INTERNATIONAL STANDARD

ISO 12643-4

Second edition
2023-11

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

Part 4: Converting equipment and systems

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

Partie 4: Systèmes et équipement de façonnage

Reference number
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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.

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

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

This document was prepared by Technical Committee ISO/TC 130, *Graphic technology*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 198, *Printing and paper machinery — Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 12643-4:2010), which has been technically revised.

The main changes are as follows:

— in Clause 3, terms and definitions, in particular concerning corrugated board machinery, have been added;

— a new Clause 4 has been added and subsequent clauses have been renumbered;

— throughout the document, requirements related to hazards dealt with in ISO 12643-1:2023 have been deleted (e.g. Safeguarding automatic reel loading in 6.2);

— in Clause 6, the requirements for machinery for the production of corrugated board, e.g. terminological amendments, has been revised;

— Figure 14 has been updated;

— in 6.3.3, the description of measures to safeguard the movable splicer module have been revised;

— in 6.8.2, an exception to the continued running of glue rollers in the gluing unit in case of an emergency stop has been added;

— in 6.16.1, limitation of the speed of the conveyor belt to 45 m/min, if access is required for production reasons, has been specified;

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— Clause 7 has been revised;

— in Clause 8, the requirement to safeguard entry into the pile carrier plate with ESPDs has been amended;

— in 9.2.4, requirement for residual pile monitoring as safety device set to PL d / SIL 2, and a figure showing the safeguarding of hazard points outside the sidelays on feeders has been added;

— in Clause 10, requirements on safeguarding the delivery on automatic flatbed die-cutting machines (sheet gripper system, analog ISO 12643-2:2023) have been added;

— in Clause 13, a subclause on requirements for interlocks has been added;

— Clause 14, which is also applicable to machinery for the production of interfolded facial tissues, has been added (taken and adapted from EN 1010-5);

— a new Clause 15 has been added;

— in Clause 16, a table on the verification of the safety requirements and/or protective/risk reduction measures has been added;

— a new Annex A with a list of significant hazards has been added;

— in Annex B, an example of noise declaration for paper converting machines has been added.

This document is intended to be used in conjunction with ISO 12643-1:2023.

A list of all parts in the ISO 12643 series can be found on the ISO website.

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

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Introduction

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

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

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

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

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

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

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

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

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

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

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

The purpose of this document is to reduce the risk of injury to operating personnel working on converting equipment.

During the development of this document, existing relevant standards of other countries were taken into consideration. In cases where it was known that there is a national requirement that differs from this document, that has been noted.

This document was developed to harmonize the following US and European safety standards:

— ANSI/PMMI B155.1[8]

— EN 1010 4[9]

— EN 1010-5[10]

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

The full set of requirements for graphic technology equipment and systems are those given in the part of ISO 12643 applicable to that type, together with the relevant requirements from ISO 12643-1:2023, to the extent specified in the Scope of the applicable part of ISO 12643.

This document supplements and modifies the general requirements of ISO 12643-1:2023. Where a requirement of this document conflicts with a requirement of ISO 12643-1:2023 the requirement of this document will take precedence.

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

Part 4: Converting equipment and systems

1 Scope

This document deals with all significant hazards, hazardous situations or hazardous events relevant to converting equipment and systems used in the corrugated board, package printing, converting and graphic technology industries (see Clause 5), when it is used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer.

This document is applicable to converting equipment not covered by other parts of ISO 12643.

This document is not applicable to the machinery or machinery components manufactured before the date of its publication.

2 Normative references

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

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

ISO 12643-1:2023, *Graphic technology — Safety requirements for graphic technology equipment and systems — Part 1: General requirements*

ISO 13849-1:2023, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13854:2017, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

ISO 13855:2010, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body*

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

ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

IEC 60529:1989+AMD1:1999, *Degrees of protection provided by enclosures (IP code)*

IEC 61496-1:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

IEC 61496-2:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

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IEC 62061:2021, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, ISO 12643-1:2023 and the following apply.

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

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

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

3.1
access height
<automatic flatbed die-cutting machine delivery zone> dimension of the maximum opening into the area below the sheet gripper, measured between the access level and the lower edge of fixed machine parts

Note 1 to entry: Examples for the access level are floor, fixed platform or footboard.

Note 2 to entry: Examples for fixed machine parts are fixed guard, fixed cover or fixed parts such as a sheet stop.

Note 3 to entry: See Figure 27.

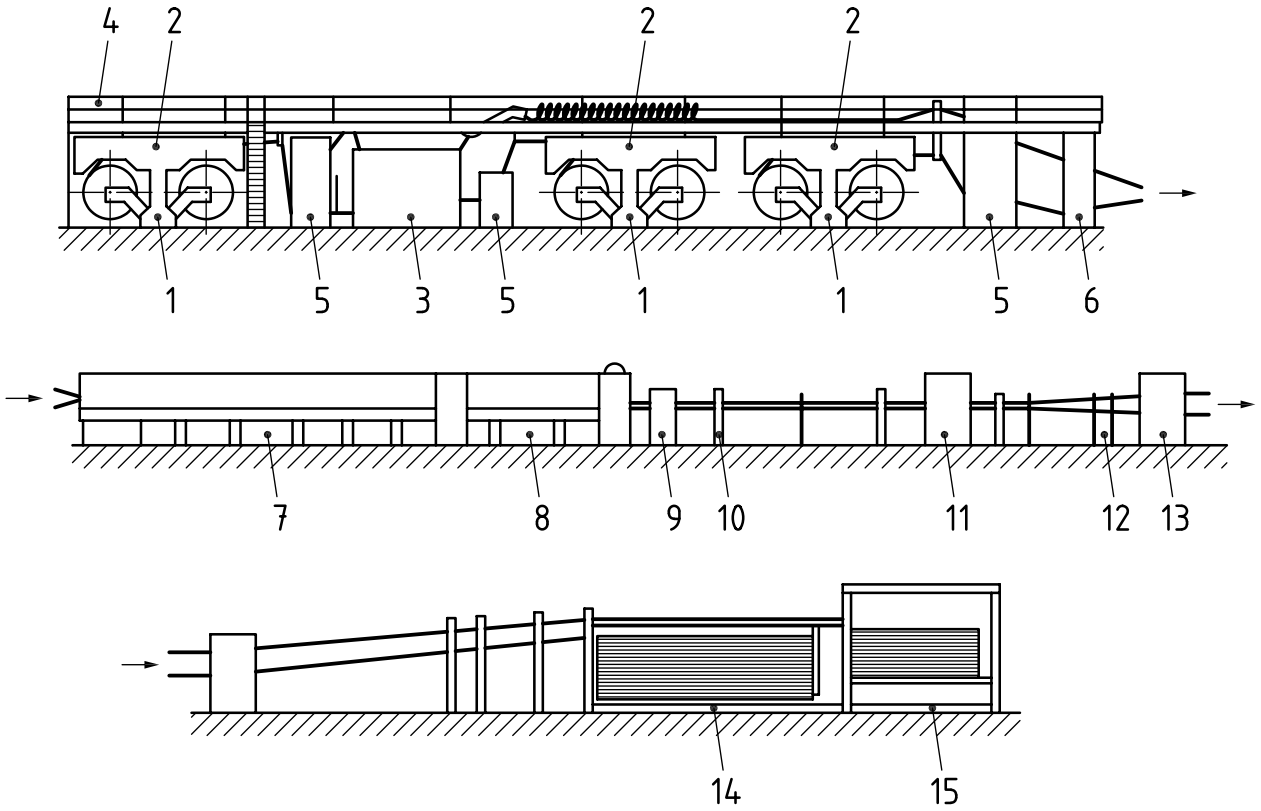
3.2
bridge
transport system positioned in an upper level (e.g. above the single facer, splicer or gluing unit) serving as storage facility

