

Graphic technology — Safety requirements for printing press systems

ICS 37.100.10

National foreword

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INTERNATIONAL STANDARD

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Graphic technology — Safety requirements for printing press systems

*Technologie graphique — Exigences de sécurité pour systèmes de
presses d'impression*



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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 12648 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 has taken into consideration material contained in ANSI B65.1-1995 *Safety standard — Printing press systems*, prEN 1010-1, *Technical safety requirements for the design and construction of printing and paper converting machines — Part 1: Common requirements*, and prEN 1010-2, *Technical safety requirements for the design and construction of printing and paper converting machines — Part 2: Printing and varnishing machines including pre-press machinery*.

Graphic technology — Safety requirements for printing press systems

1 Scope

This International Standard applies to printing press systems, including auxiliary equipment and finishing machines, in which all the machine actuators (e.g. drives) of the equipment in the system are controlled by the same control system.

It is applicable only to systems in which a printing press is part of the system. In cases where a binding/finishing system is not integrated with a printing press, ISO 12649 will apply.

This International Standard provides safety requirements for the design and construction of the classes of machines listed in Clause 2. It addresses recognized hazards specific to printing press 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 (see Clause 2) manufactured after December 31 of the year following the year of publication of this International Standard.

2 Classifications

2.1 Machines for producing printing by various processes

- relief (letterpress, flexographic);
- offset (lithographic);
- gravure (rotogravure, intaglio);
- screen printing;
- digital presses (electrostatic, ink jet, thermal, airbrush, etc.).

2.2 Auxiliary equipment

- washing equipment for cylinders and rollers;
- powder spraying devices;
- alcohol dosing devices;
- imprinting/addressing/numbering equipment;
- automatic plate clamping devices, automatic pile handling equipment;
- washing equipment;
- inserting machines;
- pile turners, reel turners, elevators;
- dryers/pollution control;
- radiation equipment;
- in-line processing and finishing equipment;
- stackers;
- palletizers;
- bundlers;
- coaters;
- chilling systems;
- electrostatic equipment;
- humidifiers;
- accumulating or piling-off devices;
- conveyors;
- unwinding, rewinding, reel transport devices.

3 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 plastics 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, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

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

ISO 13850:1996, *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 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 fixed means of access between two levels*

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

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

ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*

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)*

ANSI/NFPA 86, *Standard for Ovens and Furnaces*

EN 378-1, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Basic requirements, definitions, classification and selection criteria*

EN 563, *Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces*

EN 1127-1, *Explosive atmospheres — Explosion prevention and protection — 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*

prEN 13023, *Noise measurement methods for printing, paper converting, paper making machines and auxiliary equipment — Accuracy grades 2 and 3*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1

actuator

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

[IEV 441-15-22]

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** (4.32).

4.2

alcohol dosing equipment

equipment for dosing the amount of alcohol in the dampening water of offset printing presses

4.3**armed condition**

machine condition in which machine motion can be automatically initiated

NOTE **Zero speed** (4.88) may be considered to be an armed condition.

4.4**audible alarm**

horn, bell or other distinctive audible warning device which, when sounded, indicates impending machine motion

4.5**authorized person**

person designated as such by plant management as having been trained in the following:

- a) the task to be performed;
- b) the function of the adjustments in the work zone;
- c) proper operation of adjustments and controls;
- d) all types of hazards in the area where the task is to be performed;
- e) the application of equivalent, alternative protection to perform the task;
- f) improper actions that can cause injury; and
- g) the consequences of those improper actions

4.6**automatic plate clamping device**

device for automatic or semi-automatic changing of printing plates

4.7**auxiliary devices for printing presses**

devices used for the production process which are either built in or attached to the printing press

4.8**barrier guard**

guard closing off access to an area containing one or more hazards

4.9**category 0 stop**

stopping by immediate removal of power to the machine actuators (i.e. an uncontrolled stop)

[IEC 60204-1]

4.10**category 1 stop**

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

[IEC 60204-1]

4.11**category 2 stop**

controlled stop with power to the drive elements of the machines being maintained

[IEC 60204-1]

4.12
coating unit
coater

type of finishing machine for applying liquid substances (for example glue, varnish, ink) on substances made of paper or similar material in a predetermined thickness; the thickness of the layer is determined by a doctor blade (scraper) or by the gap between two rollers (metering gap)

4.13
continuous flow drying and curing device

device built into printing presses for drying and curing substrates after the printing process (for example by hot air, IR or UV radiation)

4.14
crawl speed

continuous motion at a steady slow speed, and initiated by a momentary contact control

4.15
cylinder screen printing press

sheet-fed printing press where the substrate (sheet) is guided along the screen by a printing cylinder

4.16
digital printing press

printing press where the printing image is produced from data stored in digital form

EXAMPLE Exposing a photo-sensitive drum or film in the machine.

