

Graphic technology — Safety requirements for printing press systems

ICS 37.100.10

National foreword

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Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii to vi, pages 1 to 107 and a back cover.

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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 à imprimer*



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Documents

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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*.

This second edition cancels and replaces the first edition (ISO 12648:2003), the following subclauses of which have been technically revised.

- 5.1: A requirement has been added to enable needed observation and adjustment with guards closed.
- 5.2.2.1: The use of risk assessment has been added to requirements, as appropriate.
- 5.5.6.3: A requirement to protect against malfunction of the interlock circuit as a result of short circuits has been added.
- 5.9.2.11: The exception to the requirements for protection of hazard zones on the unwinding unit of automatic reel-loading systems has been removed.
- 5.9.7 – 5.9.9: Requirements relating to guarding of the gripper area have been added.
- 6.5.2.4: For access platforms, a maximum handle diameter has been added.
- 9.2: A requirement for the use of symbology defined in ISO 15847 has been added.
- 9.2.3: A requirement for the colour of manual control devices in accordance with IEC 60204-1 has been added.
- 9.2.4.1.2: The location of emergency control devices has been clarified.
- 13.2.2: The timing of the audible alarm during the warning period has been changed.
- 13.2.6: Requirements for optional personnel warning lights for auxiliary equipment having armed status have been added.
- 15.2: Additional requirements for the contents of the instruction handbook have been defined.

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 [55] , EN 1010-1 [11] and EN 1010-2 [12].

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of one or more patents concerning the use of ESPDs in the delivery area. The patents identified are:

- German Patent DE 103 10 236 B3
- PCT patent application WO 2004/078626 A1

ISO takes no position concerning the evidence, validity and scope of this patent right.

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Intellectual Property R3
Kurfürsten-Anlage 52-60
D-69115 Heidelberg
Germany
Tel: +49-6221/92-3027
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Graphic technology — Safety requirements for printing press systems

1 Scope

This International Standard provides safety requirements for the design and construction of machines used in 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^[32] will apply.

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.

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.

This International Standard applies to machines manufactured one year or more after the date of publication of this International Standard.

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 plastics hoses and hose assemblies — Determination of electrical resistance*

ISO 11553:1996, *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 12100-1:2003, *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 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 13851:2002, *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 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 walkways*

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

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

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”*

1) To be published.

- 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: Construction, test and marking of type of protection encapsulation ‘m’ electrical apparatus*
- 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 61496-1:2004, *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 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 — 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*
- NFPA 86, *Ovens and furnaces*. Available from Internet <<http://www.nfpa.org/>>

3 Terms and definitions

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

3.1
access height in the sheet-fed press delivery zone
dimension of the maximum opening into the area below the sheet gripper, measured between the access level (floor, fixed platform or footboard) and the lower edge of fixed machine parts (e.g. fixed guard, fixed cover, fixed parts such as a sheet stop) (see Figure 18)

3.2
actuator
part of the actuating system to which an external actuating force is applied

[IEV 441-15-22]^[54]

NOTE 1 The actuator can 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** (3.39).

3.3
alcohol dosing equipment
device(s) used to regulate the amount of alcohol in the dampening water of offset printing presses

3.4
armed condition
machine status in which machine motion can be automatically initiated

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

3.5
audible alarm
horn, bell or other distinctive audible warning device that sounds to indicate impending machine motion

3.6
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; the consequences of those improper actions.