Note 1 to entry: The inclined belt conveyor feeds the single faced corrugated board to the bridge where it is deposited in loops and subsequently fed to the following machines

3.3
corrugating machine
corrugated board machinery
machinery which produces board consisting of one or more layers of fluted paper glued to one or more layers of flat paper or board and which produces the fluted web to be glued in-line by means of two corrugating rollers

Note 1 to entry: An example of a corrugating machine is shown in Figure 1.

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Key

1	unwind	9	rotary shear
2	splicer	10	pulling unit
3	single facer	11	slitter-scorer unit
4	bridge	12	web diverter
5	preheater	13	cut-off
6	gluing machine	14	upstacker
7	heating section	15	downstacker
8	pulling section		

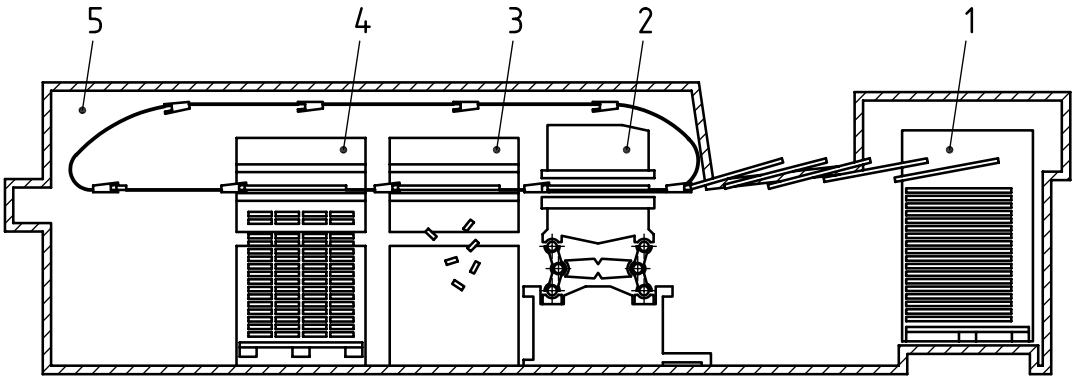
Figure 1 — Example of a machine for the production of corrugated board

3.4
cut-off
machine which cuts the material to a pre-determined length

3.5
die-cutter
flatbed die-cutting machine
machine which cuts and/or creases the material and/or strips the waste from the material

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Key

1 feeder
2 punching section
3 breaking section
4 blank separating section, delivery
5 trimming of gripper edge, delivery

Figure 2 — Example of an automatic flatbed die-cutting machine

3.6
downstacker
auto-piler
stacking device on corrugated board machines where the position of the feeding conveyor remains unchanged and the pile is created by the lowering movement of the pile carrier

3.7
folding section
part of a folder gluer which folds the substrate to its required position

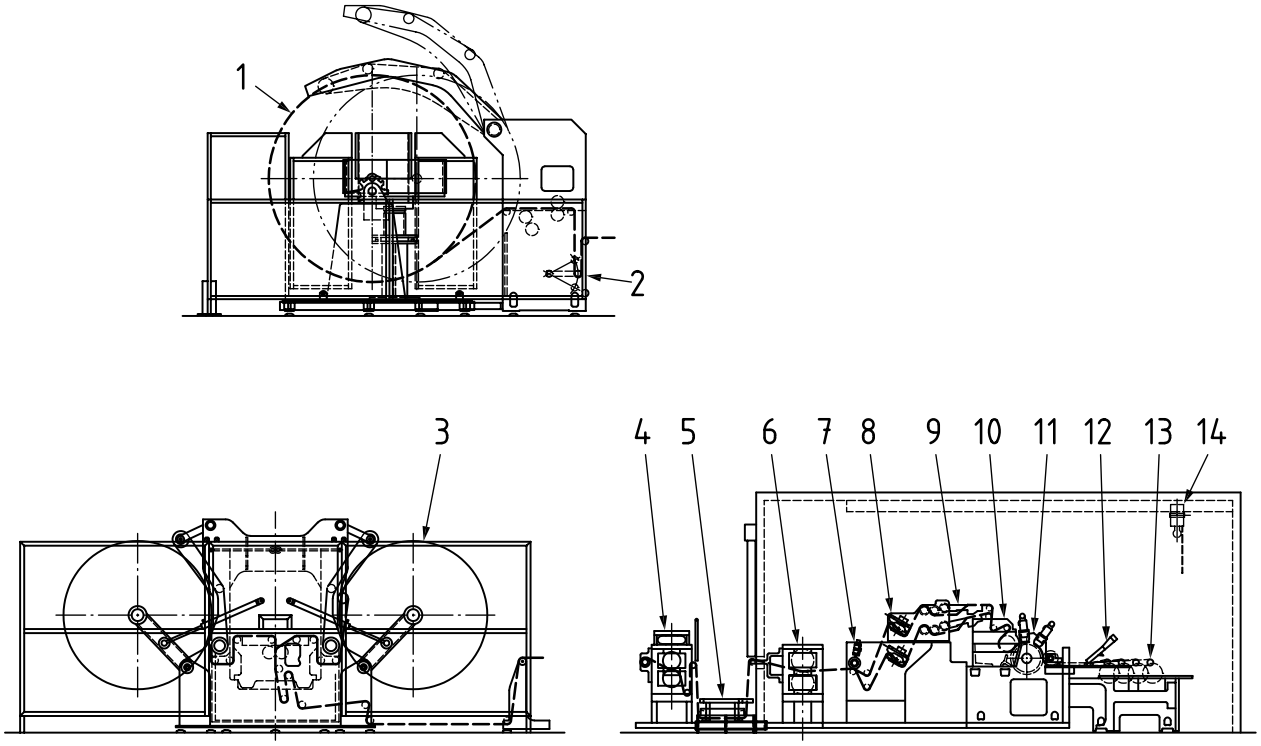
3.8
gluing machine
separate machine for applying an even layer of glue onto the top of the corrugations of one or more single faced board webs

3.9
gluing unit
part of a *single facer* (3.19) or *gluing machine* (3.8) which applies a layer of adhesive to the fluted board peaks

3.10
handkerchief machine
machine for the in-line production of tissue-based handkerchiefs, which includes calendaring, embossing, folding and cutting

Note 1 to entry: An example of a handkerchief machine is shown in Figure 3.

