International Standard

ISO 19085-12

Second edition
2024-11

Woodworking machines — Safety —

Part 12: Tenoning-profiling machines

Machines à bois — Sécurité —

Partie 12: Machines à tenonner-profiler

Reference number
ISO 19085-12:2024(en)

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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 – Safety,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 19085-12:2021), which has been technically revised. The main changes are as follows:

— the Scope has been revised to specify that machines are intended for continuous production use, and other workable materials have been added;

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

— the feed chains greasing mode (MODE 3) has been added in 4.6.2;

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

— optional workpiece supporting devices have been added to the Scope, Clause 3 and 5.10.6 to 5.10.9.

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 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 stated in ISO 12100:2010.

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 at 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, 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 the ISO 19085 series.

As far as possible, the safety requirements of parts of the ISO 19085 series refer to the relevant subclauses of ISO 19085-1:2021. Each part contains replacements and additions to the common requirements given in ISO 19085-1:2021.

All parts of the ISO 19085 series have the same structure, so that reference to ISO 19085-1:2021 is made always and only from and to the same subclause number at the last indent level.

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 either:

— confirmed as a whole;

— confirmed with additions;

— excluded entirely; 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 12: Tenoning-profiling machines

1 Scope

1.1 This document specifies the safety requirements and measures for manually loaded and unloaded

— single-end tenoning machines with a manual feed sliding table,

— single-end tenoning machines with a mechanical feed sliding table,

— single-end tenoning-profiling machines with mechanical feed,

— double-end tenoning-profiling machines with mechanical feed, also designed to be automatically either loaded or unloaded, or both, and

— angular systems for tenoning and profiling with mechanical feed

with maximum workpiece height capacity of 200 mm for single-end machines and 500 mm for double-end machines, capable of continuous production use, altogether referred to as “machines”.

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

1.3 The machines are designed to process in one pass one end or two sides, either opposite or perpendicular to each other, of workpieces made of

a) solid wood, and

b) materials with similar physical characteristics to wood (see ISO 19085-1:2021, 3.2); and

only the machines with mechanical feed, made of

c) fibre-cement,

d) rock wool and glass wool,

e) gypsum,

f) plasterboard,

g) matrix engineered mineral boards, silicate boards and sulfate boards,

h) composite materials with core consisting of polyurethane or mineral material laminated with light alloy,

i) polymer-matrix composite materials and reinforced thermoplastic, thermoset and elastomeric materials,

j) aluminium light alloy profiles, and

k) composite boards made from the materials listed above.

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

— sanding units;

— fixed or movable workpiece support;

— automatic tool changing;

— automatic workpiece returner;

— glass bead saw unit;

— hinge recessing unit;

— boring unit;

— dynamic processing unit;

— sawing unit installed out of the integral enclosure, between machine halves in double-end machines;

— foiling unit;

— coating unit;

— grooving unit with a milling tool installed out of the integral enclosure, between machine halves;

— brushing unit;

— gluing unit;

— sealing unit;

— dowels inserting unit;

— tongues inserting unit;

— inkjet marking unit;

— laser marking unit;

— labelling unit;

— workpiece back-up device (device that is either anti-chipping or anti-splintering, or both);

— quick tool changing system;

— post-formed edge pre-cutting unit;

— additional workpiece support (at either infeed or outfeed, or both);

— parallel infeed device on single-end machines;

— transversal infeed device on single-end machines;

— intermediate workpiece support on double-end machines;

— automatic infeed device;

— feed chain with dogs.

1.5 This document does not deal with any hazards related to:

a) systems for automatic loading and unloading of the workpiece to a single machine other than automatic workpiece returner;

b) single machine being used in combination with any other machine (as part of a line);

c) use of tools, other than saw blades or boring tools or milling tools for grooving, installed between machine halves and out of the integral enclosure in double-end machines;

d) use of tools protruding out of the integral enclosure;

e) chemical characteristics of all materials listed in 1.3 c) to i) and their dust.

1.6 This document is not applicable to machines intended for use in potentially explosive atmosphere nor to machines manufactured prior to 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 286-2:2010, *Geometrical product specifications (GPS) — ISO code system for tolerances on linear sizes — Part 2: Tables of standard tolerance classes and limit deviations for holes and shafts*

ISO 11553-1:2020, *Safety of machinery — Laser processing machines — Part 1: Laser safety requirements*

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

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 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*

IEC 60825-1:2014, *Safety of laser products — Part 1: Equipment classification and requirements*

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

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

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.

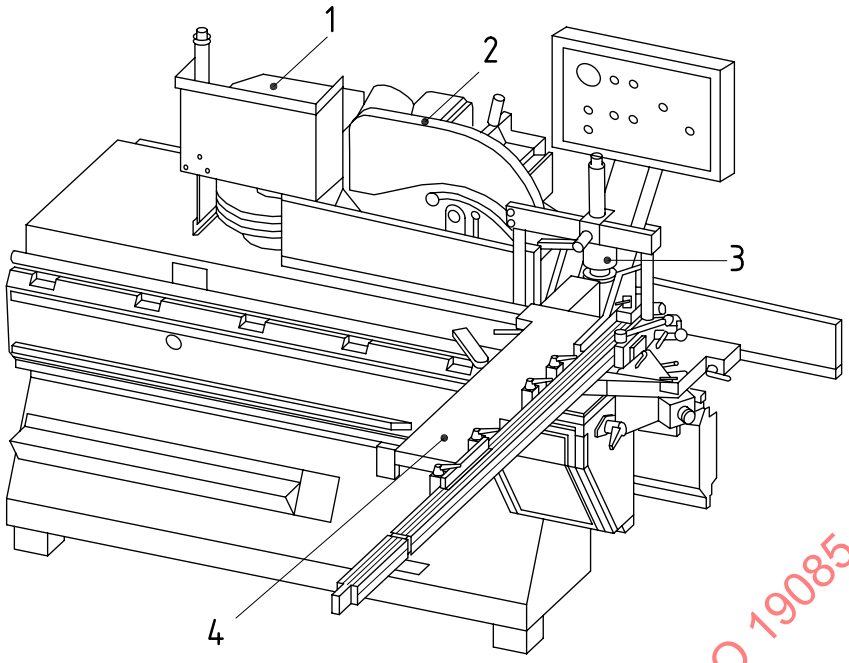
ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

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

3.1
single-end tenoning machine with a manual feed sliding table
machine designed for the production of *tenons* (3.10) on one end of a workpiece during one cycle where the tenon is cut by means of milling tools and saw blades each mounted on its own spindle and with a manual feed sliding table supporting the workpiece during processing

Note 1 to entry: Figure 1 illustrates an example of a single-end tenoning machine with a manual feed sliding table.



Key

1	milling tool enclosure	3	workpiece clamping device
2	saw blade enclosure	4	manual feed sliding table

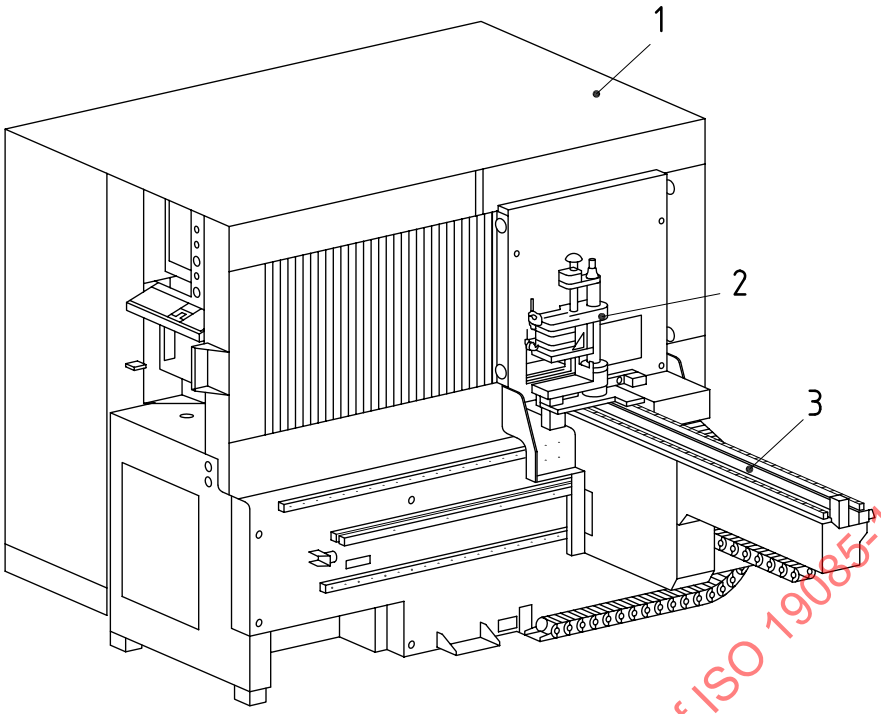
Figure 1 — Example of a single-end tenoning machine with a manual feed sliding table

3.2
single-end tenoning machine with a mechanical feed sliding table
machine designed for the production of *tenons* (3.10) on one end of a workpiece during one cycle where the tenon is cut by means of milling tools and saw blades each mounted on its own spindle, with a mechanical feed sliding table and with one operator position for both loading and unloading

Note 1 to entry: Figure 2 illustrates an example of a single-end tenoning machine with a mechanical feed sliding table.

3.3
single-end tenoning-profiling machine with mechanical feed
machine designed for either producing *tenons* (3.10) or *profiling* (3.9), or both, on one side of the workpiece in one pass

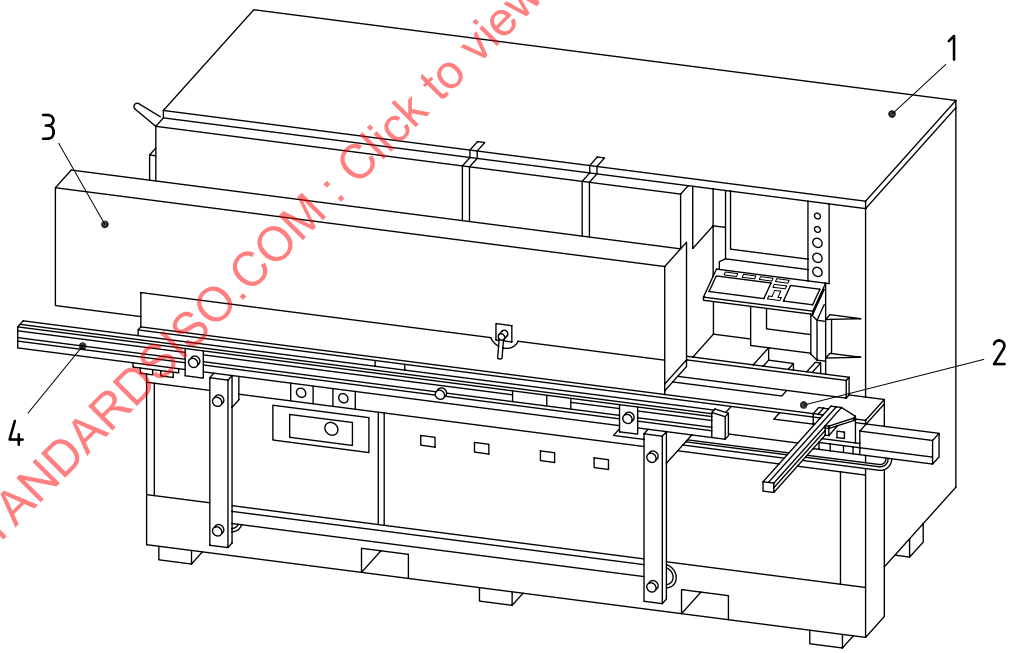
Note 1 to entry: This machine is also known as “shaper-sander” or “shape and sand machine” (e.g. in North America). See Figure 3 illustrates an example of a single-end tenoning-profiling machine with mechanical feed.



Key

1 tools enclosure
2 workpiece clamping device
3 mechanical feed sliding table

Figure 2 — Example of a single-end tenoning machine with a mechanical feed sliding table



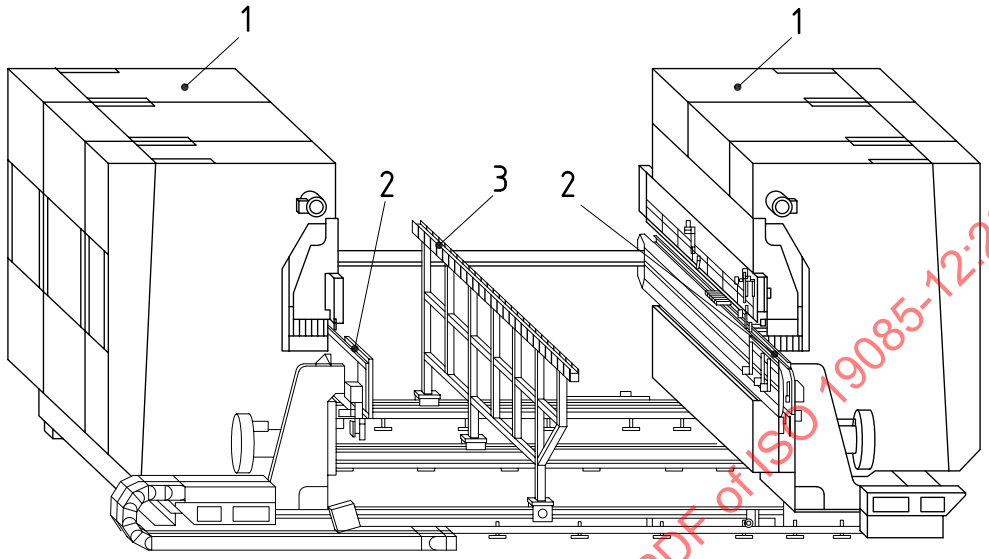
Key

1 tools enclosure
2 workpiece support
3 power-driven upper feed-rollers enclosure
4 adjustable workpiece support

Figure 3 — Example of a single-end profiling machine with mechanical feed

3.4
double-end tenoning-profiling machine with mechanical feed
double-end machine
machine consisting of a pair of *machine halves* (3.6), primarily designed for either producing *tenons* (3.10) or *profiling* (3.9), or both, on opposing sides of a workpiece in one pass

Note 1 to entry: Figure 4 illustrates an example of a double-end tenoning-profiling machine with mechanical feed.



Key

1 *machine half* (3.6)
2 workpiece feeding chain
3 intermediate workpiece support

Figure 4 — Example of a double-end tenoning-profiling machine fed by chains

3.5
angular system
angular system for tenoning and profiling with mechanical feed
combination of a *single-end tenoning machine with a mechanical feed sliding table* (3.2) and a *single-end profiling machine with mechanical feed* (3.3) disposed in sequence perpendicularly to each other

Note 1 to entry: Figure 5 illustrates an example of an angular system for tenoning and profiling with mechanical feed. The transfer of workpiece from the tenoning side to the profiling side can be automatic or by the intervention of the operator.

