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BSI Standards Publication

Safety of packaging machines

Part 10: General Requirements

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National foreword

This British Standard is the UK implementation of EN 415-10:2014.

The UK participation in its preparation was entrusted to Technical Committee MCE/3/3, Packaging machines.

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

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Foreword

This document (EN 415-10:2014) has been prepared by Technical Committee CEN/TC 146 “Packaging machines - Safety”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2014, and conflicting national standards shall be withdrawn at the latest by July 2014.

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

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This standard is part of a series of standards comprising the following parts:

— EN 415-1, *Packaging machines safety — Part 1: Terminology and classification of packaging machines and associated equipment*;

— EN 415-2, *Packaging machines safety — Part 2: Pre-formed rigid container packaging machines*;

— EN 415-3, *Safety of packaging machines — Part 3: Form, fill and seal machines*;

— EN 415-4, *Safety of packaging machines — Part 4: Palletizers and depalletizers*;

— EN 415-5, *Safety of packaging machines — Part 5: Wrapping machines*;

— EN 415-6, *Safety of packaging machines — Part 6: Pallet wrapping machines*;

— EN 415-7, *Safety of packaging machines — Part 7: Group and secondary packaging machines*;

— EN 415-8, *Safety of packaging machines — Part 8: Strapping machines*;

— EN 415-9, *Safety of packaging machines — Part 9: Noise measurement methods for packaging machines, packaging lines and associated equipment, grade of accuracy 2 and 3*;

— EN 415-10, *Safety of packaging machines — Part 10: General requirements* (the present document).

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

Introduction

Packaging machines are used extensively in Europe in an increasingly wide range of industries. They contain several significant hazards that have the potential to cause serious injury.

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

The requirements of the machine specific parts of EN 415 take precedence over the requirements of EN 415-10. The requirements of the machine specific parts of EN 415 may supplement or modify the corresponding clauses of EN 415-10.

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

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.

1 Scope

This European Standard gives general requirements for packaging machines which are defined in the scope of EN 415-1 or are in the scope of another relevant machine specific part of EN 415. When used together with a relevant machine specific part of EN 415, it gives the requirements for that specific type of machine.

This document deals with safety requirements and their verification for design, construction, installation, commissioning, operation, adjustment, maintenance and cleaning of packaging machines when used as intended and under the conditions of misuse foreseeable by a manufacturer.

The extent to which hazards, hazardous situations and events are covered is indicated in Clause 4.

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. 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 EN ISO 12100:2010. Such deviations or additions are outside the scope of this standard.

Exclusions

This European Standard is not applicable to the following:

— machines that were manufactured before the date of publication of this document by CEN.

This standard does not consider the following:

— the risk resulting from the use of machines in public accessed areas.

NOTE For machines used in public accessed areas different or additional requirements can apply. It is the responsibility of the manufacturer to identify such additional risks, which are outside the scope of this standard or such deviating risks which arise from this specific use, and provide suitable protective measures in accordance with EN ISO 12100.

— the use of packaging machines in potentially explosive atmospheres;

— specific health, safety or hygiene hazards associated with the products that may be handled by the machines, but does include general advice on this subject;

— hazards that may be associated with decommissioning packaging machines.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 349, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body*

EN 415-1, *Packaging machines safety - Part 1: Terminology and classification of packaging machines and associated equipment*

EN 415-9, *Safety of packaging machines - Part 9: Noise measurement methods for packaging machines, packaging lines and associated equipment, grade of accuracy 2 and 3*

EN 614-1, *Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles*

EN 614-2, *Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks*

EN 618, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of bulk materials except fixed belt conveyors*

EN 619, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of unit loads*

EN 626-1:1994+A1:2008, *Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufacturers*

EN 626-2, *Safety of machinery - Reduction of risk to health from hazardous substances emitted by machinery - Part 2: Methodology leading to verification procedures*

EN 953, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards*

EN 1005-2, *Safety of machinery - Human physical performance - Part 2: Manual handling of machinery and component parts of machinery*

EN 1005-3, *Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation*

EN 1005-4, *Safety of machinery - Human physical performance - Part 4: Evaluation of working postures and movements in relation to machinery*

EN 1037, *Safety of machinery - Prevention of unexpected start-up*

EN 1672-2:2005+A1:2009, *Food processing machinery - Basic concepts - Part 2: Hygiene requirements*

EN 1837, *Safety of machinery - Integral lighting of machines*

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

EN 12198-2, *Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 2: Radiation emission measurement procedure*

EN 12198-3, *Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery − Part 3: Reduction of radiation by attenuation or screening*

EN 13478, *Safety of machinery - Fire prevention and protection*

EN 60204-1:2006,[1)] *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005, mod.)*

EN 60529:1991,[2)] *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60825-1:2007, *Safety of laser products - Part 1: Equipment classification and requirements (IEC 60825-1:2007)*

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1) This standard is impacted by the stand-alone amendment EN 60204-1:2006/A1:2009, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (EN 60204-1:2005/A1:2008)*

2) This standard is impacted by the stand-alone amendment EN 60529:1991/A1:2000, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989/A1:1999)* and EN 60529:1991/A2:2013, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989/A2:2013)*.

EN 60947-5-5, *Low voltage switchgear and controlgear - Part 5-5: Control circuit devices and switching elements - Electrical emergency stop device with mechanical latching function (IEC 60947-5-5)*

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

EN 61496-1:2004+A1:2008, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests (IEC 61496-1:2004, mod.)*

EN 61800-5-2:2007, *Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional (IEC 61800-5-2:2007)*

EN ISO 4413:2010, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 7010, *Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010)*

EN ISO 11553-1:2008, *Safety of machinery - Laser processing machines - Part 1: General safety requirements (ISO 11553-1:2005)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13732-1:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13732-3:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 3: Cold surfaces (ISO 13732-3:2005)*

EN ISO 13849-1:2008, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13850, *Safety of machinery - Emergency stop - Principles for design (ISO 13850)*

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

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

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

EN ISO 13857:2008, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 14119:2013, *Safety of machinery – Interlocking devices associated with guards – Principles for design and selection (ISO 14119:2013)*

EN ISO 14122-1:2001,[3)] *Safety of machinery - Permanent means of access to machinery - Part 1: Choice of fixed means of access between two levels (ISO 14122-1:2001)*

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

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

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

CLC/TS 61496-3, *Safety of machinery - Electro-sensitive protective equipment - Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR) (IEC/TS 61496-3)*

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

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 60204-1:2006, EN 415-1 and the following apply.

3.1
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

3.2
film compensator
device which maintains a constant film tension

3.3
film reel mandrel
device which may be fixed to the machine or which is loose and which supports a reel of film

3.4
hot melt adhesive
adhesive that is solid at room temperature and which can be applied at elevated temperature

3.5
minimum distance
calculated distance between the safeguard and the hazard zone necessary to prevent a person or part of a person reaching the hazard zone before the termination of the hazardous machine function

3) This standard is impacted by the stand-alone amendment EN ISO 14122-1:2001/A1:2010, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels — Amendment 1 (ISO 14122-1:2001/Amd 1:2010)*.

Note 1 to entry: Different minimum distances may be calculated for different conditions or approaches, but the greatest of these minimum distances is used for selecting the position of the safeguard.

3.6
modified atmosphere
atmosphere where the normal atmosphere within a package 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 products.

3.7
packaging material
material used to make a package

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

3.8
product
substance, article, pack or group of packages with or without pallet that are handled in the packaging machine

3.9
safety distance
Safe separation distance
S_r
minimum distance that a protective structure is required to be placed from a hazard zone

3.10
safety related parts of control systems
SRP/CS
part of a control system that responds to safety-related input signals and generates safety-related output signals

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

Note 2 to entry: If monitoring systems are used for diagnostics, they are also considered as SRP/CS.

[SOURCE: EN ISO 13849-1:2008, 3.1.1]

3.11
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

3.12
teleservice
machine control mode where faults can be diagnosed, parameters changed and machine functions can be initiated from a remote location

Note 1 to entry: Collecting data or monitoring machine parameters is not considered as teleservice.

4 List of significant hazards

4.1 General

This clause lists all the significant hazards, hazardous situations and events that can be found on most packaging machines.

Before using this document, the manufacturer shall establish that the hazards on his machine correspond to the hazards described in this document.

4.2 Mechanical hazards

4.2.1 Moving parts

Packaging machines may incorporate moving parts which present a variety of mechanical hazards including crushing, shearing, cutting, entanglement, friction, impact, drawing-in and trapping. Some of these hazards may persist after the power supply has been cut off due to stored energy or gravity.

4.2.2 Slip, trip and fall hazards

Slip accidents can occur if liquids or solids from the machine, e.g. lubricants, packaging materials or the product, spill onto traffic routes, work stations or means of access around the machine.

Trip accidents may occur if parts of the machine protrude beyond the machine frame at low level, or if cables and pipes associated with the machine are installed without proper consideration of tripping hazards.

Falls may occur if people climb or stand on parts of the machine above floor level, e.g. for magazine loading, size changing, maintenance or cleaning.

4.2.3 Loss of stability

If packaging machines become unstable and move unexpectedly or fall over, they can cause crushing and impact injuries. Loss of stability can occur in the following circumstances:

a) while the machine is in operation, for example:

   1) if components are unbalanced;

   2) if the machine footings are unstable;

   3) if the centre of gravity of the machine is high or close to the boundary of the base area;

   4) if someone stands on the machine;

   5) when the machine is positioned on a slope;

b) while the machine is being moved, for example:

   1) if suitable lifting instructions are not provided;

   2) when the volume and shape of the machine could suggest a position of the centre of gravity different from the actual centre of gravity;

   3) on machines fitted with wheels when the machine is being moved on a slope or uneven surface.

4.2.4 Hazards from guards

Guards may present crushing, shearing and impact hazards when they open or close or are handled if they have a high mass or move under gravity or power.

4.3 Pneumatic and hydraulic equipment

Pneumatic and hydraulic equipment present crushing, shearing, ejection of parts and injection of fluids hazards. Stored energy in pneumatic or hydraulic systems may cause mechanisms to move unexpectedly

even when power supplies are disconnected. In addition, hydraulic oil and pneumatic lubricating oil may present a potential fire hazard and can contaminate products. Failure of a hose assembly can constitute a whiplash hazard.

4.4 Hazards from electrical equipment

Electrical equipment on the machine can generate a potential electric shock and burn hazard and in the presence of combustible materials, a potential fire hazard. Electrical systems can act as an ignition source in the presence of flammable substances or products which are capable of creating an explosive atmosphere.

If liquids, e.g. product spillage or cleaning agents like water, come into contact with the electrical conductors, there is a risk of electric shock.

4.5 Hazards from electrostatic phenomena

Electric shock hazards can arise if parts of the machine or materials are electrostatically charged, e.g. a plastic guide rail that is rubbed by passing products or plastic film unwinding from a reel. Electrostatic discharge can be a source of ignition in the presence of flammable substances or explosive atmospheres.

Electrostatic discharge can cause hazards for persons with inactive or active implantable medical devices.

4.6 Thermal hazards

4.6.1 Hot Surfaces

Parts of the machine, e.g. sealing mechanisms and drive motors, which have a high surface temperature, may cause burning hazards.

The burning hazard will usually continue to exist for a period of time after power has been disconnected.

4.6.2 Cold surfaces

Parts of the machine or products, e.g. on packaging machines for frozen product, which have a very low surface temperature, may cause burning hazards.

The frostbite hazard will usually continue to exist for a period of time after power has been disconnected.

4.7 Noise

Noise generated by packaging machines can result in:

— permanent hearing loss;

— tinnitus;

— fatigue, stress, etc.;

— other effects such as loss of balance, loss of awareness;

— interference with speech communication;

— inability to hear acoustic warning signals.

4.8 Radiation

Some packaging machines incorporate sources of radiation that may give rise to hazards. For example:

a) low frequency radio and micro-waves, e.g. induction sealing;

b) infrared, visible light and ultraviolet light, e.g. for inspection of containers;

c) lasers, e.g. for measuring or marking of packages or labels. Laser radiation can cause burn injuries, especially of the eyes with the potential consequence of blindness. The laser can be an ignition source and cause fire and explosion in the presence of flammable or explosive materials. The decomposition products which result from the contact of the laser on packaging materials can present hazards to health. See EN ISO 11553-1 for other hazards from lasers;

d) X and Gamma rays, e.g. for inspection or irradiation of products or packages. Corrosion or mechanical damage of sealed radioactive sources can result in release of hazardous radiation;

e) Alpha and Beta rays, electron ion or neutron beams, e.g. for inspection of packs.

Ionizing and non-ionizing radiation can cause hazards for persons with inactive or active implantable medical devices or cause harm to human cells like damage to skin.

4.9 Hazards from products and materials

4.9.1 Hazards generated by products

Packaging machines are used to pack a wide range of products, some of which may be potentially hazardous to persons operating or in the vicinity of the packaging machine during normal operation or if a package containing a hazardous substance is damaged in the packaging machine.

Hazards generated by the product can include:

a) Ingestion or inhalation of harmful substances, e.g. insecticides, aggressive or harmful chemicals, pharmaceuticals;

b) fire or explosion, e.g. by flammable liquids, explosives, dusty products;

c) biological hazards, e.g. vaccines;

d) impact by ejected products;

e) electric shock from electrostatic discharges, e.g. by products rubbing against plastic guide rails (see 4.5).

4.9.2 Hazards generated by packaging materials

Packaging machines are intended to use a range of packaging materials, which can present the following hazards:

a) inhalation of harmful smoke, gas or vapours from overheated or burning of materials;

b) inhalation of harmful or unpleasant dusts, e.g. from paper;

c) cuts from handling packaging materials, e.g. film, strap or paper edges;

d) fire due to overheating of combustible packaging materials, e.g. plastic films and paper;

e) electric shock from electrostatic discharges, e.g. at plastic film reel unwind mechanisms or plastic sheet feeding mechanisms.

