



BSI Standards Publication

Graphic technology — Safety requirements for graphic technology equipment and systems

Part 1: General requirements

National foreword

This British Standard is the UK implementation of EN ISO 12643-1:2023. It is identical to ISO 12643-1:2023. It supersedes BS ISO 12643-1:2009 and BS EN 1010-1:2004+A1:2010, which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PAI/43, Graphic technology.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Published by BSI Standards Limited 2023

ISBN 978 0 580 97117 4

ICS 37.100.10

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2023.

Amendments/corrigenda issued since publication

Date	Text affected
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English Version

Graphic technology - Safety requirements for graphic
technology equipment and systems - Part 1: General
requirements (ISO 12643-1:2023)

Technologie graphique - Exigences de sécurité pour les
systèmes et l'équipement de technologie graphique -
Partie 1: Exigences générales (ISO 12643-1:2023)

Graphische Technik - Sicherheitsanforderungen an
Ausrüstungen und Systeme der graphischen Technik -
Teil 1: Allgemeine Anforderungen (ISO 12643-1:2023)

This European Standard was approved by CEN on 19 November 2023.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

This document (EN ISO 12643-1:2023) has been prepared by Technical Committee ISO/TC 130 "Graphic technology" in collaboration with Technical Committee CEN/TC 198 "Printing and paper machinery - Safety" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2024, and conflicting national standards shall be withdrawn at the latest by June 2026.

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

This document supersedes EN 1010-1:2004+A1:2010.

Any feedback and questions on this document should be directed to the users' national standards body/national committee. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Endorsement notice

The text of ISO 12643-1:2023 has been approved by CEN as EN ISO 12643-1:2023 without any modification.

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Foreword

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

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

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

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

This third edition cancels and replaces the second edition (ISO 12643-1:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

- in [5.3.2](#), the requirements for guards (fixed guards with hinges, inclusion of examples of fastening devices, e.g. rotary clamping closures, adaptation to ISO 13857:2019) have been revised;
- former 6.5.5 (interlocking with guard locking) has been deleted (related machine-specific requirements are provided in the subsequent parts of ISO 12643 series);
- in [5.3.6](#), the requirements for hold-to-run controls have been revised;
- in [5.3.8](#), the requirements for reel unwinding devices, rewinding devices and reel transport systems have been revised (monitoring of the chucking cones, adaptation of the requirements to smaller machinery, monitoring of the circumferential speed with regard to overwinding, area protection, protective devices at rewinding devices with manual or automatic reel change);
- in [5.3.10](#), the requirements for pile carrier movements at feeders and deliveries have been revised;
- in [5.4.2](#), the requirements for explosion and fire protection have been revised;
- in [5.4.8.2](#), the requirements for UV radiation to the cited EN 12198-1:2000 have been adapted: no distinction between UVA and UVB/UVC anymore, reference to effective UV radiation;

- a new subclause (5.4.10) about doctor blades has been added;
- in 5.7.2, information that touch sensitive control devices shall not be used for initiating safety functions has been clarified;
- in 5.7.2.3, colours for controls have been adapted;
- in 5.7.2.5.1.2, the comprehensive requirements for emergency stop devices have been replaced by reference to IEC 60204-1:2016/AMD 1:2021 and ISO 13850:2015 (references to safety functions of IEC 61800-5-2, e.g. STO);
- in 5.7.6, the requirements of ESPDs to IEC 61496-1:2020 and IEC 61496-2:2020 has been adapted; likewise, the heights of the light beams for a 3-beam solution have been adapted;
- in 5.8, the requirements to fixed and portable control station have been adapted;
- in 5.10, the requirements for control systems has been revised:
 - the term "irreversible injuries" has been introduced;
 - an overview table of the performance levels defined in the document has been inserted;
- in Clause 6, detailed listings of the validation methods for all safeguarding measures has been added;
- in 8.3.1, the requirements for instruction handbook with regard to noise emission values and hearing protection have been amended;
- Annex A has been revised and has been converted to a normative annex;
- the list of significant hazards has been moved to Annex B;
- the noise comparison values in Annex D has been added;
- a normative Annex F on occurrence of a hazardous explosive atmosphere has been added;
- an informative Annex G on the relationship between protection zones against explosion and equipment to be used has been added.

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

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

Introduction

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

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

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.)

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

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e. g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

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

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope and in [Clause 5](#) of this document.

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

This document was developed to harmonize the requirements of the following U.S. and European safety standards:

- EN 1010-1:2004+A1:2010;
- EN 1010-2:2006+A1:2010;
- EN 1010-3:2002+A1:2009;
- EN 1010-4:2004+A1:2009;
- EN 1010-5:2005;
- ANSI B65-1:2011;
- ANSI B65-2:2011;
- ANSI B65-3:2011;
- ANSI B65-5:2011.

Requirements specific to prepress and press equipment and systems, binding and finishing equipment and systems, converting equipment and systems, corrugated board manufacturing equipment and systems and stand-alone platen presses that are not included in this document, are given in subsequent parts of ISO 12643 that contain additional requirements specific to that type of equipment.

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

Part 1: General requirements

1 Scope

This document provides safety specifications for the design and construction of new equipment used in prepress systems, printing press systems, binding and finishing systems, converting systems, corrugated board manufacturing systems and stand-alone platen presses. It is applicable to equipment used in stand-alone mode, or in combination with other machines, including ancillary equipment, in which all the machine actuators (e.g. drives) of the equipment are controlled by the same control system.

The requirements given in this document are applicable to the equipment covered by ISO 12643 (all parts), unless otherwise noted. This document is intended to be used in conjunction with the applicable part of ISO 12643 that contains additional requirements specific to a particular type of equipment.

This document addresses recognized significant hazards specific to equipment and systems in the following areas:

- mechanical;
- electrical;
- slipping, tripping, falling;
- ergonomics;
- noise;
- UV and laser radiation;
- fire and explosion;
- thermal;
- substances and material used for processing;
- failure, malfunction of control system;
- other types of emissions [e.g. ozone, ink mist, volatile organic compounds (VOCs), etc.].

This document is not applicable to:

- equipment manufactured before the date of its publication;
- ordinary office equipment for digital printing and paper processing, such as digital printers, copiers, sorters, binders and staplers, which is intended for use outside the printing and paper industry;
- winder-slitters and sheeters in paper finishing (sheeters with unwinders);
- office-type collating machines equipped with friction feeders;
- mail processing machines;

- machines used for filling packages (such as machines for shaping, filling, and closing the package); and
- textile printing presses.

The safety principles established in this document can also be applicable to the design of equipment within areas of technology that are not specified in ISO 12643 (all parts).