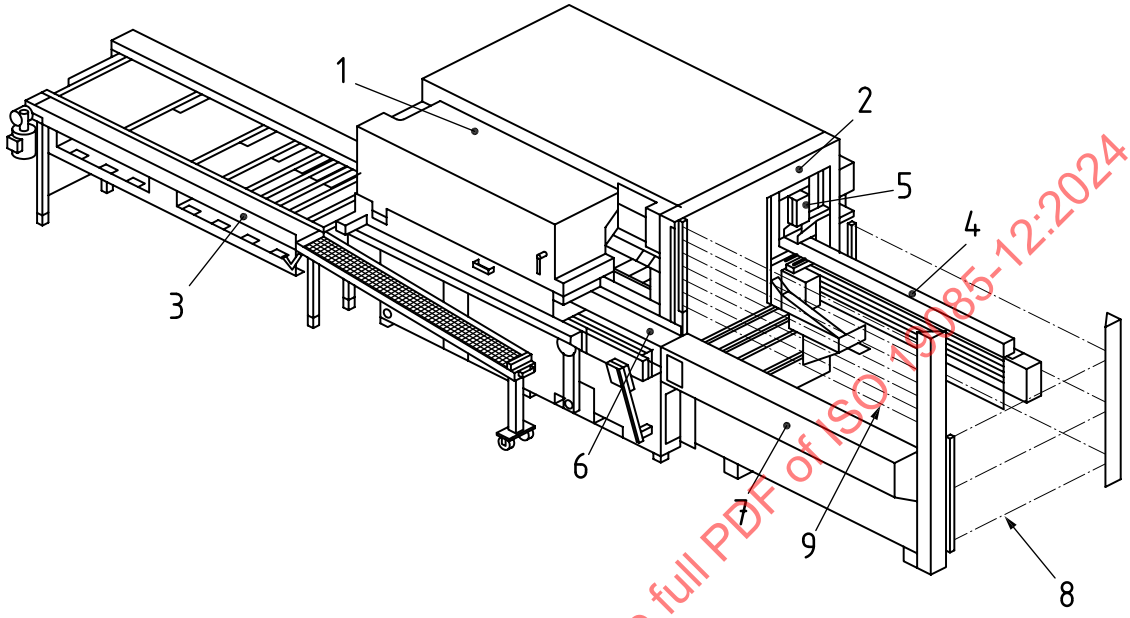
3.6
machine half
<double-end machines> part of a machine consisting of a frame, working units, workpiece support and feeding system

Note 1 to entry: Each machine half processes one side of the workpiece. One or both machine halves are capable of being moved to accept workpieces of different dimensions. Examples of feeding systems are chain beam and top pressure beam.

3.7
integral enclosure
guarding designed to fit close to a single-end machine or to each *machine half* (3.6) of a double-end machine, to provide a measure for sound attenuation, where certain setting adjustments can be available outside the enclosure

3.8
complete enclosure
guarding primarily designed for noise attenuation and to allow the operator to move around freely within it, where all machine setting and adjustments are available inside it and access is normally through a door or opening

Note 1 to entry: The complete enclosure usually contains openings for workpiece loading and unloading. These openings are usually equipped with sound-absorbing sections, e.g. tunnels.



Key
1 *profiling* (3.9) unit
2 tenoning unit
3 *automatic workpiece returner* (3.18)
4 mechanical feed sliding table
5 workpiece clamping device
6 workpiece support
7 fixed guard at loading/unloading position
8 active optoelectronic protective device 1
9 active optoelectronic protective device 2

Figure 5 — Example of an angular tenoning and profiling system with mechanical feed

3.9
profiling
shaping of an edge of a workpiece by milling tools, saw blades or sanding units

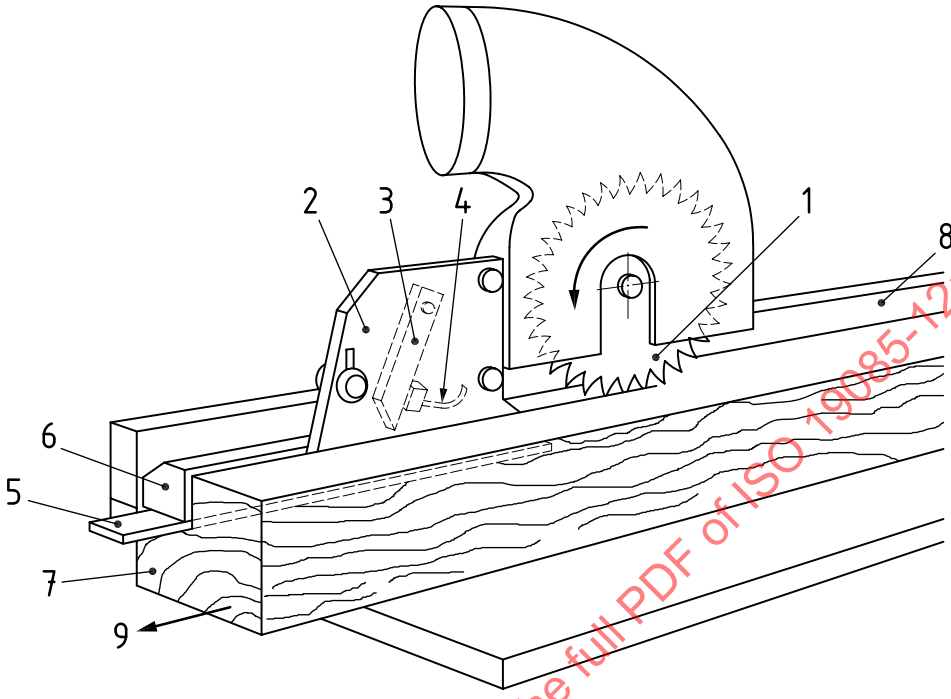
Note 1 to entry: Profiling also includes panel sizing.

3.10
tenon
machined projection and slots on the end of a workpiece to facilitate the joining of workpieces

Note 1 to entry: A tenon can also be profiled.

3.11
glass bead saw unit
work unit fitted with a tool, usually a saw blade, with or without coaxial mounted milling tool, to cut out a glass bead from the machined profile of the workpiece

Note 1 to entry: Figure 6 illustrates an example of a glass bead saw unit.

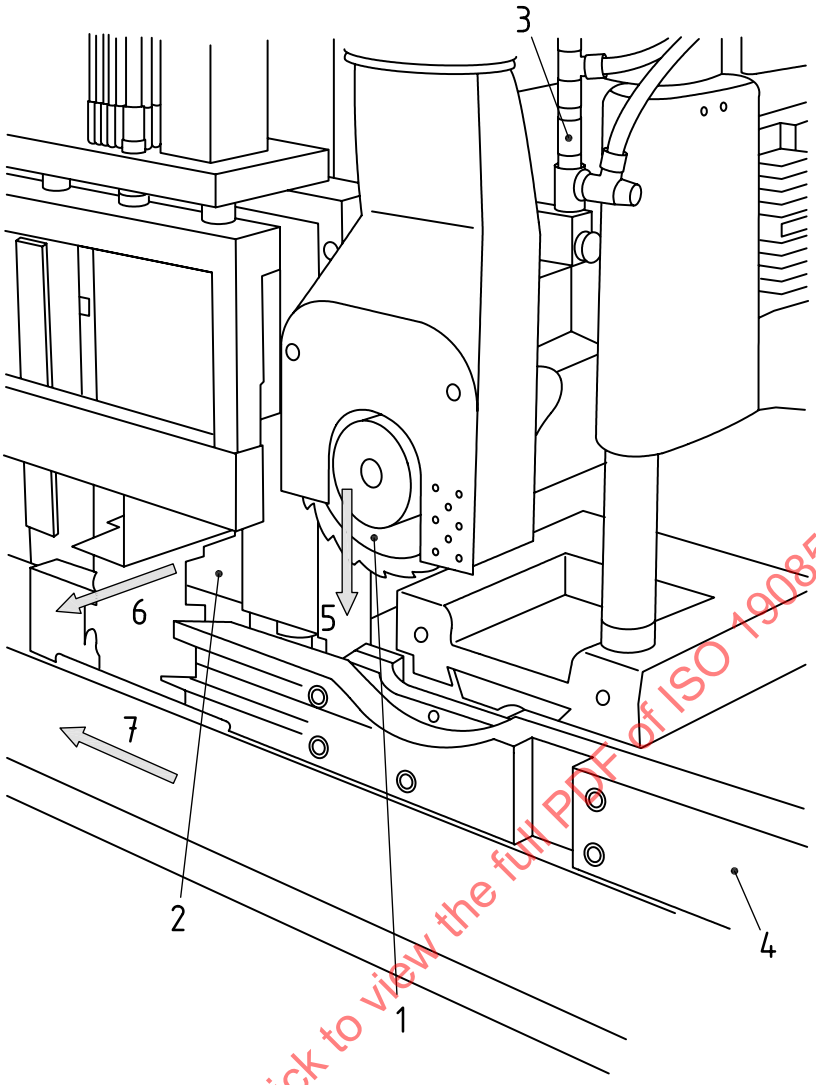


Key
1 glass bead saw-blade
2 bead ledge separator
3 anti-kickback finger
4 pressure device
9 feed direction
5 guiding channel for glass bead ledge
6 glass bead ledge
7 workpiece
8 fence

Figure 6 — Example of a glass bead saw unit

3.12
hinge recessing unit
work unit fitted with a milling tool to recess hinges for window fittings

Note 1 to entry: Figure 7 illustrates an example of a hinge recessing unit. The tool spindle moves in a vertical or horizontal plane during processing and returns to its starting position ready for the following (succeeding) workpiece.



Key

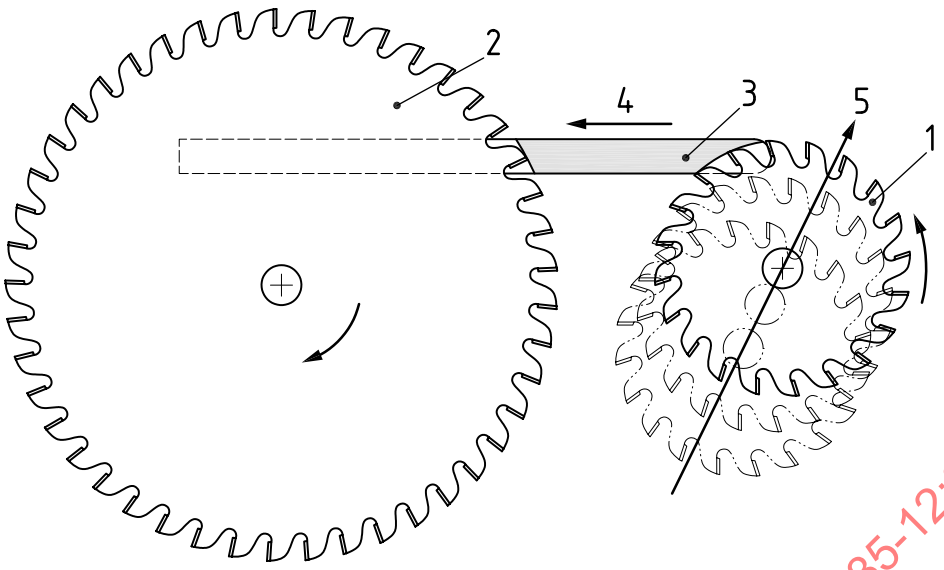
1 vertical hinge recessing unit
2 horizontal hinge recessing unit
3 actuator for movement of vertical hinge recessing unit
4 fence
5 processing movement of the vertical hinge recessing unit
6 processing movement of the horizontal hinge recessing unit
7 feed direction

Figure 7 — Example of a hinge recessing unit

3.13
post-formed edge pre-cutting
cut made by a separate saw blade or hogger in the front profiled edge of the workpiece deep enough to prevent surface damage when the main saw blade makes its cut

Note 1 to entry: Figure 8 illustrates an example of post-formed edge pre-cutting.

3.14
post-formed edge pre-cutting unit
unit with a saw blade or hogger used specifically for *post-formed edge pre-cutting* (3.13)



Key

1 post/soft-formed edge pre-cutting saw blade or hogger
2 main saw blade
3 workpiece
4 feed direction of the sliding table
5 movement of post/soft-formed edge pre-cutting saw blade

Figure 8 — Post-formed edge pre-cutting

3.15
boring unit
unit provided with one or more boring tools

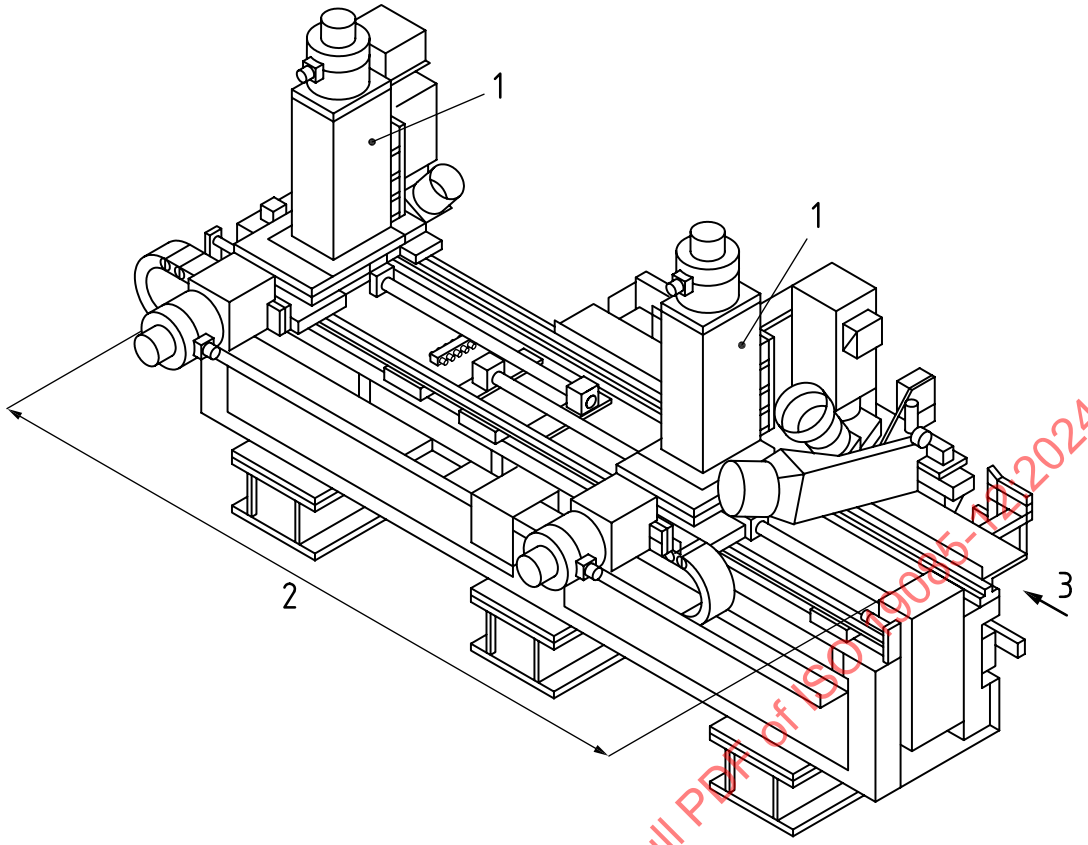
3.16
dynamic processing unit
milling/sawing/boring/disk-sanding unit which moves with the workpiece during processing and returns to its starting position ready for the following (succeeding) workpiece

Note 1 to entry: Figure 9 illustrates an example of a dynamic processing unit.

3.17
sealing unit
unit to apply sealant to the processed side of the workpiece after machining

3.18
automatic workpiece returner
powered system that brings the machined workpiece from the machine end to the loading position

Note 1 to entry: Examples of a workpiece returner are provided in Figure 10 and Figure 11 for single-end and *double-end machines* (3.4) with mechanical feed, respectively.



