INTERNATIONAL STANDARD

ISO 12643-3

Second edition
2010-12-15

Graphic technology — Safety requirements for graphic technology equipment and systems —

Part 3: Binding and finishing equipment and systems

Technologie graphique — Exigences de sécurité pour les systèmes et l'équipement de technologie graphique —

Partie 3: Systèmes et équipement de reliure et de finissage

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 12643-3 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition of ISO 12643-3 constitutes a technical revision of the first edition (ISO 12643-3:2008). Significant changes incorporated into this second edition include, but are not limited to, updated requirements for performance levels (PL) or safety integrity levels (SIL) as defined in the current version of ISO 13849-1 and IEC 62061, respectively.

It is the intent of ISO/TC 130 that both the first and second editions of ISO 12643-3 be applicable until 2011-12-31. ISO 12643-3:2008 is thus provisionally retained until this date.

As from 2012-01-01, ISO 12643-3:2010 will cancel and replace ISO 12643-3:2008. Accordingly, as from 2012-01-01, only ISO 12643-3:2010 will be applicable to new equipment manufactured.

ISO 12643 consists of the following parts, under the general title *Graphic technology — Safety requirements for graphic technology equipment and systems*:

— *Part 1: General requirements*

— *Part 2: Prepress and press equipment and systems*

— *Part 3: Binding and finishing equipment and systems*

— *Part 4: Converting equipment and systems*

— *Part 5: Stand-alone platen presses*

Introduction

During the development of this part of ISO 12643, existing relevant standards of other countries were taken into consideration. An effort has been made to harmonize the requirements of all countries, recognizing that national standards or laws may dictate national requirements. In cases where it was known that there is a national requirement that differs from this part of ISO 12643, that has been noted.

This part of ISO 12643 was developed to harmonize the requirements of the following US and European safety standards:

— ANSI B65.2, *Graphic technology — Safety requirements for binding and finishing systems and equipment*

— ANSI B65.3, *Safety standard — Guillotine paper cutters, mill trimmers and integral handling equipment*

— ANSI B65.4, *Safety standard — Three-knife trimmers including rotary, and single- and multiple-knife trimmers*

— EN 1010-1, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 1: Common requirements*

— EN 1010-3, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 3: Cutting machines*

— EN 1010-4, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 4: Bookbinding, paper converting and finishing machines*

Graphic technology — Safety requirements for graphic technology equipment and systems —

Part 3:
Binding and finishing equipment and systems

1 Scope

This part of ISO 12643 provides safety requirements specific to binding and finishing equipment and systems. It is intended to be used in conjunction with the general requirements given in ISO 12643-1.

This part of ISO 12643 provides additional safety requirements for the design and construction of new equipment used to convert printed or blank substrates into cut, folded, collated, assembled, bound, or otherwise finished product. It can also be applicable to processes for preparing substrate for the printing process.

It is applicable to a wide range of equipment used in the binding and finishing process.

2 Normative references

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

ISO 12643-1, *Graphic technology — Safety requirements for graphic technology equipment and systems — Part 1: General requirements*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

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

ISO 14119, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14123-1, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers*

ISO 14123-2, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 2: Methodology leading to verification procedures*

IEC 62061, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

EN 1539, *Dryers and ovens in which flammable substances are released — Safety requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12643-1, ISO 13849-1 and the following apply.

3.1
anti-repeat device
mechanical or electromechanical mechanism that ensures that only one cutting cycle occurs for each manual activation or automatic cut if the primary stopping system or **single-cycle device** (3.33) fails

3.2
automatic cutting sequence
programmed succession of clamping operations and/or cutting movements that is initiated by the operator and proceeds to a specified point without further intervention by the operator

3.3
back-rounding and pressing machine
apparatus for processing book signatures, i.e. for rounding the spine and the trimmed front edge of book signatures and compressing the resulting signatures

3.4
backgauge
movable device (automatic or manual) on a guillotine cutter, positioned square to the cutting table, used to stop the stack of material to be cut when the material is pushed into the opening under the cutting blade by the operator, as well as to determine the dimensions of the cut

3.5
backgauge drive
mechanism to position the **backgauge** (3.4) prior to the initiation of the cut

3.6
backlining and head-banding machines
⟨hard-cover bookbinding⟩ equipment for the automatic production of hard-cover books where the binding together of the signatures is rounded or flat, with glue, gauze, or paper

3.7
book cover crease forming machine
⟨hard-cover bookbinding⟩ apparatus for creating, under heat and pressure, a permanent bend in the cover of a hard-cover book, then pressing the entire cover surface

3.8
book press
device used for flattening books

3.9
book signature press
power-operated device used for flattening book signatures, which are fed and aligned manually

3.10
casing-in machine
⟨hard-cover bookbinding⟩ apparatus for gluing the end papers of the book signatures to the interior surfaces of the book cover

3.11
clamp
device using pressure to secure product so that it does not move during an operation

3.12
clamp drive
mechanism by which the **clamp**(s) (3.11) of the paper cutter is (are) forced against the material to be cut

3.13
coater
finishing machine that applies a predetermined thickness of a liquid substance (e.g. glue, varnish, ink) on substrates made of paper or a similar material

3.14
counter-stacker
machine for stacking piles of leaflets, books, magazines or newspapers such that the successive layers are positioned at 180° to the previous layer

3.15
cutting cycle
⟨machines with (a) manually driven **clamp**(s) (3.11)⟩ programmed succession of operations that begins when the knife drive is activated and ends when the knife returns to its retracted position

3.16
cutting cycle
⟨machines with (a) power-driven **clamp**(s) (3.11)⟩ programmed succession of operations that begins when high-pressure clamping is initiated and ends when the knife(knives) and clamp(s) return to their retracted positions after a single clamp/knife stroke

3.17
cutting zone
three-dimensional space through which any part of the knife(knives) and/or **clamp**(s) (3.11) travels during the entire **cutting cycle** (3.16)

3.18
gang stitcher
machine for stitching folded sheets of paper, during the operation in which individual folded sheets are removed by feeding grippers and the open sheets are stacked on top of each other on a transport chain for subsequent back-stitching

3.19
gathering machine
apparatus that assembles sheets or folded sheets in a binding line

3.20
guillotine cutter
power-driven machine having a single knife that is used primarily to cut paper products, stacks of paper, or other substrates, as specified by the manufacturer

NOTE This definition includes equipment classified as mill trimmers.

3.21
high-pressure clamping
operation of **clamp**(s) (3.11) with a dynamic force in excess of 300 N for machines up to and including 1,6 m in width, or in excess of 500 N for machines greater than 1,6 m in width, when measured at 75 % of the clamp opening (e.g. with the clamp at 25 % of its maximum travel distance measured from the retracted position)

NOTE The 75 % value is to ensure that the measurement is made at the position that approximates to the size of an operator's hand.

3.22
inserting machine
apparatus that inserts printed matter such as leaflets and magazines at a predetermined position in other printed products, such as newspapers or magazines

3.23
knife drive
mechanism by which the knife of the guillotine is forced through the material to be cut

3.24
laminator
paper-finishing machine that applies a solid material (e.g. foil, paper) to a substrate made of paper or a similar material

3.25
low-pressure clamping
〈for machines with (a) power-driven **clamp**(s) (3.11)〉 operation of clamps with a dynamic force not exceeding 300 N for machines up to and including 1,6 m in width, or not exceeding 500 N for machines greater than 1,6 m in width, when measured at 75 % of the clamp opening (with the clamp at 25 % of its maximum travel measured from the retracted position)

NOTE The 75 % value is to ensure that the measurement is made at the position that approximates to the size of an operator's hand.

3.26
manual clamping
operation of **clamp**(s) (3.11) in which the dynamic and static forces and motion of the clamp are directly supplied by the operator

3.27
paper drill
machine used to drill holes into piles of paper

3.28
paper-embossing machine
machine for finishing paper surfaces by using cylinders to press a design in relief into the paper

3.29
paper-finishing machine
apparatus used for applying liquid or solid coating material to a substrate made of paper or a similar material

3.30
perfect binder
machine for the automatic production of brochures (soft-cover) or book signatures (hard-cover) where gathered folded sheets or single sheets are bound to form book or brochure signatures by applying glue on the pre-processed book back, and where book or brochure signatures are inserted into covers by gluing the cover on the back and/or sides

3.31
safety distance
minimum distance a protective device is required to be placed from a hazard zone

3.32
sheet-folding machine
apparatus to cut, perforate and/or crease single or multiple folds in single sheets of paper

3.33
single-cycle device
mechanism that ensures that only one cutting cycle occurs for each manual activation or automatic cut

NOTE See **anti-repeat device** (3.1).

3.34
stored energy
potential energy that may be released without actuation of the machine drive or controls

4 Conformity with this part of ISO 12643

In order to claim conformity with this part of ISO 12643, all equipment manufactured as of 2012-01-01 shall be in accordance with this second edition of ISO 12643 rather than ISO 12643-3:2008.

5 Guarding of significant hazards

5.1 General

Guarding, consistent with operation of the machine, shall be provided in those areas where it is recognized that operators are exposed to significant hazards. The guarding requirements of ISO 12643-1 apply. See Annex A for a list of hazards associated with binding and finishing equipment and systems.

5.2 Interlocks

5.2.1 Exception for machine motion at inching speed

If a machine is operating at inching speed and under conditions defined in ISO 12643-1, motion may continue when an interlocked guard is opened.

5.2.2 Exception for machine motion at production speed

This exception shall apply only to the specific machines identified in this part of ISO 12643 and does not apply to all equipment.

NOTE This exception might not comply with current European standards or the Machinery Directive[9,10].

There might be parts of the equipment that cannot be observed or adjusted with the guard closed and need to be accessed by an authorized person with an interlocked guard open. Under these circumstances, the following alternative safety measures shall be taken:

a) A mechanical key lock shall be provided adjacent to the access area. There shall be only one key for this lock. The key for this lock shall be accessible only by an authorized person.

b) The key lock shall operate as a hold-to-run device as follows:

   1) inserting the key shall initiate a timer that has a maximum setting of 2 min;

   2) turning the key shall override the guard interlock of only that guard, up to the preset time limit;

   3) as long as the key is held in the turned position, the guard may be opened with machine motion at production speed until such time as the timer reaches the preset time limit;

   4) when the key is released, it shall automatically return to the neutral position and the guard interlock shall be automatically reactivated;

   5) if the key remains in the lock for a period longer than the preset time limit (which shall not exceed 2 min), the interlock on the guard shall be reactivated automatically and the equipment safety system shall stop machine motion.

c) The bypassing means shall meet the requirements of PL_r d of ISO 13849-1 or SIL 2 of IEC 62061.

d) When adjustments are necessary, they shall be performed from outside the hazardous area.

e) A safety label identifying the possible existing hazards with the guard open shall be provided adjacent to the lock. The label shall clearly indicate that, when the key is in the lock, the adjacent guard is overridden.

If a machine is equipped with this alternative safety measure, information regarding its safe use shall be contained in the instruction handbook.

5.3 Guarding of hoppers and hopper feeders

5.3.1 Manually loaded hoppers

On machines using manually loaded hoppers, the hazard points on the separating elements of the hopper feeder shall be safeguarded in accordance with 5.3.4. The exception defined in 5.2.2 may be applied to the hopper feeder, if necessary.

5.3.2 Guarding of automatically fed hoppers

On automatically fed hoppers where manual intervention during normal operation is not required and the material used makes access difficult, tunnel-type guards arranged with a safety distance of 550 mm from the nearest hazard point are considered adequate.

The exception defined in 5.2.2 may be applied to the hopper feeder, if necessary.

5.3.3 Protection of unused hoppers and hopper feeders

For hoppers that are not used and cannot be stopped, blanking boards shall be provided to safeguard the hazard points at the separating elements.

5.3.4 Separating elements on hopper feeders

The hazard points on separating elements outside the sidelays on feeders shall be safeguarded for every format size used.

For hazard points within sidelays, residual-pile monitoring that complies with PL_r b of ISO 13849-1 or SIL 1 of IEC 62061 shall be used.

NOTE This safeguarding can be achieved, for example, by product, by using accordion-type bellows or by the use of additional guards.

5.4 Guarding on binding and finishing machines

5.4.1 Hand-fed riveting, eyeletting and attaching machines

Hazard points between tools on riveting, eyeletting and attaching machines either shall be prevented by design or shall be safeguarded.

Means to satisfy this requirement include, but are not limited to, the following:

— observing a maximum distance of 4 mm between the tools in the open position;

— ensuring that the closing force of the movable tool is less than 50 N; a stronger closing force is allowed to become effective only after a sensing device has confirmed that no part of a human body is located between the two tools.

NOTE The sensing device function, for example, can be based on the fact that the workpiece and a body part have different electrical resistances or different thicknesses.

Hazard points are safeguarded if guards are provided in accordance with ISO 13857 or the machine can be started only by two-hand control.

For machines that are not guarded by a fixed or movable guard, a workpiece support shall be provided, and two-hand controls meeting the requirements of ISO 12643-1 shall be used. If the workpiece needs to be held by hand outside the hazard zone, a hold-to-run control shall be provided for starting the machine instead of the two-hand control.

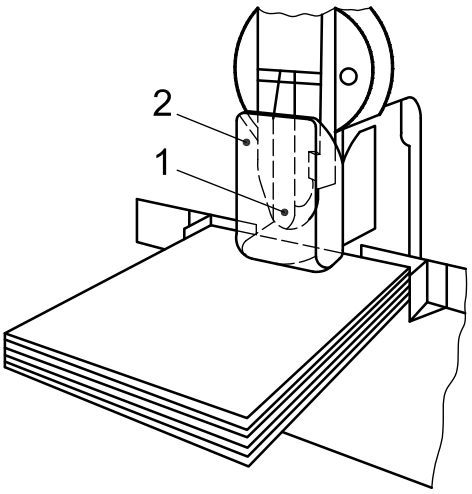
5.4.2 Hand-fed flat- and saddle-stitching machines

Adjustable guards shall be provided on flat-stitching, saddle-stitching and combination-stitching machines for operational reasons (see Figure 1 and Figure 2). Instructions that describe the safe adjustment of the guards in a clear and easily understandable format shall be provided on the machine.

NOTE This marking requirement is satisfied, for example, by providing labels that illustrate the safety distances required for the various stitching thicknesses by means of sketches and measurements.