2 Normative references

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

ISO 3691-4:2020, *Industrial trucks — Safety requirements and verification — Part 4: Driverless industrial trucks and their systems*

ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 3864-2:2016, *Graphical symbols — Safety colours and safety signs — Part 2: Design principles for product safety labels*

ISO 3864-3:2012, *Graphical symbols — Safety colours and safety signs — Part 3: Design principles for graphical symbols for use in safety signs*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 7731:2003, *Ergonomics — Danger signals for public and work areas — Auditory danger signals*

ISO 11553-1:2020, *Safety of machinery — Laser processing machines — Part 1: Laser safety requirements*

ISO/TR 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO 11689:1996, *Acoustics — Procedure for the comparison of noise-emission data for machinery and equipment*

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

ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

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

ISO 13849-2:2012, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

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

ISO 13851:2019, *Safety of machinery — Two-hand control devices — Principles for design and selection*

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

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

ISO 13856-1:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*

ISO 13856-2:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars*

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

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

ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*

ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

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

ISO 14122-4:2016, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*

ISO 19353:2019, *Safety of machinery — Fire prevention and fire protection*

IEC 60079-0:2017, *Explosive atmospheres — Part 0: Equipment — General requirements*

IEC 60079-1:2014, *Explosive atmospheres — Part 1: Equipment protection by flameproof enclosures “d”*

IEC 60079-2:2014, *Explosive atmospheres — Part 2: Equipment protection by pressurized enclosure “p”*

IEC 60079-5:2015+AMD1:2022, *Explosive atmospheres — Part 5: Equipment protection by powder filling “q”*

IEC 60079-6:2015+AMD1:2020, *Explosive atmospheres — Part 6: Equipment protection by liquid immersion “o”*

IEC 60079-7:2015+AMD1:2017, *Explosive atmospheres — Part 7: Equipment protection by increased safety “e”*

IEC 60079-10-1:2020, *Explosive atmospheres — Part 10-1: Classification of areas — Explosive gas atmospheres*

IEC 60079-10-2:2015, *Explosive atmospheres — Part 10-2: Classification of areas — Combustible dust atmospheres*

IEC 60079-11:2011, *Explosive atmospheres — Part 11: Equipment protection by intrinsic safety “i”*

IEC 60079-13:2017, *Explosive atmospheres — Part 13: Equipment protection by pressurized room “p” and artificially ventilated room “v”*

IEC 60079-14:2013, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection*

IEC 60079-15:2017, *Explosive atmospheres — Part 15: Equipment protection by type of protection “n”*

IEC 60079-18:2014+AMD1:2017, *Explosive atmospheres — Part 18: protection by encapsulation “m”*

IEC 60079-25:2020, *Explosive atmospheres — Part 25: Intrinsically safe electrical systems*

IEC 60079-26:2021, *Explosive atmospheres — Part 26: Equipment with Equipment Protection Level (EPL) Ga*

IEC 60079-28:2015, *Explosive atmospheres — Part 28: Protection of equipment and transmission systems using optical radiation*

IEC 60079-31:2022, *Explosive atmospheres — Part 31: Equipment dust ignition protection by enclosure "t"*

IEC 60079-33:2012, *Explosive atmospheres — Part 33: Equipment protection by special protection 's'*

IEC 60204-1:2016+AMD1:2021, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60825-1:2014, *Safety of laser products — Part 1: Equipment classification and requirements*

IEC 60947-2:2016+COR1:2016+A1:2019, *Low-voltage switchgear and controlgear — Part 2: Circuit-breakers*

IEC 60947-3:2020, *Low-voltage switchgear and controlgear — Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-5-1:2016+COR1:2016, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

IEC 60947-5-3:2013, *Low-voltage switchgear and controlgear — Part 5-3: Control circuit devices and switching elements — Requirements for proximity devices with defined behaviour under fault conditions (PDDb)*

IEC 61010-1:2010+COR:2011+A1:2016, modified+A1:2016/COR1:2019, *Safety requirements for electrical equipment for measurement, control, and laboratory use — Part 1: General requirements*

IEC 61310-1:2007, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals*

IEC 61310-2:2007, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

IEC 61310-3:2007, *Safety of machinery — Indication, marking and actuation — Part 3: Requirements for the location and operation of actuators*

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

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

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

ISO 80079-36:2016, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements*

ISO 80079-37:2016, *Explosive atmospheres — Part 37: Non-electrical equipment for explosive atmospheres — Non-electrical type of protection constructional safety "c", control of ignition sources "b", liquid immersion "k"*

EN 1127-1:2019, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 12198-1:2000+A1:2008, *Safety of machinery — Assessment and reduction of risks arising from radiation emitted by machinery — Part 1: General principles*

EN 13023:2003+A1:2010, *Noise measurement methods for printing, paper converting, paper making machines and auxiliary equipment — Accuracy grades 2 and 3*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13849-1:2023, ISO 12100:2010 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

actuator

part of a device to which an external action is to be applied

Note 1 to entry: The actuator can take the form of a handle, knob, pushbutton, roller, plunger, trip wire, pressure-sensitive mat, etc.

Note 2 to entry: There are some actuating means that do not require an external actuating force, but only an action; e.g. light beams. Such actuating means are not considered to be actuators.

Note 3 to entry: See also the definition for *machine actuator* (3.35).

3.2

armed condition

machine status in which machine motion can be automatically initiated

Note 1 to entry: *Zero speed* (3.87) is considered to be an armed condition.

3.3

audible alarm

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

3.4

auxiliary device

mechanism or machine, either built-in or attached, used for the production process

Note 1 to entry: Examples for auxiliary devices are:

- continuous flow drying devices,
- pre-melter on a binder,
- gluers,
- perforating units,
- die cutters,
- numbering devices,
- imprinters,
- registration systems,
- prefolder,
- prefeeder,
- breakers (i.e. blank sheet separator), etc.

3.5

barrier guard

guard (3.24) that reduces or prevents physical access to a hazard zone by closing off access to an area containing one or more hazards

EXAMPLE A perimeter fence or tunnel guard.

3.6

binding and finishing system

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

3.7

bypass

temporary, time-limited suppression of one or more *safety functions* (3.64) through the use of safety-relevant parts of a control system

3.8

chucking cones

rotating parts of shaftless winding and unwinding devices, which are inserted into the ends of the core of the roll and enable the winding or unwinding of the roll of material

3.9

contact/pressure roller

<reel rewinding devices> driven or non-driven roller that is in contact with the material reel and is used to guide and ensure the winding hardness of the flat web that is to be rewound

3.10

continuous run

machine motion at a sustained speed until changed by the operator

3.11

control station

assembly of one or more control actuators that initiates or stops machine movement or potential of machine movement [torque at *zero speed* (3.87)], or places the machine in the *armed condition* (3.2)

3.12

control zone

control configuration of single or multiple machine motions using the same control devices

3.13

doctor blade

blade that wipes the excess (surface) ink from a gravure cylinder or anilox roller before printing or the excess coating from a cylinder during finishing operations

[SOURCE: ISO 12637-3:2009, 32]

3.14

drive

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

- drives with no stored energy, such as direct-motor drives;
- drives having stored energy, such as motor-flywheel-clutch drives and hydraulic-pneumatic drives

3.15

electrical hazard

source of potential injury or death from electric shock or burn

3.16**electro-sensitive protective device
ESPD**

assembly of devices and/or components working together for protective tripping or presence-sensing purposes (person, part of person, object) using non-contact detection means

Note 1 to entry: Light curtain, light beam, ultrasonic proximity sensor, vision-based protective devices, scanner, etc.

