INTERNATIONAL STANDARD

ISO 12643-2

Second edition
2010-12-15

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

Part 2: Prepress and press equipment and systems

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

Partie 2: Systèmes et équipement pour la préimpression et la presse

Reference number
ISO 12643-2:2010(E)

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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 12643-2 was prepared by Technical Committee ISO/TC 130, *Graphic technology*.

This second edition of ISO 12643-2 constitutes a technical revision of the first edition (ISO 12643-2:2007). Significant changes incorporated into this second edition include, but are not limited to, the following:

— inclusion of prepress equipment;

— requirements for performance levels (PL) or safety integrity levels (SIL) as defined in the current version of ISO 13849-1 and IEC 62061, respectively;

— addition of requirements for printing plate changes;

— addition of requirements for emergency stop on auxiliary draw nips.

It is the intent of ISO/TC 130 that both the first and second editions of ISO 12643-2 be applicable until 2011-12-31. ISO 12643-2:2007 is thus provisionally retained until this date.

As from 2012-01-01, ISO 12643-2:2010 will cancel and replace ISO 12643-2:2007. Accordingly, as from 2012-01-01, only ISO 12643-2:2010 will be applicable to new equipment manufactured.

ISO 12643 consists of the following parts, under the general title *Graphic technology — Safety requirements for graphic technology equipment and systems*:

— *Part 1: General requirements*

— *Part 2: Prepress and press equipment and systems*

— *Part 3: Binding and finishing equipment and systems*

— *Part 4: Converting equipment and systems*

— *Part 5: Stand-alone platen presses*

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Introduction

During the development of this part of ISO 12643, 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 part of ISO 12643, that has been noted.

This part of ISO 12643 was developed to harmonize the requirements of the following US and European safety standards:

— ANSI B65.1, *Graphic technology — Safety standard — Printing press systems*

— EN 1010-1, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 1: Common requirements*

— EN 1010-2, *Safety of machinery — Safety requirements for the design and construction of printing and paper converting machines — Part 2: Printing and varnishing machines including pre-press machinery*

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

Part 2:
Prepress and press equipment and systems

1 Scope

This part of ISO 12643 provides safety requirements specific to prepress and press equipment and systems. It is intended to be used in conjunction with the general requirements given in ISO 12643-1.

This part of ISO 12643 provides additional safety requirements for the design and construction of new prepress and press equipment, and the auxiliary equipment integrated into the press control system.

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

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

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

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

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

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

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

EN 1539, *Dryers and ovens in which flammable substances are released — Safety requirements*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12643-1, ISO 13849-1 and the following apply.

3.1
access height
〈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)

NOTE See Figure 1.

3.2
alcohol dosing equipment
device(s) used to regulate the amount of alcohol in the dampening water of offset printing presses

3.3
automatic plate-clamping device
mechanism used to secure a printing plate during the automatic or semi-automatic changing of the plates

3.4
bypass
temporary, time-limited suppression of one or more safety functions through the use of safety-relevant parts of a control system

3.5
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

3.6
continuous-flow drying and curing device
mechanism built into printing presses to dry and cure inks and coatings that have been applied to substrates

EXAMPLE Hot air, IR or UV radiation.

3.7
crawl speed
continuous movement at a steady slow speed, and initiated by a momentary contact control

3.8
cylinder screen printing press
sheet-fed machine in which the substrate (sheet) to be printed is pressed against the screen by an impression cylinder

3.9
digital printing machine
machine used in commercial/industrial applications where the printing image is produced in the machine from data stored in digital form and transferred to the substrate without the use of a printing plate

NOTE This includes digital printing presses and wide-format ink jet printing devices.

3.10
draw roller
power-driven roller that pulls a substrate

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3.11
enabling device
mechanism that needs to be in a specified state or condition in order for a second actuator or device to start a machine under hold-to-run control, 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

3.12
forms printing press
leporello printing press
machine for the production of continuous forms where paper webs printed with one or more colours are accordion-folded or wound onto 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.

3.13
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 (device for scraping excess ink off a gravure cylinder); 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

3.14
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

3.15
powder-spraying device
equipment used to spray powder onto the printed material on the delivery side of sheet-fed printing presses

3.16
prepress equipment
machines used in the first stage of the graphic technology workflow, prior to printing, that include all the operations necessary for the preparation of images and image carriers

NOTE Adapted from ISO 12637-1.

3.17
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

3.18
printing plate
base material that stores the image to be printed (pictures and/or text) and transfers ink onto a substrate, thus printing the image

3.19
printing table
supportive surface to hold the substrate to be printed during the printing process (as on certain types of screen printing presses)

3.20
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 plate is mounted in the production machine

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3.21
reel rewinding device
part of a machine used for rewinding the processed web-type material

3.22
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

3.23
reel unwinding device
part of a machine used for unrolling web-type material for processing

3.24
screen frame
device for taking up the printing screen

3.25
screen printing press
machine using printing plates with woven material (sieve-like screens) that partially allow ink to penetrate through the material

3.26
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

3.27
speed limit
control that, when activated, prevents acceleration of machine motion

3.28
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, etc.

3.29
washing equipment for printing plates
machines for washing printing plates outside the printing press

EXAMPLE Screen washing equipment.

3.30
web-fed press
press in which a substrate passes through the printing couple(s) in a continuous form, as fed from a roll

3.31
web-type material
web of paper, board, foil or similar material that is to be handled or processed

4 Conformity with this part of ISO 12643

In order to claim conformity with this part of ISO 12643, all equipment manufactured as of 2012-01-01 shall be in accordance with this second edition of ISO 12643-2 rather than ISO 12643-2:2007.

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5 Equipment subject to requirements

5.1 General

This part of ISO 12643 is applicable to the equipment listed in 5.2 to 5.4. This equipment may be used in a stand-alone configuration, or in combination with other machines affected by an integrated control system. This may include combinations of the machines noted below.

NOTE This part of ISO 12643 is intended to include the wide range of equipment used in the printing process. The equipment listed in 5.2 to 5.4 provides examples of the more typical equipment covered by this part of ISO 12643, but is not all-inclusive.

5.2 Prepress equipment

The following prepress equipment is covered by this part of ISO 12643:

a) exposure equipment for the production of films and printing formes;

b) equipment for developing films and printing formes;

c) washing machines for printing formes;

d) machines for bending printing formes;

e) punching machines for film and printing plates;

f) cutting machines for film and printing formes;

g) machines for the production of gravure printing formes;

h) scanners;

i) proofing presses.

5.3 Printing presses and coating/varnishing machines

The following are machines used for printing by various processes and are covered by this part of ISO 12643:

a) relief (letterpress, flexographic);

b) offset (lithographic);

c) sheet-fed printing presses, including coating/varnishing machines;

d) web-fed rotary presses, including coating/varnishing machines and similar machinery;

e) gravure (rotogravure, intaglio);

f) screen printing;

g) digital printing machines (electrostatic, ink jet, thermal, airbrush, etc.), including sheet-fed digital printing machines, web-fed digital printing machines, wide-format ink jet machines and similar machinery;

h) combination presses (e.g. offset/flexo/screen).

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5.4 Other equipment covered by this part of ISO 12643

In addition to the equipment listed above, the following equipment is also covered by this part of ISO 12643:

a) washing equipment for cylinders and rollers;

b) washing equipment for printing plates, rollers and scrapers;

c) varnishing equipment;

d) powder-spraying devices;

e) alcohol dosing devices;

f) imprinting/addressing/numbering equipment;

g) automatic plate-clamping devices, automatic pile-handling equipment;

h) washing equipment;

i) inserting machines;

j) pile turners, reel turners, elevators;

k) dryers/pollution control, including continuous-flow drying devices, ultraviolet curing, infrared drying, electron beam, hot air, etc.;

l) radiation equipment;

m) in-line processing and finishing equipment;

n) stackers;

o) palletizers;

p) bundlers;

q) coaters;

r) chilling systems;

s) electrostatic equipment;

t) humidifiers;

u) accumulating or piling-off devices;

v) conveyors;

w) unwinding, rewinding, reel transport devices;

x) measuring and control devices;

y) auxiliary devices on inking and dampening units.

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6 Guarding of significant hazards

6.1 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. The guarding requirements of ISO 12643-1 and this part of ISO 12643 apply.

6.2 Guard openings

Guard openings shall comply with ISO 12643-1.

In addition, 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-adjusting 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, guarding in accordance with ISO 13857 (as required by ISO 12643-1) 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.

6.3 Guarding in-running nips

6.3.1 Guarding in-running nips on sheet-fed presses

If technically feasible, trip nip bars in accordance with ISO 12643-1, shall be used where frequent access is required to the area during machine motion, and cylinders are directly accessible after the interlocking guard has been opened.

If it is not possible to use trip nip bars as described above, hold-to-run control speed limitations defined in ISO 12643-1 apply.

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

Where cylinders have gaps that exceed those defined for smooth cylinders (see ISO 12643-1), trip nip bars in accordance with ISO 12643-1 should be used. Nip guards shall not be used with these cylinders. For such trip guards, the requirements of PL_r d of ISO 13849-1 or SIL 2 of IEC 62061 shall be satisfied and the interlocking system shall be designed such that the requirements for stopping paths defined in ISO 12643-1 are satisfied. Trip nip bars and cylinder gaps shall be designed such that cylinder nips cannot be accessed behind trip nip bars, causing a hazard.

To comply with the requirements of ISO 12643-1, the interlocking systems will normally have to be designed such that, after opening the interlocking guard, a predetermined number of revolutions, depending on the functional characteristics of the trip guard, is not exceeded.

6.3.2 Guarding in-running nips on web-fed presses

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

NOTE For example, such measures include:

— guarding;

— an electrically interlocked, movable nip bar on the outgoing side between the two blanket cylinders of a web offset printing press, that ensures that the bar is in position prior to reverse movement.

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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:

— the speed shall not exceed 3 m/min;

— the 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 distinctive audible warning signal, different from the audible warning signal used for forward inch, 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.

6.3.3 Guarding in-running cylinder nips on newspaper presses

In deviation from ISO 12643-1, nip guards may be used for web-fed newspaper printing presses on cylinder gaps of up to 19 mm circumferential slots. For new machines, however, efforts should be made to limit cylinder gaps to 12 mm circumferentials slots.

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.

6.3.4 Guarding in-running nips on cylinder screen printing presses

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

NOTE This can be achieved, for example, by interlocking guards, or guarding by the screen printing plate.

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

Such additional measures can include electrical interlocking, which allows cylinder rotations only under hold-to-run control in accordance with ISO 12643-1 as long as the printing plate is lifted.

6.4 Interlocks

6.4.1 General

Interlocks shall function in accordance with ISO 12643-1.

6.4.2 Continuous motion at crawl speed with an interlocking guard open

As an exception to ISO 12643-1, if the only hazard being protected by the interlocking guard is an in-running nip, continuous machine motion at crawl speed with a guard open shall be permitted only if all in-running nips remain guarded by either a nip guard or a trip nip guard conforming to the requirements of ISO 12643-1. Maximum crawl speed is determined by the ability of the slowest acting trip nip guard to safeguard the hazard.

6.4.3 Closing an interlocking guard

As an exception to ISO 12643-1, closing the interlocking guard on dampening, coating or inking devices may initiate the rotation of dampening or coating ductor rollers or metering rollers if it is ensured that, at this time, no hazard points can be accessed.

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

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6.5 Hold-to-run controls

6.5.1 General

In addition to the requirements of ISO 12643-1, the specific requirements set forth in 6.5.2 and 6.5.3 apply.

6.5.2 Specific requirements for sheet-fed presses

When interlocking guards are opened and any exposed hazard point is not safeguarded, sheet-fed printing press systems shall only be allowed to be started under hold-to-run in accordance with ISO 12643-1.

When interlocking guards are opened and all hazards are protected, crawl speed is permitted under the provisions of 6.4.2.

When interlocking guards are opened and direct access to unprotected in-running nips on plate cylinders, blanket cylinders, and impression cylinders, or unprotected hazard points on the sheet transport system is possible, the machine may be started under hold-to-run control in accordance with ISO 12643-1, with a maximum speed of 1 m/min or a displacement limited to a maximum of 25 mm.

NOTE 1 Sheet-fed presses usually have non-smooth cylinders with large gaps that are more hazardous than smooth cylinders on web presses.

NOTE 2 Examples of “sheet transport systems” include gripping systems and transport drums.

NOTE 3 For example, direct access is possible where such in-running nips can be reached in the event of a person inadvertently entering a hazardous area, or where nips are located in the immediate vicinity of places where setting-up or cleaning operations need to be performed.