On combination-stitching machines in the saddle-stitching mode, the guard for the upper tool shall extend to the height of the upper edge of the lower tool (upper edge of the saddle) and shall enclose the upper tool to prevent inadvertent access (see Figure 2).

Guarding may be by either two separate guards or a combined reversible guard. Combined reversible guards shall be suitable for saddle stitching as well as for flat stitching.

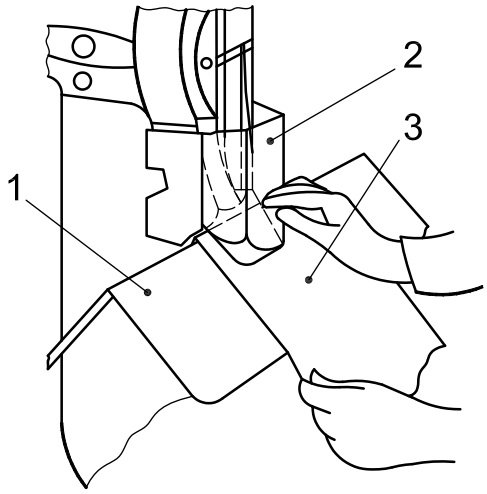


Key

1 upper tool

2 guard

Figure 1 — Flat stitcher



Key

1 upper edge of saddle

2 guard

3 workpiece

Figure 2 — Saddle stitcher

5.4.3 Gang stitchers and drum stitchers

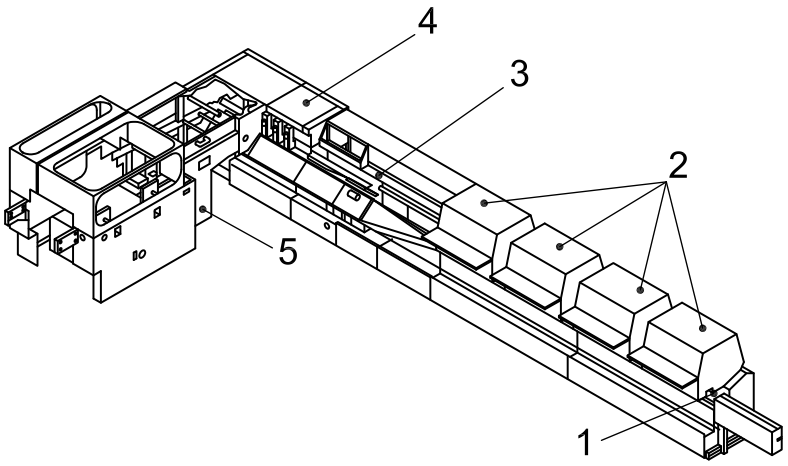
5.4.3.1 Feeders on gang stitchers and drum stitchers

Depending on the design, fixed guards, movable guards, residual-pile monitoring or other means of guarding may be used (see Figure 3).

Where the bottom of the feeder on the transport channel side (see Figure 4) needs to remain open for functional reasons, the lower edges of the guards on the transport channel side shall be extended as low as technically feasible.

EXAMPLE An example of a “functional reason” would be for the use of air vortexes.

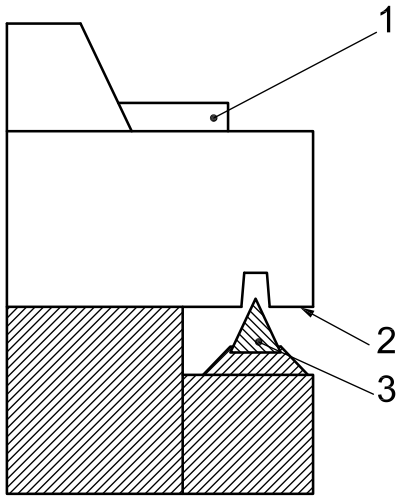
The exception defined in 5.2.2 may be applied to the feeder, if necessary.



Key

1 transport chain
2 feeder
3 thickness control
4 stitching unit
5 trimmer

Figure 3 — Gang stitcher



Key

1 hopper
2 bottom of feeder
3 transport chain

Figure 4 — Feeder

5.4.3.2 Guarding stitching section of gang stitchers

Hazard points on the stitching section shall be safeguarded by interlocked guards on the operator's side. The other side shall be guarded in accordance with ISO 12643-1. Guard apertures shall be in accordance with ISO 13857.

The transport pins shall be made of a flexible material to prevent a shearing hazard against the guard.

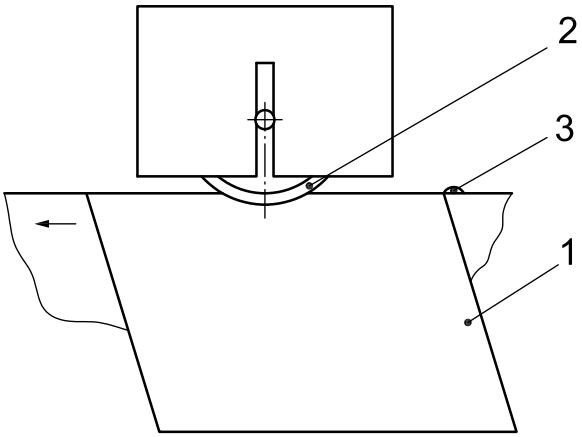
5.4.3.3 Caliper roll

Where an in-running nip exists on the caliper roll used for thickness control (see Figure 5), one or both of the following means of protection shall be used:

— maximum clamping force of 50 N with roller deflection at 20 mm; or

— guarding in accordance with ISO 12643-1.

The transport pins shall be made of a flexible material to prevent a shearing hazard against the guard.



Key

1 folded sheets
2 in-running nip of caliper roll
3 transport chain

Figure 5 — Caliper roll for thickness control

5.4.3.4 Transport-chain pushers on gang stitchers

A safety distance of at least 25 mm shall be maintained between transport-chain pushers and fixed machine parts.

5.4.3.5 Starting gang stitchers and drum stitchers with a guard open

Gang stitchers and drum stitchers may be started for make-ready by means of a two-hand control with interlocking guards in the open position and machine motion at a speed greater than 10 m/min, provided that the requirements of the exception in ISO 12643-1 are met.

5.4.3.6 Trimmer on gang stitchers and drum stitchers

The trimmer on gang stitchers and drum stitchers shall be safeguarded in accordance with 5.10.

5.4.4 Gathering machines

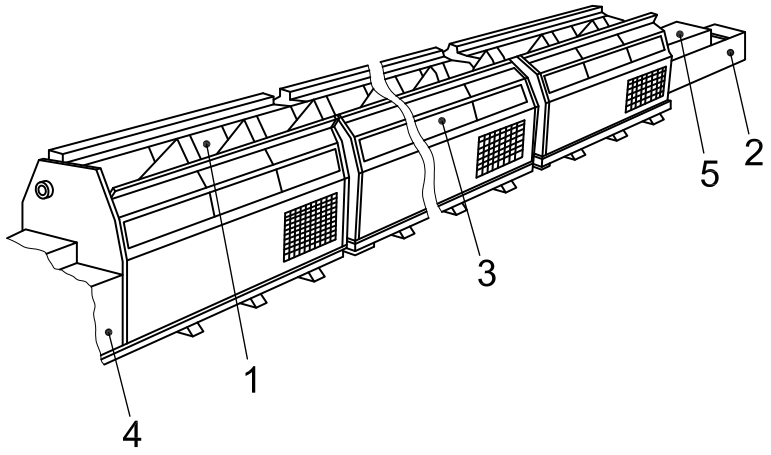
5.4.4.1 General

Gathering machines shall be guarded in accordance with 5.4.4.2 and 5.4.4.3. The exception defined in 5.2.2 may be applied, if necessary.

5.4.4.2 Guarding transport chains

For safeguarding the hazard points on the manual feeding unit, a minimum distance of 25 mm is required between the transport chain and fixed machine parts. Where the minimum distance cannot be achieved and maintained, trip bars meeting the requirements of ISO 12643-1 may be used for safeguarding. Hazard points that can be reached from the manual feeding section in the following feeder shall be safeguarded by fixed or interlocking tunnel-type guards (see Figure 6) having a minimum length of 300 mm.

Hazard points on the gathering device (transport device) shall be safeguarded by fixed or interlocking guards.



Key

1 hopper
2 manual feeding
3 gathering device (transport device)
4 following machines
5 tunnel guard

Figure 6 — Gathering machine (plan view)

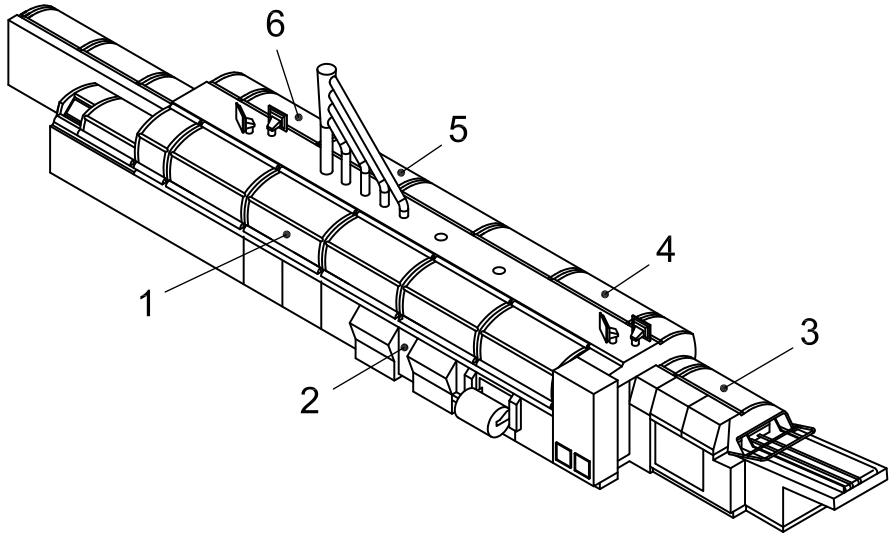
5.4.4.3 Starting gathering machines with a guard open

Gathering machines may be started for make-ready by means of a two-hand control with interlocking guards in the open position and machine motion at a speed greater than 10 m/min, provided that the requirements of the exception in ISO 12643-1 are met.

5.4.5 Perfect binders

5.4.5.1 Guarding book carriage hazards

The hazard points existing between book carriages and between the book carriage and the machine frame, as well as during cover pressing, shall be guarded in accordance with ISO 12643-1. Depending upon the design, fixed guards, movable guards or other means of guarding may be used (see Figure 7).



Key

1	milling unit	4	pressing unit
2	gluing unit	5	book carriage
3	cover feeder	6	delivery

Figure 7 — Perfect binder (plan view)

5.4.5.2 Hazards in the gluing unit

The hazard points existing in the gluing unit (glue rollers, glue applicators) and the hazard points that may exist between materials and machine parts (book backs and clamps, book backs and glue rollers, etc.) shall be guarded in accordance with ISO 12643-1. Depending upon the design, fixed guards, movable guards or other means of guarding may be used.

Guarding in accordance with ISO 12643-1 shall be provided to protect personnel from hot glue spray, both during production and when routinely accessing other nearby areas. The guards adjacent to the hot glue mechanism shall be interlocked so that the hot-glue spray mechanism is deactivated when the guard is open.

5.4.5.3 Glue pans

The glue pans for hot melt shall be provided with a temperature control and maximum-temperature monitoring in accordance with PL_r c of ISO 13849-1 or SIL 1 of IEC 62061. Any hazardous hot-melt vapour shall be exhausted both from the perfect binder and from outside the machine for pre-melters, unless protection from exposure to the vapour is provided by other means.

Perfect binders using polyurethane hot-melt glues for binding shall be designed such that the machine does not emit hazardous concentrations of isocyanates, or that these are removed by an exhaust system. The requirements of ISO 14123-1 and ISO 14123-2 shall be met.

Contact with hot surfaces of the hot-melt pan shall be prevented by guarding or by insulation.

5.4.5.4 UV radiation dryers

Where radiation UV dryers are used, the maximum values of emitted radiation shall comply with ISO 12643-1.

Where the machine operates with an automatic feed, and routine and regular manual intervention is not required, tunnel-type guards with a safety distance of 550 mm from the nearest hazard point are considered adequate.

5.4.5.5 Delivery area

It shall be ensured that the book-carriage (clamp) hazards of the delivery of the perfect binder cannot be accessed. The safety distance from the clamp hazard to the guard shall be a minimum of 550 mm.

5.4.5.6 Starting perfect binders with a guard open

Perfect binders may be started for make-ready by means of a two-hand control with one or more interlocking guards in the open position and machine motion at a speed greater than 10 m/min, provided that the requirements of the exception in ISO 12643-1 are met.

Where functional circumstances require the book cover to be fed manually during set-up of the perfect binder, the machine may be started when one or more interlocking guards are in the open position with a hold-to-run control and a maximum speed of 10 m/min.

5.4.5.7 Milling head cutter (saw)

On high-speed binding lines, where inertia may prevent effective stopping of the milling-head cutter when the interlocking guard covering the book carriages (clamps) is opened, access to the hazardous motion shall be prevented until the motion has stopped.

5.4.5.8 Additional requirements for hand-fed perfect binders

Where there is a risk of injury if the operator's hand goes beyond the book clamp loading area, there shall be a sensing device that will stop machine motion before injury occurs.

The cover-scoring blades shall be guarded with fixed or interlocking guards.

The milling-head cutter shall be protected against unintended access by the use of self-adjusting plates that open to allow a book block to pass over the saw, then automatically close.

