

INTERNATIONAL STANDARD

ISO 12649

First edition
2004-05-01

Graphic technology — Safety requirements for binding and finishing systems and equipment

*Technologie graphique — Exigences de sécurité pour les systèmes et
les équipements de reliure et de finition*



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Published in Switzerland

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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 12649 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

...

Introduction

During the development of this International Standard, 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 International Standard, that has been noted.

This International Standard was developed to harmonize three U.S. safety standards:

- ANSI B65.2, Safety standard — Binding and finishing systems,
- ANSI B65.3 Safety standard — Guillotine cutters, mill trimmers, and integral handling equipment,
- ANSI B65.4, Safety standard — Three-knife trimmers, including rotary, and single- and multiple-knife trimmers;

and three European standards:

- prEN 1010-1, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machinery — Part 1: Common requirements*,
- EN 1010-3, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machinery — Part 3: Cutting machines*,
- EN 1010-4, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machinery — Part 4: Bookbinding, paper converting and paper finishing machines*.

Graphic technology — Safety requirements for binding and finishing systems and equipment

1 Scope

This International Standard provides safety specifications for the design and construction of binding and finishing equipment operated in a system configuration or in stand-alone mode.

This International Standard provides safety requirements for the design and construction of equipment used to convert printed or blank substrates into cut, folded, collated, assembled, bound, or otherwise finished product. It may also be applied to processes for preparing substrate for the printing process.

It addresses recognized hazards specific to binding and finishing equipment and systems in the following areas:

- mechanical;
- electrical;
- slipping, tripping, falling;
- ergonomics;
- noise;
- radiation;
- fire and explosion;
- thermal;
- emissions.

This International Standard applies to new machines manufactured after December 31 of the year following the year of issue of this International Standard.

Equipment covered by this International Standard may be used in a stand-alone configuration, or in combination with other machines affected by an integrated control system. These may include but are not limited to, the combinations of the machines noted in Clause 4.

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 8031, *Rubber and plastic hoses and hose assemblies — Determination of electrical resistance*

ISO 11553, *Safety of machinery — Laser processing machines — Safety requirements*

ISO/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO 12100-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

ISO 12648:2003, *Graphic technology — Safety requirements for printing press systems*

ISO 13849-1:1999, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

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

ISO 13851, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 13852:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

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

ISO 13855, *Safety of machinery — Positioning of protective equipment with respect to the approach speeds of parts of the human body*

ISO 13856-1, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for the design and testing of pressure-sensitive mats and pressure-sensitive floors*

ISO 14119:1998, *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 14122-1, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of a fixed means of access between two levels*

ISO 14122-2, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and gangways*

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

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*

ISO 15847:—¹⁾, *Graphic technology — Graphical symbols for printing press systems and finishing systems, including related auxiliary equipment*

1) To be published.

- IEC 60079-1, *Electrical apparatus for explosive gas atmospheres — Part 1: Flameproof enclosures “d”*
- IEC 60079-2, *Electrical apparatus for explosive gas atmospheres — Part 2: Pressurized enclosures “p”*
- IEC 60079-5, *Electrical apparatus for explosive gas atmospheres — Part 5: Powder filling “q”*
- IEC 60079-6, *Electrical apparatus for explosive gas atmospheres — Part 6: Oil-immersion “o”*
- IEC 60079-7, *Electrical apparatus for explosive gas atmospheres — Part 7: Increased safety “e”*
- IEC 60079-11, *Electrical apparatus for explosive gas atmospheres — Part 11: Intrinsic safety “I”*
- IEC 60079-14, *Electrical apparatus for explosive gas atmospheres — Part 14: Electrical installations in hazardous areas (other than mines)*
- IEC 60079-18, *Electrical apparatus for explosive gas atmospheres — Part 18: Encapsulation “m”*
- IEC 60204-1:2000, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*
- IEC 60825-1, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide*
- IEC 60947-5-1, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*
- IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements*
- IEC 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals*
- IEC 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*
- IEC 61496-1, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*
- IEC 61496-2, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*
- EN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces*
- EN 1127-1, *Explosive atmosphere — Explosion prevention and protection — Part 1: Basic concepts and methodology*
- EN 1539, *Dryers and ovens, in which flammable substances are released — Safety requirements*
- EN 1760-2, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars*
- EN 12198-1:2000, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 1: General principles*
- EN 13023, *Noise measurement methods for printing, paper converting, paper making machines and auxiliary equipment — Accuracy grades 2 and 3*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO 13849-1:1999 and the following apply.

3.1

actuator

part of the actuating system to which an external actuating force is applied

[IEV 441-15-22]^[39]

NOTE 1 The actuator may take the form of a handle, knob, pushbutton, roller, plunger, etc.

NOTE 2 There are some actuating means that do not require an external actuating force, but only an action.

NOTE 3 See also **machine actuator (3.48)**

3.2

anti-repeat device

mechanical or electromechanical mechanism to ensure that only one cutting cycle occurs for each manual activation or automatic cut if the primary stopping system or **single-cycle device (3.83)** fails

3.3

armed condition

machine status in which machine motion can be automatically initiated

NOTE **Zero speed (3.92)** can be considered to be an armed condition.

3.4

audible alarm

horn, bell or other distinctive audible warning device which sounds to indicate impending machine motion

3.5

authorized person

person identified by plant management as having special training or designated to act in specified situations

NOTE The specified situations can include special tasks to be performed; the function of the adjustments in the work zone; proper operation of adjustments and controls; all types of hazards in the area where the task is to be performed; the application of equivalent, alternative protection to perform the task; improper actions that can cause injury; and the consequences of those improper actions.

3.6

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

3.7

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

3.8

backgauge

movable device (automatic or manual) on a guillotine cutter, positioned square to the cutting table, and which is 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, and to determine the dimensions of the cut

3.9

backgauge drive

mechanism to position the **backgauge (3.8)** prior to the initiation of the cut

3.10**backlining and head banding machines**

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

3.11**barrier guard****distance guard**

guard (3.35) that reduces or prevents physical access to a hazard zone by closing off access to an area containing one or more hazards

EXAMPLE A perimeter fence or tunnel guard.

3.12**binding and finishing system**

combination of machines functioning in an integrated configuration to turn an incomplete printed product into a finished product by means of one or more processes, such as cutting, folding, binding, stitching, gluing, wrapping, etc.

