International Standard

ISO 19085-6

Second edition
2024-04

# Woodworking machines — Safety —

## Part 6: Single spindle vertical moulding machines (toupie)

*Machines à bois — Sécurité —*

*Partie 6: Toupies monobroches à arbre vertical*



Reference number
ISO 19085-6:2024(en)



ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 39, *Machine tools*, Subcommittee SC 4 *Woodworking machines,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 142, *Woodworking machines,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19085-6:2017), which has been technically revised. The main changes are as follows:

— the Scope now specifies that machines are intended for continuous production use;

— the list of significant hazards has been moved to Annex A;

— the structure has been simplified and modified, in particular in 5.6;

— Subclause 6.2 has been updated and a new full noise test code has been added in Annex F.

A list of all parts in the ISO 19085 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

# Introduction

The ISO 19085 series of International Standards provides technical safety requirements for the design and construction of woodworking machinery, as well as for the content of the relevant instruction handbook. It concerns designers, manufacturers, suppliers and importers of the machines specified in the Scope.

This document is a type-C standard as defined in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate in the drafting process of this document.

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

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards (as defined in ISO 12100), the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The full set of requirements for a particular type of woodworking machine are those given in the part of ISO 19085 applicable to that type, together with the relevant requirements from ISO 19085-1:2021, to the extent specified in the Scope of the applicable part of ISO 19085.

As far as possible, the safety requirements of parts of the ISO 19085 series refer to the relevant clauses of ISO 19085-1. Each part includes replacements and additions to the common requirements given in ISO 19085-1.

All parts of the ISO 19085 series have the same structure, so that reference to ISO 19085-1 is made always and only from and to the same subclause number, last indent.

Clauses 1 to 3 are specific to each part and, therefore, are distinct from ISO 19085-1:2021, Clauses 1 to 3.

For Clauses 4 to 7 and the annexes, each subclause in ISO 19085-1:2021, is cited as:

— confirmed as a whole;

— confirmed with additions;

— excluded in total; or

— replaced with specific text.

This is indicated by one of the following possible statements:

— “ISO 19085-1:2021, [subclause/Annex], applies.”;

— “ISO 19085-1:2021, [subclause/Annex], applies with the following additions.” or “ISO 19085-1:2021, [subclause/Annex], applies with the following additions, subdivided into further specific subclauses.”;

— “ISO 19085-1:2021, [subclause/Annex], does not apply.”;

— “ISO 19085-1:2021, [subclause/Annex], is replaced by the following text.” or “ISO 19085-1:2021, [subclause/Annex], is replaced by the following text, subdivided into further specific subclauses.”.

Other subclauses and annexes specific to this document are indicated by the introductory sentence: “Subclause/Annex specific to this document.”.

# Woodworking machines — Safety —

# Part 6: Single spindle vertical moulding machines (toupie)

## 1 Scope

This document specifies the safety requirements and measures for single spindle vertical moulding machines (defined in 3.1), capable of continuous production use and hereinafter referred to also as "machines".

The machines are designed to cut solid wood and material with similar physical characteristics to wood.

This document deals with all significant hazards, hazardous situations and events as listed in Annex A, relevant to the machines when they are operated, adjusted and maintained as intended and under the conditions foreseen by the manufacturer including reasonably foreseeable misuse. Transport, assembly, dismantling, disabling and scrapping phases have also been taken into account.

This document is also applicable to machines fitted with one or more of the following devices/additional working units, whose hazards have been dealt with:

a) device to adjust the arbor vertically;

b) device to tilt the arbor;

c) device to fit a manually operated tenoning sliding table;

d) glass bead saw unit;

e) adjustable table insert;

f) device for changing the direction of rotation of the spindle;

g) device for fixing shank mounted tools on the arbor;

h) interchangeable arbor;

i) quick tool/arbor change system;

j) demountable power feed unit;

k) support for the demountable power feed unit with power-driven adjustments.

This document does not apply to

— machines equipped with outboard bearings,

— machines equipped with powered movements of a front extension table and/or a tenoning sliding table.

This document is not applicable to machines intended for use in potentially explosive atmospheres or to machines manufactured prior to the date of its publication.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 19085-1:2021, *Woodworking machines — Safety — Part 1: Common requirements*

EN 847-1:2017, *Tools for woodworking — Safety requirements — Part 1: Milling tools, circular saw blades*

EN 847-2:2017, *Tools for woodworking — Safety requirements — Part 2: Requirements for shanks of shank mounted milling tools*

EN 847-3:2013, *Tools for woodworking — Safety requirements — Part 3: Clamping devices*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 19085-1:2021 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

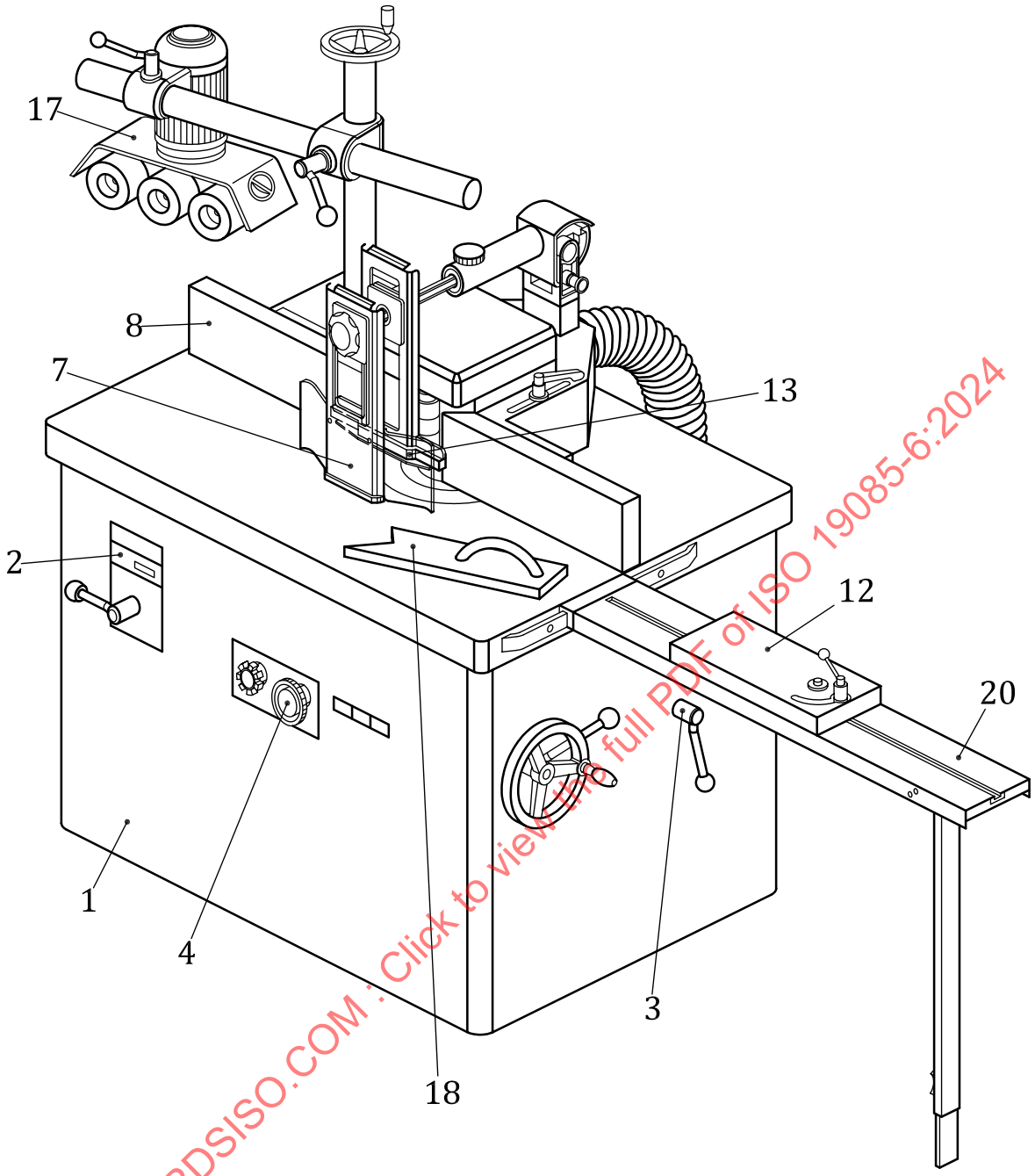
**3.1**
**single spindle vertical moulding machine**
hand-fed machine fitted with a single vertical arbor, which is fixed in position during the cutting operation, and a horizontal table, which is fixed in total or in part during the cutting operation

Note 1 to entry: The arbor passes through the table and its drive is situated beneath the table.

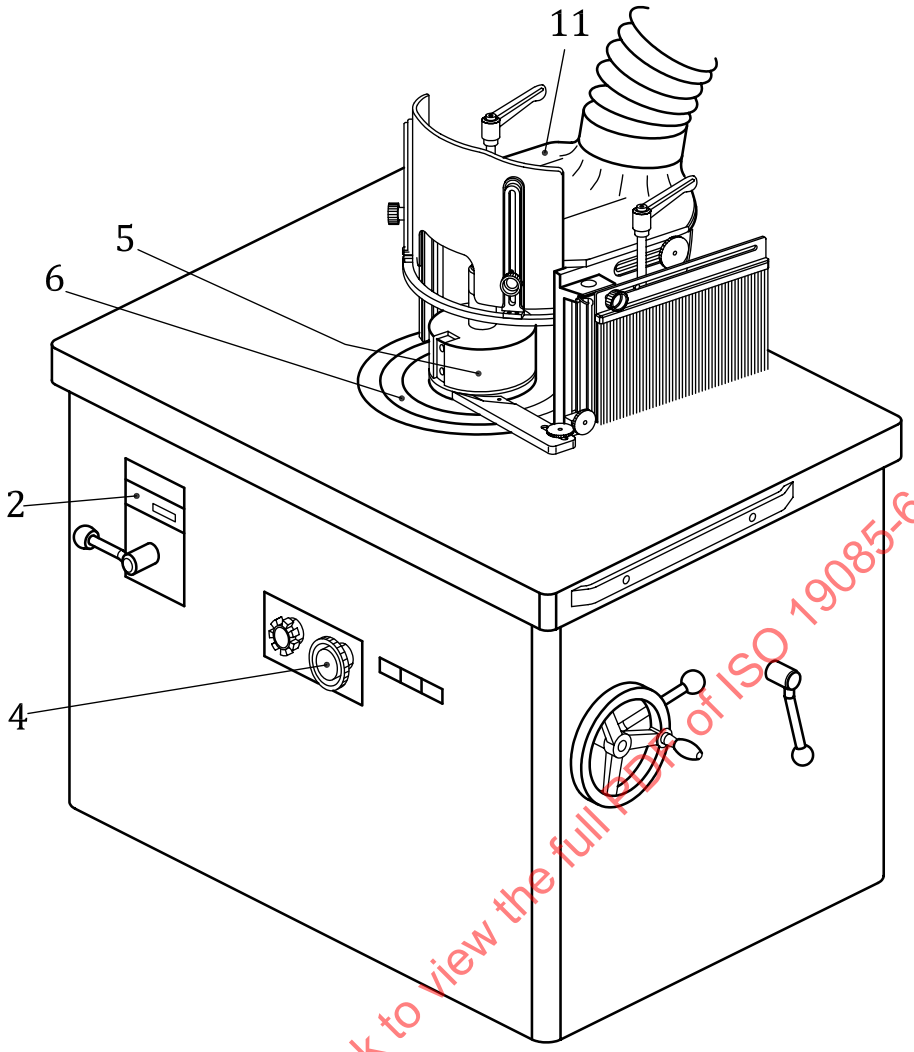
Note 2 to entry: The main parts of the machine and their terminology are shown in Figure 1.

Note 3 to entry: These machines are also known as shapers in the USA and toupie in Europe.