5.4.6 Paper drills

5.4.6.1 Single-head hand-fed paper drills

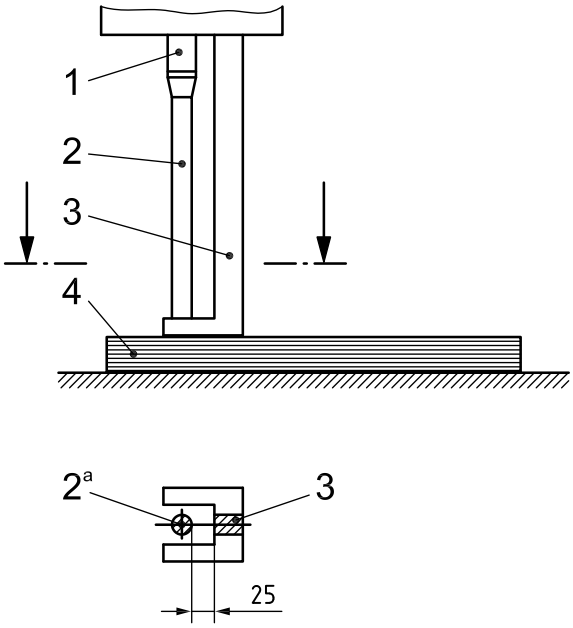
On single-head paper drills with manual feeding, the stroke of the drill or workpiece shall be under hold-to-run control (hand-controlled or foot-controlled) or shall be hand-operated. In addition, a hold-down device (see Figure 8 and Figure 9) shall be provided on the drill in order to prevent persons from coming into unintentional contact with the drill from the front. When the hold-to-run control is released, the drill or workpiece shall return to its start position.

The minimum distance between the hold-down device and the chuck jaw or the drill, whichever has the larger radius, shall be 25 mm (see Figure 8).

5.4.6.2 Guarding the trapping hazard on multi-head drilling machines

On multi-head drilling machines, the trapping hazard existing on drills and chuck jaws shall be safeguarded by a fixed or interlocking guard. On multi-drill machines, hazard points on the chuck jaws shall be protected by the use of fixed or interlocking guards. The minimum distance between the hold-down device or guard (cover) and the chuck jaw or the drill, whichever has the larger radius, shall be 25 mm.

Dimensions in millimetres

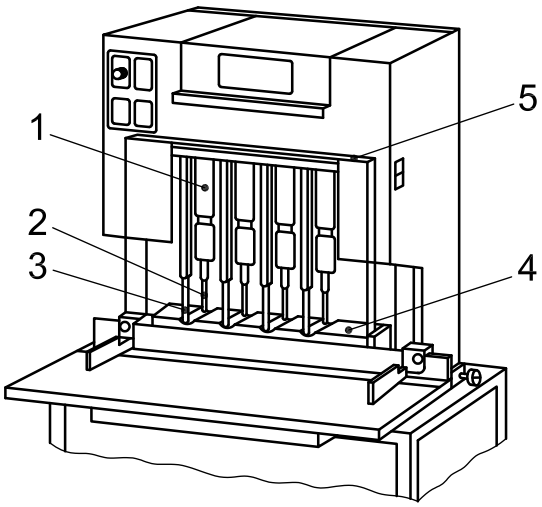


Key

1 chuck jaw
2 drill
3 hold-down device
4 material

[a] Indicates the chuck jaw (1) or the drill (2), whichever has the larger radius.

Figure 8 — Paper drill



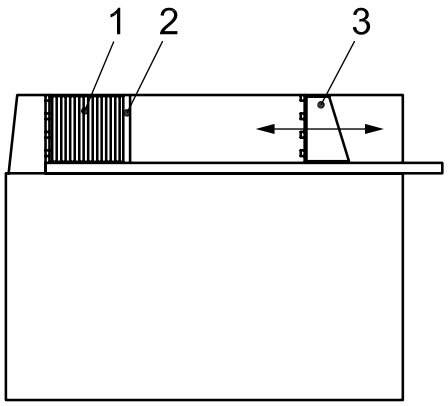
Key

1 chuck jaw
2 drill
3 hold-down device
4 material
5 guard (cover)

Figure 9 — Multi-head paper drill

5.4.7 Book signature presses

On book signature presses, the hazard point between the moving pressing plate and the intermediate plate positioned against the material supply (see Figure 10) shall be safeguarded by using a hold-to-run control.



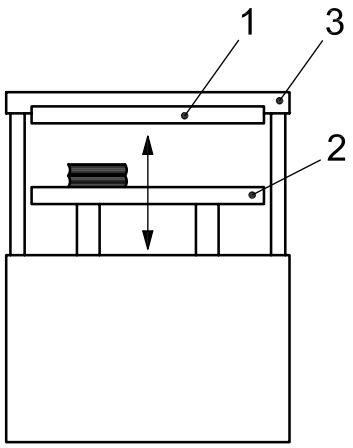
Key

1 book signatures
2 intermediate plate
3 pressing plate

Figure 10 — Book signature press

5.4.8 Book press

The hazard points between the movable pressing plate and the fixed pressing plate or the forming bar (see Figure 11), if any, shall be safeguarded. One means of safeguarding this area is by use of a trip device in accordance with ISO 12643-1.



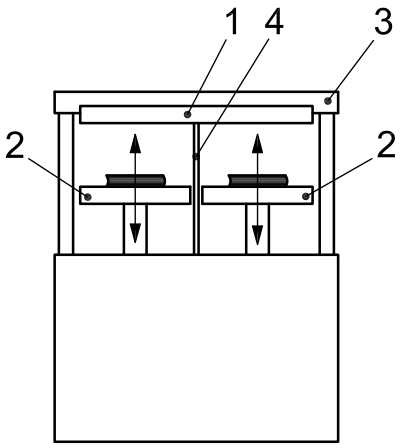
Key

1 trip device
2 movable pressing plate
3 fixed pressing plate

Figure 11 — Book press

On book presses where several pressing plates can be moved individually, the hazard points between the movable pressing plates shall be safeguarded. One means of safeguarding this area is by fitting a guard between the pressing plates (see Figure 12).

If the hazard is safeguarded by fitting a guard between the pressing plates, clearance between the guard and moving pressing plates shall not exceed 6 mm.



Key

1 trip device
2 movable pressing plate
3 fixed pressing plate
4 guard

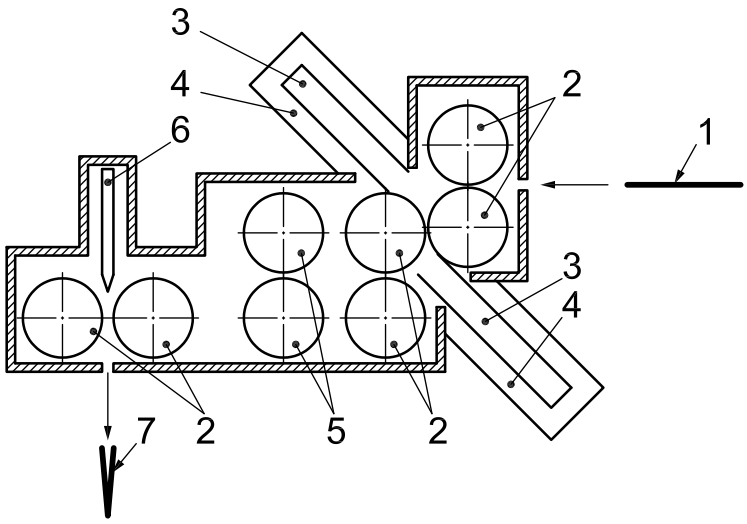
Figure 12 — Book press with two movable pressing plates

5.4.9 Sheet-folding machines

5.4.9.1 Guarding hazard points at the folding rollers

The hazard points at the folding rollers shall be protected by fixed or interlocking guards. Adjustments shall be made from outside the guards. Safeguarding may also be accomplished by using a device with a guarding function.

NOTE An example of a safeguarding device is a buckle plate, as shown in Figure 13.



Key

1	unfolded sheet	5	cutting and creasing device
2	folding roller	6	folding knife
3	buckle plate	7	folded sheet
4	sound enclosure		

Figure 13 — Sheet-folding machine

5.4.9.2 Hazard points on cutting, creasing and perforating devices

Hazard points on cutting, creasing and perforating devices shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending on the design.

5.4.9.3 Safeguarding crushing points between folding knives and folding rollers

The crushing points between folding knives and folding rollers shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending on the design.

5.4.9.4 Safeguarding in-running nips on feeding and delivery belts

In-running nips on feeding and delivery belts shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending on the design.

5.4.9.5 Machine motion with a guard open

When interlocked guards are in the open position, the machine may be operated by two-hand control at production speed as long as the requirements of ISO 12643-1 are met, with the further exception that a selector switch is not required.

NOTE The selector switch is not necessary because a sheet-folding machine is operated in a single mode by one person.

5.4.10 Book production lines for the production of hard-cover books

5.4.10.1 General

Book production lines may be started for make-ready with interlocking guards in the open position by means of a two-hand control and machine motion at a speed no greater than 20 m/min, provided that the requirements of the exception in ISO 12643-1 are met.

NOTE Hold-to-run control speeds in production lines differ due to cycle variations so that a continuous machine speed can result in individual elements having higher speeds at the various stages of the process.

5.4.10.2 Safeguarding in-running nips on conveyor belts

The in-running nips on the belts of a feeding and delivery conveyor shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending on the design. Access from the conveyor belts to any hazard point in the machine shall be prevented.

5.4.10.3 Safeguarding hazard points on preheater

The hazard points on the preheater shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending upon the design.

EXAMPLE Hazard points might be created by preheating rollers, hot parts and transport mechanisms.

Where the preheater is accessible, a pictogram warning of hot parts shall be posted in the vicinity of the preheater.

With the guards in the open position, the preheater shall operate only under hold-to-run control that meets the requirements of ISO 12643-1.

5.4.10.4 Safeguarding hazard points in glue sections

The hazard points in the glue sections shall be protected by fixed or interlocking guards. Safe glue replenishment should be possible during the production run.

Where hot melt is used, the hot-melt pans shall be provided with temperature control and limit-temperature monitoring.

EXAMPLE 1 Hazard points might exist, for example, at in-running nips between glue rollers and at in-running nips between book signatures and glue rollers.

EXAMPLE 2 Safe glue replenishment might be provided, for example, by a piping system or by a method of replenishment from outside the safety devices.

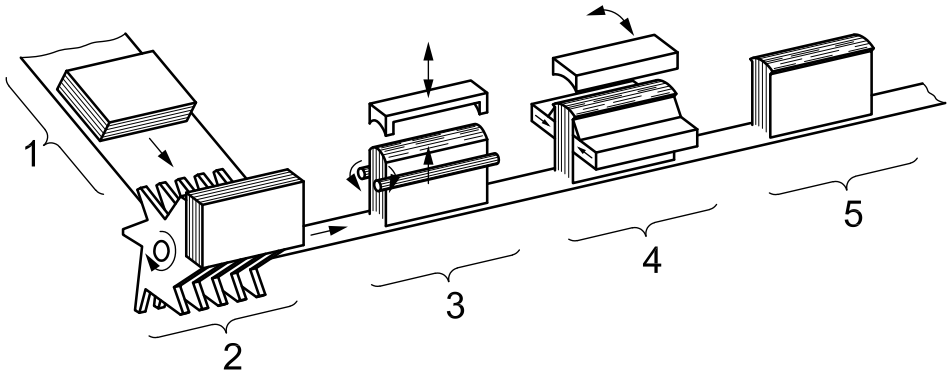
5.4.11 Back-rounding and pressing machines

5.4.11.1 Safeguarding in-running nips on feed and delivery belts

In-running nips on the feed and delivery belts shall be safeguarded in accordance with ISO 12643-1. Access from the conveyor belt to any hazard point inside the machine shall be prevented. A safety distance of at least 550 mm between the conveyor belt and any hazard point inside the machine shall be maintained unless the hazard point is guarded by a fixed or interlocking guard.

5.4.11.2 Safeguarding hazard points on tipping section

Hazard points in the tipping section (see Figure 14) shall be protected by fixed or interlocking guards.



Key

1 feeding of book signatures
2 tipping of book signatures
3 pre-forming section
4 back-rounding and pressing section
5 delivery

Figure 14 — Back-rounding and pressing section (principle)

5.4.11.3 Safeguarding hazard points on pre-forming, back-rounding and pressing sections

Hazard points in the pre-forming, back-rounding and pressing sections (see Figure 14) shall be protected by fixed or interlocking guards.

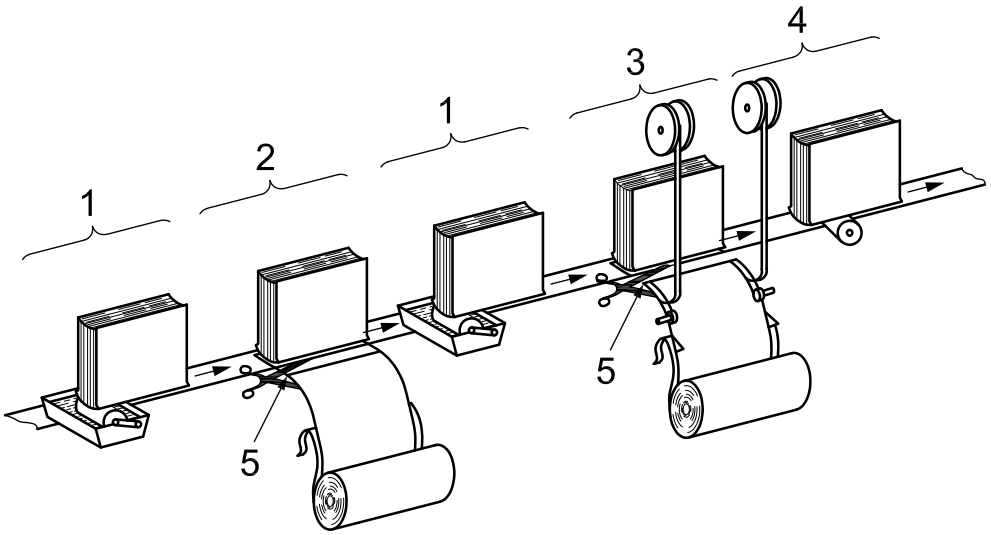
5.4.12 Backlining and head-banding machines

5.4.12.1 Safeguarding in-running nips

Where book signatures are transported between vertically mounted conveyor belts, the in-running nip between the two conveyor belts on the feeding side shall be safeguarded by a tunnel-type guard at least 550 mm long.

5.4.12.2 Safeguarding hazard points on glue section

In the glue section (see Figure 15), hazard points (e.g. glue rollers) shall be protected by guards.



Key

1 glue section
2 gauzing section
3 head-banding section
4 counter-pressure section
5 cutting point

Figure 15 — Backlining and head-banding machine (principle)

5.4.12.3 Safeguarding gauze section hazards

The cutting point in the gauzing section (see Figure 15) shall be protected by fixed guards. The in-running nips on the rollers of the gauzing section (unwinding) shall be safeguarded in accordance with ISO 12643-1.