Key

1 dynamic processing unit
2 movement zone
3 feed direction

Figure 9 — Example of a dynamic processing unit

3.19
coating unit
unit that applies a coating to the processed side of the workpiece after machining

3.20
gluing unit
unit that applies glue to the processed side of the workpiece before inserting dowels or to prepare it for further subsequent operation after exiting the machine

3.21
brushing unit
unit with roller provided with non-abrasive brushes for cleaning the processed side of the workpiece

3.22
dowels inserting unit
unit that inserts dowels into the processed workpiece

3.23
tongues inserting unit
unit that inserts tongues (e.g. plastic tongues) into the processed workpiece

3.24
inkjet marking unit
unit that applies marks by inkjet technology on the surface of the processed workpiece

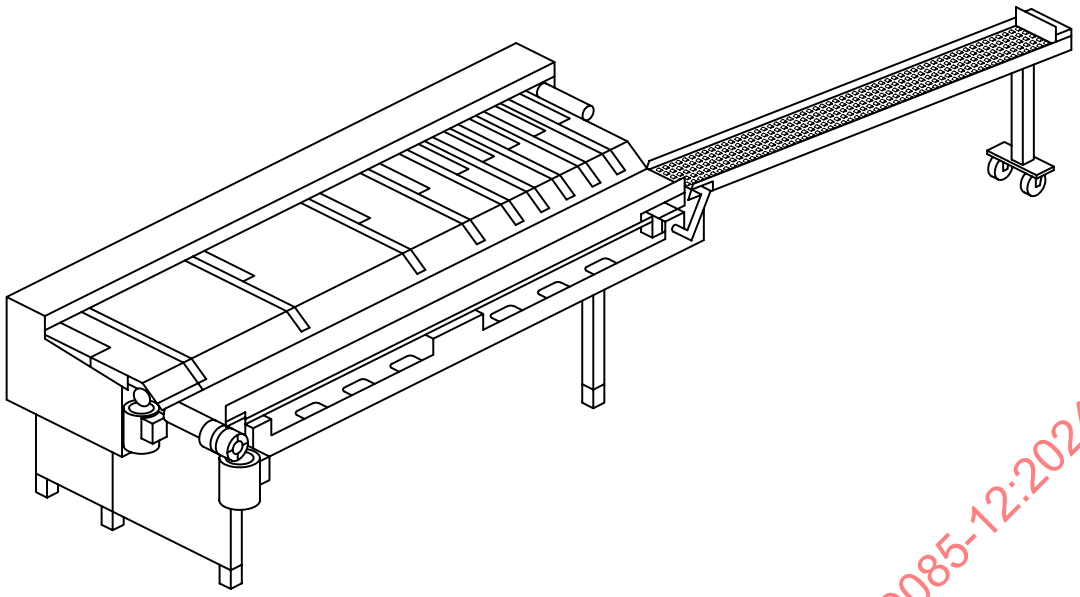
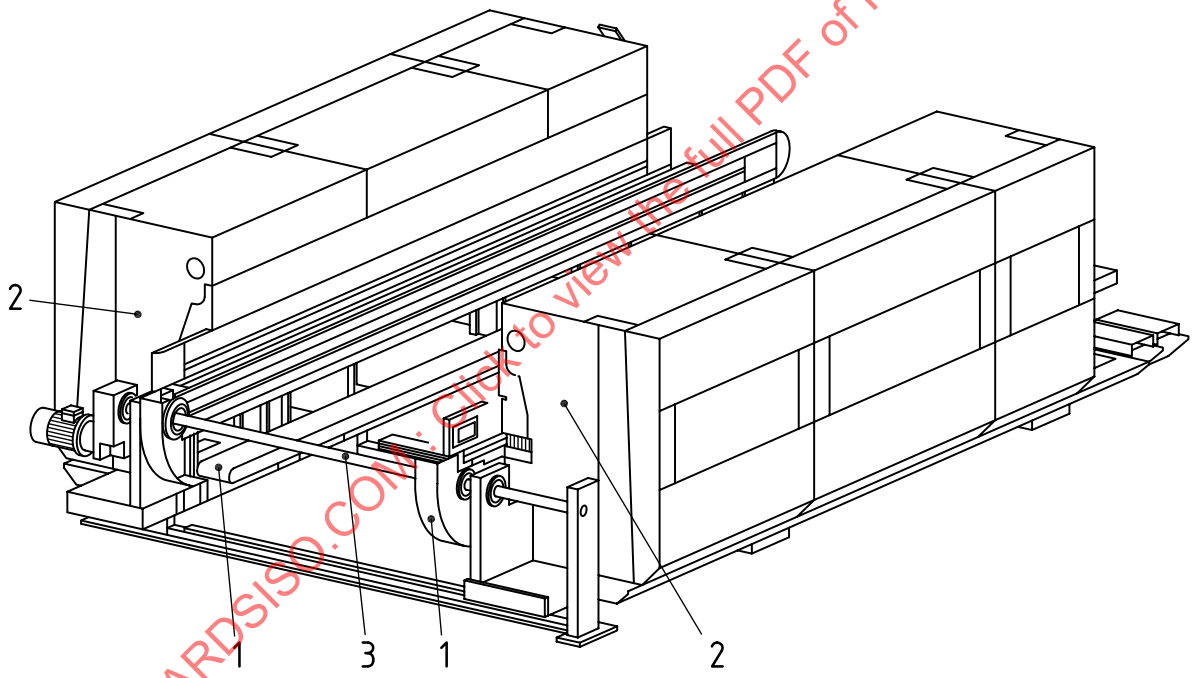


Figure 10 — Example of an automatic workpiece returner for a single-end machine



Key

1 workpiece returner
2 *machine half* (3.6)
3 feed shaft

Figure 11 — Example of a workpiece returner for a double-end machine

3.25
laser marking unit
unit that marks the surface of the processed workpiece by laser technology

3.26
labelling unit
unit that applies, or prints and applies, labels on the surface of the processed workpiece

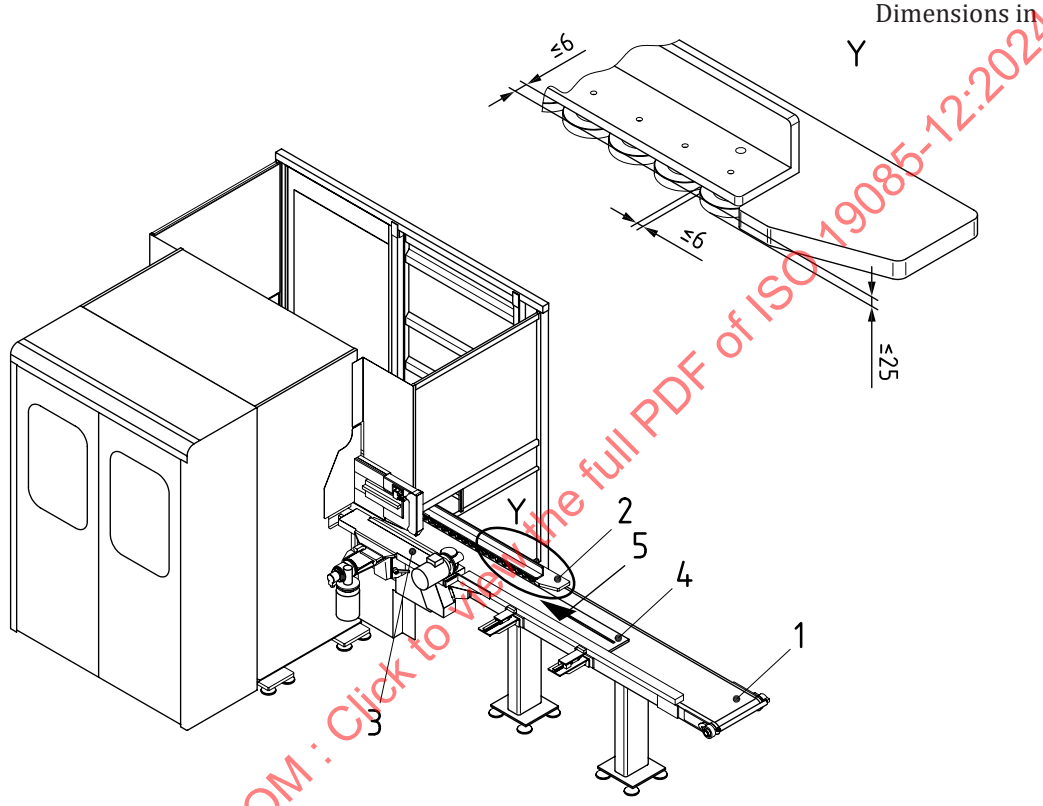
3.27
additional workpiece support
workpiece support that eases handling and manual loading or unloading of panels

Note 1 to entry: An additional workpiece support can be installed at the infeed or at the outfeed side of the machine.

3.28
parallel infeed device
<single-end machines> belt or roller conveyor with a lateral workpiece feeding belt and a reference fence with idle guiding rollers, for loading workpieces parallel to the feed direction

Note 1 to entry: An example of a parallel infeed device is shown in Figure 12.

Dimensions in millimetres

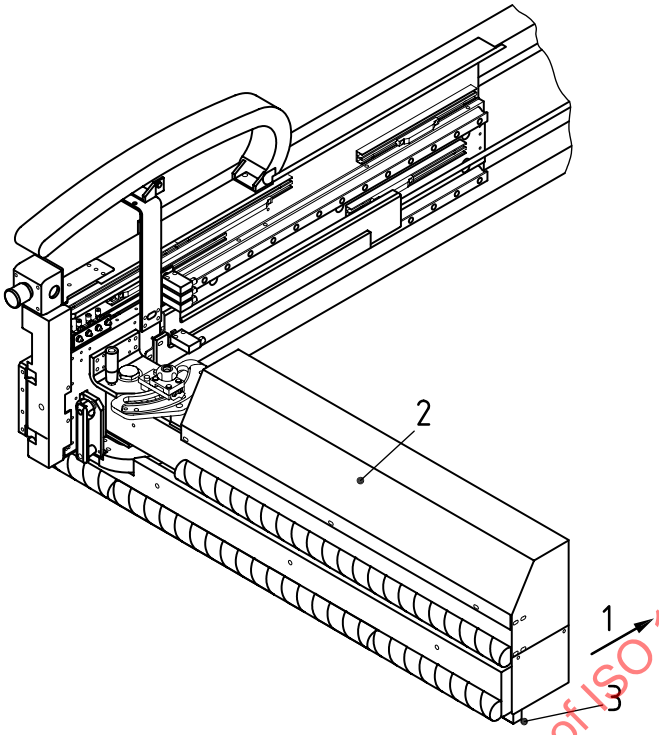


Key
1 belt conveyor
2 reference fence with idle guiding rollers
3 lateral feeding belt
4 workpiece
5 feed direction

Figure 12 — Example of a parallel infeed device

3.29
transversal infeed device
<single-end machines> power-driven device that transversally loads workpieces at a right angle to the feed direction

Note 1 to entry: An example of a transversal infeed device is shown in Figure 13.



Key

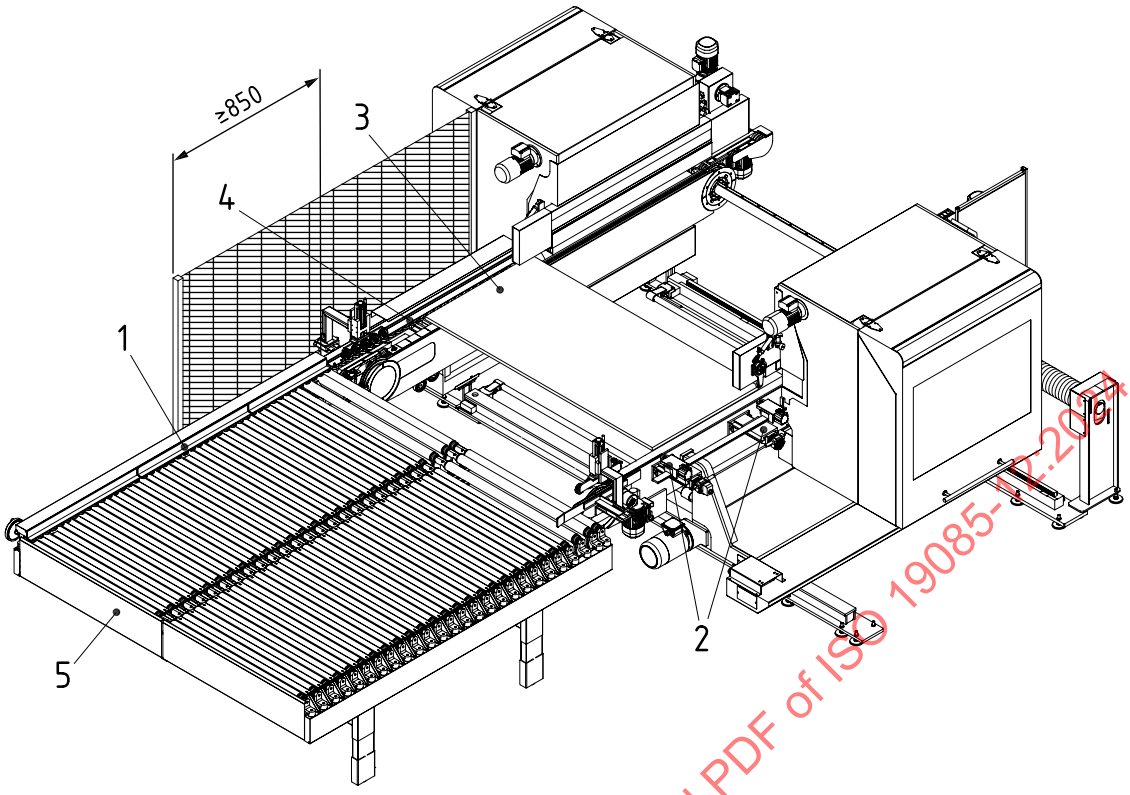
1 feed direction
2 moving arm
3 workpiece clamping device/pins

Figure 13 — Example of a transversal infeed device

3.30
automatic infeed device
power-driven roller or belt infeed table provided with a device for pushing the workpiece against the reference fence during feeding

Note 1 to entry: An example of an automatic infeed device is shown in Figure 14 (the right side guard is not shown).

Dimensions in millimetres



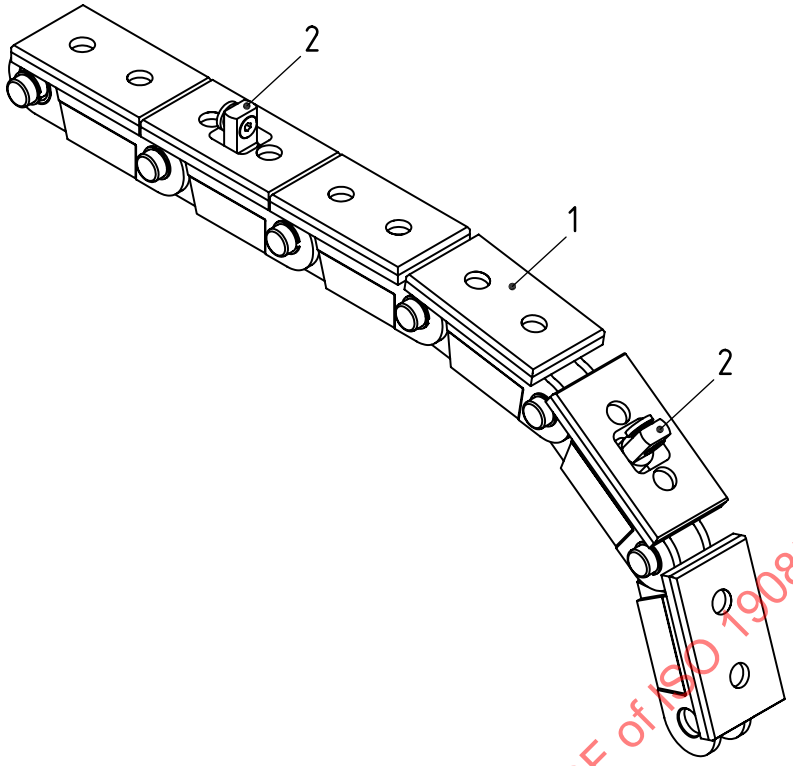
Key

1 pre-alignment fence
2 pushing device
3 workpiece
4 reference fence
5 power-driven roller infeed table

Figure 14 — Example of an automatic infeed device

3.31
dog
lug
<feed chain> element protruding from the feed chain aimed at improving workpiece guidance during machining

Note 1 to entry: An example of a feed chain provided with dogs is shown in Figure 15.