3.17**emergency stop command**

change of signal state, the direct result of actuation of an *emergency stop device* (3.18)

3.18**emergency stop device**

manually actuated control device used to initiate an *emergency stop function* (3.19)

[SOURCE: ISO 13850:2015, 3.3]

3.19**emergency stop function**

safety function (3.64) initiated by a mechanism actuated 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

3.20**emergency stop pushbutton**

emergency stop device (3.18) comprising an extended mushroom-head or palm-type actuator, positive opening contact element(s) and an engagement or latching-in feature

3.21**explosive atmosphere**

mixture with air, under atmospheric conditions, of *combustible* (3.89) substances in the form of gas, vapour, or dust which, after ignition, permits self-sustaining propagation

[SOURCE: IEC 60079-0:2017, 3.38, modified — “flammable” substituted by “combustible”.]

3.22**exposing device**

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

3.23**fixed guard**

guard (3.24) that is securely affixed by fasteners that require a tool(s) to remove in order to gain access to an area with a *significant hazard* (3.68)

3.24**guard**

physical barrier that restricts access to a *significant hazard* (3.68)

3.25**hazardous area**

<explosive atmospheres> area in which an *explosive atmosphere* (3.21) is present, or can be expected to be present, in quantities such that special precautions for the construction, installation and use of equipment are required

Note 1 to entry: IEC 60079-10-1:2020 gives a classification of hazardous areas containing explosive gas atmospheres.

Note 2 to entry: IEC 60079-10-2:2015 gives a classification of hazardous areas containing explosive dust atmospheres.

Note 3 to entry: For the purposes of this document, an area is a three-dimensional region or space.

[SOURCE: IEC 60079-0:2017, 3.2, modified — Note 3 to entry has been added.]

3.26

hazard point

location of a hazard on a machine where a person can be injured

3.27

hazard zone

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

[SOURCE: ISO 12100:2010, 3.11, modified — "exposed to a hazard" has been substituted by "exposed to risk of injury or damage to health".]

3.28

hold-to-run control

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

Note 1 to entry: Hold-to-run control, in some countries, is known as inching/jogging (not necessarily related to measurement).

3.29

inch

jog

<operation of machinery> machine motion requiring maintained activation engagement of a *hold-to-run control* (3.28) and which will continue, until the control is released, at a limited maximum operating speed or until a pre-determined displacement has been reached

3.30

infrequently used working area

area in which an activity is carried out, such as observation, *make-ready* (3.38), jam clearing, minor servicing, crossing inserting hoppers or conveyer belts, etc., that is routine, repetitive, integral to (but not necessarily during) production, and is done only on an occasional basis

3.31

irreversible injury

injury leading to severe permanent health damage or at least 6 months functional impairment

[SOURCE: Decision 2010/15/EU^[62]]

3.32

disabling injury

injury leading to loss of limbs or death or disability >10 %

[SOURCE: Decision 2010/15/EU^[62]]

3.33

in-running nip

in-going nip

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

Note 1 to entry: See [Figure 4](#) for examples of in-running nips.

3.34

interlock

<for safeguarding> arrangement that interconnects guard(s) or device(s) with the control system and/or all or part of the electrical energy distributed to the machine

3.35**machine actuator**

power mechanism of the machine used to effect motion (for example, motor, solenoid, pneumatic or hydraulic cylinder)

[SOURCE: IEC 60204-1:2016+AMD1:2021, 3.1.39]

3.36**maintained-contact control**

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

3.37**maintenance**

operation required to ensure that the machine remains in acceptable operating condition and that is usually performed when the machine is not available for production

Note 1 to entry: Maintenance (for example, repairing or replacing broken, worn or damaged parts; performing lubrication; preventive servicing) is 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 performed with energy isolated, when possible.

3.38**make-ready**

task 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.

3.39**manual control device**

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

3.40**manually fed**

feeding of material where substrate is placed into and/or removed from the machine by hand

3.41**mechanical hazard**

hazard that could result in injury to a person created by motion of machinery, components or material

EXAMPLE Crushing and shearing points; trapping points; *in-running nips* (3.33); cutting, punching and impact points; 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.

3.42**momentary-contact control**

control that is opened or closed only during its actuation

3.43**motion zone**

area defined by any machine component, or group of machine components, which is driven directly by the system drive motor(s) or *machine actuator(s)* (3.35), or indirectly by other means

3.44**movable guard**

guard (3.24) that does not require a tool to move or remove it to gain access to a *significant hazard* (3.68)

3.45**nip guard**

guard (3.24) located at an *in-going nip* (3.33)

EXAMPLE Nip bar, finger bar, finger guard.

3.46

normal operation

functions and conditions that usually exist during set-up, *make-ready* (3.38), production and minor servicing, adjusting and cleaning performed by operators, but not including *maintenance* (3.37) operations

3.47

operating position

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

3.48

permissive period

time interval during which machine motion can be initiated

3.49

personnel warning light

red or green light used to indicate the ready, running and *safe conditions* (3.62) of the machine relative to personnel safety

Note 1 to entry: These lights are not the same as *machine status light* (3.71).

3.50

portable control station

control device (not in a fixed position) that transmits signals using a cableless system or flexible cord

Note 1 to entry: The cord can be permanently connected or plugged-in.

3.51

positive opening

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

3.52

raised workplace

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

3.53

ready condition

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

3.54

reel rewinding device

reel rewinding unit

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

3.55

reel rewinding devices with automatic reel change

devices for changing the web from the (full) material reel to a new material reel (core) for rewinding that is carried out in an automated reel changing unit, e.g. in the form of a high-speed impact cutting process

Note 1 to entry: The web is continuously fed to the automatic reel rewinding device.