5.4.12.4 Safeguarding head-banding section hazards

The hazard points inside the head-banding section (see Figure 15) and the cutting points at the cutting knives and at the rotary knives on the unwinding unit of the head-banding section shall be protected by fixed or interlocking guards.

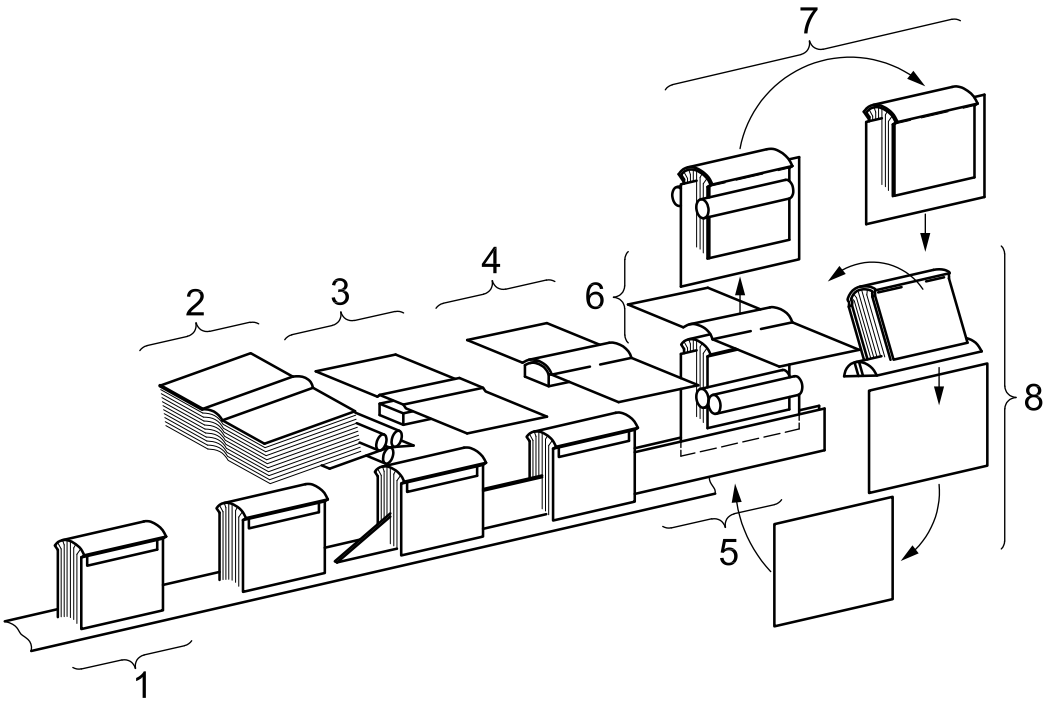
5.4.12.5 Safeguarding counter-pressure section hazards

The hazard points at the counter-pressure sections (see Figure 15) shall be protected by fixed or interlocking guards.

5.4.13 Casing-in (case-binding) machines

5.4.13.1 Safeguarding hazard points between book transport and fixed machine parts

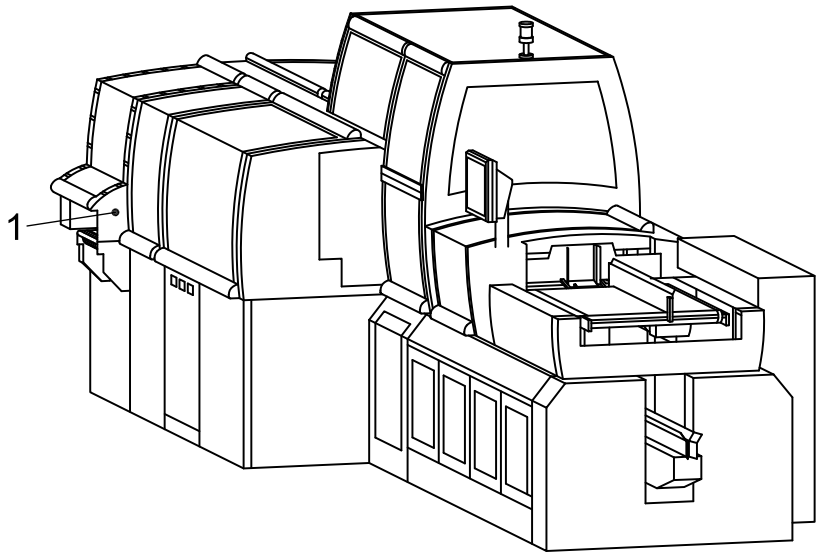
The hazard points between book-transport fingers and fixed parts of the machine shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending upon the design. A safety distance of at least 550 mm between the book-transport fingers and fixed parts of the machine shall be maintained unless the hazard point is guarded by a fixed or interlocking guard. See Figure 16 and Figure 17.



Key

1	feeding	5	gluing section
2	book cover feeder	6	casing-in section
3	cover bending section	7	counter-pressure section
4	forming section	8	delivery

Figure 16 — Casing-in machine (principle)



Key

1 tunnel-type guard

Figure 17 — Casing-in machine showing tunnel-type guard

5.4.13.2 Safeguarding hazard points at delivery

The hazard points (e.g. crushing points at the transport device) at the delivery shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used depending on the design. Figure 17 shows the use of a tunnel guard. Hazard points inside the machine shall not be accessible from the delivery side. A safety distance of at least 550 mm between the hazard and the open end of the guard nearest the hazard shall be maintained unless the hazard point is guarded by a fixed or interlocking guard.

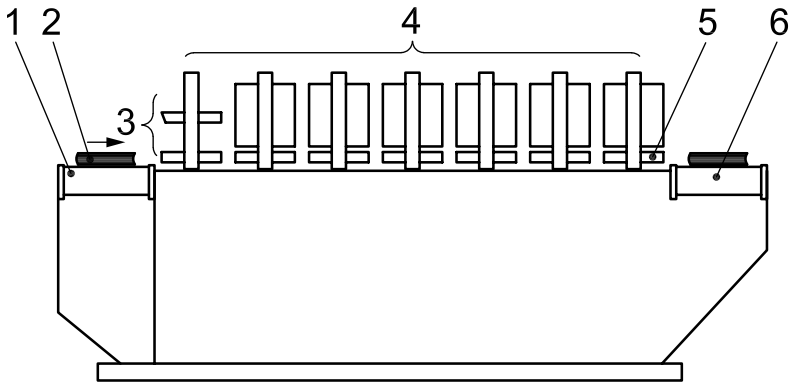
5.4.14 Book-cover crease-forming machines (presses)

5.4.14.1 Safeguarding in-running nips

In-running nips on the feed and delivery belts (see Figure 18) shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending on the design. It shall not be possible for a person to reach a hazard point inside the machine from the delivery. A safety distance of at least 550 mm between the hazard and the open end of the guard nearest the hazard shall be maintained unless the hazard point is guarded by a fixed or interlocking guard.

5.4.14.2 Safeguarding hazard points in tipping section

The hazard points (e.g. crushing points created by the tipping and transport device) in the tipping section (see Figure 18) shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending upon the design.



Key

1	feeding belt	4	pressing section
2	book signature	5	crease-forming rail
3	tipping section	6	delivery belt

Figure 18 — Book-cover crease-forming machine (press)

5.4.14.3 Safeguarding hazard points at pressing section

The crushing points at the pressing section (e.g. between books and crease-forming devices) (see Figure 18) shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of guarding may be used, depending upon the design. Pictograms warning of hot parts shall be posted in the vicinity of accessible heated book-cover crease-forming devices.

5.4.14.4 Motion with a guard open

Book-cover crease-forming machines may be started for make-ready by means of a two-hand control with interlocking guards in the open position and machine motion at a speed greater than 10 m/min but no more than 20 m/min, provided that the requirements of the exception in ISO 12643-1 are met.

NOTE A hold-to-run speed greater than 10 m/min could be needed to ensure that the book in the machine does not burn during the glue melting process.

5.5 Inserting and collating machines

Machines with automatic feeders may be started for make-ready by means of a two-hand control with interlocking guards in the open position and machine motion at a speed greater than 10 m/min, provided that the requirements of ISO 12643-1 are met.

5.6 Counter-stackers

5.6.1 Safeguarding divert gates (waste separator)

The crushing point on the divert gate (see Figure 19) shall be safeguarded.

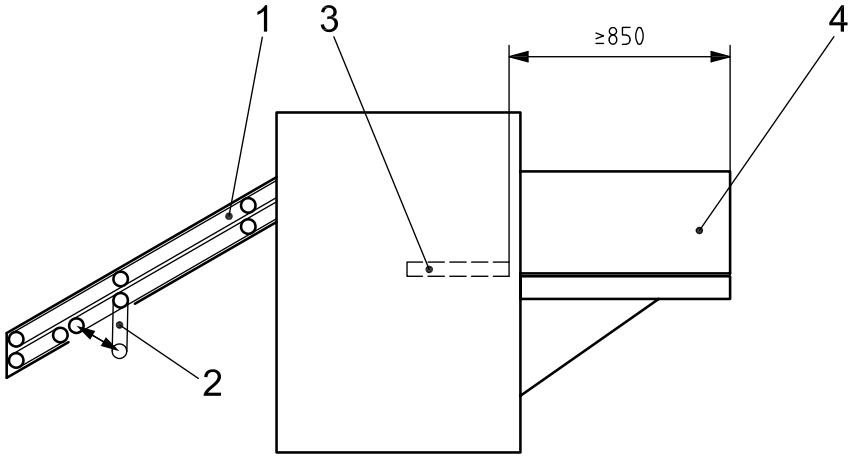
NOTE This safeguarding can be achieved, for example, by limiting the closing force (see ISO 12643-1 for suggested guidelines).

5.6.2 Safeguarding hazard points at turntable

The hazard points at the turntable shall be guarded in accordance with ISO 12643-1. Fixed guards, movable guards or other means of safeguarding may be used, depending upon the design. Safety distances shall comply with ISO 13857. At least one side of the turntable shall be protected by an interlocking guard in order to allow access for the removal of jams.

On the side where the stacked material is delivered, access to the turntable shall be prevented by a fixed or interlocked tunnel-type guard, or other means of safeguarding. If a fixed or interlocked tunnel-type guard is used, the safety distance from the open end of the tunnel guard to the hazard point shall be at least 850 mm (see Figure 19).

Dimensions in millimetres



Key

1	feeding belt	3	turntable
2	divert gate	4	delivery tunnel with delivery belt

Figure 19 — Counter-stacker

5.6.3 Pneumatic system

When an interlocking guard is opened or the emergency stop device is activated, the pneumatic system of the counter-stacker, including any accumulators, shall be depressurized in order to prevent inadvertent hazardous movement of the counter-stacker.

5.7 Paper-embossing machines

5.7.1 Safeguarding in-running nips on guide rollers

The in-running nips between guide rollers and between guide rollers and fixed machine parts shall be safeguarded by providing a minimum separation of 120 mm, or by fixed or interlocking guards.

5.7.2 Stretch rollers and counter rollers

Stretch rollers and counter rollers shall have a minimum separation of 120 mm (clearance between the two rollers).

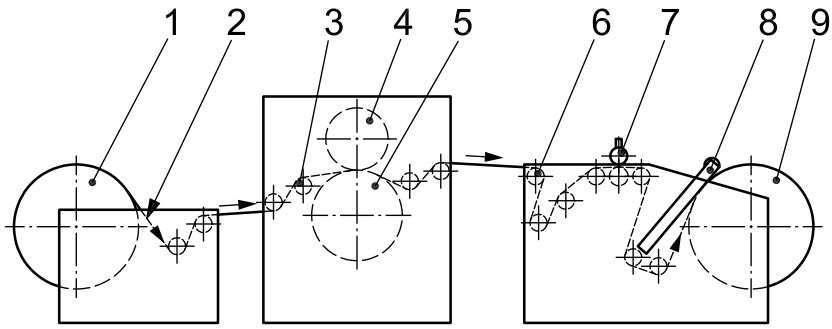
5.7.3 Safeguarding movement of counter roller

The movement of the counter roller when travelling into and out of position shall be safeguarded.

If speed limitation is used as the safeguard, movement of the counter roller shall be limited to 5 m/min under hold-to-run, or to a non-hazardous continuous speed of less than 0,5 m/min. An emergency stop button shall be within reach of the operator.

5.7.4 Warning of heated parts

Where embossing rollers (see Figure 20) are heated, a pictogram shall be posted on or near the machine warning the operator of hot machine parts. Hot pipes shall have adequate insulation up to a height of 2,7 m above the operator platform. In the case where the operator is standing on the floor, rather than on a raised platform, the floor is considered to be the “platform” for this requirement.



Key

1	unwinding unit	6	guide rollers
2	paper web	7	cutting unit
3	stretch roller	8	drive roller
4	embossing roller	9	rewinding unit
5	counter roller		

Figure 20 — Paper-embossing machine

5.8 Finishing machines

5.8.1 Coaters

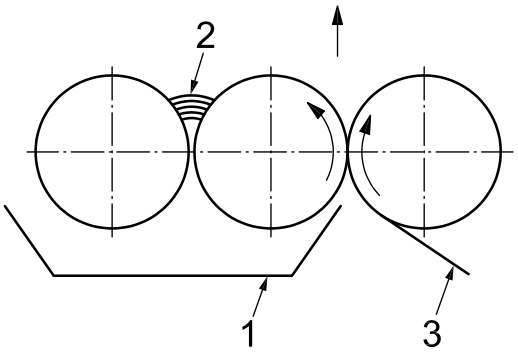
5.8.1.1 Safeguarding reel-unwinding and reel-rewinding units

Reel-unwinding and reel-rewinding units shall be safeguarded in accordance with ISO 12643-1.

5.8.1.2 Safeguarding in-running nips

The in-running nip between guide rollers and between guide rollers and fixed machine parts shall be safeguarded by providing a minimum separation of 120 mm, or by fixed or interlocking guards.

The in-running nip on the dosing gap (see Figure 21) shall be guarded.