Key

1 feed chain

2 dogs or lugs

Figure 15 — Example of a feed chain provided with dogs

3.32
MODE 2
adjustment mode
condition for adjusting tools and other processing units, with guards opened

3.33
MODE 3
feed chains greasing mode
<double-end machines> condition with safeguards disabled for greasing workpiece feeding chains

3.34
jog
control device for momentary activation of a function or a movement

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.

Table B.1 summarizes the performance levels required (PL_r) of Clauses 4 and 5 for each safety function.

4.2 Control devices

ISO 19085-1:2021, 4.2, applies with the following additions, subdivided into further specific subclauses.

4.2.1 General

The main electrical control devices of the machine for control power-on, start of a tool spindle and of other processing units, normal stop, integrated feed, top pressure beam movement, machine half movement and mode selection shall be located together in a position from where the loading position can be seen.

No reset function control devices, no control devices for control power-on and no mode selection shall be positioned on mobile control sets.

When a wireless control set loses its connection to the machine an emergency stop shall be automatically activated.

The safety related parts of control systems (SRP/CS) for the automatic activation of emergency stop when wireless connection is lost shall achieve PL_r = c.

In addition, the requirements in 4.2.2 to 4.2.6 shall apply to the relevant type of machine.

4.2.2 Single-end tenoning machines with a manual feed sliding table

An emergency stop control device shall be located at the loading position. On machines with sliding table stroke longer than 2 m an additional emergency stop control device shall be located on-board of the sliding table at the operator side.

4.2.3 Single-end tenoning machines with a mechanical feed sliding table

Emergency stop control devices shall be located at the loading and at the unloading positions.

4.2.4 Single-end tenoning-profiling machines with mechanical feed

Emergency stop control devices shall be fitted at locations

a) such that they can be reached from the loading and unloading positions of the machine,

b) on each mobile set of controls,

c) not more distant than 0,5 m from each hold-to-run control device,

d) on the main control panel.

4.2.5 Double-end tenoning-profiling machines with mechanical feed

Additional control devices for cycle start, operational and normal stop may be provided on mobile control sets with cable connection or wireless.

Emergency stop control devices shall be fitted at locations

a) on each mobile or fixed set of controls,

b) at the loading and unloading positions of each machine half as long as there is no set of controls,

c) not more distant than 0,5 m from each hold-to-run device,

d) inside each enclosure, where MODE 2 is provided, and positioned with a maximum distance of 2 m from each other.

4.2.6 Angular systems for tenoning and profiling with mechanical feed

Emergency stop control devices shall be fitted in accordance with 4.2.3 and 4.2.4.

NOTE The two parts (tenoning and profiling) of the angular system have different loading and unloading positions one from the other.

4.3 Start

4.3.1 Direct start

ISO 19085-1:2021, 4.3.1, applies to single-end tenoning machines with a manual feed sliding table.

4.3.2 Start via control power-on

ISO 19085-1:2021, 4.3.2, applies to all machines with mechanical feed.

On single-end tenoning machines with a mechanical feed sliding table, power driven movement of the sliding table shall only be possible if the following requirements for the clamping system are met:

a) pneumatic or hydraulic pressure is applied; and

b) the piston of the pneumatic or hydraulic cylinder is not fully extended.

The SRP/CS for this interlocking shall achieve PL_r = c.

If any tool spindle or other processing spindle is running, this shall be permanently indicated either on the display or by a light signal integrated with the start control or near to it.

In normal processing mode (MODE 1), start of the feed motor shall only be possible when the tool spindles motors are running or the tools of all spindles not involved in the current operation cannot come into contact with the workpiece, because the tools are removed from the spindles or the non-rotating spindles are retracted to a non-cutting position.

For spindle units that are adjusted manually, by hand wheel or power operated, see 7.3.2 p).

For automatically adjusted spindle units under numerical control (NC) or computer numerical control (CNC), reaching of the non-cutting position shall be detected, for example, via a sensor or an encoder.

The SRP/CS for the interlocking of feed start with detection of spindle retraction shall achieve PL_r = b.

The SRP/CS for the interlocking of feed start with all tool spindle drives shall achieve PL_r = b.

4.3.3 Laser marking unit

Subclause specific to this document.

Laser marking unit activation shall only be possible when the feed is running and the workpiece is detected to be under the laser marking unit.

The SRP/CS for the interlocking of laser marking unit activation with feed shall achieve PL_r = c.

The SRP/CS for the interlocking of laser marking unit activation with workpiece detection shall achieve PL_r = b.

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

4.4 Safe stops

4.4.1 General

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

On machines with laser marking unit, activating a safe stop (normal, operational, emergency) shall also disable the laser marking unit.

The SRP/CS for disabling the laser marking unit with the safe stop shall achieve PL_r = c.

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, applies.

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, applies with the following additions, subdivided into further specific subclauses.

4.6.1 Manual adjustments mode for tools and other processing units (MODE 2)

In single and double-end tenoning-profiling machines with mechanical feed, manual adjustment mode (MODE 2) shall be provided if it is necessary to adjust tools and other processing units with the guards open. If MODE 2 is implemented, the following requirements apply.

a) The selection of MODE 2 shall initiate stopping the feed as well as tool spindles and other processing units, unless spindles and units are provided with their own movable guard with interlocking and guard locking and the relevant interlocking movable guard is closed and locked.

b) Movement of the feed and of powered units' adjustment, one at a time, shall only be possible either by hold-to-run control or by jog control together with an enabling control. The relevant maximum feed speed shall be limited to 2 m/min, but the requirements of 4.11 do not apply. The relevant hold-to-run control or enabling control devices shall be located on a mobile set of controls.

   NOTE The control systems for jog control, the limited maximum feed speed of 2 m/min and the selection of the unit to be adjusted are not safety related.

c) During MODE 2, start of each sanding unit shall only be possible if provided with relevant separate start control device. The SRP/CS for starting of sanding belts drives shall achieve PL_r = c.

d) The active optoelectronic protective device (AOPD) preventing access between machine halves in double-end machines required in 5.6.4.3 (see Figure 15 Keys 4 and 5) shall remain effective, unless all tool spindles and all other processing units are stopped, even those that are individually safeguarded.

4.6.2 Feed chains greasing mode (MODE 3)

For greasing the feed chains in double-end machines, the feed chains greasing mode (MODE 3) shall be implemented by applying the following requirements.

a) The selection of MODE 3 shall initiate stopping of all powered movements.

b) The unlocking of movable guards with interlocking and guard locking shall be possible only if all relevant spindles and reachable movements have come to a standstill (this also includes movements of the halves, pneumatic movements, feed movements and axes movements).

c) Any unexpected start of rotation, movements and adjustments of tools and other processing units shall be prevented. The SRP/CS for preventing any unexpected start of rotation, movements and adjustments shall achieve PL_r = c.

d) Movement of the feed shall only be possible either via a hold-to-run control or via jog control (no PL required) in combination with enabling control, at a limited speed not greater than 10 m/min. No PL is required for limited feed speed monitoring.

e) AOPD preventing access between machine halves (see 5.6.4.3 and Figure 15 Keys 4 and 5) may be disabled only when all spindles and movements are stationary, e.g. by time delay or standstill detection. The SRP/CS for disabling this AOPD when all spindles and movements are stationary shall achieve PL_r = c.

f) Any unexpected start of the movements of machine halves and workpiece intermediate support shall be prevented. The SRP/CS for preventing any unexpected start of these movements shall achieve PL_r = c.

If in MODE 2 all tools and all processing units are stopped, greasing the feed chains may be done with MODE 2 and MODE 3 is not required.

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

4.7 Tool speed changing

4.7.1 Speed changing by shifting the belts on the pulleys

ISO 19085-1:2021, 4.7.1, does not apply.

4.7.2 Speed changing by incremental speed change motor

ISO 19085-1:2021, 4.7.2, applies with the following additions.

As an exception, no PL is required for the SRP/CS for speed selection of the sanding belt units.

4.7.3 Infinitely variable speed by frequency inverter

ISO 19085-1:2021, 4.7.3, applies with the following additions.

Requirements on speed monitoring stated in ISO 19085-1:2021 apply to the maximum rotational speed set by the manufacturer for each spindle.

As an exception, speed monitoring is not required for:

— sanding belt units;

— boring units;

— all tools where direct ejection of tools or their parts can be excluded, i.e. where all following conditions are fulfilled:

  1) tools are installed inside integral enclosure;

  2) axis of rotation of the tools is perpendicular to feed direction;

  3) all possible ejection trajectories are intercepted by feed chain or top pressure beam or upper feed roller case.

4.8 Failure of any power supply

ISO 19085-1:2021, 4.8, applies with the following additions.

If the pneumatic pressure is less than the threshold value for safe operation of the machines, which is to be determined by the manufacturer, the machine shall stop. The automatic start of the machine shall be prevented.

The SRP/CS for the interlocking of pressure detection with machine operation shall achieve PL_r = b.

4.9 Manual reset control

ISO 19085-1:2021, 4.9, applies.

4.10 Standstill detection and monitoring

ISO 19085-1:2021, 4.10, applies.

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.

5 Safety requirements and measures for protection against mechanical hazards

5.1 Stability

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

The requirements on an integrated device for moving the machine and ISO 19085-1:2021, Annex C do not apply.

5.2 Risk of break-up during operation

ISO 19085-1:2021, 5.2, is replaced by the following text.

For single-end tenoning machines with sliding table, with manual or mechanical feed, even if included in an angular system for tenoning and profiling, powered adjustment of any tool spindle in the working position shall only be possible when the sliding table is at the loading position. Contact between tools and parts of the machine during powered adjustment of the spindles shall be avoided, for example, by a manually adjustable mechanical restraint device according to ISO 12100:2010, 3.28.7.

The SRP/CS for interlocking of spindle power adjustment with sliding table position shall achieve PL_r = c.

For all other machines, see 7.3.2 e) and f).

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

5.3 Tool and tool fixing design

5.3.1 General

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

For shafts with outboard bearings, it shall not be possible to lock the tool without the outboard bearing, or it shall not be possible to start the spindle without the outboard bearing mounted. The SRP/CS for interlocking of spindle start with the outboard bearing mounted shall achieve at least PL_r = c.

With regard to the balancing requirements shown in EN 847-1:2017, 6.2.4, the manufacturer shall declare for each spindle the maximum speed, maximum mass and dimensions of the tools that can be used with it (also see 5.3.2).

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

On machines with quick tool changing system or automatic tool changing, tool release shall only be possible if the spindle is stopped and an unexpected start is prevented – this second requirement applies only when the operator changes the tool manually.

The SRP/CS for the interlocking between tool release and spindle standstill shall achieve PL_r = c or consist of two independent systems both achieving PL_r = b.

The SRP/CS for the prevention of any unexpected start of spindle shall achieve PL_r = c.

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

5.3.2 Spindle locking

ISO 19085-1:2021, 5.3.2, applies.

5.3.3 Circular saw blade fixing device

ISO 19085-1:2021, 5.3.3, applies.

5.3.4 Flange dimensions for circular saw blades

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

For fixing saw blade, two saw flanges, or a single flange in the case of flush mounted saw blade shall be provided. The diameter of all flanges shall be at least $D/6$, where D is the diameter of the largest saw blade for which the machine is designed.

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

5.3.5 Spindle rings

Subclause specific to this document.

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

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

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

5.4 Braking

5.4.1 Braking of tools

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

The requirements stated in ISO 19085-1:2021 apply also to sanding belt units.

The test for braking function shall be carried out in accordance with Annex D.

5.4.2 Maximum run-down time

ISO 19085-1:2021, 5.4.2, applies with the following additions.

The following exceptions shall apply:

— for tools with run-up time exceeding 10 s, the maximum run-down time shall be less than the run-up time but in no case exceed 30 s;

— for sanding belt units, the run-down time shall not exceed 30 s.

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 moveable guards

5.5.2.1 General

ISO 19085-1:2021, 5.5.2.1, applies.

5.5.2.2 Moveable guards with interlocking

ISO 19085-1:2021, 5.5.2.2, applies.

5.5.2.3 Moveable guards with interlocking and guard locking

ISO 19085-1:2021, 5.5.2.3, applies.

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, does not apply.

5.5.5 Electro-sensitive protective equipment (ESPE)

ISO 19085-1:2021, 5.5.5, applies.

5.5.6 Pressure sensitive protective equipment (PSPE)

ISO 19085-1:2021, 5.5.6, applies.

5.5.7 Enabling control

ISO 19085-1:2021, 5.5.7, applies.

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.

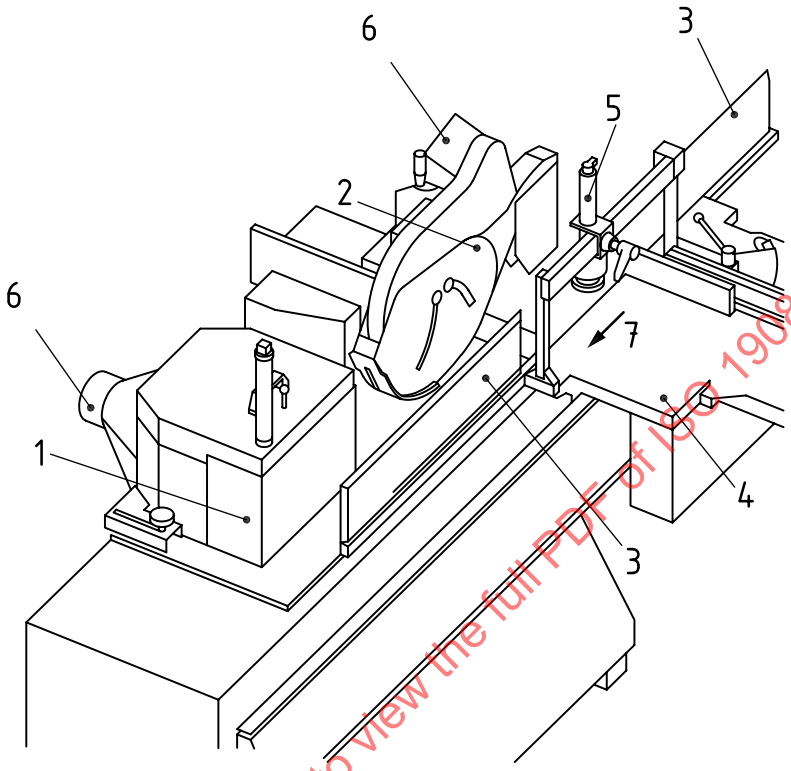
5.6.1 Single-end tenoning machines with a manual feed sliding table

Access to the tools shall be prevented by automatically adjustable guards (see Figure 16 Keys 1 and 2).