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Key

1	star-type unwinding	8	aligning section
2	dancer roller	9	longitudinal folding section
3	unwinding device	10	sheeter cylinder
4	smoothing section	11	cross folding cylinder
5	web guide control	12	waste suction device
6	embossing section	13	counting and transfer section
7	longitudinal cutting section	14	noise hood

Figure 3 — Machine for the production of handkerchiefs

3.11
inclined belt conveyor
transport system for feeding the single-faced corrugated board onto the *bridge* (3.2)

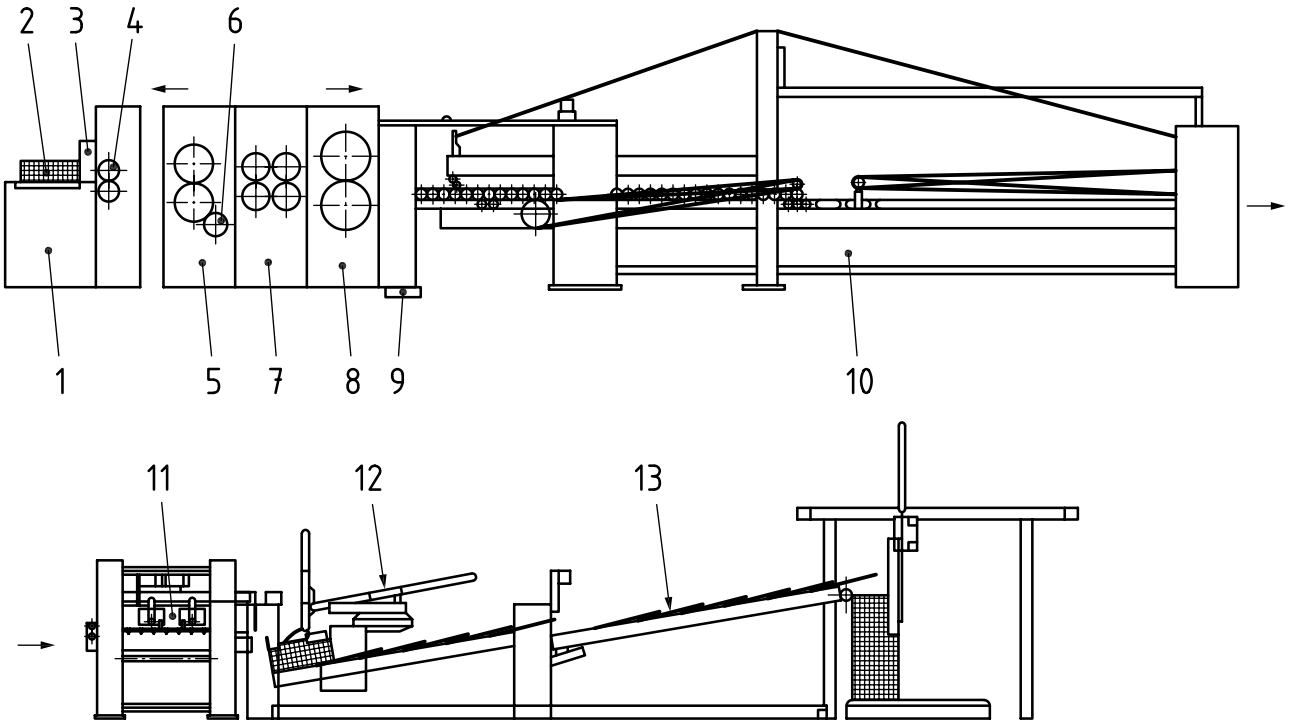
3.12
inclined belt conveyor side
that side of a *single facer* (3.19) where the corrugated board is delivered and fed onto the *bridge* (3.2) by the inclined *belt conveyor* (3.11)

3.13
in-line machine
machine for processing board and corrugated board, consisting of a number of units such as a feeding unit, one or more printing units, slitter-scorer unit, rotary die-cutter, gluing unit, folding unit, stitching unit, taping unit

Note 1 to entry: Depending on the type of machine, one or more of the units listed may be missing.

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Key

1	feeding unit	8	rotary die-cutter
2	blank pile	9	waste discharge conveyor belt
3	side alignment	10	folding unit
4	feed rollers	11	stitching unit
5	printing unit	12	counter-ejector and squaring unit
6	ink roller	13	delivery
7	slitting and scoring unit		

Figure 4 — In-line machine

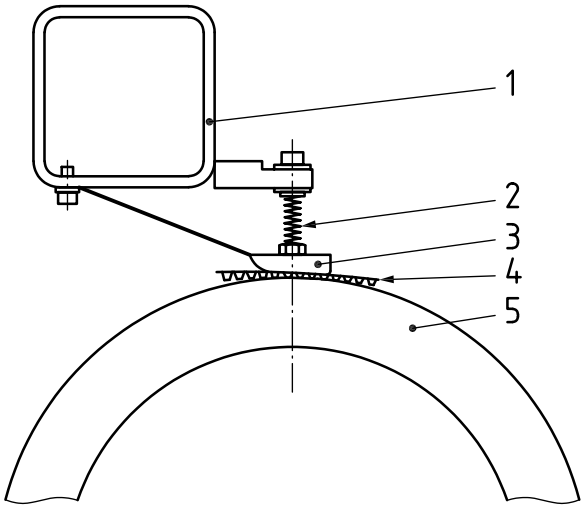
3.14
pile turner
machine that is used to turn over/rotate material

Note 1 to entry: Can be part of a *pre-feeder* (3.15).