3.13**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

3.14**book press**

press used for flattening books after binding

3.15**book signature press**

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

3.16**casing-in machine**

〈hard-cover bookbinding〉 apparatus for gluing the end papers of the book signatures to the interior surfaces of the book cover

3.17**category 0 stop****uncontrolled stop**

stopping by immediate removal of power to the **machine actuators (3.48)**

[IEC 60204-1:2000]

3.18**category 1 stop**

controlled stop with power available to the **machine actuators (3.48)** to achieve the stop and then removal of power when the stop is achieved

[IEC 60204-1:2000]

3.19**category 2 stop**

controlled stop with power left available to the **machine actuators (3.48)**

[IEC 60204-1:2000]

3.20**clamp**

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

3.21

clamp drive

mechanism by which the **clamp(s) (3.20)** of the paper cutter is/are forced against the material to be cut

3.22

coater

finishing machine that applies a predetermined thickness of a liquid substance (for example glue, varnish, ink) on substrates made of paper or a similar material

3.23

counter-stacker

machine for stacking of piles of leaflets, books, magazines or newspapers such that the successive layers are at 180°

3.24

cutting cycle

⟨for machines with (a) manually driven **clamp(s) (3.20)**⟩ programmed succession of operations that begins when the knife drive is activated and ends when the knife returns to its retracted position

3.25

cutting cycle

⟨for machines with (a) power-driven **clamp(s) (3.20)**⟩ programmed succession of operations that begins when high-pressure clamping is initiated and ends when the knife(s) and clamp(s) return to their retracted positions after a single clamp/knife stroke

3.26

cutting zone

three-dimensional space through which any part of the knife(s) and/or **clamp(s) (3.20)** travel(s) during the entire **cutting cycle (3.24, 3.25)**

3.27

drive

mechanism, divided into the following two general categories, which causes a machine or any of its elements to move:

- drives with no stored energy, which include, but are not limited to, direct-motor drives;
- drives having stored energy, which include, but are not limited to, motor-flywheel-clutch drives and hydraulic-pneumatic drives

3.28

electrical hazard

source of potential injury or death from electric shock or burn

[adapted from ISO 12100-1:2003]

3.29

electro-sensitive protective device

ESPD

apparatus that detects the presence of a person or part of a person or object in a defined area, using any detection means including, but not limited to, photoelectric, light screen, ultrasonic, etc.

3.30

emergency stop device

manually actuated control used to initiate an **emergency stop function (3.31)**

[adapted from ISO 13850:1996]

3.31**emergency stop function**

mechanism activated by a single human motion and intended to halt machine activity in order to avoid injury to persons, damage to machinery or damage to work in progress

3.32**fixed guard**

guard (3.35) that is securely affixed by fasteners that require a tool(s) to remove in order to gain access to an area with a significant hazard

3.33**gang stitcher**

machine for stitching folded sheets of paper, during the operation of 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

3.34**gathering machine**

apparatus that assembles sheets or folded sheets in a binding line

3.35**guard**

physical barrier that restricts access to a significant hazard

3.36**guillotine cutter**

power-driven machine having a single knife which 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.

3.37**hazard zone**

any area within and/or around machinery in which a person is exposed to risk of injury or damage to health

[adapted from ISO 12100-1:2003]

3.38**high-pressure clamping**

operation of **clamps (3.20)** with a dynamic force in excess of 300 N for machines up to and including 1,6 m in width, or 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 % requirement is to ensure the measurement is made at the position that approximates the size of an operator's hand.

3.39**hold-to-run control**

control that starts and maintains machine motion only as long as the control is activated

3.40**inch****jog**

(operation of machinery) machine motion requiring maintained activation engagement of a hold-to-run control and which will continue until the control is released or until a pre-determined displacement (limited inch) has been reached

3.41**inch speed**

how fast the machine is operating while in **inch (3.40)** mode

3.42

infrequently used workplace

area in which an activity is carried out, such as observation, make-ready, jam clearing, minor servicing, crossing inserting hoppers or conveyer belts, etc., that is routine, repetitive, integral to (but not necessarily during) production, and done only on an occasional basis

3.43

in-running nip

area created either by two rotating components that are rotating inward, or by one component rotating toward an adjacent surface (see Figure 1)

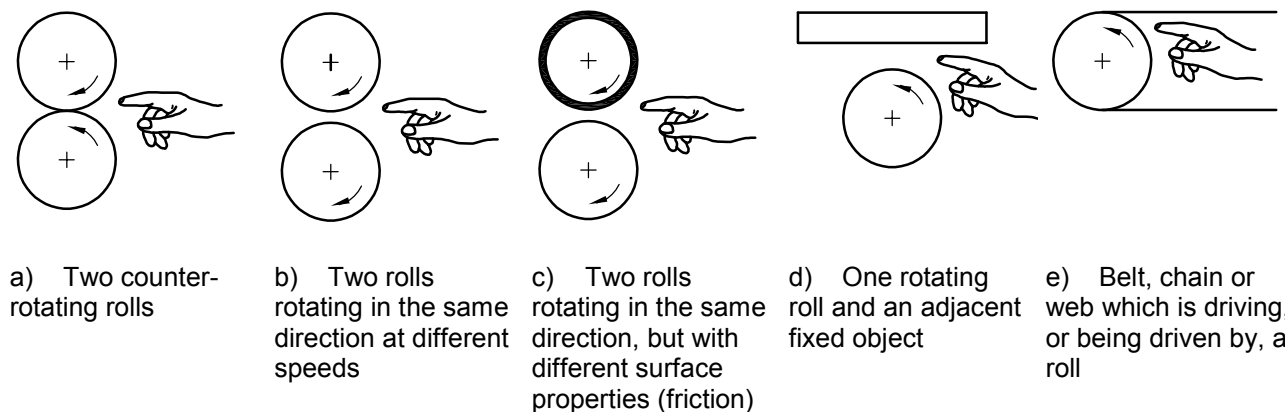


Figure 1 — In-running nips

3.44

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

3.45

knife drive

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

3.46

laminator

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

3.47

low-pressure clamping

(for machines with a power-driven clamp(s)) operation of **clamps (3.20)** at a dynamic force not exceeding 300 N for machines up to and including 1,6 m in width, or 500 N force dynamic 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 % requirement is to ensure the measurement is made at the position that approximates the size of an operator's hand.

3.48

machine actuator

power mechanism used to effect motion of a machine

[ISO 13850:1996]

3.49**maintained-contact control**

control that remains in an open or closed state after its activation

3.50**maintenance**

operation(s) required to assure that the machine remains in acceptable operating condition and that is/are usually performed when the machine is not available for production

NOTE Maintenance (for example, repairing or replacing broken, worn or damaged parts; performing lubrication; preventive servicing; etc.) is normally performed by qualified maintenance personnel, or operators, who have been trained about the types of hazards in the area in which their tasks are to be performed and about how these hazards can be avoided. Such maintenance is generally performed with energy isolated, when possible.

3.51**manual clamping**

operation of **clamps** (3.20) in which the dynamic and static forces and motion of the clamp are directly supplied by the operator

3.52**manual control device**

mechanism comprising part of the actuating system to which a manual action is applied

[Adapted from IEC 441-15-22]^[39]

3.53**mechanical hazard**

source of potential injury to a person created by motion of machinery, components or material (for example, crushing and shearing points; trapping points; in-running nips; cutting, punching and impact points)

EXAMPLES Gear, chain and worm drives; V-belt, flat belt, cord and rope drives; pulling and supporting elements on continuous conveyors; spoke wheels and fly wheels; shafts and shaft ends; rollers; slides; push rods and similar parts, tools and clamping devices.

3.54**mechanical hazard point**

location of a mechanical hazard on a machine where a person can be injured by parts of a machine or by machine movement, such as tools of machines or parts thereof, work pieces or parts thereof, or materials being processed

3.55**momentary contact control**

control that is opened or closed only during its actuation

3.56**motion control**

control that initiates machine movement or movement at **zero speed** (3.92), or places the machine in the **armed condition** (3.3)

3.57**motion control station**

device station that contains at least an emergency stop control and which may contain a motion-initiation control

3.58**motion zone**

area defined by any machine component, or group of machine components, which is driven directly by the binding and finishing system drive motor(s) or indirectly by other means

3.59

movable control station

control station that is permanently wired to the equipment, but which can be moved within a range limited by the length of the attached cable

3.60

movable guard

guard (3.35) that does not require a tool to move or remove it to gain access to a significant hazard

3.61

nip guard

guard (3.35) located at an in-going nip

EXAMPLES Nip bar, finger bar, finger guard.