3.56

reel rewinding devices with manual reel change

devices for changing the web from the (full) material reel to the new material reel (core) for rewinding that is carried out manually while the material reel stands still

3.57**reel stand**

equipment which allow the winding or unwinding of the material

3.58**reel unwinding device****reel unwinding unit**

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

3.59**remote access**

connection to the processor of a machine for the purpose of conducting diagnostics, data extraction, software updates, etc. from either a local or remote location

3.60**residual pile monitoring system**

device that monitors the feed stack to detect when it gets close to being empty

3.61**routine and regular access**

repetitive access to a *hazard point* ([3.26](#)) that is required during normal production activity

3.62**safe condition**

machine status in which movement which is likely to cause injury is prevented, which can apply to the entire machine or to one or more motion zones, and which exists only when one or more *stop/safe pushbuttons* ([3.74](#)) is/are actuated or *emergency stop device(s)* ([3.18](#)) also meeting the criteria of stop/safe pushbutton(s) is/are actuated

3.63**safety distance**

minimum distance a protective device is required to be placed from a *hazard zone* ([3.27](#))

[SOURCE: ISO 13857:2019, 3.2]

3.64**safety function**

function of a machine whose failure can result in an immediate increase of risk(s)

[SOURCE: ISO 12100:2010, 3.30]

3.65**separating element**

part on feeders of sheets, blanks or similar materials that separates the individual sheets, blanks

3.66**sheet-fed**

material supply, in which the substrate is fed in separate sheets, either manually or mechanically

3.67**side lays**

assembly with adjustable side stoppers on which incoming sheets are aligned laterally

3.68**significant hazard**

hazard that could result in *irreversible injuries* ([3.31](#)) or *disabling injuries* ([3.32](#)) or death

3.69

smooth cylinder

smooth roller

elongated body, solid or hollow, with a circular cross-section having a smooth surface with either of the following:

- grooves no more than 4 mm deep (measured in the radial direction) and no more than 8 mm wide (measured in the circumferential direction), with no sharp or cutting edges (see [Figure 1](#)); or
- grooves no more than 4 mm wide (measured in the circumferential direction), with no sharp or cutting edges

Note 1 to entry: "Cylinders" includes plate cylinders, blanket cylinders, impression cylinders, etc. Ink rollers, dampening water rollers or distribution drums are not considered to be cylinders as defined in this document.

Dimensions in millimetres

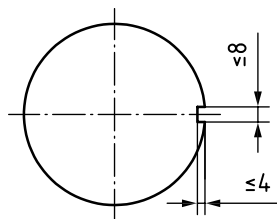


Figure 1 — Smooth roller/cylinder

3.70

splicer

machine which cut processed material and join (splice) new material together

3.71

machine status light

light that indicates machine status or machine process condition

Note 1 to entry: Status lights are not the same as *personnel warning lights* ([3.49](#)).

3.72

stop control device

manually actuated control intended to stop machine motion during *normal operation* ([3.46](#))

3.73

stop/safe function

safety function ([3.64](#)) initiated by a mechanism actuated 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 and to place the machine in a *safe condition* ([3.62](#))

3.74

stop/safe pushbutton

manually actuated control used to initiate a *stop/safe function* ([3.73](#)) and comprised of an extended mushroom-head or palm-type actuator, positive opening contact element(s) and engagement or latching-in feature

3.75

substrate

material on which the process is conducted

EXAMPLE Board, corrugated board, plastic film, aluminium foil, sheet metal and photographic paper

Note 1 to entry: The process can refer to printing, laminating, varnishing, etc.

3.76**support roller
bearer drum**

driven or non-driven rollers used to drive or support the material reel

Note 1 to entry: As a rule, support rollers/bearer drums are under the rewinding roll.

3.77**tool**

implement, such as a key (e.g. double bit key, three-square socket key, square socket key) or wrench, designed to operate a fastener

Note 1 to entry: An item such as a coin or fingernail file is not considered to be a tool.

3.78**touch-sensitive control device
TSCD**

electronic input device, controlled by touching, lifting off or moving across a sensitive surface or display with one or more fingers or a stylus/pen, whose actuation generates a position and/or selection signal

EXAMPLE Touchpads, touchscreens, digitalization boards.

Note 1 to entry: In contrast to contact-based operating elements (switches, push buttons) reliable generation of the operating signals by the TSCD depends on the dedicated software and hardware used in the TSCD. Furthermore, the control points are not at a fixed position and cannot be felt.

3.79**trip device**

protective device where actuation initiates the stopping action

3.80**trip nip bar**

movable protective bar located at an in-running nip which, when actuated, initiates stopping action

3.81**troubleshooting**

procedure for rectifying of operational failures, such as clearing blockages

3.82**two-hand control**

safety device that consists of two *manual control devices* (3.39) which requires simultaneous actuation by a single operator to initiate potentially hazardous machine motion

3.83**unit
device**

part of a larger machine with a specific function or purpose

Note 1 to entry: These terms can be used interchangeably for processes related to press equipment and systems

3.84**warning period**

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

3.85**web-fed**

material supply, in which the substrate is fed from a roll or a pack of continuous stock

3.86

cableless motion control
wireless control

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

EXAMPLE Radio, infra-red.

3.87

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 1 to entry: Zero speed is considered to be an *armed condition* ([3.2](#)).

3.88

glow temperature

minimum ignition temperature of a dust layer or a dust cloud

3.89

combustible

capable of being ignited and burned

[SOURCE: ISO 13943:2017, 3.52]

3.90

flammable

capable of *flaming combustion* ([3.91](#)) under specified conditions

[SOURCE: ISO 13943:2017, 3.180]

3.91

flaming combustion

combustion in the gaseous phase, usually with emission of light

[SOURCE: ISO 13943:2017, 3.52]

3.92

zone

<explosive atmospheres> *hazardous areas* ([3.25](#)) classified into zones based upon then frequency of the occurrence and the duration of an *explosive atmosphere* ([3.21](#))

[SOURCE: IEC 60079-14:2013, 3.2.6]

3.93

service temperature

maximum or minimum temperature reached at specific points of the equipment when the equipment is operating at rated conditions, including ambient temperature and any external sources of heating or cooling

Note 1 to entry: Equipment can reach different service temperatures in different parts.

[SOURCE: ISO 80079-36:2016, 3.8, modified — The symbol T_s has been omitted.]

4 Significant hazards

For the list of significant hazards covered by this document, see [Annex B](#).

5 Safety requirements and/or protective measures

5.1 General

Machinery shall be in accordance with the safety requirements and/or protective measures of this subclause. In addition, machinery shall be designed according to the principles of ISO 12100:2010 for relevant but not significant hazards that are not dealt with by this document (e.g. sharp edges of the machine frame). Safe reach distances shall be in accordance with ISO 13857:2019.

5.2 Risk assessment

Risk assessment on machinery covered by the ISO 12643 series shall be conducted in accordance with ISO 12100:2010.

5.3 Safeguarding of significant hazards

5.3.1 General principles

Machinery shall be designed using the risk assessment process and principles of ISO 12100:2010 for hazards, and the relevant parts of ISO 12643 for machine-specific hazards. In accordance with the risk assessment, guarding that is appropriate to the level of risk shall be provided to prevent persons being exposed to significant hazards. The selection of guarding should be chosen in accordance with ISO 14120:2015. Exposure to significant hazards is not considered to exist if, during normal operation, the distance to the hazard complies with those specified in ISO 13857:2019.