6.5.3 Specific requirements for forms presses

In deviation from the requirements for hold-to-run controls specified in ISO 12643-1, 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 when this is required for production reasons and all of the following requirements are met:

— other interlocking guards that cannot be seen from the operating position shall be closed;

— a selector switch shall be used for this kind of operation;

— the hold-to-run speed shall be as low as possible under production conditions;

— a warning shall be provided in the instruction handbook (including a statement of the operator's responsibility and a description of safe working practices).

6.6 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.

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

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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 or more of the following methods:

a) provision of trip devices;

b) separate stop device that is not included in the emergency stop circuit of the printing press;

c) zone control using the emergency stop circuit.

6.7 Additional safeguarding methods for machine devices and components

6.7.1 General

General requirements for guarding are specified in ISO 12643-1.

6.7.2 Feeding units, delivery units (pile lifting and lowering devices)

6.7.2.1 Guarding sheet gripper from unintentional hand access

In the area of the sheet delivery, any unintentional access to movable parts of the sheet gripper system from above and from the side shall be prevented by fixed or interlocked protective devices. At the sides and in the area of the sample sheet removal, these protective devices shall reach down at least to the bottom edge of the sheet gripper system.

Any residual risk caused by reaching underneath protective devices (e.g. in order to remove sample sheets or to place wedges in the pile) shall be indicated in the instruction handbook (see ISO 12643-1).

6.7.2.2 Guarding rotating sheet gripper systems from full body access

In the area of rotating sheet gripper systems on sheet deliveries, measures for safeguarding the full body access of persons shall be in place on all access sides if either

— the access height, h, is 800 mm or more (see Figure 1), or

— full body access is necessary more than once a week.

NOTE Full body access more than once a week is generally only necessary when make-ready and cleaning work can be carried out only by accessing the area with the whole body.

6.7.2.3 Safeguarding full body access by electro-sensitive protective devices (ESPDs)

6.7.2.3.1 Arrangement of light beams of ESPDs for machines having a single access level

The light beams of the ESPD on machines having a single access level shall be arranged as specified in Table 1 and shown in Figure 1. For the arrangement of light beams of the ESPD on multi-level machines, see 6.7.2.3.3. The requirements of ISO 13855 relating to the horizontal distance between the light beams and the rotating gripper systems need not be met.

NOTE The primary protective action lies in the prevention of unexpected start-up of the press. In addition, the basic shape of the printing press, the delivery pile carrier and the pile itself prevent or impede unhindered access to the hazard zone, making consideration of access time to the hazard unnecessary.

For information to be provided in instruction handbooks on the residual hazards of ESPDs, see 6.7.2.3.4 and ISO 12643-1.

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Table 1 — Arrangement of the ESPD in relation to the access height

Dimensions in millimetres

Access height	Arrangement of the ESPD in relation to the access level(s)		
h	Light beam 1[a]	Light beam 2[b]	Light beam 3[c]
$h \leqslant 1\,200$	300	not required	400 below h ($h - 400$)[d]
$1\,200 < h \leqslant 1\,500$	300	in the centre between light beams 1 and 3	400 below h ($h - 400$)[d]
$h > 1\,500$	300	700	1 100

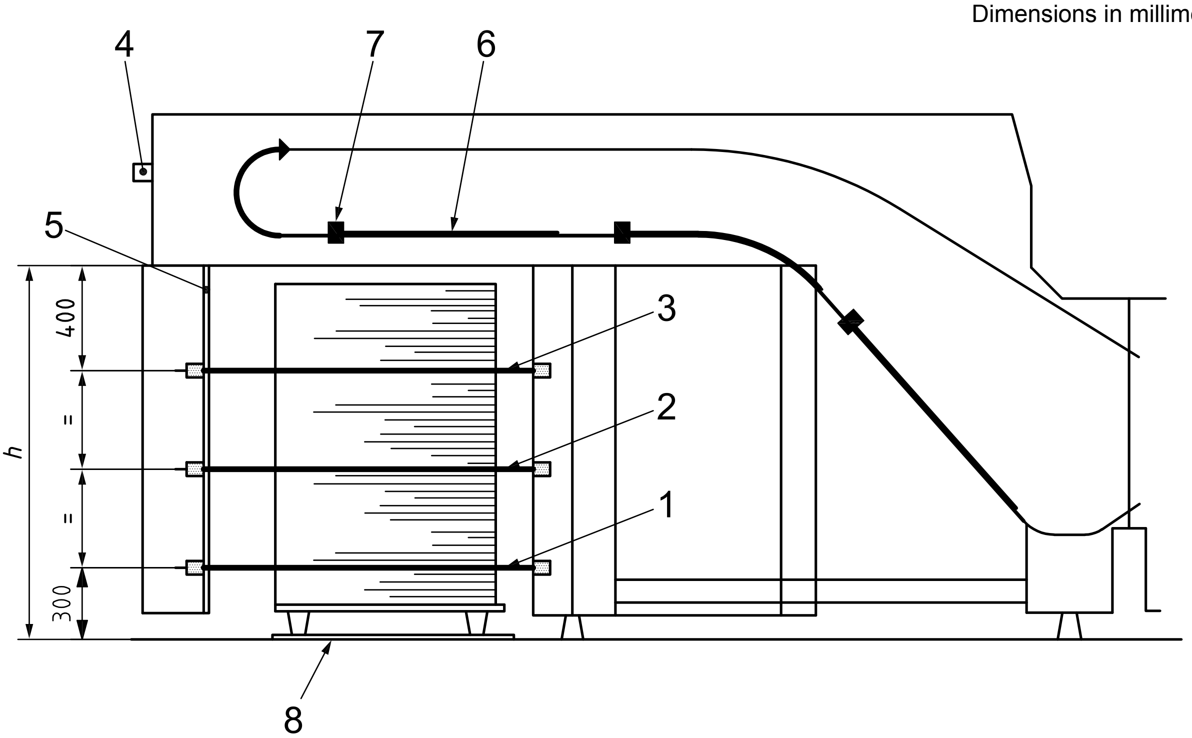
[a] Arrangement measured from the access level or from a fixed or swinging platform; due to the structural tolerances at the location of installation, the permissible tolerance for the arrangement is ±35 mm.

[b] Light beam between light beams 1 and 3, if the distance between light beam 1 and light beam 3 is greater than 500 mm.

[c] A maximum of 1 100 mm in height.

[d] See Figure 1.

Dimensions in millimetres



Key

1 light beam 1
2 light beam 2
3 light beam 3
4 reset button
5 sample sheet removal
6 sheet
7 sheet gripper system
8 access level

h access height

Figure 1 — Access height ⩽1 500 mm in the delivery zone

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6.7.2.3.2 Bypassing light beams

6.7.2.3.2.1 General

For the functions of sample sheet removal, insertion of wedges into the pile, correction of pile formation, exit of the pile, and complete pile removal (including insertion of empty pallets and moving in equipment, such as a hand forklift truck), a time-limited bypass of individual or several light beams is permissible only if the respective requirements for the individual functions are met under the conditions defined in 6.7.2.3.2.2 to 6.7.2.3.2.7.

The duration of the individual bypass sequences shall not exceed 20 s. After that time, the bypassed light beams shall be reactivated automatically.

The bypass function may be activated by either a manual control or an automated sequence.

6.7.2.3.2.2 Bypass function for removing sample sheets

Bypassing only the top light beam (see Figure 1), in the area where sample sheets are removed by the sample sheet removal equipment, shall be permitted only if all of the following conditions are met:

— the machine is in paper run mode (sheets are being delivered);

— the light beams are active on all other access sides of the delivery.

As an exception to the requirements of ISO 12643-1, the detection of the paper run mode, the sample sheet removal equipment and its individual signal processing shall meet the requirements of at least PL_r b of ISO 13849-1 or SIL 1 of IEC 62061.

6.7.2.3.2.3 Bypass function for inserting wedges and correcting the pile formation

Bypassing the top light beam on any single side (see Figure 1) shall be possible only if all the following conditions are met:

a) the bypass control is a pushbutton positioned on the side being accessed;

b) three light beams are installed for safeguarding the access side;

c) all light beams are active on all other access sides.

Bypassing the top beam on the drive side and operator side at the same time is permitted. However, if bypassing the top beam from the front side, bypassing the top beam from any other side at the same time shall not be permitted. See Table 2.

When a bypass function is active and the main drive is at standstill, start-up shall be prevented.

Table 2 — Requirements relating to bypassing top beam

Bypass condition	Permitted/not permitted
Top beam on drive side only	Permitted
Top beam on operator side only	Permitted
Top beam on front side only	Permitted
Top beam on both drive side and operator side	Permitted
Top beam on both drive side and front side	Not permitted
Top beam on both operator side and front side	Not permitted
Top beam on operator, drive and front sides	Not permitted

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6.7.2.3.2.4 Bypass function for inserting empty pallets and moving in equipment

Bypassing the bottom light beam (see Figure 1) on the side being accessed shall be possible only if all the following conditions are met:

a) the bypass control is a pushbutton positioned on the side being accessed;

b) three light beams are installed to safeguard the access side;

c) the auxiliary pile support (e.g. rake, wooden pile board, roller blind) or an equivalent device prevents access to the hazard zone;

d) all top and middle light beams on all access sides and all bottom light beams on all other access sides are active;

e) the pile support plate is raised no more than 120 mm.

Detection to determine correct positioning of the auxiliary pile support (preventing access to the hazard zone) may be done by means of a safety position switch, which is activated when the plate is in the correct position. In this case, the safety position switch does not require a separate actuating element. The switch control system shall comply with PL_r d of ISO 13849-1 or SIL 2 of IEC 62061.

NOTE Since metal rods and wooden boards, which need to be removed from the press and can be used for several presses, are used as auxiliary pile supports, it is not possible to use encoded safety position switches with separate actuating elements.

6.7.2.3.2.5 Manual bypass function for pile removal, including inserting empty pallets

Bypassing the light beams on the side where the pile is exiting shall be possible only if all the following conditions are met:

a) the pile removal control is located on the side from which the pile exits the delivery zone;

b) the machine is in press run mode;

c) the pile support plate is no more than 120 mm above the floor;

d) the paper run has been present and detected since the last pile removal and the last tripping/malfunction;

e) three light beams are arranged to safeguard the access side;

f) all top, middle and bottom light beams on all other access sides are active during the entire process.

The bypass sequence shall meet all of the following requirements:

— bypass only the bottom light beam (see Figure 1) on the removal side for not more than 20 s;

— during this time, a sensor is to be triggered, which detects the exit of the pile and switches off the light beams on the exit side for a maximum of 20 s;

— light beams 2 and 3 (see Figure 1) shall be reactivated automatically after this time (maximum of 20 s) has elapsed;

— light beam 1 (see Figure 1) remains switched off for a further duration of maximum 20 s while inserting the empty pallet;

— during this period (maximum 20 s), it is possible to bypass the bottom light beam (see Figure 1) for only one additional period of 20 s by activating the remove pile control again;

— the bottom light beam (see Figure 1) is automatically activated again after the expiration of its bypass time.

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6.7.2.3.2.6 Automatic bypass function for pile removal

Bypassing the light beams at the side where the pile is moved out shall be possible only if there is a means of detecting the direction of the pile movement from the safeguarded area to a position outside the safeguarded area.

NOTE The press is in an automatic mode and needs to sense when the pile is full so that it can be removed. So that the pile can move outside the safeguarded area, the light beams require disabling to allow the press to continue running while the pile movement is occurring. Once the pile has moved past the plane of the light beams, the light beams are reactivated.

Pile removal may be detected by the use of one or more sensors (e.g. ultrasound, light beam, etc.), arranged inside the delivery zone, behind the ESPD.

The machine shall be designed such that the sensors cannot be easily defeated or bypassed.

EXAMPLE Defeat or bypass of the sensors can be prevented, for example, through the arrangement of sensors, a plausibility check of signals, etc.

As an exception to the requirements of ISO 12643-1, the sensor and the related control system shall meet the requirements of at least PL_r b of ISO 13849-1.

6.7.2.3.2.7 Status lights for bypass function

A yellow status light shall be used to indicate that the bypass function is activated (released automatically or at the push of a button). The end of the bypass duration may be indicated by the yellow status light flashing. A green status light shall be used to indicate that all light beams are activated and uninterrupted. The interruption of a light beam shall be indicated by a red status light. The status lights shall be placed on all access sides that are protected by light beams. The integration of the status lights into the control system may be single-channel, e.g. via an electronic control system. Status lights shall be positioned in such a way as to ensure that they cannot be confused with the optional personnel warning lights defined in ISO 12643-1, if used.

6.7.2.3.3 Machines with multiple access levels

On machines with several access levels (e.g. with movable platforms), the protective measures described in 6.7.2.3.1 to 6.7.2.3.2.7 shall be provided on every access level (see Figures 2 and 3).