3.7
automatic plate clamping device
mechanism used to secure a printing plate during the automatic or semi-automatic changing of the plates

3.8
auxiliary devices for printing presses
mechanisms or machines, either built-in or attached, used for the production process

3.9
barrier guard
guard (3.32) that reduces or prevents access to a hazard zone by closing off access to an area containing one or more hazards

3.10**bypass function****bypass sequence**

temporary, time-limited suppression of one or more safety functions through the use of safety-relevant parts of a control system

3.11**category 0 stop****uncontrolled stop**

stopping by immediate removal of power to the **machine actuators** (3.39)

[IEC 60204-1:2000]

3.12**category 1 stop**

controlled stop with power available to the **machine actuators** (3.39) to achieve the stop and then removal of power when the stop is achieved

[IEC 60204-1:2000]

3.13**category 2 stop**

controlled stop with power to the **machine actuators** (3.39) being maintained

[IEC 60204-1:2000]

3.14**coating unit****coater**

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

NOTE The thickness of the layer is determined by a doctor blade (scraper) or by the gap between two rollers (metering gap).

3.15**continuous-flow drying and curing device**

mechanism built into printing presses to dry and cure inks and coatings that have been applied to substrates after the printing process (e.g. by hot air, IR or UV radiation)

3.16**continuous run**

machine motion at a steady speed initiated by a momentary contact control

3.17**control station**

defined location containing one or more controls

3.18**control zone**

control configuration of single or multiple machine motions using the same control devices (see Clause 8)

3.19**crawl speed**

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

3.20
cylinder
smooth roller

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 1)

Dimensions in millimetres

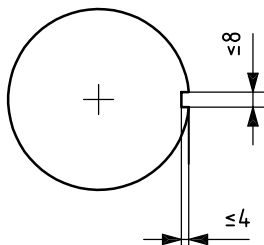


Figure 1 — Smooth roller/cylinder

3.21
cylinder screen printing press

sheet-fed machine in which the substrate (sheet) to be printed is guided along the screen by a printing cylinder (3.20)

3.22
digital printing press

machine in which the printed image is produced from data stored in digital form (e.g. exposing a photo-sensitive drum or film in the machine)

3.23
electrical hazard

source of potential injury or death from electric shock or burn

3.24
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.

3.25
emergency stop device

manually actuated control used to initiate an **emergency stop function** (3.26)

[ISO 13850:1996]

3.26
emergency stop function

mechanism initiated 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

3.27
enabling device

mechanism that must be in a specified state or condition in order for a second actuator or device to start a machine under **hold-to-run control** (3.34), and which will stop machine movement as soon as one of the hold-to-run controls is released or the status of the mechanism changes

3.28**exposing devices**

machinery used for creating images by exposing photo-sensitive material such as printing plates or printing formes

3.29**fixed guard**

guard (3.32) that is securely affixed by fasteners that require a tool(s) to gain access to an area with a significant hazard

3.30**forms printing press****leporello printing press**

machine for the production of continuous forms where paper webs printed with one or more colours are accordeon-folded or wound on to a reel

NOTE In addition to the printing section, the machine consists of devices for punching, remaliners (sprocket punching), cross perforation, longitudinal perforation and leporello (zig-zag) folding.

3.31**gravure press**

machine consisting of a printing cylinder, 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 and an impression cylinder covered with a rubber composition, which presses the substrate into contact with the ink in the cells of the printing cylinder

3.32**guard**

physical barrier that restricts access to a **significant hazard** (3.80)

3.33**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]

3.34**hold-to-run control**

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

3.35**inch****jog**

(operation of machinery) machine motion requiring maintained activation engagement of a **hold-to-run control** (3.34) and which will continue until the control is released or until a pre-determined displacement (limited inch) has been reached

3.36**inch speed**

how fast the press is operating while in **inch** (3.35) mode

3.37**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

3.38**in-running nip**

area created either by two rotating components that are rotating inward, or by one rotating component rotating toward an adjacent surface (see Figure 2)