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 protective devices shall provide protection against hazards. These operations shall be carried out using a hold-to-run device as specified in this document, and specified in the requirements for hold-to-run controls defined in the subsequent parts of the ISO 12643 series for prepress and press equipment and systems, for binding and finishing equipment and systems, for converting equipment and systems, or for stand-alone platen presses.

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.

EXAMPLE A transparent guard or remote viewing system.

Hazards for crushing of parts of the human body are not considered to exist if the minimum distances as specified in ISO 13854:2017 are maintained or exceeded.

5.3.2 Guards

5.3.2.1 Guard types and travel

5.3.2.1.1 Types of guards

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

NOTE 1 Due to ergonomic principles a fixed guard can be hinged and not interlocked.

When fixed guards are used and it is foreseeable that they will be removed particularly when performing maintenance, adjustment, setting, their fastenings shall remain attached to the guard or to the machinery when the guard is removed.

EXAMPLE See [Figure 2](#) and ISO 14120:2015, Annex A.

Rotary clamping closures are suitable when they are either to be opened with a tool or are provided with a lockable handle.

This requirement does not necessarily apply to fixed guards that are only liable to be removed for example, when the machine is completely overhauled, is subject to major repairs or is dismantled for transfer to another site.

All movable guards shall be interlocked in accordance with [5.3.5](#).

Guards that are designed to be opened, removed, and/or moved at least once per working shift (typically 8 h) during normal operation or for set-up purposes with or without the use of a tool, shall be interlocked.

NOTE 2 Guards and doors are removed for "set-up" purposes, for example:

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

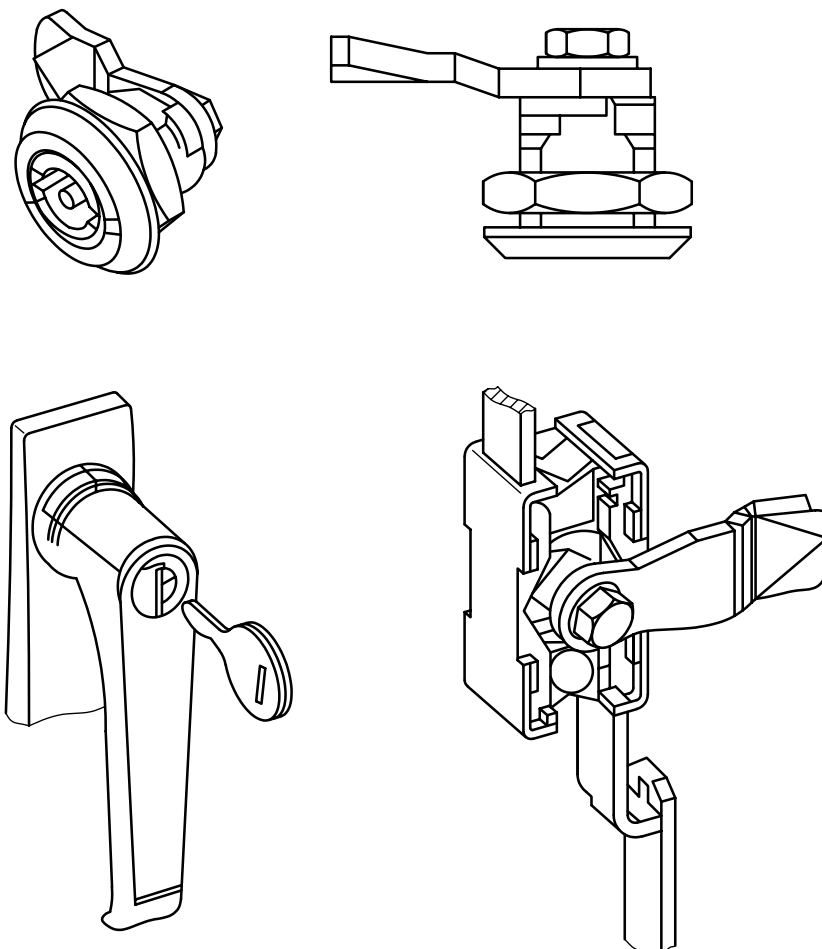


Figure 2 — Examples of a retained fastening

The interlock system shall operate as described in [5.3.5.1](#).

When the interlocking guard is open, one of the measures set out in [5.3.6](#) shall become effective.

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

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

Guards shall not create any additional significant hazards to personnel and shall satisfy the requirements of ISO 14120:2015 and ISO 14119:2013.

5.3.2.1.2 Power-driven travel of movable guards

For the safeguarding of power-driven travel of movable guards, see [5.4.16.1](#).

5.3.2.1.3 Protection against gravity falls of guards

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

EXAMPLE The following are examples of means that can be used for safeguarding:

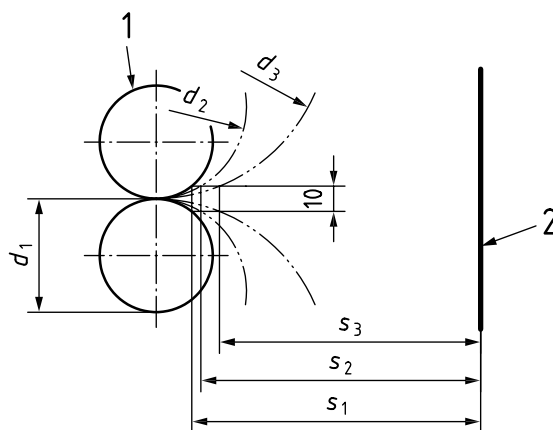
- devices for balancing the mass;
- pneumatic springs;
- devices which automatically hold the parts open;
- power-driven worm gear drives actuated by hold-to-run controls if the hazard points can be observed from the position where the hold-to-run control is actuated;
- ensuring that the centre of gravity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

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

5.3.2.2 Guard dimensioning, positioning and safety distances

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 fixed guard. This is achieved by being in accordance with the requirements of ISO 13857:2019.

Dimensions in millimetres

**Key**

- 1 rolls with different diameters
 2 guard
 d_1, d_2, d_3 three different diameters
 s_1, s_2, s_3 related safety distances

Figure 3 — Measuring safety distance at the in-running nips

When using general guarding rather than nip guarding (see [5.3.4](#).) then safety distances from guards to in-running nips shall be as specified in ISO 13857:2019.

The safety distance according to ISO 13857:2019 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](#)).

5.3.2.3 Guard openings

Guard openings shall be in accordance with the requirements of ISO 13857:2019. For guarding in-running nips that are accessible while a movable guard is open, see [5.3.4](#) and/or [5.3.6](#).

5.3.3 In-running (in-going) nips

Hazards from in-running nips exist, for example, between the following:

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

NOTE 1 An example of a non-powered surface is a roller that is driven by movement of product. For non-powered surfaces, this hazard depends on a number of factors (e.g. type of material, wrapping angle, inertia, etc.).