Figure 2 shows two reference levels, one for the ground and one for the platform. This requires a set of light beams on each side, positioned at a height appropriate for that reference level. Figure 3 shows a situation in which a movable ramp may create an additional reference level on that side, and necessitates additional light beams to ensure that all reference levels are considered.

When the movable platform is raised, the light beams of the exiting side of access level 1 (Figure 3, item 3) shall be activated.

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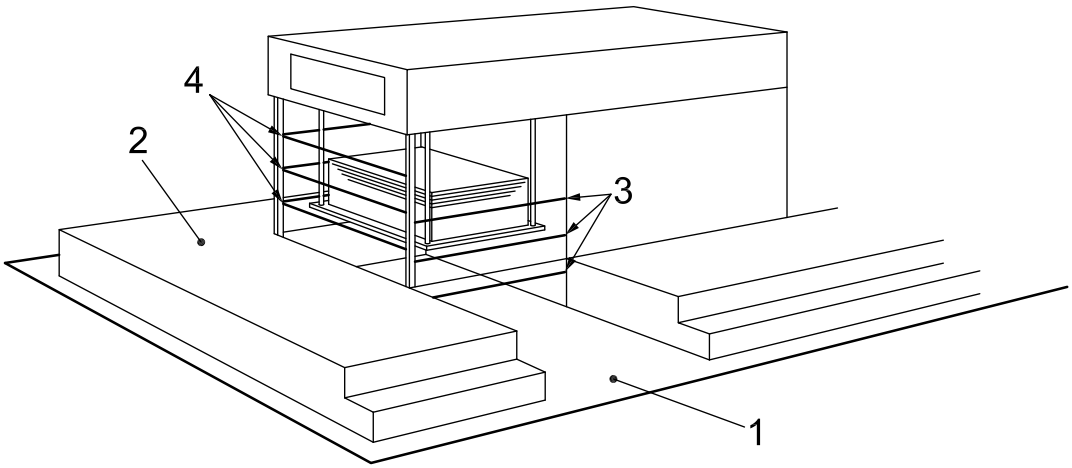
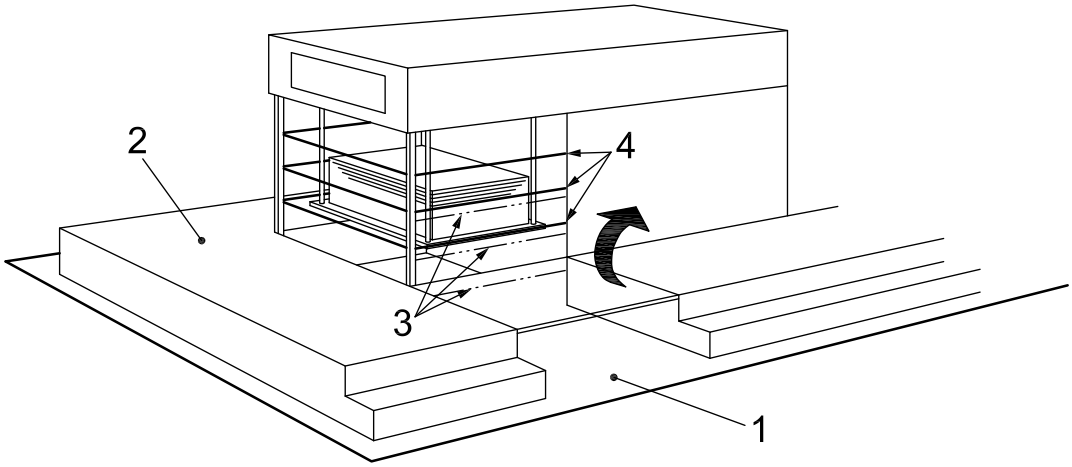


Key

1 access level 1 (e.g. pile exit)
2 access level 2 (e.g. platform, footboard)
3 light beams of level 1
4 light beams of level 2

Figure 2 — Multiple access levels without movable platform



Key

1 access level 1 (e.g. pile exit)
2 access level 2 (e.g. platform, footboard)
3 light beams of level 1
4 additional light beams of level 2

Figure 3 — Multiple access levels with movable platforms

6.7.2.3.4 Information on ESPDs in the instruction handbook

When using ESPDs to safeguard the delivery, all residual risks that still exist shall be indicated in the instruction handbook in accordance with ISO 12643-1.

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6.7.2.4 Other methods of full body access safeguarding

As an alternative to safeguarding in accordance with 6.7.2.3, full body access safeguarding can be achieved using one or more of the following methods, providing an equivalent level of safety is met:

a) fixed and interlocking guards (see ISO 12643-1 for requirements);

b) pressure-sensitive mats (see ISO 12643-1 for requirements);

c) laser scanners;

d) trip bars;

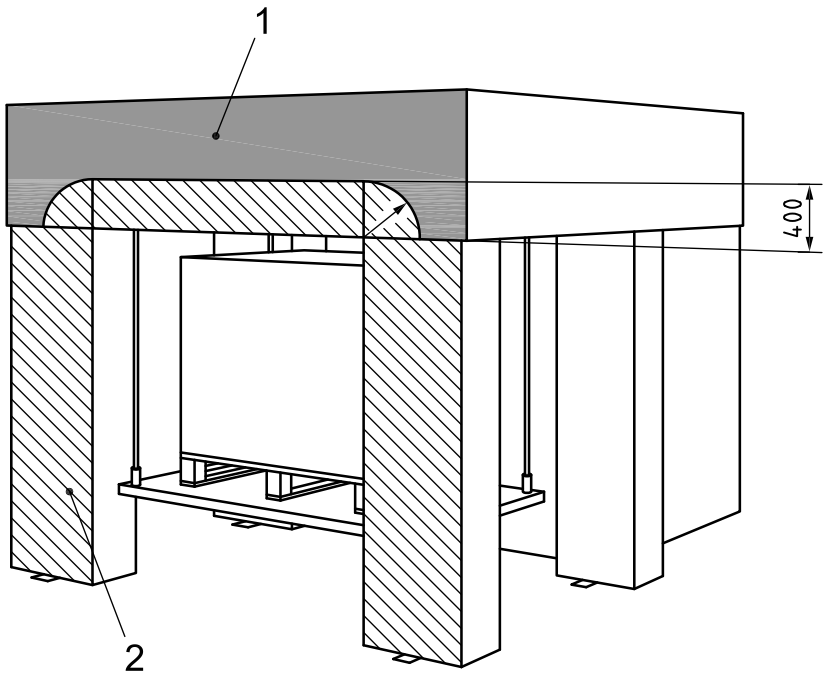
e) light curtains.

6.7.2.5 Reset control for feeding and delivery units

The reset control shall be placed in a location from which the hazard area can be fully viewed and reaching the reset control from inside the hazard area is prevented. This requirement is met if the reset control is inside the permissible area at least 400 mm away from, but not lower than, the bottom edge of the press contour (see Figure 4).

NOTE The reset control is defined in ISO 12643-1.

Dimensions in millimetres



Key

1 permissible area

2 not permissible area

Figure 4 — Permissible area for reset control location

On presses having several access areas where all hazard zones cannot be fully viewed from a single location, additional reset controls shall be provided. This is to ensure that the hazardous area affected by each of the reset controls can be viewed from the position of that reset control.

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EXAMPLE Examples of presses having several access areas where all hazard zones cannot be fully viewed from a single location include elevated presses or presses with dual deliveries.

In the following circumstances, it shall be necessary to press the reset control before movement in the delivery area can be initiated using a separate control:

— after switching on the press at the main switch;

— after activating the ESPDs;

— when the protective device that safeguards full body access to hazard areas has been tripped.

EXCEPTION — It is not necessary to press the reset control if persons inside the hazard area are safely detected due to the construction of the protective devices (e.g. laser scanners).

Pressing the reset control shall not lead to an automatic start-up of machine motion.

EXCEPTION — Pressing a reset control may initiate motion of both the main pile and auxiliary pile system.

NOTE This is to allow the operator to quickly reset the pile system within the time period allowed before the machine stops.

6.7.2.6 Safeguarding the sheet gripper system

The delivery is considered to be sufficiently safeguarded against full body access to the hazard zone of the sheet gripper system under the following operating states.

a) While the delivery is separated from the drive train using couplings, the coupling action and restart shall not cause any hazardous movements.

b) The opening above the pile carrier or the moved-in auxiliary pile support (e.g. rake, wooden pile board, roller blind) or equivalent device shall be no greater than 160 mm.

c) While the press is delivering material to a raised pile support plate or to an auxiliary pile support (e.g. rake, wooden pile board, roller blind) or equivalent device; and the presence of the pile support in use is detected either at insertion or by the time it has reached 160 mm below the access to the hazard; and the opening above the uppermost pile carrier shall be no greater than 300 mm; and no change of state of the main drive has occurred.

d) While the machine is at a standstill, the use of horizontal light beams, arranged underneath the gripper system in accordance with ISO 13855, shall prevent the start of the machine (see Figure 5). If the existing light curtains do not meet the requirements of ISO 13855, other protective devices shall be provided in accordance with 6.7.2.2. The distance between the individual light beams underneath the gripper system shall not exceed 40 mm.

If none of the above conditions exist, the delivery shall not operate without the presence of additional safeguarding against entry into the hazardous area.

For example, if the pile support has not been detected by the time it has descended to a distance of 160 mm below the access to the hazard, the machine shall either shut down or the hazardous area shall be protected by additional safeguarding, such as light beams, guards, etc.

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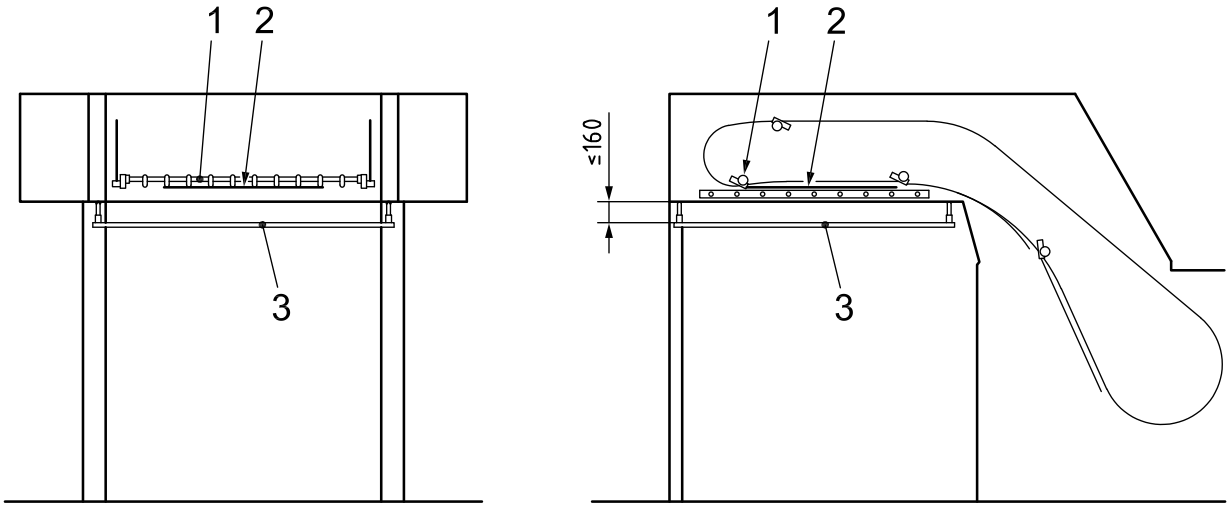
Dimensions in millimetres

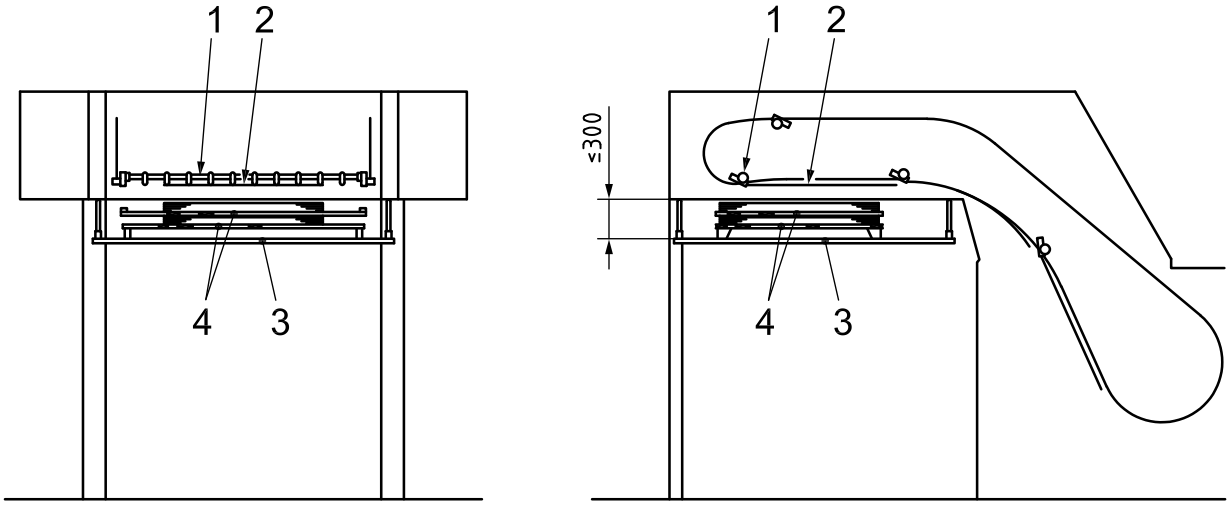


Key

1 sheet gripper system
2 sheet
3 pile carrier

a) Front and side views with pile carrier support in place ($\leqslant$ 160 mm)