3.62

non-motion zone

area defined by any machine component, or group of machine components, which, due to system configuration, is not driven by the drive motor(s) of the binding and/or finishing system, or by the web

NOTE A freestanding (not machine-mounted) console is considered to be a non-motion zone.

3.63

non-operational machine

apparatus configured for functions other than delivering products, such as make-ready or wash-up

3.64

normal operation

usual functioning and conditions that exist during set-up, make-ready, production and minor servicing, adjusting and cleaning performed by operators, but not including **maintenance (3.50)** operations

3.65

operating position

location where normal functions (make-ready and other routine, repetitive tasks) requiring control of the main drive motor(s) are performed

3.66

operational machine

apparatus that is configured to deliver product, is composed of at least one motion zone, and may include non-motion zones

3.67

paper drill

machine used to drill holes into piles of paper

3.68

paper embossing machine

machine for finishing paper surfaces by using cylinders to press a design, etc., in relief into the paper

3.69

paper finishing machine

apparatus used for applying liquid or solid coating material on a substrate made of paper or a similar material

3.70

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

3.71**personnel warning lights**

red and green lights used to indicate the ready, running and safe conditions of the machine relative to personnel safety

NOTE These lights are not the same as machine **status lights** (3.85).

3.72**portable control station**

control station that can be disconnected from one location, moved to another location and be reconnected

3.73**positive mechanical action**

linkage of one component with another component such that movement of the former inevitably compels movement of the latter, either by direct contact or by a rigid connection

NOTE 1 This definition also applies to a component that prevents any movement of another component by virtue of its presence.

NOTE 2 When the movement of one mechanical component simply allows another component to move freely (e.g. by gravity, spring force, etc.), there is no positive mechanical action of the former component on the latter.

3.74**positive opening**

contact separation as the direct result of a specified movement of the **actuator** (3.1) through non-resilient members, e.g. those not dependent on springs

3.75**programmable system**

apparatus which a machine operator can use to enter and record various data and functions, including cutting dimensions, auxiliary operations and, if so equipped, automatic cut sequences, and which, on command, will step the machine through the functions recorded in a specific programmed sequence

NOTE The system might be capable of storing one or more job sequences in its memory.

3.76**raised workplaces**

areas where functions are regularly performed, and are at least 0,5 m above access level

3.77**ready condition**

status of a machine in which motion can be initiated by the operator

3.78**remote control**

connection to the control station of a machine by use of an external communication link

3.79**routine and regular access**

repetitive access to a hazard point that is required for manual feeding of a machine during normal production activity

3.80**safe condition**

machine status in which movement of the main drive motor(s) (prime mover) of the motion zone is prevented, which may apply to the entire machine or to one or more motion zones, and which exists only when one or more stop/safe or emergency stop pushbuttons is/are latched in the depressed position

3.81

sheet-folding machine

apparatus to cut, perforate and/or crease single or multiple folds in single sheets of paper

3.82

significant hazard

potential source of severe or disabling injury or death

3.83

single-cycle device

mechanism that ensures that only one cutting cycle occurs for each manual activation or automatic cut

NOTE

See **anti-repeat device** (3.2).

3.84

**smooth roller
cylinder**

elongated solid body with a circular cross-section having a smooth surface; i.e. with grooves or elevations no more than 4 mm deep and with circumferential slots no more than 8 mm wide with no sharp or cutting edges (see Figure 2)

Dimensions in millimetres

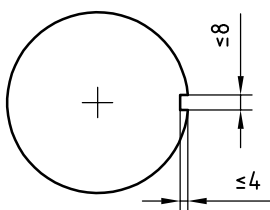


Figure 2 — Smooth roller/cylinder

3.85

status lights

lights that indicate machine status or machine process condition

NOTE

These are not the same as **personnel warning lights** (3.71).

3.86

stored energy

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

3.87

tool

implement, such as a key or wrench, designed to operate a fastener

NOTE

An improvised implement such as a coin or fingernail file is not considered to be a tool.

3.88

trip nip bar

movable protective bar located at an in-running nip which, when pushed, activates the interlocked safety system of the machine

3.89

two-hand control

safety device that consists of two manual control devices that must be operated simultaneously by a single operator to initiate potentially hazardous machine motion

3.90**warning period**

time interval during which machine motion is prevented and a warning is given to personnel that machine motion is about to occur

3.91**wireless control**

transmission of commands and signals between a machine-control system and the motion-control station(s) using means other than a physical connection

3.92**zero speed**

condition of machine movement in which the drive control system is actively holding the machine at a position and while machine movement is not discernible, machine movement can be initiated without warning

NOTE **Zero speed** can be considered to be an **armed condition (3.3)**.

4 Equipment subject to requirements

Equipment covered by this International Standard may be used in a stand-alone configuration, or in combination with other machines affected by an integrated control system. This International Standard is intended to apply to a wider range of equipment used in the binding and finishing process. These may include but are not limited to, the combinations of the machines noted in the following list:

- addressing equipment;
- attaching machines;
- book presses (press for pressing books after binding);
- book stackers;
- bundle presses (to compress bundles of product);
- bundle wrappers;
- bundling machines (strappers);
- case makers;
- casing-in machines;
- conveyors;
- counter-stackers;
- cutters and trimmers;
- depalletizers;
- die cutters;
- drilling and sewing machines;
- embossers;
- foil stampers;
- folders;

- gathering machines;
- gripper conveyors;
- guillotine cutters;
- imprinting equipment;
- inserters, card feeders;
- laminators;
- mailing systems;
- numbering equipment;
- off-line coaters;
- onserters, attaching machines;
- overcover/protective wrapper gluers;
- palletized product wrappers;
- perfect binders;
- pocket printers;
- polywrappers;
- robotics (e.g. automatic guided vehicles);
- rotary trimmers, slitters;
- scoring equipment;
- side gluers;
- stampers;
- stitching/sewing machines (e.g. gang stitchers, saddle stitchers);
- stream feeders.

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. Exposure to significant hazards is not considered to exist if, during normal operation, the distance to the hazard complies with those specified in ISO 13852:1996. Machinery shall be designed according to the principles of ISO 12100-1 and ISO 12100-2:2003 for hazards that are relevant, but not significant, and which are not covered by this International Standard.

Significant hazards (for example crushing, cutting, shearing, pinching, hot surfaces, explosion, etc.) vary from machine to machine. It is important that each machine be evaluated to determine what hazards might exist and that shall be guarded.

Machines should be designed to allow normal production operations such as make-ready, wash-up, operator-performed maintenance or troubleshooting without machine motion. Where machine motion is required to

perform these functions, guards and safety devices shall provide protection against hazards. These operations shall be carried out using a hold-to-run device as specified in 5.5.1.2 or 5.6.

Where moving components or product flow require surveillance, equipment shall be designed to allow the needed visibility and to allow adjustments, if needed, to equipment operation with the guards remaining closed.

EXAMPLES A transparent guard or remote viewing system.

5.2 Guards

5.2.1 Types of guards

For the purpose of this International Standard, there are two types of guards, fixed and movable.

Guards that do not have to be opened frequently shall be interlocked or shall be fixed in such a way that their removal necessitates the use of a tool, such as a key or wrench, designed to operate a fastener.