4.17
electrical hazard

source of potential injury or death from electric shock or burn

4.18
emergency stop device

manually actuated control device used to initiate an emergency stop function

[ISO 13850:1996]

4.19
emergency stop function

function initiated by a single human action that is intended to avoid injury to persons, damage to machinery or damage to work in progress

4.20
enabling device

actuating device that needs to be operated in addition to at least one more actuator or device in order to start a machine under hold-to-run control; machine movement is stopped as soon as one of the hold-to-run controls or enabling devices is released

4.21
exposing equipment

machinery used for taking images by exposing photo-sensitive material such as printing plates or printing forms

4.22
fixed guard

guard that is securely affixed by fasteners that require a tool(s) to gain access to a significant hazard

4.23**forms printing press****leporello printing press**

machine for the production of continuous forms where paper webs printed with one or multiple colours are leporello folded or wound onto a reel

NOTE In addition to the printing section, the machine consists of devices for punching, rema liners, cross perforation, longitudinal perforation and leporello folding.

4.24**gravure press**

machine consisting of a printing cylinder, an impression cylinder and an inking system, in which ink is applied to the printing cylinder by an ink roll or spray, and the excess is removed by a doctor blade; the impression cylinder, covered with a rubber composition, presses the substrate into contact with the ink in the cells of the printing surface

4.25**guard**

physical barrier that restricts access to a significant hazard

4.26**hazard zone**

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

NOTE Adapted from ISO 12100-1.

4.27**hold-to-run control**

control that starts and maintains machine motion only as long as the control is activated (see 5.5)

4.28**in-running nip****in-going nip**

area created by either two rotating components that are rotating inward, or one rotating component rotating toward an adjacent surface

See Figure 1.

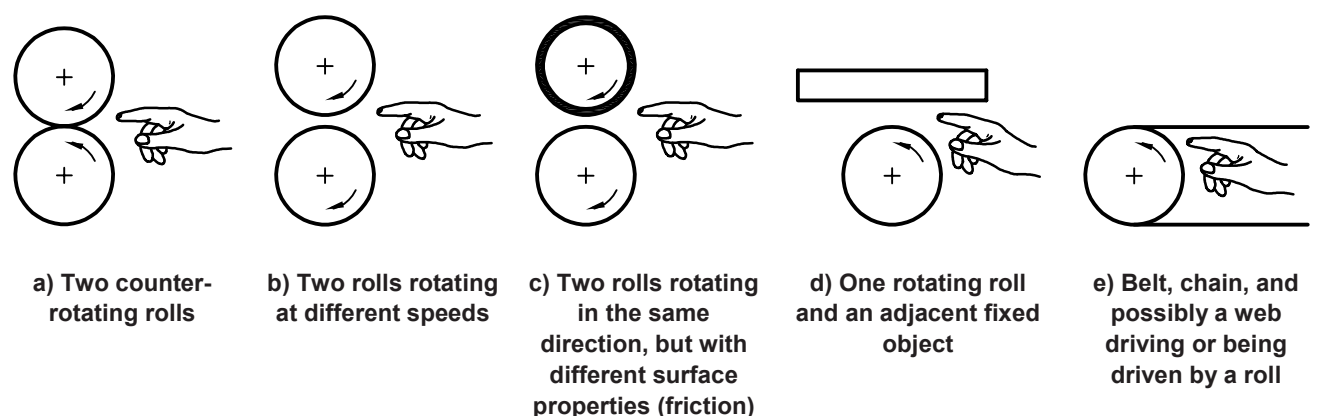


Figure 1 — In-running nips

4.29
inch
jog

motion condition requiring maintained activation of a hold-to-run control; motion will continue until the control is released or until a pre-determined displacement has been reached (limited inch)

4.30
inch speed

speed at which the press is operating while in inch mode

4.31
infrequently used workplace

area where a function that is routine, repetitive, and integral to (but not necessarily during) production, but done on an infrequent basis, is conducted

NOTE Examples of such activities include observation, refill of the ink pan, blanket change and plate change, access to elevated sheet-fed presses, make-ready, minor servicing, jam clearing, etc.

