



DPC: 25/30401688 DC

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Date: 22 September 2025

Origin: European

Latest date for receipt of comments: 15 November 2025

Project No. 2019/02588

Responsible committee: MCE/3/3 Packaging machines

Interested committees:

Title: Draft BS EN ISO 24158-1 Packaging machinery. Part 1: General safety requirements.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 24158-1

Packaging machinery — Part 1: General safety requirements

ICS: 55.200

ISO/TC 313

Secretariat: **UNI**

Voting begins on:
2025-09-22

Voting terminates on:
2025-12-15

This document has not been edited by the ISO Central Secretariat.

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 24158-1:2025(en)

Full document details: 25/30401688 DC

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Published in Switzerland

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Foreword

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

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

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This document was prepared by Technical Committee ISO/TC 313, *Packaging Machinery* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 146, *Packaging machines - Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 24158 series can be found on the ISO website.

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

Introduction

Packaging machines are used extensively in an increasingly wide range of industries. They contain several significant hazards that have the potential to cause severe injury. Packaging machines provide exceptional value and utility when used as intended but can also present significant risk of harm when misused.

The ISO 24158 series provides safety requirements for the design and construction of packaging machinery.

This document is a Type C standard as defined in the Introduction of ISO 12100:2010.

The requirements of the machine specific parts of ISO 24158 can supplement or modify the corresponding clauses of this document and have precedence over the requirements of this document. When a machine specific standard does not exist, the safety measures of this document can be applied according to the result of risk assessment on the specific machine.

The machinery concerned and the extent to which hazards, hazardous situations and events covered are indicated in the scope of this document.

When provisions of this Type C standard are different from those, which are stated in Type A or B standards, the provisions of this Type C standard take precedence.

Packaging machinery —

Part 1: General safety requirements

1 Scope

This document contains general requirements and measures for packaging machinery that performs packaging functions

- to prepare product or packaging material for handling in packaging machinery
- to pack or create packages
- to unpack or disassemble packages
- to inspect product or packaging to ensure the quality or quantity
- to handle, arrange, or dispense product or packaging
- to perform auxiliary functions to enable the execution of packaging functions.

Examples for packaging machines are:

- filling machines
- closing machines
- labelling, decorating and coding machines
- cleaning, sanitizing, cooling and drying machines
- fill and seal machines
- inspection machines
- container and component handling machines
- form, fill and seal machines
- cartoning machines
- wrapping machines
- group packaging machines
- pallet or loading unit forming and dismantling machines
- pallet wrapping machines
- strapping machines

NOTE 1 These machines are used for primary (first) packaging, secondary (second) packaging and tertiary (third) packaging.

The hazards on a specific machine can vary depending on its working principle; the type, size and mass of the product; the packaging material; auxiliary equipment attached to the machine and the environment in which the machine is used.

The requirements of this document can be used for modifying or rebuilding packaging machinery, and for integrating packaging machinery into a system.

This document contains safety requirements and risk reduction measures for the intended use, as well as reasonably foreseeable misuse of packaging machinery for the design, construction, installation, commissioning, operation, adjustment, maintenance and cleaning of packaging machines. This document describes procedures for identifying hazards, assessing risks, and reducing risks to an acceptable level over the life cycle of the machinery. This document also includes requirements for verifying the risk reduction measures to achieve an acceptable risk.

The extent to which hazards, hazardous situations and events are covered is indicated in [Annex B](#).

NOTE 2 It is supposed that the deviations from the requirements of this document are based on a documented risk assessment demonstrating acceptable risk. The requirements of this document are not supposed to inhibit innovation as long as acceptable risk is achieved.

Exclusions

This international standard is not applicable to the following:

- machines that were manufactured before the date of publication of this document
- the use of packaging machines in potentially explosive atmospheres
- conveyors that are not an integrated part of packaging machines
- packaging machinery used by retail consumers
- the risk resulting from the use of machines in public accessed areas.

2 Normative references

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

ISO 3740:2019, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards*

ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3746:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

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

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

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

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

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

- ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs*
- ISO 10218-2:2025, *Robotics — Safety requirements — Part 2: Industrial robot applications and robot cells*
- ISO 11200:2014+Amd 1:2018, *Acoustics - Noise emitted by machinery and equipment - Guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions*
- ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*
- ISO 11202:2010+Amd 1:2020, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections*
- ISO 11204:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections*
- ISO 11553-1:2020, *Safety of machinery — Laser processing machines — Part 1: Laser safety requirements*
- ISO 12001:1996, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*
- ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*
- ISO 13732-1:2006, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*
- ISO 13732-3:2005, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 3: Cold surfaces*
- ISO 13849-1:2023, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*
- ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*
- ISO 13854:2017, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*
- ISO 13855:2024, *Safety of machinery — Positioning of safeguards with respect to the approach of the human body*
- ISO 13856-1:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*
- ISO 13856-2:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars*
- ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*
- ISO 14118:2017, *Safety of machinery — Prevention of unexpected start-up*
- ISO 14119:2024, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*
- ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*
- ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access*
- ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

- ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*
- ISO 14122-4:2016, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders*
- ISO 14159:2002, *Safety of machinery — Hygiene requirements for the design of machinery*
- ISO 19353:2019, *Safety of machinery — Fire prevention and fire protection*
- ISO 20607:2019, *Safety of machinery — Instruction handbook — General drafting principles*
- ISO 80079-36:2016/Cor 1:2019, *Explosive atmospheres - Part 36: Non-electrical equipment for explosive atmospheres - Basic method and requirements*
- IEC 60079-0:2017, *Explosive atmospheres - Part 0: Equipment - General requirements*
- IEC 60079-14:2024, *Explosive atmospheres - Part 14: Electrical installation design, selection and installation of equipment, including initial inspection*
- IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*
- IEC 60825-1:2014, *Safety of laser products — Part 1: Equipment classification and requirements*
- IEC 60825-4:2022, *Safety of laser products — Part 4: Laser guards*
- IEC 61496-1:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*
- IEC 61496-2:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*
- IEC 61496-3:2018, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for active opto-electronic protective devices responsive to diffuse reflection (AOPDDR)*
- IEC 61800-5-2:2016, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional*
- IEC/TS 61496-4-2:2022, *Safety of machinery - Electro-sensitive protective equipment - Part 4-2: Particular requirements for equipment using vision based protective devices (VBPD) - Additional requirements when using reference pattern techniques (VBPDP)*
- IEC/TS 61496-4-3:2022, *Safety of machinery - Electro-sensitive protective equipment - Part 4-3: Particular requirements for equipment using vision based protective devices (VBPD) - Additional requirements when using stereo vision techniques (VBPDS)*
- IEC 62061:2021, *Safety of machinery - Functional safety of safety-related control systems*
- EN 614-1:2006+A1:2009, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*
- EN 614-2:2000+A1:2008, *Safety of machinery — Ergonomic design principles — Part 2: Interactions between the design of machinery and work tasks*
- EN 1005-2:2003+A1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*
- EN 1005-3:2002+A1:2008, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*
- EN 1005-4:2005+A1:2008, *Safety of machinery — Human physical performance — Part 4: Evaluation of working postures and movements in relation to machinery*
- EN 1127-1:2019, *Explosive atmospheres — Explosion prevention and protection - Part 1: Basic concepts and methodology*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010, and the following shall apply.