NOTE 1 An improvised tool, such as a coin or fingernail file, is not considered to be a tool in the context of this International Standard.

All movable guards shall be interlocked in accordance with 5.5.

Guards that are designed to be opened, removed, and/or moved at least once per working shift (on average) during normal operation, for make-ready (set-up) operations, or to permit access to a hazardous area, with or without the use of a tool, shall be interlocked.

NOTE 2 A typical shift is 8 h.

Guards and doors may be removed for set-up and for other purposes such as

- to supply the material to be processed;
- to change the format;
- to change tools;
- for make-ready.

The interlock system shall operate as described in 5.5.1.

When the interlocked guard is open, one of the measures set out in 5.6 shall become effective.

Where production processes need to be watched, guards shall be designed to ensure sufficient visibility of the functional process and not to impair vision by reflections.

EXAMPLES Mesh-type guards painted in matte black, placement of lighting behind the guard, etc.

Guards shall not create any additional significant hazards to personnel and shall satisfy the requirements of ISO 14120.

5.2.1.1 Automatic travel of movable guards

Automatic travel of movable guards shall not create any significant mechanical hazards.

This can be achieved, for example, by limiting the force of the guard movement. The following guidelines are suggested:

- a) 50 N or less where the likely contact surface of the guard is a blunt edge or projection and there is no risk of cutting or stabbing injuries;

- b) 150 N or less where the likely contact surface of the guard is a plane such that there is no risk of a crushing injury.

Higher values may be chosen based upon risk analysis.

5.2.1.2 Protection against gravity falls of guards

Guards that can be opened shall be safeguarded against gravity falls if such a fall creates a risk of injury. The following are examples of means that may be used for safeguarding:

- devices for balancing the mass;
- pneumatic springs;
- devices which automatically hold the parts open;
- power-driven worm gear drives actuated by hold-to-run controls if the hazard points can be observed from the position where the hold-to-run control is actuated;
- ensuring that the centre of gravity of the guard in the open position is sufficiently far behind the axis of rotation to prevent closing.

Springs used for balancing the mass shall be designed such that no hazard shall result from failure of the spring or movement of the guard. Compression-type springs are preferred. Springs shall not display any permanent deformation, even after extensive use.

5.2.2 Guard distances and gaps

The safety distance between the guard and the in-running nip is measured from that point where the distance between the rotating surfaces, or the rotating surface and a fixed surface, is 10 mm (see Figure 3). Safety distances shall be as specified in ISO 13852:1996.

The design and construction of the barrier guard shall ensure that personnel cannot encounter the hazard by reaching up, over, under, around or through the barrier guard.

The safety distance for guide rollers shall be 120 mm, as specified in ISO 13854.

Dimensions in millimetres

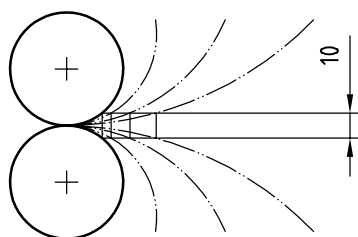


Figure 3 — Measuring safety distance at in-running nips

5.2.2.1 Reaching upwards

If there is a low risk (as determined by risk assessment) from the hazard zone when reaching upward, then the height of the hazard zone shall be 2 500 mm or more, as specified by ISO 13852:1996. Otherwise,

a) either the height of the hazard zone shall be 2 700 mm or more,

or

b) other safety measures shall be used.

NOTE For further information on risk assessment, see ISO 14121^[35].

5.2.2.2 Reaching over protective structures

If there is a low risk (as determined by risk assessment) from a hazard zone when reaching over a protective structure, the horizontal distance to the hazard zone as specified in ISO 13852:1996, Table 1, shall be used as minimum values. There shall be no interpolation of the values specified in that table. Therefore, when the known height of the hazard zone (a), height of the protective structure (b), or horizontal distance to the hazard zone (c) is between two values in ISO 13852:1996, Table 1, the value used shall be that which provides the higher level of safety.

If there is a high risk (as determined by risk assessment) from a hazard zone when reaching over a protective structure, the horizontal distance to the hazard zone as specified in ISO 13852:1996, Table 2, shall be used as minimum values. There shall be no interpolation of the values specified in that table. Therefore, when the known height of the hazard zone (a), height of the protective structure (b), or horizontal distance to the hazard zone (c) is between two values in ISO 13852:1996, Table 2, the value used shall be that which provides the higher level of safety.

5.2.3 Guard openings

Guard openings shall comply with the requirements of ISO 13852:1996. For guarding in-running nips that are accessible while a movable guard is open, see 5.4.

5.3 In-running (in-going) nips

Hazards from in-running nips may exist between the following:

- two counter-rotating surfaces, powered or non-powered;
- one surface rotating toward an adjacent fixed part of the machine;
- surfaces rotating in the same direction, but with different peripheral speeds or surface properties, such as friction;
- guide roller and driving belt, conveyor belt, and possibly the web in unwind/rewind devices;
- non-powered riding rollers (guide rollers) that are driven by the movement of the product.

Examples of in-running nips are shown in Figure 1.

5.4 Guarding in-running nips

All in-running nips that are accessible during normal operation shall be guarded by one of the following types of guards:

- barrier guard or fence guard with or without openings. If the guard has an opening, the safety distances shall be established in relation to the width of the opening, in accordance with of ISO 13852:1996, Table 4;
- nip guard, on smooth-surface rollers, as bars designed in suitable sections and extending across the entire working width (see Figure 4 for examples of nip guards);
- trip nip bars shall be in accordance with 5.7.4.

When machine motion is reversed, out-going nips that do not generally pose a hazard can become in-running nips and shall be guarded as such.

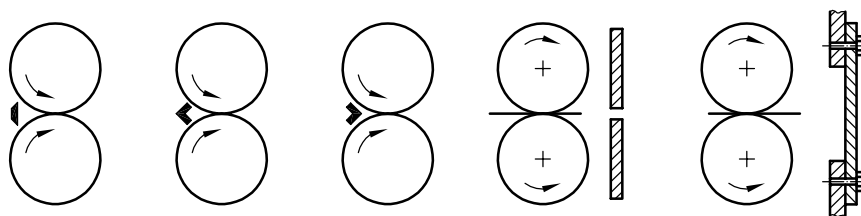
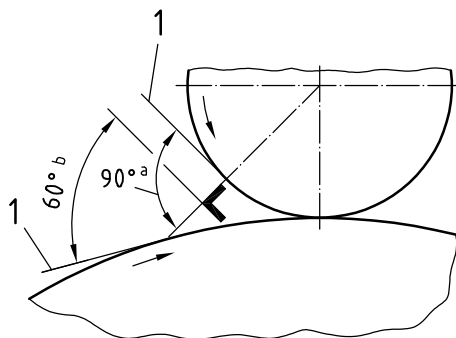


Figure 4 — Examples of nip guards

Whenever possible, the angle between the surface of the cylinder and the surface of the guard should be 90° to prevent wedging. However, if other design considerations, such as stiffness of the guard, web path, etc., make the use of a 90° angle less desirable, an angle of not less than 60° is permitted (see Figure 5).



Key

1 tangents

^a Preferred.

^b Acceptable.