Dimensions in millimetres



Key

1 sheet gripper system
2 sheet
3 pile carrier
4 pile support

b) Front and side views with pile and pile carrier support in place ($\leqslant$ 300 mm)

Figure 5 — Guarding of sheet gripper system (*continued*)

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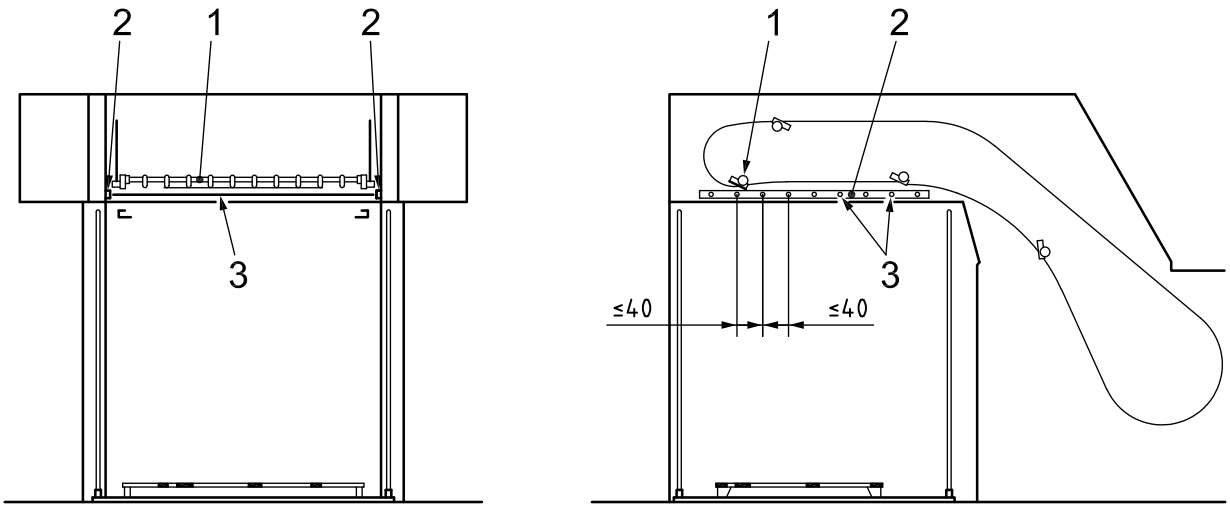
Dimensions in millimetres



Key

1 sheet gripper system

2 sensor parts

3 light beams

c) Front and side views with light beams ($\leqslant$ 40 mm)

Figure 5 — Guarding of sheet gripper system

6.7.2.7 Guarding the area beneath the pile carrier on presses having an access height of 800 mm or more

On presses having an access height to the delivery of 800 mm or more (see 6.7.2.2), access to the area beneath the pile carrier plate and the lowerable auxiliary pile device shall be safeguarded in addition to safeguarding the edge of the pile carrier plate in accordance with ISO 12643-1. This safeguarding shall be achieved using area protection devices with ESPDs or other protective devices in accordance with 6.7.2.3 and 6.7.2.4. The bypass functions as defined in 6.7.2.3.2 also include safeguarding of the area beneath the pile support systems.

The two-beam provisions of ISO 12643-1 may be applied provided there is alternative guarding for the movement of the gripper bars.

Independent movement of the pile carrier without the use of additional guarding defined in 6.7.2.3.1 or 6.7.2.3.2 is also permitted by hold-to-run control if the hazardous area can be viewed from the position of the hold-to-run control.

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6.7.3 Transport carriages

Where transport carriages are driven automatically and cylinders are handled automatically, the hazard points between fixed and movable parts shall be safeguarded by one or more of the following measures:

a) trip devices and/or photoelectric curtains;

b) hold-to-run control as defined in ISO 12643-1 where hazard points are within operator's view from the location of the hold-to-run control;

c) safeguarding the hazard zone as described in 6.2 and ISO 12643-1.

Carriages for transporting cylinders shall be resistant to tilt and shall be secured against unintended travel (see ISO 12643-1). Where carriages are moved manually, handles shall be provided.

Cylinders on the carriage shall be secured against falling by means of securing supports or safety stirrups.

When removing printing cylinders, hazardous overtravelling on the transport carriage shall be prevented by the use of mechanical stops.

6.7.4 Guarding plate-clamping devices

Movements of automatic plate-clamping devices shall be safeguarded. Means of safeguarding include, but are not limited to, the following:

a) fixed or interlocking guards in accordance with 6.2 and ISO 12643-1;

b) trip nip bars in accordance with ISO 12643-1 (satisfying the requirements of PL_r d of ISO 13849-1 or SIL 2 of IEC 62061);

c) electro-sensitive protective devices in accordance with ISO 12643-1;

d) limiting operating force to a non-hazardous level;

e) limiting maximum clearance between movable and fixed parts to 4 mm.

6.7.5 Continuous-flow drying devices on web presses

For continuous-flow drying devices, when guards cannot be used to protect against heat hazards, a warning shall be provided in accordance with 14.6.5. See ISO 12643-1 for requirements relative to warnings on machines with hot machine parts.

6.7.6 Folders for web presses

6.7.6.1 Exception for folder set-up

Where access to the folder is required for folder set-up, speeds up to 8 m/min are permitted with the one or more guards open in accordance with the requirements of ISO 12643-1.

EXAMPLE For removing waste sheets.

6.7.6.2 Exception for folder delivery guarding

In contrast to the requirements of ISO 12643-1, the distance between the guard and the delivery surface shall be no more than 75 mm, regardless of the distance between the unguarded access area and the hazard (see Figure 6).

The distance between the delivery fly (fan) and the enclosure that forms an in-running nip shall be a minimum of 120 mm (see Figure 6).

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Dimensions in millimetres

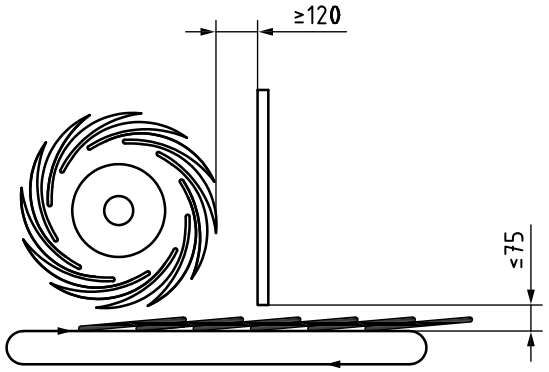

Figure 6 — Openings for folder guards

Folders shall be designed to allow observation of moving components or product flow, and to allow adjustments to folder operation with the guards closed.

NOTE 1 An example of a means of allowing adjustments with the guards closed would be the provision of a transparent guard or remote viewing system by which the necessary observation of moving components or product could be made.

EXCEPTION — It is recognized that there may be areas in the folder delivery that cannot be observed with the guard closed, and it may be necessary for an authorized person to observe moving components or product flow at production speed with an interlocking guard open. Under these circumstances, alternative safety measures shall be taken. All adjustments shall be made from outside the hazardous area.

The following alternative safety measures shall be taken.

— A mechanical key lock shall be provided adjacent to the access area. There shall be only one key for this lock. The key for this lock shall be accessible only by an authorized person.

— The key lock shall be interlocked with a timer that has a maximum capability of 4 min. See Note 2.

— When the key is inserted into the lock, the interlock on the guard is overridden for a maximum of 4 min, and the authorized person can access the area.

— The bypassing means shall meet the requirements of PL_r d of ISO 13849-1 or SIL 2 of IEC 62061.

— When adjustments are necessary, they shall be performed from outside the hazardous area.

— When the key is removed from the lock, the timer shall automatically stop and the interlock on the guard shall be automatically reactivated.

— If the guard remains open longer than the allotted time, the interlock on the guard shall be automatically reactivated and the press safety system shall stop machine motion.

NOTE 2 This exception might not comply with current European standards.

NOTE 3 An alerting mechanism can be helpful in warning the operator that the allotted period is about to elapse.

A hazard label warning of the possible existing hazards with the guard open shall be provided adjacent to the lock. The label shall clearly indicate that when the key is in the lock, the adjacent guard is overridden.

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If a machine is provided with this alternative safety measure, information regarding its safe use shall be contained in the instruction handbook.

Under no circumstances shall the guards in the cutting area of the folder be designed in such a manner that allows them to be open during machine motion at production speed.

6.7.7 Safety distances for web feed on web-fed presses

In the areas where the web on a web-fed press is fed through a webbing slot, if it is impossible to apply the safety distances specified in ISO 13857 (as required by ISO 12643-1), a safety distance of 200 mm shall be observed for gaps with a width of more than 20 mm and less than 30 mm.

Where web material runs over passageways, the height of the passage shall be at least 2 m. If this is not possible for design reasons, and if there is a risk of injury to face and neck, web edges shall be safeguarded, e.g. by use of a guard with black and yellow markings.

EXCEPTION — As an exception to the requirements of ISO 12643-1, a maximum operating speed of 10 m/min is permitted for web-up on newspaper presses. Under this exception, to initiate machine motion at 10 m/min, a special web-up mode shall be added to the control system.

NOTE This exception might not comply with EN 1010-1[13] or the Machinery Directive[10][11].

6.7.8 Screen printing presses

6.7.8.1 Crushing point between screen printing frame and machine frame

The crushing point between the screen printing frame (upper unit holding the screen printing stencil) and the machine frame (table) shall be safeguarded. This shall be accomplished by one or more of the following methods.

a) Using trip devices, which shall be arranged such that their operation is positively ensured each time the gap between screen printing frame and machine table is accessed. Hazardous reaching over the device shall be prevented. The force to operate the device shall be a maximum of 300 N (dynamic). Where the material is manually fed directly between the screen printing frame and the machine table, and the stopping function of the device is being tripped by safety position switches, a trip device shall be arranged with redundant safety position switches to ensure initiation of the stopping operation, even in the event of a single switch failure.

b) Using ESPDs, the arrangement of which shall take account of the hand approach speed as defined in ISO 13855. Such devices shall be arranged such that it is not possible to access the machine between two adjacent beams or to defeat them.

c) Limiting the closing force of the screen printing frame to a non-hazardous low level. A non-hazardous level is a maximum of 300 N if there are no crushing hazards due to sharp edges.

d) Using fixed guards in accordance with ISO 13857 that can be provided on that side of the machine where access for feeding and ink replenishment is not required.

6.7.8.2 Crushing point between doctor blade and screen printing frame

The crushing point between the doctor blade and screen printing frame shall be safeguarded.

NOTE This can be done, for example, by adjusting the stop gauge such that the minimum distance of 25 mm between the doctor blade and the screen frame is ensured.

Where various sizes of screen frames are used, the instruction handbook shall give advice on the proper adjustment of stop gauges.

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6.7.8.3 Crushing hazards caused by the movement of the doctor blade

Crushing hazards caused by the movement of the doctor blade shall be safeguarded.

NOTE 1 This can be done, for example, by using the safety distances defined in ISO 13857 between the doctor blade and fixed parts of the printing press.

Where the descending doctor blade causes crushing points between the doctor blade and the printing table or printing cylinder, and where such crushing points cannot be safeguarded for operational reasons, the instruction handbook shall contain a warning of the existing residual risk. The lifting path of the doctor blade shall be as short as possible.

NOTE 2 For example, the crushing point between the doctor blade and the printing table or printing cylinder on screen printing presses can generally not be safeguarded because ink replenishing needs to be done manually.

6.7.8.3.1 Protection during access between screen printing frame and machine frame

Where access between the screen printing frame and the machine frame is required (e.g. for cleaning the screen), a control element shall be provided, in addition to the measures described under 6.7.8.1, that, when actuated, prevents unintended start-up of the machine.

6.7.8.3.2 Protection between movable screen frame and fixed machine parts

On cylinder screen printing presses, safeguarding shall be provided for the crushing point between the movable screen frame and fixed machine parts.