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

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

3.1 carousel

rotating machine element which locates and transports product, e.g. containers through one or more processes in a packaging machine

3.2 change parts

machine parts designed to handle a specific product, packaging material or pack size that are changed when the machine is set up to handle a different product, packaging material or pack size

3.3 cleaning

removal of soil

[SOURCE: ISO 14159:2002, 3.4]

3.4 compensator

device which maintains a constant tension of the packaging material

3.5 hot melt adhesive

adhesive that is solid at room temperature and which can be applied at elevated temperature

3.6 modified atmosphere

atmosphere where the normal atmosphere is completely or partially replaced by one or more selected gases

Note 1 to entry: Usually the objective is to extend shelf or storage life of the packaged product.

3.7 packaging machine

machine that performs one or more packaging functions

Note 1 to entry: Packaging functions include

- prepare product or packaging material for handling in packaging machinery
- pack or create packages
- unpack or disassemble packages
- inspect product or packaging to ensure the quality or quantity
- handle, arrange, or dispense product or packaging
- perform auxiliary functions to enable the execution of packaging functions.

3.8

packaging material

material or component used to make a package

EXAMPLE Corrugated board, carton board, stretch film, paper, polypropylene.

3.9

package

[noun]

packaging material and its contents

[SOURCE: ISO 21067-1:2016, 2.1.3 modified]

3.10

product

substance, article, packaging, package or group of packages that are handled in the packaging machine

3.11

reasonably foreseeable misuse

use of machinery in a way not intended by the supplier or user, but which may result from readily predictable human behaviour

Note 1 to entry: For example, reasonably foreseeable misuse includes the following human factors (not intended as an all-inclusive list):

- inappropriate actions as a result of mistakes, errors, and poor judgment, excluding deliberate abuse of the machine
- inappropriate actions or reactions taken in response to unusual circumstances such as equipment malfunction
- the tendency to take the “path of least resistance” in carrying out a task; and
- misreading, misinterpreting or forgetting information.

[SOURCE: ANSI/PMMA B155.1:2016, definition 3.39]

3.12

rotary mechanism

generic configuration where packaging functions are performed whilst the product is transported through the machine in a circular path

3.13

safety distance

safe separation distance

S_r

minimum distance a protective structure is required to be placed from a hazard zone

[SOURCE: ISO 13857:2019, 3.3]

3.14

safety related parts of control systems

SRP/CS

part of a control system that performs a safety function, starting from a safety-related input(s) to generating a safety-related output(s)

Note 1 to entry: The safety-related parts of a control system start at the point where the safety-related inputs are initiated (including e.g. the actuating cam and the roller of the position switch) and end at the output of the power control elements (including e.g. the main contacts of a contactor).

[SOURCE: ISO 13849-1:2023, 3.1.1]

3.15

sanitizing (disinfection)

physical or chemical procedures

- performed with liquid agents, e.g. peracetic acid, or
- performed with gaseous agents, e.g. hydrogen peroxide, or
- performed with radiation, e. g. ultraviolet rays, or
- performed with heat, or
- performed by a combination of some of these methods

which are used to reduce the number of germs

Note 1 to entry: Examples are:

- immersion bath in the sterilising agent with drying by means of germ-reduced hot air and/or UV light,
- dry germ reduction procedure and dilution of the sanitizing agent with germ-reduced water.

Germ reduction procedures can be used for:

- packaging materials (bottles, cans, kegs, containers, closures),
- machine surfaces in the food industry, splash area,
- conveyor area of germ-reduced filling and sealing.

3.16

soil

any unwanted matter, including product residues, micro-organisms, residual detergent or disinfecting agents

[SOURCE: ISO 14159:2002, 3.31, modified]

3.17

strap

band of material, usually made from mild steel, polypropylene or polyester, which is passed around a group of products, tensioned and then sealed to hold the products together

3.18

remote service

machine control mode where faults can be diagnosed, parameters can be changed, and machine functions can be initiated from a geographical location that is different from the machine position

3.19

electro-sensitive protective equipment

ESPE

assembly of devices and/or components working together for protective tripping or presence sensing purposes and comprising as a minimum

a sensing device

controlling/monitoring devices

output signal switching devices and/or a safety-related data interface.

[SOURCE: IEC 61496-1:2020,3.5, modified-(notes 1 and 2 to entry have been removed)]

3.20

active opto-electronic protective device

AOPD

ESPE whose sensing function is performed by opto-electronic emitting and receiving elements detecting the interruption of optical radiations generated, within the device, by an opaque object present in the specified detection zone (or for a light beam device, on the axis of the light beam)

[SOURCE: IEC 61496-2:2020,3.201, modified-(note 1 to entry has been removed)]

3.21

active opto-electronic protective device responsive to diffuse reflection

AOPDDR

device, whose sensing function is performed by opto-electronic emitting and receiving elements, that detects the diffuse reflection of optical radiations generated within the device by an object present in a detection zone specified in two or three dimensions

[SOURCE: IEC 61496-3:2018, 3.301, modified-(notes 1 and 2 to entry have been removed)]

3.22

interlocking swing door

movable interlocked guards, typically in pairs, which are pushed open with the product and closed with power, e. g. springs, or open and close with power

4 Risk assessment

The packaging machine manufacturer shall carry out a risk assessment to identify the specific hazards, potential hazardous situations and events on the machine. The packaging machine manufacturer shall assess the risk associated with the hazards and select risk reduction measures to achieve an acceptable level of risk.

NOTE 1 The manufacturer can also be a modifier, rebuilder, or an integrator of machinery.

For machinery intended for the food or pharmaceutical industries, the manufacturer shall perform a risk assessment to identify hygienic hazards and select appropriate risk reduction measures. This shall include product contamination hazards.

Risk assessment on machinery covered by all parts of ISO 24158 shall be conducted in accordance with ISO 12100:2010. If the machine presents hazards that are not dealt with in this standard, the manufacturer should assess these hazards by using the principles detailed in ISO 12100:2010. Such deviations or additions are outside the scope of this standard.

During the risk assessment process, the manufacturer shall identify hazards, hazardous situations and events on the individual machine in addition to the hazards described in this document.

NOTE 2 Manufacturers and users collaborate to attain the goal of acceptable risk through the risk assessment process. Effective communication between manufacturer and user is recommended where possible, but the success of the risk assessment process is not depended on this relationship.

The application of this document does not release the manufacturer from the responsibility of performing a risk assessment for the packaging machinery.

Where the hazards, hazardous situations and events are similar to those described [Annex B](#) of this document, the relevant requirements of [Clause 5](#) shall be selected.

5 Safety requirements and risk reduction measures

5.1 General

All the machines in the scope of this standard shall comply with the safety requirements of [5.2](#) to [5.3](#) and, where the equivalent hazard exists, with [5.4](#) to [5.19](#) of this document.

Where hazards, hazardous situations or events or risk reduction measures on a machine are not addressed in this document, the machine shall be designed according to the requirements of ISO 12100:2010 Clause 6.

NOTE 1 Significant hazards and hazardous situations considered for the risk reduction measures in this document are described in informative [Annex B](#).

Risks shall be reduced for all phases of the life cycle of the machine, using the hazard control hierarchy given in ISO 12100:2010, Clause 4.

NOTE 2 Risk reduction measures are a combination of the measures taken by the machine supplier or the user. Measures which can be incorporated at the design stage are preferable to, and generally more effective than, those which are implemented by the user.