4.10 Hazards due to neglecting ergonomic principles

Hazards to safety and health, e.g. fatigue, mental stress, strain injuries or occupational diseases can occur when people are carrying out the following activities on packaging machines:

a) operating, e.g. assuming a bad posture or performing unnatural hand or arm movements or using excessive effort caused by inadequate design or location of actuators or displays;

b) operating, cleaning and maintaining of machines under poor lighting conditions;

c) loading packaging materials, e.g. assuming a bad posture, using excessive effort, fatigue;

d) loading or unloading products, e.g. assuming a bad posture or performing unnatural hand or arm movements or using excessive effort;

e) performing size or product changing, e.g. assuming a bad posture or performing unnatural hand or arm movements or using excessive effort;

f) cleaning the machine, e.g. assuming a bad posture or performing unnatural hand or arm movements or using excessive effort;

g) maintenance, e.g. assuming a bad posture or using excessive effort;

h) moving the machine or the guards or other parts, e.g. using excessive effort.

4.11 Hazards due to neglecting hygienic design principles

On machines that are intended to pack foodstuffs, cosmetics, pharmaceuticals or other products where hygiene is a consideration, product contamination hazards can result if inappropriate contact materials or construction methods are used or if lubricants or other contaminating substances or improper conditions are allowed to come into contact with the product.

4.12 Hazards caused by failures

4.12.1 General

The following hazards can be generated on packaging machines by:

a) mechanical hazards due to uncontrolled lowering or falling of machine assemblies or product;

b) mechanical hazards due to unexpected locking of brakes or other components;

c) mechanical hazards because of an inability to stop movements, e.g. failure of a braking function;

d) mechanical hazards due to unexpected movement of assemblies when power is reconnected or due to stored energy;

e) mechanical and chemical hazards due to unexpected release of substances;

f) fire or explosion hazards, e.g. because of the inability to stop a heating function.

4.12.2 Failure of power supplies

The hazards mentioned in 4.12.1 can arise by failures of the power supplies as loss or restoration of energy or fluctuation of the power supplies. See also 4.9.1.

4.12.3 Failure of safety related parts of control systems

Hazards can arise if components in safety related parts of control systems fail. Failures may occur due to mechanical damage, contact failure, electronic component failure.

Systematic faults may occur, especially in programmable systems. Failures can lead to loss of safety functions resulting in unexpected start-up of moving parts, incorrect sequencing of machine operations or the prevention of moving parts from stopping as expected. Malfunctions or responses to an external disturbance such as electromagnetic interference can lead to a hazardous situation.

4.12.4 Failure of electronic drive systems

When the power supply of an electronic drive system is not disconnected after a safety related stop has been initiated (e.g. the guards are open), there is a risk of unexpected start-up with consequential mechanical hazards if the control system malfunctions or responds to an external disturbance such as electromagnetic interference.

Adjustable speed electrical power drive systems have an increased risk because of their working principle and high acceleration.

4.13 Hazards caused by the presence of stored energy

Stored energy may lead to hazards like unexpected movement and be caused for example by:

a) requirement of the machine function;

b) failure to provide a means for the automatic release of energy;

c) failure of an energy dissipating device, e.g. because of internal or external influences, misalignment, assembly errors, ageing, lack of maintenance;

d) operator errors, e.g. due to lack of information or not following the required procedure;

e) operator errors because the means of energy dissipation is not easily accessible or identifiable;

f) design of the mechanism, e.g. because parts can move under gravity or the mechanism incorporates tension or compression springs;

g) product jam, e.g. because mechanisms move when a jammed product is removed.

4.14 Hazards due to remote diagnostics or control

Hazardous situations can arise if it is possible to control a machine from a remote location or alter the software of a machine from a remote location.

In particular, hazards by unexpected start up can occur if:

a) guards are removed;

b) it is possible to defeat the interlocking systems from the remote location;

c) unauthorized people can gain access to the machine's controls in the remote location.

4.15 Reasonably foreseeable misuse

Reasonably foreseeable misuse is the use of a machine in a way that is not intended by the manufacturer and which can easily be anticipated because of known human behaviour.

If the machine can operate independently in different hazard zones, the complete stop of the whole machine can reduce the machine efficiency. This could encourage users to defeat guards.

NOTE 1 Foreseeable misuse can for example be:

- defeating of guards or protective equipment because of improper design of the machine;
- behaviour that results from the quest for convenience or efficiency (use the way of least resistance);
- access through apertures not intended for access.

NOTE 2 Reasons for defeating guards can for example be:

- time delay between the stop and the restart of the production;
- distance from the operator's position to the next safe means of access;
- available items which can be used as a step with the consequence of the possibility of climbing over the guard.

4.16 Hazards from specific elements or processes of packaging machines

4.16.1 Cutting devices

Mechanical cutting devices present a cutting or shearing hazard:

a) when the machine is in normal operation;

b) when the machine’s power supplies are isolated and the mechanism moves unexpectedly, e.g. due to stored energy;

c) when threading film the operator touches the exposed cutting surface;

d) when the device is handled during setting-up, cleaning or maintenance.

4.16.2 Sealing devices

Mechanical sealing devices present a crushing hazard:

a) when the machine is in normal operation;

b) when the machine’s power supplies are isolated the mechanism moves unexpectedly due to stored energy.

Heated sealing devices present a burning hazard during normal operation. They also present a burning hazard for a period of time after power has been disconnected from the device.

There is a risk of electrical insulation in heating elements breaking down giving rise to an electric shock hazard.

There is a risk of fire if packaging materials remain in contact with a heated sealing device for too long or if the temperature of the sealing device is too high, e.g. if the temperature of the heater controls is set too high or if the temperature control fails and the temperature rises unexpectedly.

Certain materials, such as polyester film, can give off hazardous fumes if they are overheated by the sealing device.

4.16.3 Film reel unwind mechanisms

Film reel unwind mechanisms present the following hazards:

a) reels rotating at high speed can generate crushing or impact hazards if stopped suddenly;

b) reels with a high mass can generate a drawing-in hazard if they are supported on rollers;

c) the edges of the film can be a cutting hazard;

d) there can be a drawing-in hazard when the film is passed over rollers;

e) there can be a shearing hazard between the film compensator and fixed parts of the film reel mandrel;

f) there can be an impact hazard if the film breaks and the film compensator move unexpectedly.

4.16.4 Conveyors

4.16.4.1 General

Some conveyors can be installed where operators can stand or walk on them. Therefore there are hazards of slipping, tripping and falling, e.g. during cleaning, maintenance and trouble shooting. Falling can also result from an automatic start of a conveyor while a person is standing or walking on it.

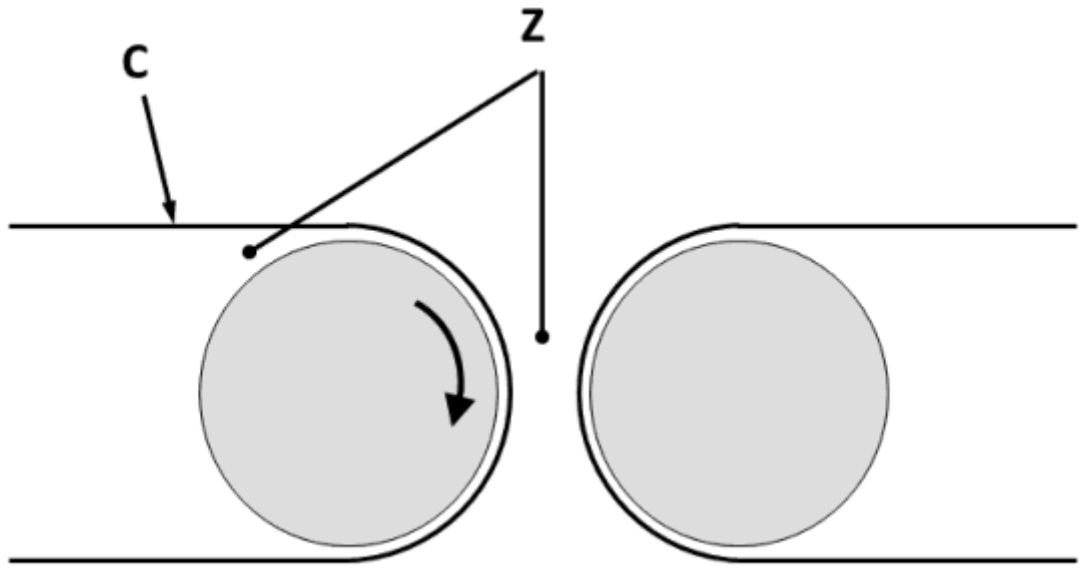
Drawing-in and entanglement hazards, especially of hair, can occur when persons are exposed below a conveyor (e.g. during cleaning, trouble-shooting or maintenance).

Drawing-in or trapping hazards can be generated by in-running nips and where traction elements pass over rollers, wheels or fixed parts of the conveyor frame.

Additional hazards can occur when fixed parts of the construction or guards are insufficiently stable against foreseeable mechanical strain, e.g. of conveyed product or packs so that they can be deformed or where abrasion or other influences expand gaps between moving and fixed parts.

4.16.4.2 Belt and slat-band conveyors

Drawing-in or trapping hazards can be generated by in-running nips where belts pass over rollers (as shown in Figure 1) or fixed parts of the conveyor frame or at conveyor junctions, e.g. when the following conveyer does not rotate, rotates slower or has less friction than the previous conveyor, as shown in Figure 1.



Key

C conveyor

Z hazard zone

Figure 1 — Junction of belt conveyors

4.16.4.3 Roller conveyors

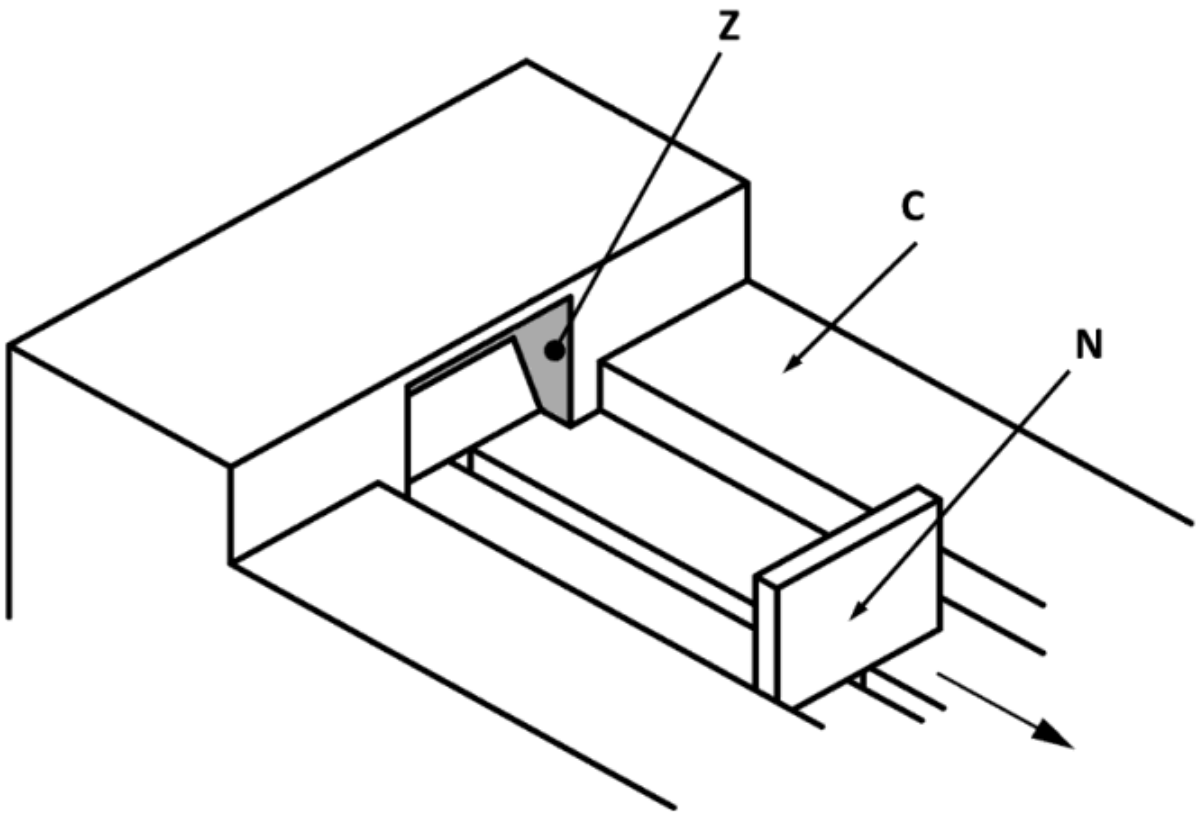
Drawing-in or trapping hazards can be generated by in-running nips between rotating rollers of roller conveyors and their substructure or machine parts.

4.16.4.4 Screw conveyors

Screw conveyors present drawing in, entanglement, shearing and crushing hazards.

4.16.4.5 Conveyors with carriers

In addition to the general hazards presented by conveyors, for conveyors with carriers there are additional entanglement, drawing-in, shearing and crushing hazards especially where carriers emerge from or run into the machine frame or pass by fixed parts, as shown in Figure 2.



Key

C conveyor

N carrier

Z hazard zone

Figure 2 — Conveyor with carrier

4.16.5 Handles and hand-wheels

Handles or hand-wheels to operate machines manually, e.g. for adjustment or cleaning, can cause impact, friction or entanglement hazards if the handle or hand-wheel:

a) moves under power;

b) moves unexpectedly due to stored energy, e.g. because of eccentric masses or springs.

Errors in operation of manual or electronic hand wheels can cause hazardous movement of the machine.

4.16.6 Size or product changing

Typically, packaging machines are constructed to handle a range of product and pack sizes. Changes of size or product can give rise to the following hazards:

a) hazard zones on the machine may be exposed when components are moved;

b) handling change parts may give rise to ergonomic hazards;

c) where size or product changing is carried out under power, mechanical hazards can arise.

4.16.7 Hot melt adhesive equipment

On machines that use hot melt adhesive, there are burning hazards from contact with hot surfaces and a scalding hazard from contact with the adhesive. When loading cold adhesive into molten adhesive, there is a risk of scalding from splashes of molten adhesive.

On machines where the adhesive is pressurised and jetted or sprayed onto the packaging material, there is a risk of scalding from adhesive jetted out of the machine, e.g. if the glue gun is misaligned or during maintenance operations.