NOTE This can be achieved, for example, by the use of safety distances in accordance with ISO 13854[1], or interlocking guards.

7 Changing of printing plates

7.1 General

The changing of printing plates shall be done with the help of appropriate means for lifting or handling the plates to ensure easy and safe loading and unloading.

7.2 Automatic printing plate changes

If the changing of printing plates is done by automatic operation, the changing of printing plates may be done without printing units being separated during the plate change.

If the cylinder is rotated by automatic means when mounting the plate to the cylinder, hazard points between the cylinder and fixed machine parts (machine frame) shall be safeguarded by one or more of the following measures:

a) use of guards in accordance with ISO 12643-1;

b) use of ESPDs in accordance with ISO 12643-1;

c) use of safety devices with approach reaction (e.g. trip devices, pressure-sensitive mats).

7.3 Semi-automatic printing plate changes

If the changing of printing plates is done by semi-automatic operation (i.e. an operator needs to assist when mounting the plate to the cylinder, and the cylinder is not rotated by automatic means), the hazard points between the cylinder and fixed machine parts (machine frame) shall be safeguarded by one or more of the following measures:

a) use of guards in accordance with ISO 12643-1;

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b) use of hold-to-run control with at least PL_r d of ISO 13849-1 or SIL 2 of IEC 62061;

c) use of a foot pedal (designed as a hold-to-run control with at least PL_r d of ISO 13849-1 or SIL 2 of IEC 62061) if the operator requires the use of both hands when mounting printing plates. Movement shall be limited to a maximum speed of 5 m/min or maximum distance of 75 mm.

8 Requirements for protection against other hazards

8.1 General

Protection shall be provided against other hazards as defined in ISO 12643-1. In addition, the requirements of 8.2 to 8.11 apply.

See Annex A for a list of hazards associated with printing press systems.

8.2 Protection against fire and explosion in continuous-flow devices

8.2.1 Explosion zones

For a list of protection zones against explosion, see Annex B.

8.2.2 Continuous-flow drying devices

8.2.2.1 General

Continuous-flow drying devices built into printing and coating units where flammable substances are released during the drying and/or curing process of the ink or coating shall satisfy the requirements of EN 1539, unless these requirements are superseded by national requirements.

NOTE 1 In the United States, NFPA 86[9] supersedes the requirements of EN 1539.

Evaporation of flammable substances is generally not expected where inks and/or coatings are used for which the safety data sheet indicates that the explosion limit is “not applicable” at the operating temperature of the drying device. Where the use of such inks and/or coatings is required in order to comply with the requirements stated, this shall be indicated in the instruction handbook.

NOTE 2 Evaporation of flammable substances during the drying process may, for example, be expected on gravure, screen printing and web presses. This may, however, not be the case on offset web presses when using commercial offset printing inks (for example cold-set inks instead of heat-set inks) that are absorbed by the substrate.

8.2.2.2 Interface with automatic cylinder and roller washing devices

8.2.2.2.1 Substrate transporting solvents

On continuous-flow drying devices, any hazards from emission of flammable substances caused by the substrate transporting solvents out of the automatic cylinder and roller washing device shall be avoided.

This requirement is fulfilled:

a) on a sheet-fed printing press

   1) where the design of the continuous-flow drying unit takes account of the solvent transported by the substrate in accordance with EN 1539 (see 8.2.2.1, Note 1); or

   2) where the cylinder and/or roller washing device is electrically interlocked with the paper transport system, so the paper transport during the washing process is prevented and can be restarted only after the cylinders are sufficiently dry;

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b) on a web-fed rotary printing press, where the design of the continuous-flow drying unit takes account of the solvent in accordance with EN 1539 (see 8.2.2.1, Note 1), including a combination of:

   1) design-stage calculations of maximum solvent flow;

   2) commissioning-stage testing of the blanket wash system, usually done by qualified personnel or a qualified agent of the wash system manufacturer, to verify the calculations and to determine the safety of the wash system (part of the testing procedure is the measurement of solvent concentrations inside the dryer and exhaust duct using a total hydrocarbon analyser equipped with a flame ionization detector at worst-case conditions of solvent flow).

8.2.2.2.2 Vapours and mists

On printing presses, where continuous-flow drying devices are fitted on one press together with automatic cylinder and roller washing devices, any risk of ignition, where solvent vapours and mists released during the washing process are heated up by the drying unit, shall be prevented.

This requirement is fulfilled by one or more of the following:

a) by designing the continuous-flow drying unit to take into account the solvent vapours and mists in accordance with EN 1539 unless these requirements are superseded by national requirements (see 8.2.2.1, Note 1);

b) by providing an exhaust unit between the washing and the drying unit, thus reducing the risk of ignition;

c) if the control systems of the washing and drying devices satisfy PL_r d of ISO 13849-1 or SIL 2 of IEC 62061, by interlocking the washing and the drying devices to allow the start of the washing operation only if the dryer temperature is in a non-hazardous condition, and to prevent the start of the drying device until there is no risk of ignition of the flammable solvent vapours.

   NOTE One means of accomplishing this is by the use of a flammable vapour sensor that monitors the level of solvent vapours and prevents the flammable concentration of vapour levels.

8.2.2.2.3 Leakage and spillage of solvents

The risk of ignition due to leaks of the solvent from the washing device shall be prevented.

EXAMPLE Such risks on web presses would be solvent leaking onto the substrate running into the drying device; on sheet-fed presses, they would be solvent leaking onto the drying device, or spillage during the filling process.

This requirement is fulfilled by one or more of the following:

a) when the solvent reservoir and washing device are fixed and sealed, by providing hose and connections of highest leak-proof quality, permanently fitted, adequately dimensioned and of materials that are suitable for the solvent used;

b) by positioning the washing devices and hoses so that, in case of leakage, neither the liquid solvent nor its vapours can reach the continuous-flow drying device;

c) by monitoring the area surrounding the continuous-flow drying device so that the device is disabled in the event of spillage/leakage.

8.2.2.3 Ignition of substrate

Ignition of the substrate by the continuous-flow drying device shall be prevented. This can be achieved, for example, by reducing the dryer temperature when the printing process is stopped, or by separating the substrate from the radiation source by use of air knives (air curtain) or deflectors.

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8.2.2.4 Exhaust systems of drying devices

When exhaust systems are provided as a safety ventilation system to prevent hazards of fire and explosion, their function shall be monitored. Failures in the exhaust system shall cause the substrate feeding system to stop automatically. For example, on sheet-fed printing presses, failure in the dryer exhaust system causes both the feeders and the drying system to stop automatically. On rotary web presses, failure in the dryer exhaust system causes automatic stopping of the solvent dispensing areas (for example ink plate rollers on units, or automatic blanket washing devices).

The control system for monitoring the function of the exhaust system shall satisfy PL_r d of ISO 13849-1 or SIL 2 of IEC 62061.

8.3 Explosion protection exceptions

8.3.1 General

The explosion protection exceptions defined in ISO 12643-1 apply in addition to the exceptions defined in 8.3.2 and 8.3.3.

8.3.2 Exceptions for screen printing presses

Explosion protection measures on screen printing presses need not be provided, even when using screen printing inks with a flash point of 40 °C to 55 °C, if adequate air ventilation in the working area is ensured. The need for adequate air ventilation shall be indicated in the instruction handbook.

Where the intended use of a machine allows the use of screen printing inks with a flash point below 40 °C, see ISO 12643-1.

8.3.3 Exceptions for automatic washing devices

Where automatic cylinder washing (e.g. impression or blanket) and roller washing devices are attached to printing presses, explosion protection measures otherwise required due to the washing solvent being used are not required if all of the following conditions are met:

a) the flash point of the washing solvent is at least 55 °C, or the flash point of the washing solvent is at least 40 °C, and the amount of washing solvent used does not exceed 0,08 l per printing unit and washing cycle;

b) the solvent does not heat up to a temperature in excess of the flash point (for example due to heating equipment or waste heat from motors);

c) explosive concentrations cannot build up when applying the solvent.

8.4 Spillage from washing devices

Safe replenishing of the washing agent shall be ensured.

EXAMPLE 1 The following are examples of ways to satisfy this requirement:

— designing washing agent tanks to allow one person handling the equipment to replenish the washing agent without the hazard of spilling or overflowing;

— avoiding tank overflow when replenishing the washing agent by use of devices that check the filling level (“tank full” indicators, inspection glasses, adequate openings for filling, etc.).

When the washing device is disconnected by the user, provision shall be made to prevent leakage of washing agents from the lines.

EXAMPLE 2 An example of a means to prevent leakage is the use of self-locking hose couplings.

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8.5 Working platforms, access stairs, passageways and raised workplaces

8.5.1 General

Working platforms, access stairs, passageways and raised workplaces shall meet the requirements of ISO 12643-1.

8.5.2 Exception for sheet-fed presses

As an exception to ISO 12643-1, on sheet-fed offset printing presses with a format width of no more than 750 mm, it is acceptable to provide a single footstep for access to the platform fitted between units (printing units, coating units, delivery units) if all the following conditions are met:

a) the difference in height between floor or gangway and platform is not more than 750 mm;

b) the depth of the footstep is at least 250 mm, and the width at least 300 mm;

c) the footstep is fitted half way between the floor or gangway and the platform;

d) suitable handles are provided.

8.6 Electrostatic toner dust

Where electrostatic toners are used as printing substances (such as in digital printing presses), it shall be ensured that persons are not endangered by toner dust.

NOTE This can be achieved, for example, by the following:

— using the least hazardous toners needed for the process;

— providing totally enclosed systems;

— providing adequate dust separation equipment and filters.

8.7 Washing equipment for printing plates, rollers and doctor blades

8.7.1 Hazards due to emission of washing agents

Personnel shall be protected from hazards from emissions of washing agents used in external washing devices for printing plates, rollers, and doctor blades.

NOTE One or more of the following safety measures might be used to protect personnel from such hazards:

— using non-hazardous solvents when possible (with respective warnings given in the instruction handbook);

— using closed-type washing equipment, equipped with an interlocking guard for the charging doors, so that the doors can be opened only after the drying process is finished, and a means of exhausting solvent vapours;

— exhausting solvent vapours.

8.7.2 Grounding of washing equipment

Where solvents with a flash point below 55 °C are used on external washing equipment for printing plates, rollers and doctor blades, and where explosion hazards exist due to spraying of the washing agent, all parts inside the washing device shall be conductive and electrostatically grounded (resistance less than 10^6 Ω).

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8.7.3 Unintended escape of solvents

Where solvents with a flash point below 55 °C are used on external washing equipment for printing plates, rollers and doctor blades, hazards from unintended escape of solvents (e.g. leakage or during pumping) shall be prevented.

NOTE 1 Penetration into non-explosion-proof areas can be prevented, for example, by using catch tanks of adequate size.

NOTE 2 For further information on fire and explosion protection, see 8.2.

8.8 Alcohol dosing devices

8.8.1 Concentration

Alcohol dosing devices as auxiliary devices on dampening units shall be equipped with means that limit the concentration of alcohol in the dampening water to the percentage required for the printing process.

Additional explosion protection measures in the dosing equipment and printing press area are not required if the dosing device is equipped such that a maximum of 15 % by volume of alcohol in the dampening water for normal operation cannot be exceeded.

In addition, if an electric/electronic control system is used to control the alcohol concentration in the dampening water, this system shall satisfy the requirements of ISO 12643-1 to ensure that a failure of the primary control system shall not allow the alcohol in the dampening water to exceed 20 % by volume.

8.8.2 Prevention of leakage and overflow

Adequate measures for alcohol dosing devices shall be provided to prevent leakage and overflow of concentrated alcohol into non-explosion-proof areas. Adequate measures include the use of collecting tanks or means of draining the alcohol into the dampening recirculator.

Alcohol dosing devices shall be designed such that the tank cannot fall, and that the tank and the hoses connecting the tank to the dosing device are safeguarded against damage (e.g. by placing the tanks in closed cabinets).

The instruction handbook shall contain instructions for the proper setting-up of the tanks.

8.9 Refrigerating devices in ink and dampening units

Refrigerating devices of auxiliary devices in ink and dampening units shall comply with EN 378-1.

8.10 Powder-spraying devices

Safe replenishing of anti-setoff powder used during the printing process shall be ensured.

8.11 Hazardous emissions of sheet-fed presses

Guidelines for designers relating to the measurement of hazardous emissions of sheet-fed presses are contained in Annex C.

9 Additional requirements for functions, operations, colours and mechanical specifications of manual control devices

9.1 General

In addition to the requirements of ISO 12643-1, the requirements of 9.2 to 9.8 apply.