3.15
pre-feeder
system that provides material to the feed of the machine

3.16
pressing device
part of a gluing machine of a corrugating machine, that ensures that the single faced web is evenly immersed into the glue film

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Key

1 cross beam/support
2 load spring
3 single faced web
4 pressing shoe
5 applicator roll

Figure 5 — Pressing device with spring-loaded design

3.17
rotary shear
rotary cutter for cutting the traveling corrugated cardboard web across the working width in the event of format change and for removing waste material

Note 1 to entry: Rotary shears are necessary for the cross-cutting of the corrugated board web, when the format is changed, or waste are removed.

3.18
separator
part of machine which separates the die cut material

3.19
single facer
equipment where corrugations are embossed into a paper web by using two corrugating rollers and where a liner is glued onto one side

3.20
slitter-scorer
machine which slits and scores material to a pre-determined depth

3.21
upstacker
stacking device on corrugated board machines where the position of the pile carrier remains unchanged and the pile is created by the upward movement of the conveyor belt

3.22
web diverter
system of movable elements for diverting and feeding the slit webs delivered from the slitting and scoring unit into the sheeter

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3.23
weighting device
assembly of a corrugating machine which controls the degree of drying in the heating and pulling section

Note 1 to entry: The more heating plates are in contact with the web and thus with the heating plate the higher is the degree of drying.

4 Significant hazards

The list of significant hazards covered by this document is given in Annex A.

5 Equipment and interrelation between this document and ISO 12643-1:2023

5.1 General

This document covers a variety of equipment used in printing plants and converting operations. Those used primarily in a converting operation are listed in 5.2, while those that may be used in a printing operation covered in other parts of ISO 12643 are listed in 5.3.

Converting equipment and systems used in the corrugated board, package printing, converting and graphic technology industries complies with the requirements of ISO 12643-1:2023, as far as not modified or replaced by the requirements of this document.

5.2 Machines used primarily in a converting operation

Machines used primarily in a converting operation include the following:

— machinery for the production of envelopes;

— handkerchief machines;

— machinery for the production of interfolded facial tissues;

— machinery for the production of corrugated board;

— folding-box gluer machines;

— in-line machines;

— automatic flatbed punching machines;

— tube-winding machines;

— box-making machines;

— finishing/window equipment;

— hole punching machines;

— laminating machines/laminators;

— pre-feeding/stack-turning machines.

5.3 Machines used in both printing and converting processes

Examples of machines used in both printing and converting processes include the following:

— label printing machines (see also ISO 12643-1:2023 and ISO 12643-2:2023);

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— coating machines (see also ISO 12643-3:2023);

— curing and drying machines (see also ISO 12643-2:2023);

— cutters, creasers and die-cutters (see also ISO 12643-3:2023);

— breakers (separators, stripping station) (see also ISO 12643-1:2023);

— embossing equipment (see also ISO 12643-2:2023);

— tension control equipment (see also ISO 12643-1:2023);

— rewinding/roll equipment/slitting and rewinding equipment (see also ISO 12643-1:2023);

— foil unwinders (see EN 13418:2013);

— extruders (see EN 1114-1:2011).

NOTE This document is not applicable to winder-slitters and sheeters in paper finishing (sheeters with unwinders).

6 Machinery for the production of corrugated board

6.1 All machines

6.1.1 Emergency stop

Emergency stop devices shall be provided in accordance with ISO 13850:2015 and, as a minimum, on each control station that initiates the start of the entire machine. Emergency stop devices shall be no more than 15 m apart.

Emergency stop devices shall stop the motion of the entire machine unless control zones are being used (see 6.1.2).

As an exception, the glue rollers of the gluing unit may continue running if the hazard points on the gluing unit are safeguarded by guards.

As an exception, the ink and print rollers of the printing unit may continue running if the hazard points on the printing unit are safeguarded by guards.

6.1.2 Control zones with stop/safe pushbuttons

Where the machine is configured into control zones, they shall be as follows (see Figure 6):

— one control zone for each single facer group (unwind of liner with preheater, single facer, unwind of medium);

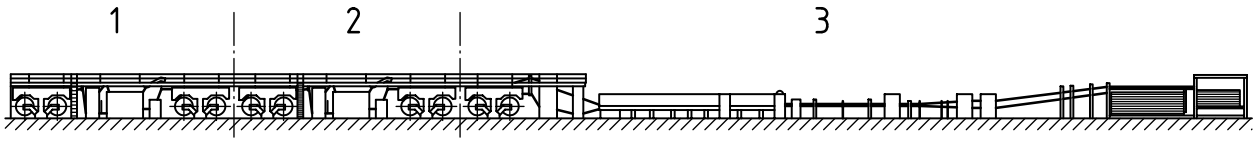
— one control zone for the liner unwind before heating up to stacker device.

At minimum, one stop/safe pushbutton in accordance with ISO 12643-1:2023, 5.7.2.5.2 shall be provided in each control zone.

NOTE Control zones can overlap.

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Key

1 first control zone for first single facer group

2 second control zone for second single facer group

3 third control zone for liner unwind up to stacker device

Figure 6 — Example of control zones

6.1.3 Steam pipes

Steam pipes that can be accessed from any working level shall be insulated up to a height of 2,70 m from the working level for protection against contact with hot parts.

6.2 Unwinding stations

6.2.1 General

Means shall be provided to ensure that reel cores, which might be stuck to a chucking cone, can be safely removed, e.g. using an automatic reel core ejector that pushes the core away from the chucking cone.

6.2.2 Chucking cones and lifting arms

Inserting chucking cones and moving lifting arms shall be accomplished with hold-to-run control. Hold-to-run speeds for inserting the chucking cones and moving the lifting arms may be increased to 15 m/min maximum if the hold-to-run buttons are located at a minimum distance of 850 mm from the lifting arms.

6.2.3 Braking systems

The blowers for the braking systems on unwinding stations shall have at least the degree of protection IP 23, as specified in IEC 60529:1989+AMD1:1999+AMD2:2013. Accumulation of flammable dust in the brakes shall be prevented.

NOTE The accumulation of flammable dust in the brakes can be reduced if the louvres provided in the ventilator housing open to the bottom while the lifting arms are in operating position.

6.3 Splicers

6.3.1 Guarding hazard points

On splicers, any hazard points between the dancer roller carriage and guide rollers, and between the dancer roller and fixed parts of the machine shall be avoided by design measures or be safeguarded (see Figure 7).