NOTE 3 This clause contains requirements for risk reduction measures used for packaging machinery. [Clauses 5.2 – 5.3](#) include requirements structured around the first two steps of the 3 step method of risk reduction according to ISO 12100:2010 (inherently safe design and safeguarding). [Clauses 5.4 – 5.18](#) include requirements based on specific hazards (e.g., trapping, stability, hot and cold surfaces, etc.). [Clause 5.19](#) lists requirements for particular machine assemblies or mechanisms (e.g., pneumatic equipment, cutting, sealing, conveyors, etc.).

5.2 Inherently safe design

5.2.1 General

Risks should be eliminated or reduced by inherently safe design according to ISO 12100:2010.

NOTE Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine. Examples are drive systems which are not able to exceed the force limits, designing the point of gravity inside the footprint of the machine (considering the foreseeably applied forces). Inherently safe design does not include measures which are applied only for risk reduction such as safety related parts of control systems or safeguarding.

5.2.2 Physical aspects

For inherently safe design for mechanical hazards, packaging machines shall be designed to adequately reduce the risk of injuries by not exceeding the applicable force and pressure threshold values by design features, e. g. the maximum available power of drives. The measurement of force and pressure shall be verified in accordance with ISO 10218-2:2025, Annex N.

NOTE Annex M of ISO 10218-2:2025 gives guidance on threshold limit values and Annex N gives guidance on measuring forces or pressures. These values are considered as applicable for mechanisms of packaging machinery, too. See ISO 10218-2:2025, 5.13.7.2 for contact situations which are also applicable to moving parts of packaging machinery.

To prevent a crushing hazard between a fixed and moving part or between two moving parts, minimum distance shall be provided in accordance with ISO 13854:2017.

The risk of entanglement and friction presented by rotating shaft ends can be considered as minimized if they are smooth, have no protruding parts and do not protrude from the machine more than $\frac{1}{4}$ of their diameter.

5.2.3 Visibility and maintenance aspects

Where feasible, access points for setting or maintenance shall be placed outside hazard zones or accessible without opening or dismantling guards, e. g. by

- providing transparent guarding or condition indicators for inspecting points placed in hazard zones;
- providing lubricating supply devices for lubrication zones placed in hazard zones;
- providing lubrication points outside hazard zones;
- not placing power supply equipment under the lifting mechanisms, e. g. fluid pumps, fluid valves, gears.

5.3 Safeguarding

5.3.1 General

Where safeguarding is applied, it shall be singular or a combination of measures. The kind of safeguarding will result from the function of the machine and the combination of risks which are present on the machine.

The safeguarding for a machine (e. g. guards, Electro-Sensitive Protective Equipment (ESPE) or two-hand-controls) shall prevent access to hazard zones for all product and pack sizes for which the machine has been specified. Where this is not practical, adjustable guards or change-part guards shall be used. The design of the guards and the number, size and position of access doors in guards shall ensure that the machine can be operated, cleaned, prepared to handle different products or pack sizes and maintained with tolerable risk.

If not stated otherwise in this document, slot shaped openings shall not be wider than 180 mm to prevent whole body access.

Where there is a significant risk from ejected materials or substances (e.g. product, glue or broken glass), guards shall be used.

Where no specific choice of fixed or interlocking guards is specified in this document, the guards shall be chosen according to ISO 14120:2015.

Interlocking guards or ESPE shall be used where access to the hazard zone is foreseeable once a week or more often.

Where a machine has more than five interlocking guards or ESPE and

- where the status of these guards or ESPE is not easily identifiable from the operator panel's position, or
- where the necessary walking distance for the operator to check these guards or ESPE is more than 20 m, or
- where barriers hinder adequate access, e. g. cross-under of conveyors, use of footbridges,

the control panel or other clearly visible display shall signal which guard is open or which interlock is in a fault condition.

5.3.2 Power and force limiting by safety functions

Where the design of the machine includes moving parts which are not intended to be safeguarded, e.g. to allow collaborative operations, the safety related parts of the control system shall be designed to adequately reduce the risk of injuries by not exceeding the applicable threshold values. The measurement of force and pressure shall be verified in accordance with ISO 10218-2:2025, Annex N.

NOTE Annex M of ISO 10218-2:2025 gives guidance on threshold limit values and Annex N gives guidance on measuring forces or pressures. These values are considered as applicable for mechanisms of packaging machinery, too. See ISO 10218-2:2025, 5.13.7.2 for contact situations which are also applicable to moving parts of packaging machinery.

5.3.3 Guards

Guards shall comply with [5.3.9](#), [5.3.9](#) ISO 14120:2015 and the following list:

- a) The guard shall retain ejected product.
- b) Guards shall be designed so that they will remain in place after a breakage e.g. by use of laminated glass for guards made of glass.
- c) When using tempered safety glass, product contamination by broken glass shall be prevented or product contaminated by broken glass shall be rejected.
- d) Where guards are made of a transparent material and there is a significant risk of someone walking into the guard, the guard shall be marked or fitted with features which make the guard clearly visible.

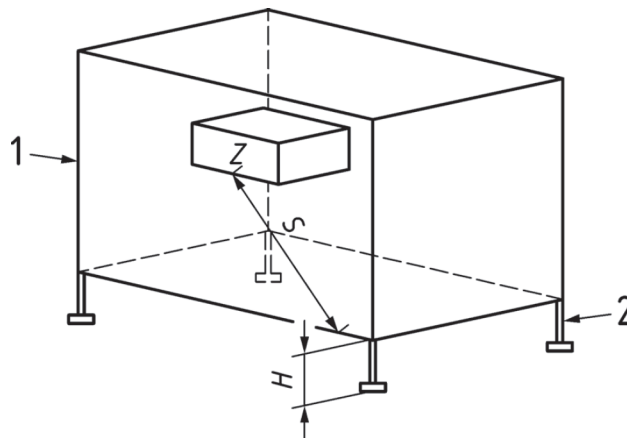
- e) Unless otherwise specified in this document, the guards shall be dimensioned and positioned so that the safety distances comply with those specified in ISO 13857:2019.
- f) Open topped distance guards shall be at least 2 000 mm high from the floor or other plane of access and the distance from the upper edge of the guards to the nearest hazard zone shall comply with ISO 13857:2019, Table 2.
- g) For the distance between floor level and the lowest edge of the guard (H in [Figure 1](#)) and the safety distance (S in [Figure 1](#)), which is the shortest distance from the lower edge of the guard to the hazard zone (Z in [Figure 1](#)) and could also be inclined, the following requirements shall apply:
 - 1) if the distance H (see [Figure 1](#)) is less than or equal to 20 mm the safety distance S (see [Figure 1](#)) to the nearest hazard zone (Z in [Figure 1](#)) shall comply with ISO 13857:2019, Table 4
 - 2) where the is greater than 20 mm but less than or equal to 40 mm, the safety distance S (see [Figure 1](#)) to the nearest hazard zone (Z in [Figure 1](#)) shall be at least 550 mm.
 - 3) the distance H (see [Figure 1](#)) between the floor and the lower edge of the guard shall not exceed 180 mm. Where there is foreseeable that the distance H (see [Figure 1](#)) of 180 mm impedes necessary interventions like removing packages, waste or soil with suitable tools during operation without the need of opening the guard, it is permissible to increase this distance to a maximum of 240 mm.

NOTE 1 Guards that prevent necessary task could be an incentive for defeating the guard in this situation.