Key

1 collecting pan

2 dosing gap

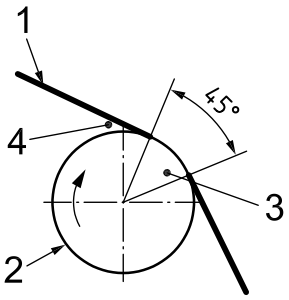
3 material web

Figure 21 — Dosing gap

The in-running nips in the coating unit between coating roller and cooling roller/coating roller shall be protected by fixed or interlocking guards.

The in-running nips between the coated, tear-resistant material web and guide rollers that can be accessed in the machine from passageways and that have a wrapping angle of 45° or more (see Figure 22) shall be protected by fixed guards.

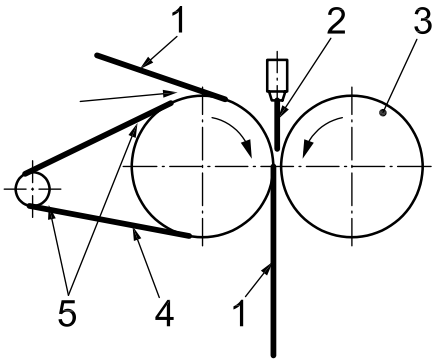
The in-running nips on the polytetrafluoroethylene (PTFE) belt (see Figure 23) shall be safeguarded.



Key

1 coated web
2 guide roller
3 wrapping angle
4 in-running nip

Figure 22 — Wrapping angle on guide rollers



Key

1 material web
2 polyethylene (PE)
3 cooling roller
4 polytetrafluoroethylene (PTFE) belt
5 nip point

Figure 23 — Coating with polyethylene

5.8.1.3 Safeguarding hot material and surfaces

Contact with hot-melt material used for coating shall be prevented by fixed guards.

5.8.1.4 Exhaust equipment

Where coatings that emit hazardous vapours are being used, the machine shall be equipped with exhaust equipment at the point of application.

NOTE Because the requirements for exhaust equipment vary with the substances used, it is not possible to specify technical requirements in this part of ISO 12643.

5.8.1.5 Safeguarding movement of rollers

The traversing movement of the coating rollers, or coating roller and cooling roller, shall be safeguarded. One means of safeguarding is by operating at a speed of 5 m/min under hold-to-run control, or by the use of interlocking guards.

5.8.1.6 Explosion prevention

For a list of explosion zones for electrical apparatus, see Annex B.

5.8.1.7 Continuous-flow dryers on coating devices

5.8.1.7.1 Flammable substances

Where coating material that may emit flammable substances is being used during the drying process, the requirements of EN 1539 apply.

NOTE National requirements might supersede the use of EN 1539. For example, in the United States, NFPA 86[8] applies.

5.8.1.7.2 Safeguarding hazard points on dryers

The hazard points created when closing the upper and the lower part of the dryer shall be safeguarded.

NOTE 1 This safeguarding can be achieved, for example, by hold-to-run control.

The automatic closing movement of the dryer shall be safeguarded. Automatic closing shall be possible only for the last 300 mm of the aperture.

NOTE 2 Examples of safeguarding methods include the use of trip bars, light curtains, etc.

5.8.1.7.3 Prevention of ignition of material web

Ignition of the material web when passing through the continuous-flow dryer shall be prevented.

NOTE This can be achieved in case of a stoppage of the machine or the coating unit, for example, by adequately reducing the performance of the continuous-flow dryer and maintaining the material web at an adequate distance from the source of radiation by an air wiper.

5.8.1.7.4 Surface temperature of accessible parts

The surface temperature of parts that are accessible from the outside shall not exceed the maximum values specified in ISO 13732-1.

5.8.1.7.5 Safety check valves

Where hydraulic or pneumatic cylinders are provided for opening the dryer, overridable safety-rated check valves shall be fitted to the lifting cylinders.

5.8.1.7.6 Protection from falling shut

To prevent the dryer from falling shut during inspection operations, mechanical devices shall be provided to secure the dryer open.

NOTE For example, the dryer can be prevented from falling shut by means of struts that are inserted during inspection.

5.8.2 Laminators

5.8.2.1 Reel-unwinding and reel-rewinding units

Reel-unwinding and reel-rewinding units shall be safeguarded in accordance ISO 12643-1.

5.8.2.2 Safeguarding in-running nips

The in-running nips between guide rollers and between guide rollers and fixed machine parts shall be safeguarded.

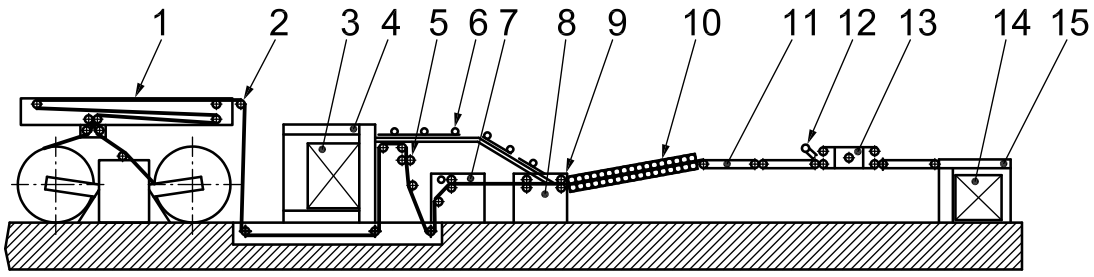
The in-running nips between the foil-laminated tear-resistant web and guide rollers that can be accessed in the machine from passageways and that have a wrapping angle of 45° or more (see Figure 22) shall be protected by fixed or interlocking guards.

The in-running nip on the laminating rollers shall be protected by fixed or interlocking guards. Where the thickness of the laminated material is 18 mm or more, the opening width shall be a maximum of 30 mm and the distance from the guard opening to the nip shall be a minimum of 200 mm.

The in-running nips on the transport rolls that feed sheets (see Figure 24, item 6) shall be safeguarded.

If safeguarding is done by roll displacement, it shall be ensured that the rolls have a displacement of at least 25 mm or roller contact resulting from its own mass, provided it does not exceed the force (resulting from the mass) of 50 N.

In-running nips on the glue rollers (see Figure 24, item 7) and on the dosing gap (see Figure 21) shall be protected by interlocking guards.



Key

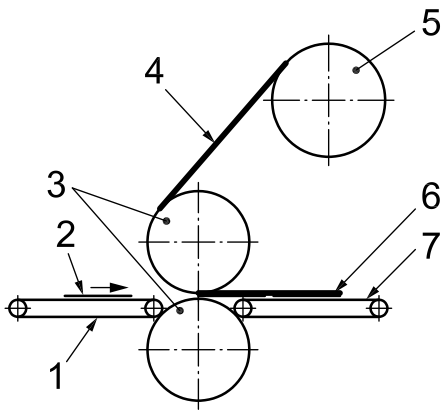
1	unwinding unit	6	transport rolls	11	transport belt
2	guide roller	7	glue unit roller	12	package stop
3	stack in feeder	8	sheeter	13	turning belt
4	feeder	9	laminating rollers	14	stack in delivery
5	rotary knife	10	pressing belt	15	delivery

Figure 24 — Web-fed laminator for sheet material

5.8.2.3 Safeguarding traversing movement of laminating rollers

During make-ready and cleaning, the traversing movement of the laminating rollers (see Figure 25) shall be safeguarded.

If safeguarding is achieved by speed limitation, speed shall not exceed 5 m/min under hold-to-run control. If guards are used, they shall be interlocked.



Key

1	feeding belt	5	unwinding unit
2	substrate (single sheets)	6	laminated single sheet
3	laminating rollers	7	delivery belt
4	foil web		

Figure 25 — Foil laminator

5.8.2.4 Safeguarding opening and closing movement of laminating rollers

Where the travel path of the laminating rollers is greater than 6 mm, the opening and closing movement of the rollers shall be safeguarded.

If safeguarding is achieved by speed limitation, speed shall not exceed 5 m/min under hold-to-run control. If guards are used, they shall be interlocked.

5.8.2.5 Safeguarding heated lamination rollers

Where hot foil is used for lamination, guards shall be used to prevent contact of personnel with the heated lamination rollers.

5.8.2.6 Safeguarding cutting devices

Cutting devices, including rotary knives (see Figure 24), shall be safeguarded by the use of interlocking guards in accordance with the requirements of ISO 12643-1 for guarding rotary tools.

5.8.2.7 Safeguarding feeders and delivery in laminators

The feeder and delivery for the laminating material shall be safeguarded in accordance with the requirements of ISO 12643-1 for guarding feeding units and delivery units.

5.8.2.8 Sheeters on laminating machines

5.8.2.8.1 Safeguarding in-running nips

The in-running nip between pressure rollers or guide rollers and a pressing belt (see Figure 24) shall be safeguarded.

If safeguarding is achieved by limiting the force of the rollers, it shall be ensured that the pressure rollers are held in position by their own mass and have a displacement of at least 120 mm.

On pressing belts, the in-running nip between the upper and the lower pressing belts on the infeed point shall be safeguarded. Any of the following measures is considered to be adequate:

a) use of guards meeting the requirements of ISO 12643-1;

b) where the pressure belt entrance opening is 120 mm, limiting the safety distance to 850 mm, measured from the point of entrance of the pressing belt up to the point at which there is a distance of 10 mm between the upper and the lower pressing belts (see Figure 26), and safeguarding access from the side;

c) where the pressure belt entrance opening is 120 mm and the 850 mm safety distance cannot be met, limiting the force of the pressure rollers to 200 N and safeguarding access from the sides.

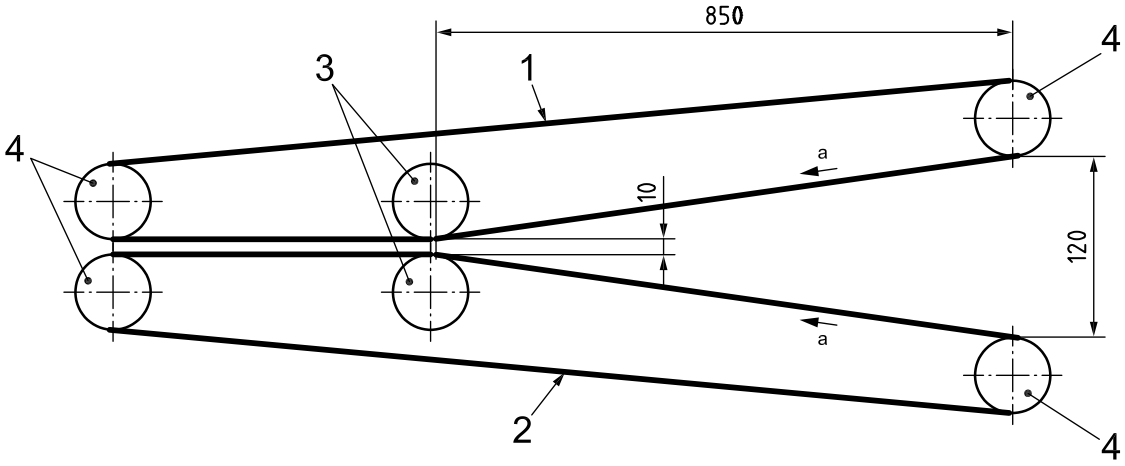
5.8.2.8.2 Safeguarding crushing points

The crushing point between transport belt and package stop (see Figure 24) shall be safeguarded by fixed or interlocking guards if the maximum clamping force when closing is more than 150 N.

5.8.2.8.3 Safeguarding shearing points

Shearing points between the turning belt and the transport belt, ahead of and behind the turning belt, shall be safeguarded (see Figure 24).

Dimensions in millimetres



Key

1 upper pressing belt
2 lower pressing belt
3 pressure rollers
4 guide rollers
a Direction of belt.

Figure 26 — Pressing belt

5.9 Guillotine cutters

5.9.1 Knife cycles

All knife drives and controls shall incorporate a single-cycle device. Any programmable sequence of knife and clamp motions shall be operator-initiated and shall be interlocked to safety devices. Actuation of a stop control shall override the programmed sequence and stop the hazardous motion.

At the end of each cutting cycle, the knife shall automatically stop in a fully retracted position, with the knife edge completely covered by the clamp. Failure of the knife to stop at this position shall place the machine in a condition in which it is required to be reset or restarted manually.

Motion of the knife in the cutting direction shall stop upon any interruption of the cutting cycle or activation of safety devices, and the knife shall return to a fully retracted position (see also 5.9.2).

Machines that use light curtains, or other protective means that are dependent on the stopping performance, shall monitor stopping performance (both stopping time and position) at each knife stop. Failure of the knife to stop within the designed stopping performance shall place the machine in a condition in which it is required to be reset or restarted manually.

NOTE 1 Machines with a hydraulically operated knife can be monitored only after an interruption of the cutting cycle.

The method used to monitor stopping performance shall be capable of determining whether the knife stops within the specified stopping criteria. If the knife does not stop within the specified stopping criteria, the machine shall be placed in a condition in which it is required to be reset or restarted manually.

Machines incorporating motor/flywheel/clutch-knife drives shall be equipped with an anti-repeat device.

NOTE 2 Examples of mechanical devices that might be used to accomplish this include safety bolts, latches, safety clutches, cutout/flat spot in main drive gear.

The cutting edge of the knife shall not extend beyond the clamp during the clamping and the unclamping portions of the cutting cycle. The clamping and unclamping portions of the cutting cycle are those times when the clamp is in motion. Once the clamp has come to rest on the product to be cut, the knife will pass beyond the clamp to complete the cutting portion of the cutting cycle. This is the only time during which the knife is permitted to extend beyond the clamp.

5.9.2 Interruption of cutting cycles

In machines with knife drives utilizing stored energy, the knife shall stop in the event of loss of any power source affecting the knife drive (electrical, hydraulic, pneumatic, etc.).

Machines with a crank-driven knife movement that cannot reverse its movement shall be so designed that the clamp is not allowed to retract to its starting position automatically after the cutting cycle has been interrupted.

Machines with a hydraulically operated knife movement shall be so designed that, in the event of the cycle being interrupted, knife and clamp automatically retract to their starting position.

5.9.3 Clamping

5.9.3.1 Clamping pressure

During manual loading, positioning and unloading of material by an operator, high-pressure clamping shall be prohibited through design. Low-pressure or manual clamping is permissible during positioning of the material within the cutting zone. High-pressure clamping shall be possible only while machine operation is under two-hand control or during an automatic cut sequence.