The hot melt adhesive may generate unpleasant fumes, particularly if it is overheated. If the adhesive is overheated there is a risk of it catching fire.

4.16.8 Modified atmosphere packaging

Packaging machines may use special atmospheres during the packing process to produce packages with an enhanced shelf life. The gases used are typically oxygen, nitrogen and carbon dioxide. These gases present the following hazards:

a) Oxygen: risk of fire and explosion. Especially on machines which use an oil lubricated rotary vane vacuum pump where is a risk of fire and explosion if the oxygen level in the pump exceeds 21 %.

b) Nitrogen: asphyxiation or fatigue due to reduction in oxygen levels.

c) Carbon dioxide: respiratory paralysis because of intoxication.

5 Safety requirements and/or protective measures

5.1 General

Packaging machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document.

NOTE 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.

When selecting protective measures, the following hierarchy applies in all phases of the life cycle:

a) eliminate or reduce the risk by inherently safe machinery design and construction;

b) install the necessary protective measures in relation to risks that cannot be eliminated;

c) inform users of the residual risks due to any limitations of the protective measures adopted, indicating whether any particular training is required and specifying any need to provide personal protective equipment.

The following requirements apply to all packaging machines where the equivalent hazard exists.

5.2 Requirements to minimize mechanical risks

5.2.1 Protective measures against risks from moving parts

5.2.1.1 Inherently safe design – physical aspects

One method of inherently safe design is to reduce forces, pressure and energy to values which do not cause injuries. Examples of values that are discussed presently as applicable are given in informative Annex B.

If the values given in Annex B are not applicable, the values for energy shall not exceed 4 J in general and 10 J if the motion is reversed. The movement shall automatically be reversed within 1 s when a resistance is detected.

Crushing hazards can be considered as eliminated when the distance between moving and fixed parts and between one moving part and another is dimensioned in compliance with EN 349.

NOTE 1 The safety distances for crushing may be ineffective in case of drawing-in.

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 1/4 of their diameter or 20 mm, whichever is the smaller.

NOTE 2 The measures indicated above may not be applicable or effective in all circumstances. For example. the methods for elimination of entanglement and friction hazards as described above may not be effective where clothes or personal protective equipment with high friction are used, e.g. rubber gloves. Subsequent clauses of this document indicate situations where these measures are known to be effective.

5.2.1.2 Fixed or interlocking movable guards

a) Moving parts shall be safeguarded by fixed or interlocking movable guards complying with this clause and 5.2.1.3, 5.2.1.4, 5.10.2, 5.16.3 and EN 953. Where no specific choice for a type of guard is specified in this document, the guards shall be chosen using EN 953.

b) Unless otherwise specified in this document the guards shall be dimensioned and positioned so that the safety distances comply with those specified in Clause 4 and Annexes A and B of EN ISO 13857:2008.

c) Unless otherwise specified in other parts of EN 415 open topped distance guards shall be at least 2 000 mm high from the floor or other access platform.

NOTE This measure is against climbing over a guard by using easily available means.

The distance from their upper edge to the nearest hazard zone shall comply with EN ISO 13857:2008, Table 2.

d) Where there is a gap between the guard and the floor e.g. for cleaning or removing products or packs, the following requirements apply:

   1) if the gap is less than or equal to 20 mm the safety distances to the nearest hazard zones shall comply with EN ISO 13857:2008, Table 4;

   2) where the gap is greater than 20 mm but less than or equal to 40 mm, the safety distances to the nearest dangers zones shall be at least 550 mm. where access is not foreseeable, the safety distance can be reduced to 130 mm;

   3) where the gap is greater than 40 mm but less than or equal to 240 mm the safety distance to the nearest hazard zones shall be at least:

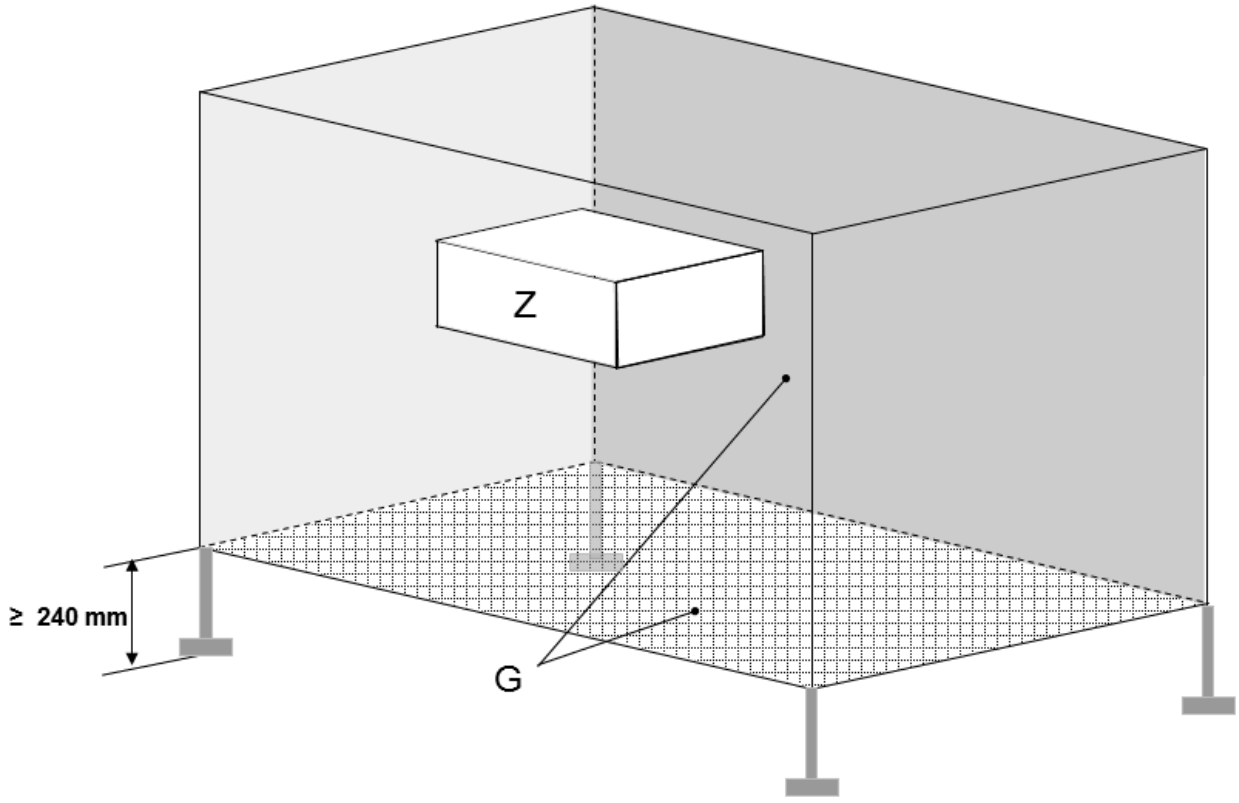
      i) 850 mm, if the height of the lowest hazard zone is lower than or equal to 300 mm above the lower edge of the guard;

ii) 550 mm, if the height of the lowest hazard zone is higher than 300 mm above the lower edge of the guard.

NOTE List entry 3) applies only when access to the hazard zone by lower limbs is not reasonably foreseeable. In all other cases EN ISO 13857:2008, Table 7 applies.

4) where the gap is greater than 240 mm, a guard complying to a) of this subclause shall be fixed underneath the machine (see Figure 3) or one of the protective measures indicated in 5.2.1.3 shall be used, or all hazard zones which could be reached shall be safeguarded individually according to a) and b) of this subclause;

e) Where there is a risk of parts or products being ejected from the machine the guards and their position shall be designed to contain these parts or products;



Key

Z hazard zone

G fixed guard

Figure 3 — Horizontal fixed guard at the bottom

f) where whole body access is possible to a machine, persons shall be able to leave the hazard zone, e.g. by an interlocking movable guard that can be opened from inside the machine or an aperture with ESPE. For protective measures see 5.16.2;

g) On machines where opening an interlocking movable guard could expose a person to a hazard, the interlocking movable guard shall be fitted with a guard locking device complying with EN ISO 14119:2013, 5.7 that prevents the guard from opening as long as the hazard is present;

h) moveable guards shall be interlocked with devices that comply with EN ISO 14119:2013, 5.7 and shall be installed as indicated in Clause 5 of that standard. Safety related parts of interlocking systems shall comply with 5.15.

If it is necessary to remove fixed guards regularly (e.g. for maintenance, cleaning) the fixing systems shall remain attached to the guard or the machinery when the guard is removed.

5.2.1.3 Apertures in guards

5.2.1.3.1 General

Apertures in guards for loading or discharging of product or packaging components shall be designed, positioned and dimensioned to prevent persons reaching into hazard zones and to prevent or, if this is not practicable, discourage whole body access.

The safety requirements to prevent access through an aperture to a hazard zone vary depending on the dimensions of the aperture, the height of the aperture from the nearest access platform, the shape of the guarding around the aperture and presence or not of a conveyor in the aperture.

Three main types of aperture are defined as shown in Figure 4:

a) small apertures, designated as “S”;

b) medium apertures designated as “$M_{a)}$”, “$M_{b)}$” and “$M_{c)}$”;

c) large apertures designated as “L”.

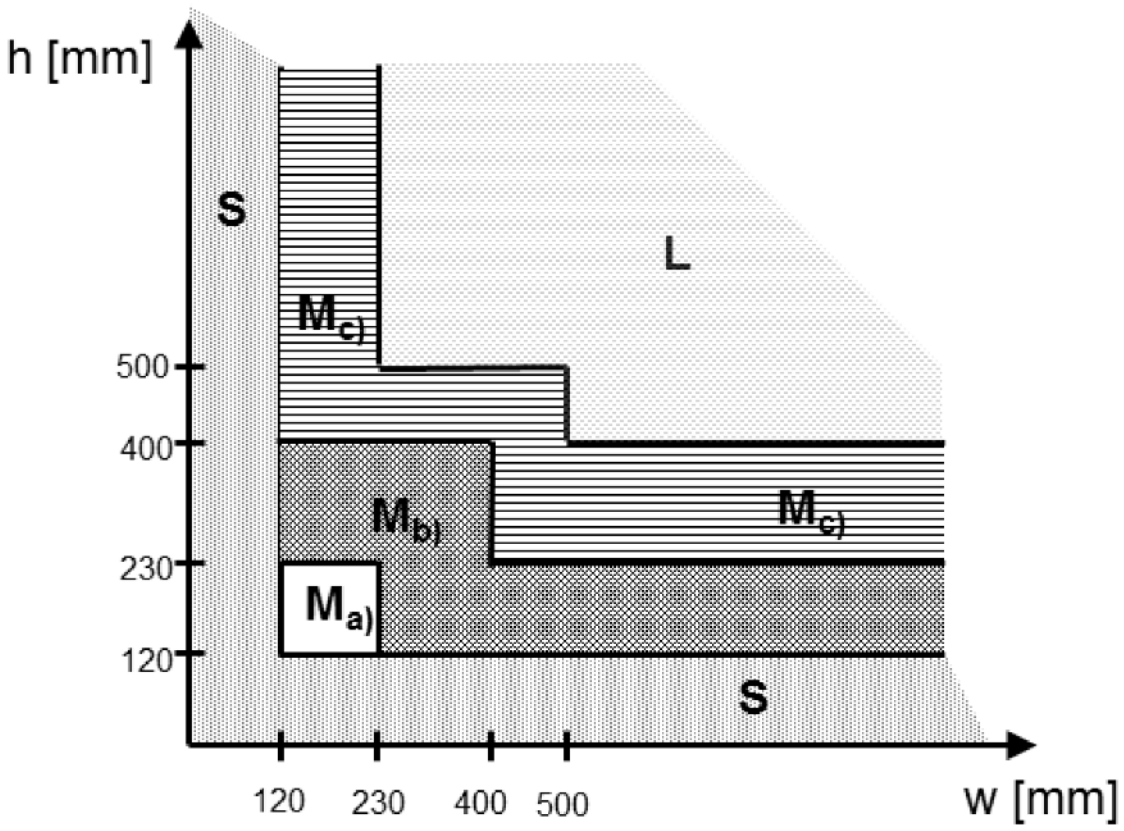
Preferably the guards around apertures for entry or exit of conveyors shall be tunnel shaped when they are greater than small apertures (S) as described in 5.2.1.3.2. Where positions behind tunnel guards have to be reached regularly, these tunnel guards or parts of them shall be designed to be movable and interlocked complying with 5.2.1.2.

One or more interlocking movable guards or apertures with ESPE complying with 5.15 shall be provided for access. These are apertures giving access to all the parts of the machine where regular access is required or foreseeable so that it is unnecessary to reach into the safeguarded zone through other apertures than the intended one. The instructions shall state the intended means of access.

The requirements for safeguarding apertures with guards shall be chosen depending on their dimensions as indicated in Figure 4.

Table 1 indicates the safety distances for medium-sized apertures according to the dimensions of the apertures under the presumption that the cross section of a possible tunnel is the same as that of the aperture.

Where the distance between the access platform and the lower edge of an aperture to the access platform or between the access platform and the conveying level is 1 600 mm or more and when there is no foreseeable reason to gain access to the entry or exit point (e.g. for troubleshooting, maintenance, cleaning) no further safeguarding is required, but EN ISO 13857:2008, Table 2 applies. Conveyors and any other installation (e.g. guards) shall be designed to prevent people climbing up to the aperture.