Where this distance H (see [Figure 1](#)) is greater than 40 mm but less than or equal to 240 mm, and where no hazard zone (Z in [Figure 1](#)) can be reached with the lower limbs, the safety distance to the nearest hazard zone (Z in [Figure 1](#)) shall not be less than 850 mm.

NOTE 2 ISO 13857:2019, Table 7 considers the safety distances for the lower limbs.

- 4) if 1), 2) or 3) are not applied, the hazard zones which could be reached shall be safeguarded.



Key

1	guard
2	machine foot
Z	hazard zone
S	safety distance
H	distance between floor and guard

Figure 1 — Distance between floor and lower edge of the guard

[Table 1](#) gives an overview of the safety distances depending on the distance between the floor and the lower edge of the guard.

Table 1 — Safety distances depending on the distance between the floor and the lower edge of the guard

Distance H	Safety distance S
≤ 20 mm	ISO 13857:2019, Table 4
$20 \text{ mm} < H \leq 40$ mm	$S \geq 550$ mm
$40 \text{ mm} < H \leq 240$ mm	$S \geq 850$ mm

5.3.4 Interlocking guards

Interlocking guards shall comply with [5.3.1](#) and the following requirements:

Interlocking devices shall comply with ISO 14119:2024.

When an interlocking guard is opened, it shall not be possible to reach a hazard zone before all hazardous functions have stopped or reached a safe state.

The overall system stopping performance, and the minimum distance shall be calculated according to ISO 13855:2024.

Where this objective is not achieved, a guard locking device complying with ISO 14119:2024, 5.7 or another measure to ensure the necessary approach time according to ISO 13855:2024 shall be applied.

5.3.5 Adjustable guards

Adjustable guards shall either

- a) be linked to the functional size changing parts so that they are adjusted positively with those parts, or
- b) be fitted with interlocking devices which ensure that the machine cannot be started or operated unless the guards related to the required size are adjusted properly.

5.3.6 Change part guards

Change part guards shall either

- a) be connected to the functional change parts so that the machine cannot function without the appropriate guard being fitted, or
- b) be fitted with interlocking devices complying with ISO 14119:2024 to prevent the machine from running without the correct change part guard in place.

Change part guards shall comply with the ergonomic design requirements of [5.17.2](#).

5.3.7 ESPE

5.3.7.1 General

Electro sensitive protective equipment (ESPE) shall comply with IEC 61496-1:2020, IEC 61496-2:2020, IEC 61496-3:2018, IEC/TS 61496-4-2:2022, and IEC/TS 61496-4-3:2022 as applicable for the type of ESPE.

5.3.7.2 Positioning of AOPD

5.3.7.2.1 Horizontal positioning

The minimum distance between the AOPD and the nearest hazard zone shall comply with ISO 13855:2024, 6.2.

The positioning of the AOPD shall consider the tasks to be performed on the machine, potential reasonably foreseeable misuse, and the approach speed of a person.

To calculate the minimum distance between an AOPD and the nearest hazard zone, a minimum approach speed of 1 600 mm/s shall be used.

Where access to a hazard is by walking on a roller, chain or belt conveyor, an approach speed of 800 mm/s may be used, when all the following conditions are fulfilled:

a) For roller conveyors:

The distance between the rollers is greater than 120 mm, there are no infill plates between the rollers and the side frames supporting the rollers are no wider than 40 mm.

b) For chain conveyors or belt conveyors:

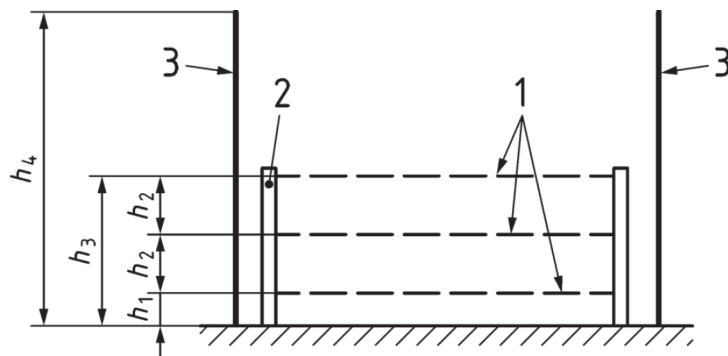
- 1) the minimum distance between the centre of the chains or belts is 550 mm, and
- 2) the belts or chains are no wider than 40 mm, and
- 3) the space between the chains or belts is designed so that it cannot be walked on. This requirement shall be fulfilled for a minimum of 1 000 mm in front and 1 000 mm behind the AOPD.

However, to prevent reaching over the AOPD, Table 2 of ISO 13855:2024 shall be used.

5.3.7.2.2 Vertical Positioning

For the vertical positioning of AOPD the following shall apply as shown in [Figure 2](#) and [Figure 3](#) for examples:

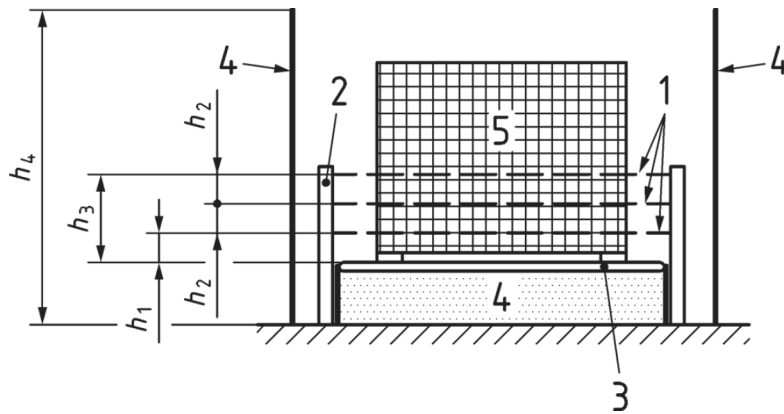
- 1) the lowest beam shall not be positioned higher than 300 mm over the lower edge of the opening (h_1 in [Figure 2](#) and [Figure 3](#));
- 2) the distance between two beams (h_2 in [Figure 2](#) and [Figure 3](#)) shall not exceed 400 mm;
- 3) the distance between the upper beam and the top edge of the opening shall not exceed 400 mm
- 4) for openings higher than 1 100 mm, at least three beams are required which are positioned in a height of:
 - a) lowest beam: $200 \text{ mm} < h_1 \leq 300 \text{ mm}$
 - b) highest beam: h_3 (see [Figure 2](#) and [Figure 3](#)) $\geq 1\,000 \text{ mm}$ over the lower edge of the opening.



Key

- | | |
|-------|---|
| 1 | beams of AOPD |
| 2 | column of AOPD |
| 3 | fixed guard |
| h_1 | distance between floor level and lowest beam |
| h_2 | distance between two beams |
| h_3 | distance between floor level and highest beam |
| h_4 | height of the guard |

Figure 2 — Positioning of AOPD above floor level or plane conveyor

**Key**

- | | |
|----|---|
| 1 | beams of AOPD |
| 2 | column of AOPD |
| 3 | conveyor |
| 4 | fixed guard |
| 5 | product |
| h1 | distance between floor level and lowest beam |
| h2 | distance between 2 beams |
| h3 | distance between floor level and highest beam |
| h4 | height of the guard |

Figure 3 — Positioning of AOPD above roller conveyor**5.3.7.3 Muting of AOPD**

The AOPD may be muted to allow product or material to enter or exit the machine. Muting functions shall comply with ISO 13849-1:2023, 5.2.2.5 and the following.

