – Surface finishing machine with belt conveyor - Polishing of marble strips with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the machine belt conveyor. *Position of the workpiece*: in the middle of the machine belt conveyor.		
☐ **Test 4 – Surface finishing machine with belt conveyor - Polishing of granite strips with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the machine belt conveyor. *Position of the workpiece*: in the middle of the machine belt conveyor.		
☐ **Test 5 – Surface finishing machine with fixed table - Polishing of marble slabs with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the fixed table. *Position of the workpiece*: in the middle of the fixed table.		
☐ **Test 6 – Surface finishing machine with fixed table - Polishing of granite slabs with grinding or polishing heads** *Direction of work*: x-axis, i.e. on the front long edge of the fixed table. *Position of the workpiece*: in the middle of the fixed table.		
For each machine only the relevant tests defined above shall be performed.		

Tool and grinding or polishing data	Standard conditions	Conditions chosen within permitted range or conditions deviating from standard
☐ **Test 1 - Surface finishing machine with belt conveyor** Minimum number of simultaneous machining heads: 80 % Machining head pressure: at least 70 % Transverse speed peak: 40 m/min Belt conveyor speed rate: 1 m/min		
☐ **Test 2 - Surface finishing machine with belt conveyor** Minimum number of simultaneous machining heads: 80 % Machining head pressure: at least 70 % Transverse speed peak: 40 m/min Belt conveyor speed rate: 1 m/min		
☐ **Test 3 - Surface finishing machine with belt conveyor** Minimum number of simultaneous machining heads: 80 % Machining head pressure: at least 70 % Transverse speed peak: 10 m/min Belt conveyor speed rate: 3 m/min		
☐ **Test 4 - Surface finishing machine with belt conveyor** Minimum number of simultaneous machining heads: 80 % Machining head pressure: at least 70 % Transverse speed peak: 10 m/min Belt conveyor speed rate: 3 m/min		
☐ **Test 5 - Surface finishing machine with fixed table** Longitudinal speed peak: 0,5 m/min Transverse speed peak: 5 m/min		
☐ **Test 6 - Surface finishing machine with fixed table** Longitudinal speed peak: 0,5 m/min Transverse speed peak: 5 m/min		

Testing material	Standard conditions	Conditions chosen within permitted range or conditions deviating from standard
☐ **Test 1 - Surface finishing machine with belt conveyor** Min slab length 2 000 mm Min slab width: 1500 mm		
☐ **Test 2 - Surface finishing machine with belt conveyor** Min slab length 2 500 mm Min slab width: 1 700 mm		
☐ **Test 3 - Surface finishing machine with belt conveyor** Min strip width: 500 mm		
☐ **Test 4 - Surface finishing machine with belt conveyor** Min strip width: 500 mm		
☐ **Test 5 - Surface finishing machine with fixed table** Min slab length 2 500 mm Min slab width: 1 700 mm		
☐ **Test 6 - Surface finishing machine with fixed table** Min slab length 2 500 mm Min slab width: 1 700 mm		

Photo or detailed illustration of the machine tested	
Testing results	
Testing laboratory	Firm/Institution:…… Address:…… Telephone:…… Date:…… Signature:…… Test carried out:…… Place:…… Date:……

A.6 Declaration and verification of noise emission values

The noise declaration shall be a dual-number declaration as defined in EN ISO 4871:2009, i.e. the measured values and the measurement uncertainty associated to each value shall be indicated separately. Noise emission data to be declared shall be as follows:

— For machines with workstations designated by the manufacturer and where no measured A-weighted emission sound pressure level exceeds 80 dB, declare the value at these workstations. Where a value is less than 70 dB, instead of the value, insert the statement “LpA less than 70 dB”;

— For machines with workstations designated by the manufacturer where at least one measured A-weighted emission sound pressure level exceeds 80 dB, declare:

  — the value measured at the workstations where it exceeds 70 dB. Where a value is less than 70 dB, instead of the value, insert the statement “LpA less than 70 dB”;

  — the values measured at the positions on a path around the machine (see A.2.1). Where a value is less than 70 dB, instead of the value, insert the statement “LpA less than 70 dB”;

— For machines without workstations designated by the manufacturer, declare the values of the A-weighted emission sound pressure level measured at the positions on a path around the machine (see A.2.1). Highlight the position where the highest value is measured. Where a value is less than 70 dB, instead of the value, insert the statement “LpA less than 70 dB.

The noise declaration shall mention explicitly that noise emission values have been obtained according to this noise test code. It shall indicate which basic measurement standard has been used and refer to this noise test code for operating conditions including details of the mounting and operating conditions of the machine during the determination of its noise emission. The noise declaration shall clearly indicate deviation(s) from this noise test code and/or from the basic standard used, if any.

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 workroom 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.

Annex ZA
(informative)

Relationship between this European standard and the essential requirements of EU Directive 2006/42/EC

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

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements except those of Chapter 3 of Annex I of that Directive and associated EFTA regulations.

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

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