Any openings shall be in accordance with the requirements of ISO 13857:2019, Table 4.

These guards shall completely cover the tools at any time except for the time necessary for machining and for passing the workpiece during the return stroke.

Opening and closing of the automatically adjustable guards can be either power operated or achieved by means of mechanics built into the sliding mechanism or by the workpiece itself. If power operated, the SRP/CS for the closing of the automatically adjustable guards shall achieve PL_r = c.



Key

1	power operated automatically adjustable guard for milling tool	5	workpiece clamping device
2	automatically adjustable guard by workpiece for saw blade	6	chips and dust extraction outlet
3	impeding device	7	feed direction
4	sliding table		

Figure 16 — Example of tool guarding

In addition, an impeding device shall be attached to the sliding table (see Figure 16 Key 3). This device shall prevent horizontal access, in a direction perpendicular to the device, to any exposed tool or part of the tool over the full length of the travel of the table. Any impeding device fixed to the sliding table shall not be removable without the aid of a tool.

Where it is necessary that parts of the safeguarding provided are opened or removed, e.g. for tool changing, setting, adjustment, cleaning, off-cut removal etc., these parts shall be moveable guards with interlocking and guard locking. As an exception, guard locking is not required if the rundown time is less than 10 s.

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

5.6.2 Single-end tenoning machines with a mechanical feed sliding table

Access to the tools shall be prevented by means of a combination of fixed and automatically adjustable guards, which, together with the workpiece, prevent access to the tools, e.g. see Figure 17.

The movements of the automatically adjustable guards can be either power operated or achieved by means of mechanical connection with the sliding table.

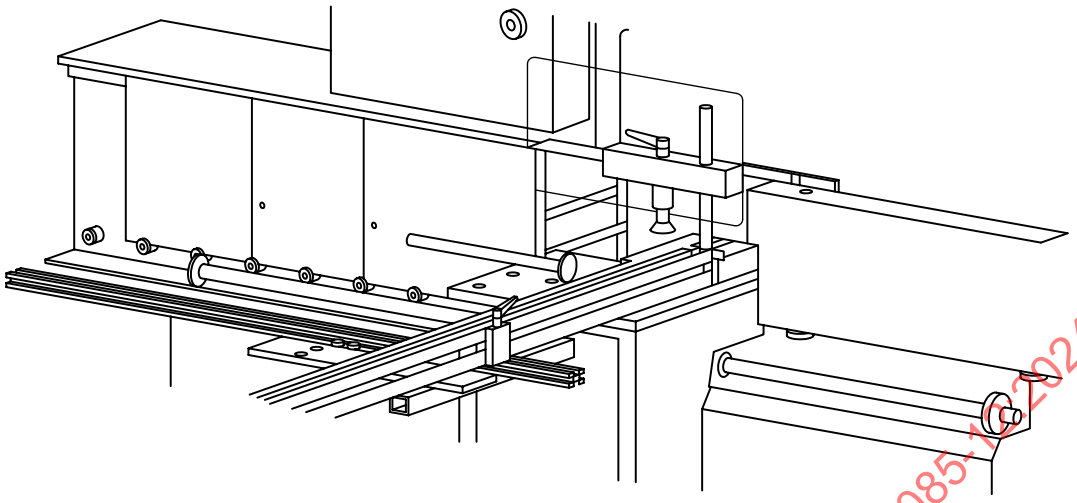


Figure 17 — Example of a combination of guards enclosing the tools

In addition, where it is necessary that parts of the safeguarding are opened, for example, for tool changing, setting, adjustment, cleaning and off-cut removal, these parts shall be moveable guards with interlocking and guard locking.

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

5.6.3 Single-end tenoning-profiling machines with mechanical feed

5.6.3.1 General

Access to the rotating tools, including sanding tools, shall be prevented by means of fixed guards which make up

— a complete enclosure, or

— an integral enclosure, except for the opening between the feed chain and the top pressure beam, or between the lower workpiece support and the upper feed rollers.

Where access is provided for tool changing, cleaning, adjustment or setting, this access shall be via a moveable guard with interlocking and guard locking.

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

5.6.3.2 Measures against access to hazard points through the opening between lower workpiece support and upper feeder rollers

The risk of contact with the tools through the opening between the lower workpiece support and the upper feed rollers shall be minimised by the provision of impeding devices (see ISO 12100:2010, 3.27) that shall be positioned (see Figure 18):

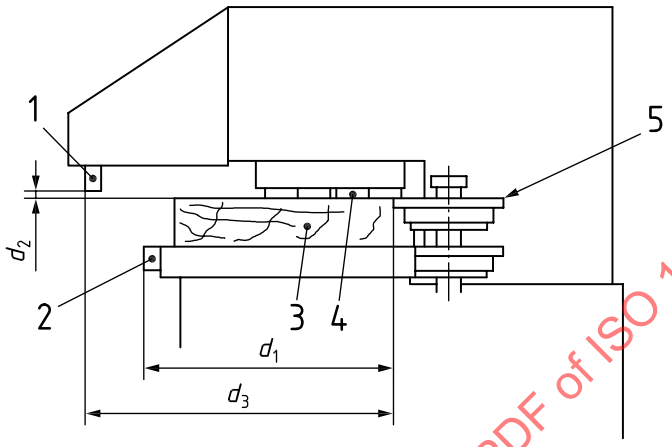
a) below the workpiece support (e.g. the table) in such a way that the horizontal distance, d_1, between the front edge of the impeding device below the workpiece and the tool is more than or equal to 230 mm; and

b) above the workpiece, fitted to the top pressure beam or the feed roller beam so that

1) on machines with a maximum height capacity lower than or equal to 150 mm, the horizontal distance, d_3, between the front edge of the device above the workpiece and the tool is more than or equal to 350 mm;

2) on machines with a maximum height capacity higher than 150 mm, the horizontal distance, d_3, between the front edge of the device above the workpiece and the tool is more than or equal to 550 mm;

3) the vertical distance, d_2, between the impeding device and the workpiece is automatically adjusted to less than or equal to 15 mm.



Key

1 impeding device above the workpiece
2 impeding device below the workpiece
3 workpiece
4 feed rollers
5 tool

Figure 18 — Illustration of impeding devices

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

5.6.3.3 Measures against access to hazard points through the opening between feed chain and top pressure beam

The opening between feed chain and top pressure beam shall fulfil the following requirements.

— Where the opening height is lower than or equal to 60 mm, a pictogram shall be affixed at the infeed and outfeed ends of the top pressure beam and at 4 m pitch along the top pressure beam drawing attention to the residual risk.

— Where the opening is higher than 60 mm, a pictogram shall be affixed at the infeed and outfeed ends of the top pressure beam drawing attention to the residual risk [see 7.2.2 e)]. Along the top pressure beam length, a horizontal safety distance of 1 m perpendicular to the pressure beam direction shall be kept by the deterring effect of the workpiece support.

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

5.6.4 Double-end tenoning-profiling machines with mechanical feed

5.6.4.1 General

Access to the rotating tools, including sanding tools, shall be prevented by means of fixed guards which make up

— a complete enclosure, or

— an integral enclosure, except for the opening between the workpiece support and the top pressure beam.

Where access is provided for tool changing, cleaning, adjustment or setting, this access shall be via a movable guard with interlocking and guard locking.

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

5.6.4.2 Guarding of sanding belts

Access to the sanding belt, other than to that part necessarily exposed for sanding the workpiece, shall be prevented by fixed guards, in combination with a moveable guard with interlocking and guard locking.

Fixed guards shall be provided to prevent shearing and crushing hazards between the workpiece and the external sanding unit.

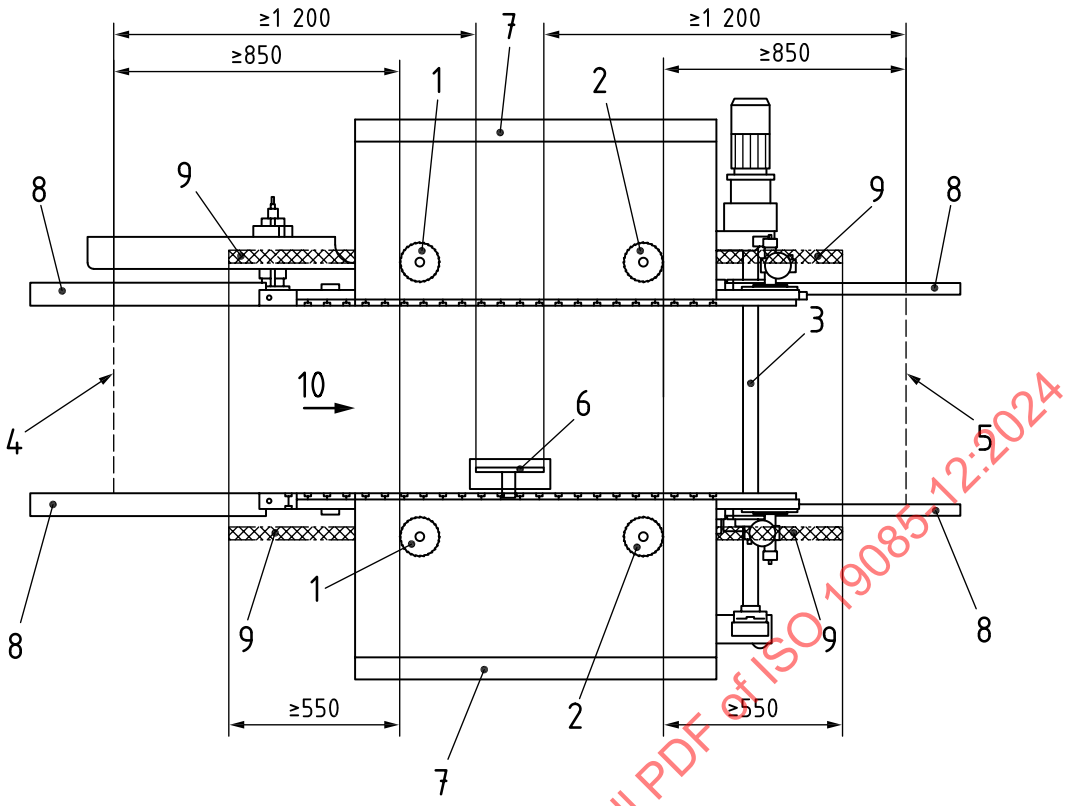
Verification is done by checking relevant drawings and circuit diagrams, inspecting the machine, and relevant functional testing of the machine.

5.6.4.3 Guarding of units installed out of the integral enclosure

If sawing units or milling units for grooving installed out of the integral enclosure and between machine halves are provided, saw blades and milling tools shall be guarded by fixed guards, except for the part involved in machining (see Figure 19 Key 6).

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

Dimensions in millimetres



Key

1	first tools	6	sawing or milling unit for grooving installed outside the integral enclosure
2	last tools	7	integral enclosure
3	feed shaft	8	workpiece support
4	infeed end AOPD	9	fixed guard above the workpiece support
5	outfeed end AOPD	10	feed direction

Figure 19 — Safeguards positions to prevent access between machine halves

5.6.4.4 Access between machine halves

The machine shall be fitted with two AOPDs with at least two beams each, positioned at infeed and outfeed ends.

The AOPDs shall:

a) activate a normal stop when triggered;

b) extend across the full width of the opening between the chain beams;

c) be positioned at a height of 400 mm above the floor level for the lower light beam and for the upper light beam at a height of 900 mm ± 100 mm above the floor level;

d) be positioned at a distance of at least 850 mm from the periphery of the first and last tools (maximum mountable diameter), and of at least 1 200 mm from the periphery of the grooving tool (maximum mountable diameter) installed outside of the integral enclosure between the machine halves (see Figure 19).

In any case, the outfeed end AOPD shall be positioned external (downstream) to the feed shaft where this is provided. See Figure 19.

Access between the machine halves from the sides below the part of the workpiece support (see Figure 19 Key 8) protruding from the integral enclosure (see Figure 19 Key 7) shall be prevented by vertical fixed

guards, extending from the AOPD position (see Figure 19 Keys 4 and 5) to the integral enclosure. Any opening below such guards shall not be higher than 180 mm.

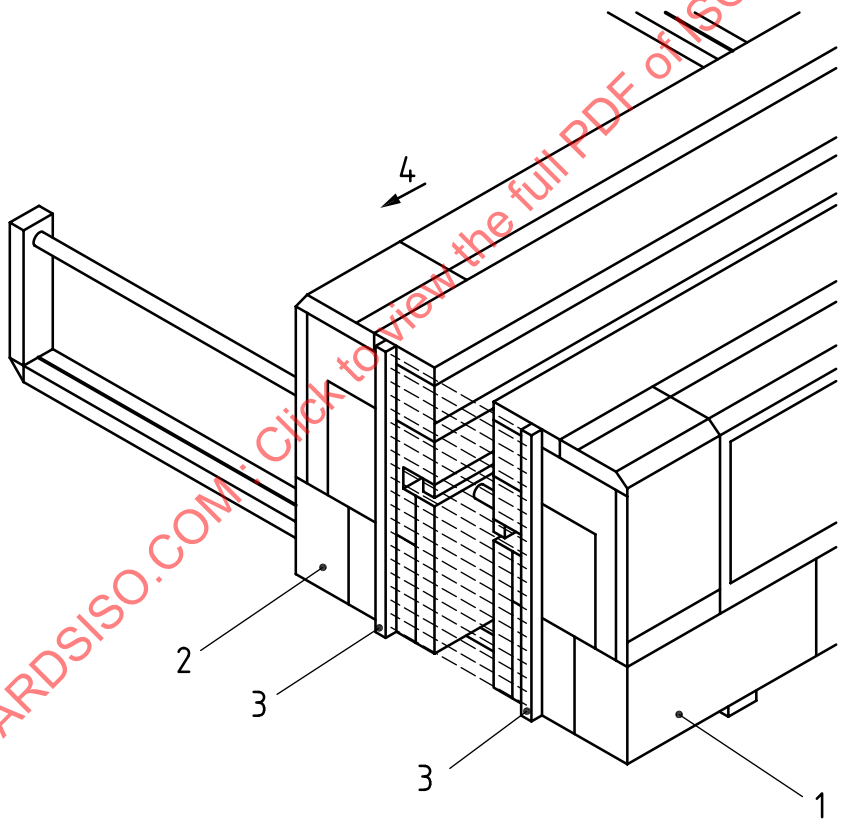
Access to the tools inside the integral enclosure from the sides, above the part of the workpiece support (see Figure 19 Key 8) protruding from the integral enclosure (see Figure 19 Key 7) shall be prevented by vertical fixed guards (see Figure 19 Key 9) extending horizontally up to at least 550 mm from the periphery of the closest tool (with maximum mountable diameter) installed inside the integral enclosure and vertically from the workpiece support up to 1 600 mm from the floor level or the top level of the machine enclosure, whichever is less.