- a) Muting shall be limited to a period that is sufficient for the product to pass through the detection zone. When the corresponding time is exceeded, the muting function shall be cancelled, and all hazardous movements of the machine in the safeguarded space shall be stopped. The muting shall begin or end when the nearest edge of the product is ≤ 200 mm away from the AOPD.
- b) The muting function shall distinguish a person from the product that is allowed to pass the detection zone. Distinguishing between a person and product can be accomplished with, for example:
 - by an additional signal for muting is taken from the control system of the machine, so that muting only starts when the expected product is present, or
 - by using a laser scanner which is programmed for the shapes of the product.
- c) For conveyors other than roller or chain conveyors, e.g. flat belt conveyors, a muting system shall be used that cannot be initiated by a conveyed person but that is able to distinguish between persons and product, e.g.
 - by using a laser scanner which is programmed for the shapes of the product, or
 - an additional signal for muting is taken from the control system of the machine, so that muting only starts when the expected product is present.
- d) an operational stop of the product in the detection zone is not permissible.

NOTE The informative Annex D of IEC 62046:2018 provides examples for the configuration of photoelectric muting sensors.

5.3.8 Separation of hazard zones

Where the machine can operate independently in different zones or the complete stop of the whole machine is impracticable, the zones of the machine shall be able to operate separately with tolerable risk. The machine shall be segregated into clearly identifiable zones where operators can perform their tasks safely in one zone while the machine is running in the other zones.

NOTE For separation of hazard zones, see ISO 11161:2007.

5.3.9 Openings in guards

5.3.9.1 General

Openings in guards for interventions or entry or exit of product or packaging material shall comply with the following.

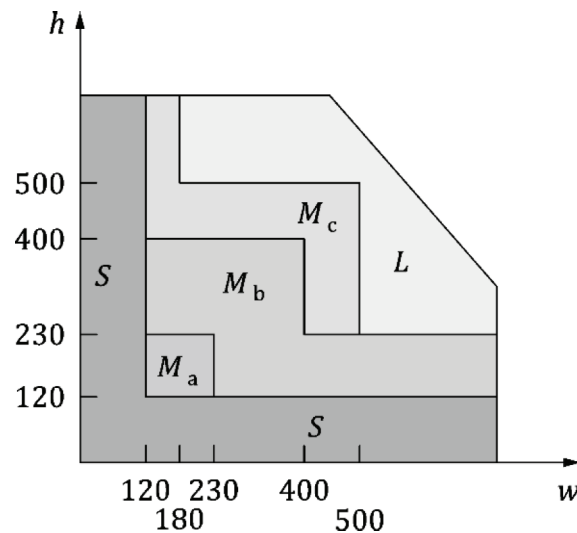
Crushing or shearing hazards by product moving through an opening or passing a fixed part of the machine or guard, except along guide rails without interruptions of more than 4 mm guiding the product, shall be minimized by one of the following ways unless stated otherwise in this document:

- a) limiting the force of the object in transit, according to [5.2](#)
- b) using the distances in ISO 13854:2017
- c) fitting a pressure sensitive edge to the fixed part complying with ISO 13856-2:2013
- d) fitting a hinged interlocking guard complying with [5.3.9.3.8](#) which opens in the moving direction of the product.

The safety requirements to prevent access to a hazard zone through an opening vary depending on the dimensions of the opening, the height of the opening from the nearest access platform, the shape of the guarding around the opening and presence of a conveyor in the opening.

Three main types of opening are defined as shown in [Figure 4](#):

- 1) small openings, designated as “S”
- 2) medium openings designated as “M_a”, “M_b” and “M_c”
- 3) large openings designated as “L”.

**Key**

L	dimensions of large openings
M	dimensions of medium openings
S	dimensions of small openings
w	clear width of the opening
h	clear height of the opening

Figure 4 — Entry or exit points - dimensions of openings

Depending on the dimensions of the opening, the safeguarding measures stated in [5.3.9.2](#), [5.3.9.3](#) or [5.3.9.4](#) of this document shall apply.

At entry or exit points no additional safeguarding is required when all the following conditions are fulfilled:

- the distance between the access platform and the lower edge of a product entry or exit opening or between the access platform and the product conveying plane is 1 600 mm or more
- there is no foreseeable reason to gain access to the product entry or exit point (e.g. for troubleshooting, maintenance, cleaning)
- the design prevents climbing to the opening.
- the safety distances of ISO 13857:2019, Table 2 are met.

5.3.9.1.1 Overview

[Table 2](#) gives an overview over the examples of safeguarding methods for openings in guards and can be used for quick allocation of suitable application requirements.

Table 2 — Overview over safeguarding measures for openings in guards

Clause No.	Header
5.3.9.2	Small openings
5.3.9.3	Medium openings
5.3.9.3.1	General
5.3.9.3.2	Medium openings without conveyor and without tunnel guard
5.3.9.3.3	Medium openings with bent tunnel guard
5.3.9.3.4	Medium openings with conveyor but without tunnel
5.3.9.3.5	Medium openings with conveyor and tunnel guard

Table 2 (continued)

Clause No.	Header
5.3.9.3.6	Power operated guard
5.3.9.3.7	ESPE trip device
5.3.9.3.8	Preventing crushing and shearing on machines with flighted conveyors
5.3.9.4	Large openings
5.3.9.4.1	General
5.3.9.4.2	Interlocking swing door
5.3.9.4.3	Power operated roller shutter guard
5.3.9.4.4	Interlocking horizontal bars with AOPD
5.3.9.4.5	Use of AOPD where there is a low risk of crushing or shearing
5.3.9.4.6	Use of AOPD where there is a high risk of crushing or shearing
5.3.9.4.7	Vertical AOPD for products with only varying width
5.3.9.4.8	Automatic selection of active detection zones with a safety protective device, e.g. a laser scanner

5.3.9.2 Small openings

For small openings (area S [Figure 4](#)) the safety distance to the nearest hazard zone through the opening shall comply with ISO 13857:2019.

Where for technical reasons the reach distances indicated above are not feasible, one of the safeguarding methods indicated in [5.3.9.3.3](#) to [5.3.9.3.8](#) or a method to the same effect shall be used.

5.3.9.3 Medium openings

5.3.9.3.1 General

For medium openings as shown in [Figure 4](#) one of the following safeguarding methods shall be used.

Tunnel guards or parts of them for foreseeable regular interventions once a week or more often shall be movable and interlocking.

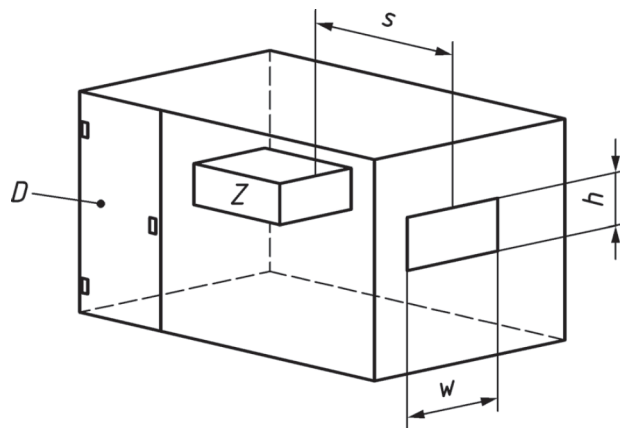
[Table 3](#) indicates the safety distances for medium openings according to the dimensions of the openings under the presumption that the cross section of a possible tunnel is the same as that of the opening. Safety distances for medium openings shall meet the requirements of [Table 3](#).