If safeguarding by distance, the following requirements apply:

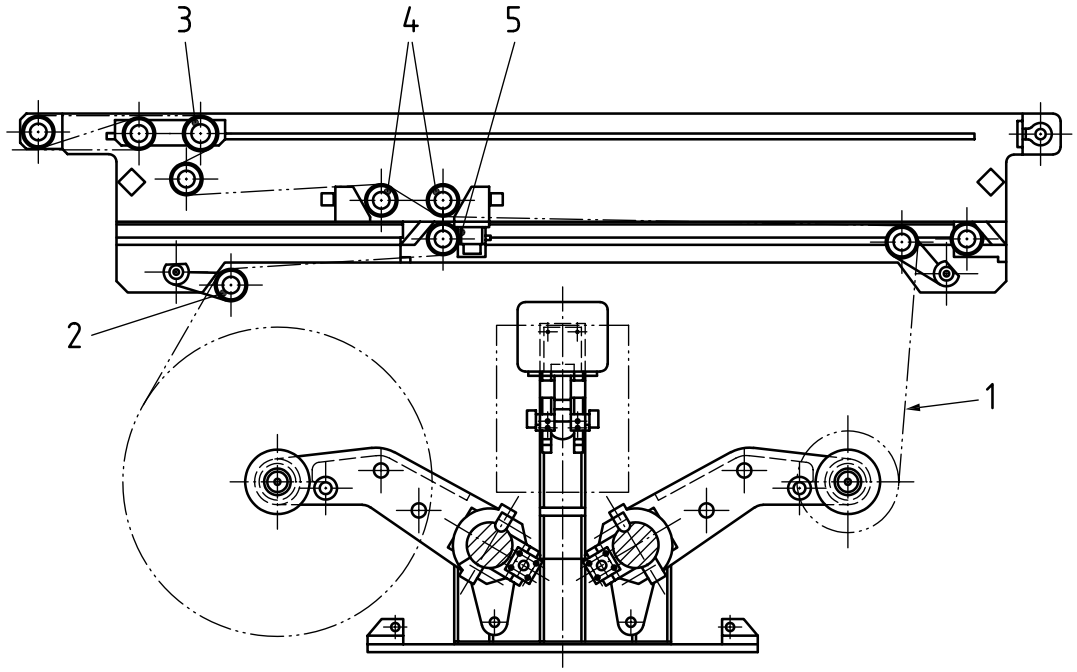
— a minimum distance of 25 mm if the hazard points are at a height greater than 2,20 m;

— a minimum distance of 120 mm if the hazard points are at a height less than or equal to 2,20 m.

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6.3.2 Dancer roller

Where hold-to-run control is used for safeguarding, the hold-to-run speed shall not exceed 15 m/min.



Key

1 paper web
2 guide rollers
3 dancer roller
4 splice knife
5 splice carriage

Figure 7 — Splicer

6.3.3 Splicers

On splicers, hazard points between the movable splicing carriage and fixed machine parts shall be prevented by safety measures or be safeguarded (see Figure 7). Safeguarding is possible by one or more of the following measures:

— providing minimum distances of 25 mm for hazard points above 2,20 m and of 120 mm at heights less than or equal to 2,20 m;

— a hold-to-run control meeting the requirements of ISO 12643-1:2023, 5.3.6, if it is possible to observe the hazard points and hazard zones from the point of operation of the hold-to-run control;

— a moving speed of the splicing unit of max. 15 m/min and a force reduction to 300 N when moving out into the working areas, if it is ensured that a reel/reel core is clamped on both sides as access restriction.

NOTE This can be done, for example, by the paper break sensor, which releases a machine stop after a missed splice as a result of a missing new paper reel and thus also stops the movement of the splicing units.

If these measures cannot be observed, the hazard zone shall be protected by fixed guards, movable guards or protective devices with an approach reaction (safety edges, safety mats, ESPDs). The distance to the maximum reel geometry shall be at least 500 mm. ISO 13855:2010 does not have to be considered

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(unintentional access to the area is not to be expected, access to the working area is focused, the hazard is only present for a short period after the splice).

6.3.4 Knife

The cutting edge of the knife shall be safeguarded in the rest position. Safeguards shall also be in place to prevent a person accessing the blade when it is cutting. The control system which controls the cutting cycle of the knife shall meet at least ISO 13849-1:2023, PL d or IEC 62061:2021, SIL 2.

NOTE These safeguards can be different than those in the rest position.

6.3.5 Pneumatic and hydraulic control systems

Where pneumatic or hydraulic control systems are used for starting the cutting cycle, a well-tried check valve shall be supplied to ensure that the knife remains in the safe position in case of leakage or hose breakage. The control system shall meet at least ISO 13849-1:2023, PL d.

6.3.6 Frame edges

Where the machine frame of the splicer is lower than 2 m at the sides (as measured from the floor), frame edges shall be provided with black-yellow padding for protection against impacts.

6.3.7 Splicers in elevated positions

If adjustment or setup of the movable splicing carriage cannot be accomplished from floor level, safe access shall be provided.

6.3.8 Warning lights

A yellow warning light shall flash for 2 s prior to the initiation of the automatic splicing operation and during the entire period of automatic motion. The integration of the warning lights into the control system may be single-channel, e.g. via an electronic control system.

6.4 Preheater

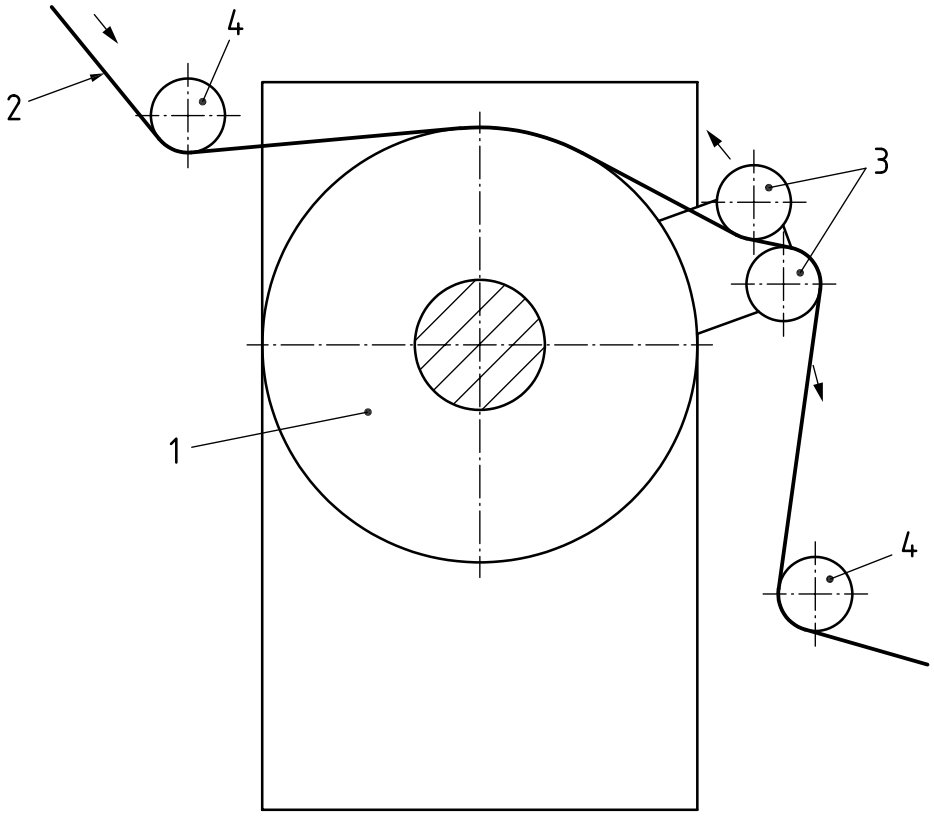
6.4.1 In-running nips

The in-running nips between the wrap roller and the preheating cylinder, and between the wrap roller and fixed machine parts or guide rollers (see Figure 8), shall be safeguarded by one or more of the following measures:

— using a minimum distance of 120 mm;

— guarding in accordance with ISO 12643-1:2023, 5.3.4.

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Key

1 preheating cylinder
2 paper web
3 wrap roller
4 guide roller

Figure 8 — Preheater, side view

6.4.2 In-running nips between preheating cylinder and cross beams

The in-running nips between the preheating cylinder and any cross beam shall be safeguarded by maintaining a minimum distance of 300 mm between these parts.

6.4.3 Wrap roller and rotating arms

The rotating arms shall be safeguarded by interlocking guards or ESPDs which are interlocked with the drive system of the rotating arms.

If hold-to-run mode is provided inside of the guarded area it shall fulfil the requirements of ISO 12643-1:2023, 5.3.6.

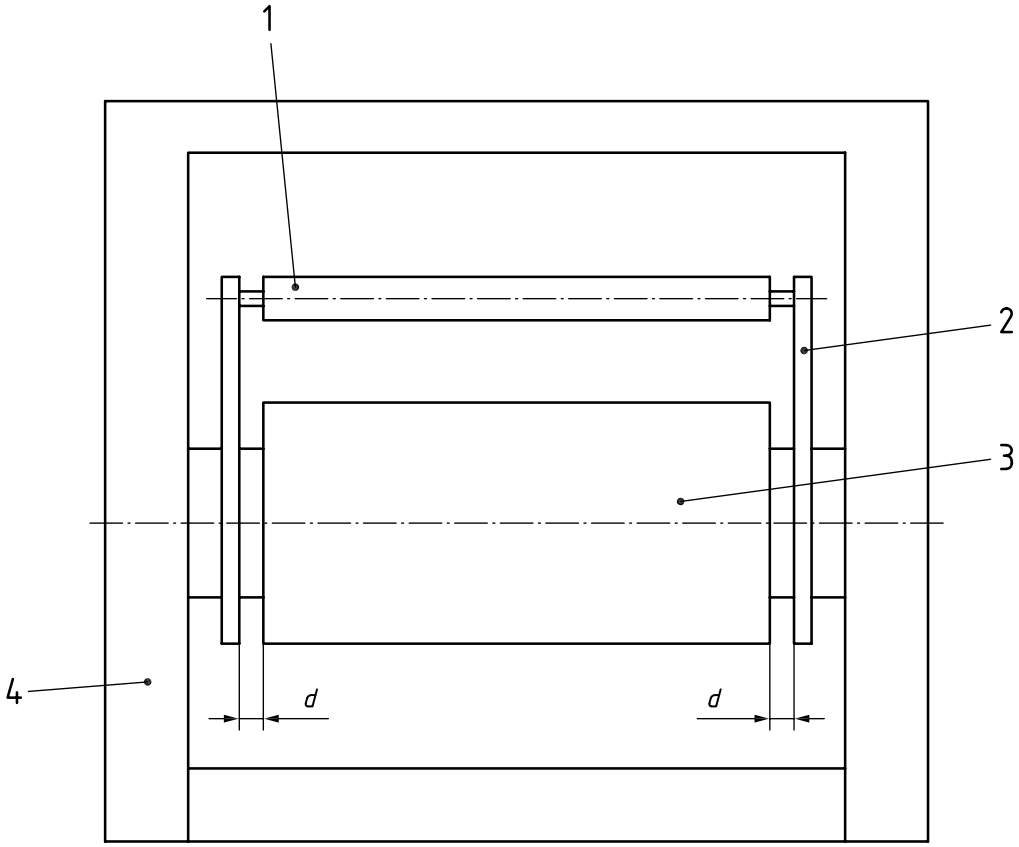
The drives for the wrap roller shall be safeguarded by fixed guards completely enclosing the drives.

Rotating arms (see Figure 9, item 2) shall be designed such that any openings in the rotating arms do not create a shearing hazard. Rotating arm or machine side shall be designed in such a way that parts of the body are deflected by the arm when rotating at its maximum circumferential speed of 5 m/min.

The distance (see Figure 9, d) between the preheating cylinder and the rotating arm shall be 6 mm or less or 30 mm or more.

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Key

1 wrap roller
2 rotating arm
3 preheating cylinder
4 machine frame
d distance between preheating cylinder and rotating arm

Figure 9 — Preheater, feeding side

6.4.4 Hot surfaces

Where the temperature of any surface is higher than 65 °C, warning signs indicating the hot surfaces shall be fitted to both sides of the preheater.

6.4.5 Walkways

If walkways with fall-off protection are located near preheaters, the distance between the fall-off protection and movable parts of the preheater shall be at least 120 mm.

For fall-off protection and walkways, see ISO 12643-1:2023, 5.4.4.