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

5.6.4.5 Crushing between machine halves during the closing movement

Crushing hazard between machine halves or machine closing half and intermediate workpiece support or intermediate workpiece support and fixed machine half shall be prevented by one of the following measures:

a) AOPD with a pitch of 30 mm or less, placed over the full height of the internal edges of machine ends (see Figure 20): the AOPD shall trigger the safe stop of the machine half; a manual reset control shall be provided;



Key

1	fixed half	3	AOPD
2	movable half	4	feed direction

Figure 20 — AOPD at the outfeed end

b) limiting device (see ISO 12100:2010, 3.26.8) which prevents the machine halves from coming closer than 500 mm: the machine halves shall only be permitted to come closer than 500 mm by using a hold-to-run control device or a jog control together with an enabling control (the jog control may achieve no PL_r); the SRP/CS for interlocking by a limiting device shall achieve PL_r = c;

c) hold-to-run control for the closing movement or jog control together with an enabling control (the jog control may achieve no PL_r).

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

5.6.4.6 Crushing between machine halves and fixed parts of the machine during the opening movement

Crushing and shearing hazards between the fixed parts of the machine and the moving/opening of the machine halves shall be prevented by one of the following measures:

a) a mechanically actuated trip device (PSPE), which shall comply with the following requirements:

   1) it shall extend over at least the full length of the crushing area;

   2) it shall have a maximum tripping force of 150 N with a test probe Ø80 mm in accordance with ISO 13856-2:2013;

   3) the PSPE shall trigger a safe stop of the machine half before the PSPE is fully compressed;

b) an AOPD with one beam, which shall comply with the following requirements:

   1) it shall extend over at least the full length of the crushing area;

   2) it shall be positioned so that the sensor is at least 50 mm in front of the crushing area;

   3) the residual movement after actuation shall be no more than 50 mm;

   4) the AOPD shall trigger a safe stop of the machine half;

c) a limiting device, which shall prevent the machine half coming closer than 500 mm to a fixed part of the machine; further movement in the same direction shall only be possible by means of a hold-to-run control device or a jog control together with an enabling control (the jog control is allowed to achieve no PL_r); the SRP/CS for interlocking by a limiting device shall achieve $PL_r = c$;

d) a hold-to-run control for the opening movement of the machine half or a jog control together with an enabling control (the jog control is allowed to achieve no PL_r).

In a) and b), a manual reset control shall be provided.

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

5.6.5 Angular systems for tenoning and profiling with mechanical feed

Requirements stated in 5.6.2 and 5.6.3 shall apply respectively to the tenoning and the profiling side of the machine.

Crushing and shearing hazards between fixed parts of the machine and either the sliding table or the machined workpiece, or both, shall be prevented

a) at the loading/unloading side, by a fixed guard (see Figure 5 Key 7) extending from the level of the workpiece support downwards to a distance from the floor not greater than 180 mm; in addition, when the crushing points are closer than 850 mm, an AOPD with a pitch of 40 mm or less shall be provided and placed at a distance of at least 150 mm from the crushing points and up to a height of at least 1 400 mm (see Figure 5 Key 9);

b) at the other sides, by one of the following – different solutions may be installed on different sides or sections of the machine:

   1) fixed guards with a height greater than 1 800 mm and extending downwards to a distance from the floor not greater than 180 mm;

2) optoelectronic protective devices (AOPD, see Figure 5 Key 8) with at least three beams, positioned at heights of 300 mm, 700 mm and 1 100 mm above the floor level and at a horizontal distance not lower than 850 mm from any crushing and shearing points.

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

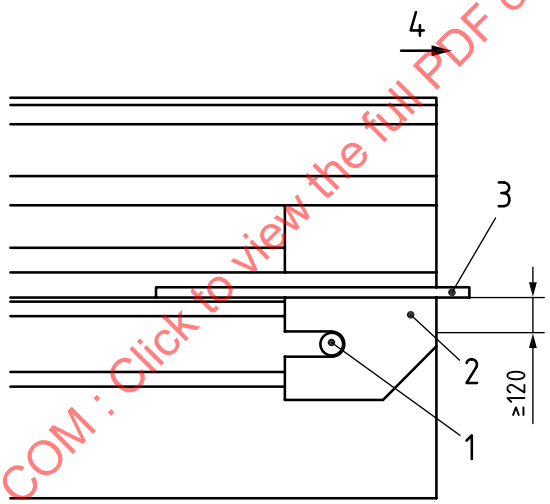
5.6.6 Guarding of drives

Access to hazardous movements of drives, for example, for the tools or feed mechanism except the feed shaft, shall be prevented by fixed guards, and, where access is required more than once a week, also by movable guards with interlocking. Movable guards shall be provided with interlocking and guard locking, if the run-down time is higher than 10 s, and where access to the tools is also possible, independently from the run-down time.

As an exception, at the rear side of single-end tenoning-profiling machines with mechanical feed and of angular systems for tenoning and profiling with mechanical feed, where it is possible to reach the tools, moveable guards are not required if the run-down time is less than 10 s. In this case fixed guards only are sufficient to prevent access to the tools and drives.

For double-end tenoning-profiling machines with mechanical feed, the feed shaft (if any) shall be positioned at a vertical distance of at least 120 mm below the workpiece lower surface (see Figure 21).

Dimensions in millimetres



Key

1	feed shaft	3	workpiece
2	workpiece support	4	feed direction

Figure 21 — Feed shaft at machine out feed

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

5.6.7 Guarding of the chain or feed mechanisms

5.6.7.1 General

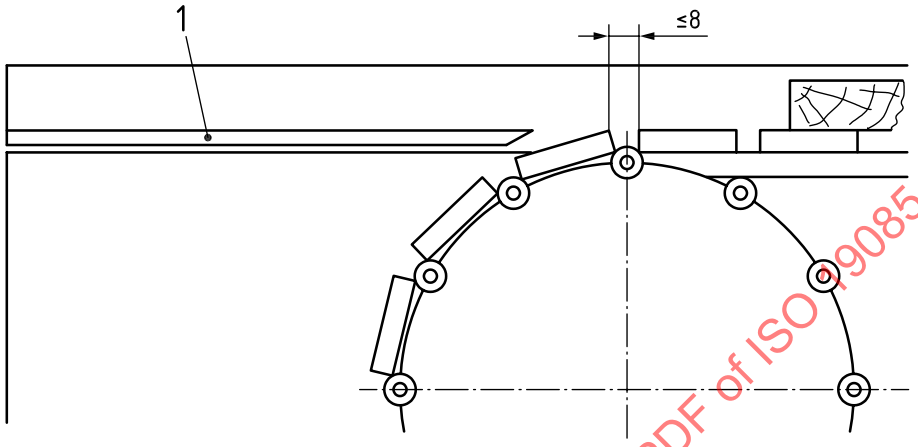
Access to chains and pressure devices shall be prevented by the enclosure required by 5.6.3 and for such parts outside the enclosure by fixed guards except for that part of the chain and the pressure device necessarily exposed for holding and feeding the workpiece.

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

5.6.7.2 Infeed end of the machine

At the infeed end, outside the enclosure, the hazard of crushing between the closing pads of the chain shall be minimised by adequate design of the chain, for example, by limiting opening between chain pads to 8 mm maximum where accessible from above (e.g. see Figure 22) or by providing a fixed guard (e.g. flexible plate) to prevent direct access from above.

Dimensions in millimetres



Key

1 workpiece support

2 feed direction

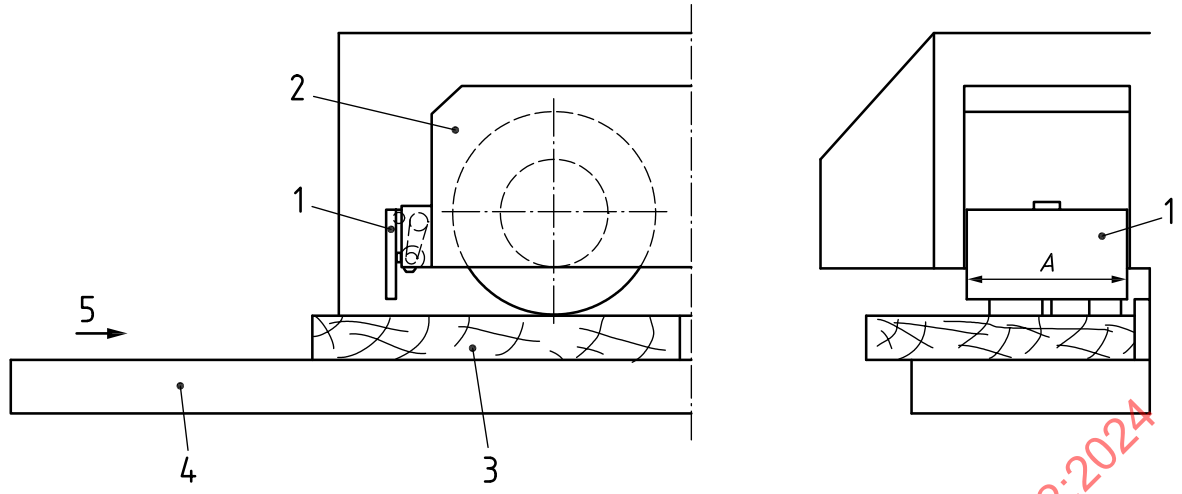
Figure 22 — Example of an adequate feed chain design

Access to the trapping points of each top pressure beam shall be prevented by a mechanically actuated trip device (PSPE, see Figure 23) which shall meet the following requirements.

a) The width of the sensor of each trip device shall extend at least over the full width of the beam (see *A* in Figure 23).

b) The trip sensor shall be designed and positioned so that a test wedge, lying on a workpiece moving at the maximum feed speed, cannot reach the hazard point with its front end and can still be retracted (not clamped). The test wedge shall be made of solid wood, 200 mm long, 100 mm wide, 12 mm high at its front and 40 mm high at its rear.

c) The trip device shall not in itself create a trapping hazard.



Key

1	trip device sensor	4	workpiece support
2	feed roller or top pressure beam	5	feed direction
3	workpiece	*A*	trip device sensor width

Figure 23 — Example of a trip device at the infeed end of single-end profiling machines with integrated feed

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

5.6.7.3 Outfeed end of the machine

At the outfeed end, the hazard of being drawn between the chain and the fixed part of the machine shall be reduced by using a workpiece support or a suitable extension to the casing minimising the gap between it and the chain to a maximum of 8 mm.

Where the feed chain is provided with dogs, entanglement, crushing and shearing hazards between the feed chain dogs and fixed parts of the machine shall be prevented providing safeguards keeping a distance to these points not lower than 850 mm from the accessible parts of the outfeed side of the machine in any direction.

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

5.7 Impact hazard

ISO 19085-1:2021, 5.7, applies with the following additions.

As an exception, the workpiece feed speed may exceed 25 m/min.

Machines with feed speed exceeding 40 m/min shall be provided either with:

— an outfeed table, designed for unloading perpendicularly to the feed direction; or

— either a mechanical system for unloading or a workpiece transfer, or both.

5.8 Clamping devices

ISO 19085-1:2021, 5.8, is replaced by the following text subdivided into further specific subclauses.

5.8.1 Single-end tenoning machines with sliding table

Machines shall be provided with workpiece clamping.

The sliding table shall have a facility for fitting one or more side clamps to prevent the workpiece turning during cutting.

On machines with a mechanical feed sliding table, clamping shall be powered and designed such that the workpiece remains clamped until the tool spindles have stopped rotating if there is a failure of the power supply.

Where powered clamping is provided, crushing hazards shall be prevented by one of the following measures:

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

b) reduction of the gap between clamp and workpiece to 6 mm or less by a manually adjustable device in combination with clamping stroke limitation to a maximum of 10 mm; or

c) guarding of the clamp by a guard fixed to the clamping device to reduce the gap between workpiece and guard to less than 6 mm; the maximum extension of the clamp outside the guard shall not exceed 6 mm.

The SRP/CS for the prevention of any unexpected activation of second stage clamping force in a) shall achieve PL_r = c.

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

5.8.2 Machines other than single-end tenoning machines with sliding table

Clamping is referred to top pressure beam of the machine or upper feed rollers or feeding clamps, whichever is the case.

On machines with manual height adjustment of the feed mechanism, by hand-wheel or power operated, instructions shall be given in accordance with 7.3.2 g).

On machines with automatic height adjustment of the feed mechanism under NC or CNC-control, upward movement of the feed mechanism while the tools are rotating shall only be possible providing a means of detecting that any workpiece entered the infeed of the machine has passed the tools. The SRP/CS for interlocking of upward automatic height adjustment with workpiece detection shall achieve PL_r = b.

When the top pressure beam or the upper feed rollers are detected to be incorrectly automatically adjusted for the height of the loaded workpiece, the feed shall stop. The SRP/CS for the interlocking of the automatic height adjustment for the loaded workpiece height and the feed shall achieve PL_r = b.

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

5.9 Measures against ejection

5.9.1 General

ISO 19085-1:2021, 5.9.1, applies with the following additions.

If provision is made to see through the guards, and there is a risk of ejection, visibility shall be provided by the use of polycarbonate (see 5.9.2). Wire mesh shall not be used.

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 A.

As an exception, in single-end tenoning machines with a manual feed sliding table, guards to prevent ejection from saw blade when guarded separately from milling tool may be of class B.

The 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, applies.

5.9.2.3 Guards of class B

ISO 19085-1:2021, 5.9.2.3, applies.

5.9.3 Devices to minimize the possibility or effect of ejection or kickback

Subclause specific to this document.

Means, for example, deflectors, shall be fitted to move off-cuts away from the saw-blade in order to prevent them from coming into contact with the subsequent tools and being ejected from the machine, or the off-cuts shall be hogged and extracted.

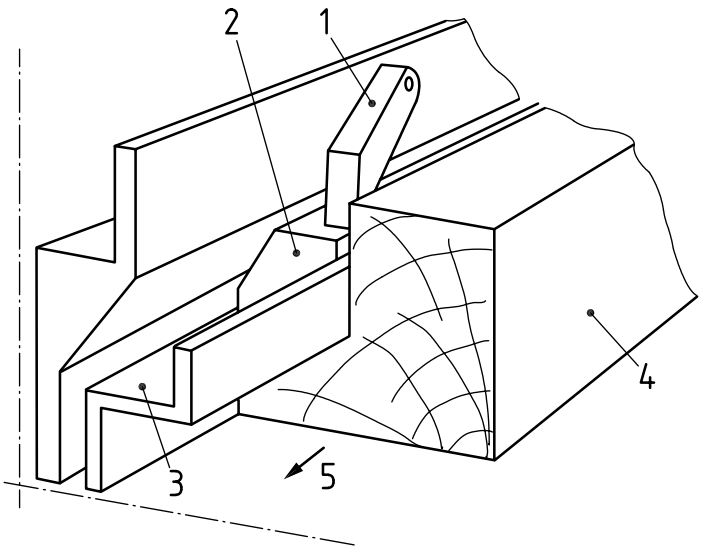
Single-end tenoning machines with a manual feed sliding table shall be designed so that climb cutting is not possible.

Single-end tenoning-profiling machines with mechanical feed with or without a sliding table (also when integrated in an angular system for tenoning and profiling) if fitted with a glass bead saw unit shall be equipped with:

— a bead ledge separator;

— a device to guide the bead ledge, e.g. a guiding channel (see Figure 24 Key 3);

— a device to avoid or minimize the risk of kick-back of the bead ledge, e.g. an anti-kickback finger in front or behind the saw-blade (see Figure 24).