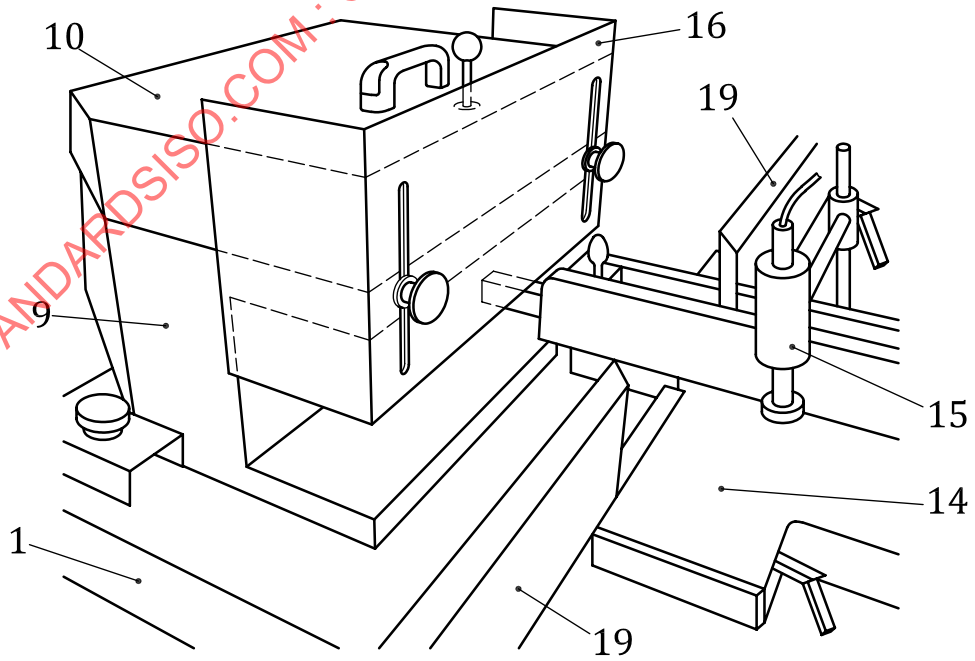
Note 4 to entry: The arbor can be tiltable and interchangeable or not interchangeable.




**a) Example of a single spindle vertical moulding machine equipped for straight work**




**b) Example of a single spindle vertical moulding machine equipped for curved work**




**c) Example of a tool safeguard for tenoning with fixed and adjustable guards mounted on the machine and on the sliding table**

**Key**

| | | | |
|---|---|---|---|
| 1 | main frame | 11 | curved work guard |
| 2 | speed indicator | 12 | adjustable end stop |
| 3 | spindle lock | 13 | table pressure pad |
| 4 | start and stop controls | 14 | sliding table |
| 5 | tool | 15 | workpiece clamping device |
| 6 | table rings | 16 | adjustable guard |
| 7 | fence pressure pad | 17 | de-mountable power feed unit |
| 8 | fence plates connected to straight work guard | 18 | push stick |
| 9 | enclosure | 19 | guards fixed to the sliding table |
| 10 | hinged cover | 20 | extension table |

**Figure 1 — Single spindle vertical moulding machine terminology**

**3.2**
**straight work**
profiling or grooving of a workpiece with one face in contact with the table and a second with the fence, and where the work starts at one end of the workpiece and continues through to the other end

Note 1 to entry: See Figures 1 a) and 2.

**3.3**
**stopped straight work**
machining of only a part of the workpiece length

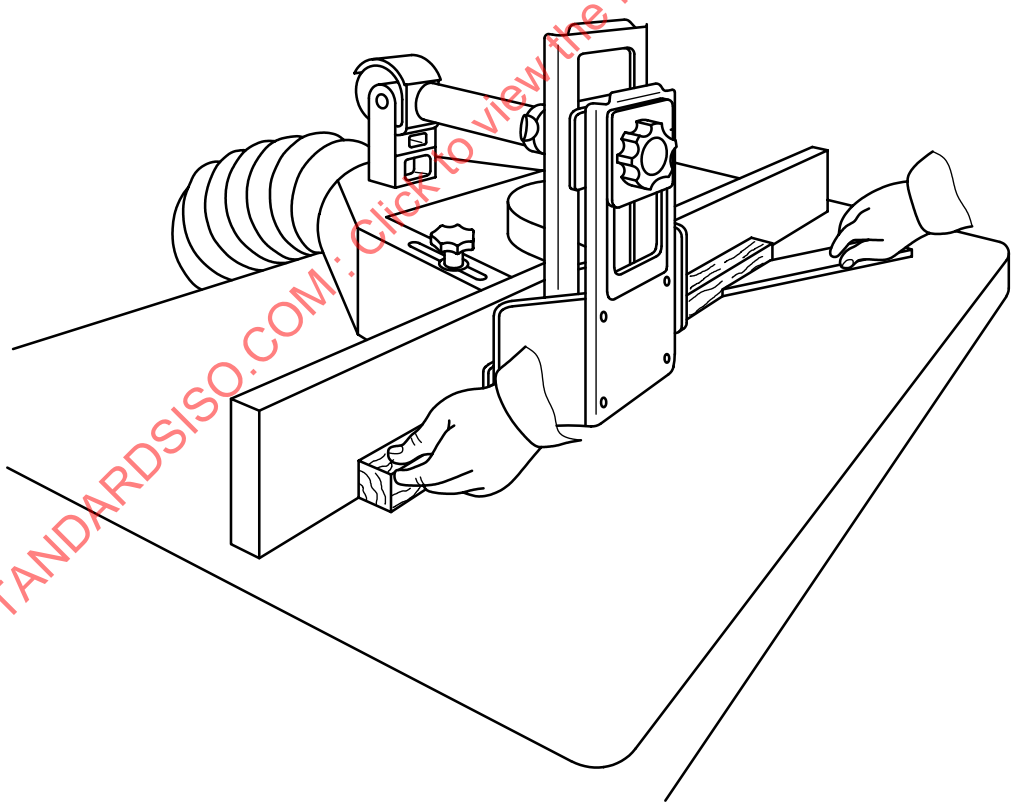


**Figure 2 — Example of straight work**

**3.4**
**curved work**
profiling or grooving of a curve on a workpiece by having one side in contact with the table (or if held in a jig with the jig in contact with the table) and the other in contact with the vertical reference of a steady or ball ring guide when using a jig

Note 1 to entry: See Figures 1 b) and 3.

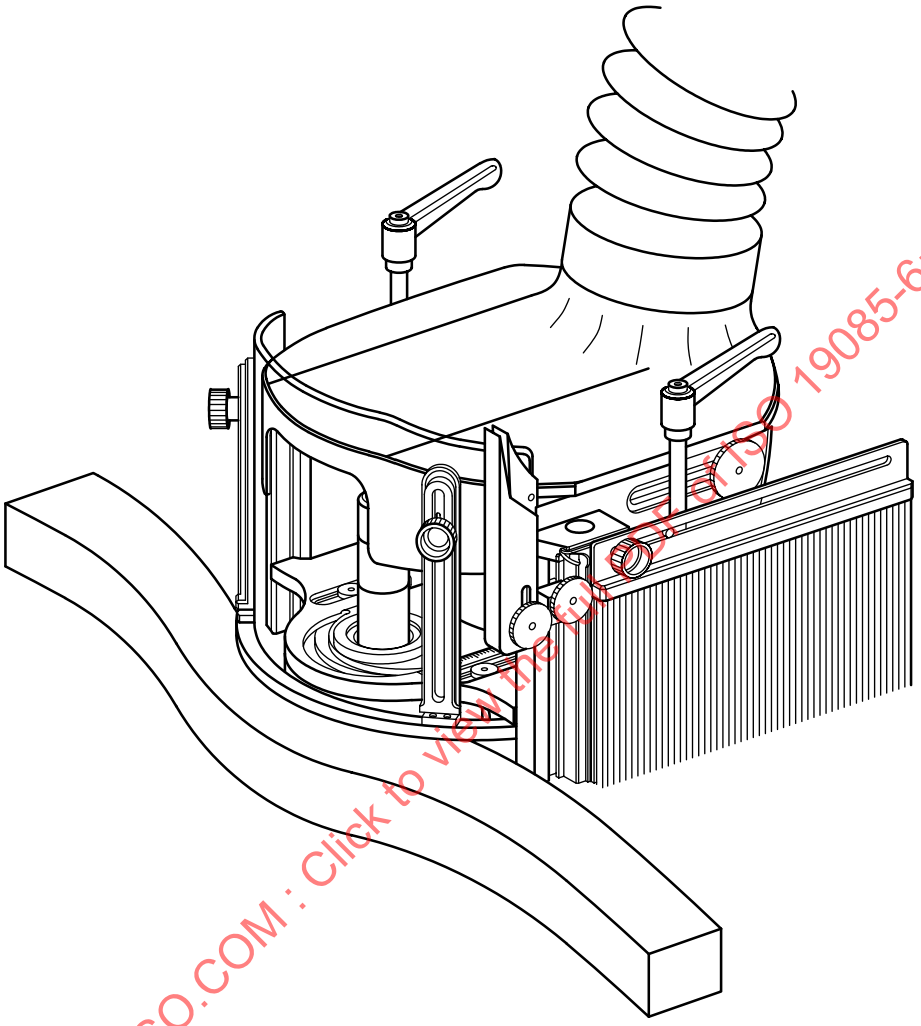
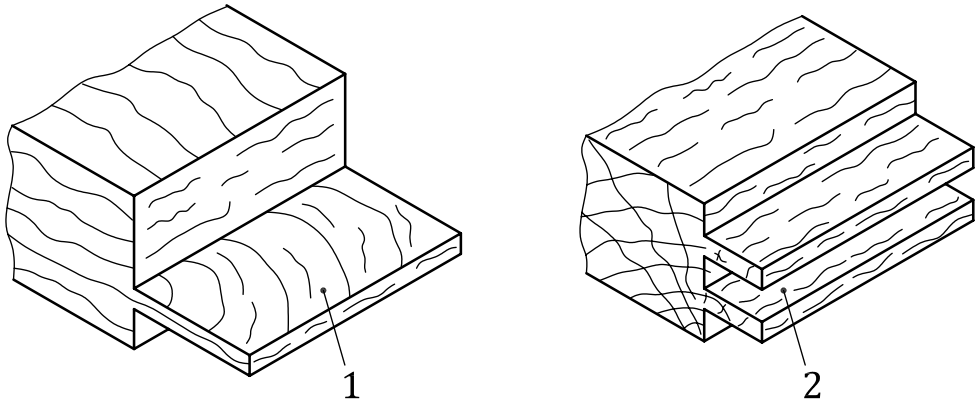


**Figure 3 — Example of curved work**

**3.5**
**tenoning**
machining of tenons and slots at the end of a workpiece to facilitate the joining of workpieces

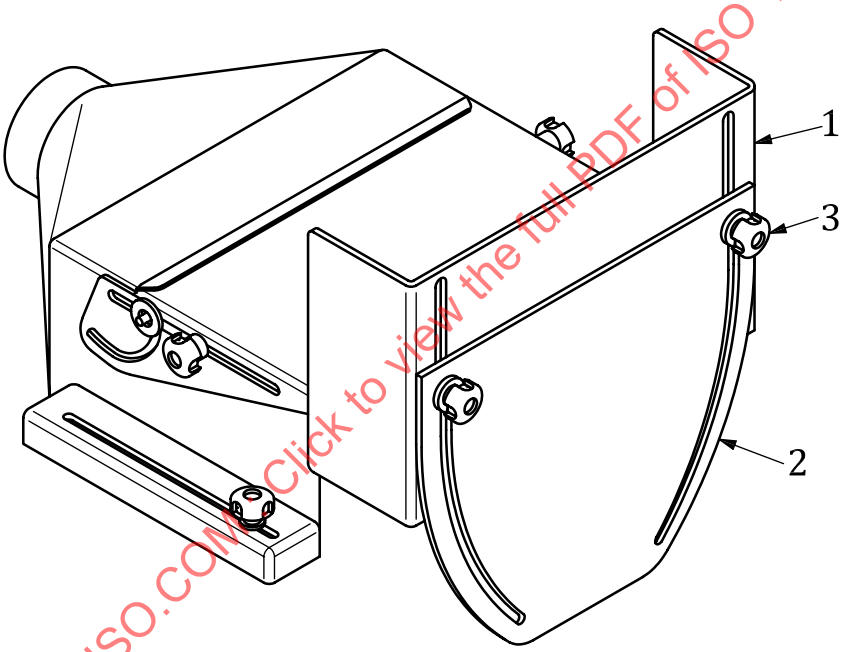
Note 1 to entry: See Figures 1 c), 4 and 5.