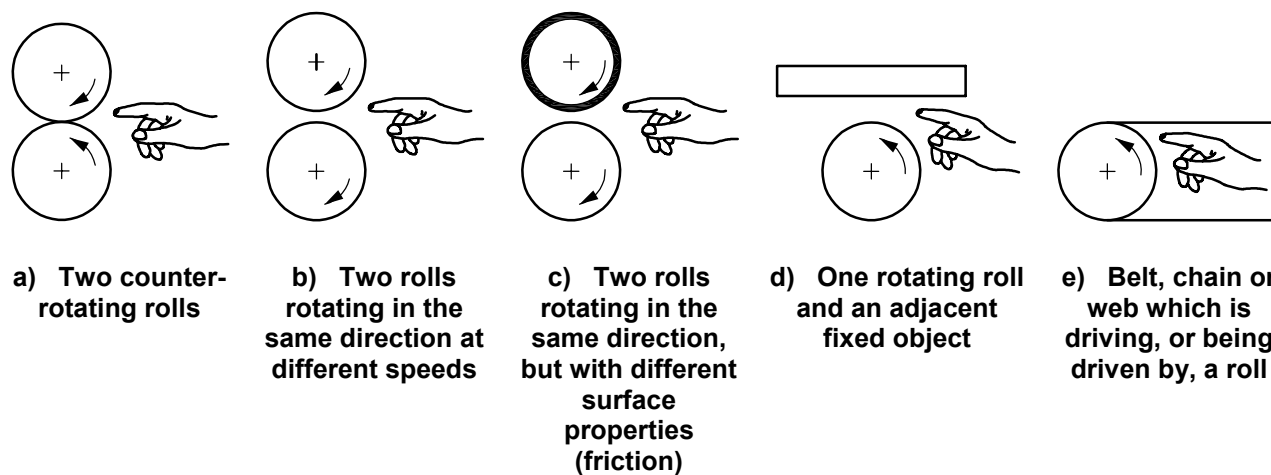


Figure 2 — In-running nips

3.39**machine actuator**

power mechanism used to effect motion of a machine

[ISO 13850:1996]

3.40**maintained-contact control**

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

3.41**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 (e.g., 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.

3.42**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.

3.43**manual control device**

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

[Adapted from IEV 441-15-22]^[54]

3.44**mechanical hazard**

source of potential injury to a person, created by motion of machinery, components or material (e.g. 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.

3.45

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 (knife blades, etc.) of machines, or parts thereof; work pieces or parts thereof, or materials being processed.

3.46

momentary contact control

control that is opened or closed only during its actuation

3.47

motion control

control that initiates machine movement or movement at **zero speed** (3.92), or places the machine in the **armed condition** (3.4)

3.48

motion control station

station that contains a **motion control** (3.47)

3.49

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 **machine actuator(s)** (3.39), or indirectly by the web

3.50

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

3.51

movable guard

guard (3.32) that does not require a tool to move or remove it to gain access to a significant hazard

3.52

newspaper printing presses

machines that are designed and built mainly for printing newspapers

3.53

nip guard

guard (3.32) located at an in-going nip

EXAMPLES Nip bar, finger bar, finger guard.

3.54

non-motion zone

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

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

3.55

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** (3.41) operations

3.56

operating position

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

3.57

permissive period

time interval during which machine motion can be initiated (see 13.2.3)

3.58

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** (3.81).

3.59

pile turner

device attached to sheet-fed printing presses and used to turn piles of printed paper for further processing, such as back-printing on a second run

3.60

portable control station

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

3.61

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.

3.62

positive opening

contact separation as the direct result of a specified movement of the **actuator** (3.2) through non-resilient members, e.g. those not dependent on springs

3.63

powder spraying devices

equipment used to spray powder onto the printed material on the delivery side of sheet-fed printing presses

3.64

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

3.65

printing forme

printing plate

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

3.66**printing table**

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

3.67**proofing press**

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

3.68**raised workplace**

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

3.69**ready condition**

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

3.70**reel rewinding device**

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

3.71**reel turner**

device used to turn reels (webs) of substrate for easier handling, e.g. for correct positioning of the reel when feeding webs to printing presses

3.72**reel unwinding device**

part of a machine used for unrolling web-type material for processing

3.73**remote control**

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

3.74**routine and regular access**

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

3.75**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

3.76**screen frame**

device for taking up the printing screen

3.77**screen printing press**

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

3.78**separating elements**

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

3.79

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

3.80

significant hazard

potential source of severe or disabling injury, or death

3.81

status lights

lights that indicate machine status or machine process condition

NOTE These are not the same as **personnel warning lights** (3.58).