4.32
machine actuator

power mechanism used to effect motion of a machine

[ISO 13850:1996]

4.33
maintained contact control

control that remains opened/closed after activation of the control

4.34
maintenance

operation that is usually performed when the machine is not available for production

EXAMPLE Examples of maintenance operations are repairing or replacing broken, worn or damaged parts; performing lubrication; preventive servicing, etc. Maintenance 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. When possible, this should be performed with energy isolated.

4.35
make-ready

tasks preceding a production run, such as adjusting ink controls for proper colour, plate alignment for proper registration, adjusting pressures, measurement with quality control devices, etc.

4.36
manual control device

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

NOTE Adapted from IEV 441-15-22.

4.37
mechanical hazard

source of potential injury to a person that is created by motion of machinery, components or material

4.38
mechanical hazard points

locations in the machines where persons can be injured by parts of machines or machine movement, such as

- tools of machines, or parts thereof;
- work pieces, or parts thereof; or
- materials being processed

4.39**momentary contact control**

control that is opened/closed only during actuation of the control

4.40**motion control**

control that initiates machine motion

4.41**motion control station**

operator control station containing both an emergency stop and a motion initiation control

4.42**motion zone**

area defined by any press component, or group of press components, that is driven directly by the press system drive motor(s) or indirectly by the web

4.43**movable control station**

control station that is permanently wired to the equipment, but can be moved within the confines of the attached cable

4.44**movable guard**

guard that does not require a tool to gain access to a significant hazard

4.45**newspaper printing presses**

presses that are designed and built mainly for printing newspapers

4.46**nip guard**

guard (nip bar, finger bar, finger guard) located at an in-going nip

4.47**non-motion zone**

area defined by any press component, or group of press components that, due to press configuration, is not driven by the press system drive motor(s) or the web

NOTE When the console is freestanding (not press-mounted), it is a non-motion zone.

4.48**non-operational press**

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

4.49**normal operation**

condition that exists during set-up, make-ready, production and minor servicing/adjusting and cleaning performed by operators; this does not include maintenance operations (see 4.34)

4.50**operating position**

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

4.51**operational press**

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

4.52

operator control station

panel containing at least an emergency stop control

4.53

personnel warning lights

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

NOTE These lights are not the same as machine status lights.

4.54

pile turner

device for turning substrates and attached to sheet-fed printing presses in order to turn piles of printed paper for further processing

NOTE An example of further process may be back printing in a second run.

4.55

portable control station

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

4.56

positive mechanical action

(of a component on another component) action in which the moving mechanical component inevitably moves another component along with it, either by direct contact or by rigid elements

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

NOTE 2 When a mechanical component moves and thus allows another component to move freely (e.g. by gravity, spring force, etc.), there is no positive mechanical action of the first component on the other component.

4.57

positive opening

achievement of contact separation as the direct result of a specified movement of the actuator through non-resilient members

NOTE For example, not dependent upon springs.

4.58

powder spraying devices

devices for spraying powder onto the printed material on the delivery side of sheet-fed printing presses

4.59

pre-press machinery

machines and equipment for the production of master copies and/or printing plates

4.60

press system

printing press and a series of machines that supply substrate into and through the printing press and guide or direct the substrate to a cutting, folding or delivery device that delivers the product to the last working station integrated with the printing press control system

4.61

printing form

printing plate

base material that stores the image to be printed (pictures and/or text) and transfers ink on a substrate (such as printing plates, printing cylinders, screen), thus printing the image

4.62**printing plate bending machine**

machine for bending or folding printing plates before they are clamped in the printing press

4.63**printing table**

table to hold the substrate to be printed during the printing process (as on certain types of screen printing presses)

4.64**proofing press**

machine for printing a small number of copies, generally used for assessing print quality before the printing form is mounted in the machine, with manual feeding and delivery