Key

L	dimensions of large apertures
M	dimensions of medium-sized apertures
S	dimensions of small apertures
w	clear width of the aperture
h	clear height of the aperture

Figure 4 — Entry or exit points - dimensions of apertures

Table 1 — Safety distances for medium-sized apertures

	Safety distance (mm)				
	1	**2**	**3**	**4**	**5**
Size of aperture (from Figure 4)	Apertures without a conveyor or tunnel guard (see Figure 5)	Apertures with bent tunnel guards with or without a conveyor (see Figure 6 and Figure 7)	Apertures with a conveyor but without a tunnel guard (see Figure 8)	Apertures with a conveyor and a tunnel guard (see Figure 9 and Figure 10)	Minimum tunnel and conveyor length l (see Figure 6 to Figure 10)
$M_{a)}$	s ≥ 1 000	for 135° ≥ α ≥ 90°, for s_2 ≥ 300 $(s+s_2)$ ≥ 850	s ≥ 900	s ≥ 850	l ≥ 500
$M_{b)}$	s ≥ 1 200	$s + s_2$ ≥ 900 for 135° ≥ α ≥ 90°, else: column 1 applies for s_2 ≥ 300	s ≥ 1 000	s ≥ 900	l ≥ 500
$M_{c)}$	5.2.1.3.12 applies	s ≥ 1 100 for 135° ≥ α ≥ 90°, else: column 1 applies	s ≥ 1 400	s ≥ 1 100	l ≥ 1 000

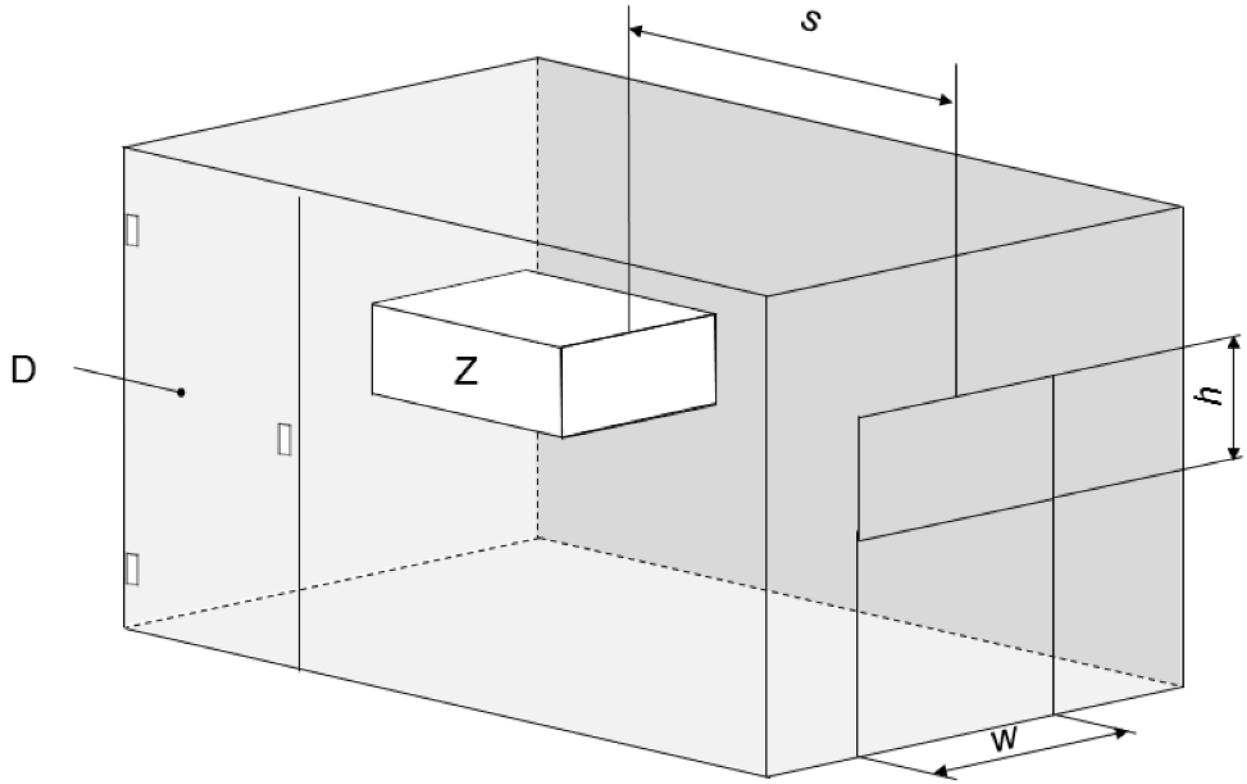
5.2.1.3.2 Small apertures

For apertures where the width or height is less than or equal to 120 mm (area S in Figure 4), the safety distance to the nearest hazard zone through the aperture shall comply with EN ISO 13857:2008, Tables 3, 4 or 6, or, on machines which can foreseeably be used in public areas, with EN ISO 13857:2008, Table 5 whichever is applicable in the respective situation.

Where for technical reasons the reach distances indicated above are not applicable, one of the safeguarding methods indicated in 5.2.1.3.3 to 5.2.1.3.18 or a method to the same effect shall be used.

5.2.1.3.3 Medium-sized apertures without conveyor

For medium-sized apertures $M_{a)}$, $M_{b)}$ and $M_{c)}$ as shown in Figure 4 without entry or exit of a conveyor as shown in Figure 5 the safety distances as stated in column 1 of Table 1 shall be applied.



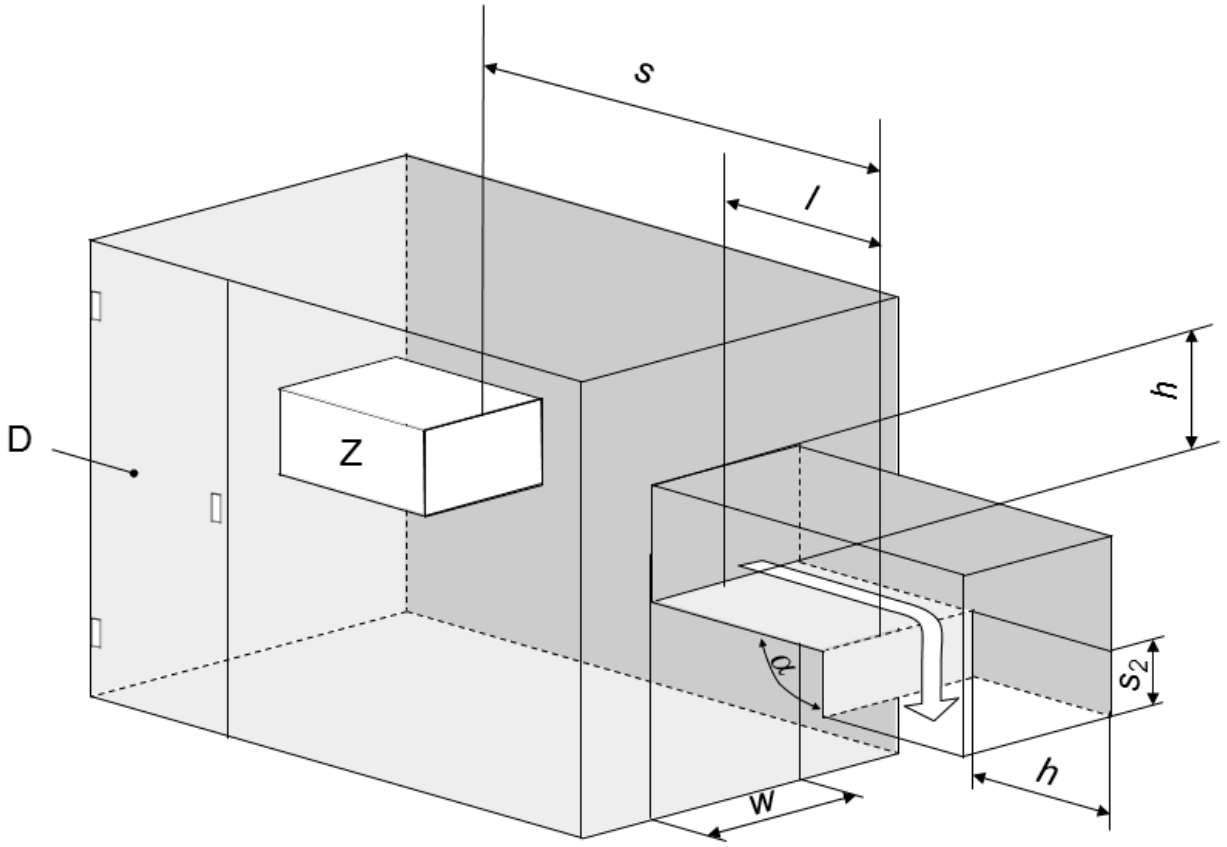
Key

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

Figure 5 — Medium-sized aperture without conveyor and without tunnel guard

5.2.1.3.4 Medium-sized apertures with bent tunnel guard

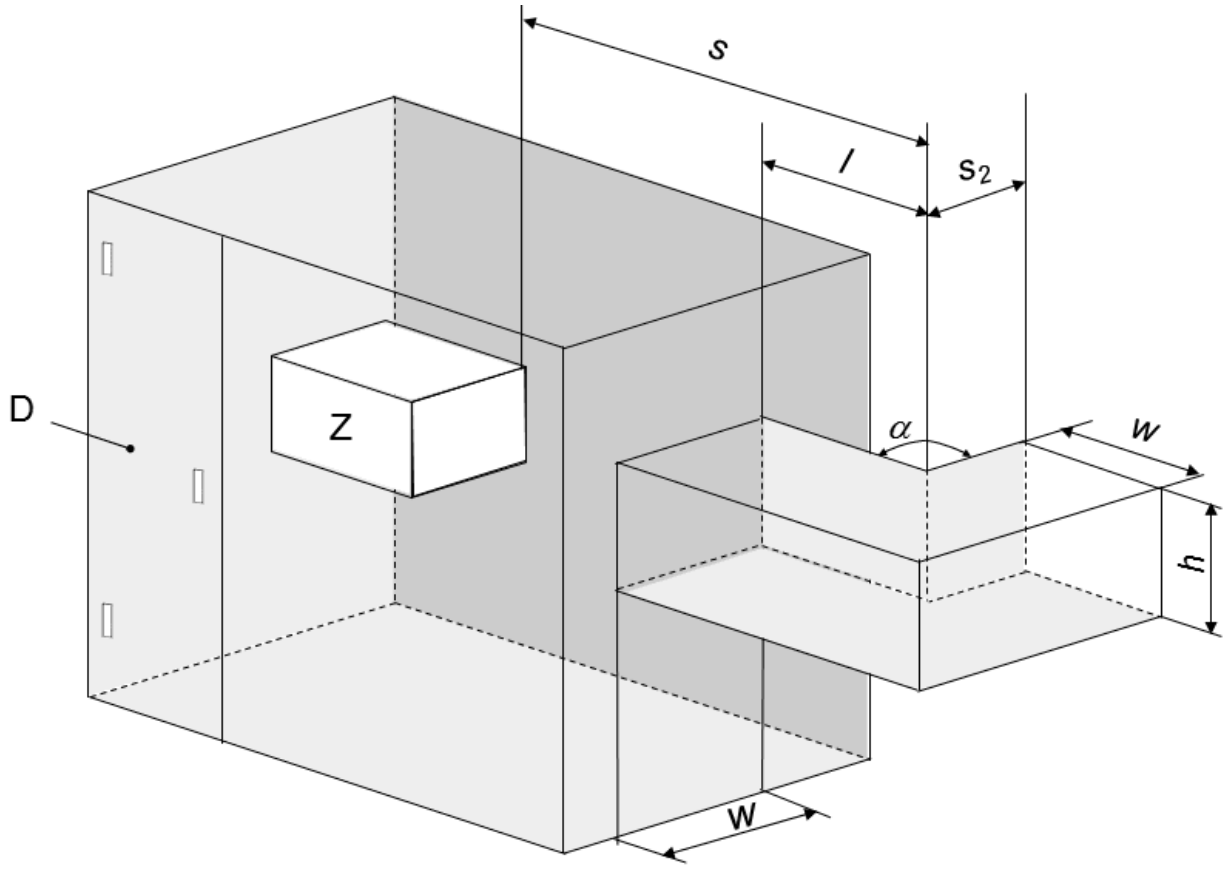
For medium-sized apertures $M_{a)}$, $M_{b)}$ and $M_{c)}$ as shown in Figure 4 where a bent tunnel guard is applied as shown in Figure 6 and Figure 7 the safety distances as stated in column 2 of Table 1 shall be applied.



Key

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

Figure 6 — Medium-sized aperture with vertically bent tunnel guard



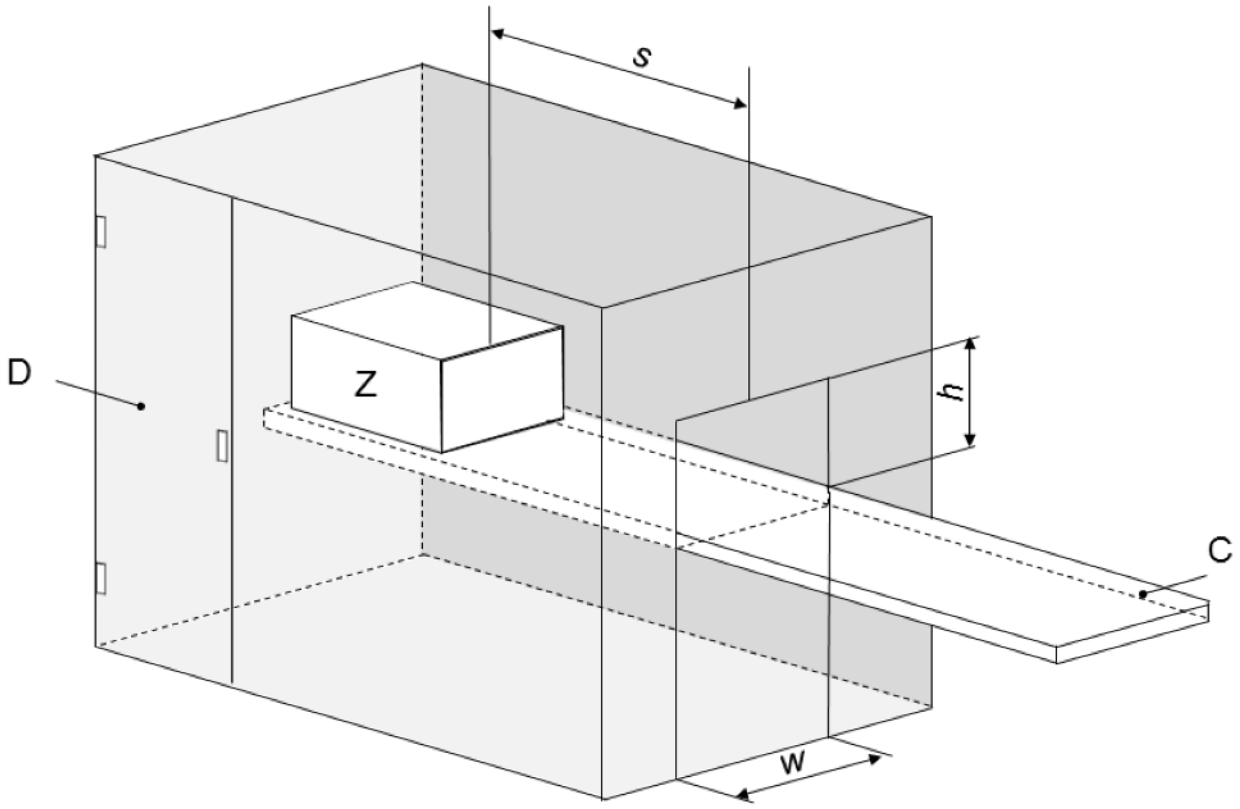
Key

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

Figure 7 — Aperture with conveyor and horizontal bent tunnel guard

5.2.1.3.5 Medium-sized apertures with conveyor but without tunnel

For medium-sized apertures $M_{a)}$, $M_{b)}$ and $M_{c)}$ as shown in Figure 4 where a conveyor enters or exits as shown in Figure 8 the safety distances as stated in column 3 of Table 1 shall be applied.