3.82

tool

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

NOTE An item such as a coin or nail file is not considered a tool.

3.83

trip bar

protective bar that, when pushed, activates the interlocked safety system of the machine

3.84

trip nip bar

movable protective bar located at an **in-running nip** (3.38) that, when pushed, activates the interlocked safety system of the machine

3.85

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

3.86

warning period

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

3.87

washing device for roller/cylinder

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

3.88

washing equipment for printing formes

machines for washing printing formes outside the printing press

EXAMPLE Screen washing equipment.

3.89

web-fed press

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

3.90

web-type material

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

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** (3.4).

4 Classification of machines covered by this International Standard

4.1 Machines for producing printing by various processes

The following categories of printing press are covered by this International Standard:

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

New technologies should incorporate the safety principles set forth in this International Standard, in their design.

4.2 Auxiliary equipment

Auxiliary equipment that is part of a printing press system is covered by this International Standard.

EXAMPLE The following are examples of auxiliary equipment often part of a printing press system, depending on the process:

- 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.

5 Guarding against 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. Machinery shall be designed according to the principles of ISO 12100-1 and ISO 12100-2 for hazards that are relevant, but not significant, and which are not covered by this International Standard.

Significant hazards (e.g. 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 shall be guarded against.

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 5.4.2, 5.4.3 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 Guard types and travel

5.2.1.1 Types of guard

For the purpose of this International Standard there are two types of guard, 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 (see 3.82), such as a key or a spanner, designed to operate a fastener.

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, removed 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 A typical shift is 8 h.

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

- 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.

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

5.2.1.2 Automatic travel of movable guards

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

This can be achieved 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;
- 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.

5.2.1.3 Protection against gravity falls of guards

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

- devices for balancing the mass;
- 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;
- 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 positioning

5.2.2.1 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.

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

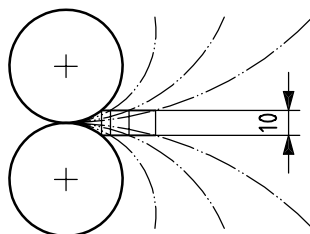


Figure 3 — Measuring safety distances at in-running nips

5.2.2.2 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. Otherwise,

- a) either the height of the danger 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^[37].

5.2.2.3 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 value. 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 (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 value. 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 (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. For guarding in-running nips that are accessible while a movable guard is open, see 5.4

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 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.

5.3 In-running (in-going) nips

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

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

NOTE For non-powered surfaces, this hazard will depend on a number of factors; e.g. 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) that are driven by the movement of the web.

Examples of in-running nips are shown in Figure 2.

5.4 Guarding in-running nips

5.4.1 General

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

- a) 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 ISO 13852:1996, Table 4.
- b) nip guard (allowed) on smooth surface rollers/cylinders only, as bars designed in suitable sections and extending across the entire working width (see Figure 4 for examples of nip guards);
- c) trip nip bars, in accordance with 9.7.

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.

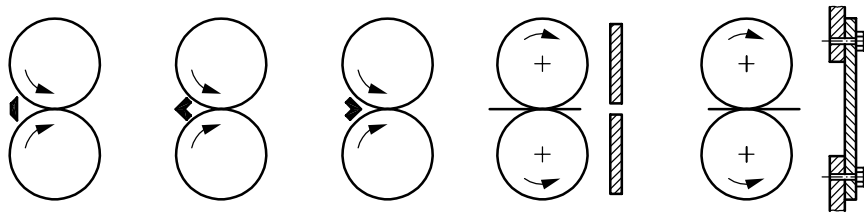
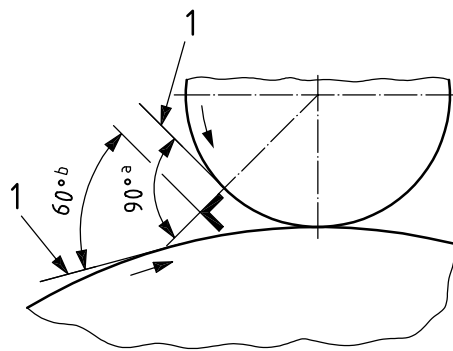


Figure 4 — Examples of nip guards

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 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 form presses, the clearance should be smaller, if possible, considering both safety and production concerns.