4.65**raised workplace**

workplace that is at least 0,5 m above access level

4.66**ready condition**

condition in which machine motion can be operator initiated

4.67**reel rewinding device**

that part of a machine used for rewinding the processed web-type material

4.68**reel turner**

device for turning webs wound onto reels for easier handling, for example, for correct positioning of the reel when feeding webs to printing presses

4.69**reel unwinding device**

that part of a machine used for unwinding web-type material for processing

4.70**remote control**

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

4.71**routine and regular access**

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

4.72**safe condition**

condition in which movement of the main drive motor(s) (prime mover) of the motion zone is prevented

NOTE This condition may apply to the entire press system or to one or more motion zones. The safe condition exists only when one or more stop/safe or emergency stop pushbuttons are latched in the depressed position.

4.73**screen frame**

frame for taking up the printing screen

4.74**screen printing press**

printing press using printing forms with woven material (screens) that partially allow ink to penetrate through the material

4.75

separating elements

elements on feeders of sheets or blanks or similar materials that separate the individual sheets, blanks, etc.

4.76

sheet-fed press

machine for printing sheet-size substrates, including proofing presses, in which sheets may be fed by feeders (automatic or manual), or from sheeters attached to unwinding units

4.77

significant hazard

potential source of severe or disabling injury, or death

NOTE This International Standard only addresses significant mechanical hazards.

4.78

**smooth roller
cylinder**

rotationally symmetric solid body with smooth surface; i.e. with grooves or elevations of a maximum of 4 mm deep and with circumferential slots of a maximum of 8 mm in width with no sharp or cutting edges

See Figure 2.

Dimensions in millimetres

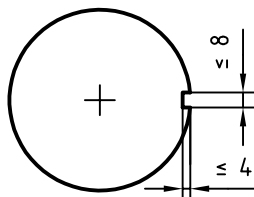


Figure 2 — Smooth roller/cylinder

4.79

status lights

lights that indicate machine process condition

NOTE These are not the same as personnel warning lights.

4.80

trip nip bar

a movable protective bar located at an in-going nip that when pushed activates the interlocked safety system of the machine

4.81

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

4.82

warning period

period during which machine motion is prevented, and a warning is given to personnel that machine motion is about to occur

4.83

washing device for roller/cylinder

device integrated into the printing press for washing cylinders and rollers such as ink rollers, blanket cylinders, printing cylinders, plate cylinders

4.84**washing equipment for printing forms**

machines for washing printing forms outside the printing press

EXAMPLE An example would be screen washing equipment.

4.85**web-fed press**

press in which a substrate passes through the printing couple, or couples, in a continuous form, as fed from a roll

4.86**web-type material**

web of paper, board, foil or similar material that is to be handled or processed

4.87**wireless control**

using means other than physical connection for transmitting commands and signals between a machine control system and the operator control station(s)

4.88**zero speed**

condition of machine motion in which the drive control system is actively holding the machine at a position

NOTE 1 In this condition, machine movement is not discernible; however, machine movement can be initiated without warning.

NOTE 2 Zero speed may be considered to be an **armed condition** (see 4.3).

5 Guarding of significant hazards

Guarding, consistent with operation of the machine, shall be provided in those areas where recognized exposure to significant hazards exists to operators. 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 (all parts) for hazards that are relevant, but not significant, and that are not covered by this International Standard.

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 or these operations shall be carried out using a hold-to-run device as specified in 5.5.

5.1 Guards

5.1.1 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 nail file, does not meet the requirements of this International Standard.

All movable guards shall be interlocked.

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

NOTE 2 A typical shift is 8 h.

NOTE 3 An example of setting-up and other purposes for which guards and doors may be removed include:

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

The interlock system shall operate as described in 5.4.1.

When the interlocked guard is open, one of the measures set out in 5.5 shall become effective.

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

5.1.1.1 Automatic travel of movable guards

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

NOTE 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 an edge or projection and there is no risk of cutting or stabbing injuries; or
- b) 150 N or less where the likely contact surface of the guard is a plane so that there is no risk of a crushing injury.

Higher values may be chosen based upon risk analysis.

5.1.1.2 Protection against gravity falls of guards

Guards that can be opened shall be safeguarded against gravity falls if this creates a risk of injury.