**Key**

1 tenon
2 slot

**Figure 4 — Example of a workpiece with tenon/slot**




**Key**

1 manually adjustable guard
2 self-adjusting guard
3 device with double function: to adjust part no. 1 and to guide part no. 2

**Figure 5 — Example of a tool safeguard for tenoning with manually and automatically adjustable guards**

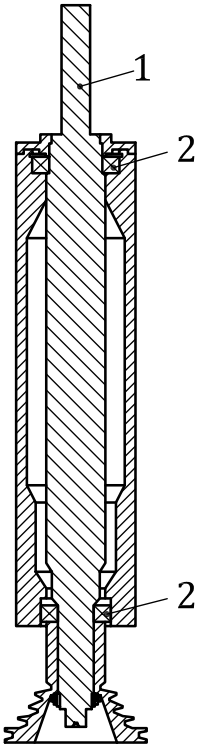


### 3.6
### glass bead saw unit
work unit fitted with a saw blade to cut out a glass bead from the machined profile of the workpiece

Note 1 to entry: Example is given in Figure 13.

### 3.7
### single piece arbor
system where the arbor cannot be changed without dismounting the bearings

Note 1 to entry: See Figure 6.




**Key**

1 arbor

2 bearings

**Figure 6 — Examples of a single piece arbor**

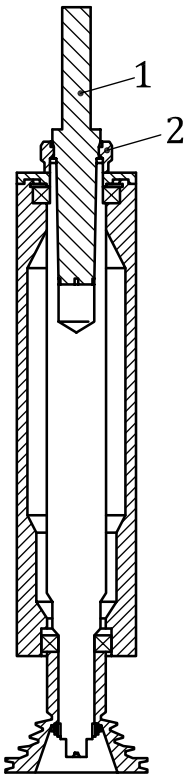
**3.8**
**interchangeable arbor**
arbor, connected to the drive spindle, which can be changed either with (removable arbor) or without (quick change arbor) the aid of a tool

Note 1 to entry: See Figures 7 a) and b).

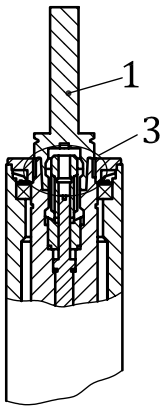
**3.9**
**quick tool/arbor change system**
system for quick change of the arbor or of shank mounted tools without the aid of a tool

Note 1 to entry: See Figure 7 b), Key 3.

Note 2 to entry: A pre-mounted combination of tool and arbor is called shank mounted tool (see EN 847-2:2017, Clause 1).




a) Removable arbor




b) Quick change arbor

**Key**

1 arbor
2 connecting device
3 quick tool/arbor change system

**Figure 7 — Examples of interchangeable arbors**

**3.10**
**initiation control**
control which after actuation enables providing power to specific machine actuators, for example, by a programmable logic control

# 4 Safety requirements and measures for controls

## 4.1 Safety and reliability of control systems

ISO 19085-1:2021, 4.1, applies with the following additions.

Annex B provides an informative summary table of performance levels (PL) specified in Clauses 4 and 5 for each safety function.

## 4.2 Control devices

ISO 19085-1:2021, 4.2, applies with the following additions.

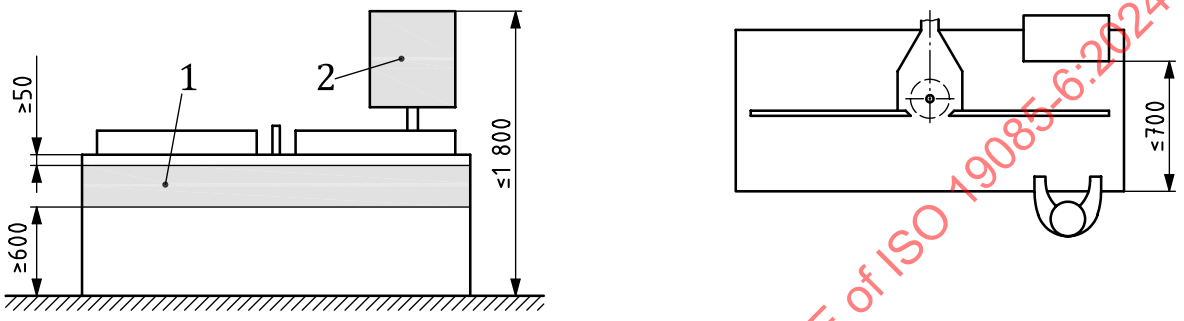
The main electrical control devices for start, normal stop, emergency stop (if required, see 4.4.4), spindle speed changing (see 4.7), direction of rotation (see 4.7.5) and arbor adjustment (see 4.14), shall be located as follows:

a) on the front side of the machine in the shaded area as shown in Figure 8 a) and at least 50 mm below the tabletop; or

b) on the front side of a fixed or movable control panel at a maximum distance of 700 mm from the front edge of the table [see Figure 8 b)].

Machines fitted with a side tenoning sliding table or a front extension table shall be provided with an additional emergency stop control device, which shall be located on the sliding table or its support.

Dimensions in millimetres




**a) Front view** **b) Top view**

**Key**

1 location area for controls

2 fixed or movable control panel

**Figure 8 — Position of controls**

Verification is done by checking the relevant drawings, circuit diagrams, measurements, and inspecting the machine.

## 4.3 Start

### 4.3.1 Direct start

ISO 19085-1:2021, 4.3.1, is replaced by the following text.

Before start of the machine, all relevant safeguards shall be in place and operational. This is achieved by the arrangements described in 5.6. Start shall only be possible by actuation of the start control device provided for that purpose. Unintended actuation shall be impeded, e.g. by a control device with shroud.

The demountable power feed unit may be started without arbor and glass bead saw unit running.

The SRP/CS for prevention of unexpected start shall achieve $PL_r$ = c.

The SRP/CS for interlocking of start with safeguards shall achieve $PL_r$ = c.

For electrically operated machines, IEC 60204-1:2016, 7.5 and 9.2.3.2, apply.

Verification is done by checking the relevant drawings, circuit diagrams, inspecting the machine and performing relevant functional testing of the machine.

### 4.3.2 Start via control power-on

ISO 19085-1:2021, 4.3.2, does not apply.

## 4.4 Safe stops

### 4.4.1 General

ISO 19085-1:2021, 4.4.1, applies with the following additions.

A socket shall be provided for the connection of a demountable power feed unit on machines with a table bore diameter greater than 190 mm. The electrical connection of this socket shall be such that actuation of the control device for normal stop, emergency stop will also cut power to the socket [see 7.3.2 f)].

### 4.4.2 Normal stop

ISO 19085-1:2021, 4.4.2, applies.

### 4.4.3 Operational stop

ISO 19085-1:2021, 4.4.3, does not apply.

### 4.4.4 Emergency stop

ISO 19085-1:2021, 4.4.4, applies.

## 4.5 Braking function of tools

ISO 19085-1:2021, 4.5, applies.

## 4.6 Mode selection

ISO 19085-1:2021, 4.6, does not apply.

## 4.7 Tool speed changing

### 4.7.1 Speed changing by shifting the belts on the pulleys

ISO 19085-1:2021, 4.7.1, applies.

### 4.7.2 Speed changing by incremental speed change motor

ISO 19085-1:2021, 4.7.2, applies.

### 4.7.3 Infinitely variable speed by frequency inverter

ISO 19085-1:2021, 4.7.3, applies.

### 4.7.4 Speed limiting device for tenoning

Subclause specific to this document.

Machines designed to be fitted with a sliding table for tenoning, which are capable of tool speeds higher than 4 800 $min^{-1}$, shall have a speed limiting device which will prevent the tool from rotating faster than 4 800 $min^{-1}$ while tenoning with tooling of a diameter greater than 275 mm. For example, for tool drives with frequency inverter this can be achieved by interlocking the guarding system described in 5.6.4.2 with the speed monitoring system described in 4.7.3.

The SRP/CS for the interlocking of the guarding system with the speed monitoring system shall achieve $PL_r$ = c.

Verification is done by checking the relevant drawings, circuit diagrams, inspecting the machine and performing relevant functional testing of the machine.

### 4.7.5 Changing the direction of tool rotation

Subclause specific to this document.

On machines equipped with a spindle which is capable of rotating in only one direction, the spindle shall always rotate in an anticlockwise direction when viewed from the top.

Where spindles are designed to run in two directions of rotation, the following requirements shall be met:

a) a selector of direction of rotation shall be fitted. For the position of this device, 4.2 applies;

b) a visible warning device shall inform the machine operator when the clockwise direction of rotation is selected;

c) the colour of the warning device shall be yellow; the visible warning device may be supplemented by an audible one;

d) start of the spindle rotation shall not be possible by the selector of the direction of rotation;

e) the selector of the direction of rotation shall be either

   1) a two-position selector fitted with a blocking device such that

      i) the “normal” position, without blocking, corresponds to the anticlockwise direction of rotation;

      ii) the “non-normal” position, with blocking, corresponds to the clockwise direction of rotation;

      iii) selection of the clockwise direction of rotation shall only be possible after manual override of the blocking device;

      iv) the selector of direction of rotation shall indicate the selected direction of rotation and be actuated in consistency with it;

   2) a three-position selector, with one neutral position and without blocking device for selection of clockwise direction. When the spindle has been started in the clockwise direction of rotation, the selector shall automatically return to its neutral position; or

   3) a combination of manually operated push buttons such that

      i) the anticlockwise direction of rotation is started by the start button of the spindle drive; and

      ii) the clockwise direction of rotation is started by the start button of the spindle drive together with an initiation control device (e.g. push button), which is positioned so that both hands are necessary for starting the spindle drive.

The SRP/CS for indication of the selected clockwise direction does not need to achieve any $PL_r$.

The SRP/CS for selection of the direction of rotation shall achieve $PL_r$ = b.

The SRP/CS for initiation control shall achieve $PL_r$ = b.

See also 7.3.2 f) 4) i).

Verification is done by checking the relevant drawings, circuit diagrams, inspecting the machine and performing relevant functional testing of the machine.

## 4.8 Failure of any power supply

ISO 19085-1:2021, 4.8, applies.

### 4.9 Manual reset control

ISO 19085-1:2021, 4.9, does not apply.

### 4.10 Standstill detection and monitoring

ISO 19085-1:2021, 4.10, does not apply.

### 4.11 Machine moving parts speed monitoring

ISO 19085-1:2021, 4.11, applies.

### 4.12 Time delay

ISO 19085-1:2021, 4.12, applies.

### 4.13 Teleservice

ISO 19085-1:2021, 4.13, applies.

### 4.14 Power-driven adjustment of arbor, demountable power feed unit, fences and table insert

Subclause specific to this document.

Power-driven movements for adjusting the arbor in height and inclination, the demountable power feed unit in height and horizontally, and the fences and the table insert, shall only be possible under pre-set electronic control after actuation of an initiation control device or by hold-to-run control.

The SRP/CS for initiation control shall achieve $PL_r$ = c.

The surface of any part of the machine that can be touched by the tool in any position (i.e. adjustable table insert, fence plates and table rings) shall be made of easily machinable material with a thickness of at least 5 mm (see ISO 19085-1:2021, 3.3). Alternatively, damage through collision shall be prevented by either of the two following measures.

a) Limit the speed to 10 mm/s for linear and 5°/s for rotational movements under hold-to-run control [see also 7.3.2 f) 2) vi)].

   For speed monitoring; no PL is required.

b) Maintain a minimum distance of 5 mm between edges of the tool and any part of the machine during adjustment and after stopping adjustment. Further movements shall be possible only under hold-to-run control, and their maximum speed shall be limited to 2 mm/s for linear and 1°/s for rotational movements.

   For speed monitoring and for detection of the position of the tool in relation with any part of the machine that can touch the tool no PL is required.

Where power-driven movements are controlled by hold-to-run control, not more than one power-driven movement at a time shall be possible. The SRP/CS for limitation of concurrent movements under hold-to-run control shall achieve $PL_r$ = b.

Arbor inclination shall only be possible with the spindle drive being stopped. The SRP/CS for the interlocking of arbor inclination with spindle drive shall achieve $PL_r$ = c.

Spindle rotation is allowed during power-driven arbor height adjustments.

Unexpected start of power-operated movements under pre-set electronic control shall be prevented after the pre-set position has been reached. The SRP/CS for prevention of unexpected start shall achieve $PL_r$ = c. This can be achieved, for example, by the following measure: after actuation of the initiation control for

power-operated movements under pre-set electronic control, a time delay device shall cut power to the actuators with a time delay set to the maximum possible adjustment time.

The SRP/CS for power cut-off by time delay shall achieve $PL_r$ = c.