Dimensions in millimetres

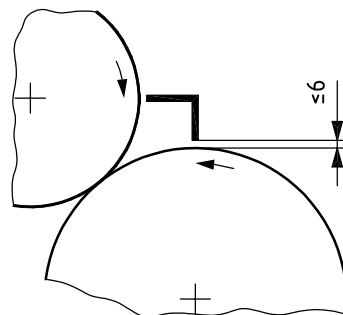
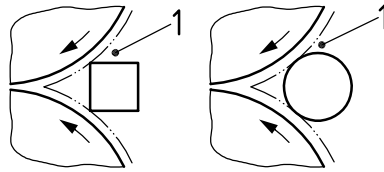


Figure 6 — Safeguarding an in-running nip by means of a fixed nip guard

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 9.7.



Key

1 wedge pocket

Figure 7 — Shapes creating wedge pockets

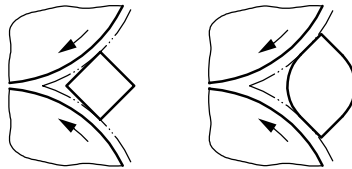


Figure 8 — Shapes not creating wedge pockets

5.4.2 Guarding in-running nips on sheet-fed presses

If technically feasible, trip nip bars in accordance with 9.7 shall be used where frequent access is required to the area during machine motion, and cylinders are directly accessible after the interlocked 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 5.6.1 a) shall apply.

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

Where cylinders have gaps that exceed those defined for smooth cylinders (see 3.79), trip nip bars, in accordance with 9.7, 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 9.7 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.

To comply with the requirements of 5.5, the interlocking systems will normally have to be designed such that, after opening the interlocked guard, a predetermined number of revolutions, depending on the functional characteristics of the trip guard, is not exceeded.

5.4.3 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.

Such measures include:

- guarding in accordance with this clause;
- 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.

On machines with varying web paths where 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, providing all of the following conditions are met:

- speed shall not exceed 3 m/min;
- movement shall not exceed 1,2 cylinder revolutions;
- 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;
- a modified audible warning signal shall be used;
- 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).

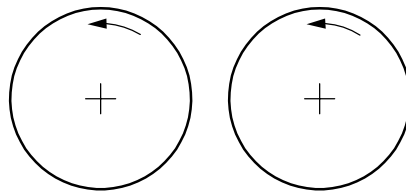


Figure 9 — Non-hazardous rollers rotating in the same direction

5.4.4 Guarding in-running cylinder nips on newspaper presses

In deviation from 5.4.1 b), nip guards may be used for web-fed newspaper printing presses on cylinder gaps of up to 19 mm circumferential slots (see 3.20). For new machines, however, efforts should be made to limit cylinder gaps to 12 mm circumferential.

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.

5.4.5 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 can be achieved by the provision of trip nip bars or electro-sensitive protective devices.

Trip nip bars shall satisfy the requirements of 9.7, and category 3 of ISO 13849-1:1999. Electro-sensitive protective devices shall comply with 9.6. The safety device shall cause the upper unit in time to prevent any risk of injury. The hand-approach speed specified in ISO 13855 does not need to be met.

5.4.6 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.

This can be achieved by interlocked guards, or guarding by the printing forme (screen).

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

Such additional measures can be electrical interlocking, which allows cylinder rotations only under hold-to-run control according to 5.6.1 as long as the printing forme is lifted.