Figure 5 — Minimum cylinder-to-guard angle

The clearance between the nip guard and the respective machine part shall not exceed 6 mm (see Figure 6). On small-format machines, the clearance should be smaller, if possible, considering both safety and production concerns.

Nip guards shall not be shaped or oriented such that a “wedge pocket” is created (see Figures 7 and 8). The shapes shown in Figure 7 may be used as trip nip bars, since activation of the trip nip bar stops hazardous motion, as specified in 5.7.4.

Dimensions in millimetres

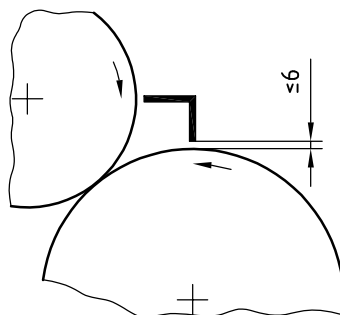
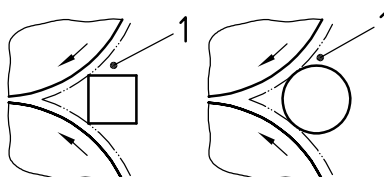


Figure 6 — Safeguarding an in-running nip by means of a fixed nip guard



Key

1 wedge pocket

Figure 7 — Shapes creating wedge pockets

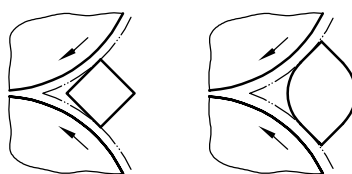


Figure 8 — Shapes not creating wedge pockets

Rollers rotating in the same direction do not create a hazardous in-running nip if the rollers have the same surface characteristics and circumferential speeds (see Figure 9).

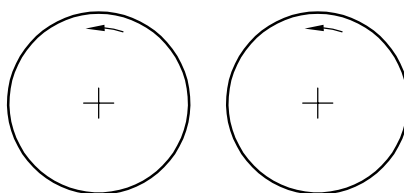


Figure 9 — Non-hazardous rollers rotating in the same direction

5.5 Interlocks

5.5.1 Opening an interlocked guard

When an interlocked guard is opened, moved or removed while the machine is in continuous motion, the machine shall stop, utilizing the maximum braking action established for that binding and finishing system. When any interlocked guard is open, initiation of continuous run shall not be permitted. Closing or replacing an interlocked guard shall not cause the machine to restart its operation (see 5.5.2). Machine motion shall not be able to be initiated without the operator going through a normal starting sequence.

The following exceptions are noted, but may be disallowed for specific types of equipment, as noted elsewhere in this International Standard.

5.5.1.1 Exception for machine motion at inching speed

If a machine is operating at inching speed and under conditions defined in 5.6, motion may continue.

5.5.1.2 Exception for machine motion at production speed

This exception shall apply only in accordance with the subclauses of Clause 7, dealing with specific machines, and does not apply to all equipment.

It is possible that this exception might not comply with current European standards or the Machinery Directive.

There may be parts of the equipment that cannot be observed or adjusted with the guard closed, and it may be necessary for an authorized person to access this area with an interlocked guard open. Under these circumstances, alternative safety measures shall be taken. All adjustments shall be made from outside the hazardous area.

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:
 - inserting the key shall initiate a timer that has a maximum setting of 2 min;
 - turning the key shall override the guard interlock of only that guard, up to the preset time limit;
 - 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;
 - when the key is released, it shall automatically return to the neutral position and the guard interlock shall be automatically reactivated;
 - if the key remains in the lock for more than 2 min, the interlock on the guard shall be automatically reactivated and the equipment safety system shall stop machine motion.
- c) The bypassing means shall meet the requirements of category 3 of ISO 13849-1:1999.
- d) When adjustments are necessary, they shall be performed from outside the hazardous area.
- e) A warning 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 provided with this alternative safety measure, information regarding its safe use shall be contained in the instruction handbook.

5.5.2 Closing an interlocking guard

Closing the interlocking guard shall not cause the machine to restart its operation. The machine shall go through the normal starting sequence.

5.5.3 More than one interlocking guard open

Where more than one interlocking guard is open and there are any unguarded hazard zones that cannot be observed from a single point of operation, only an inch function or reverse function (as specified in 10.2.3.5) shall be permitted if multiple operators depress and maintain a hold-to-run control at each unguarded area during the same permissive period. Releasing any hold-to-run control shall stop machine motion.

5.5.4 Remote control with interlocked guard open

When any interlocked guard is open, initiation of motion of the system by remote control shall be prohibited.

5.5.5 Interlock design for personnel safety

Interlocks shall be designed so that they cannot be overridden without the use of special tools.

NOTE While it is recognized that all interlocking schemes are capable of being defeated, the intent of the above requirement is to ensure that the interlocking arrangement is designed in such a manner that it cannot be defeated by commonly available items such as tape, paper, a single common magnet, etc., which are not considered to be tools.

The requirements of ISO 14119:1998, Clauses 5 and 6, shall be satisfied.

5.5.5.1 Personnel safety switches for interlocking guards

For personnel safety switches built in accordance with IEC 60947-5-1 and installed in accordance with IEC 60204-1:2000, it may be assumed that no malfunctions will occur.

For machines where routine and regular access (see 3.79) is not required, it is therefore sufficient to provide only one personnel safety switch for each interlocking guard.

Control systems of safety-position switches shall satisfy category 3 of ISO 13849-1:1999.

For manually fed devices where interlocking guards are used to safeguard routine and regular access to hazard points, control systems for safety-position switches shall satisfy category 4 of ISO 13849-1:1999.

5.5.5.2 Short circuits

Malfunctions of the interlock circuit as a result of short circuits between electric wires outside the switch cabinet due to physical impact shall be prevented, or redundancy shall be provided.

EXAMPLES Locating wires within ducts or within the machine frame to protect them from impact.

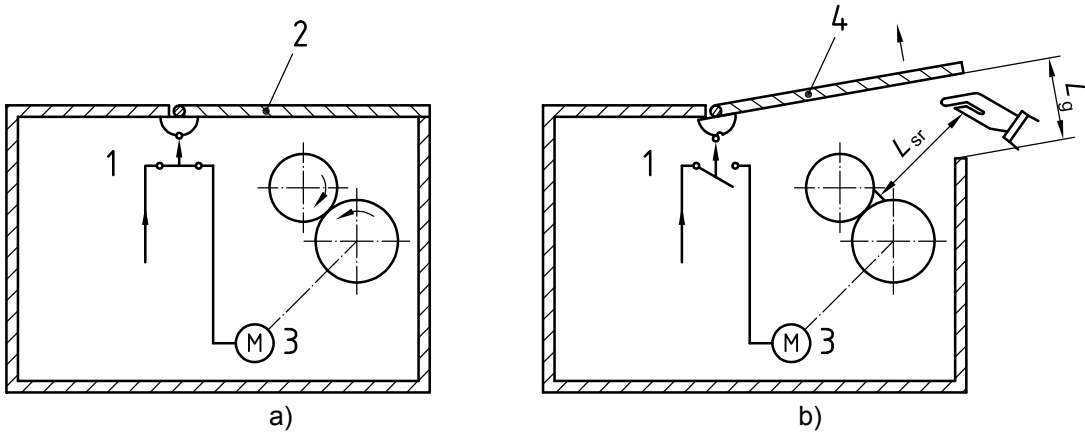
5.5.6 Interlocking with guard locking

Interlocked guards shall be designed so that the sensor (interlock) shall be activated within the limits specified in Table 1, depending on the distance to the hazard. Otherwise, guard locking shall be utilized.