Verification is done by checking the relevant drawings, circuit diagrams, inspecting the machine and performing relevant functional testing of the machine.

# 5 Safety requirements and measures for protection against mechanical hazards

## 5.1 Stability

ISO 19085-1:2021, 5.1, applies with the following additions.

A stability test shall be carried out in accordance with Annex C.

## 5.2 Risk of break-up during operation

ISO 19085-1:2021, 5.2, applies with the following additions.

As an exception to ISO 19085-1:2021, 5.2, paragraph 2, second sentence, table rings, the part of table insert not close to the tool (see Figure 17, Key 1) and the part of the machine housing, which can come in contact with the tool during adjustments, may also be made of cast-iron if these adjustments are manual or power-driven under hold-to-run control (see 4.14).

## 5.3 Tool and tool fixing design

### 5.3.1 General

ISO 19085-1:2021, 5.3.1, applies with the following additions.

The tool arbor shall not allow direct mounting of cutting knives.

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

For each arbor provided, the maximum allowed spindle speed for dedicated tools shall be calculated and provided (see Annex G for the variables to be considered and for calculation examples).

NOTE The maximum spindle speed of interchangeable arbors and arbors with quick tool/arbor change system is also influenced by their fixing/clamping system.

Maximum usable lengths for arbors and maximum tool diameters are given in Table 1.

**Table 1 — Maximum usable dimensions**

Dimensions in millimetres

| Arbor diameter [a] $d_1$ | Maximum useable length of arbor from the shoulder [a] $l_1$ | Maximum tool diameter [a] $d_2$ | |
|---|---|---|---|
| | | Shaping | Tenoning |
| 19,05 ≤ $d$ < 30 | 125 | 210 | not possible |
| 30 ≤ $d$ < 40 | 140 | 250 | 300 |
| 40 ≤ $d$ < 50 | 180 | 250 | 350 |
| 50 | 220 | 275 | 400 |

[a] See Figure G.1.

NOTE 19,05 mm is the metric equivalent for ¾".

The arbor for bore mounted tools shall be fitted with a tool fixing device which shall prevent relative movements between the ring and the arbor (see Figure 9), such as one of the following solutions:

a) a locknut with an integral arbor ring [see Figure 9 a)],

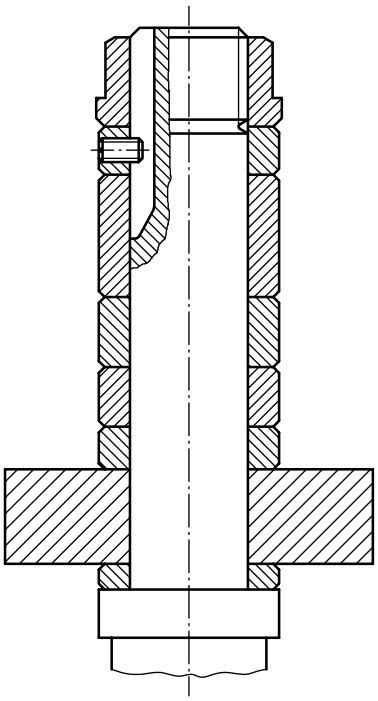
b) an arbor screw with an integral arbor ring,

c) an arbor screw with a separate arbor ring designed so that clamping is not possible without this ring [see Figure 9 b)].

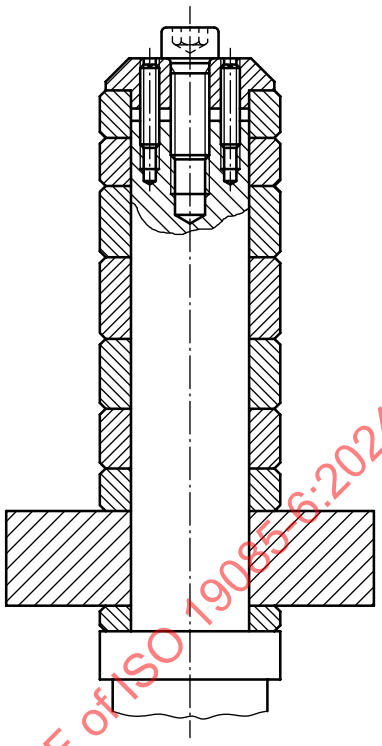
For machines designed to use shank mounted tools, the clamping unit shall provide a minimum clamping length in accordance with EN 847-2:2017, Table 2.

The system for shank clamping shall be capable of clamping shanks with different diameters, for example, by changing the clamping inserts [see Figure 9 c) and d)].

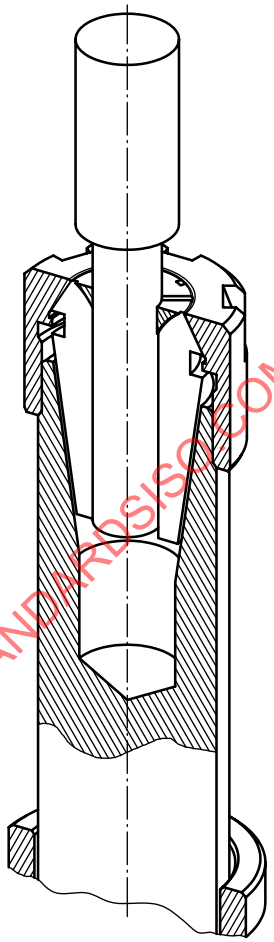
Verification is done by checking the relevant drawings, inspecting the machine and measurement.



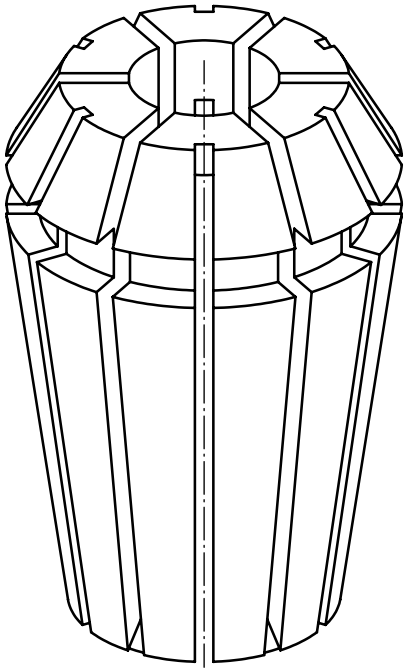
a) Example of an arbor nut



b) Example of an arbor screw



c) Example of an arbor for shank mounted tool



d) Clamping insert (collet) for shank mounted tool

**Figure 9 — Examples of tool fixing devices**

### 5.3.2 Spindle locking

ISO 19085-1:2021, 5.3.2, is replaced by the following text.

If it is necessary to hold the spindle stationary (e.g. for tool changing), a spindle locking device (e.g. blocking bar or fork) shall be provided as follows:

a) machines with a table bore diameter ≥190 mm shall have an integral locking device;

b) machines with a table bore diameter <190 mm shall have an integral or non-integral locking device.

Verification is done by checking the relevant drawings, measurement, inspecting the machine and performing relevant functional testing of the machine.

### 5.3.3 Circular saw blade fixing device

ISO 19085-1:2021, 5.3.3, applies with the following additions.

For fixing a glass bead saw blade, a two-parted flange (or, in the case of flush mounted saw blade, a single flange) shall be provided.

Verification is done by checking the relevant drawings and inspecting the machine.

### 5.3.4 Flange dimension for circular saw blades

ISO 19085-1:2021, 5.3.4, is replaced by the following text.

The outer clamping diameter of the flanges for the glass bead saw blade shall be at least $D/6$, where $D$ is the diameter of the largest circular saw blade for which the machine is designed.

Verification is done by checking the relevant drawings, measurement, inspecting the machine and performing relevant functional testing of the machine.

### 5.3.5 Arbor rings

Subclause specific to this document.

The machine shall be equipped with a set of arbor rings having a minimum wall thickness of 7,5 mm and a tolerance of H7 on their internal diameter. The arbor rings shall be capable of covering the whole useable length of the arbor. Arbors designed for use with shank mounted tools only are not required to be equipped with a set of arbor rings.

Arbor rings shall be manufactured from steel having an ultimate tensile strength of at least 580 N $mm^{-2}$.

The arbor ring set shall be subjected to an axial run-out test. The axial run-out shall not exceed 0,1 mm, when measured on the test disc at a diameter of 100 mm with the arbor ring set assembled using the same torque for tool mounting (see Figure 10).

The permissible deviation of the run-out of the test disc shall not exceed 0,01 mm.

Verification is done by checking the relevant drawings, measurements (see Figure 10) and inspecting the machine.

### 5.3.6 Quick tool/arbor change system

Subclause specific to this document.

Tool/arbor release shall only be possible if the spindle is stopped and restart is prevented.

The SRP/CS for interlocking between tool/arbor release and the spindle drive shall achieve $PL_r$ = c.

See also 7.3.2 k).

Verification is done by checking the relevant drawings, circuits diagrams, inspecting the machine and performing relevant functional testing of the machine.

### 5.3.7 Manual adjustment of arbor height

Subclause specific to this document.

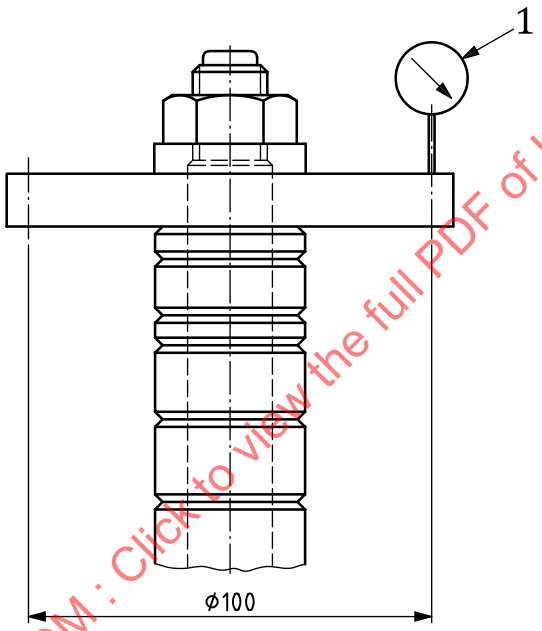
For machines where the arbor is manually adjustable in height, the adjustment device shall be a self-locking system. The machine shall be equipped with an indicator to show incremental vertical movement of the arbor.

With the arbor set in a vertical position and a force of 300 N applied vertically downwards on its exposed end, the change in arbor height shall be less than 0,5 mm.

See also 7.3.2 h).

Verification is done by checking the relevant drawings, inspecting the machine and measurement.

Dimensions in millimetres




**Key**

1 dial gauge

**Figure 10 — Arbor ring set, axial run-out test configuration**

### 5.3.8 Manual adjustment of arbor inclination

Subclause specific to this document.

Where the arbor is capable of being manually inclined, the machine shall be equipped with an indicator to show the degree of inclination. The adjustment device shall be self-locking.

With the arbor set in a vertical position and a force of 300 N applied at its exposed end, in horizontal direction and in the plane perpendicular to the axis of the inclination movement, the inclination of the arbor shall not exceed 1°.

Verification is done by checking the relevant drawings, measurement and inspecting the machine.

## 5.4 Braking

### 5.4.1 Braking of tools

ISO 19085-1:2021, 5.4.1, applies with the following additions.

A braking test shall be carried out in accordance with Annex D.

### 5.4.2 Maximum run-down time

ISO 19085-1:2021, 5.4.2, applies.

### 5.4.3 Brake release

ISO 19085-1:2021, 5.4.3, applies.

## 5.5 Safeguards

### 5.5.1 Fixed guards

ISO 19085-1:2021, 5.5.1, applies.

### 5.5.2 Interlocking movable guards

#### 5.5.2.1 General

ISO 19085-1:2021, 5.5.2.1, applies with the following additions.

Additional measures according to ISO 14119:2013, 7.2 are not required.

NOTE The motivation to defeat the interlocking devices in reasonably foreseeable manner does not exist.

#### 5.5.2.2 Movable guards with interlocking

ISO 19085-1:2021, 5.5.2.2, applies.

#### 5.5.2.3 Movable guards with interlocking and guard locking

ISO 19085-1:2021, 5.5.2.3, does not apply.

### 5.5.3 Hold-to-run control

ISO 19085-1:2021, 5.5.3, applies.

### 5.5.4 Two-hand control

ISO 19085-1:2021, 5.5.4, applies.