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, using the maximum braking action established for that press system without creating an additional hazard. 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 5.6.1, motion may continue.

5.5.2 Continuous run with an interlocked guard open

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

EXCEPTION: If the only hazard being protected by the interlocked guard is an in-running nip, continuous machine motion at crawl speed may be permitted with a guard open provided the condition specified in 9.3.3 is met.

5.5.3 Closing an interlocked guard

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

Closing the interlocked 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.

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.

5.5.4 More than one interlocked guard open

Where more than one interlocked guard is open and there are any unguarded hazard zones that cannot be observed from a single point of operation, an inch function or reverse function (as specified in 9.2.4.5.2 – 9.2.4.5.3), or a plate position function (as specified in 9.2.4.11) shall be permitted if

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

5.5.5 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).

5.5.6 Interlock design

5.5.6.1 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.

5.5.6.2 Personnel safety switches for interlocked guards

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

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

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

For manually fed devices where interlocked guards are used to safeguard routine and regular access to hazard points (see 3.74), control systems for safety position switches shall satisfy category 4 of ISO 13849-1:1999.

5.5.6.3 Short circuits of interlock circuits

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

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

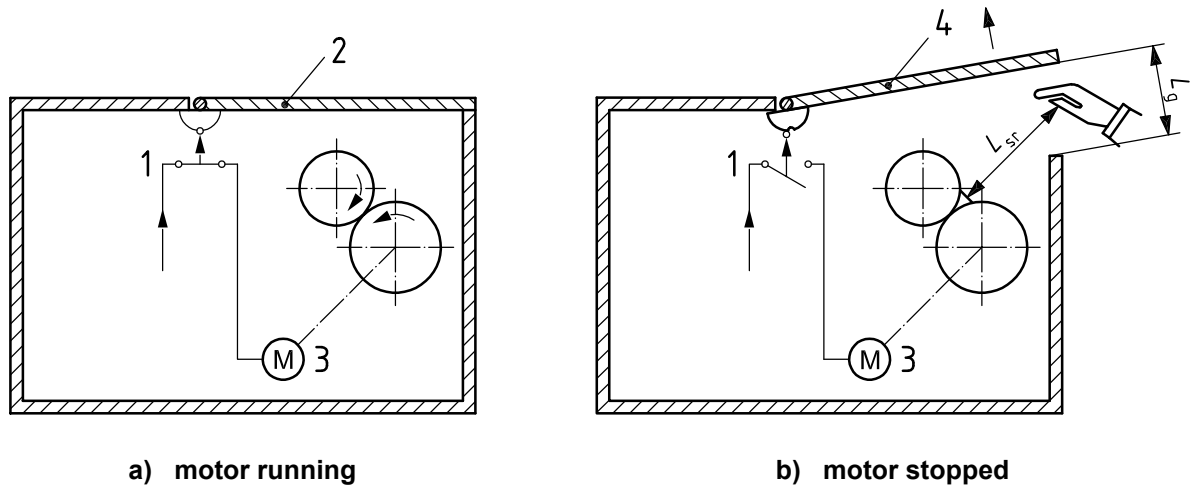
5.5.7 Interlocking with guard locking

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 EN 1010-2^[12] in that the latter requires guard locking where hazardous movement cannot be stopped within at least 10 s of actuation of the personnel safety switch.

Table 1 — 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 and < 500	≤ 40
≥ 500 and < 850	≤ 80
≥ 850	≤ 160
^a See Figure 10 for location of the measurements.	

**Key**

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

Figure 10 — Distances related to requirements for guard locking**5.6 Hold-to-run controls****5.6.1 General**

If all hazard points are safeguarded by nip guards in accordance with 5.4.1 to 5.4.6, 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 interlocked 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 interlocked guard open and hazardous points unprotected, machine motion may be initiated by means of a hold-to-run device only under the following conditions:

- with a displacement limited to a maximum of 25 mm or with a maximum operating (surface) speed of 1 m/min or
- 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 be category 3 of ISO 13849-1:1999. 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.