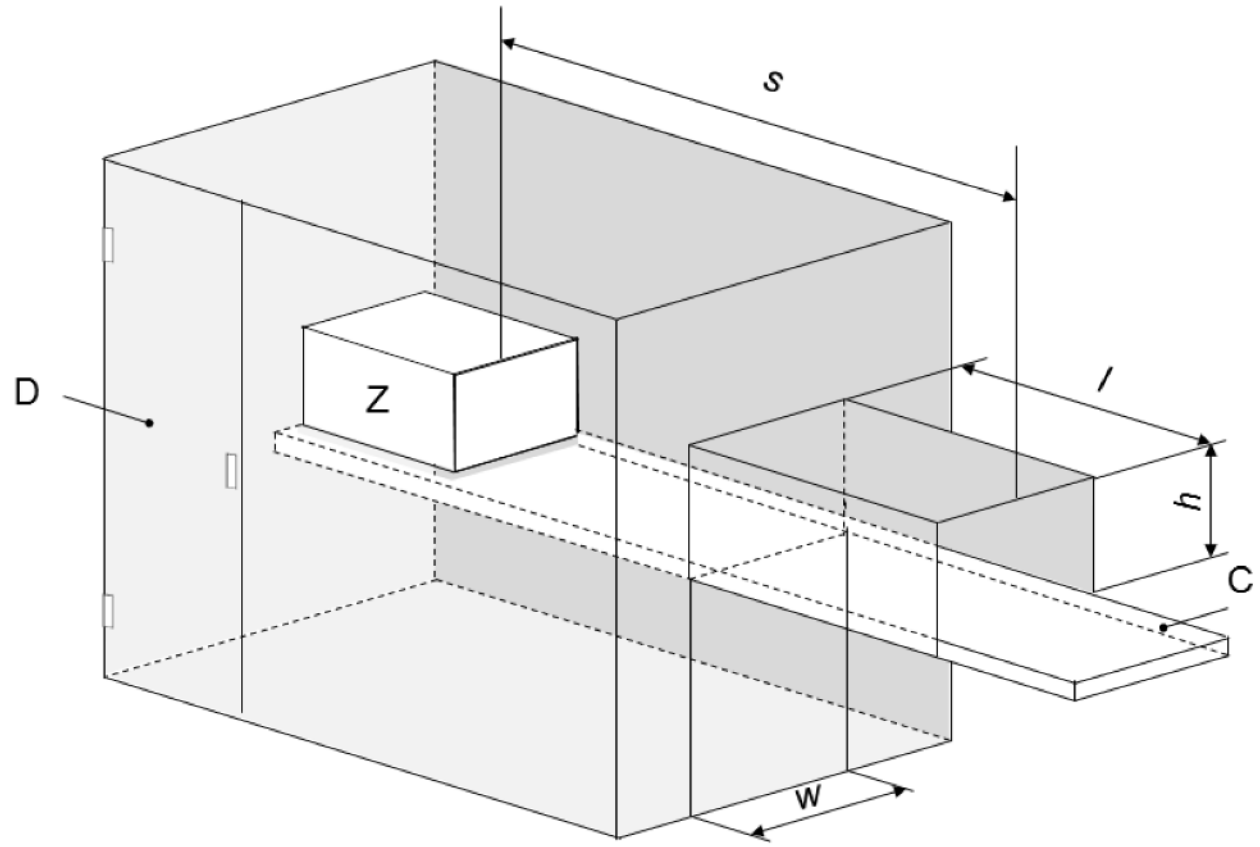
Key

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

Figure 8 — Machine with conveyor but without tunnel guard

5.2.1.3.6 Medium-sized apertures with conveyor and tunnel guard

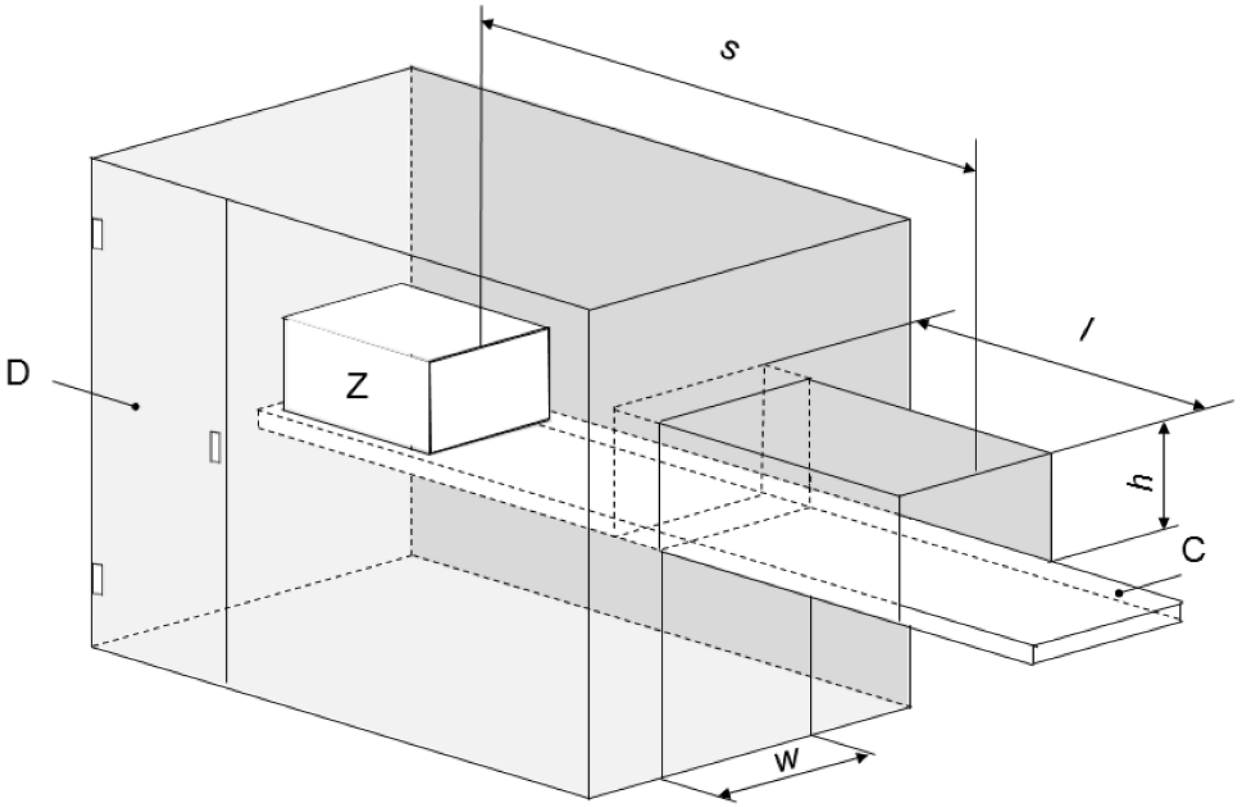
For medium-sized apertures $M_{a)}$, $M_{b)}$ and $M_{c)}$ as shown in Figure 4 where a conveyor enters or exits and a tunnel guard is applied as shown in Figure 9 and Figure 10 the safety distances as stated in column 4 of Table 1 and for a bent tunnel column 2 of Table 1 shall be applied.



Key

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

Figure 9 — Aperture with conveyor and tunnel guard



Key

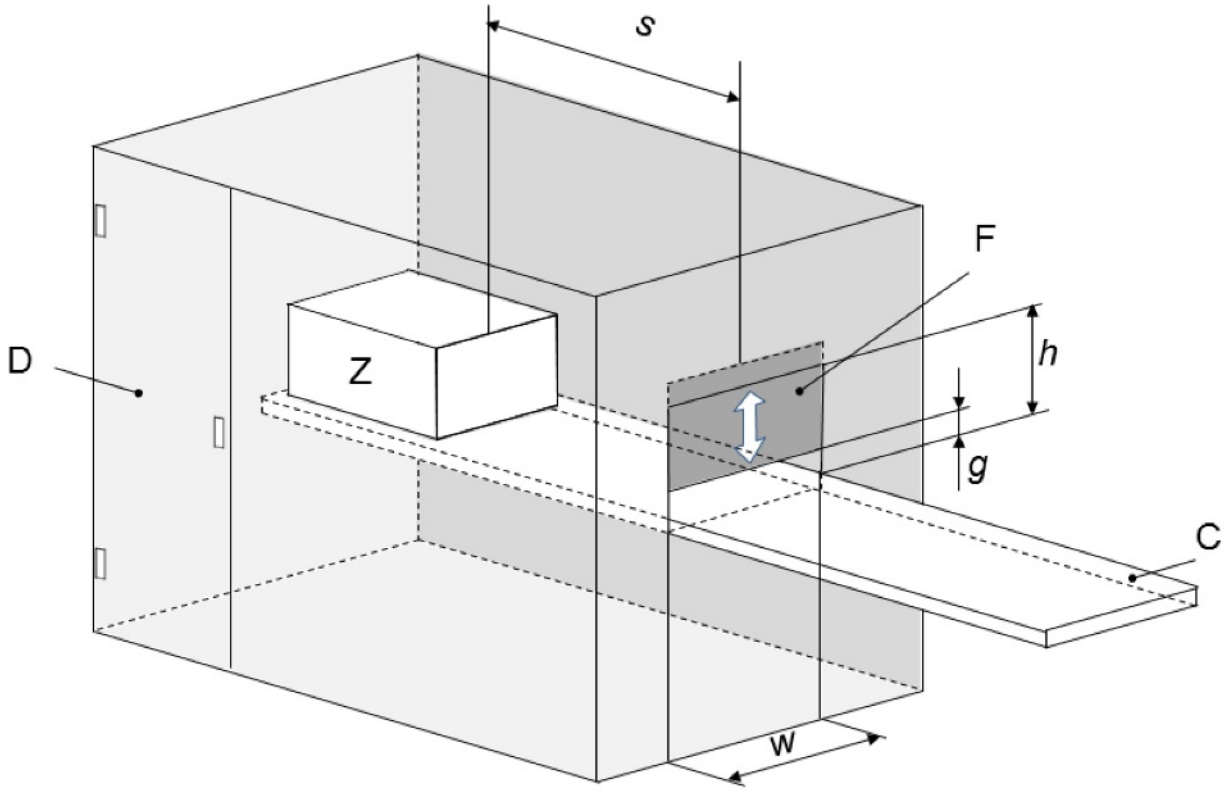
Z	hazard zone
D	interlocking movable guard
C	conveyor
h	height of aperture
w	width of aperture
l	length of tunnel
s	safety distance

Figure 10 — Aperture with conveyor and tunnel guard reaching into the safeguarded area

5.2.1.3.7 Medium-sized apertures - automatic guard

See Figure 11. The guard shall open at the earliest when the product has reached a position where a person can no longer reach into the hazard zone between the product and the guards. The automatic guard closes after the product has passed the aperture and before the product has reached a position which allows access to the hazard zone. The automatic guard shall be interlocked with the machine, to ensure that hazardous functions cannot start until the guard is in its closed position. The guard shall either not be capable of exerting a force greater than the relevant value of 5.2.1.1 or be fitted with a pressure sensitive edge complying with EN ISO 13856-2 or another equally effective safety device having the same effect that stops closing movement when an obstruction is detected.

When there remains a gap g between the automatic guard and fixed machine parts (as shown in Figure 11) and the interlocking device signals that the guard is in its closed position, the safety distances of Table 1 or 5.2.1.3.2 apply, depending on the size of the aperture.