NOTE Examples of means that may be used include:

- devices for balancing the weight;
- pneumatic springs;
- devices that 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; or
- ensuring that the centre of gravity of the guard in the open position is sufficiently far behind the axis of rotation.

Springs used for balancing the weight 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.

5.1.2 Guard distances and gaps

The safety distance between the guard and the in-running nip is measured at 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 reach the hazard by reaching up, over, under, around or through the barrier guard.

On guide rollers the safety distance shall be 120 mm, as specified in ISO 13854.

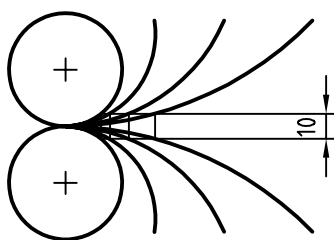


Figure 3 — Measuring safety distance at in-running nips

5.1.2.1 Reaching upwards

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

If there is a high risk from the danger zone when reaching upward, then either the height of the danger zone shall be 2 700 mm or more, or other safety measures shall be used.

5.1.2.2 Reaching over protective structures

If there is a low risk from a hazard zone when reaching over a protective structure, the values given in Table 1 of ISO 13852:1996 shall be used as minimum values. There shall be no interpolation of the values given in that table. Therefore, when the known values of a , b or c are between two values in Table 1 of ISO 13852:1996, values to be used are those that provide the higher level of safety.

If there is a high risk from a hazard zone when reaching over a protective structure, the values given in Table 2 of ISO 13852:1996 shall be used as minimum values. There shall be no interpolation of the values given in that table. Therefore, when the known values of a , b or c are between two values in Table 2 of ISO 13852:1996, values to be used are those that provide the higher level of safety.

5.1.3 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 5.3.

On sheet-fed flexographic printing presses, the feed opening between the side lays and the sides of the machine shall be guarded by means of adjustable or self-adjustable guards.

Exception: On sheet-fed printing presses that are also used for printing on board, sheet metal or other inflexible materials, it is possible that for production reasons ISO 13852:1996 cannot be applied in the feeding area. In this case, the height of the material feeding aperture shall be as small as possible, but shall not exceed 20 mm. The existence of residual risk shall be identified in the instruction handbook.

5.2 In-running (in-going) nips

Hazards from in-running nips may exist between

- two counter-rotating surfaces, powered or non-powered;

NOTE For non-powered surfaces, this hazard will depend on a number of factors; for example, type of material, wrapping angle, web speed, inertia.

- 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;
- non-powered riding rollers (guide rollers) which are driven by the movement of the web.

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

5.3 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:

- a) barrier guard/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 Table 4 of ISO 13852:1996.
- b) nip guard; on smooth surface rollers, as nip bars extending across the entire working width, designed in suitable sections. See Figure 4 for examples of nip guards.
- c) trip nip bars, which shall be in accordance with 9.6.

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

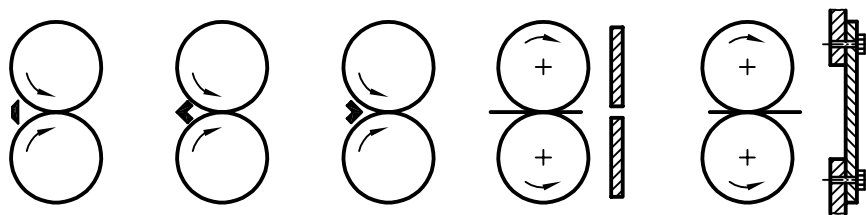
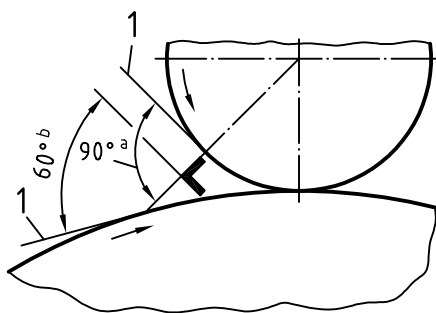


Figure 4 — Examples of nip guards

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 tangent

^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 presses, such as business forms presses, 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. If the shapes shown in Figure 7 are used as trip nip bars, such shapes are permitted, since activation of the trip nip bar stops hazardous motion, as specified in 9.6.