6.5 Single facer

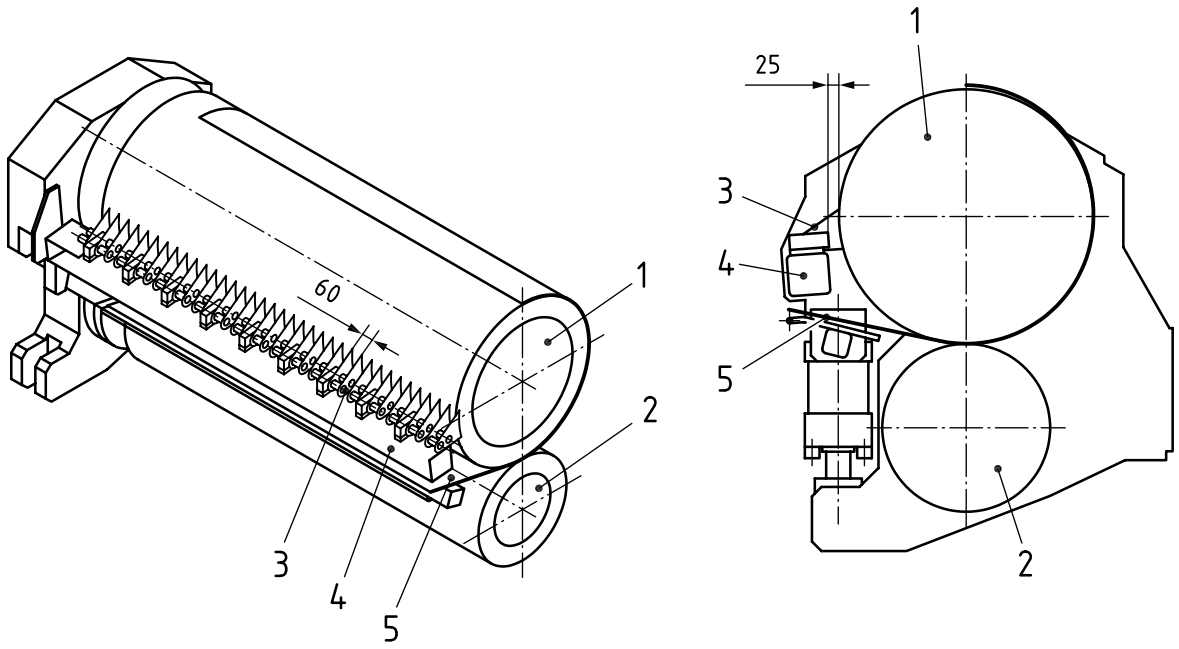
6.5.1 In-running nips

On single facers where the web is fed through a webbing slot the safety distances specified in ISO 13857:2019 (as required by ISO 12643-1:2023) shall be met.

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The in-running nips between the corrugating rollers and fixed machine parts shall be safeguarded by fixed guards. The hazard point between the corrugating roller and the cross beam with scrapers is considered to be safeguarded if the clearance between the corrugating roller and the cross beam is at least 25 mm and the clearance between the scrapers is no more than 60 mm (see Figure 10).

Dimensions in millimetres



Key

1 upper corrugating roller
2 lower corrugating roller
3 scraper
4 cross beam
5 feeding of paper web

Figure 10 — Corrugating rollers with scraper (front and side views)

6.5.2 Corrugating rollers

Where corrugating rollers are removed for changing, lifting devices and means of transport shall be provided that allow easy and safe changing of rollers.

6.5.3 Hazard points during roller change

Any hazard points that can be accessed after removal of, or during changing of, corrugating rollers shall be safeguarded in accordance with ISO 12643-1:2023.

Where corrugating rollers are mounted on an indexing turret, any movement of the turret shall be under hold-to-run control with displacement limited to a maximum of 75 mm or with a maximum operating speed of 5 m/min.

6.5.4 In-running nip between pressure roller or pressing belt and corrugating roller

The in-running nip between the pressure roller or pressing belt and the corrugating roller (see Figure 11) shall be safeguarded by fixed guards.

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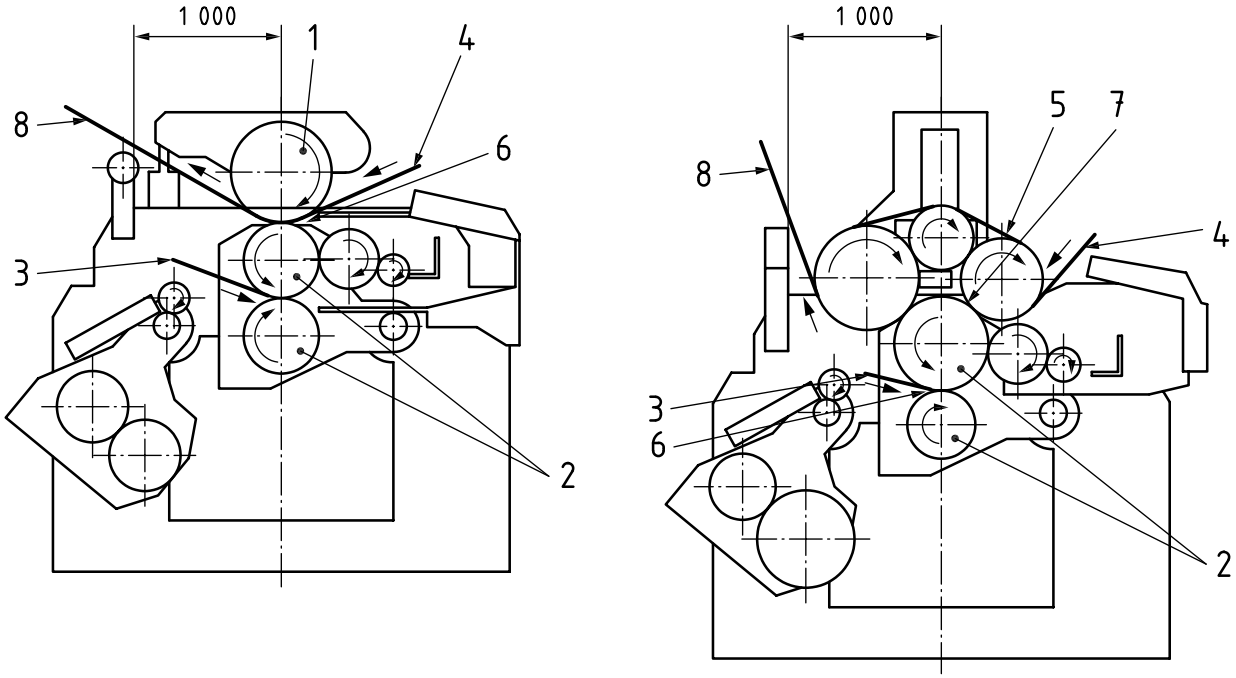
The crushing point created by the lowering of the pressure roller contacting the corrugating roller shall be safeguarded by a guard in accordance with ISO 12643-1:2023 or by using a horizontal safety distance of 1 000 mm from the hazard point (see Figure 11).

In-running nips on the pressing belt shall be safeguarded by fixed guards.

6.5.5 Pressing belt breakage

On the delivery side of the single faced web (inclined belt conveyor side), a containment device shall be provided to eliminate the risk of injury in the case of pressing belt breakage.

Dimensions in millimetres



a) Design using pressure roller **b) Design using pressing belt**

Key

1	pressure roller	5	pressing belt
2	corrugating rollers	6	in-running nip
3	medium	7	in-running nip on pressing belt
4	liner	8	single-faced web

Figure 11 — Corrugating unit

6.5.6 Walkway

The walkway on the inclined belt conveyor side (see Figure 13, item 7) shall have fall-off protection towards the corrugating rollers. Where cross beams in the form of handrails are provided for fall-off protection they shall be at a height of 1,10 m (see Figure 13, item 6).