Key

Z hazard zone
D interlocking movable guard
C conveyor
F automatic guard
g height of the gap
h height of the aperture
s safety distance

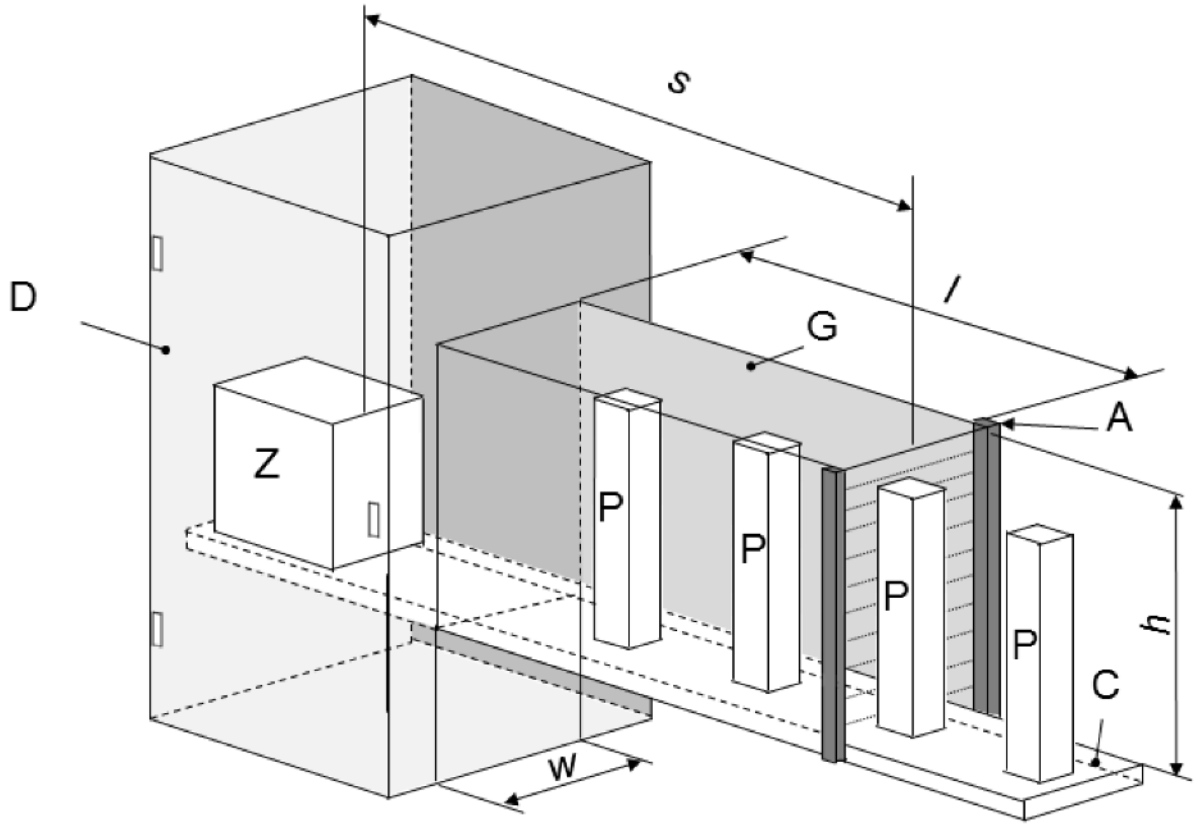
Figure 11 — Automatic guard — principle

5.2.1.3.8 Medium-sized apertures ESPE trip device

This device comprises **E**lectro **S**ensitive **P**rotective **E**quipment (ESPE), e.g. an **A**ctive **O**pto-electronic **P**rotective **D**evice (AOPD) complying with 5.15 which monitors the whole aperture (see Figure 12). The control system shall ensure that the machine stops hazardous functions by a safety related stop as described in 5.14.3 when the ESPE is tripped.

The minimum distance between the hazard and the ESPE shall comply with EN ISO 13855:2010, 6.2.

The ESPE may be muted as described in 5.2.1.4.



Key

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

Figure 12 — ESPE trip device

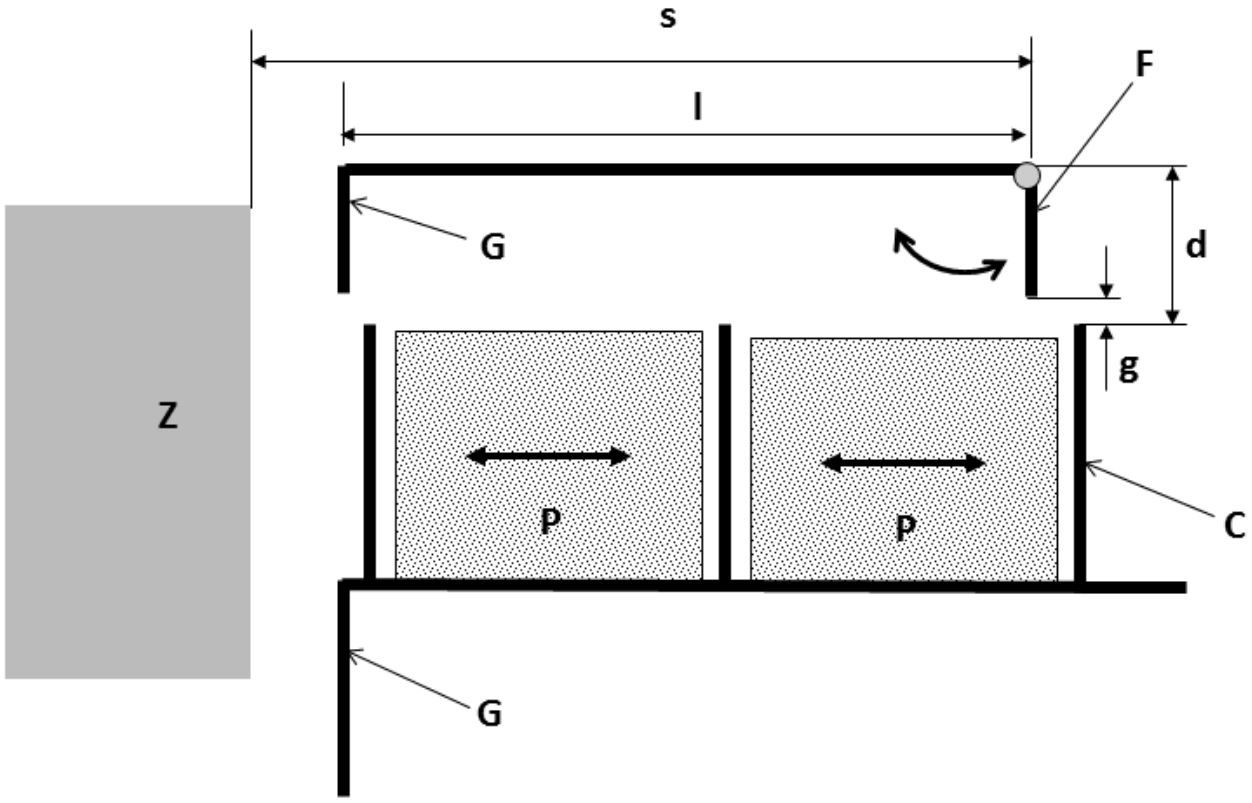
5.2.1.3.9 Medium-sized apertures — Tunnel with interlocking movable guard

Figure 13 shows safeguarding by a tunnel with interlocking movable guard. This method is suitable for conveyors with carriers. It comprises a combination of a tunnel shaped guard and an interlocking movable guard. The interlocking movable guards shall comply with 5.2.1.2 and initiate a safety related stop when tripped. The stopping time shall comply with 5.14.7. The minimum distance shall comply with EN ISO 13855:2010, Clause 9. See Figure 13. The tunnel or parts of it shall be fixed or, if required for trouble shooting, cleaning or minor interventions, designed as an interlocking movable guard. Alternatively an ESPE complying with 5.15 shall be used.

To prevent crushing hazards the carriers shall be guided by solid side guards which are at least of the same height as the carriers. The distance between the side guards and the edges of the carriers as well as between the lower edge of the interlocking movable guard and the upper edges of the carriers (g) shall not exceed

5 mm. The distance d between fixed parts of the tunnel and the upper edges of the carriers shall comply with EN 349. However d shall be at least 50 mm.

The flap also can be an AOPD.



Key

C	conveyor with carriers
F	interlocking movable guard
G	fixed guard
P	product
Z	hazard zone
s	safety distance
d	distance between carrier and fixed guard
g	distance between carrier and interlocking movable guard
l	length of tunnel guard

Figure 13 — Tunnel guard with interlocking movable guard

5.2.1.3.10 Large apertures - general

For apertures greater than stated in a) and b) of 5.2.1.3.1 one of the following safeguarding methods shall be used. These methods also take into account the risks of crushing and shearing which may arise from the mass or shape of the product passing through the aperture.

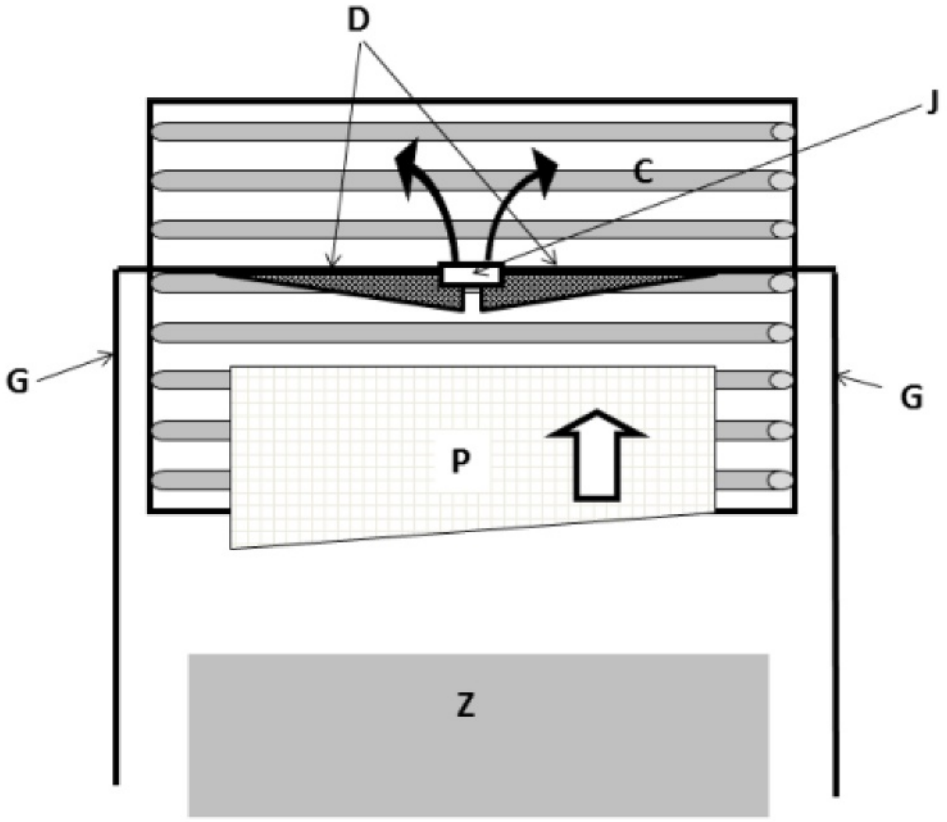
The following methods use a combination of fixed and interlocking movable guards and ESPE. The ESPE is usually muted as described in 5.2.1.4. In addition 5.2.1.5 applies.

5.2.1.3.11 Large apertures - interlocking swing door

As shown in Figures 14, 15 and 16, access through the aperture is prevented by interlocking swing doors with or without guard locking. The interlocking movable guards are pushed open by the product – in case of guard locking after being unlocked - and are closed by springs.

The machine shall not restart until the guards are closed and – in case of guard locking - locked. It shall not be possible to access the hazard zone while the load is passing the aperture. Therefore fixed side guards shall form a corridor with a minimum length of 900 mm and the distance between these guards and the product shall not exceed 230 mm. If the doors do not close within a period of 110 % of the passing time this shall lead to a safety related stop.

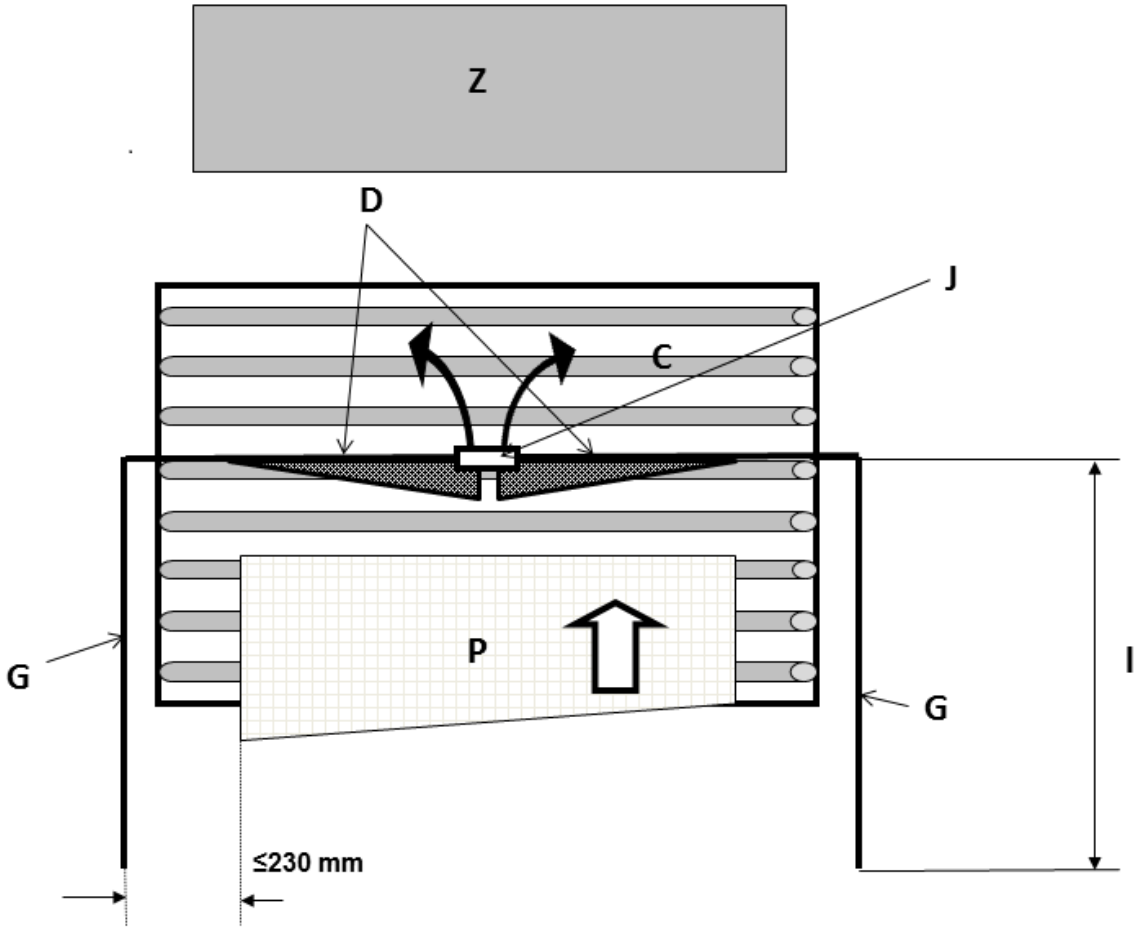
The interlocking movable guards, the conveyor and surrounding fixed parts shall be designed in order to avoid crushing and shearing hazards by opening or closing of the swing doors.