Dimensions in millimetres

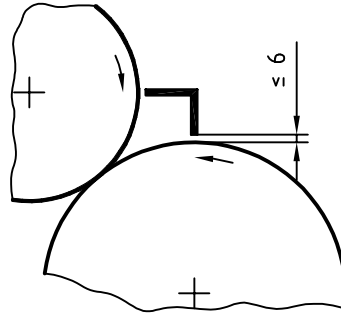
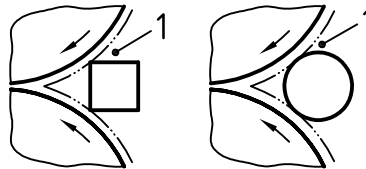


Figure 6 — Safeguarding an in-running nip by means of a fixed nip guard



Key

1 wedge pocket

Figure 7 — Shapes creating wedge pockets

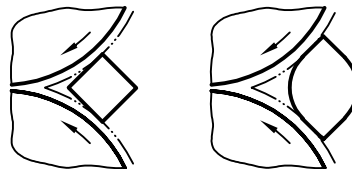


Figure 8 — Shapes not creating wedge pockets

5.3.1 Guarding in-running nips on sheet-fed presses

If technically feasible, trip nip bars in accordance with 9.6 shall be used where:

- frequent access is required to the area during machine motion; and
- cylinders are directly accessible after the interlocking guard has been opened.

If it is not possible to use trip nip bars as described above, hold-to-run control speed limitations defined in 5.5 a) shall apply.

Where cylinders have gaps which exceed those defined for smooth cylinders (see 4.78), trip nip bars, in accordance with 9.6, should be used. Nip guards shall not be used with these cylinders. For such trip guards, the requirements of category 3 of ISO 13849-1:1999 shall be satisfied and the interlocking system shall be

designed such that the requirements for stopping paths defined in 9.6 are satisfied. Trip nip bars and cylinder gaps shall be designed such that cylinder nips cannot be accessed behind trip nip bars, thus causing a hazard.

NOTE 1 Use of trip nip bars is not possible, for example, on small-size offset presses where trip nip bars would impede access to the cylinder for, for example, plate changing.

NOTE 2 To comply with the requirements of 5.4, the interlocking systems will normally have to be designed such that, after opening the interlocking guard, a predetermined number of revolutions, depending on the functional characteristics of the trip guard, is not exceeded.

5.3.2 Guarding in-running nips on web-fed presses

In-running nips that are not in the operator's view from the position where the hold-to-run control or enabling device is operated shall be safeguarded by additional measures.

NOTE Such measures include, for example:

- guarding in accordance with this clause; or
- an electrically interlocked, movable nip bar on the outgoing side between the two blanket cylinders of a rotary offset printing press, that ensures that the bar is in position prior to reverse movement.

Where on machines with varying web paths, such measures for safeguarding the in-running nip existing between blanket cylinders during the reverse movement are not feasible, the following procedure using a hold-to-run with limited inch control is permitted:

- speed shall not exceed 3 m/min; and
- movement shall not exceed 1,2 cylinder revolutions; and
- a stop control element with mechanical latch (such as a stop/safe pushbutton) or an emergency stopping device shall be in the immediate vicinity of the in-running nip; and
- a modified audible warning signal shall be used; and
- a red flashing light shall be provided that can be seen during the warning and permissive periods, and a red warning light (steady burn, not flashing) shall be provided during operating time of the hold-to-run control in the immediate vicinity of any unguarded in-running nip that cannot be observed.

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.

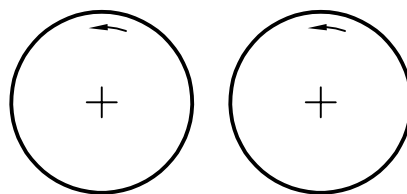


Figure 9 — Non-hazardous rollers rotating in the same direction

5.3.3 Guarding in-running cylinder nips on newspaper presses

In deviation from 5.3 b), nip guards may be used for web-fed newspaper printing presses with cylinder gaps of up to 19 mm. For new machines, however, efforts should be made to limit cylinder gaps to 12 mm.

NOTE Some press cylinder lock-up devices, such as on newspaper presses, require gaps up to 19 mm, measured without the blanket. With the blanket in place, the gap is reduced significantly.