During loading, unloading or positioning by a gripper, high-pressure clamping is permitted.

In machines equipped with power-driven clamps, the interruption of any function that incorporates high-pressure clamping shall cause all clamping motion in the downward direction to stop.

NOTE Power failure is considered to be an interruption of function.

5.9.3.2 Low-pressure clamping

The clamping force of a power-driven clamp during low-pressure clamping shall not exceed 300 N on cutting machines of up to and including 1,6 m wide, or 500 N on cutting machines greater than 1,6 m wide.

5.9.3.3 Low-pressure and manual clamping

Low-pressure clamping may be obtained by the use of either a manual control or a power-driven clamping device.

Low-pressure power-driven clamping may be obtained by means of an operator-initiated control. Such control shall be separate from the control used for high-pressure clamping.

The control for power-driven low-pressure clamping shall not be of the latching type. Upon release of the control, the clamp shall immediately return to its retracted position.

For manual clamping controls, release of the clamp actuator shall cause the clamp to remain stationary or return to the retracted position.

During knife servicing, the clamp may be latched by a separate control.

5.9.3.4 Clamps

Cutouts, lips or holes on the side of the clamp facing the knife shall be safeguarded by the use of covers or plugs.

5.9.3.5 Automatic clamp operation

Any programmable system sequence of clamp motion shall be operator-initiated and shall be interlocked to safety devices. Actuation of a stop control shall override the programmed sequence and shall stop the hazardous motion.

5.9.4 Failure of knife and clamp linkages

Failure of the mechanical linkages supporting the knife carrier or clamp shall not result in hazardous movement of the knife or clamp.

NOTE This requirement is satisfied, for example, by providing additional mechanical or other means to prevent the knife or clamp from falling.

5.9.5 Backgauge

5.9.5.1 General

Any power-driven backgauge shall be interlocked with the knife and the clamp controls to prevent forward backgauge movement during high-pressure clamping and cutting.

If a programmable sequence is stopped as the result of the activation of a safety device, hazardous movement of the backgauge shall also stop.

Power-up shall not result in backgauge motion.

Actuation of a stop control shall override the programmed sequence and shall stop hazardous motion.

5.9.5.2 Guarding the rear of machines

Guards and/or other safety devices shall prevent access to knife, clamp and backgauge hazard points on guillotines from the rear of the machine.

5.9.5.3 Automatic backgauge travel

Where the backgauge can travel automatically, the hazard point between the back edge of the clamp and the backgauge shall be safeguarded by one or more of the following measures:

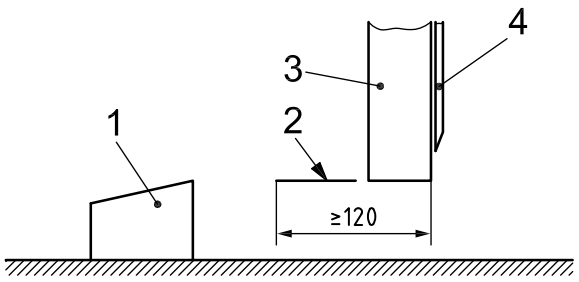
— active electro-sensitive protective devices (ESPDs);

— automatic travel limited to at most 25 mm before the clamp, with further travel possible only under hold-to-run control with a maximum speed of 3 m/min;

— protection against reaching below the clamp by providing a guard that makes the hazard point between guard and backgauge at least 120 mm behind the front edge of the clamp (see Figure 27);

— hold-to-run control.

Dimensions in millimetres



Key

1 backgauge
2 guard
3 clamp
4 knife

Figure 27 — Protection against reaching below the clamp

5.9.5.4 Backgauge spindle

Access to the entire length of the backgauge spindle from the top shall be prevented.

NOTE For example, for safeguarding this point, a blind covering the spindle on the rear table might be used.

Access to the spindle from the underside of the rear table shall be prevented by fixed guards unless access is prevented by the position of the spindle.

5.9.6 Guarding front (operating side) of a guillotine

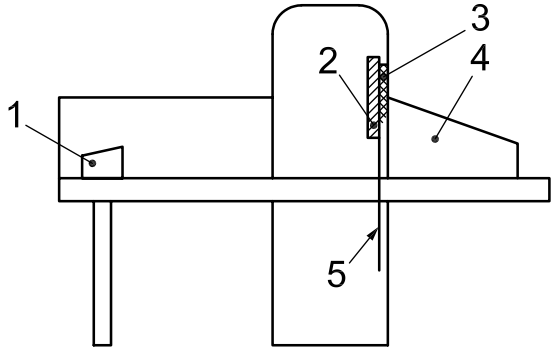
ESPDs protecting against incidental contact with the knife and the clamp shall be active during that portion of the cutting cycle and/or high-pressure clamping during which hazardous motion occurs or is possible.

Access to knife and clamp hazard points shall be prevented from the front (operating side) of the machine by one or more of the following means, which shall be combined with the use of two-hand control:

— an interlocking guard in accordance with ISO 14119 and ISO 14120 without side openings in the guard; and openings on the front side of the guard shall be designed in accordance with ISO 13857 (see Figure 28);

— active ESPDs extending to the machine table without side openings in the guard; the front table shall extend at least 30 mm beyond the safety distance (outermost beam) of the ESPD; positioning of the ESPD shall be in accordance with Figure 29;

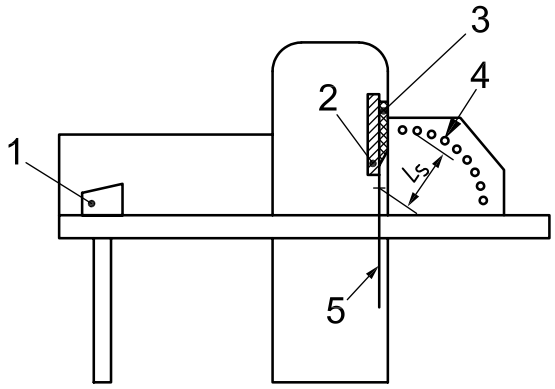
— active ESPDs that do not extend to the machine table; the front table shall extend at least 30 mm beyond the safety distance (outermost beam) of the ESPD; positioning of the ESPD shall be in accordance with Figures 30, 31, 32, 33 and 34.



Key

1 backgauge
2 clamp
3 knife
4 interlocking guard
5 cutting plane

Figure 28 — Guillotine (side view) with interlocking guard on the front side



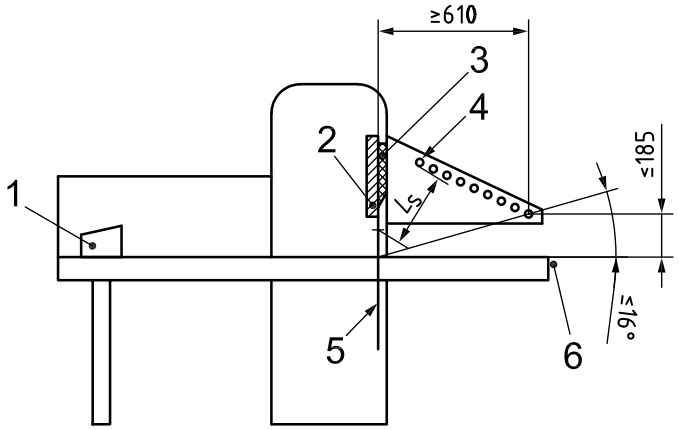
Key

1 backgauge
2 clamp
3 knife
4 ESPD
5 cutting plane

L_S safety distance

Figure 29 — Guillotine (side view) with ESPDs

Dimensions in millimetres



Key

1	backgauge	4	beam of front ESPD
2	clamp	5	cutting plane
3	knife	6	two-hand control

L_S safety distance

Figure 30 — Guillotine (side view) with ESPDs and two-hand control

The minimum distance of the ESPD is calculated as shown in Equation (1), based on a resolution capability of equal to or less than 40 mm and measured when projected on the centre point between the machine table and the lower edge of the clamp (see Figure 29 and Figure 30).

$$L_S = (2\,000 \times t) + \left[8 \times (d_R - 14)\right] \quad (1)$$

where

t is the total response time, in seconds, of the machine;

d_R is the resolution (minimum object detection) capability, in millimetres, of the ESPD;

L_S is the safety distance, in millimetres.

Equation (2) applies to all safety distances, L_S, up to and including 500 mm, with a minimum permissible distance of 250 mm. If L_S, when calculated by this equation, results in a distance of more than 500 mm, the distance may be reduced using the following equation, while maintaining a minimum distance of 500 mm:

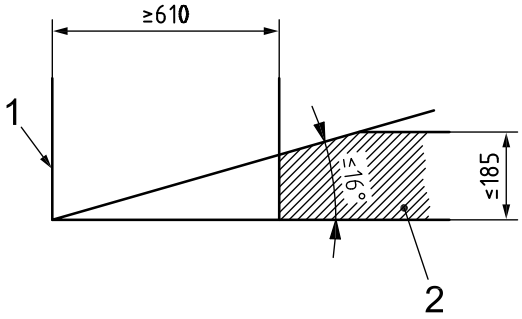
$$L_S = (1\,600 \times t) + \left[8 \times (d_R - 14)\right] \quad (2)$$

where the symbols are the same as for Equation (1).

The maximum distance of the ESPD beams, measured between the centres of the optical systems, shall not exceed 55 mm for a resolution capability of equal to or less than 40 mm.

The outermost beam of the ESPD shall be arranged on the side of the maximum opening angle of 16°, but the distance to the machine table shall not be more than 185 mm (see Figure 30). The minimum distance to the cutting plane shall be 610 mm (see Figure 31).

Dimensions in millimetres



Key

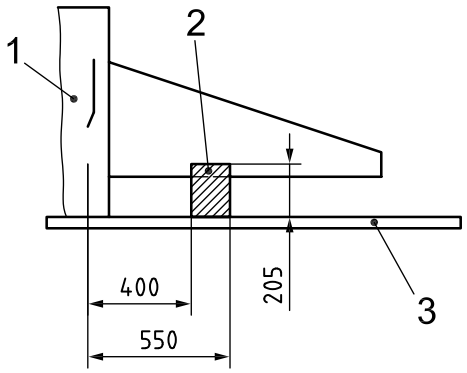
1 cutting plane

2 area admissible for outermost beam of ESPD

Figure 31 — Arrangement of the outermost beam of the ESPD for clamp openings of less than or equal to 185 mm

On guillotines with an automatic cutting sequence, an additional ESPD shall be provided at a distance of between 400 mm and 550 mm from the cutting plane, and at a height of between 0 mm and 205 mm from the table surface (see Figure 32). The first cutting cycle shall be started by two-hand control. Following cutting cycles are started automatically. During the automatic cutting sequence, the backgauge shall be allowed to travel only toward the front (direction of the clamp).

Dimensions in millimetres



Key

1 cutting plane

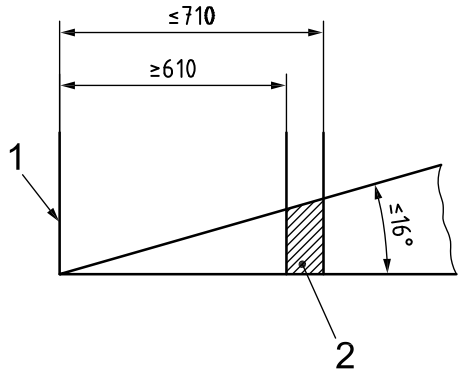
2 area admissible for additional ESPD

3 front of table

Figure 32 — Position of additional ESPD

As an exception, on machines with a usable pile height of more than 185 mm, the outermost beam of the ESPD may be arranged at a maximum angle of 16° to the lowest point of the cutting plane and at a distance of 610 mm minimum and 710 mm maximum from the lowest point of the cutting plane (see Figure 33).

Dimensions in millimetres



Key

1 cutting plane

2 area admissible for outermost beam of ESPD

Figure 33 — Arrangement of the outermost beam of the ESPD for clamp openings greater than 185 mm

On guillotines with openings less than or equal to 165 mm between the outer housing of the ESPD and machine table, the safety distance depicted in Figure 34 shall be greater than or equal to 550 mm, as specified by Equation (3), and shall be observed between the lowest point of the cutting plane and the outer edge of the housing, or guards shall be provided. On guillotines with openings greater than 165 mm, a safety distance of greater than or equal to 850 mm shall be required.

$$L_S = L_A + L_B \tag{3}$$

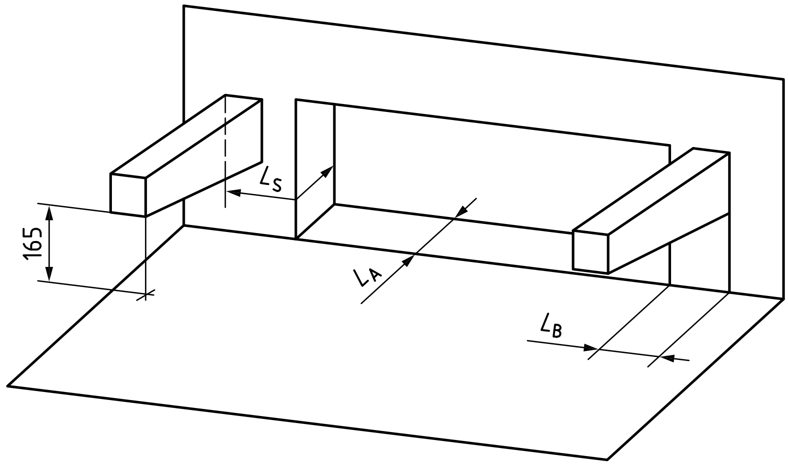
where

L_S is the safety distance, in millimetres;

L_A is the distance, in millimetres, from the lower edge of the cutting plane to the outer plane of the machine frame;

L_B is the distance, in millimetres, from the outer edge of the ESPD to the inner edge of the machine frame.

Dimensions in millimetres



Key

L_S safety distance

L_A distance from lower edge of cutting plane to outer plane of machine frame

L_B distance from outer edge of ESPD to inner edge of machine frame

Figure 34 — Safety distance

5.9.7 Pile-support angles (jogging blocks)

For cutting strips, a pile-support angle (jogging block) shall be provided (see Figure 35 for an example of a pile-support angle).