Key

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

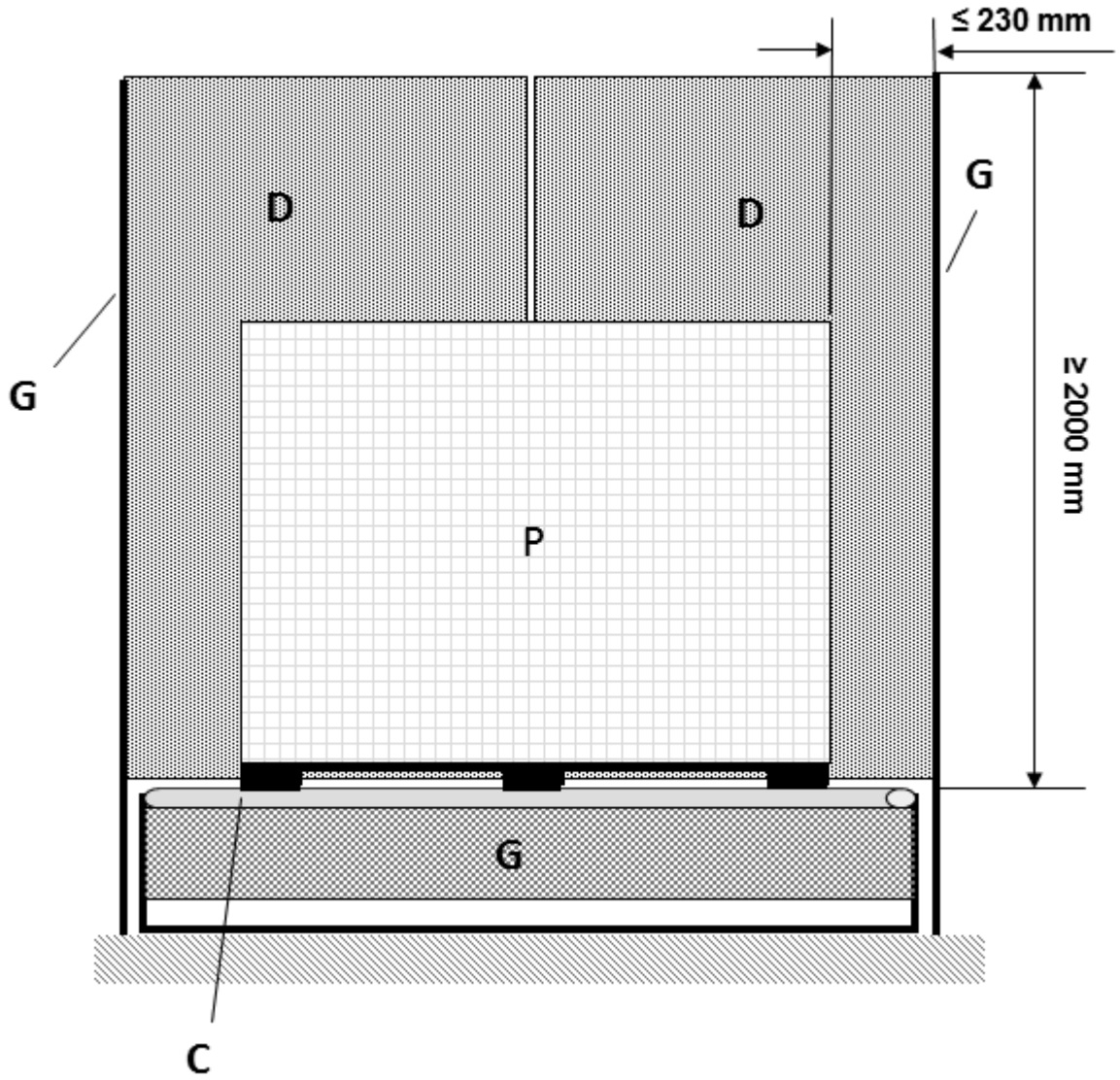
Figure 14 — Interlocking swing doors − discharge – top view



Key

C conveyor
D interlocked 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



Key

C conveyor
D interlocked swing door
G fixed guard
P product

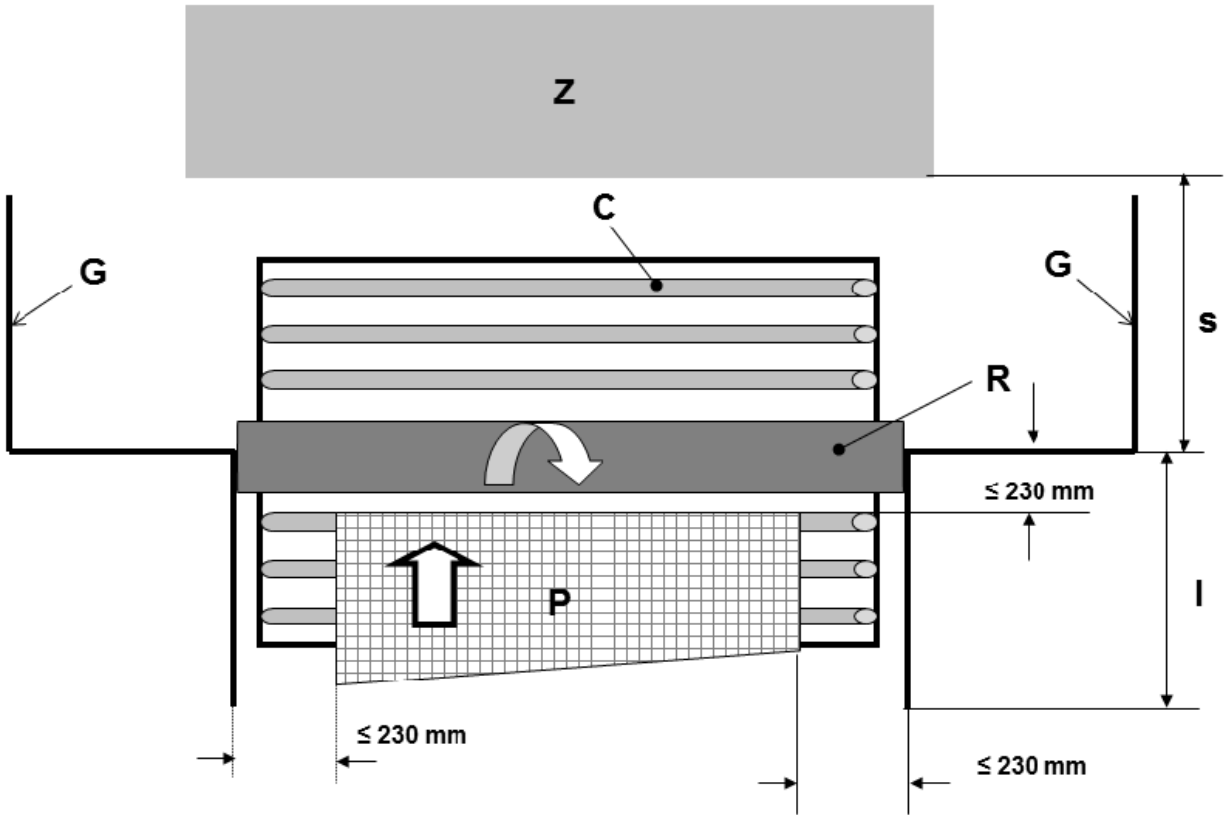
Figure 16 — Interlocking swing doors — front view

5.2.1.3.12 Large apertures — Automatic roller shutter guard

An automatic roller shutter guard as shown in Figure 17 and Figure 18 is suitable for large product exit apertures as well as for product entry apertures. The roller shutter opens when the product has reached a position where a person cannot enter the machine between the product and the guards (the clearance between the roller shutter gate and the product shall not exceed 230 mm). The distance between the roller shutter gate and the roller conveyor shall not exceed 120 mm to prevent whole body access. The automatic guard closes after the product has passed the aperture and before the product has reached a position which allows access to the hazard zone. It shall be interlocked with the machine to ensure that hazardous functions cannot start as long as the guard is not closed. The guard shall not lead to a hazard either because it complies with 5.2.1.1 or or because it is fitted with a pressure sensitive device complying with EN ISO 13856-2 or other safety device which shall have the same effect.

The distance between the product passing through the guard and the guard shall not be greater than 230 mm.

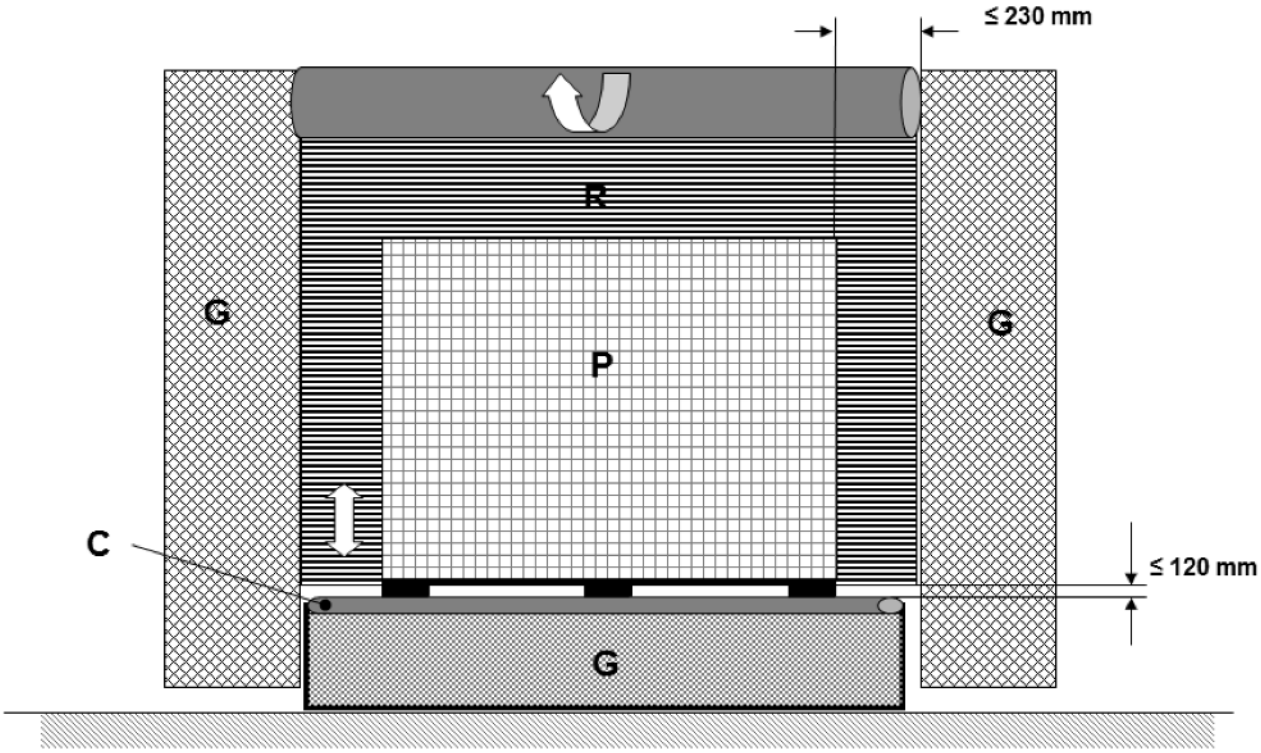
When there remains a gap g between the automatic guard and fixed machine parts (as shown in Figure 11) and the interlocking device signals that the guard is in closed position, the safety distances of Table 1 or 5.2.1.3.2 apply, depending on the dimensions of the aperture.



Key

C conveyor
G lateral guard
P product
R roller shutter gate
Z hazard zone
l length of lateral guards
s safety distance

Figure 17 — Roller shutter gate as an automatic guard — top view



Key

C conveyor
G fixed guard
P product
R roller shutter gate

Figure 18 — Roller shutter gate as an automatic guard — front view

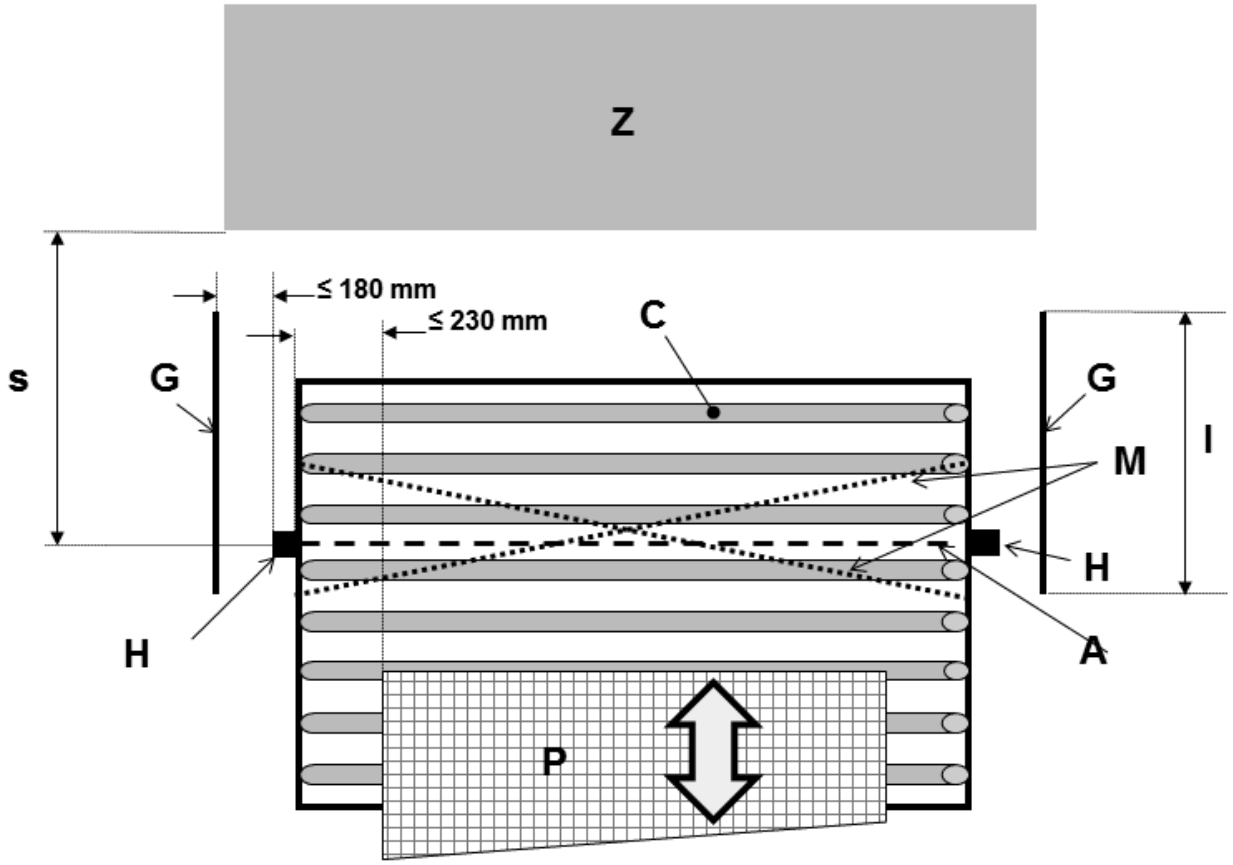
5.2.1.3.13 Large apertures - AOPD- low risk of crushing and shearing

The method shown in Figure 19 is allowed to be used where the values given in Table 5 are not exceeded. It uses a combination of fixed guards and AOPD complying with 5.15. It is suitable where the mass and velocity/energy of the product in combination with the design and positioning of guards or other fixed parts of the machine or in the vicinity do not generate a significant risk of crushing or shearing. It can be used for apertures which are used as both entry points and exit points, where no workplaces are near the aperture.