- b) one surface rotating toward an adjacent fixed part of the machine;
 c) surfaces rotating in the same direction, but with different peripheral speeds;
 d) surfaces rotating in the same direction, but with different surface properties, such as friction;

NOTE 2 Rollers rotating in the same direction do not create a hazardous in-running nip if the rollers have the same surface characteristics and same circumferential speeds.

- e) guide roller and driving belt, conveyor belt, and unwind/rewind devices;
 f) non-powered riding rollers (guide rollers) that are driven by the movement of the product (see NOTE 1).

Examples of in-running nips are shown in [Figure 4](#).

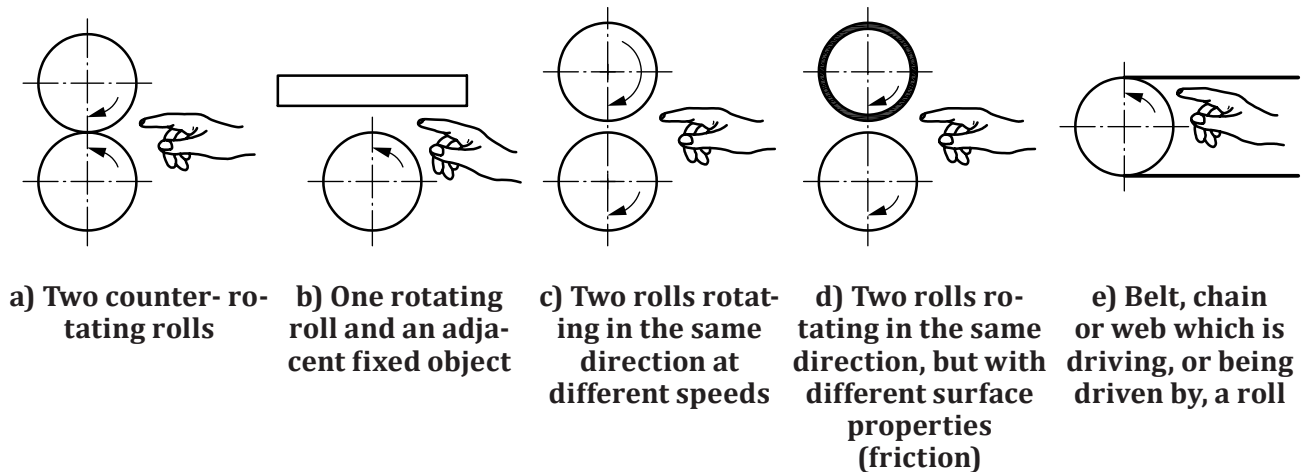


Figure 4 — In-running nips

5.3.4 Guarding in-running nips

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

- barrier guard or fence guard with or without openings; if the guard has an opening, the safety distances shall be established in relation to the width of the opening in accordance with [Table 1](#);
- nip guards, (only allowed on smooth rollers/cylinders), designed in suitable sections and extending across the entire working width (see [Figure 5](#) for examples of nip guards and [Figure 8](#) of unacceptable types of nip guards); and
- trip nip bars shall be in accordance with [5.7.7](#).

In-running nips created by rollers are not considered to be a significant hazard if the maximum draw-in force exerted does not exceed 50 N.

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.

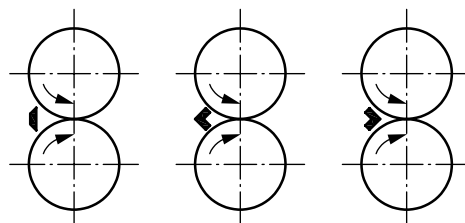
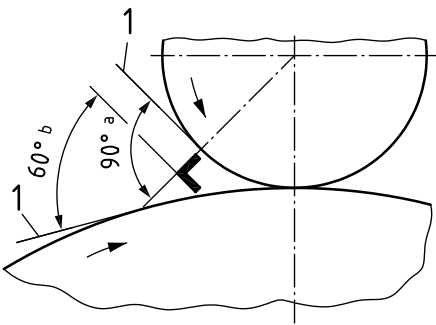


Figure 5 — Examples of nip guards

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 6](#)).



- Key**
- 1 tangent
 - ^a Preferred.
 - ^b Acceptable.

Figure 6 — Minimum cylinder-to-guard angle

Table 1 — Safety distances, L_{sr} for regular openings for persons 14 years of age and above

Dimensions in millimetres

Part of body	Illustration	Opening	Safety distance		
			L_{sr}		
			Slot	Square	Round
Finger tip		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Finger up to knuckle joint or hand		$6 < e \leq 8$	≥ 20	≥ 15	≥ 5
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	$\geq 850^a$	≥ 120	≥ 120
Arm up to junction with shoulder		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

NOTE The dimensions of openings e correspond to the side of a square opening, the diameter of a round opening and the narrowest dimension of a slot opening.

^a If the length of the slot opening is ≤ 65 mm, the thumb will act as a stop and the safety distance may be reduced to 200 mm.

The clearance between the nip guard and the respective machine part shall not exceed 6 mm under its normal operating configuration (for example, plate or blanket installed on the cylinder, if applicable) (see [Figure 7](#)). On small-format machines, the clearance should be smaller, if possible, considering both safety and production concerns.

Dimensions in millimetres

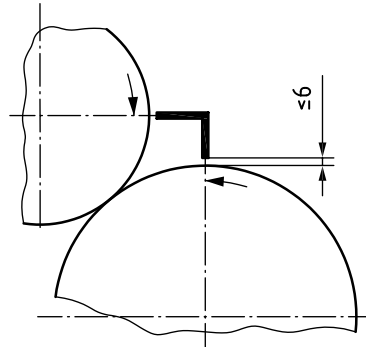
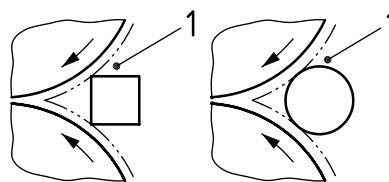


Figure 7 — Safeguarding an in-running nip by means of a fixed nip guard

Nip guards shall not be shaped or oriented such that a “wedge pocket” is created (see [Figure 8](#)). The shapes shown in [Figure 8](#) may be used as trip nip bars, since activation of the trip nip bar stops hazardous motion, as specified in [5.7.7](#).



Key

1 wedge pocket

Figure 8 — Shapes creating wedge pockets (only permissible as trip nip bars)

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

Smooth powered rollers whose surfaces are 120 mm or greater apart are not nip hazards where whole body or head access to the hazard zone is not likely.

Smooth non-powered guide rollers whose surfaces are 75 mm or greater apart are not nip hazards where whole body or head access to the hazard zone is not likely.