Dimensions in millimetres

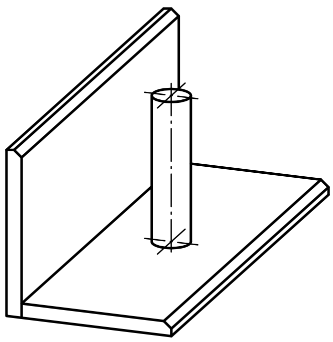


Figure 35 — Pile-support angle

5.9.8 Knife changing and adjustment

Changing and adjusting the knife shall be performed only by an authorized person (defined in ISO 12643-1).

For installing or removing the knife, means shall be provided to prevent the person handling the knife from being exposed to the cutting edge of the knife. The instruction handbook shall describe safe practices for changing knives (see 6.2.7).

When knives are being changed or adjusted, both the knife blade and hazardous movements shall be safeguarded.

Knife descent shall be possible only by one or more of the following:

- two-hand controls and safeguarding by ESPDs;
- two-hand controls with the interlocking guard closed;
- mechanical means to engage the clutch.

NOTE In the United States, knife changing is considered to be a maintenance task, and lockout/tagout procedures as defined by OSHA are applicable (see OSHA 29 CFR 1910.147[11], or ANSI Z244.1[5]).

5.9.9 Hazards from integral feeding and delivery equipment on guillotines

5.9.9.1 Crushing point at gripper

The crushing point at the gripper on the feeding table shall be safeguarded.

NOTE Measures for safeguarding this area using photoelectric devices include the following:

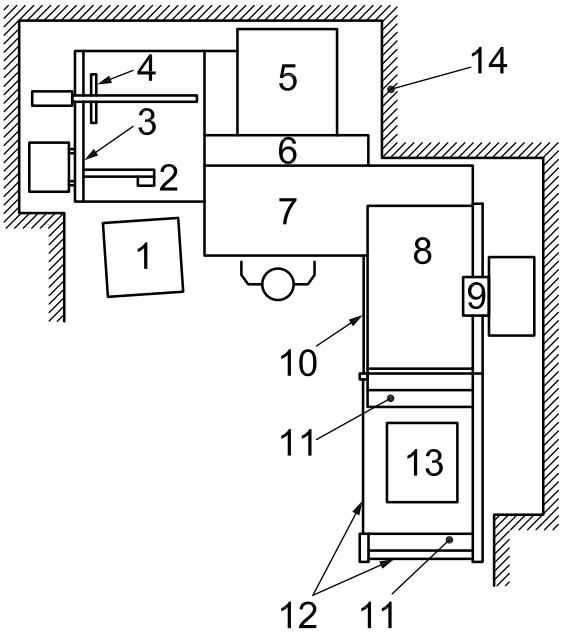
- functional photoelectric device detecting the upper edge of the paper pile;
- functional photoelectric device detecting the front edge of the paper pile;
- functional photoelectric device detecting the presence of paper in the gripper.

If photoelectric devices are used to safeguard this area, the gripper shall be allowed to close only after all photoelectric devices have been operated in the given sequence.

5.9.9.2 Hazard point between feeding table and guillotine

The hazard point between the feeding table and the guillotine, caused by the vertical movement of the table, shall be safeguarded (see Figure 36).

NOTE Safeguarding can be achieved, for example, by providing a trip device.



Key

1	paper pile	6	guillotine	11	aligning gauges
2	gripper	7	front table	12	ESPDs
3	feeding table	8	delivery table	13	pallet
4	pusher	9	hold-down	14	fence guard
5	rear table	10	guard		

Figure 36 — Loading and unloading (feeding and delivery) equipment

5.9.9.3 Hazard point between pusher and table

The hazard point between the pusher on the feeding table and the feeding table or rear table of the machine shall be safeguarded.

NOTE Safeguarding can be achieved, for example, by limiting the distance between the lower edge of the pusher and the table to no more than 6 mm.

The safety distance between the back of the pusher and fixed machine parts shall be at least 100 mm.

5.9.9.4 Hazard point between delivery table and front table

The hazard point between the delivery table and the front table of the guillotine, caused by the horizontal movement of the delivery table, shall be safeguarded.

NOTE Safeguarding can be achieved, for example, by providing guards or trip bars.

5.9.9.5 Hazard point between delivery table and fixed parts

The hazard point between the delivery table and fixed machine parts, caused by the vertical movement of the table, shall be safeguarded.

NOTE Safeguarding can be achieved, for example, by providing trip devices.

5.9.9.6 Hazard points between delivery table and floor or pallet

The hazard points between the delivery table and the floor or pallet shall be safeguarded.

This can be achieved, for example, if all of the following requirements are met:

— access from the back of the equipment is prevented by guards in accordance with ISO 13857 (see Figure 36, item 14);

— guards are provided on the front of the delivery table (see Figure 36, item 10);

— two ESPDs safeguard the delivery area (see Figure 36, item 12), or other guards such as an ESPD in front of the delivery table and trip nip guards under the delivery table safeguard the delivery area while the delivery table is in its forward or downward movement;

— an emergency stop device is provided in the delivery area.

5.9.9.7 Hazard points between delivery table and aligning gauge

The hazard points between the delivery table and the aligning gauge shall be safeguarded.

NOTE This can be achieved, for example, if the aligning gauge lowers under its own mass, or the force to lower the gauge is as recommended in ISO 12643-1 for crushing and shearing hazards.

5.9.9.8 Hazard point between hold-down and delivery table

The hazard point between the hold-down and the delivery table shall be safeguarded.

This can be achieved, for example, by one of the following:

— hold-down devices are fitted at a minimum distance of 850 mm from the edge of the delivery table;

— the maximum force of the hold-down is limited to 500 N.

5.10 Trimmers

The hazard zone at the knives shall be guarded on the feeding and delivery sides by the use of fixed or movable guards in accordance with the requirements of ISO 12643-1. Other means of guarding may be used, depending upon the design. Emergency stop buttons shall be provided at each operating position as specified in ISO 12643-1.

For manually fed machines using a conveyor that puts the product into the cutting zone, feeding and delivery openings shall be designed in accordance with ISO 13857.

On the feeding and delivery side, a safety distance of 550 mm to the nearest hazard point is acceptable if the trimmer is mounted in line and product removal is performed by mechanical means (see Figure 37).

Dimensions in millimetres

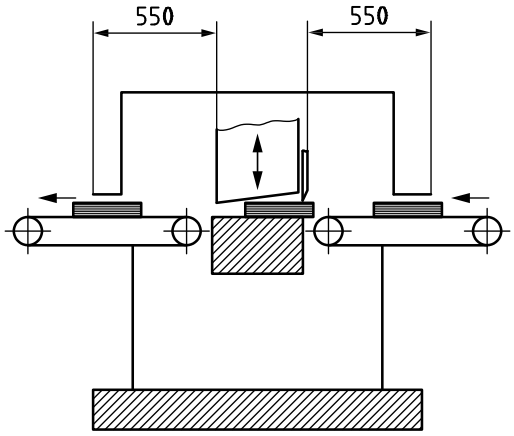


Figure 37 — Trimmer with automatic feed

Where material is fed manually into the hazard zone by the operator, the hazard points on the operator side of the trimmer shall be safeguarded by a two-hand control located on the front edge of the feed table. The requirements for two-hand controls as specified in ISO 12643-1 shall be met. Feeding apertures on the operator side of the trimmer shall be as small as possible, consistent with the size of the format cut.

When the interlocking guard is opened, it shall be possible to start the trimmer only by means of two-hand controls. Operation of the control with the guard open shall allow only a single stroke of the knives, regardless of how long the control is held. The means to control a single stroke of the knife shall comply with PL_r c of ISO 13849-1 or SIL 1 of IEC 62061.

Knife covers to be applied for knife changing and transport of knives shall be supplied with the machine.

Openings and safety distances on waste discharge chutes shall satisfy the requirements of ISO 13857.

For trimmers that have an automatic vacuum system or exhaust system to remove paper cuttings, the system shall comply with the requirements for explosion prevention and protection specified in ISO 12643-1.

5.11 Onserters/attaching machines

The exception specified in 5.2.2 may be applied to feeder guards for onserters/attaching machines, if necessary.

5.12 Overcover/protective wrapper gluers

The exception specified in 5.2.2 may be applied to feeder guards for overcover/protective wrapper gluers, if necessary.

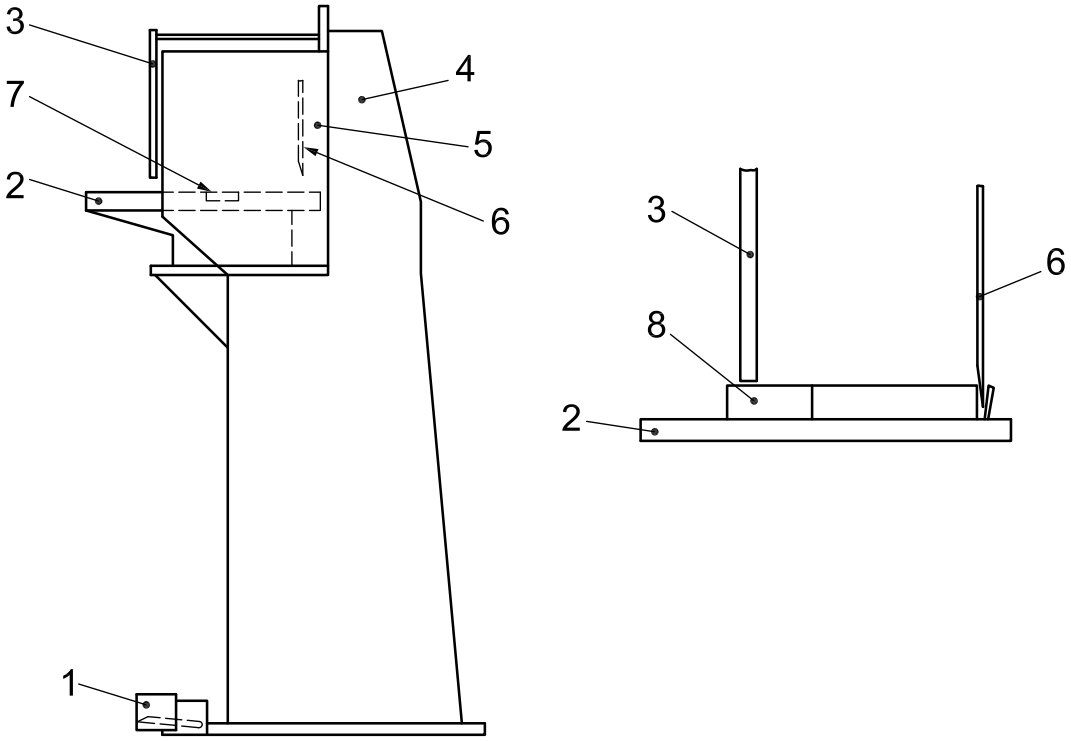
5.13 Corner-rounding machines

On corner-rounding machines (see Figure 38), the hazard point at the trimming knife or saw shall be safeguarded.

NOTE This requirement is met, for example, by providing an adjustable transparent guard in front of the knife and ensuring, by using a sensor (e.g. a photoelectric device), that the cutting operation can only be started once a pile has been fed. See Figure 38.

Operation of the knife or saw shall only be possible by means of a hold-to-run control (hand- or foot-operated).

Fixed or interlocking guards shall be provided at the back and on both sides of the knife or saw.



Key

1	foot-operated hold-to-run control	5	side guard
2	feeding table	6	knife
3	adjustable transparent guard in front of knife	7	sensing device (photoelectric)
4	guard at back	8	book block

Figure 38 — Corner-rounding machine

6 Information for use

6.1 Minimum requirements for machine markings

The requirements of ISO 12643-1 shall be met.

6.2 Contents of instruction handbook

6.2.1 Information for gang stitchers

Where production circumstances require the gang stitcher to be started by two-hand control at speeds greater than 10 m/min with the interlocking guards open, the instruction handbook shall contain the following warning:

WARNING — The person operating the two-hand control shall make sure that, before operating the control, there is no other person in the hazard area.

6.2.2 Information for gathering machines

Where production circumstances require the gathering machine to be started by two-hand control at speeds greater than 10 m/min with the interlocking guards open, the instruction handbook shall contain the following warning:

WARNING — The person operating the two-hand control shall make sure that, before operating the control, there is no other person in the hazard area.

6.2.3 Information for perfect binders

Where production circumstances do not allow the milling cutter to be stopped immediately when opening the interlocking guard covering the book carriage, the instruction handbook shall indicate the residual risk and the stopping time.

Where production circumstances require the perfect binder to be started with interlocking guards open, either by hold-to-run control at a speed greater than 5 m/min or by two-hand control at a speed greater than 10 m/min, the instruction handbook shall contain the following warning:

WARNING — The person operating the hold-to-run/two-hand control shall make sure that, before operating the control, there is no other person in the hazardous area.

Where polyurethane hot-melt glues are used, the instruction handbook shall give the following instructions:

a) indication of the need to provide adequate exhaust equipment in the area of the glue duct and the preheater, specifying the minimum exhaust volume;

b) instructions for removing hot glue ducts from the perfect binder and for cleaning the glue ducts;

   EXAMPLE Instructions for cleaning glue ducts:

   1) move the duct immediately under exhaust hood;

   2) clean duct with low-risk non-aromatic solvents;

   3) close glue duct cover during removal.

c) indication of the need for adequate ventilation in the working area;

d) indication of the need to follow the instructions on the material safety data sheet;

e) warning not to leave glue reservoirs and glue ducts open;

f) indication that an appropriate protective mask shall be provided for the operating personnel where the release of isocyanates cannot be excluded when the glue reservoir is changed or the glue ducts are cleaned or removed from the perfect binder; instructions for use of the mask shall also be given;

g) indication that appropriate protective glasses and gloves shall be used when there is a hazard of spilling of the hot glue (e.g. during pressure clearing); eye-washing and cleaning equipment should be readily available in case glue gets into the eyes; for spills on skin, washing facilities should be available in the working area;

h) indication to thoroughly clean hands when finishing work or taking breaks, and notation that operating personnel dealing with this type of glue should use a barrier hand cream or protective hand lotion;

i) indication that soiled clothes shall be changed immediately;

j) indication that eating, drinking and smoking are forbidden throughout the working area;

k) information regarding residual risks.