Key

1 anti-kickback finger behind the saw-blade
2 bead ledge
3 guiding channel for bead ledge
4 workpiece
5 feed direction

Figure 24 — Example of an anti-kickback finger and guiding channel

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

5.10 Workpiece support and guides

ISO 19085-1:2021, 5.10, applies with the following additions, subdivided into further specific subclauses.

5.10.1 Single-end tenoning machines with sliding table

Machines shall be provided with a fence on the sliding table, against which the workpiece is located during machining. If the part of the fence guiding the workpiece is adjustable and if there is a possibility of contact between the fence and the tools, this part of the fence shall be made of easily machinable material.

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

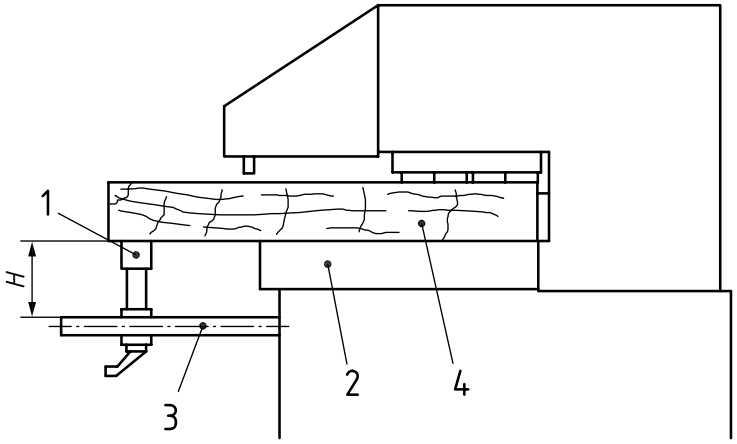
5.10.2 Single-end tenoning-profiling machines with mechanical feed

A fence shall be provided and placed upstream before the first cutting unit. Where this fence is adjustable, it shall be capable of being locked in position.

A support for overhanging workpieces (e.g. a complete window frame) shall be provided. Hand/arm/head shearing or crushing hazards between the overhanging workpieces and this support shall be minimized by positioning the bars or structure carrying this support at a gap, *H*, of at least 120 mm below the top of the feed chain or fixed table (see Figure 25).

When the risk of shearing or crushing of the whole body is present, the gap, *H*, shall be at least 500 mm.

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



Key

1	workpiece support	4	workpiece
2	machine table	*H*	minimum gap between workpiece and carrying bar
3	carrying bar for workpiece support		

Figure 25 — Support for overhanging workpieces

5.10.3 Double-end tenoning-profiling machines with mechanical feed

The workpiece shall be guided and supported by the chain beam or by similar conveyor (e.g. belt conveyor) or by feeding clamps and the top pressure beam.

Intermediate workpiece support may be provided (see Figure 4 Key 3).

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

5.10.4 Angular systems for tenoning and profiling with mechanical feed

The requirements stated in 5.10.1 and 5.10.2 shall apply to the tenoning and the profiling parts of the machine, respectively.

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

5.10.5 Automatic workpiece returner

On single-end tenoning-profiling machines with mechanical feed and on angular systems for tenoning and profiling fitted with an automatic workpiece returner, the following requirements apply (see Figure 26).

Access to the shearing and crushing points shall be prevented, for example, by fixed guards with a minimum height of 1 800 mm and a maximum distance from the floor of 180 mm, providing a horizontal distance of at least 850 mm from shearing and crushing points.

Access to the hazardous points through the gap (if any) between the workpiece returner and the machine shall be prevented by fixed guards below the workpiece returner's external sides positioned in such a way that remaining gaps are not higher than 180 mm and ladder effect is avoided, and by one of the following safeguards, positioned at the infeed:

a) an AOPD mounted inclined and meeting the following requirements:

   1) the external ray at the infeed side of the machine shall be mounted at a height of 400 mm above the floor level;

2) the external ray at the opposite of the infeed side of the machine shall be mounted at a height of 700 mm above the floor level;

3) the horizontal distance between external rays shall be not less than 400 mm;

4) the pitch between two consecutive rays shall be maximum 90 mm, measured on the horizontal projection;

5) the AOPD shall trigger a safe stop of the feed and of any dangerous movement of the workpiece returner; any unexpected start shall be prevented; the SRP/CS for the prevention of any unexpected start of these movements shall achieve PLr = c; a manually operated reset control device for reactivating the AOPD shall be provided;

b) a moveable guard with interlocking, extending in height from a maximum of 180 mm above the floor level up to at least 700 mm or the level of the workpiece support, whichever is less.

On double-end tenoning-profiling machines with mechanical feed provided with workpiece returner between machine halves (see Figure 11), access to crushing and shearing points of the workpiece returner between machine halves are prevented by the AOPD required in 5.6.4.4.

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

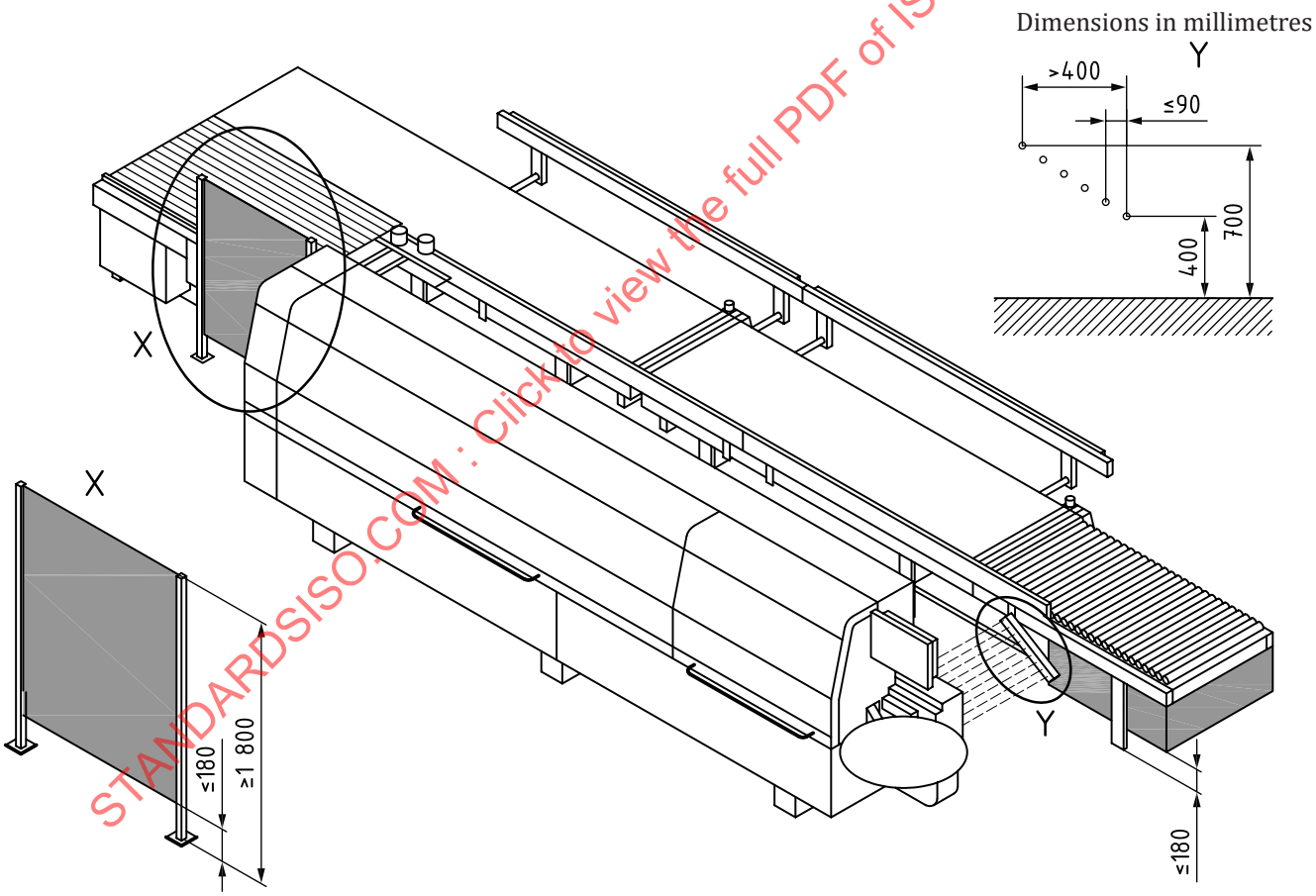


Figure 26 — Example of an automatic workpiece returner with AOPD in a single-end machine

5.10.6 Parallel infeed device

Shearing and crushing hazards between the workpiece and fixed parts of the machine at the infeed side shall be prevented by the trip device sensor on the top pressure beam (see Figure 23 Key 1). In addition,

where access at gaps between guiding rollers of the reference fence (see Figure 12 Key 2) and the workpiece is not prevented by guards, the following requirements shall be fulfilled (see Figure 12, detail Y):

a) rollers shall protrude from the guard not more than 6 mm;

b) rollers axial dimension shall not be greater than 25 mm;

c) distance between two adjacent rollers shall be not more than 6 mm.

Entanglement hazards at the lateral feeding belt shall be prevented, e.g. by fixed guards.

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

5.10.7 Transversal infeed device

Shearing and crushing hazards (e.g. during return movement of the transversal infeed device) shall be prevented by at least one of the following measures:

a) a minimum gap between the fixed parts of the machine and the infeed device of 120 mm;

b) a PSPE with a maximum tripping force of 150 N with a test probe of Ø80 mm in accordance with ISO 13856-2:2013;

c) limiting the force of the transversal infeed device towards the fixed parts of the machine to a maximum of 150 N.

The SRP/CS for limiting the power-operated movement force shall achieve PL_r = c.

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

5.10.8 Automatic infeed device

Access to the shearing and crushing points at the infeed end of the reference fence and of the pushing device shall be prevented, e.g. by fixed guards providing a horizontal distance to the hazard points not less than 850 mm from accessible sides of the automatic infeed device.

Shearing and crushing hazards during machine half movements shall be prevented by providing one or both of the following safeguards:

a) fixed guards and movable guards with interlocking;

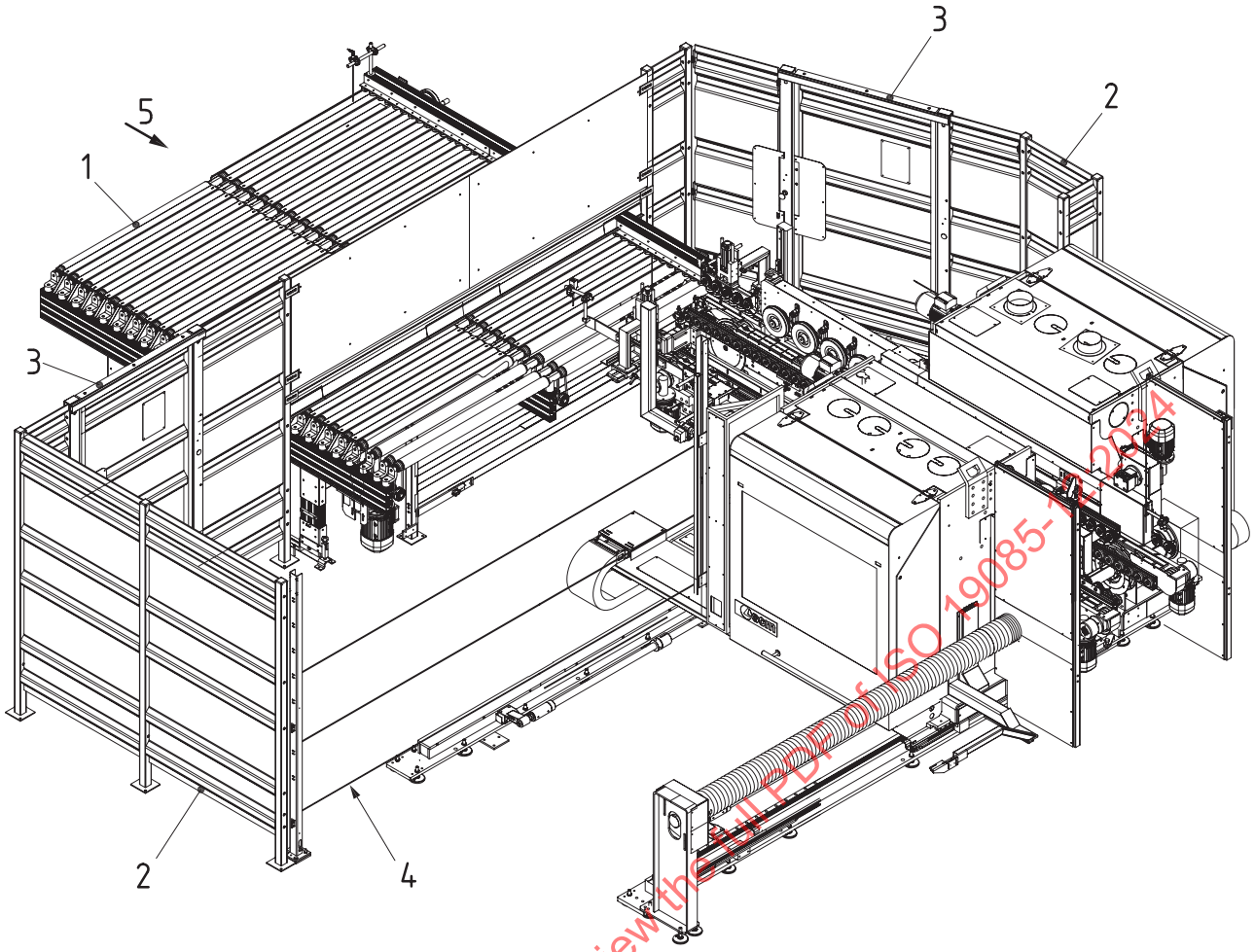
b) protective devices, which shall keep a horizontal distance to the hazard points not less than 850 mm; where AOPD are used, they shall have at least three light beams at heights of 300 mm, 700 mm and 1 100 mm from the floor level.

EXAMPLE A combination of fixed and moveable guards with interlocking and AOPD or sliding guards can be installed as shown in Figure 27.

Guards mentioned above shall have a minimum height of 1 800 mm and a maximum distance from the floor of 180 mm.

The length of the roller table shall be at least 1 400 mm.

Triggering the protective devices and opening the moveable guards with interlocking shall cause a safe stop of any reachable dangerous movement (e.g. feed, infeed device, machine half). Any unexpected start shall be prevented. The SRP/CS for the prevention of any unexpected start of these movements shall achieve PL_r = c. A manually operated reset control device for reactivating the safeguards shall be provided.



Key

1	roller table	4	AOPD
2	fixed guards	5	infeed
3	interlocking moveable guards		

Figure 27 — Example of the safeguarding of an automatic infeed device

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

5.10.9 Additional workpiece support at the outfeed

Shearing, entanglement and crushing hazards shall be prevented by keeping a horizontal distance to the hazard points not less than 850 mm from external accessible sides of the additional outfeed workpiece support.

Shearing and crushing hazards during machine half movements shall be prevented by providing one or both of the following safeguards:

a) fixed guards and movable guards with interlocking, which shall have a minimum height of 1 800 mm and a maximum distance from the floor of 180 mm;

b) protective devices, which shall keep a horizontal distance to the hazard points not less than 850 mm; where AOPD are used, they shall have at least three light beams at heights of 300 mm, 700 mm and 1 100 mm from floor level.