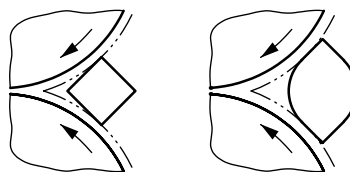


Figure 9 — Shapes not creating wedge pockets

5.3.5 Interlocks

5.3.5.1 Opening an interlocking guard

When an interlocking guard is opened, moved or removed machine motion shall be stopped without creating additional significant hazards, utilizing the maximum braking action established for that machine. When any interlocking guard is open, starting of the machine shall be prevented. Closing or reinsertion of an interlocking guard shall not cause the machine to restart its operation. Machine motion shall not be able to be initiated without the operator going through a normal starting sequence.

The following exceptions are possible.

- If a machine is operating at inching speed and under the conditions defined in [5.3.6](#), motion may continue.
- If a machine is running at a maximum (surface) operating speed of 5 m/min with continuous run and hazards are limited to in-running nips which are guarded with trip guards, motion may continue. Interlocking guards can be open in more than one zone.

5.3.5.2 More than one interlocking guard open

Where more than one interlocking guard is open and there are any unguarded hazard within the zones that cannot be observed from all operating positions, only an inch function or reverse inch function (as specified in [5.7.2.5.5](#)) shall be permitted if

- a) all in-running cylinder nips behind interlocking 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.

5.3.5.3 Interlock design

5.3.5.3.1 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 14119:2013, Clauses 5 and 6, shall be satisfied. For the purposes of this document "permanently fixing", as stated in ISO 14119:2013 7.2 c), allows the use of special fasteners and the addition of sealing materials. Examples of solutions include:

- round-head internal hexagon screws which require a special tool, and
- pop rivets.

5.3.5.3.2 Safety-position switches for interlocking guards

Safety-position switches shall be built in accordance with IEC 60947-5-1:2016+COR1:2016 and IEC 60947-5-3:2013, and shall be installed in accordance with IEC 60204-1:2016+AMD1:2021.

For machines where routine and regular access to a hazard zone is not required, it is sufficient to provide only one safety-position switch for each interlocking guard.

NOTE A single switch is adequate because it is assumed that no safety-related malfunction will occur in switches built and installed to the specified requirements.

The signal processing of the safety position switches for interlocking guards shall meet at least the PL according to ISO 13849-1:2023 for the safety related parts of the control system required for the safety function. See [5.10.1.2](#)

5.3.5.3.3 Protection of electric wires outside the switch cabinet

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

See [5.3.5.3.2](#) and [5.10.1](#) for requirements relating to design of safety-related parts of an electric/electronic control system.

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

5.3.6 Hold-to-run mode

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

When the hazard zone can be viewed from the operating position, machine motion with an interlocking guard open and hazardous points unprotected may be initiated by means of a hold-to-run device under one of 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) would reduce the ability of the machine to perform its function and where there would be no substantial increase in risk.

Safety related parts of control systems of interlocking guard systems for the safety reduced speed/displacement limited condition shall be in accordance with at least PL d of ISO 13849-1:2023 or SIL 2 of IEC 62061:2021. Safety related control systems (including selector switches relays and PLC circuits) that allow interlocked areas to be operated independently shall be in accordance with at least PL b of ISO 13849-1:2023 or SIL 1 of IEC 62061:2021.

Provided that safe speed reduction or limitation of displacement in accordance with PL d of ISO 13849-1:2023 is ensured, the signal release for starting in hold-to-run mode or stopping may be effected by one single contact, if the further processing of signals of the hold-to-run switch/contact is done in accordance with PL d of ISO 13849-1:2023.

Higher displacement or speeds may be possible with a two-hand control based on a task-based risk assessment demonstrating that acceptable risk has been achieved.

Where speeds are greater than 5 m/min, then the maximum speed shall be kept as low as possible and no faster than 10 m/min as long as either a two-hand control is used, or the control is located such that the hazard cannot be reached from the operating position. Any speed greater than 10 m/min shall have a means of achieving a level of safety equivalent to that at 10 m/min unless an exception to this requirement is specified in the requirements for hold-to-run controls.

Any exception to this requirement can be specified in the machine-specific parts of the ISO 12643 series. The hold-to-run speed shall be the slowest possible under procedural requirements.

Any two-hand control device shall meet the requirements specified in [5.7.5](#). The stopping time shall be as short as technically feasible.

See [5.10.1](#) for general requirements for control systems.

5.3.7 Protective measures for accessible hazard zones

5.3.7.1 General

Where safeguarded accessible hazard zones cannot be observed from positions from which hazardous movements can be started, the requirements of [5.3.7.2](#) to [5.3.7.4](#), shall apply.

5.3.7.2 Fence-type enclosures

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

- a) it shall not be possible for one or more persons 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.

EXAMPLE 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 13857:2019.

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

5.3.7.3 Electro-sensitive protective devices

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

NOTE For example, accessible safeguarded hazard zones are areas generally protected by means of 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 be in accordance with [5.7.6](#).

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

Pressure-sensitive mats, pressure-sensitive bumpers and trip nip bars shall function in accordance with [5.7.7](#).

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

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

For safety-related applications, the approach speed specified in ISO 13855:2010 shall be used as a basis for determining the correct positioning of the pressure-sensitive mats.

5.3.7.5 Auxiliary devices that act as guards

Auxiliary devices (see [3.4](#)) that act as 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 hazard zones, 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 5.3.5).

NOTE For example, auxiliary devices that prevent access to hazard points in their built-in position might be continuous flow drying devices on the delivery side of sheet offset printing presses where drying modules are inserted into the printing press from the side that, when removed, allow access to hazard points on the sheet gripper system. A pre-melter on a binder is another example of an auxiliary device that prevents access to the hazard point.

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

5.3.8 Guarding reel unwinding, rewinding and transport devices

5.3.8.1 Hazard point between reel and belt

On unwinding and rewinding devices where the reel is driven by a belt on the reel circumference (see Figure 10), the hazard point between the reel and the belt shall be safeguarded if the force between belt and reel is more than 300 N.

EXAMPLE This can be achieved by the use of interlocking guards or fence-type enclosures.

Safeguarding can also be required for force less than or equal to 300 N if a hazard is created by the speed of the machine.

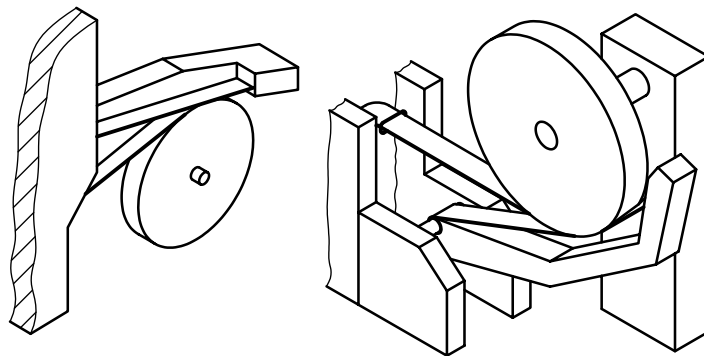


Figure 10 — Belt drives

Guards shall be provided for protecting the in-running nips on the drive belt guide rollers (see Figure 11).