### 5.5.5 Electro-sensitive protective equipment (ESPE)

ISO 19085-1:2021, 5.5.5, does not apply.

### 5.5.6 Pressure-sensitive protective equipment (PSPE)

ISO 19085-1:2021, 5.5.6, does not apply.

### 5.5.7 Enabling control

ISO 19085-1:2021, 5.5.7, does not apply.

## 5.6 Prevention of access to hazardous moving parts

ISO 19085-1:2021, 5.6, is replaced by the following text, subdivided into further specific subclauses.

### 5.6.1 Access to the tool below the table

Access to the tool below the table shall be prevented by fixed guards, by movable guards with interlocking to the spindle drive.

Any slot in the machine frame required for the adjustment of the tool shall be designed in accordance with the safety distances in ISO 13857:2019, Table 4. As an exception, the safety distance from the frame surface to the tool in any position may be reduced to:

— 120 mm if the slot width does not exceed 30 mm, or

— 200 mm if the slot width does not exceed 35 mm, or

— 120 mm if the slot width does not exceed 35 mm and straight access to the tool is impeded, or

— 200 mm if the slot width does not exceed 45 mm and straight access to the tool is impeded.

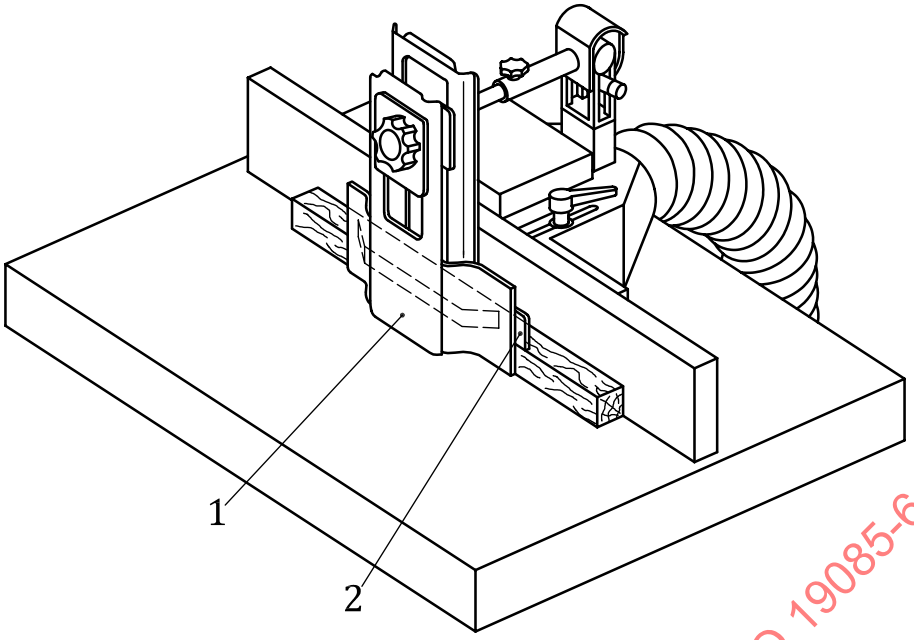
Verification is done by checking the relevant drawings, measurement, inspecting the machine and performing relevant functional testing of the machine.

### 5.6.2 Safeguarding for straight work

#### 5.6.2.1 Safeguarding the cutting area

The requirements of 5.10.2.2 shall be considered with the following additions.

Fence and table pressure pads shall be provided to keep the workpiece in contact with the table and the fence plates (see Figure 11) and to prevent unintended access to the tool (including shank mounted tool, if fitted).




**Key**

1 fence pressure pad

2 table pressure pad

**Figure 11 — Example of a pressure device**

The pressure pads and their support shall fulfil the following requirements:

a) the pressure pads shall be adjustable in height relative to the table and horizontally towards and away from the fence; all adjustments shall be capable of being carried out without the aid of a tool;

b) the fence pressure pad shall be parallel towards the fence plates and the table pressure pad shall be parallel towards the table;

c) the table pressure pad support shall be provided with a device which prevents the pressure pad, its support from falling by gravity onto the tool during adjustment;

d) the pressure pads shall be spring loaded to allow for limited variation in workpiece thickness;

e) the length of the pressure pads shall be greater than the maximum possible tool diameter and their positions shall allow to contact the workpiece before and after it contacts the tool;

f) the height of the fence pressure pad shall at least be equal to the minimum height required for the fence plates in accordance with 5.10.2.1;

g) the support of the pressure pads shall allow to move the pressure pads from their working position to a non-working position, where they are still connected to the machine but do not interfere with tool changing or the use of a de-mountable power feed unit; the support with the pressure pads shall be mechanically locked in the non-working position;

h) the pressure pads shall pass the rigidity test (see Clause H.2);

i) the support of the pressure pads shall not be fixed to the table between the fence plate and the front edge of the table;

j) the pressure pads shall be able to press a workpiece with a minimum section of 8 mm by 8 mm in the vertical and horizontal directions over the whole length specified in e);

k) the pressure pads shall be made from wood, wood based material, light alloy or plastic; the fixing components (e.g. screws) for the pressure pads shall be made from a material which is easily machinable (e.g. brass) if they can be touched by the tool;

l) the vertical adjustment range of the fence pressure pad shall be such that

   1) when adjusted to its lowest position the underside of the pressure pad shall be on the table surface, and

   2) when adjusted to its highest position the top surface of the pressure pad shall be at least at the same height as the top of the useable length of the arbor when the arbor is adjusted to its highest position;

m) the horizontal adjustment range of the fence pressure pad shall cover a distance of at least 160 mm from the arbor axis;

n) the workpiece shall not initially engage the pressure pads at same time during in-feeding: the horizontal distance between the first and second contact point of the pressure pad with the workpiece shall be greater than 10 mm;

o) the vertical adjustment of the table pressure pad shall be such that it is possible to machine workpieces of a height of at least

   1) 160 mm on machines with a table bore diameter ≤190 mm; and

   2) 250 mm on machines with a table bore diameter >190 mm.

For machines fitted with a glass bead saw unit, 5.6.5 applies.

Verification is done by checking the relevant drawings, measurement, inspection of the machine, performing the rigidity test of Annex H and relevant functional testing of the machine.

#### 5.6.2.2 Safeguarding the non-cutting area

Access to the tool at the rear of the fence plates shall be prevented by means of a fixed guard in combination with a hinged cover which does not require interlocking and which shall be positively locked in the closed position during normal operation and can be opened without the aid of a tool for tool changing.

NOTE Prevention of an unexpected start during tool change by interlocking of the hinged cover is not required since the operator has the start device under their full control.

The requirements of 6.12 apply to the guard.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

### 5.6.3 Safeguarding for curved work

**5.6.3.1** Access to the non-cutting part of the tool during operation shall be prevented by an adjustable guard [see Figure 1 b), Key 11] which shall fulfil the following requirements:

a) it shall be able to be fixed in a position relative to the table;

b) it shall be adjustable without the aid of a tool;

c) it shall encompass the largest tool for which the steady or ball ring guide is designed;

d) the adjustment range shall include all possible tool positions with respect to the table;

e) it shall be fitted with the supporting system for the workpiece guiding device required in 5.10.3;

f) it shall be fitted with an adjustable hand protector to prevent access to the non-cutting part of the tool from the front;

g) it shall support the chip exhaust outlet (also see 6.3).

**5.6.3.2** The hand protector shall be in accordance with the following requirements:

a) it shall be adjustable in height from the table surface up to the maximum height of the workpiece for which the machine is designed (see 7.3.1);

b) after adjustment it shall remain parallel to the table within 0,5 mm over a length of 100 mm;

c) the adjustment shall be possible without the aid of a tool; and

d) the hand protector shall pass the rigidity test specified in Clause H.3.

The hand protector may also allow for pressure on the workpiece during machining.

**5.6.3.3** Verification is done by checking the relevant drawings, measurements, inspecting the machine, and performing the rigidity test in Annex H and relevant functional testing of the machine.

### 5.6.4 Safeguarding for tenoning

#### 5.6.4.1 General

If the machine is fitted with a tenoning or a front sliding table, it shall be equipped with a device that allows locking of the sliding table in any position, for example, with a device with a non-positive connection.

Verification is done by checking the relevant drawings and inspecting the machine.

#### 5.6.4.2 Safeguarding the cutting area

Access to the tool from the front side shall be impeded either by

a) adjustable guards (i.e. two guards linked together or independently adjustable) mounted on the sliding table which impede access to the tool from the side of the workpiece [see Figure 1 c), Key 19] and by an adjustable guard mounted on the fixed guard described in 5.6.2.2 [see Figure 1 c), Key 16]; or

b) an adjustable guard [see Figure 5, Key 1] and by a self-adjusting guard [see Figure 5, Key 2], both mounted on the fixed guard described in 5.6.2.2.

These guards shall fulfil the requirements of 5.9.2.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

#### 5.6.4.3 Safeguarding the non-cutting area

Access to the tool shall be impeded by means of a fixed guard in combination with a hinged cover which does not require interlocking and which shall be positively locked in a closed position during normal operation and can be opened without aid of a tool for tool changing. [see Figure 1 c)]. These guards shall be in accordance with the following requirements:

a) they shall be horizontally adjustable at right angles to the direction of the feed;

b) they shall encompass the largest tool, in accordance with Table 1, for which the machine is designed at all possible arbor heights;

c) they shall be fitted with an adjustable guard which impedes the access to the tool from above and the sides [see Figure 1 c), Key 16];

d) all adjustments shall be possible without the aid of a tool;

e) the requirements of 6.12 apply.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

#### 5.6.5 Safeguarding the glass bead saw blade

On machines fitted with a glass bead saw unit, access to the non-cutting area of the saw blade shall be prevented by a fixed guard.

In addition, a guard self-adjusting to the lowest position shall impede the direct horizontal access to the saw blade in a direction perpendicular to the saw blade plane.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

#### 5.6.6 Guarding of drives

A movable guard interlocked to the tool drive shall be provided if access is required for changing the tool's rotational speed by changing the belt position.

Access to the tool drive (i.e. belt) through the slots in the machine frame required for the adjustment of the tool and for dust extraction pipes shall be impeded, but the requirements of ISO 13857:2019 on fixed guards and distance guards do not apply.

Verification is done by checking the relevant drawings, inspection of the machine and relevant functional testing of the machine.

### 5.7 Impact hazard

ISO 19085-1:2021, 5.7, does not apply.

### 5.8 Clamping devices

ISO 19085-1:2021, 5.8, applies with the following additions.

The sliding table for tenoning shall be fitted with a workpiece clamping device [e.g. Figure 1 c), Key 15].

The full clamping force of each clamping unit shall be at least 700 N over the whole range of adjustment of the clamping device.

Where pneumatic clamping is provided, 6.7 applies.

Verification is done by checking the relevant drawings, measurement, inspecting the machine and performing relevant functional testing of the machine.

### 5.9 Measures against ejection

#### 5.9.1 General

ISO 19085-1:2021, 5.9.1, applies.

#### 5.9.2 Guards materials and characteristics

##### 5.9.2.1 Choice of class of guards

ISO 19085-1:2021, 5.9.2.1, applies with the following additions.

Guards used to prevent ejection shall be of class B.

An impact test for guards shall be carried out in accordance with Annex E.

##### 5.9.2.2 Guards of class A

ISO 19085-1:2021, 5.9.2.2, does not apply.

#### 5.9.2.3 Guards of class B

ISO 19085-1:2021, 5.9.2.3, applies.

### 5.9.3 Anti-kickback devices

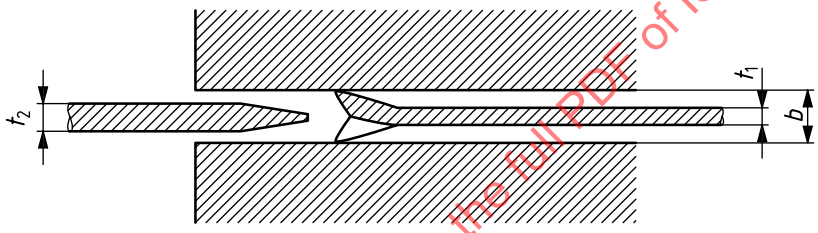
Subclause specific to this document.

Provision shall be made for the fixing (e.g. fixing holes or "T" slots) of anti-kickback devices (e.g. adjustable end stops) to the fence plates or to the extension table. "T" slots shall be parallel to the direction of feed and fixing holes shall not exceed 12 mm in diameter.