NOTE This International Standard differs from prEN 1010-4^[13] in that the latter requires guard locking where hazardous movement cannot be stopped within at least 10 s after actuation of the personnel safety switch.

Table 1 — Distance requirements for interlocked guards without guard locking

Safety distance ^a (L_{sr}) between guard opening and hazard point mm	Maximum opening ^a (L_g) of the guard while the detector changes its state mm
< 80	≤ 30
$80 \leq L_{sr} < 500$	≤ 40
$500 \leq L_{sr} < 850$	≤ 80
≥ 850	≤ 160
^a See Figure 10 for location of the measurements.	



- Key**
- 1 failsafe limit switch
 - 2 guard closed
 - 3 motor
 - 4 guard open
- L_{sr} safety distance
- L_g maximum opening

Figure 10 — Distances related to requirements for guard locking —
a) motor running; b) motor stopped

5.6 Hold-to-run controls

If all hazard points are safeguarded by nip guards in accordance with 5.4, the requirements for hold-to-run controls and speed limitations do not apply.

Where hold-to-run controls are used for safeguarding a hazard, running the machine in the hold-to-run mode after opening the interlocking guard shall be possible only when guards protecting hazardous areas that are not visible from the operating position are closed.

When the hazardous area can be viewed from the operating position, machine motion with an interlocking guard open and hazardous points unprotected may be initiated by means of a hold-to-run device only under the following conditions:

- a) with a displacement limited to a maximum of 25 mm or with a maximum operating (surface) speed of 1 m/min;

or

- b) with displacement limited to a maximum of 75 mm or with a maximum operating speed of 5 m/min where the measures defined in 5.6 a) would reduce the ability of the machine to perform its function and where there would be no substantial increase in hazard.

Guard circuitry for the hold-to-run condition shall satisfy the requirements of category 3 of ISO 13849-1:1999. Control circuitry (including selector switch relays and PLC circuits) which allows interlocked areas to be operated independently shall satisfy the requirements of category 1 of ISO 13849-1:1999.

For hold-to-run devices designed as two-hand controls, the same limitations of displacement and speed shall apply.

At speeds faster than 5 m/min, the maximum speed shall be as low as possible and no faster than 10 m/min, provided:

- a two-hand control is used;

or

- the control is located such that the hazard cannot be reached from the operating position and the operator has clear view of the hazard.

For machine-specific exceptions to this speed requirement, see Clause 7.

For machines included in Clause 4 and not having a specific exception in Clause 7, any speed greater than 10 m/min shall have a means of achieving a level of safety equivalent to that at 10 m/min.

EXCEPTION: Where machine-specific requirements allow for speeds greater than 10 m/min, all of the following requirements shall be met.

- Other interlocked guards in an area that cannot be observed by the operator from the operating position shall be closed.
- A selector switch for this kind of operation shall be provided in addition to a two-hand control.
- The hold-to-run speed shall be the slowest possible under procedural requirements.

Any two-hand control device shall meet the requirements specified in 10.5. The stopping path shall be as short as technically feasible.

See 12.1 for general requirements for control systems.

5.7 Other safeguarding measures

5.7.1 General

Where safeguarded accessible hazard zones cannot be observed from positions from which hazardous movements can be started, the requirements of 5.7.2 through 5.7.4 shall apply.

5.7.2 Fence-type enclosures

Where accessible hazard zones are safeguarded by a fence-type enclosure:

- a) it shall not be possible for (a) person(s) within the enclosure to close the interlocking access gate;
- or
- b) an additional control device shall be provided outside the enclosure in such a position that it cannot be actuated from the inside. Any hazardous movement, with the exception of movement controlled by hold-to-run, shall be permitted only after the access door has been closed and the additional control device has been actuated.

EXAMPLES Additional control devices include reset buttons, captured keys, trapped keys, and similar devices.

Fence-type enclosures shall be designed such that the distance between base level and the lower edge is a maximum of 200 mm, and between base level and the upper edge is a minimum of 1 400 mm. Safety distance requirements shall be in accordance with ISO 13852:1996.

NOTE Fence-type enclosures are often used in areas such as behind reel stands, automatic pile changers, etc.

It shall not be possible to initiate machine motion while a person is within the hazard zone except under hold-to-run conditions as defined in 5.6.

5.7.3 Electro-sensitive protective devices

Where accessible hazard zones are safeguarded by means of electro-sensitive protective devices (ESPDs), an additional control device shall be provided outside the hazard zone and shall not be accessible from any position in the hazard zone. Provisions shall be made that the hazardous movement can only be started after the person has actuated the additional control element.

NOTE Accessible safeguarded hazard zones are areas generally protected by means of, for example, guards or electro-sensitive protective devices that allow whole-body access. The objective is to prevent anyone from starting the machine while a person is within the hazard zone.

Electro-sensitive protective devices shall comply with 10.6.

5.7.4 Pressure-sensitive mats, pressure-sensitive bumpers, trip nip bars

Pressure-sensitive mats, pressure-sensitive bumpers and trip nip bars shall function in accordance with 10.7.

Where accessible hazard zones are safeguarded by means of pressure-sensitive mats, an additional control element that is not accessible from any position in the hazard zone shall be provided outside the hazard zone. Any hazardous movement, with the exception of movement controlled by hold-to-run, shall be permitted only after the additional control device has been re-actuated.

EXAMPLE An example of an additional control device is a reset button.

For safety-related applications, the approach speed specified in ISO 13855 shall be used as a basis for determining the correct positioning of the pressure-sensitive mats.

6 Requirements for protection against other hazards

6.1 General

See Annex A for a list of hazards.

6.2 Fire and explosion

6.2.1 General

For a list of explosion zones, see Annex B.

6.2.2 Fans

Fans integrated in machines to exhaust potentially explosive atmospheres (fumes, dust, etc.) shall be explosion protected and built in compliance with requirements defined for individual explosion zones (see Annex B).

6.2.3 Hoses and pipes

Hoses and pipes used for combustible or explosive materials, or for impregnating material, shall be conductive and electrostatically grounded (resistance less than $10^6 \Omega$ over the total length of the hose).

EXAMPLES Examples of combustible or explosive materials include, but are not limited to, paper, paper dust, plastic shavings, inks, coatings, glues, solvents over a certain concentration, etc.

Hoses and pipes used for exhausting solvent vapours shall be conductive and electrostatically grounded (resistance less than $10^6 \Omega$ over the total length of the hose) where the solvent concentration under any single failure may exceed 25 % of the lower explosion limit (LEL).

Measurement of resistance shall be made in accordance with ISO 8031.

Reference shall be made in the relevant sections of the instruction handbook (see 16.2).

6.2.4 Electric motors for pumps

The electric motor for pumps on supply ducts for inks, coating substances, impregnating material or glues shall be protected as specified in IEC 60079-1. Where protective motor switches are mounted on the pump, compliance with IEC 60079-7 is considered to be sufficient.

6.2.5 Prevention of ignition of explosive atmospheres by electrical apparatus

If the build-up of explosive atmospheres under normal operating conditions or under operational disturbances cannot be avoided, especially by means of ventilation, additional measures, dependent on the zones defined in Annex B, shall be taken in order to avoid ignition of the explosive atmosphere.