5.3.4 Guarding in-running nips on flatbed offset proofing presses

On flatbed offset proofing presses, the in-running nip between the movable upper unit and the fixed lower unit or printing table shall be safeguarded. This is achieved, for example, by the provision of trip nip bars or electro-sensitive protective devices.

Trip nip bars shall satisfy the requirements of 9.6 and category 3 of ISO 13849-1:1999. Electro-sensitive protective devices shall comply with 9.5. The safety device shall cause stopping of the upper unit in time not to cause any risk of injury. The hand approach speed specified in ISO 13855 need not be complied with.

5.3.5 Guarding in-running nips on cylinder screen printing presses

On cylinder screen printing presses, the in-running nip on the printing cylinder shall be safeguarded.

NOTE 1 This can be achieved, for example, by

- interlocking guards; or
- guarding by the printing form (screen).

Where the printing form is used as a means of guarding, additional protective measures are required for lifting and removal of the printing form.

NOTE 2 Such additional measures can, for example, be electrical interlocking which allows cylinder rotations only under hold-to-run control according to 5.3 as long as the printing form is lifted.

5.4 Interlocks

5.4.1 Machine response to interlock operation

System operation involving an interlock guard shall be as follows.

5.4.1.1 Opening an interlocked guard

When an interlocked guard is opened/moved/removed while the machine is in continuous motion the machine shall stop, utilizing the maximum braking action established for that press. Machine motion shall not be able to be initiated without the operator going through the normal starting sequence.

If a machine is operating at inching speed and under conditions defined in 5.5, motion may continue.

5.4.1.2 Continuous run with a guard open

When any interlocked guard is open, continuous run shall not be permitted.

Exception: If the only hazard being protected by the interlocking guard is an in-running nip, continuous machine motion at crawl speed may be permitted with a guard open provided the condition specified in 9.2.3 is met.

5.4.1.3 Closing an interlocking guard

When the guard is re-closed, the machine shall not automatically start. Closing the interlocking guard on dampening, coating or inking devices may initiate the rotation of dampening or coating ductor rollers or metering rollers if it is ensured that at this time no hazard points can be accessed. Closing the interlocking guard shall not cause the machine to restart its operation. The machine shall go through the normal starting sequence.

NOTE Restarting any independently driven dampening, coating, metering, or ink fountain rollers may be required in order to prevent malfunctions due to dried up coating or dampening agents.

5.4.1.4 More than one interlocking guard open

Where more than one interlocking guard is open and any unguarded hazard zones cannot be observed from a single point of operation, only an inch function or reverse function (as defined in 9.1.3.5) or a plate position function (as defined in 9.1.3.11) shall be permitted

- a) if all in-running cylinder nips behind interlocked guards are additionally guarded by nip guards and all other hazards are guarded; or
- b) 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.

5.4.1.5 Remote control with interlocked guard open

When any interlocked guard is open, initiation of motion of the press system by remote control shall be prohibited. See 11.1.

5.4.2 Interlock design for personnel safety

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

NOTE While all interlocking schemes are capable of being defeated, the interlocking arrangement should not be able to be defeated by commonly available items such as tape, paper, a single common magnet, etc.

5.4.2.1 Compliance with ISO 14119

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

5.4.2.2 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 occur. For machines where routine and regular access 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 (see 4.71), control systems for safety position switches shall satisfy category 4 of ISO 13849-1:1999.

5.4.2.3 Short circuits

Short circuits between two electric wires outside the switch cabinet due to physical impacts can be prevented by mechanical protection of the cable.

NOTE For example, wires may be protected by locating them within ducts or within the machine frame to protect them from impact.