The anti-kickback device shall not deflect more than 2 mm under a static force of 300 N applied in the direction of kickback. The position of the anti-kickback device shall be continuously adjustable on both sides of the arbor up to a distance equal to twice the fence plate length.

When fitted with a glass bead saw unit (see Figure 13), the machine shall be equipped with the following.

a) A bead ledge separator. It shall be manufactured from steel with an ultimate tensile strength of 580 N mm$^{-2}$ or of a comparable material, have flat sides (within 0,1 mm per 100 mm) and shall have a thickness $t_2$ less than the width of cut $b$ (kerf) and at least 0,2 mm greater than the thickness of the saw blade plate $t_1$ (see Figure 12).




**Key**

$b$ width of the cut

$t_1$ thickness of the saw blade plate

$t_2$ bead ledge separator thickness

**Figure 12 — Bead ledge separator thickness in relation to saw blade dimensions**

b) A device to guide the bead ledge, for example a guiding channel (see Figure 13, Key 5).

c) A pressure device located between the saw blade and the anti-kickback finger (see Figure 13, Key 4).

d) A device to avoid or minimize the risk of kickback of the bead ledge, for example, an anti-kickback finger (see Figure 13, Key 3). If an anti-kickback finger is fitted, it shall be designed in accordance with the following requirements.

   1) It shall be located after the glass bead saw blade in the direction of the feed.

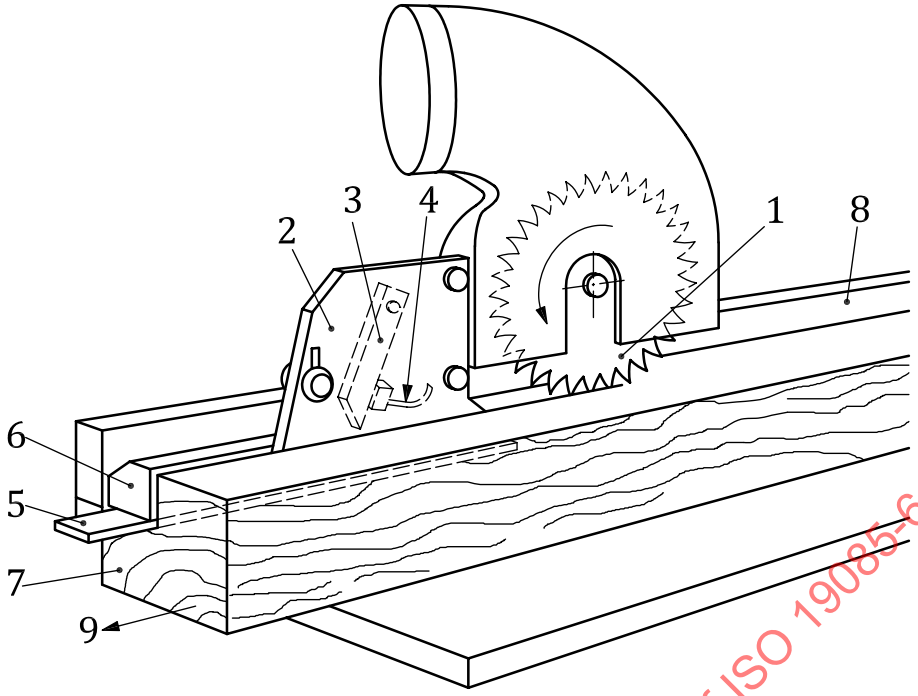
   2) It shall be made from steel with an ultimate tensile strength of 350 N mm$^{-2}$ or of a comparable material.

   3) It shall have a lower tip with a maximum radius of 0,5 mm.

   4) The angle of the tip shall be between 30° and 60° (see Figure 14).

   5) It shall be effective over the full cutting height capacity of the glass bed saw unit. Effective operation shall be between 85° and 55°, this angle being measured between a line from the tip to the axis of pivot of the fingers and the horizontal (see Figure 14).

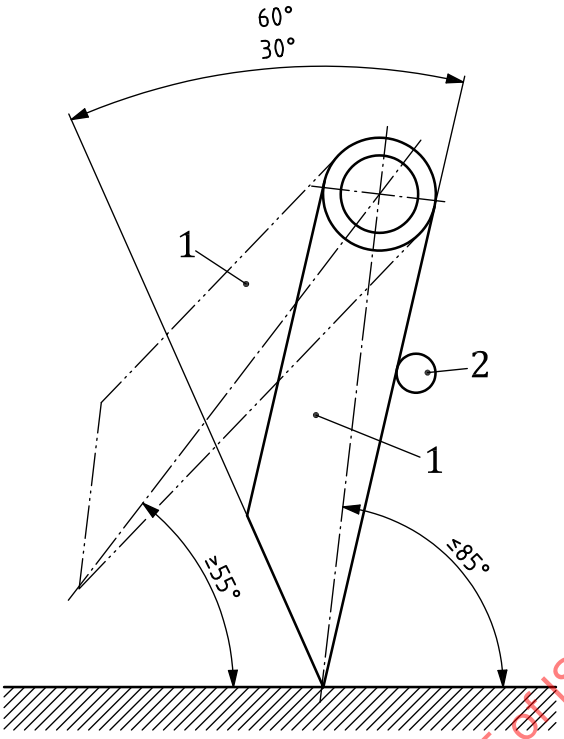
   6) A mechanical stop shall be provided to prevent the anti-kickback finger moving beyond the 85° point (see Figure 14).




**Key**

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

**Figure 13 — Example of a glass bead saw unit**




**Key**

1 anti-kickback finger
2 mechanical end stop

**Figure 14 — Example of an anti-kickback finger**

Verification is done by checking the relevant drawings, measurement, inspecting the machine and performing relevant functional testing of the machine.

## 5.10 Workpiece supports and guides

ISO 19085-1:2021, 5.10, is replaced by the following text, subdivided into further specific subclauses.

### 5.10.1 Machine table

#### 5.10.1.1 General

The machine table shall not be tiltable.

Fixing holes shall be provided on both sides of the table for fixing the extension table [see Figure 1 a), Key 20] to the machine table.

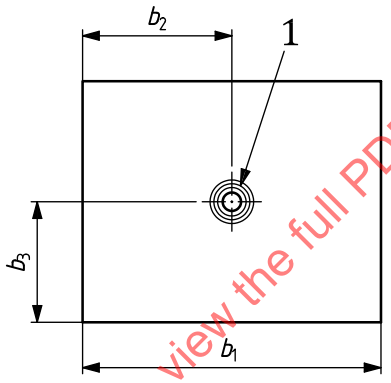
Table dimensions shall vary with the table bore diameter in accordance with Table 2 (see Figures 15 and 16).

**Table 2 — Size of the table and table rings**

Dimensions in millimetres

| | | Table bore diameter $D$ | |
|---|---|---|---|
| | | ≤190 | >190 |
| Size of the table | $b_1$ | ≥600 | ≥1 000 |
| | $b_2$ | $250 < b_2 \leq b_1/2$ | $450 < b_2 \leq b_1/2$ |
| | $b_3$[a] | 250 – 550 | |
| Ranges of internal diameter for table rings | $d_1$ | 65 to 75 | 65 to 75 |
| | $d_2$ | 105 to 115 | 105 to 115 |
| | $d_3$ | 145 to 160 | 145 to 160 |
| | $d_4$ | — | 200 to 225 |

[a] Dimension $b_3$ extends from the arbor axis to the front edge of the fixed table, or, if provided, to the front edge of an integral sliding table at the same level of the fixed table.




**Key**

1 table bore
$b_1$ total width of the table
$b_2$ left side width of the table
$b_3$ front side depth of the table

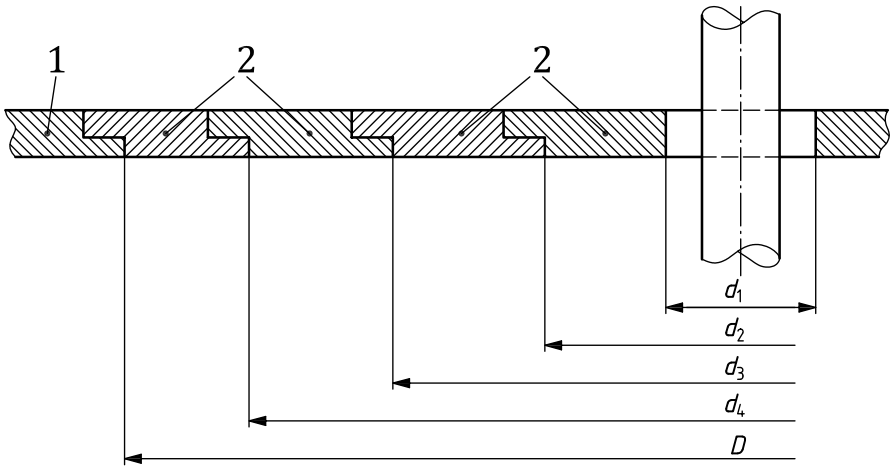
**Figure 15 — Table dimensions**

Verification is done by checking the relevant drawings, measurement and inspecting the machine.

#### 5.10.1.2 Safeguarding the space between the table and arbor

Space between the table and arbor shall be safeguarded either with table rings or an adjustable table insert.

Where the table is equipped with a set of table rings for table bore diameter $D \leq 300$ mm, their internal diameters shall be as shown in Table 2 (see Figure 16).




**Key**

| | | | |
|---|---|---|---|
| 1 | table | $d_1$ to $d_4$ | table ring internal diameters |
| 2 | table rings | $D$ | table bore diameter |

**Figure 16 — Table rings**

For table bore diameters greater than 300 mm, a fifth table ring shall be provided.

Where the table is equipped with an adjustable table insert (see Figure 17), the following requirements shall be met.

a) The side of the adjustable table insert closer to the tool shall be made of easily machinable material, for example light alloy, with a thickness of at least 5 mm.

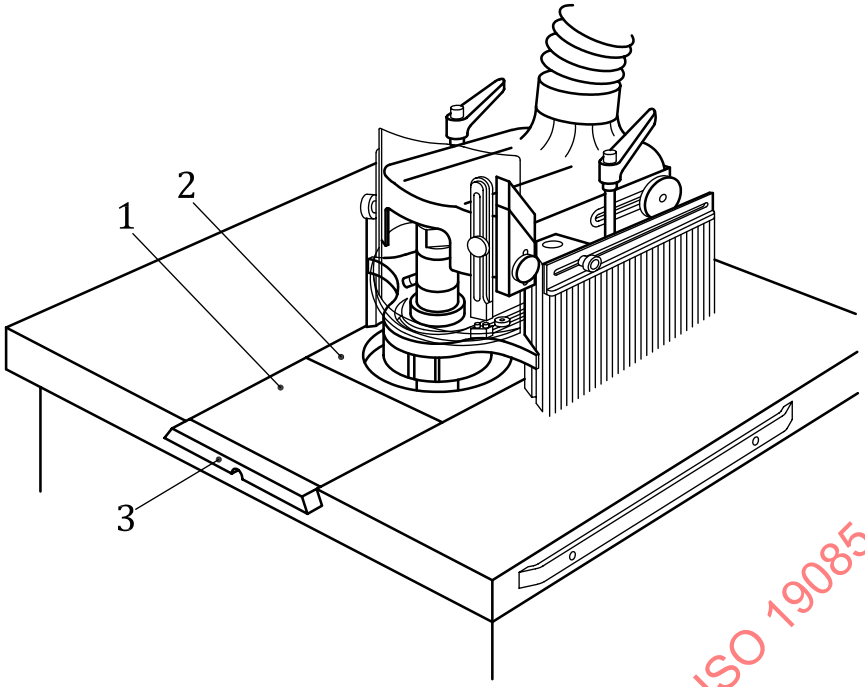
b) The side of the adjustable table insert closer to the tool shall be profiled to allow, when completely retracted, the use of the profiling tool with the greatest diameter, +5 mm, for which the machine is designed. In the advance position, the distance between the adjustable table insert and the axis of the arbor shall be ≤50 mm.

c) Power-driven adjustment of the table insert towards the tool under pre-set electronic control shall only be possible with the fence plates in their widest opening positions.

   The SRP/CS for the interlocking of the power-driven adjustment under pre-set electronic control and the fence plate widest open positions shall achieve $PL_r$ = b.

d) The section of the adjustable table insert which protrudes over the front table edge when the insert is in its widest open position shall be made of soft material like rubber with hardness between 60 and 70 Shore-A (see Figure 17, Key 3).