- Electrical apparatus shall comply with IEC 60079-14.
- For electrical apparatus used in Zone 0, IEC 60079-11 shall also apply. Electrical apparatus used in Zone 1 shall additionally comply with one or more of the following standards for explosion protection: IEC 60079-1, IEC 60079-2, IEC 60079-5, IEC 60079-6, IEC 60079-7, IEC 60079-11 and IEC 60079-18.
- Electrical apparatus designed in accordance with IEC 60079-11 shall be designed to explosion group IIA.

NOTE 1 For groups of electrical apparatus, see IEC 60079-0^[20].

- Depending on the type of solvent used, the chosen temperature class shall ensure that the electrical apparatus cannot be a source of ignition due to its surface temperature.

NOTE 2 For temperature classification, see IEC 60079-0^[20].

- Brakes and clutches shall be designed such that they cannot be a source of ignition.
- Hazardous electrostatic charges shall be minimized, as far as technically feasible (e.g. by using static eliminators).

6.2.6 Explosion protection exceptions

Explosion protection is not required for machinery where there are no combustible liquids with a flash point below 55 °C being used and no combustible liquids are sprayed or heated to a temperature above flash point under operating conditions. All other machinery shall satisfy the requirements of EN 1127-1 as well as the requirements of 6.2.4 and 6.2.5.

The requirements of EN 1127-1 are satisfied, for example, where the build-up of explosive atmospheres is prevented by adequate ventilation systems. This applies where the level of 25 % of the lower explosion limit is not exceeded even if the system fails.

EXAMPLE An example of system failure would be a breakdown of the ventilation system.

6.3 Electrical equipment

6.3.1 General

All electrical equipment shall be designed in accordance with IEC 60204-1:2000, such that electrical hazards (for example electric shock, burns) are prevented. The requirements of IEC 60204-1:2000 shall be fulfilled, taking into account the additional requirements specified in 6.3.2 through 6.3.6.

6.3.2 Supply-disconnecting device

Machines shall be provided with a device to disconnect the electric power supply in accordance with IEC 60204-1:2000, 5.3.2 a) or 5.3.2 c). The device shall be provided with a means to be locked in the OFF position.

If actuation of a stopping device will cause a low-voltage (undervoltage) tripping of the circuit breaker (shunt-trip device), a circuit breaker in accordance with IEC 60204-1:2000, 5.3.2 c) shall be provided to prevent the contactors from welding in the closed position. Where circuits as specified in IEC 60204-1:2000, 5.3.5, are not disconnected by the supply-disconnecting device, such circuits shall be provided with their own disconnecting device.

EXCEPTION: Auxiliary devices used in binding and finishing operations may be equipped with supply-disconnecting devices in accordance with IEC 60204-1:2000, 5.3.2 d) or 5.3.2 e).

6.3.3 Installation

Electrical devices and conductors shall be installed in such a way as to prevent damage from mechanical stress and environmental influences.

6.3.4 Insulated single-core conductors

For insulated single-core conductors laid between two terminals inside an enclosure (for example, a switch cabinet), the conductor identification number or letter may be omitted if

— it is identified by colour in accordance with IEC 60204-1:2000, 14.2.4, paragraph 2;

or

— the conductors are secured in position (for example by using comb-type wire fixation) in such a way that there is no confusion of conductors when changing electric components.

6.3.5 Testing of electrical equipment

All electrical equipment shall be designed such that it will withstand the testing specified in IEC 60204-1:2000, 19.2 through 19.6. Voltage tests as specified in IEC 60204-1:2000, 19.4, are not required for electronic control circuits.

6.3.6 Measuring devices

Measuring devices shall comply with IEC 61010-1.

6.4 Working platforms, access stairs, passageways and raised workplaces

6.4.1 General requirements

For regular operation, the means of access and passageways to workplaces shall comply with the requirements of ISO 14122-1, ISO 14122-2 and ISO 14122-3. For infrequently used workplaces (see 3.42), the exceptions specified in 6.4.2 shall apply.

The usable width of machine gangways shall be at least 0,5 m. For gangways fitted at a height of more than 0,3 m, adequate means of access shall be provided.

The user should be aware of the effects of mathematical conversion and rounding when converting from SI units to U.S./Imperial units. Requirements stated by the U.S. Occupational Health and Safety Administration (OSHA) may supersede the resulting conversions in the U.S.

6.4.2 Exceptions for infrequently used platforms and access steps

6.4.2.1 General

As an exception to the requirements of 6.4.1, infrequently used platforms and access steps shall comply with the requirements of 6.4.2.2 through 6.4.2.6.

6.4.2.2 Ergonomics

Ergonomic principles shall be considered in the design of such access platforms.

EXAMPLES The following are examples of measures by which this can be achieved:

- sufficient number of handholds, part of which can be reached from the reference level;
- mobile platforms;
- permanently fixed and hinged platforms.

6.4.2.3 Footstep dimensions

For single footsteps (fixed or hinged), access levels may be permanent platforms or gangways. The following dimensions shall apply:

- normal step height ≤ 300 mm;
- maximum step height 500 mm;
- minimum width (for 1 foot) 200 mm;
- minimum width (for 2 feet) 300 mm;
- minimum depth 300 mm.

Where multiple steps (fixed or hinged) are needed, the reference level shall have an effective width of at least 500 mm. The following dimensions shall apply:

- maximum height of upper footstep 1 200 mm;
- maximum height of intermediate steps 300 mm;
- minimum depth of footstep 200 mm;
- maximum height without railing 1 200 mm.

Footsteps shall always be provided with handles.

The size of platforms used infrequently for stepping or short-term standing shall be at least 200 mm × 200 mm.

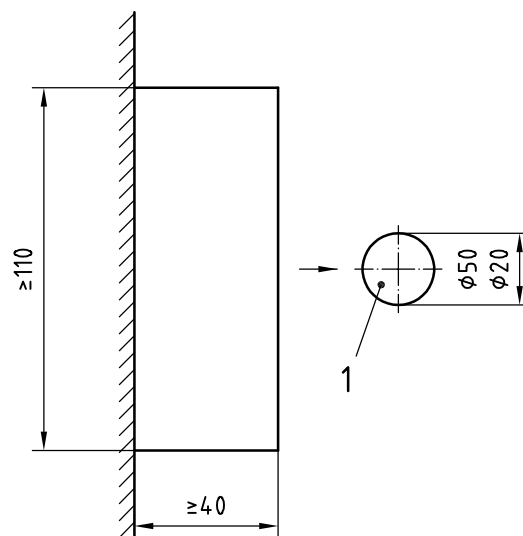
Footstep dimensions should be kept as uniform as possible throughout the press system.

6.4.2.4 Handle dimensions

Where handles are required, the following dimensions shall apply (see Figure 11):

- minimum handle clearance 40 mm;
- minimum handle length 110 mm;
- minimum handle diameter 20 mm;
- maximum handle diameter 50 mm.

Dimensions in millimetres

**Key**

1 diameter of handle

Figure 11 — Handles for infrequently used access platforms**6.4.2.5 Hinged platforms**

Hinged platforms shall be secured against unintended movement and shall be easy to position.

Hinged platforms between 0,5 m and 1,6 m high (the height is considered to be the maximum distance a person can fall from the hinged platform) shall be provided with at least one handrail. Where a handrail is not feasible and practical, a handhold shall be provided. For hinged platforms above 1,6 m high, the requirements of 6.4.1 shall apply.