Table 3 — Safety distances for medium openings

Size of opening (from 5.3.9.1)	Safety distance (mm) for openings without a conveyor and without tunnel guard as indicated in 5.3.9.3.2	Safety distance (mm) for open- ings with bent tunnel guards with or without a conveyor as indicated in 5.3.9.3.3	Safety distance (mm) for openings with a conveyor but without a tunnel guard as indicated in 5.3.9.3.4	Safety distance (mm) for openings with a conveyor and a tunnel guard as indicated in 5.3.9.3.5	Minimum tunnel and conveyor length l as indicated in 5.3.9.3.3, and 5.3.9.3.5
M_a	$s \geq 1\,000$	for $135^\circ \geq \alpha \geq 90^\circ$, for $s_2 \geq 300$ ($s+s_2$) ≥ 850	$s \geq 900$	$s \geq 850$	$l \geq 500$
M_b	$s \geq 1\,200$	$s + s_2 \geq 900$ for $135^\circ \geq \alpha \geq 90^\circ$, else: column 2 applies for $s_2 \geq 300$	$s \geq 1\,000$	$s \geq 900$	$l \geq 500$
M_c	5.3.9.4 shall apply	$s \geq 1\,100$ for $135^\circ \geq \alpha \geq 90^\circ$, else: column 2 applies	$s \geq 1\,400$	$s \geq 1\,100$	$l \geq 1\,000$

5.3.9.3.2 Medium openings without conveyor and without tunnel guard

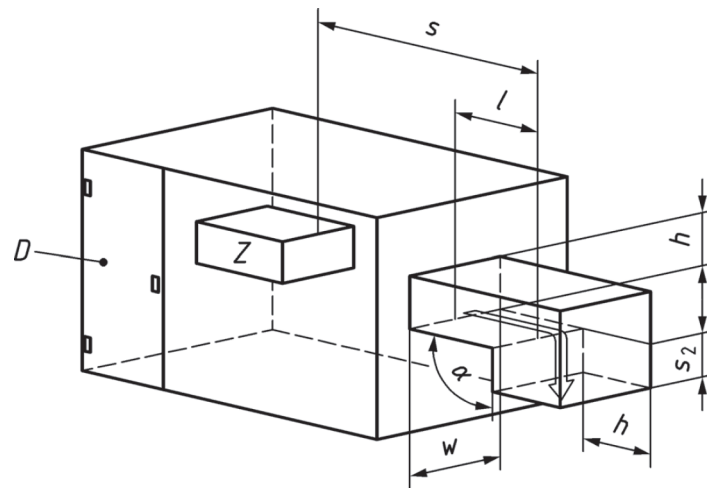
For medium openings without entry or exit of a conveyor as shown in Figure 5 the safety distances as stated in column 2 of Table 3 shall apply.

**Key**

D	interlocking guard
Z	hazard zone
s	safety distance
h	height of opening
w	width of opening

Figure 5 — Medium opening without conveyor and without tunnel guard**5.3.9.3.3 Medium openings with bent tunnel guard**

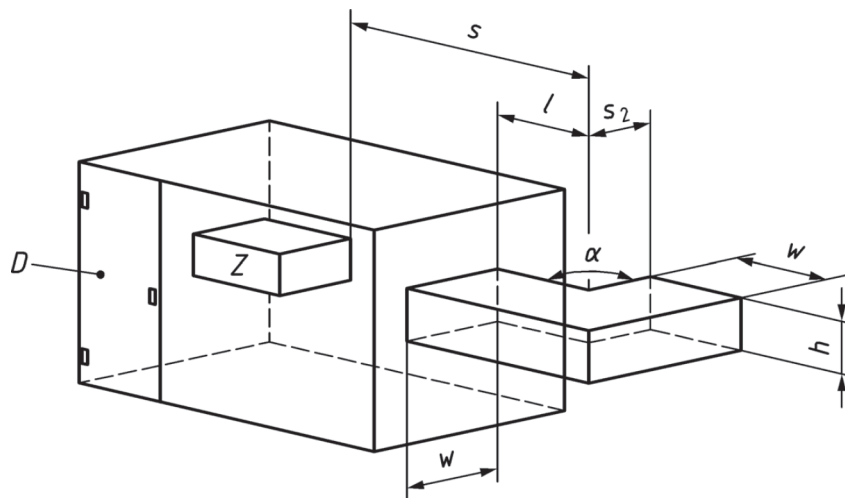
For medium openings where a bent tunnel guard is applied as shown in Figure 6 and Figure 7 the safety distances as stated in column 3 and column 6 of Table 3 shall apply.



Key

Z	hazard zone
D	interlocking guard
s	safety distance
s_2	length of the vertical part of the tunnel
h	height of opening
w	width of opening
l	length of tunnel
α	angle of bent tunnel

Figure 6 — Medium opening with vertically bent tunnel guard



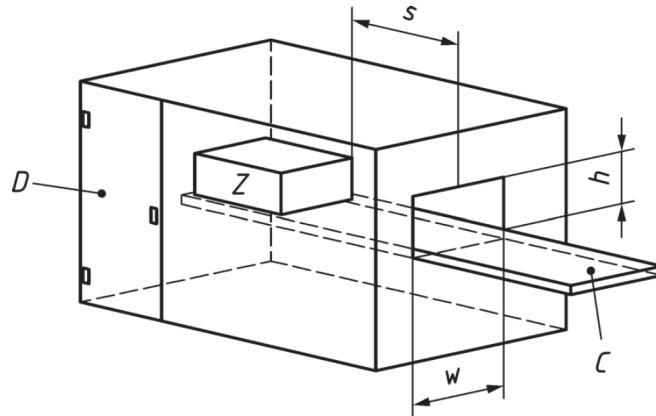
Key

Z	hazard zone
D	interlocking guard
s	safety distance
s_2	length of angled part of tunnel
h	height of opening
w	width of opening
l	length of tunnel
α	angle of bent tunnel

Figure 7 — Opening with horizontal bent tunnel guard

5.3.9.3.4 Medium openings with conveyor but without tunnel

For medium openings where a conveyor enters or exits as shown in [Figure 8](#) the safety distances as stated in column 4 of [Table 3](#) shall apply.