For power-driven adjustment of the adjustable table insert, 4.14 applies.




**Key**

1 adjustable table insert
2 easily machinable part of the table insert
3 soft material part of the table insert

**Figure 17 — Example of an adjustable table insert**

Verification is done by checking the relevant drawings, inspecting the machine, measurement and performing relevant functional testing of the machine.

### 5.10.2 Workpiece guiding for straight work

#### 5.10.2.1 General

For vertical stability of the workpiece the machine shall be equipped with two fence plates, which shall

a) have a minimum height of
   1) 120 mm for table bore diameters ≤190 mm, and
   2) 150 mm for table bore diameters >190 mm, and
b) have a minimum length for each plate of
   1) 300 mm for table bore diameters ≤190 mm, and
   2) 450 mm for table bore diameters >190 mm.

Further devices for guiding the workpiece are described in 5.6.2.1.

Verification is done by checking the relevant drawings, inspecting the machine and measurement.

#### 5.10.2.2 Fence adjustment

The fence assembly shall be capable of being fixed to the table and shall be adjustable to take account of the tool diameter and the position of the arbor.

When transverse adjustments to the feed direction are provided, the fence plates shall remain integral with their supports.

The transverse adjustment of the fence plates shall allow any opening for the tool to be reduced to a minimum. The fence plates shall either be fitted with a device to ensure continuity between them or shall be equipped with fixing arrangements which permit such a device (e.g. a false fence) to be fitted.

A fine adjustment control for transverse movement of one of the fences, with respect to the other, shall be provided.

When moved using this control, the movable fence plate shall remain parallel to the fixed fence plate and the method for its re-alignment shall be described [see 7.3.2 l)].

The part of the fence plate which can be touched by the tool shall be made of light alloy, plastic, wood or wood-based material.

All adjustments, except those to fix and adjust the device for ensuring continuity between the fence plates, shall be capable of being made without the aid of a tool.

Where power-driven adjustment of the fence is provided, the requirements of 4.14 shall be met.

The devices for fine adjustment of transverse movement and for all power-driven adjustments shall be self-locking.

Verification is done by checking the relevant drawings, circuit diagrams, measurement, inspecting the machine and performing relevant functional testing of the machine.

### 5.10.3 Workpiece guiding for curved work

**5.10.3.1** A workpiece guiding device suitable for curved work shall be provided (see Figure 18). This shall be either a guiding steady (ring guide) or a lead-in device which allows the use of a ball ring guide.

**5.10.3.2** The guiding steady shall meet the following requirements:

a) its shape or adjustment shall allow for progressive penetration of the tool into the workpiece;

b) it shall support and guide the workpiece during machining;

c) it shall have the tangential point where the depth of cut is measured clearly marked;

d) it shall pass the rigidity test in accordance with Annex H (see H.3.2);

e) its adjustment range shall consider all possible positions of the tool with respect to the table;

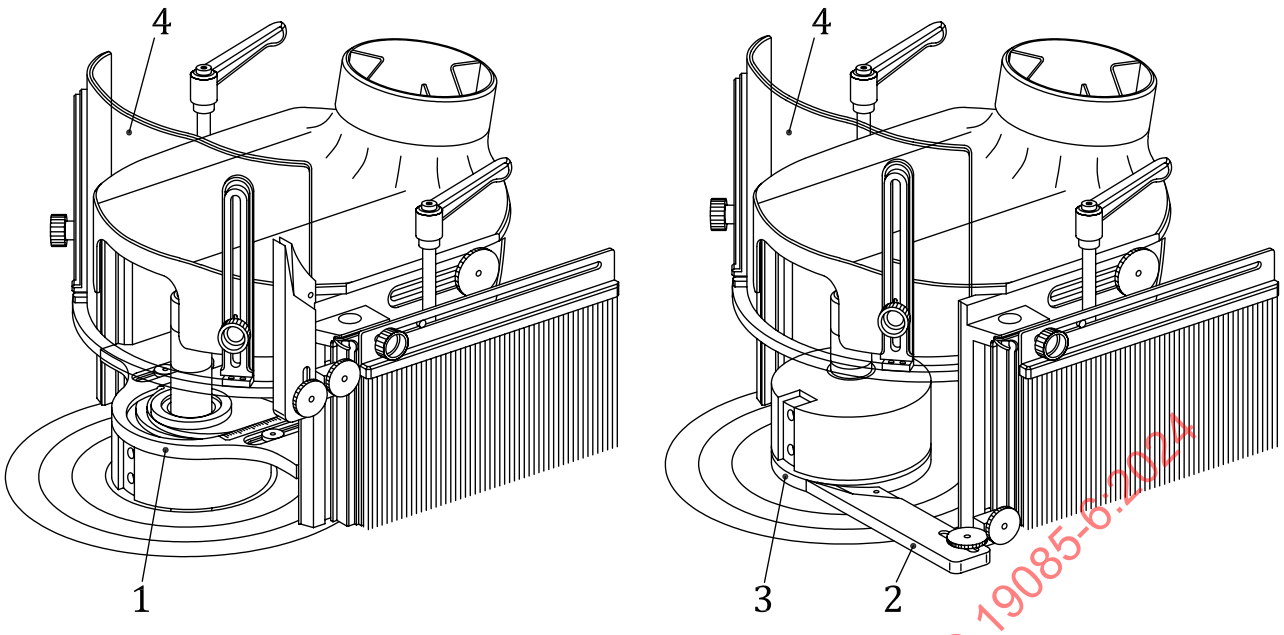
f) it shall remain parallel to the table within 0,5 mm over a length of 100 mm after adjustment.

**5.10.3.3** The lead-in device shall meet the following requirements:

a) it shall allow progressive feed of the workpiece to the tool;

b) where the machine has two directions of spindle rotation, it shall be designed to allow for its use whichever direction of rotation is selected; and

c) where the guard supporting device is designed to allow for the fixing of a guiding steady, and the lead-in device is also capable of being fixed to the supporting device, it shall be capable of being moved out of position while remaining integral with the workpiece guiding device to allow for the use of the guiding steady.




**Key**

1 guiding steady (ring guide)
2 lead-in device
3 ball ring guide
4 hand protector

**Figure 18 — Examples of curved work guiding devices**

**5.10.3.4** Verification is done by checking the relevant drawings, measurements, inspecting the machine, and performing the test in Annex H and relevant functional testing of the machine.

### 5.11 Safety appliances

Subclause specific to this document.

A push stick and a push block handle shall be provided.

Verification is done by checking the relevant drawings and inspecting the machine.

## 6 Safety requirements and measures for protection against other hazards

### 6.1 Fire

ISO 19085-1:2021, 6.1, applies with the following additions.

To avoid sparks caused by contact of the tools with the table insert, 4.14 and 5.10.1.2 apply, with the fence plates, 5.10.2.2 applies, and with the pressure pad, 5.6.2.1 applies.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

### 6.2 Noise

#### 6.2.1 Noise reduction at the design stage

ISO 19085-1:2021, 6.2.1, applies.

### 6.2.2 Noise emission measurement and declaration

ISO 19085-1:2021, 6.2.2, applies with the following additions.

Annex F specifies the noise test code for the machines.

Annex F shall be applied for noise test and declaration of single spindle vertical moulding machines.

## 6.3 Emission of chips and dust

ISO 19085-1:2021, 6.3, applies with the following additions.

The guarding systems for straight work, for tenoning, for curved work and for the glass bead saw unit shall incorporate a dust extraction outlet.

A dust extraction outlet shall be provided below the table for machines with a table bore greater than 190 mm.

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

A proper chips and dust extraction can be obtained with the recommended total air flow rates specified in Table 3.

**Table 3 — Relation between the table bore diameter and total air flow rate**

| Table bore diameter<br>mm | Minimum airflow<br>$m^3h^{-1}$ |
|---|---|
| ≤190 | 800 |
| >190 | 1 100 |

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

## 6.4 Electricity

ISO 19085-1:2021, 6.4, applies with the following additions.

Requirement related to RCD stated by IEC 60204-1:2016, 15.1, last indent, does not apply to the circuit supplying the socket dedicated to the connection of the demountable power feed unit (see also 7.2.2).

## 6.5 Ergonomics and handling

ISO 19085-1:2021, 6.5, applies with the following additions.

The height of the workpiece support shall be between 850 mm and 950 mm above the floor level.

Handles, levers and latches or mechanical units shall be reachable from the operator's position and not be located at the rear side of the machine.

Verification is done by checking the relevant drawings, inspecting the machine and performing relevant functional testing of the machine.

## 6.6 Lighting

ISO 19085-1:2021, 6.6, does not apply.

## 6.7 Pneumatics

ISO 19085-1:2021, 6.7, applies.

### 6.8 Hydraulics

ISO 19085-1:2021, 6.8, does not apply.

### 6.9 Electromagnetic compatibility

ISO 19085-1:2021, 6.9, applies.

### 6.10 Laser

ISO 19085-1:2021, 6.10, does not apply.

### 6.11 Static electricity

ISO 19085-1:2021, 6.11 applies.

### 6.12 Errors of fitting

ISO 19085-1:2021, 6.12, applies.

### 6.13 Isolation

ISO 19085-1:2021, 6.13, applies.

### 6.14 Maintenance

ISO 19085-1:2021, 6.14, applies.

### 6.15 Relevant but not significant hazards

ISO 19085-1:2021, 6.15, applies.

## 7 Information for use

### 7.1 Warning devices

ISO 19085-1:2021, 7.1, applies with the following additions.

A visible warning device shall inform the machine operator when the clockwise direction of rotation is selected.

### 7.2 Marking

#### 7.2.1 General

ISO 19085-1:2021, 7.2.1, applies.

#### 7.2.2 Additional markings

ISO 19085-1:2021, 7.2.2, applies with the following additions.

The maximum saw blade diameter and the direction of rotation shall be marked if the machine is fitted with a glass bead saw unit.

A warning label to close the hinged cover (see 5.6.2.2) before starting the spindle shall be provided.

A label close to the socket for connection of the demountable power feed unit, if any, clarifying that this socket shall be used only for this purpose.

Verification is done by checking the relevant drawings and inspecting the machine.

## 7.3 Instruction handbook

### 7.3.1 General

ISO 19085-1:2021, 7.3.1, applies.

### 7.3.2 Additional information

ISO 19085-1:2021, 7.3.2, applies with the following additions.

The following additional information shall also be provided in the instruction handbook, where relevant:

a) reasonably foreseeable misuse includes, for example, feeding small workpieces without safety appliance, mounting of a saw blade on the arbor instead of milling tools and feeding workpieces in the same direction as of the running tool (climb cutting);

b) only tools suitable for hand feed machines, conforming to EN 847-1:2017 and EN 847-2:2017 and marked MAN shall be used to reduce severity of injuries and kickback speed; shank mounted milling tools with cutting circle diameter lower than 16 mm may be used without restriction;

c) instruction on how to use all the additional safety appliances and optional equipment that can be fitted;

d) information about the relationship between the tool, workpiece and machine characteristics and appropriate rotational speeds of the spindle;

e) for machines provided with a device for moving (e.g. wheels and relevant supports), information, how transportation shall be handled and how to maintain stability of the machine before and during machining;

f) information that operators are adequately trained in the use, adjustment and operation of the machine including the correct use, connection instruction for a demountable power feed unit and positions to be taken by the operator. This includes in particular

   1) for training

      i) the principles of machine setting and operation including the correct use and adjustment of workpiece holding and guiding devices, guards and tool selection,

      ii) the safe handling of the workpiece when cutting,

      iii) the correct use and adjustment of safety appliances such as jigs, templates, extension tables and end stops, and

      iv) the use of personal protective equipment for ear and eye protection;

   2) before machine setting to

      i) ensure that the tools used are sharp, selected, maintained and adjusted in accordance with instructions given by the tool manufacturer,

      ii) use table rings or table insert to close the gap between the table and the arbor to a minimum,

      iii) use special equipment for setting, e.g. gauges where practicable,

      iv) take care when handling tools,

      v) ensure that, when using a demountable power feed unit, it is plugged into the socket provided for that purpose on the machine, and

vi) take care of possible collision of the tool with other parts of the machine before starting any adjustment movement;

3) for workpiece guiding the use of

i) a fence,

ii) a false fence wherever possible to minimize the gap between the tool and the fence plates,

iii) a push block or push stick to aid hand feeding or, wherever possible, a de-mountable power feed unit, and

iv) roller or extension tables to support long workpieces;