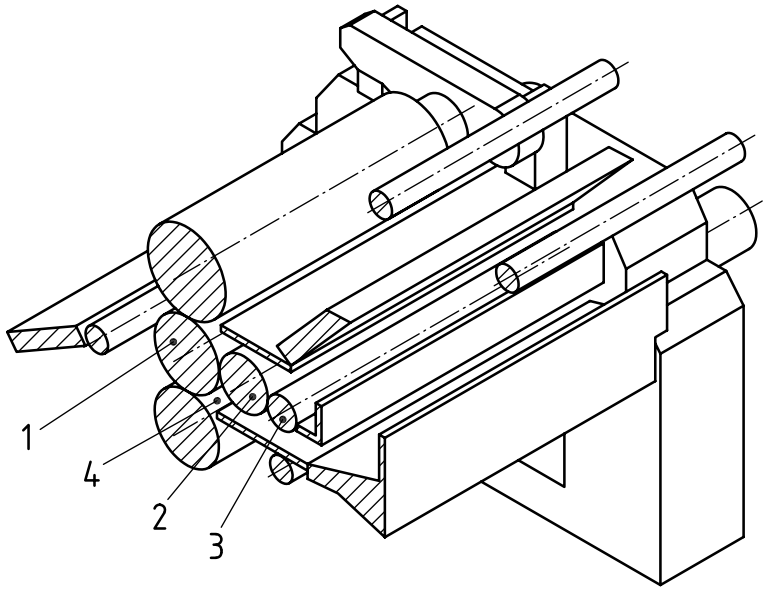
6.5.7 In-running nips between glue rollers

In-running nips between glue rollers or between glue rollers and corrugating rollers that are accessible when the gluing unit is disengaged shall be safeguarded by fixed guards in accordance with ISO 12643-1:2023.

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Where disengaging and engaging the gluing unit is an automatic operation, the gluing unit shall not create any hazard points; otherwise, this movement shall only be carried out under hold to run control at a maximum speed of 5 m/min.

Where maintenance or cleaning operations are carried out with the interlocking guard covering the gluing unit in an open position (see Figure 12), the glue rollers (applicator, scraper roll) shall only be allowed to rotate at a maximum circumferential speed of 6 m/min. Glue rollers shall rotate in the same direction with no possibility of access to an in-running nip between corrugating roller and glue roller.



Key

1 corrugating roller
2 glue applicator
3 scraper roller
4 in-running nip

Figure 12 — Gluing unit

6.5.8 Hazard points between movable gluing unit and fixed machine parts

The hazard points between the movable gluing unit and fixed machine parts (machine frame) shall be safeguarded by one of the following measures:

— a hold-to-run control as defined in ISO 12643-1:2023, 5.3.6;

— interlocking guards;

— a minimum distance of 25 mm.

6.5.9 Moveable glue units

If the in-running nips are accessible it shall only be possible to open and close the moveable glue units when the corrugator roller and pressure roller/belt, glue roller and doctor roller is stopped.

Prior to opening/closing moveable glue units a request shall be generated to stop movement of the rolls. The safety related control systems shall meet the requirements of ISO 13849-1:2023, PL d or IEC 62061:2021, SIL 2.

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6.5.10 Inclined belt conveyor

The in-running nips on belts shall be safeguarded by fixed guards.

The in-running nip between the upper belt and the lower belt shall be safeguarded by off-setting the two pulleys in such a way that the minimum clearance between the two rollers is 120 mm (see Figure 13). The inlet height shall be at least 2 100 mm measured from the walkway.

There shall be no fixed parts in the in-running nip area and the risk of drawing in shall be reduced sufficiently low.

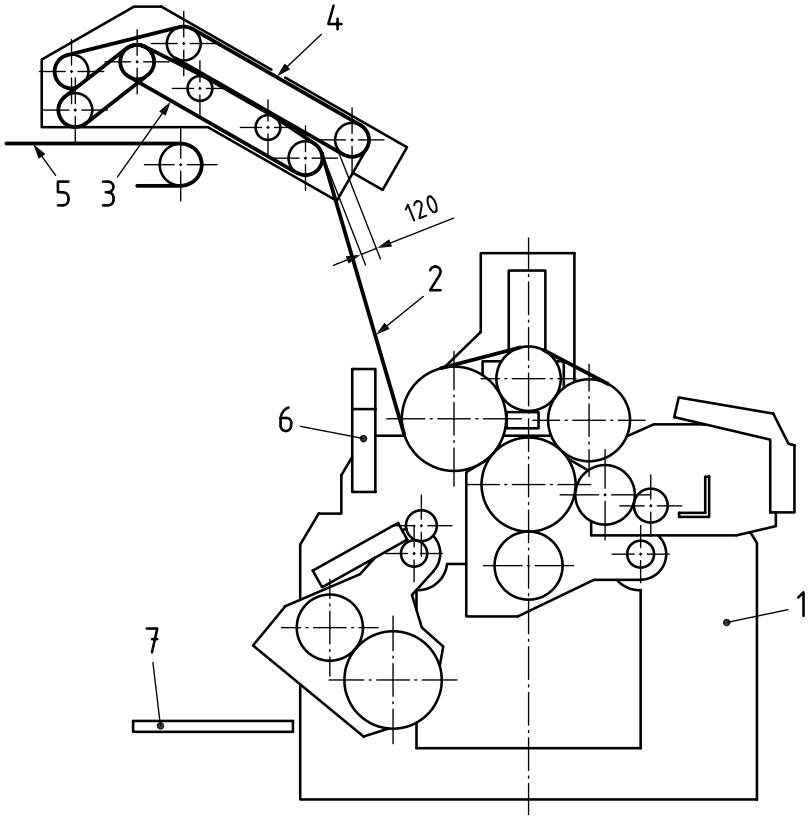
This is given if the following requirements are met:

— the nip point shall be at least 200 mm away from the inlet point;

— a maximum wrap angle in the in-running nip point of 15°;

— the pressure belt shall allow a deflection distance of at least 25 mm at the nip point, whereby a pressure force of 280 N shall not be exceeded.

Dimensions in millimetres



Key

1	single facer	5	bridge
2	single-faced web	6	fall-off protection
3	lower belt	7	walkway
4	upper belt		

Figure 13 — Single facer with inclined belt conveyor

Danger points on the inclined belt conveyor that can be accessed from the bridge shall be safeguarded by fixed guards in accordance with ISO 12643-1:2023, 5.3.4.

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