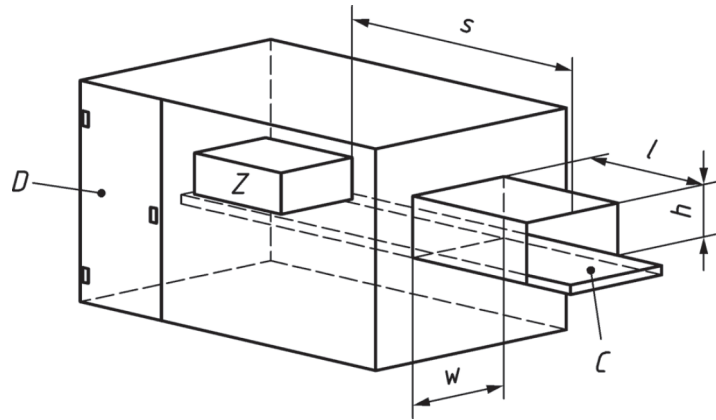
Key

Z	hazard zone
D	interlocking guard
C	conveyor
h	height of opening
w	width of opening
s	safety distance

Figure 8 — Machine with conveyor but without tunnel guard

5.3.9.3.5 Medium openings with conveyor and tunnel guard

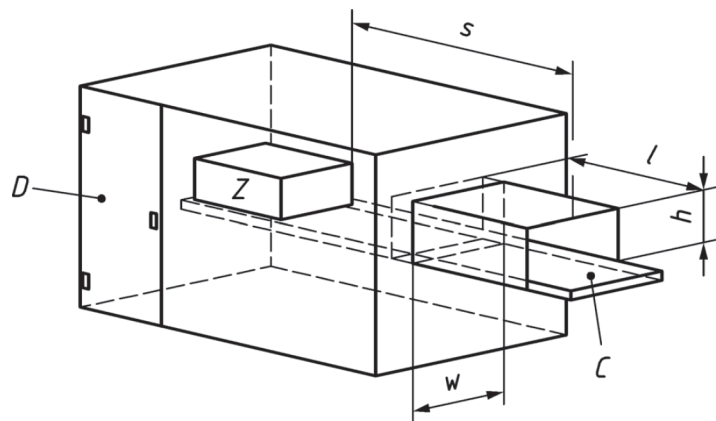
For medium openings where a conveyor enters or exits, and a tunnel guard is applied as shown in [Figure 9](#) and [Figure 10](#), the safety distances as stated in column 5 of [Table 3](#) and the minimum tunnel length as stated in column 6 of [Table 3](#) shall apply.



Key

Z	hazard zone
D	interlocking guard
C	conveyor
h	height of opening
w	width of opening
l	length of tunnel
s	safety distance

Figure 9 — Opening with conveyor and tunnel guard



Key

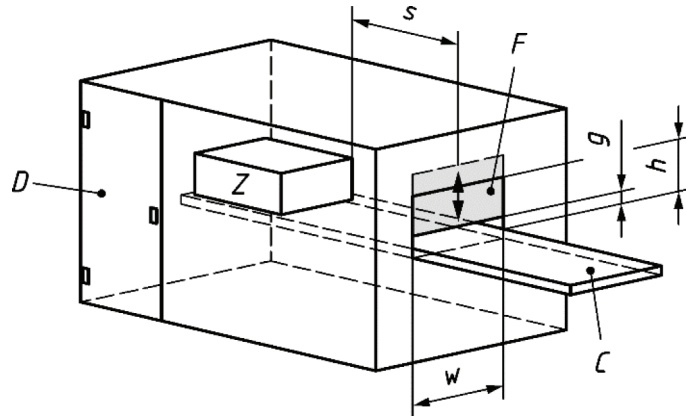
Z	hazard zone
D	interlocking guard
C	conveyor
h	height of opening
w	width of opening
l	length of tunnel
s	safety distance

Figure 10 — Opening with conveyor and tunnel guard reaching into the safeguarded space

5.3.9.3.6 Power operated guard

A power operated guard shall not open until the product has reached a position where a person cannot reach into the hazard zone between the product and the guards. The power operated guard shall close after the product has passed the opening and before the product has reached a position which allows access to the hazard zone.

When there remains a gap g between the power operated guard and fixed machine parts (as shown in [Figure 11](#)) and the interlocking device signals that the guard is in its closed position, the relevant safety distances of [5.3.9.2](#) or [Table 3](#) shall apply, depending on the size of the opening.



Key

Z	hazard zone
D	interlocking guard
C	conveyor
F	power operated guard
g	height of the gap
h	height of the opening
s	safety distance
w	width

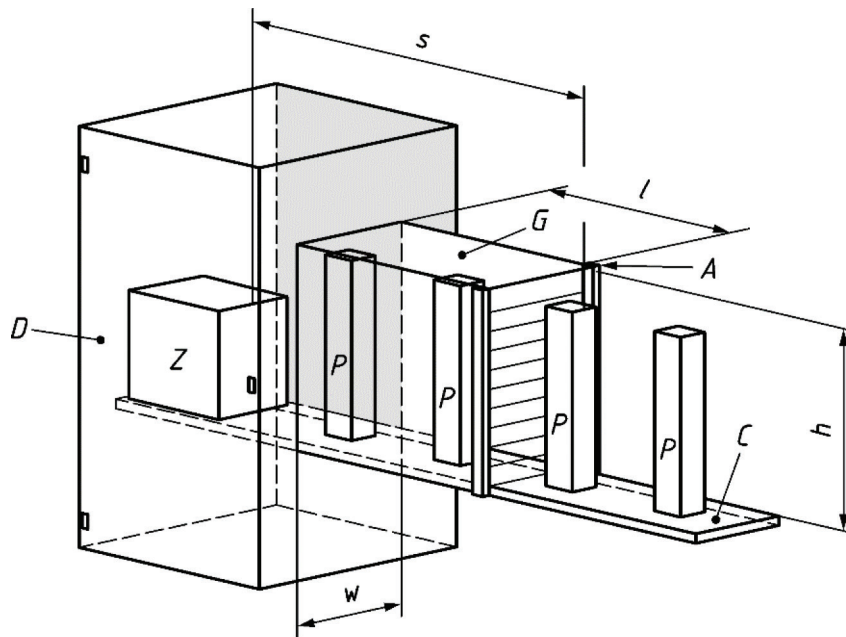
Figure 11 — Power operated guard — example

5.3.9.3.7 ESPE trip device

Packaging machinery that incorporate ESPE as shown in [Figure 12](#) shall ensure that the machine stops hazardous functions by a safety related stop as described in [5.18.4.2](#) when the ESPE is tripped. The passage of product without stopping the machine shall be ensured, e.g. by muting the ESPE.

The minimum distance between the hazard zone and the ESPE shall comply with [5.3.7.2](#).

For muting of the ESPE [5.3.7.3](#) shall apply.

**Key**

Z	hazard zone
D	interlocking guard
C	conveyor
G	tunnel guard
A	ESPE
P	product
l	length of tunnel
h	height of tunnel
w	width of tunnel
s	minimum distance

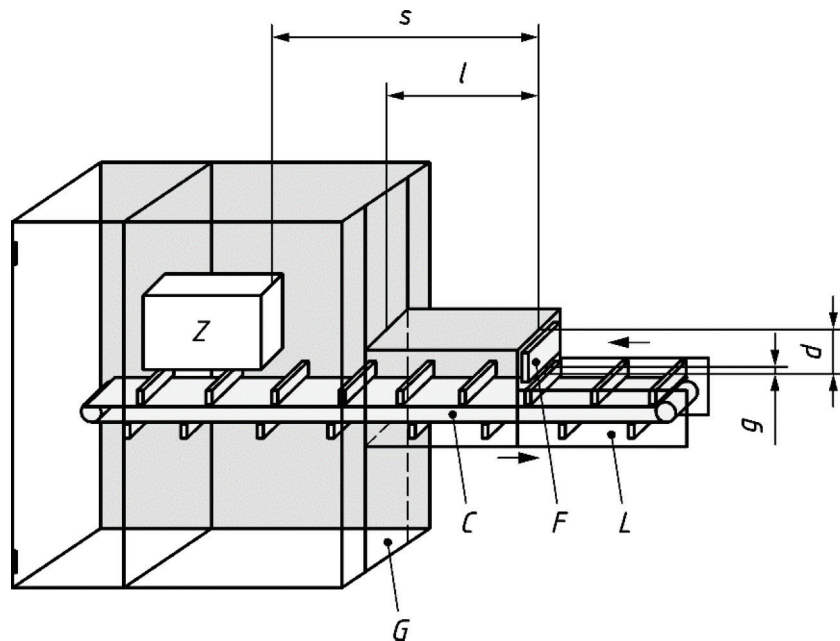
Figure 12 — ESPE trip device**5.3.9.3.8 Preventing crushing and shearing on machines with flighted conveyors**

Where flights or protruding parts of an infeed belt or chain conveyor or product moved by the flights create a crushing or shearing hazard with a fixed portion of the machine, a minimum of 120 mm shall be provided between the fixed portion and the moving component or product.