4) before machining to

i) fit the tooling to the machine to operate in the correct direction of rotation and to feed the workpiece to the tools against the direction of spindle rotation,

ii) ensure that the selected rotational speed is appropriate for the tooling being used,

iii) select and adjust the guards, especially to close the hinged cover (see 5.6.2.2) and to adjust the pressure pads, and

iv) because of the wide variety of work which can be undertaken on vertical spindle moulding machines, one type of guard cannot be considered effective for all conditions. Each operation should be considered separately, and the best practicable safeguard selected from the list below. The type of tool, cutting edge projection and the height at which the tool is set, will determine the minimum size of the hole in the table.

a) To prevent access to the tool during straight work, it is necessary to use, in conjunction with the fence, either a de-mountable power feed unit or fence and table pressure pads equipped with special shoes depending upon the workpiece dimensions.

b) To prevent access to the tool during stopped straight work, it is necessary to use, in conjunction with the fence, table and fence pressure pads equipped with special shoes depending upon the workpiece dimensions.

c) To prevent kickback, it is necessary to use back-, front-end stops fixed to the fence, to the table or to an extension table.

d) Unless the workpiece is large enough to provide a safe and adequate hand hold, the use of a jig is recommended.

e) For curved work, in addition to the use of a guiding steady (lead in device) and in conjunction with the adjustable guard (hand protector), a template is useful to prevent access to the tool.

f) For bevel cutting, in addition to the use of the fence and de-mountable power feed unit or pressure pads, it is important to ensure the firm support of the workpiece by using a special jig or adjustable canting fence in order to prevent access to the tool.

g) To feed the workpiece safely along the tool during tenoning, it is necessary to use the sliding table and enclosure provided by the manufacturer.

g) information that the cutting speed should be selected between 40 m $s^{-1}$ and 70 m $s^{-1}$ to reduce the risk of kickback;

h) precaution to be taken when lowering the tool under the table to avoid contact between the tool and any fixed part of the machine;

i) information that for machines equipped with adjustable table insert, the operator shall take care of possible crushing/shearing hazards between the workpiece and the protruding part of the table insert when the workpiece is fed with a demountable power feed unit;

j) information that for machines equipped with quick tool/arbor change system, the pull-in force of their clamping system shall be periodically checked by qualified personnel mandated by the manufacturer, including the intervals;

k) information that only tool holders conforming to EN 847-3:2013 shall be used when a quick tool change system is provided;

l) information on how to re-align the fence plates (see 5.10.2.2).

Verification is done by checking the instruction handbook and relevant drawings.

# Annex A
(informative)

# List of significant hazards

ISO 19085-1:2021, Annex A, is replaced by the following text.

Table A.1 lists all significant hazards, hazardous situations and events (see ISO 12100:2010), identified by risk assessment as significant for single spindle vertical moulding machine, and which require action to eliminate or reduce the risk.

**Table A.1 — List of significant hazards**

| No. | Hazards, hazardous situations and hazardous events | Subclause of ISO 12100:2010 | Subclause of this document |
|---|---|---|---|
| 1 | Mechanical hazards related to<br>a) machine parts or workpieces due to | | |
| | 1) shape | 6.2.2.1, 6.2.2.2, 6.3 | 5.3, 5.6, 5.10, 7.2, 7.3, 6.15 |
| | 2) relative location | | 4.2, 5.6, 6.5, 7.2 |
| | 3) mass and stability (potential energy of elements which may move under effect of gravity) | | 4.9 |
| | 4) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion) | | 4.8, 5.4, 5.6, 5.10 |
| | 5) mechanical strength | | 5.9 |
| | b) accumulation of energy inside the machinery due to liquids and gases under pressure | 6.2.10, 6.3.5.4 | 4.8, 6.7, 6.13 |
| 1.1 | Crushing hazard | | 4.14, 5.4, 5.6, 5.8, 5.10, 6.13 |
| 1.2 | Shearing hazard | | 4.14, 5.4, 5.6, 5.10, 6.13 |
| 1.3 | Cutting or severing hazard | | 4.3, 4.5, 4.8, 5.3, 5.4, 5.6, 6.13 |
| 1.4 | Entanglement hazard | | 4.4, 4.5, 5.6, 5.10, 6.13 |
| 1.5 | Drawing-in or trapping hazard | | 4.3, 4.4, 4.5, 5.4, 5.6, 5.10, 6.13 |
| 1.6 | Impact hazard | | 4.11, 5.10 |
| 1.9 | High pressure fluid injection or ejection hazard | | 5.9, 6.13 |
| 2 | Electrical hazards due to | | |
| 2.1 | Contact of persons with live parts (direct contact) | 6.2.9, 6.3.5.4 | 6.4, 6.13 |
| 2.2 | Contact of persons with parts which have become live under faulty conditions (indirect contact) | 6.2.9 | 6.4, 6.13 |
| 2.4 | Electrostatic phenomena | 6.2.9 | 6.11 |
| 4 | Hazards generated by noise, resulting in | | |
| 4.1 | Hearing loss (deafness), other physiological disorders (loss of balance, loss of awareness) | 6.2.2.2, 6.3 | 6.2, 7.1, 7.3 |
| 4.2 | Accidents due to interference with speech communication, acoustic signals | | |
| 7 | Hazards generated by materials and substances (and their constituent elements) processed or used by the machinery | | |
| 7.1 | Hazards from contact with or inhalation of harmful fluids and dusts | 6.2.3, 6.2.4 | 6.3, 7.3 |
| 7.2 | Fire hazard | 6.2.4 | 6.1 |
| 8 | Hazards generated by neglecting ergonomic principles in machinery design | | |

**Table A.1** *(continued)*

| No. | Hazards, hazardous situations and hazardous events | Subclause of ISO 12100:2010 | Subclause of this document |
|---|---|---|---|
| 8.1 | Unhealthy postures or excessive effort | 6.2.7, 6.2.8, 6.2.11.12, 6.3.5.5, 6.3.5.6 | 4.2, 6.5 |
| 8.2 | Hand-arm or foot-leg anatomy | 6.2.8.3 | 6.5 |
| 8.4 | Local lighting | 6.2.8.6 | 7.3 |
| 8.5 | Mental overload and underload, stress | 6.2.8.5 | 7.3 |
| 8.6 | Human error, human behaviour | 6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4 | 7.3 |
| 8.7 | Design, location or identification of manual controls | 6.2.8 f), 6.2.11.8 | 4.2 |
| 8.8 | Design or location of visual display units | 6.2.8, 6.4.2 | 4.2 |
| 9 | Combination of hazards | 6.3.2.1 | 4.3, 4.4, 4.7, 4.8, 5.6, 6.13, 6.14 |
| 10 | Unexpected start-up, unexpected overrun/overspeed (or any similar malfunction) from | | |
| 10.1 | Failure/disorder of the control system | 6.2.11, 6.3.5.4 | 4.1, 4.14, 6.13 |
| 10.2 | Restoration of energy supply after an interruption | 6.2.11.4 | 4.8, 6.7 |
| 10.3 | External influences on electrical equipment | 6.2.11.11 | 4.1, 6.9 |
| 10.4 | Other external influences (gravity) | 6.2.12.2 | 5.10 |
| 10.5 | Errors in the software | 6.2.11.7 | 4.1, 4.14 |
| 10.6 | Errors made by the operator (due to a mismatch of machinery with human characteristics and abilities; see 8.6) | 6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2, 6.4 | 4.2, 6.5, 7.3 |
| 11 | Impossibility of stopping the machine in the best possible conditions | 6.2.11.1, 6.2.11.3, 6.3.5.2 | 4.4, 4.5, 6.13 |
| 12 | Variation in the rotational speed of tools | 6.2.2.2, 6.3.3 | 4.7 |
| 13 | Failure of the power supply | 6.2.11.1, 6.2.11.4 | 4.8 |
| 14 | Failure of the control circuit | 6.2.11, 6.3.5.4 | 4.1 |
| 15 | Errors of fitting | 6.2.7, 6.4.5 | 6.12 |
| 16 | Break-up during operation | 6.2.3 | 5.2, 5.9 |
| 17 | Falling or ejected objects or fluids | 6.2.3, 6.2.10 | 4.8, 7.3 |
| 18 | Loss of stability/overturning of machinery | 6.3.2.6 | 5.1 |

# Annex B
(informative)

# Performance level required

ISO 19085-1:2021, Annex B, is replaced by the following text.

Table B.1 gives a quick-view summary of the performance level required, $PL_r$, for each safety function. However, refer to Clauses 4 and 5 for the full requirements.

**Table B.1 — Safety functions and performance level required, $PL_r$**

| Area | No. | Safety function/devices | $PL_r$ | Subclause of ISO 19085-1:2021 | Subclause of this document |
|---|---|---|---|---|---|
| Start | 1 | Prevention of unexpected start | c | | 4.3.1 |
| | 2 | Interlocking of start with safeguards | c | | 4.3.1 |
| | 3 | Initiation control for start of the clockwise direction of rotation | b | | 4.7.5 |
| Stop | 4 | Normal stop (braking function excluded) | c | 4.4.2 | |
| | 5 | Emergency stop (braking function excluded) | c | 4.4.4 | |
| Tool braking | 6 | Activation of the brakes | c | 4.5 | |
| | 7 | Electric braking system (excluding PDS/SR) | b | 4.5 | |
| | 8 | SS1 of PDS/SR | c | 4.5 | |
| | 9 | Interlocking of brake release | c | 5.4.3 | |
| Spindle speed | 10 | Speed indication (belt position) | b | 4.7.1 | |
| | 11 | Speed selection | c | 4.7.2 | |
| | 12 | Speed monitoring | c | 4.7.3 | |
| | 13 | Interlocking of the guarding system for tenoning with speed monitoring system | c | | 4.7.4 |
| | 14 | Selection of direction of rotation | b | | 4.7.5 |
| Controls | 15 | Speed monitoring of moving parts (except tools) | b | 4.11 | |
| | 16 | Time delay | c | 4.12 | |
| Axes movement | 17 | Initiation control for powered axes and adjustments | c | | 4.14 |
| | 18 | Limitation of concurrent movements under hold-to-run control | b | | 4.14 |
| | 19 | Interlocking of arbor inclination adjustment with spindle drive stop condition | c | | 4.14 |
| | 20 | Power cut-off by time delay | c | | 4.14 |
| | 21 | Interlocking of table insert movement with the position of the fence plates | b | | 5.10.1.2 |
| Quick tool/ arbor change system | 22 | Interlocking between tool/arbor release and spindle drive | c | | 5.3.6 |
| Safeguards | 23 | Interlocking of movable guards | c | 5.5.2.2 | |
| | 24 | Hold-to-run control | b/c | 5.5.3 | |

# Annex C
(normative)

# Stability test

ISO 19085-1:2021, Annex C, applies.

# Annex D
(normative)

# Test for braking function

ISO 19085-1:2021, Annex D, applies.

# Annex E
(normative)

# Impact test for guards

ISO 19085-1:2021, Annex E, applies.

# Annex F
(normative)

# Noise test code

## F.1 General

ISO 19085-1:2021, Clause F.1, applies.

## F.2 Determination of the A-weighted emission sound pressure level at workstations

### F.2.1 Basic standards and measurement procedure

ISO 19085-1:2021, F.2.1, applies.

### F.2.2 Measurement time interval

ISO 19085-1:2021, F.2.2, is replaced by the following requirements.

The measurement time interval shall be 30 s, including three cuts.

### F.2.3 Position of microphones at workstations

ISO 19085-1:2021, F.2.3, is replaced by the following text.

The microphone shall be positioned as follows:

— 1,6 m above floor level,

— 0,25 m to the right of the spindle centreline, viewed from the operator position,

— above the straight work fence.

For the safety of the operator performing the test the microphone shall be mounted from the back side of the straight work fence, e.g. on a tripod.

### F.2.4 Measurement uncertainty

ISO 19085-1:2021, F.2.4, applies.

## F.3 Determination of the A-weighted sound power level

### F.3.1 Basic standards and measurement procedure

ISO 19085-1:2021, F.3.1, applies.

### F.3.2 Sound power level determination on very large machines

ISO 19085-1:2021, F.3.2, does not apply.

### F.3.3 Measurement time interval

ISO 19085-1:2021, F.3.3, is replaced by the following requirements.