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.

NOTE This International Standard differs from EN 1010-1^[11] in that the latter 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 9.5.1 to 9.5.3. The stopping path shall be as short as technically feasible.

See 11.1 for general requirements for control systems.

5.6.2 Specific requirements for sheet-fed presses

When interlocked 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 5.6.1 a).

When interlocked guards are opened and all hazards are protected, crawl speed is permitted under the provisions of 9.3.3.

When interlocked 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 5.6 b). In this case, continuous run while an interlocked guard is open shall not be possible.

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

NOTE 2 “Sheet transport systems”, e.g. gripping systems, transport drums.

NOTE 3 “Direct access” is 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 On small-size sheet-fed presses, movements can be non-powered.

5.6.3 Specific requirements for forms presses

In deviation from the requirements of 5.6.1, 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 all of the following requirements are met:

- other interlocked guards outside the area that can be observed shall be closed;
- a selector switch shall be used for this kind of operation;
- warning shall be provided in the instruction handbook (including a statement of the operator's responsibility and a description of safe working practices);
- hold-to-run speed shall be as low as possible under production conditions.

5.7 Automatic format setting operations

Where a hazard exists, automatic format setting operations may be performed at speeds up to, and including, 0,5 m/min without additional safety measures. However, if there is a crushing hazard for the head or trunk of the body, format setting shall be permitted only with a hold-to-run control. The location of the hold-to-run control shall allow the operator to clearly see the hazard points.

EXAMPLES Automatic format setting devices include sheet side lays, suction heads, turner bars, compensators, slitters, etc.

If additional safety measures are needed in the area of the format setting device, personnel shall be protected from motion of the device(s) by one of the following methods:

- a) provision of trip devices or
- b) a separate stop device that is not included in the emergency stop circuit of the printing press or
- c) zone control using the emergency stop circuit.

5.8 Other safeguarding measures

5.8.1 General

Where safeguarded accessible hazard zones cannot be observed from positions from which hazardous movements can be started, the requirements of 5.8.2 to 5.8.5 shall apply.

5.8.2 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.

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.

5.8.3 Electro-sensitive protective devices

Where accessible hazard zones are safeguarded by means of electro-sensitive protective devices (ESPDs), an additional control element 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, e.g. 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 9.6.

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

Pressure-sensitive mats, pressure-sensitive bumpers and trip nip bars shall function in accordance with 9.7.

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

EXAMPLE 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.

5.8.5 Auxiliary devices that act as guards on printing and coating units

Auxiliary devices that are built into printing and coating units and act as fixed guards to prevent access to hazard points in the built-in position shall be fitted so that they can be removed only by means of tools. Auxiliary devices that prevent access to hazardous areas, and that need to be removed frequently or accessed for set-up, act as movable guards and shall be interlocked with any hazardous movement (see 5.5).

EXAMPLE A continuous-flow drying device on the delivery side of sheet offset printing presses where drying modules are inserted into the printing press from the side that, when removed, allows access to hazard points on the sheet gripper system.

NOTE Auxiliary devices are listed in 4.2 and defined in 3.8.

When the machine is operated with the auxiliary device removed, thus exposing a hazard, alternative guards shall be used to protect the user from the hazard point(s).

5.9 Guarding of machine devices and components

5.9.1 Feeding units, delivery units (pile lifting and lowering devices) on sheet-fed printing presses and coating units

5.9.1.1 Load take-up equipment

Load take-up equipment shall be designed such that it can stand a static load test with a load of $\times 1,25$ the maximum load capacity without showing permanent deformation or apparent defects. It shall stand a dynamic load test with a load of $\times 1,1$ the maximum load capacity under normal operating conditions.