Triggering the protective devices and opening the moveable guards with interlocking shall cause a safe stop of any reachable dangerous movement (e.g. feed, machine half). Any unexpected start shall be prevented. The SRP/CS for the prevention of any unexpected start of these movements shall achieve PL_r = c. A manually operated reset control device for reactivating the safeguards shall be provided.

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

6 Safety requirements and measures for protection against other hazards

6.1 Fire

ISO 19085-1:2021, 6.1, applies.

6.2 Noise

6.2.1 Noise reduction at the design stage

ISO 19085-1:2021, 6.2.1, applies with the following additions.

With the exception of single-end tenoning machines with a manual feed sliding table, machines shall be provided with noise enclosure. If this noise enclosure is part of the guarding system, the requirements in 5.6.2 to 5.6.5 shall be fulfilled. If the noise enclosure is effective for the noise hazards only, i.e. other guards are provided against the mechanical hazards, the noise enclosure is not required to be interlocked (also see 7.3.2).

The enclosure should be lined with sound absorbing material where possible. A lining material with a noise absorbing factor, α, of 0,7 at 1 kHz measured in accordance with the requirements of ISO 354:2003 may be used.

ISO 15667:2000 provides guidelines for noise control by enclosures and cabins.

6.2.2 Noise emission measurement and declaration

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

Annex F shall be applied for noise test and declaration of

— a single-end tenoning machine with a manual feed sliding table,

— a single-end tenoning machine with a mechanical feed sliding table,

— a single-end tenoning-profiling machine with mechanical feed,

— a double-end tenoning-profiling machine with mechanical feed, and

— an angular system for tenoning and profiling with mechanical feed.

6.3 Emission of chips and dust

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

Requirements referring to tools apply to sanding units too.

6.4 Electricity

ISO 19085-1:2021, 6.4, applies.

6.5 Ergonomics and handling

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

The height of the workpiece support surface shall be designed in accordance with ergonomic principles (see EN 1005-4); typical examples of height of the workpiece support are between 800 mm and 1 100 mm above the floor level.

If the machine is fitted with a movable control panel, this panel shall be fitted with a handle or alike to move it in the desired position.

If graphical symbols related to the operation of actuators are used, they shall be in accordance with IEC 61310-1:2007, Table A.1.

6.6 Lighting

ISO 19085-1:2021, 6.6, applies.

6.7 Pneumatics

ISO 19085-1:2021, 6.7, applies.

6.8 Hydraulics

ISO 19085-1:2021, 6.8, applies.

6.9 Electromagnetic compatibility

ISO 19085-1:2021, 6.9, applies.

6.10 Laser

ISO 19085-1:2021, 6.10, applies with the following additions.

Accessible parts of laser marking unit shall be of laser class 1 in accordance with IEC 60825-1:2014. Access to other parts of higher laser class in accordance with IEC 60825-1:2014 shall be prevented by either fixed guards or movable guards, or both, interlocked with the laser unit enabling and the requirements of ISO 11553-1:2020 and of IEC 60825-1:2014 shall be fulfilled.

The SRP/CS for interlocking between movable guards and laser marking unit enabling shall achieve PL_r = c.

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.

6.16 Extreme temperatures

Subclause specific to this document.

Where a foiling unit is fitted, it shall retract automatically disengaging the rollers from the workpiece in case of a power supply failure.

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

6.17 Substances

Subclause specific to this document.

Laser marking unit and gluing unit shall be provided with one dedicated extraction outlet for each.

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

7 Information for use

7.1 Warning devices

ISO 19085-1:2021, 7.1, applies.

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, is replaced by the following text.

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

a) in machines fitted with manual height adjustment, by hand-wheel or power operated, of top pressure beam or upper feed rollers, a pictogram or written warning shall be permanently affixed to the machine stating that the top pressure beam shall be correctly adjusted to accommodate the workpiece to be machined;

b) on double-end machines provided with two separate pneumatic isolators, one for each half, a warning label shall be placed in proximity of each pneumatic supply disconnection device warning that the other pneumatic supply is not isolated by isolation of the current pneumatic supply disconnection device;

c) an arrow for spindles that can rotate in clockwise direction and double arrow for spindles that can rotate in both directions of rotation;

d) for each spindle requiring speed monitoring in accordance with 4.7.3, a label like Figure 28, positioned close to the spindle, indicating the monitored speed of the spindle and that tools allowed to be mounted are only those with a maximum rotational speed, n_{max}, equal to or greater than the monitored speed of the spindle;

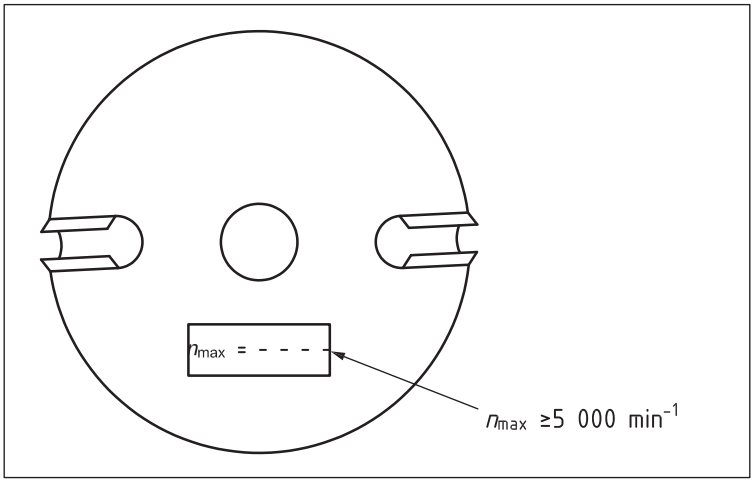


Figure 28 — Example of a label for spindles

e) on single-end machines fed by chain, a pictogram shall be affixed drawing attention to the residual risk as required in 5.6.3.3;

f) where machine is fitted with a laser marking unit, a warning symbol for accessible laser radiation in accordance with EN 12198-1:2000+A1:2008.

Verification is done by checking 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 addition.

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

a) information on the reasonably foreseeable misuse includes machining sparks generating metals;

b) information that the maximum length of the workpieces to be processed shall not exceed the free space at the outfeed end of the machine minus 500 mm;

c) on single-end machines, information that the maximum width of the workpieces to be processed shall not exceed the free space at the side of the workpiece support minus 500 mm;

d) on double-end machines, information that, at the side of the moving machine half, a minimum free space of 500 mm between the moving machine half and the other fixed adjacent machines, part of the building or stocks of material, etc. shall be ensured, if crushing and shearing hazards are not prevented by the measures given in 5.6.4.6;

e) where relevant, information on how to avoid contact between the tools which are adjusted manually and the other parts of the machine;

f) where relevant, information on how to avoid contact between the tools and other parts of the machine during powered adjustment of the spindles, e.g. the correct positioning of the manually adjustable mechanical restraint device or by validating the operation of the relevant work programme in the numeric control system;

g) on machines with manual height adjustment, by hand-wheel or power operated, of top pressure beam or upper feed rollers, information to avoid rising up the feed mechanism while tools are rotating and workpieces or parts of it are still in the machine; on machines with automatic height adjustment, when rising of the feed mechanism is impeded, a message shall be given for the operator to check for the presence of workpieces;

h) 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;

j) in single-end tenoning machines with a mechanical feed sliding table, also when integrated in angular systems for tenoning and profiling with integrated feed, instructions for safe use

   1) to ensure workpieces are properly supported using additional support if necessary,

   2) to divert off-cuts away from the cutting area into a suitable receptacle and to empty this when necessary,

   3) to maintain the sliding table so that it is free running throughout the extent of its travel and to take the necessary care to prevent a person being crushed or sheared between the moving table and any fixed structure, for example, by providing a perimeter barrier around the machine,

   4) to prevent the creation of an obstruction in the table traverse area and within one meter from it – mark the area on the floor to help achieve this;

k) instruction for safe use, which shall also include:

   1) the wear of respiratory protection to reduce the risk of inhalation of harmful gases, on machines using polyurethane (PU) glue or with laser marking unit;

   2) to use only milling tools and saw blades rated for a speed equal to or higher than the maximum rotational speed of the spindle indicated by the corresponding warning label [see 7.2.2 d)];

   3) to stop all tools before greasing the feed chain in single-end machines;

l) information that the gluing unit when using PU glue shall be connected to a dedicated extraction system, separate from the chips and dust extraction systems (CADES);

m) where foiling unit is fitted, instruction on the correct stopping procedure to avoid overheating;

n) information that the laser marking unit shall be connected to a dedicated extraction system, separate from the CADES;

o) a warning that manually adjustable spindles not in use shall be moved to a non-cutting position before starting integrated feed or their tools shall be removed;

p) when using PU glue, an explanation that its temperature limit shall not be exceeded because it generates carcinogenic substances;

q) instruction for connecting the machine, at its installation, to the CADES designed in accordance with relevant standards [see ISO 19085-1:2021, 7.3.1 e)], and instruction for checking the local laws on safety in the work place regarding any emission or dust content in recirculation in the CADES itself.

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 the machines 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	Relevant subclause in this document
1	Mechanical hazards related to — machine parts or workpieces due to		
	a) shape	6.2.2.1, 6.2.2.2, 6.3	4.2, 5.3, 5.6, 5.10, 6.15 7.2, 7.3
	b) relative location		4.2, 4.3, 4.8, 5.6, 7.2
	c) mass and stability (potential energy of elements which can move under the effect of gravity)		4.8, 4.9
	d) mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)		4.3, 4.8, 5.6, 5.10
	e) mechanical strength		5.2
	— accumulation of energy inside the machinery by gases under pressure	6.2.10, 6.3.5.4	4.8, 6.7, 6.13, 7.3
1.1	Crushing hazard		4.3, 4.4, 4.8, 5.4, 5.10, 5.6, 6.12, 6.13
1.2	Shearing hazard		4.3, 4.4, 5.4, 5.10, 5.6, 6.12, 6.13
1.3	Cutting or severing hazard		4.3, 4.4, 4.5, 4.8, 5.4, 5.6, 6.12, 6.13
1.4	Entanglement hazard		4.4, 4.5, 5.6, 6.12, 6.13
1.5	Drawing-in or trapping hazard		4.3, 4.4, 4.5, 5.4, 5.6, 6.12, 6.13
1.6	Impact hazard		4.3, 5.7, 5.10, 6.12
1.9	High pressure fluid injection or ejection hazard	6.2.10	4.4, 6.7, 6.8, 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
3	Thermal hazards resulting in		
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	6.2.4	6.16
3.2	Damage to health by hot or cold working environment	6.2.4	6.16
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	Interference with speech communication, acoustic signals		
6	Hazards generated by radiation		

Table A.1 *(continued)*

No.	Hazards, hazardous situations and hazardous events	Subclause of ISO 12100:2010	Relevant subclause in this document
6.5	Laser	6.3.4.5	6.10
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 b), 6.2.4	6.3, 6.17, 7.3
7.2	Fire	6.2.4	6.1
8	Hazards generated by neglecting ergonomic principles in machinery design		
8.1	Unhealthy postures or excessive effort	6.2.7, 6.2.8.2, 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	6.6, 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	6.2.8.7, 6.2.11.8	4.2
8.8	Design or location of visual display units	6.2.8.8, 6.4.2	4.2
9	Combination of hazards	6.3.2.1	4.6, 4.7.3
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, 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
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities)	6.2.8, 6.2.11.8, 6.2.11.10, 6.3.5.2	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	Variations 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
19	Slip, trip and fall hazards in relationship with machinery (due to their mechanical nature)	6.3.5.6	7.3

Annex B
(informative)

Performance levels required

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

Table B.1 summarizes the performance level required for each safety function. Clauses 4, 5 and 6 give the full requirements.

Table B.1 — Safety functions and their PL_r

Area		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	4.3.1
	2	Interlocking of start with safeguards	c	4.3.1	4.3.1
	3	Interlocking of powered feed with tool rotation	c	4.3.1	
	4	Prevention of unexpected control power-on	c	4.3.2	4.3.2
	5	Interlocking of control power on with safeguards	c	4.3.2	4.3.2
	6	Interlocking of power-driven movements of mechanical feed sliding table with clamping system	c		4.3.2
	7	Interlocking of feed start with tool spindle drive	b		4.3.2
	8	Interlocking of feed start with spindle retraction	b		4.3.2
	9	Interlocking of laser marking unit activation with feed	c		4.3.3
	10	Interlocking of laser marking unit activation with workpiece detection	b		4.3.3
Stop	11	Normal stop (braking function excluded)	c	4.4.2	
	12	Laser marking unit disabling with any safe stop	c		4.4.1
	13	Monitoring of the stand-still condition	c	4.4.3	
	14	Emergency stop (braking function excluded)	c	4.4.4	
Braking	15	Activation of the brakes	c	4.5	
	16	Electronic braking system (excluding PDS/SR)	b	4.5	
	17	SS1 of PDS/SR	c	4.5	
	18	Interlocking of brake release	c	5.4.3	
Mode selection	19	Mode selection	c	4.6	
	20	Start of sanding unit drives	c		4.6.1
	21	Prevention of unexpected start of rotation, movements and adjustments of tools and other processing units	c		4.6.2
	22	Disabling the AOPD between halves when all spindles and movements are stationary for MODE 3	c		4.6.2
	23	Prevention of unexpected start of the movements of machine halves and workpiece intermediate support	c		4.6.2
Spindle speed	24	Speed selection	c	4.7.2	4.7.2
	25	Speed monitoring	c	4.7.3	4.7.3

Table B.1 *(continued)*

Area		Safety function/devices	PL_r	Subclause of ISO 19085-1:2021	Subclause of this document
Controls	26	Manual reset	c	4.9	
	27	Standstill detection and monitoring	c	4.10	
	28	Speed monitoring of machine moving parts except tools	c	4.11	
	29	Time delay	c	4.12	
	30	Interlocking pressure detection with machine operation	b		4.8
	31	Interlocking of spindle power adjustment with sliding table position	c		5.2
	32	Automatic activation of emergency stop when wireless connection is lost	c		4.2.1
	33	Interlocking of laser marking unit movable guards and laser marking unit enabling	c		6.10
Tool fixing	34	Interlocking of tool release with spindle standstill	c/b+b		5.3.1
	35	Interlocking of spindle start with outboard bearings mounted	c		5.3.1
	36	Prevention of unexpected start for manual tool change	c		5.3.1
Safeguards	37	Hold-to-run	b/c	5.5.3	
	38	Interlocking of dangerous movements with ESPE	c	5.5.5	
	39	Interlocking of dangerous movements with PSPE	c	5.5.6	
	40	Interlocking of movable guards	c	5.5.2.2, 5.5.2.3	
	41	Guard locking of movable guards	c	5.5.2.3	
	42	Enabling control	c	5.5.7	
	43	Power operated automatically adjustable guards closing	c		5.6.1
	44	Interlocking by limiting device	c		5.6.4.5, 5.6.4.6
Clamping	45	Prevention of unexpected activation of second stage clamping force	c		5.8.1
	46	Interlocking of upward automatic height adjustment with workpiece detection.	b		5.8.2
	47	Interlocking of automatic height adjustment for the loaded workpiece height with the feed	b		5.8.2
Workpiece feeding devices	48	Prevention of unexpected start of feed and of any dangerous movement of the workpiece returner	c		5.10.5
	49	Limiting the force of the power-operated movement	c		5.10.7
	50	Prevention of unexpected start of reachable dangerous movements (e.g. Feed, infeed device, machine half)	c		5.10.8, 5.10.9