Hinged platforms are generally provided in areas where space limitations prevent fixed platforms with handrails. Wherever feasible, the design of the platform should provide operators with sufficient support for ascending to or descending from the platform, as well as protection from falling off the platform.

6.4.2.6 Mobile hand-operated platforms

Mobile hand-operated platforms provided between stationary machine units do not require any fall-off protection on the machine side if the clearance between machine and platform does not exceed 200 mm (see Figure 12). For platforms more than 1,5 m high where the clearance exceeds 70 mm, toe-plates shall be provided as minimum protection.

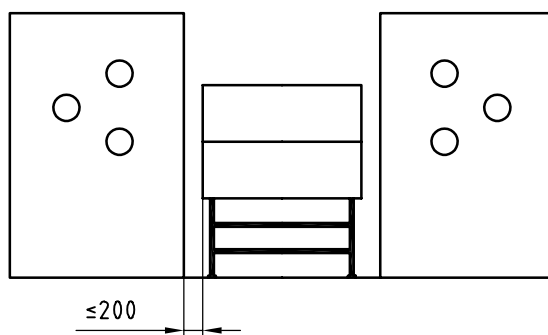


Figure 12 — Mobile platform

6.4.3 Platform, gangway, and step surfaces

Platform, gangway and step surfaces shall be slip resistant in accordance with ISO 14122-2.

EXAMPLE By using profiled metal plate.

Plates of material with a low slip-resistance capability (e.g. glass) fitted in access floors to allow the operator to observe the production process are permissible if they are fitted at a distance of at least 200 mm from the nearest fall-off edge (e.g. access stairs), and the accessible area of such materials does not exceed 18 000 mm² with a maximum width of 90 mm. Calculations or tests should be conducted to verify that a static load of 1 500 N applied to an area of 50 mm × 50 mm in the centre of such material will not lead to damage.

6.4.4 Access stairs and passageways

Access stairs and passageways shall have a clear height for passage of at least 2 m. If, for construction reasons, this height cannot be maintained, the protruding parts shall be padded and provided with hazard markings.

The maximum pitch angle on access stairs shall be 45°. Higher pitch angles may be allowed depending on the results of a risk analysis (see Annex C).

Where stairs with pitch angles between 20° and 45° are used, the height of one flight of stairs should not exceed 3 m. Only where spatial restrictions exist may the height of one flight be a maximum of 4 m. Stairs with a total height of more than 4 m shall be fitted with an intermediate platform; the flight above the platform shall have a maximum height of 3 m. The platform should be at least 800 mm long where possible, but shall in no case be less than 600 mm.

The user should be aware of the effects of mathematical conversion and rounding when converting from SI units to U.S./Imperial units. Requirements stated by the U.S. Occupational Health and Safety Administration (OSHA) may supersede the resulting conversions in the U.S.

6.4.5 Extended use raised workplaces

Raised workplaces at which personnel spend an extended period of time should have a clear working area of at least 1,5 m² per person and a width of at least 1 m unless this inhibits ergonomic requirements (e.g. handling of objects).

6.4.6 Infrequently used workplaces

For infrequently used workplaces (see 3.42) that cannot be accessed by stairs, secured ladders may be used if the access height does not exceed 2 m. Toe boards and intermediate rails on railings are not required if the falling height is less than 2 m.

6.4.7 Railings, toe plates and self-closing gates

Railings with handrails, intermediate rails, toe plates or self-closing gates shall satisfy the requirements specified in 6.4.1.

EXCEPTION: The toe plate is not required up to a falling height of 1,6 m; however, intermediate rails shall be fitted in the middle between handrails and floor.

6.5 Stability

6.5.1 Unforeseeable changes of position

Machines and their elements shall be designed and equipped to be stable and to ensure that no unanticipated changes of position can occur; i.e. so that they do not fall over and are not capable of being unintentionally moved by vibration, wind pressure, impact or other foreseeable external forces or internal dynamic forces (inertial forces, electrodynamic forces, etc.).

Means for preventing unanticipated changes of position include

- adequate size of the base;
- low centre of gravity;
- adequate means for anchoring;
- adequate design of wheels on track-mounted assemblies.

Such special safety measures may include, but are not limited to,

- restriction of the movements of parts of the machine;
- warning indicators or alarms if stability is endangered;
- provision of interlocks to prevent tipping;
- anchoring the machine securely to a foundation.

Both static and dynamic stability shall be considered. If special safety measures are required, a warning shall be provided on the machine and/or in the instruction handbook.

6.5.2 Unintended travel

Movable machines (machines on wheels) shall be safeguarded against unintended travel.

Measures to prevent unintended travel include, but are not limited to, the following:

- for machines with four wheels, providing a means of locking at least one wheel;
- for machines with two wheels and two caster wheels, providing a means of locking at least one caster wheel;
- for machines with four caster wheels, providing a means of locking at least two caster wheels.

Where possible, automatic locking devices should be fitted.

Unintended travel on wheels and caster wheels with no brakes may occur on machines such as the following: small UV dryers, dampening water devices, inserting devices, jogging tables, sheet folding, riveting, stitching and eyeletting machines, strapping and tying machines, bundling and baling presses, printing slotters, rotary die-cutters and combined machines (in-line).

NOTE Self-locking gears are an example of automatic locking devices.

6.6 High contact temperatures

Contact temperatures of accessible heated parts on machines shall not be greater than the limit values specified in EN 563.

NOTE The limit values in EN 563 are expected to be retained in the new International Standard EN/ISO 13732-1 currently under development.

Means to safeguard against contact with heated parts include the use of insulation or guarding by distance.

The surface temperature of those parts of continuous flow-drying devices where access is possible shall not exceed the limit values as specified in EN 563. Those parts of continuous flow-drying devices that are accessible after opening the interlocking device, and where temperatures are in excess of limit temperatures, shall be provided with a hazard warning.

6.7 Noise

Machines shall be so designed and constructed that risks from noise emission produced by the machines are reduced to the lowest practical level for that type of machine. Means to reduce noise include sound absorption materials, covers, silencers, vibration dampening or selection of component materials or other methods as specified in ISO/TR 11688-1.

Sound measurements to determine the noise emission shall be carried out in accordance with the requirements specified in EN 13023.

NOTE Examples of significant sources of noise include gears; hydraulic devices; compressors, pumps; exhaust fans; blast air nozzles; suction devices (paper dust, trimmings); paper embossing; cutting, die-cutting, creasing of paper, board, paper grinders; cylinder rolling motion; paper stops; separation of paper or board from printing form; power transmission systems; pneumatic systems.

6.8 Radiation hazards

6.8.1 Laser devices incorporated in machinery

Laser devices incorporated in machinery shall comply with the requirements of ISO 11553 and IEC 60825-1. The equipment shall be provided with fixed or interlocking guards in order to prevent access to positions where laser radiation emission is above the category 1 limit values as specified by IEC 60825-1 for the intended use of the machine.

During repairs, it may be necessary for trained personnel to operate the machine for short periods of time without fixed or interlocking guards. If this requires access to positions where laser radiation emission is above the category 1 limit values, additional safety measures shall be taken in accordance with IEC 60825-1.

Means of additional safety measures include providing instruction to personnel regarding the use of personal protective equipment.

NOTE For user information, see Clause 16.