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9.2 Emergency stop and ink, dampening, metering, coating or fountain rollers

Actuation of an emergency stop or stop/safe device need not cause the motion of the ink, dampening and coating rollers to stop, where continuing motion is required for operational reasons and all hazard points are safeguarded; i.e.

— in-running nips between the ink fountain roller and the ductor roller are not accessible, even when the ink fountain is in the open position; or

— all in-running nips on the dampening and the coating fountain roller and metering roller are safeguarded by fixed guards.

If interlocking guards are used, motion protected by the guard shall stop when the guard is opened.

9.3 Emergency stop on auxiliary draw nips

Actuation of an emergency stop or stop/safe device need not cause the motion of the draw roller to stop, where continuing motion is required for operational reasons, provided that all nip points created by draw rollers are safeguarded.

NOTE Motion includes zero speed.

If interlocking guards are used, motion protected by the guard shall stop when the guard is opened.

9.4 Alternative controls for stop/safe function on sheet-fed presses

On sheet-fed presses, a keypad or touchscreen may be used as an alternative to the stop/safe pushbutton defined in ISO 12643-1, provided that such a device provides an equivalent level of safety. This interlocking function shall send a safe signal to a light close to the stop/safe control that was pressed. The interlocking electric circuit stop/safe shall be reactivated after a main power failure.

To reset the interlocking electric circuit stop/safe, the same contact shall be activated twice within 2 s.

NOTE This is to prevent inadvertent operation.

An equivalent level of safety is achieved when risk assessment shows the control ensures the following.

— When the interlocking electric circuit stop/safe is activated, machine motion shall be prevented and the machine shall be placed in the safe condition.

— Single-point failure of the latching component and in the interlocking electric circuit stop/safe shall not result in the machine automatically reverting to the ready condition.

— The latching mechanism and the interlocking electric circuit stop/safe shall be designed such that a person is prevented from unintentionally releasing the pushbutton to the ready condition.

— A green indicator light shall be integrated with each stop/safe control to indicate when the control has been activated and the machine has been placed into a safe condition.

— Release of the stop/safe shall only be possible by activating the same contact that was used to set the safe.

— If multiple stop/safe controls are initiated, each and every control shall be reset to place the machine in the ready condition.

— When the stop/safe control has been reset, the green indicator light for that control shall not be illuminated.

NOTE Because of national requirements, the use of a keypad or touchscreen for stop/safe control might not be allowed in all countries.

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9.5 Ready control

The ready control shall be a maintained-contact pushbutton, mechanically interlocked with the associated stop/safe pushbutton. When depressed, it shall release the associated stop/safe pushbutton and may place the machine in the ready condition.

9.6 Speed limit control

When the press is at a standstill, activating any speed limit control shall prevent any machine motion until all speed limit controls are deactivated.

When the press is in continuous run, activating any speed limit control shall prevent acceleration until all speed limit controls are deactivated (speed limit function). Press speed can be reduced using the slower control.

Pressing a stop/safe pushbutton shall take precedence over the speed limit function.

9.7 Plate position control

If all hazards are protected, activating a plate position control shall initiate press motion and rotate (index) the press cylinders to stop at a predefined position (a new plate position) for ease of mounting a printing plate. Successive depressions of the control during the permissive period may initiate indexing to the next plate position. The plate position control may be a momentary-contact control.

When an interlocking guard is open and hazard points are unprotected, activating the plate position control shall initiate the press motion only in accordance with hold-to-run conditions as defined in ISO 12643-1.

NOTE A plate position control device is not used for registration purposes.

9.8 Colours for manual control devices

In addition to the requirement for colours of manual control devices specified in ISO 12643-1, the colours shown in Table 3 shall also apply.

Table 3 — Colours for manual control devices

Control	Requirement	Preference	Remarks
Speed limit	Green, black, white or grey	Green	Used primarily on newspaper presses
Plate position (or comparable control)	Black, white or grey	Grey	

10 Control systems for screen printing presses

The control system shall comply with ISO 12643-1. Trip devices shall comply with ISO 12643-1.

In addition, the following requirements shall be satisfied on screen printing presses where substrates are fed manually between the printing plate and the printing table:

a) safety-related parts of the control system that relate to the closing movement of the screen frame and the printing table shall comply with ISO 12643-1;

b) trip devices shall satisfy PL_r e of ISO 13849-1 or SIL 3 of IEC 62061 in addition to the requirements of ISO 12643-1;

c) electro-sensitive protective devices shall comply with ISO 12643-1.

NOTE Manual feeding of the substrate between the printing plate and the printing table is used on several types of semi-automatic screen printing presses.

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11 Safety requirements for prepress equipment

11.1 Electrical equipment of prepress machinery

As an exception to ISO 12643-1, for prepress machinery that is used for the production of master copies, film and printing plate exposure, and that falls within the scope of IEC 60950-1, and is not used in areas where printing on paper or paper converting takes place, the electrical equipment may be designed so that electrical hazards (such as burns or shocks) are prevented in accordance with IEC 60950-1, and the equipment has the degree of protection IP2X or IP23, where appropriate, in accordance with IEC 60529.

Prepress machinery may be equipped with a supply-disconnecting device meeting the requirements for supply-disconnecting devices specified in ISO 12643-1.

11.2 Electric/electronic control system of prepress machinery

The parts of the electric/electronic control system of prepress machinery shall comply with the requirements specified for the performance levels for control systems specified in ISO 12643-1. The parts of the electric/electronic control system of machines and equipment for the preparation of printing plates may be designed in accordance with PL_r b of ISO 13849-1 or SIL 1 of IEC 62061. The control systems of an interlocking device for safety devices that prevent access to laser radiation class 3R, 3B or 4, as classified in IEC 60825-1, shall be designed to comply with PL_r d of ISO 13849-1 or SIL 2 of IEC 62061.

11.3 Exposing equipment

Exposing equipment that poses a risk of injury caused by bursting lamps shall be equipped with safety screens of heat-resistant material, which shall be attached free of stress.

Safety screens are considered to be heat-resistant if they have an adequate mechanical strength at normal operating temperatures. Safety screens are “attached free of stress” if bursting of the screen is not to be expected, even with the material expanding under increasing temperatures.

11.4 Safeguarding the discharge of liquids

Appropriate facilities shall be provided to ensure safe filling and emptying of developing and fixing chemicals and gum arabic liquids.

11.5 Safeguarding in-running nips on engraving machines

On engraving machines for gravure cylinders, the in-running nip between gravure cylinder and engraving tool shall be safeguarded by one of the following:

a) enclosing the gravure cylinder by an interlocking guard;

b) providing a fixed guard with a maximum distance of 6 mm between the gravure cylinder and the guard.

The trapping hazard caused by the rotation of the gravure cylinder shall be safeguarded.

NOTE 1 This might be done, for example, by means such as:

— enclosing the gravure cylinder by an interlocking guard;

— using a cylinder with a smooth surface including cylinder fixture and drive elements;

— enclosing an individual trapping point by fixed or interlocking guards.

NOTE 2 Trapping hazards might be caused by the chuck jaws, for example.

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11.6 Safeguarding against copper swarf hazard

The risk of skin and eye injuries created by the potential for copper swarf to adhere to the hands shall be described in the instruction handbook.

11.7 Safeguarding bending unit on printing plate bending machines

On printing plate bending machines, safety check valves shall be provided directly on the lifting cylinders of the bending device if breakage of hoses or loss of pressure of the respective source of energy can create crushing hazards with a crushing force of at least 500 N.

11.8 Safeguarding printing plate punching devices

The movement of the punching tool shall be safeguarded by designing the opening of fixed punching tools in accordance with the requirements for safe tools specified in ISO 13857.

12 Signals and warning devices

As an exception to the requirements of ISO 12643-1, for technological reasons, a permissive period of no more than 12 s is permitted with the addition of a flashing light or an audible signal (or both) in the hazardous area(s) (e.g. in the delivery area). The warning shall cycle throughout the entire permissive period.

NOTE Technological reasons might include, but are not limited to, preheating of temperature detectors during automatic plate changing sequence for an entire printing press.

A change in direction of machine motion within the same permissive period is permitted without the initiation of a new warning period (see Figure 7).

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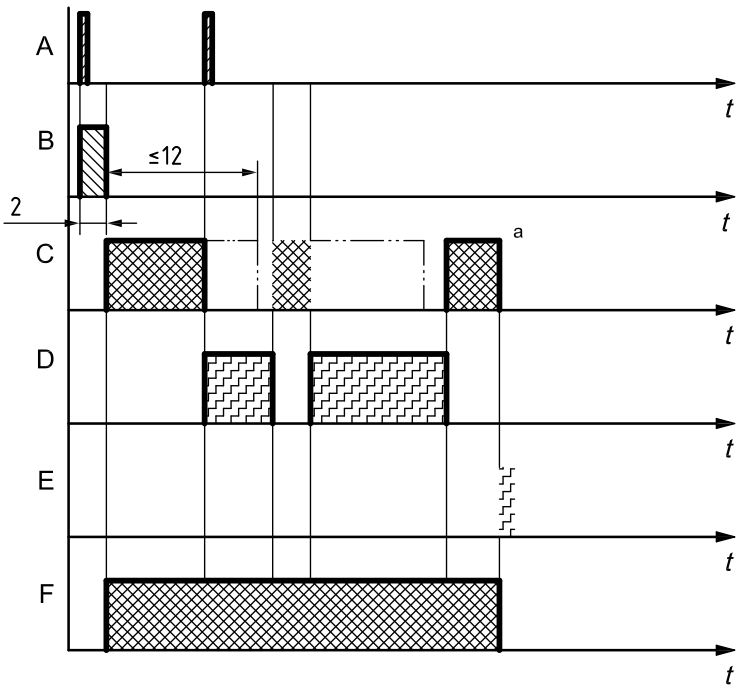

Key

t time, s

A automatic start button

B warning period and audible alarm

C permissive period

D machine motion

E stop, stop/safe, breaking of safety circuit

F flashing light or audible signal in the hazardous area(s)

a Cancellation of the permissive period.

Figure 7 — Audible warning system for automatic machine mode with double-push sequence

13 Control zones for web presses having multiple folders

As an exception to the requirements of ISO 12643-1, for control zones on a web press system having multiple folders, the emergency stop control shall stop the printing units and associated operating equipment on both sides of the unit where the emergency stop control was activated.

14 Contents of instruction handbook

14.1 General

In addition to the requirements of ISO 12643-1, the requirements of 14.2 to 14.10 apply.

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14.2 Sheet-fed printing press systems

14.2.1 Residual risk from ink ducts

The instruction handbook shall warn the user of any residual risk existing when ink ducts are swung down.

NOTE For example, there might be in-running nips between ink ducts and ductor roller.

14.2.2 Residual risks in sheet delivery area

The instruction handbook shall warn the user of residual risks existing when gaining access under the guards in the sheet delivery area.

NOTE For example, access might be needed for removing sample sheets or for inserting pile wedges.

14.2.3 Sheet-fed presses used for printing on board or metal sheet

The instruction handbook shall warn the user of the residual risk existing where the requirements of ISO 13857 cannot be applied in the feeding area for production reasons on sheet-fed printing presses that are also used for printing on board or metal sheet.

14.2.4 Rollers

If activation of the emergency stop control does not stop ink, dampening, metering, coating or fountain rollers, the instruction handbook shall provide information on how these rollers are to be stopped.

EXAMPLE For example, by operation of the main supply switch.

14.2.5 Powders (anti-setoff powders)

The instruction handbook shall specify the use of the least hazardous powders needed for the process.

14.3 Web-fed printing press systems

14.3.1 Rollers

If activation of the emergency stop control does not stop ink, dampening, metering, coating or fountain rollers, instructions shall be provided in the handbook regarding how these rollers are to be stopped.

EXAMPLE For example, by operation of the main supply switch.

14.3.2 In-running nips

The instruction handbook shall identify hazards that exist when operations are carried out in the vicinity of areas where in-running nips could be generated under hold-to-run control and where such areas cannot be observed from the point of operation of the hold-to-run control. It shall also describe safe working practices.

EXAMPLE For example, operation of a stop control with mechanical latch or emergency stop device before beginning operation in the hazardous area.

14.3.3 Operation by two-hand control with guard open

Where production reasons require the printing press to be started by two-hand control with guards open and a speed higher than 10 m/min, the instruction handbook shall contain a warning that the person operating the two-hand control shall make sure that there is no second person in the hazardous area before starting the hold-to-run operation.

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14.4 Screen printing presses

14.4.1 Ventilation and admissible liquids

The instruction handbook shall indicate the admissible inks, coatings, washing liquids and solvents (admissible flash point), and shall provide instructions for adequate ventilation of the working area at the place of installation.