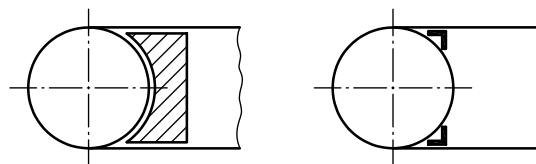


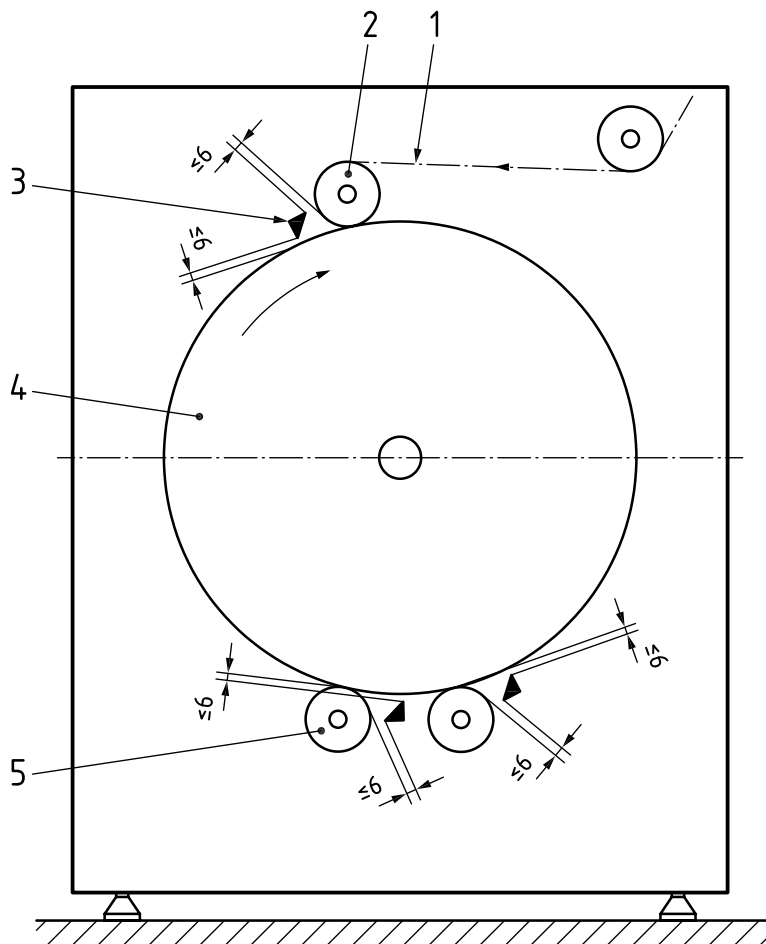
Figure 11 — Examples of safeguarding of belt in-running nips on belt drives

5.3.8.2 Drawing-in nips at reel unwinding and rewinding devices with support rollers or bearer drums

On unwinding and rewinding devices, the in-running nips between material reel, and support rollers shall be safeguarded (see 5.3.4) by means of guards or safety devices having approach reaction [trip devices, pressure-sensitive mats, electro-sensitive protective devices (ESPDs)]. The safety device selected shall be effective for all reel diameters. Access to the in-running nip from the side shall not be possible.

In-running nips created by rollers are not considered to be a significant hazard if the maximum force exerted does not exceed 150 N.

For trip devices and pressure-sensitive mats, see [5.3.7.4](#) and [5.7.7](#). For electro-sensitive protective devices (ESPDs), see [5.3.7.3](#) and [5.7.6](#).



Key

- 1 web
- 2 pressure roller
- 3 protective profile
- 4 driven material reel
- 5 bearer drum

Figure 12 — Example of a bearer drum roller with safeguards

5.3.8.3 Requirements for chucking cones for manual reel loading and unloading

Where shaftless unwinding or rewinding is used, the chucking cones in the loading and unloading area (see [Figure 13](#)) shall be designed so that they can be inserted only in the hold-to-run control mode. Control devices shall be arranged such that hazard points between chucking cones and reel can be observed from the position of the hold-to-run control allocated to the unwinding and rewinding unit. The hold-to-run speed of in/out motion of the chucking cones shall not exceed 5 m/min (see [5.3.6 b](#)).

When the reel is lifted up or moved from the loading and unloading area, the opening of the chucking cones shall not create a hazardous situation, such as crushing the upper body or other irreversible injuries by a reel falling out from the chucks. Therefore, the following is required:

- If the only safety measure is a control system it shall be in accordance with at least PL d of ISO 13849-1:2023 or SIL 2 of IEC 62061:2021; or
- If one or more of the following conditions are met, the control system shall be in accordance with at least PL b of ISO 13849-1:2023 or SIL 1 of IEC 62061:2021:
 - the roll weight is maximum 25 kg;
 - the roll is raised maximum 150 mm from the floor;
- If all of the following conditions are met, the control system shall be in accordance with at least PL c of ISO 13849-1:2023 or SIL 1 of IEC 62061:2021:
 - the distance between full roll and access floor level is a minimum of 180 mm;
 - the shaft is a maximum of 700 mm above access floor level;
 - web speed: lower than or equal to 3 m/s; and
 - roll width up to 520 mm.

The position of the chucking cones in the loading and unloading area shall be monitored to prevent unsafe movement. In cases that could create a hazardous situation, for example crushing the upper body or other irreversible injuries and the only safety measure is a control system, it shall be in accordance with at least PL d of ISO 13849-1:2023 or SIL 2 of IEC 62061:2021.

NOTE 1 With manual reel-loading, the control system check that the full insertion of the chucking cones into the roll takes place within the machine-specific loading and unloading area (see [Figure 13](#), item 4).

For automatic reel-loading, see [5.3.8.10.1](#).

Provisions shall be made to ensure that shaftless unwinding and rewinding units can be started only after the chucking cones are fully inserted.

NOTE 2 This is ensured, for example, by monitoring the position of the chucking cones by means of sensors.

NOTE 3 For example, this can be accomplished for manually operated machines by providing the operator with a clear view of the chucking cones using mirrors or a video monitor. For fully automatic machines, this can be accomplished by using a pressure-sensing monitor.

Where the position of the chucking cones is monitored by sensors, it shall meet the requirements of [5.10.1.2](#). The return movement of the reel core removing device shall not cause any crushing hazard points with the lifting arms. Safeguarding shall be achieved by:

- limiting the return movement to a speed of 0,5 m/min,
- limiting the force to 150 N, or
- limiting speed to 5 m/min in hold-to-run operation.

Higher speeds in hold-to-run operation shall only be possible with two-hand control.