5.4.3 Interlocking with guard locking

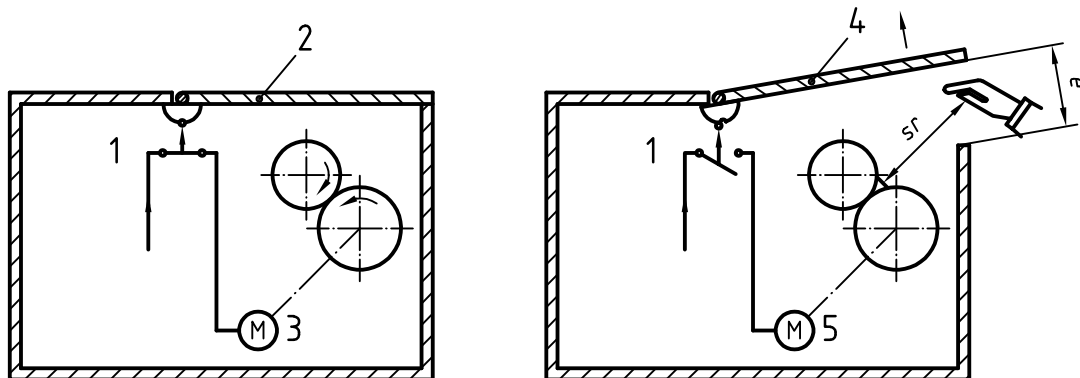
Guard locking is required only when the guard opening distance does not comply with Table 1.

NOTE EN 1010-2 also requires guard locking where hazardous movement cannot be stopped within at least 10 s after actuation of the personnel safety switch.

Table 1 — Requirements for interlocked guards without guard locking (see Figure 10)

Dimensions in millimetres

Safety distance, s_r , between guard opening and hazard point	Maximum opening, e , of the guard while the detector changes its state
< 80	≤ 30
≥ 80 and < 500	≤ 40
≥ 500 and < 850	≤ 80
≥ 850	≤ 160

**Key**

- 1 failsafe limit switch
- 2 guard closed
- 3 motor run
- 4 guard open
- 5 motor stop

Figure 10 — Distances related to requirements for guard locking

5.5 Hold-to-run controls

If all hazard points are safeguarded by nip guards in accordance with 5.3, the requirements for hold-to-run controls and speed limitations do not apply.

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

In cases in which the hazardous area can be viewed from the operating position, with an interlocking guard open and hazardous points unprotected, machine motion can only be initiated by means of a hold-to-run device 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 a) above would reduce the ability of the machine to perform its function and where there would be no substantial increase in hazard.

When using a hold-to-run control with a guard open, the hold-to-run control shall be located so that the hazard can be monitored from the control position.

Guard circuitry for the hold-to-run condition shall be category 3 of ISO 13849-1. Control circuitry (including selector switch relays and PLC circuits) that 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.

Where a particular type of machine needs to run with a speed greater than 5 m/min, the maximum speed shall be as low as possible, and in no case more 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.

NOTE EN 1010-1 permits motion at speeds between 5 m/min and 10 m/min only with the use of a two-hand control.

Any two-hand control device shall meet the requirements defined in 9.4. The stopping path shall be as short as technically feasible.

See 11.1 for general requirements for control systems.

5.5.1 Specific requirements for sheet-fed presses

When interlocking guards are opened and any exposed hazard point is not safeguarded, sheet-fed printing press systems shall only be allowed to be started under hold-to-run according to 5.5 a).

When interlocking guards are opened and all hazards are protected, continuous machine motion at crawl speed is permitted. The provisions of 9.2.3 shall apply.

When interlocking guards are opened and direct access to unprotected in-running nips on cylinders or unprotected hazard points on the sheet transport system is not possible, the machine may be started under hold-to-run control according to 5.5 b). In this case, starting for continuous run while an interlocking guard is open shall not be possible.

NOTE 1 “Cylinders” includes plate cylinders, blanket cylinders, impression cylinders or transfer cylinders. Ink rollers and dampening water rollers, for example, are not considered to be cylinders in the meaning of this International Standard.

NOTE 2 “Sheet transport systems” are, for example, gripping systems, transport drums.

NOTE 3 “Direct access” is, for example, possible where in-running nips can be reached after falling in or where nips are located in the immediate vicinity of places where setting-up or cleaning operations need to be carried out.

NOTE 4 “Continuous run” is starting the machine with a self-holding actuating element (other than hold-to-run), for example, for running the machine at a reduced speed or for cylinder positioning where the cylinder stops at a predetermined position.

NOTE 5 On small-size sheet-fed presses, movements can be non-powered.

5.5.2 Specific requirements for forms presses

In deviation from the requirements of 5.5, on forms printing presses, starting the machine by two-hand control with guards open shall be possible with a speed higher than 10 m/min where this is required for production reasons and the following requirements are fulfilled:

- other interlocking guards outside the area that can be observed are closed;
- a selector switch is used for this kind of operation;