6.2.4 Information for sheet folding machines

Where production circumstances require the sheet folding machine to be started by two-hand control at a speed greater than 10 m/min with guards open, the instruction handbook shall contain the following warning:

WARNING — The person operating the two-hand control is responsible for safe working practices. Before starting the machine, the operator shall make sure that there is no other person in the hazard area.

6.2.5 Information for inserting machines

Where production circumstances require the inserting machine to be started by two-hand control at a speed greater than 10 m/min with guards open, the instruction handbook shall contain the following warning:

WARNING — The person operating the two-hand control is responsible for safe working practices. Before starting the machine, the operator shall make sure that there is no other person in the hazard area.

6.2.6 Information for machines for the production of envelopes

The instruction handbook for machines for the production of envelopes shall contain a warning of the residual risk existing between the staggering wheel and the paper guides, if operator intervention is required at this point during production runs.

Where production circumstances require the machine to be started at a speed of more than 5 m/min with guards open, either when using a stroboscope and hold-to-run control, or at a speed greater than 10 m/min by two-hand control, the instruction handbook shall contain the following warning:

WARNING — The person operating the hold-to-run/two-hand control shall make sure that, before operating the control, there is no other person in the hazard area.

6.2.7 Information for guillotines

The instruction handbook for guillotines shall contain the following additional information:

— total response time of the system, in milliseconds;

— resolution capability of ESPDs, in millimetres;

— minimum distance of ESPDs, in millimetres.

The handbook for guillotines shall also contain the instruction that safety devices shall be checked for effectiveness before each work shift and each time a knife has been changed, and that test results shall be recorded.

Measures to be taken in case of failure of transmission elements shall be described in order to enable safe repair, e.g. instructions that the paper pile shall not be withdrawn by force.

The instruction handbook shall indicate that there is a residual risk caused by the spindle under the rear table of the guillotine.

The instruction handbook shall describe safe working practices for changing knives, including the means of safeguarding knife blades and of adjusting the knives in order to prevent hazards from exposed knife edges. It shall give detailed instructions on the removal of the knives, using the tools and the knife covers supplied, and on the subsequent storage in knife boxes.

The instruction handbook shall indicate the need for regular checks of the guillotine against manufacturer specifications. Tests shall include the functioning of the control systems, monitoring of the stopping performance, clamping force, functioning of the ESPD, functioning of the two-hand control, and overrun protection in accordance with 5.9.1. The instruction handbook shall indicate that test results shall be recorded.

6.2.8 Information for integral feeding and delivery equipment for guillotines

The instruction handbook for integral feeding and delivery equipment for guillotines shall warn of the residual risks associated with the feeding and delivery tables and with the gripper.

NOTE An example of such residual risks are impact hazards from the travelling table in front of the feeding table, hazards from the travelling delivery table in the delivery area, or crushing hazards from the gripper.

The instruction handbook shall describe the correct positioning of the paper pile for feeding to ensure safe working conditions. It shall state, for instance, the distance and the angle between the paper pile and the feeding table.

The instruction handbook shall indicate that the floor area in front of the feeding table shall be painted in yellow and black warning colours in order to inform persons that this area is reserved for the paper pile.

The instruction handbook shall indicate that the floor area over which the delivery table passes shall be painted in yellow and black warning colours.

6.2.9 Information for trimmers

The instruction handbook for trimmers shall indicate that knife covers shall be used during setup operations.

6.2.10 Information for corner-rounding machines

The instruction handbook for corner-rounding machines shall indicate that the guard shall be adjusted to the maximum height of the pile inserted in order to safeguard the hazard point on the knife or saw.

Annex A
(informative)

Hazards associated with binding and finishing equipment and systems

Table A.1 lists many significant hazards that may be encountered in binding and finishing systems. When performing risk assessment for an individual piece of equipment, this list may assist the manufacturer in identifying the risks on their piece of equipment. The manufacturer should be aware that there may be other hazards, not included in this list, which need to be identified during the risk assessment process.

NOTE Additional information on hazard analysis is given in ISO 14121-1[2].

Table A.1 — Significant hazards, hazard zones, and safety measures

Significant hazards	Hazard zone
Mechanical hazards: — crushing; — shearing; — cutting or severing; — entanglement; — drawing-in; — trapping; — impacts.	Guillotines: — hazard zone knife/clamping bar; — knife; — clamping bar; — backgauge; — automatic mode. Integral feeding and delivery equipment for guillotines: — feeding table; — rear table of guillotine; — gripper; — delivery table. Index cutting machines: — feeding and delivery; — automatic feeding and delivery; — knives. Trimmers: — knives; — manual feeding; — automatic mode. Rotary cutters: — rotary knives. Corner-rounding machines: — knives, saws. Label-punching machines: — punching knife; — waste opening. Stitching, riveting, eyeletting and attaching machines: — between tools; — hold-to-run control; — entire machine.

Table A.1 (*continued*)

Significant hazards	Hazard zone
Mechanical hazards (continued)	Gang stitchers: — trimmer feeder; — stitching section; — thickness control; — difficult overall vision; — transport chain; — hold-to-run control; — entire machine. Gathering machines: — hand-fed, feeder; — automatic feeding and delivery; — manual feeding, transport chain; — gathering device (transport device); — difficult overall vision; — hold-to-run control with guards open; — entire machine. Perfect binders: — book carriages; — gluing rollers; — heating of glue; — cover feeder; — delivery; — difficult overall vision; — hold-to-run control with guards open; — milling-head cutters; — entire machine. Paper drills: — drill; — drill/clamp jaws; — entire machine. Book signature presses: — clamping plate/material; — entire machine. Book presses: — clamping plate/pressing plate, forming bar; — pressing plates; — entire machine. Sheet folding machines: — folding device; — cutting, creasing and perforating unit; — folding knife; — in-running nips on belts; — hold-to-run control; — entire machine.

Table A.1 (*continued*)

Significant hazards	Hazard zone
Mechanical hazards (continued)	Book production lines: — in-running nips on belts; — preheater; — pressing section; — glue section; — gauze section; — head-banding section; — book cover magazine; — cover bending section; — casing-in section; — hold-to-run control with guards open; — entire machine. Back-rounding and pressing machines: — in-running nips on belts; — tipping section; — preheater; — pre-forming, back-rounding and pressing sections; — entire machine. Backlining and head-banding machine: — in-running nips on belts; — glue section; — gauze section; — head-banding section; — counter-pressure section; — entire machine. Casing-in machine: — transport finger; — book cover feeder; — cover bending section; — forming section; — casing-in, gluing section; — counter-pressure section; — delivery; — entire machine. Book cover crease-forming machine: — in-running nips on belts; — tipping section; — pressing section; — hold-to-run control with open guards; — entire machine. Inserting machines: — feeder; — automatic feeding and delivery; — difficult overall vision; — hold-to-run control with open guards; — entire machine. Counter-stackers: — in-running nips on belts; — waste separator; — turntable; — delivery; — pneumatic system; — entire machine.

Table A.1 (*continued*)

Significant hazards	Hazard zone
Mechanical hazards (continued)	Paper-embossing machine: — difficult overall vision; — web threading device; — reel unwind and rewind; — guide rollers; — stretch roller; — in-running nip embossing roller/counter roller; — counter roller; — rotary knife; — entire machine. Coaters: — difficult overall vision; — web threading device; — reel unwind and rewind; — guide rollers; — dosing gap; — coating unit; — in-running nip on belt; — continuous-flow dryers; — entire machine. Foil laminators: — reel unwind and rewind; — in-running nips on belts; — guide rollers; — laminating rollers; — cutting unit; — entire machine. Laminators with glue application: — difficult overall vision; — web threading device; — reel unwind and rewind; — feeder, delivery; — in-running nips on belts; — guide rollers; — rotary knife; — transport rolls; — glue unit; — laminating rollers; — sheeter; — pressing belt; — package stop, conveyor belt; — turning belt; — entire machine.

Table A.1 (*continued*)

Significant hazards	Hazard zone
Slipping, tripping, falling	Production area: — work platforms, access stairs, passageways, steps.
Electrical hazards: — direct or indirect contact; — thermal radiation (burns).	All machinery: — electrical equipment; — equipment made live under electrical fault conditions.
Thermal hazards: — burns due to possible contact with hot surfaces.	Perfect binders: — hot-melt glue reservoirs. Book production lines: — preheating section; — hot-melt glue reservoirs. Back-rounding and pressing machines: — preheater. Backlining and head-banding machines: — hot melt. Casing-in machines: — heated forming section. Book cover crease-forming machines (press): — heated crease-forming rails. Machines for the production of hot air nozzles. Paper-embossing machines: — heated embossing roller. Coaters: — hot liquid material; — continuous-flow dryer. Foil laminators: — heated laminating rollers.
Hazards generated by noise, resulting in hearing loss	Sheet folding machines
Hazards generated by radiation: — UV radiation; — laser.	Binders: — radiation dryers (UV dryers, high-frequency dryers).
Hazards from substances and material used for processing, machine operation or which are emitted during the process: — hazards resulting from contact with, or inhalation of, harmful fluids, gases, fumes, dusts.	Perfect binders: — polyurethane hot melt. Coaters: — hazardous substances.
Hazards caused by neglect of ergonomic principles in machine design: — unhealthy body postures.	Guillotines: — knock-up devices; — optical cutting line indicators. Stitching, riveting, eyeletting and attaching machines: — adjustments. Book production lines: — glue replenishment.

Table A.1 (*continued*)

Significant hazards	Hazard zone
Faults, malfunctions in the control systems: — faults or failures in safety circuits.	Guillotines: — knife and clamping bar, ESPDs and their related signal processing. Label punching machines: — punching area. Stitching, riveting, eyeletting, attaching machines Gang stitchers Gathering machines Perfect binders Paper drills Book signature presses Book presses Sheet folding machines Book production lines Back-rounding and pressing machines Backlining and head-banding machines Casing-in machines Book cover crease-forming machines Machines for the production of envelopes Inserting machines Counter-stackers Paper-embossing machines Coaters Foil laminators Laminators with glue application
Hazards from fire and explosion	Coaters Laminators with glue application

Annex B
(informative)

Protection zones against explosion

B.1 General classification of hazardous places

To determine the extent of measures necessary to avoid effective ignition sources, the hazardous places are classified into zones based on the frequency and duration of occurrence of a hazardous explosive atmosphere.

NOTE 1 In the following text, where the term “gas” or “gas/vapour” is used, it implicitly covers mist atmospheres.

A place in which an explosive atmosphere is not expected to occur in such quantities as to require special precautions shall be regarded as non-hazardous within the meaning of this part of ISO 12643.

Taking into account the sedimentation of dust and the possible formation of an explosive atmosphere from dispersion of dust layers, different sets of zones have been defined for gasses/vapours and dusts.

In view of this, other measures for the avoidance of effective ignition sources for combustible dusts compared to combustible gasses/vapours are required.

NOTE 2 Information on the control and classification of hazardous places for gases and vapours by the use of ventilation is given in IEC 60079-10[3].

B.2 Zones for gases/vapours

The following zones are defined:

a) **Zone 0:** A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is present frequently, continuously, or for long periods.

   NOTE In general, these conditions, when they occur, arise inside containers, pipes and vessels, etc.

b) **Zone 1:** A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mists is likely to occur occasionally in normal operation.

   NOTE This zone can include, among others:

   — the immediate vicinity of zone 0;

   — the immediate vicinity of feed openings;

   — the immediate vicinity around filling and emptying openings;

   — the immediate vicinity around fragile equipment, protective systems, and components made of glass, ceramics and the like;

   — the immediate vicinity around inadequately sealed glands, for example on pumps and valves with stuffing boxes.

c) **Zone 2:** A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

   NOTE This zone can include, among others, places surrounding zones 0 or 1.

Table B.1 shows examples of an explosion zone in which explosive atmospheres may exist. For the equipment identified in Table B.1, neither Zone 0 nor Zone 2 exist.

Table B.1 — Explosion zones

Equipment type	Zone	Zone description
Roller-coating, units with closed side frames reaching down to floor level	1	The area of the roller coater between the side frames of the roller-coating unit. The service walkway between the roller-coating units up to a width of 2 m and a height of 2 m, including the area between the side frames. The area of the fountain for coating, impregnating and gluing materials, the area of the container which is connected with the roller coater unit and the area of the storage tank, established by a 500 mm radius on all sides. The area of the web-type material, established by a 250 mm radius on all sides, based on the maximum coating width, extending up to the entrance of the web-type material into the dryer tunnel, the maximum length, however, being a length of 2 m of the freshly coated web-type material.
Roller coaters with side frames with cutouts or with side frames that do not reach to floor level	1	The area of the fountain for coating, impregnating and gluing materials, established by a radius equal to the length of the rollers, on all sides, but not exceeding 500 mm. The space underneath the roller coaters down to floor level in an area established by the vertical projection of the danger areas of the roller coater units. The area of the container which is connected to the machine and the area of the storage tank, established by a 500 mm radius on all sides. The area of the web-type material itself, established by a 250 mm radius on all sides, based on the maximum coating width, from the entrance of the material web into the first roller coating unit up to the entrance of the material web into the dryer tunnel or 500 mm after leaving the last roller-coating unit.

Bibliography

[1] ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

[2] ISO 14121-1, *Safety of machinery — Risk assessment — Part 1: Principles*

[3] IEC 60079-10 (all parts), *Explosive atmospheres — Part 10: Classification of areas*

[4] ANSI B65.2, *Graphic technology — Safety requirements for binding and finishing systems and equipment*

[5] ANSI Z244.1, *Control of Hazardous Energy — Lockout/Tagout and Alternative Methods*

[6] EN 1010-1, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 1: Common requirements*

[7] EN 1010-4, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 4: Bookbinding, paper converting and finishing machines*

[8] NFPA 86[1)], *Standard for ovens and furnaces*

[9] Directive 98/37/EC, *Mechanical equipment — Machinery,* of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery

[10] Directive 2006/42/EC, *Mechanical equipment — Machinery,* of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC (recast)

[11] OSHA 29 CFR 1910.147, *The control of hazardous energy (lockout/tagout)*

1) Available from National Fire Protection Agency, 1 Batterymarch Park, Quincy, Massachusetts, USA 02169-7471; www.nfpa.org.

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