14.4.2 Access between screen printing frame and machine frame

The instruction handbook shall indicate that, before access between the screen printing frame and the machine frame is allowed (e.g. for cleaning the screen), unintended start-up of the machine shall be prevented, e.g. by actuation of a selector switch.

14.4.3 Use of different size screens

Where screens of different sizes are being used, the instruction handbook shall contain instructions for adjusting stop gauges so that the distance between doctor blade and screen frame is no less than 25 mm.

14.4.4 Crushing point between doctor blade and screen or machine table

Where the crushing point between the doctor blade and the screen or machine table cannot be safeguarded for operational reasons, the instruction handbook shall warn the user of the existing residual risks, e.g. when replenishing inks.

14.4.5 Residual risks related to doctor blade

The instruction handbook shall warn the user of residual risks caused by the doctor blade being used without a screen, or a screen of smaller size being installed.

14.5 Automatic cylinder and roller washing device

The instruction handbook shall specify the requirement to set the washing parameters such that, depending on the washing agent used, solvent vapours will not be created.

EXAMPLE Parameters such as pressure of the washing liquid, speed of rotation of washing rollers and brushes, length of the washing process, etc.

NOTE Solvent vapours can cause risks of explosion or damage to health.

14.6 Continuous-flow drying devices

14.6.1 Inks and coatings

Where the use of inks and coatings is restricted to certain types to avoid the risk of explosion in accordance with 8.2.2 and ISO 12643-1, the instruction handbook shall contain relevant information. The handbook should also include the suggested maximum flow rate, at a specific lower explosive limit, of ink, coating and wash solvents into the dryer.

14.6.2 Solvents

The instruction handbook shall contain a warning that, to avoid an explosive hazard, solvents not be placed in the area of the continuous-flow drying device (e.g. during manual washing of cylinders or rollers).

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14.6.3 Mist of UV inks and UV coatings

The instruction handbook for UV continuous-flow drying devices shall note that the use of some types of UV inks or UV coatings might result in an inhalation hazard due to the build-up of mists, and that exhaust equipment might be required to remove mists to prevent such build-up.

14.6.4 Solvents for manual washing

The instruction handbook shall provide information that, when washing cylinders and rollers by hand (manually), rather than with an automatic washing device, solvent ignition within the drying device should be avoided by one or more of the following means:

— removing the web from its operating position (threaded through the drying device) before starting the washing;

— using cleaning material (solvents) that has a safety data sheet indicating that the explosion limit is “not applicable” at the expected operating temperature of the drying device;

— using user-created “standard operating procedures” for press operators so that the flow rate of solvents into the drying device is limited to that rate producing an acceptable solvent concentration limit, as defined by EN 1539, unless these requirements are superseded by national requirements (see 8.2.2.1, Note 1).

14.6.5 High contact temperatures on continuous-flow drying devices

The surface temperature of those parts of continuous-flow drying devices where access is possible shall not exceed the limit values specified in ISO 13732-1. Those parts of continuous-flow drying devices that are accessible after opening the interlocking device, and where temperatures are in excess of limit temperatures, shall be provided with a hazard warning.

14.7 Oxidizers, incinerators and thermal cleaning plants

The instruction handbook shall provide information on methods for reducing the following residual risks:

— inlet concentration of flammable substances not limited to established maximum design concentration standards;

— flammable condensate and deposits on internal duct surfaces;

— insufficient forced ventilation;

— insufficient oxygen, process space temperature, mixing, residence time, and catalyst function (if applicable) for oxidation of flammable substances;

— uncontrolled ignition sources such as electrical and mechanical sparks, static electricity, and flashback;

— overheating caused by failure of temperature control, heater failure and insulation failure.

14.8 Alcohol dosing devices

The instruction handbook shall indicate that alcohol spillages need to be removed immediately.

14.9 Washing equipment for printing plates

If washing equipment for printing plates, rollers and doctor blades necessitates the use of washing solvents with a flash point above 55 °C, this shall be noted in the instruction handbook.

14.10 Prepress machinery

The instruction handbook shall supply instructions for using personal protection equipment for adequate guarding against contact with solvent vapours, dust or copper swarf.

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Annex A
(informative)

Hazards associated with printing press systems

Table A.1 lists many significant hazards that may be encountered in printing press systems. When performing risk assessment for an individual piece of equipment, this list may assist the manufacturer in identifying the risks on their piece of equipment. The manufacturer should be aware that there may be other hazards not included in this list that need to be identified during the risk assessment process.

NOTE Additional information on risk assessment is given in ISO 14121-1[2].

Table A.1 — Significant hazards and hazard zones

Significant hazards	Hazard zone
Mechanical hazards: — crushing; — shearing; — cutting or severing; — entanglement; — drawing-in; — trapping; — impacts.	Production area: — between rollers, cylinders, drums; — short linear movements; — wheels for floor travel; — revolving handwheels; — guards; — make-ready, cleaning, maintenance operations and trouble-shooting (hold-to-run); — impact hazards in passageways, access ways; — loss of stability; — stationary knives; — rotary tools; — transport of hazardous tools; — on feeding and delivery units (pile lifting and lowering devices); — unwinding and rewinding units for web material. Sheet-fed printing presses and coating units: — sheet gripping devices, rollers, cylinders, perforating tools, feed openings; — in-running nips behind interlocking guards; — dampening unit, coating unit; — sheet delivery; — automatic format setting; — pile changing devices; — offset proofing presses; — digital printing presses. Web-fed rotary printing presses and coating units: — in-running nips on rollers and cylinders, feed openings; — in-running nips behind interlocking guards; — dampening unit, coating unit; — automatic format setting; — automatic travel of transport carriages; — folder; — webs; — automatic loading on unwinding unit; — hold-to-run control for plate printing; — rollers with equidirectional revolutions; — digital printing presses.

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Table A.1 (*continued*)

Significant hazards	Hazard zone
Mechanical hazards (continued)	Screen printing presses: — crushing points — screen frame/printing table; — crushing points — doctor blade/screen frame; — crushing points by doctor blade movement; — unintentional start-up; — hazard — cylinder screen printing presses. Cylinder and roller washing devices: — built into machines. Drying devices: — built into machines. Powder-spraying devices: — built into machines; — powder replenishment. Auxiliary devices on inking and dampening units: — built into machines; — refrigerating devices. Plate-clamping devices: — built into machines; — hazardous movements. Washing devices for printing plates, rollers and scrapers: — installation in machine. Pile turners and reel turners: — crushing hazard — floor/lifting member; — uncontrolled gravity falling in case of leakage or hose breakage; — load-lifting device; — emergency stop device. Measuring and control devices: — crushing and shearing points in machines.
Slipping, tripping, falling	Production area: — work platforms, access stairs, passageways, steps.
Thermal hazards: — burns due to possible contact.	All machinery: — hot machine parts. Drying devices: — surface temperature.
Electrical hazards: — direct or indirect contact thermal radiation (burns).	All machinery: — electrical equipment; — equipment made live under electrical fault conditions.
Hazards generated by radiation: — laser; — UV radiation.	Sheet-fed printing presses, web-fed printing presses, coating units, prepress machinery: — laser exposing equipment; — laser counting devices. Drying devices, prepress machinery: — emission of UV radiation.

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Table A.1 (*continued*)

Significant hazards	Hazard zone
Hazards generated by noise resulting in hearing loss	All printing machines and their ancillary equipment.
Hazards from substances and material used for processing, machine operation or that are emitted during the process: — hazards resulting from contact with, or inhalation of, harmful fluids, gases, fumes, dusts.	Sheet-fed printing presses, web-fed printing presses, coating units: — ozone build-up; — toner dust; — exhaust fans and suction devices. Cylinder and roller washing devices: — replenishing of washing agent; — removal of washing device. Continuous-flow drying devices: — ozone build-up. Auxiliary devices on inking and dampening units: — leakage of washing agents.
Hazards from fire and explosion	Web-fed printing presses and coating units: — explosion hazards on exhaust fans. Screen printing presses: — explosion hazard. Cylinder and roller washing devices: — use of washing agent. Continuous-flow drying devices: — heating; — leakages; — emission of flammable substances; — ignition of flammable substances. Auxiliary devices on inking and dampening units: — alcohol dosing devices. Washing equipment for plates, rollers and doctor blades: — explosive atmospheres, fire hazards.
Hazards generated by neglect of ergonomic principles in machine design: — unhealthy body postures.	Production area: — operating postures; — lifting of heavy loads; — design of actuators and displays, handles. Sheet-fed printing presses and coating units: — hold-to-run control; — gangways; — installation and removal of heavy machine parts. Web-fed printing presses and coating units: — hold-to-run control; — installation and removal of heavy machine parts.
Failure, malfunction of control system: — faults or failures in safety circuits.	Sheet-fed and web-fed printing presses, coating units and all auxiliary equipment.

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Annex B
(informative)

Protection zones against explosion

B.1 General classification of hazardous places

To determine the extent of measures necessary to avoid effective ignition sources, the hazardous places are classified into zones based on the frequency and duration of occurrence of a hazardous explosive atmosphere.

NOTE 1 In the following text where the term “gas” or “gas/vapour” is used, it implicitly covers mist atmospheres.

A place in which an explosive atmosphere is not expected to occur in such quantities as to require special precautions is regarded as non-hazardous within the meaning of this part of ISO 12643.

Taking into account the sedimentation of dust and the possible formation of an explosive atmosphere from dispersion of dust layers, different sets of zones have been defined for gases/vapours and dusts.

In view of this, other measures for the avoidance of effective ignition sources for combustible dusts, compared to combustible gases/vapours, are required.

NOTE 2 Information on the control and classification of hazardous places for gases and vapours by the use of ventilation is given in IEC 60079-10[5].

B.2 Zones for gases/vapours

The following zones are defined:

a) Zone 0:

A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is present frequently, continuously, or for long periods.

NOTE 1 In general these conditions, when they occur, arise inside containers, pipes and vessels, etc.

b) Zone 1:

A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mists is likely to occur occasionally during normal operation.

NOTE 2 This zone can include, amongst others:

— the immediate vicinity around zone 0;

— the immediate vicinity around feed openings;

— the immediate vicinity around filling and emptying openings;

— the immediate vicinity around fragile equipment, protective systems, and components made of glass, ceramics, etc.;

— the immediate vicinity around inadequately sealed glands, for example on pumps and valves with stuffing-boxes.

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c) Zone 2:

A place in which an explosive atmosphere consisting of a mixture of air with flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation, but, if it does occur, will persist for a short period only.

NOTE 3 This zone can include, amongst others, places surrounding zones 0 or 1.

Table B.1 shows examples of explosion zones in which explosive atmospheres may exist. For the equipment identified in Table B.1, a separate Zone 2 does not exist.

Table B.1 — Examples of explosion zones

Equipment type	Zone	Zone description
Rotary web gravure printing machines	1	The area of the printing unit between the printing unit side frames. The service walkway between the printing units up to a height of 2 m including the area between the side frames. The area of the ink fountain, the area of the ink container of the printing unit, connected with the printing unit and the area of the storage tank and the surrounding area up to a distance of 500 mm on all sides. The area of the web material and the area surrounding it up to a distance of 250 mm on all sides, based on the maximum possible printing width, up to the point of entrance into the dryer, at a maximum, however, of up to a length of 2 m of the freshly printed web-type material.
Sheet-fed rotary gravure printing machines	1	The area between the side frames, in which the printing unit, for example with ink fountain, plate cylinder, intermediate roller and the freshly printed material, are located. The area of the ink fountain, extending at right angle to the axis of the fountain roller in a radius of 1 m and to the sides in a radius of 500 mm. The area of the ink container, connected to the machine and the area of the storage tank in a radius of 500 mm on all sides.
Rotary web flexographic printing machines, wallpaper printing machines	1	The area of the ink fountain defined by a radius corresponding to the length of the rollers, but not more than 500 mm. The space below the printing units down to floor level in an area that results from the vertical projection of the hazard area of the printing units. The area of the ink container of the printing units that is connected with the machine and the area of the storage tank defined by a 500 mm radius on all sides. The area of the web material established by a 250 mm radius on all sides, based on the maximum printing width, from the entrance of the web material into the first print unit to the entrance of the web material into the dryer tunnel, including exhaust and ventilation ducts, or up to 500 mm behind the point where the web material leaves the last printing unit, respectively.
Screen printing machines for printing on sheets, web or three-dimensional objects	1	The area around the screen printing frame or cylinder established by a 500 mm radius on all sides and the vertical projection of this area down to floor level. The area of the storage containers established by a 500 mm radius on all sides. The area of the freshly printed sheet or web material established by a 250 mm radius on all sides, based on the maximum printing format, including an area beginning at the exit and extending for 2 m from there or up to the entrance of the dryer tunnel, respectively.