Access to the hazard zone in the machine and the crushing and shearing hazard between the moving flights of the return side and the guard shall be safeguarded.

Where this is not feasible or where the distance would allow to reach the hazard zone, a pendulum type guard or AOPD shall be used, as shown in [Figure 13](#).

To prevent crushing hazards the flights shall be guided by stable side guides without gaps greater than 4 mm which are at least of the same height as the flights. The distance between the side guides and the edges of the flights as well as between the lower edge of the interlocking guard and the upper edges of the flights (g) shall not exceed 5 mm. The distance d between fixed parts of the tunnel and the upper and lateral edges of the flights shall comply with ISO 13854:2017.

**Key**

C	conveyor with flights
F	pendulum type guard
G	guard
L	side guides
Z	hazard zone
d	distance between carrier and fixed guard
g	distance between carrier and pendulum type guard
l	tunnel length
s	safety distance / minimum distance

Figure 13 — Tunnel guard with interlocking guard – sectional view

5.3.9.4 Large openings

5.3.9.4.1 General

For large openings one of the safeguarding methods in this Subclause and [5.3.9.4.2– 5.3.9.4.8](#) shall be used. These methods also consider the risks of crushing and shearing which may arise from the mass or shape of the product passing through the opening. These methods use a combination of fixed and interlocking guards and ESPE. In addition, [5.4](#) shall apply.

NOTE 1 The following methods presume that access to the hazard zone is prevented while the product passes the opening. Where this is not the case, access shall be prevented by additional safeguarding measures.

The maximum dimensions for large openings shall comply with the following requirements:

NOTE 2 Interlocking swing doors are interlocking guards fitted in pairs to a large opening and are either pushed open by the moving product or powered or closed using e.g. springs or other power.

Where there are slot shaped openings, the maximum distance between fixed parts or between fixed and moving parts shall not exceed 180 mm as shown in [Figure 4](#).

At entry or exit openings the following shall apply:

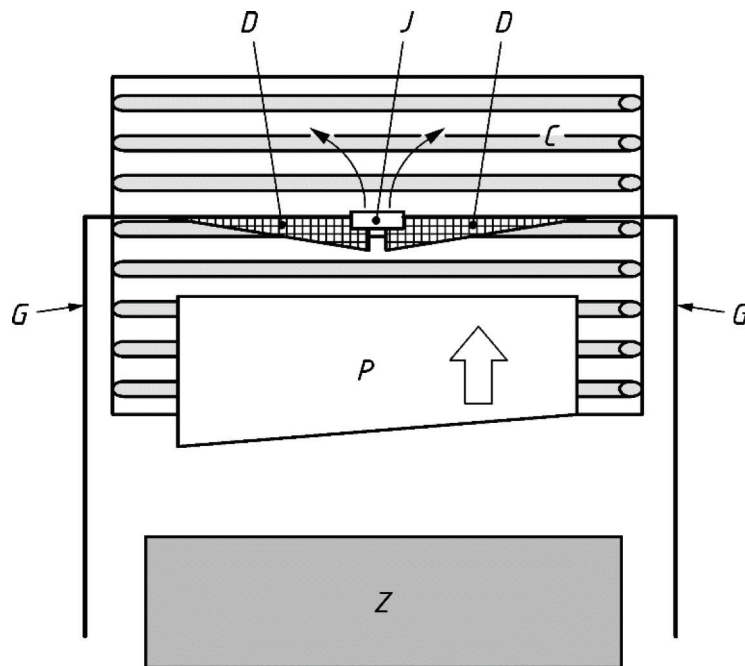
- On flat conveyors, like slat band or belt conveyors, the maximum distance between the product and fixed parts, shall not exceed 180 mm.

- b) On chain and roller conveyors, the maximum distance between the product and fixed parts shall not exceed 230 mm due to the potential product misorientation.
- Access to hazard zones in the machine below conveyors shall be prevented by design or by safeguarding.

5.3.9.4.2 Interlocking swing door

Interlocking guards, usually fitted in pairs (swing doors) to a large opening, which are either pushed open by the moving product and close using springs or open and close power operated.

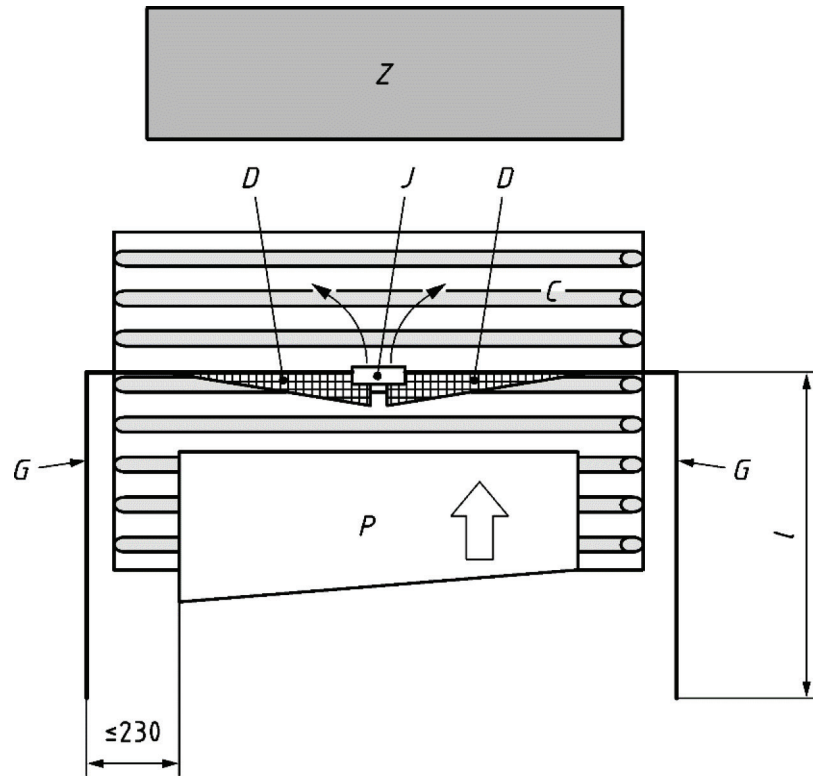
Where interlocking swing doors, as shown in [Figure 14](#), [Figure 15](#) and [Figure 16](#), are used to guard a large opening, these interlocking swing doors shall close as soon as the product has passed through the opening. If the intended delay time in closing the swing doors is exceeded, a safety related stop shall be initiated.



Key

C	conveyor
D	interlocking swing door
G	fixed guard
J	interlocking device
P	product
Z	hazard zone

Figure 14 — Interlocking swing doors – discharge – top view



Key

C	conveyor
D	interlocking swing door
G	fixed guard
J	interlocking device
P	product
Z	hazard zone
l	length of lateral guards

Figure 15 — Interlocking swing doors – in-feed – top view