5.9.1.2 Breaking strength of components

On lifting and lowering devices with production format sizes greater than $2,5 \text{ m}^2$, the breaking strength of the steel link chains shall be at least six ($\times 6$) times the permissible static load; on pile lifting and lowering devices with production format sizes less than $2,5 \text{ m}^2$, the breaking strength of the steel link chains shall be at least three ($\times 3$) times the permissible static load.

Calculations shall be based on a minimum specific density of $1\,400 \text{ kg/m}^3$ for paper and a minimum specific gravity of 200 kg/m^3 for corrugated board.

5.9.1.3 Lifting height of pile lifting and lowering devices

5.9.1.3.1 Pile carrier

On pile lifting and lowering devices with production format sizes greater than $2,5 \text{ m}^2$, and a lifting height greater than $1,5 \text{ m}$, provisions shall be made to prevent the pile carrier from moving more than 100 mm in case of failure of a rope, chain, supporting nut or gear drive in areas where such a failure may cause injury.

This requirement is satisfied for worm drives, by providing an additional nut of the same type as the supporting nut in order to back up the supporting nut in the event of a breakage or thread wear. The requirement is satisfied for chains (or ropes), for example, by providing one or more unloaded double chains that, in the event of a chain breakage, take over the load and function of the operating chain.

EXCEPTION: This requirement does not apply to gears that are rated for double load. This requirement also does not apply to lifting and lowering devices with a hydraulic or pneumatic drive if, in case of leakage in the pipe system, the lowering speed of the pile carrier does not accelerate to more than $\times 1,5$ the speed under normal operating conditions.

See also 5.9.1.4.1.

5.9.1.3.2 Pile carrier plate

On pile lifting and lowering devices with production format sizes greater than $2,5 \text{ m}^2$, the area below the pile carrier plate shall be safeguarded by guards or by electro-sensitive protective devices. ISO 13855 need not be considered.

On pile carrier plates, the hazard points between the edges of the pile carrier plate and the place where the operator may stand shall be safeguarded by one of the following means, in order to prevent injury to the operator.

- a) On feeders with production format sizes of up to and including 1 m^2 , and on deliveries with format production sizes of up to and including $0,175 \text{ m}^2$, the pile carrier plate shall be allowed to lower automatically down to a height of 120 mm above the floor, and further down to the base only in the hold-to-run control mode.
- b) On feeders with production format sizes of greater than 1 m^2 , and on deliveries with format production sizes of greater than $0,175 \text{ m}^2$, one of the following protective measures shall be provided in order to safeguard the exposed edges of the pile carrier plates.
 - Resilient, non-switching, overhanging shields with their forward edges protruding over the hazardous edges by at least 250 mm shall be used (see Figure 11).
 - Electro-sensitive protective devices located in front of the pile carrier plate edges shall be used. ISO 13855 need not be considered. The movement of the pile carrier plate may be automatically initiated when the electro-sensitive protection device is no longer actuated.
 - A horizontal distance of 300 mm between the vertical projection of the machine frame and the pile carrier plate shall be used. The protruding parts of the machine frame shall not be higher than 1,5 m above the base. Carrier arms reaching into the safety distance (300 mm) shall be at least 120 mm above the floor (see Figure 12). To lower the pile carrier plate below 120 mm, hold-to-run control shall be used.
 - Pressure-sensitive bumpers or trip devices shall be used.
 - Hold-to-run control shall be used on feeders at a horizontal distance of at least 850 mm from the hazard point and at a position from where the hazard point is in the operator's view.
- c) On feeders and deliveries with production format sizes greater than $2,5 \text{ m}^2$, the hazard point shall be safeguarded by one or more of the following safety devices:
 - guard;
 - photoelectric device in front of the edge of the pile carrier plate, or on board feeding and delivery units by a photoelectric device fitted at a distance of 300 mm minimum from the edge of the pile carrier plate;
 - other presence-sensing devices as defined in 9.6 and 9.7.

Where platforms or gangways are fitted to the feeding or delivery unit, the hazard point between platform or gangway and the edge of the pile carrier plate shall be safeguarded.