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Table B.1 (*continued*)

Equipment type	Zone	Zone description
Rotary and flatbed film printing machines	1	The area of the printing table, established by a 500 mm radius on all sides and the vertical projection of this area down to floor level. The area of the storage containers established by a 500 mm radius on all sides. The area of the freshly printed web material, established by a 250 mm radius on all sides, based on the maximum printing width, extended from the exit of the printing machine up to the entrance of the dryer tunnel.
Machines for printing imitation leather and film	1	The area of the printing unit between the printing unit side frames. The area of the ink fountain, the area of the ink container of the printing unit that is connected with the machine and the area of the storage tank, established by a 500 mm radius on all sides. The area of the web itself, established by a 250 mm radius on all sides, based on the maximum printing width, up to the entrance of the web-type material into the dryer tunnel, the maximum length, however, being a length of 2 m of the freshly printed material.
Wash-out machines and washing machines in which combustible liquids with flash points below 55 °C are used	0 1	The inside of the machine. The area of the machine established by a 5 m radius on all sides and the vertical projection of this area down to floor level and up to a height of 1,5 m above the machine.
Roller coating units with closed side frames reaching down to floor level	1	The area of the roller coater between the side frames of the roller coating unit. The service walkway between the roller coating units up to a width of 2 m and up to a height of 2 m, including the area between the side frames. The area of the fountain for coating, impregnating and gluing materials, the area of the container that is connected with the roller coater unit and the area of the storage tank, established by a 500 mm radius on all sides. The area of the web-type material, established by a 250 mm radius on all sides, based on the maximum coating width, extending up to the entrance of the web-type material into the dryer tunnel, the maximum length, however, being a length of 2 m of the freshly coated web-type material.
Roller coaters with side frames with cut-outs or with side frames that do not reach to floor level	1	The area of the fountain for coating, impregnating and gluing materials, established by a radius equal to the length of the rollers, on all sides, but not exceeding 500 mm. The space underneath the roller coaters down to floor level in an area established by the vertical projection of the hazard areas of the roller coater units. The area of the container that is connected to the machine and the area of the storage tank, established by a 500 mm radius on all sides. The area of the web-type material itself, established by a 250 mm radius on all sides, based on the maximum coating width, from the entrance of the web material into the first roller coating unit up to the entrance of the web material into the dryer tunnel or 500 mm after leaving the last roller coating unit.

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Annex C
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Emission levels of sheet-fed presses resulting from tests conducted in Europe

C.1 General considerations

This annex gives results of tests conducted in Europe in accordance with ISO 14123-1[3] and ISO 14123-2[4].

The purpose of this annex is to provide a listing of emissions that could pose a potential hazard, either short-term or long-term, due to exposure. This information is intended to be used by sheet-fed press designers to help minimize such potential hazards.

The data contained in this annex are for information only. This annex makes no requirements relating to emission levels of machines, nor does it imply that the emissions measured are safe levels.

It is recognized that emissions of various types result from the operation of printing equipment. Such emissions may be a result of the interaction of the materials used with the printing process itself, as well as how the operator utilizes the materials. Therefore, measurements need to take into consideration the specific material being used and the conditions under which it is generally used. This information should be included in the test report.

It is important that equipment users adhere to the emissions exposure requirements of the country/locality in which the equipment is used.

Measurements were made using an air exchange rate of two times per hour. Materials tested were those typically used in Europe. Other materials may be used in other countries and test results may be different using those materials.

Results of emission tests done on a single machine apply to all machines in that same series. For example, the results of tests conducted on a two-colour press of a specific model are also valid for all other configurations of that same model of press. Therefore, there is no further need to do the test on each product of this series.

C.2 Ozone

C.2.1 Health hazard considerations

UV curing lamps give off considerable heat and convert some of the oxygen present in the air into ozone. Mechanical extraction cools the lamp, but also leads to continuous generation of ozone by the conversion of oxygen present in the freshly supplied air around the lamp.

C.2.2 Measurement

C.2.2.1 Measuring location

The measuring location should be at the face of the delivery (1 m distance and 1,65 m height), since this is the relevant main working area.

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C.2.2.2 Measuring conditions

The measuring conditions should be set at 80 % maximum press speed as specified by the manufacturer, with the dryer set at maximum power.

C.2.3 Results

Results of measurement: $\leqslant$0,05 mg/m^3 ozone.

C.3 Powder

C.3.1 Health hazard considerations

Dusts emitted during the handling of anti-setoff powders contain particles of a wide range of sizes. The likely health risk from inhalation of a specific particle is dependent upon the nature (anti-setoff powder, starch, sugar, etc.) and size of the particle. The two main size fractions are total inhalable and respirable. Inhalable dust approximates to the fraction of airborne material that enters the nose and mouth during breathing, and is therefore available for deposition in the respiratory tract. Respirable dust approximates to the fraction of airborne material that penetrates to the gas exchange region of the lung.

Dust of anti-setoff powder is regarded as hazardous to health when present at a substantial concentration in air.

Dust of any kind can irritate the respiratory tract and block the nose. Other physical hazards should also be considered. Explosion risks may result from the material becoming airborne; in particular, organic dusts can form explosive mixtures with air at concentrations above the lower explosive limit.

Dust hazards are generally lower for UV curing technology since anti-setoff powders are eliminated, as the printed ink is virtually cured instantaneously by UV light.

C.3.2 Measurement

C.3.2.1 Measuring location

The measuring location should be at the face of the delivery (1 m distance and 1,65 m height), since this is the relevant main working area.

C.3.2.2 Measuring conditions

The measuring conditions should be set for:

— particle size of 20 µm or 30 µm;

— device setting of 20 % to 25 %;

— 80 % press speed.

C.3.3 Results

Results of measurement: $\leqslant$2,5 mg/m^3 total inhalable dust.

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C.4 Ink mist and varnish mist

C.4.1 Health hazard considerations

All ink and varnish types may become airborne due to fast roller speeds and produce an aerosol ink mist and/or varnish mist in the workplace. This is more prevalent with increased press speeds. The mist formed can irritate the respiratory tract if not adequately controlled.

Mist derived from UV printing technology contains uncured polymer components that are classed as irritants and potential sensitizers. For certain people, exposure to UV ink mist and varnish mist may also result in skin sensitization, which can manifest itself at any time as an allergic reaction. For a sensitized person, further contact with the material concerned, even at very low doses, may cause a severe reaction. Inks, varnishes and lacquers may give rise to other hazards due to the chemical ingredients added to improve their colour qualities.

C.4.2 Measurement

C.4.2.1 Ink mist

C.4.2.1.1 Measuring locations

C.4.2.1.1.1 **Location 1** (if considered necessary)

The measuring location should be at the main control panel of the feeder and at the face of the delivery (1 m distance and 1,65 m height), since these are the relevant main working areas.

C.4.2.1.1.2 Location 2

The measuring location should be situated centrally between two printing units at a height of 1,65 m, if accessible, or at a height of 1,65 m from the nearest platform.

C.4.2.1.2 Measuring conditions for both locations

The measuring conditions should be set for:

— 80 % press speed;

— process colours (four base colours);

— maximum format and solid area;

— printing material (paper, cardboard, etc.).

C.4.2.2 Varnish mist

C.4.2.2.1 Measuring locations

C.4.2.2.1.1 **Location 1** (if considered necessary)

The measuring location should be the face of the delivery (1 m distance and 1,65 m height), since this is the relevant main working area.

C.4.2.2.1.2 Location 2

The measuring location should be situated centrally before or after the coating unit, depending on the design concepts, at a height of 1,65 m, if accessible, or at a height of 1,65 m from the nearest platform.

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C.4.2.2.2 Measuring conditions for both locations

The measuring conditions should be set for:

— 80 % press speed;

— high-gloss varnish; maximum format and solid area;

— printing material (paper, cardboard, etc.);

— screen roller with 60 lines and 13 g/m^2 spec. cell volume.

C.4.3 Results

Results of measurement: $\leqslant$2,5 mg/m^3 mist.

C.5 Ammonia

C.5.1 Health hazard considerations

Ammonia vapour may be emitted by application of dispersion varnish at the coating unit in offset processes. Ammonia vapour acts as a respiratory tract irritant.

C.5.2 Measurement

C.5.2.1 Measuring locations

C.5.2.1.1 Location 1 (if considered necessary)

The measuring location should be at the face of the delivery (1 m distance and 1,65 m height), since this is the relevant main working area.

C.5.2.1.2 Location 2

The measuring location should be situated centrally before or after the coating unit, depending on the design concepts, at a height of 1,65 m, if accessible, or at a height of 1,65 m from the nearest platform.

C.5.2.2 Measuring conditions for both locations

The measuring conditions should be set for:

— 80 % press speed;

— high-gloss varnish; maximum format and solid area;

— printing material (paper, cardboard, etc.);

— screen roller with 60 lines and 13 g/m^2 spec. cell volume.

C.5.3 Results

Results of measurement: $\leqslant$4 mg/m^3 ammonia.

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C.6 Volatile organic compounds-isopropyl alcohol (VOC-IPA) and VOC hydrocarbon compounds (cleaners/solvents)

C.6.1 Health hazard considerations

A wide variety of solvents are used in the printing industry for processes and consumables such as wash-up sequences, inks and dampening fountain solution. Some of these can cause harm to people working in the industry, if they are inhaled or absorbed through the skin, and reports of dermatitis, skin irritation, dizziness, drowsiness and nausea are common complaints. More serious effects, including damage to the central nervous system, asthma and liver or kidney damage may also occur. These effects are more pronounced for lower-boiling-point organic solvents (i.e. solvents with flash points less than 21 °C), such as those commonly used for washing and cleaning processes. Many of these lower-boiling-point solvents also present a greater fire hazard.

Isopropanol (isopropyl alcohol or IPA), which is used in the dampening fountain solution in offset presses, is a major contributor to the total solvent content of press room air. IPA can cause dermatitis, dizziness, drowsiness and other effects on the central nervous system if inhaled or absorbed through the skin.

Wash-up solvents have commonly included white spirit and similar mixtures of petroleum distillates. Vegetable oil derivatives and high-boiling-point solvents are now available for use as roller and blanket cleaners, and these products usually reduce the risk to health by inhalation. Skin contact may remain a hazard so that a skin care regimen may be necessary.

The effects of exposure to wash-up solvents depend on the type of solvent used. The misuse of solvents can result in dry skin, dermatitis, headaches, nausea or effects that do not show up until much later. Some solvents also present a fire hazard.

C.6.2 Measurement

C.6.2.1 VOC-IPA

C.6.2.1.1 Measuring locations

C.6.2.1.1.1 Location 1 (if considered necessary)

The measuring location should be 1 m distance from the face of the delivery at a height of 1,65 m, since this is the relevant main working area.

C.6.2.1.1.2 Location 2

The measuring location should be situated centrally between two printing units at a height of 1,65 m, if accessible, or at a height of 1,65 m from the nearest platform.

C.6.2.1.2 Measuring conditions for both locations

The measuring conditions should be set for:

— 80 % press speed in production mode;

— conventional process colours (four base colours);

— maximum format and solid area;

— printing material (paper, cardboard, etc.);

— 9 % alcohol within the dampening water.

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C.6.2.2 VOC hydrocarbon compounds (cleaners/solvents)

C.6.2.2.1 Measuring locations

C.6.2.2.1.1 Location 1 (if considered necessary)

The measuring location should be 1 m distance from the face of the delivery at a height of 1,65 m, since this is the relevant main working area.

C.6.2.2.1.2 Location 2

The measuring location should be situated centrally between two printing units at a height of 1,65 m, if accessible, or at a height of 1,65 m from the nearest platform.

C.6.2.2.2 Measuring conditions for both locations

The measuring conditions should be set for maximum wash programs (such as inking unit, blanket, impression cylinder, etc.; individual or in combination) and cleaners with:

— flash point 55 °C;

— toluene and xylene content below 1 %, aromatic compound content ($>C_9$) below 1 %;

— cleaners free from chlorinated hydrocarbons, fluorochlorinated hydrocarbons, terpenes, *n*-hexane, secondary amines and amides.

C.6.3 Results

The results of measurement for IPA and for VOC hydrocarbon compounds are given in Table C.1

Table C.1 — Results of measurement for IPA and VOC hydrocarbon compounds

Compound	Maximum concentration of compound	
	Location 1	Location 2[b]
IPA	$\leqslant$200 mg/m^3 IPA	$\leqslant$500 mg/m^3 IPA
VOC hydrocarbon compounds (cleaners/solvents)[a]	$\leqslant$250 mg/m^3	$\leqslant$300 mg/m^3

[a] For hydrocarbon compounds in group 1.

[b] Momentary value.

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1) Available from National Fire Protection Agency, 1, Batterymarch Park, Quincy, Massachusetts, USA 02169-7471; www.nfpa.org.

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