At apertures for product entry (see Figure 19) the distance between the lateral fixed guard and the fixture of the AOPD shall not be greater than 180 mm to prevent whole body access and the distance between the AOPD and the outer edge of the product shall not be greater than 230 mm to prevent whole body access while the product is passing. The height of columns of the AOPD shall be at least 1 900 mm from floor level.

NOTE If the values given in Table B.1 of Annex B are not exceeded there is no significant crushing hazard.

The AOPD may be muted as described in 5.2.1.4.



Key

A	AOPD
C	conveyor
G	fixed guard
H	columns of AOPD
M	muting beams
P	product
Z	hazard zone
l	length of lateral guards
s	minimum distance according to 5.2.1.3.18

Figure 19 — AOPD product entry and exit

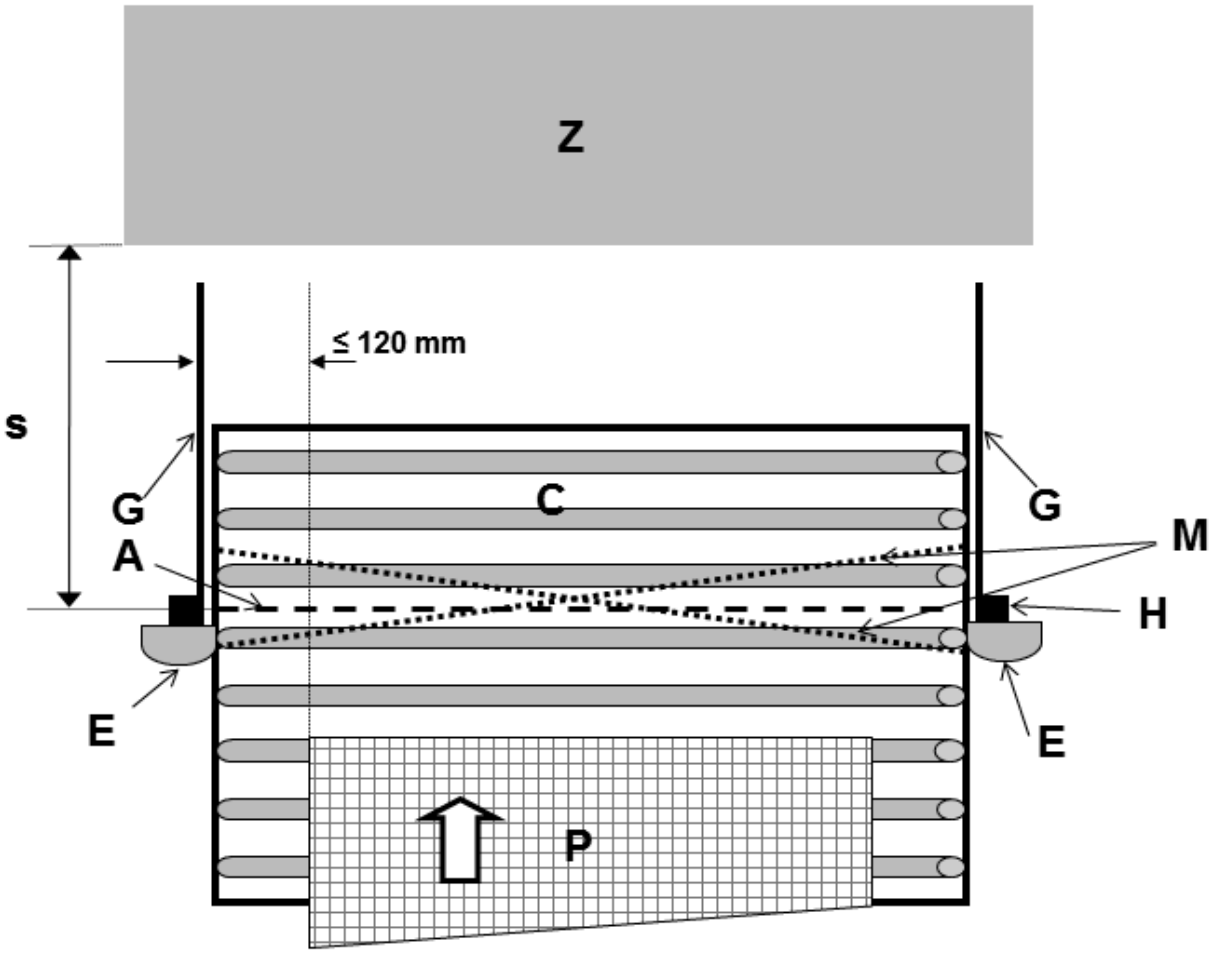
5.2.1.3.14 Large apertures - AOPD with pressure sensitive edge

This method uses a combination of fixed guards and AOPD complying with 5.15. To reduce the risk of crushing or shearing of parts of the body, pressure sensitive edges are mounted at both lateral guards as shown in Figure 20. The pressure sensitive edges shall reach from the bottom of the conveyor to the top of the lateral guard.

Tripping of the pressure sensitive edges shall initiate a safety related stop as described in 5.14.3 and the values of 5.2.1.1 shall not be exceeded during stopping time.

This method is preferable for product entry and applicable where there are work stations near the aperture and where crushing or shearing is a significant risk.

The AOPD may be muted as described in 5.2.1.4.



Key

A	AOPD
C	conveyor
E	pressure sensitive edge
G	fixed guard
H	columns of AOPD
M	muting beams
P	product
Z	hazard zone
s	minimum distance according to 5.2.1.3.18

Figure 20 — AOPD with pressure sensitive edge

5.2.1.3.15 Large apertures - AOPD with interlocking swing doors

This method comprises interlocking swing doors complying with 5.2.1.2 and an AOPD complying with 5.15. It shall be used if access is necessary beside the conveyor. It can also be used if there is a significant crushing risk by the moving product. As shown in Figure 21 and Figure 22, access to the safeguarded area beside the in-feed conveyor is given by interlocked swing doors. The interlocking remains active during muting of the AOPD. To prevent crushing and shearing hazards the force, pressure and energy necessary to open the

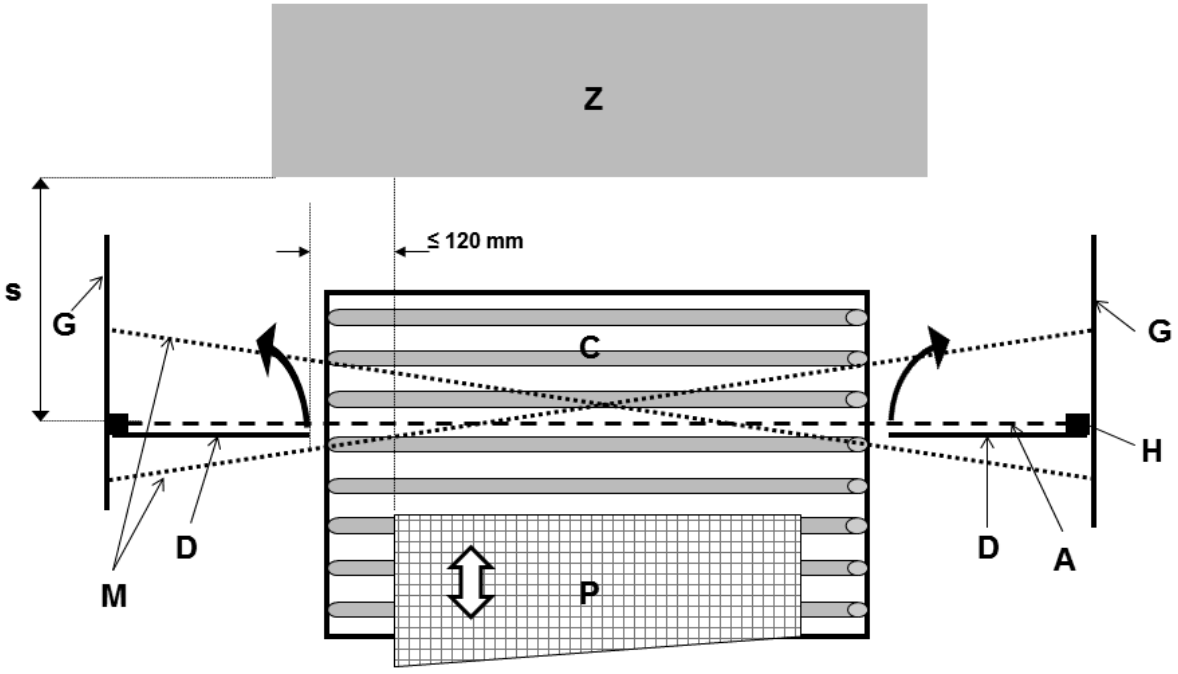
swing doors shall not exceed the values given in 5.2.1.1 and the distance between the fixed lateral guards and the outer edges of the conveyor shall not be less than 500 mm.

Access under or around the area safeguarded by the AOPD shall be prevented by fixed or interlocking movable guards complying with 5.2.1.2. This may include guarding under conveyors.

The gap between the outer edge of the product and the lateral guards shall be no greater than 120 mm.

The AOPD shall be positioned according to Figure 21 and Figure 22.

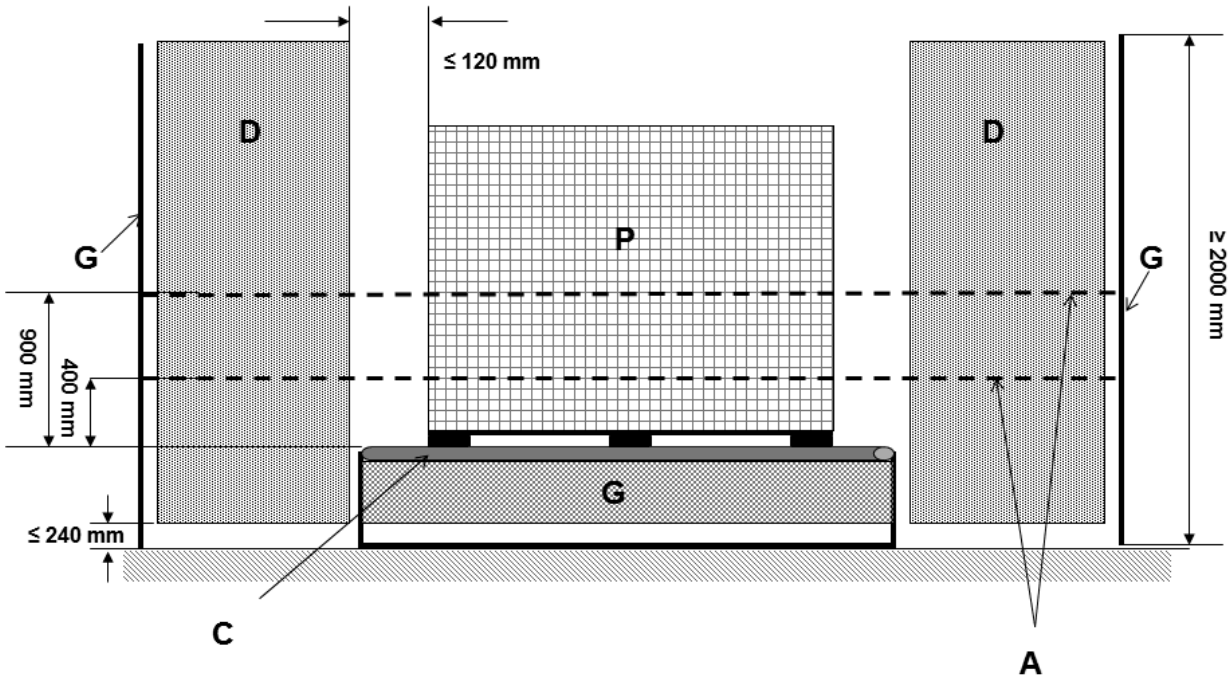
The AOPD may be muted as described in 5.2.1.4.



Key

A	AOPD
C	conveyor
D	interlocked swing door
G	fixed guard
H	columns of AOPD
M	muting beams
P	product
Z	hazard zone
s	minimum distance according to 5.2.1.3.18

Figure 21 — Fixed and interlocking movable guards with AOPD — top view



Key

A AOPD (example with two beams)
C conveyor
D interlocked swing door
G fixed guard
P product

Figure 22 — Fixed and interlocking movable guards with AOPD — front view

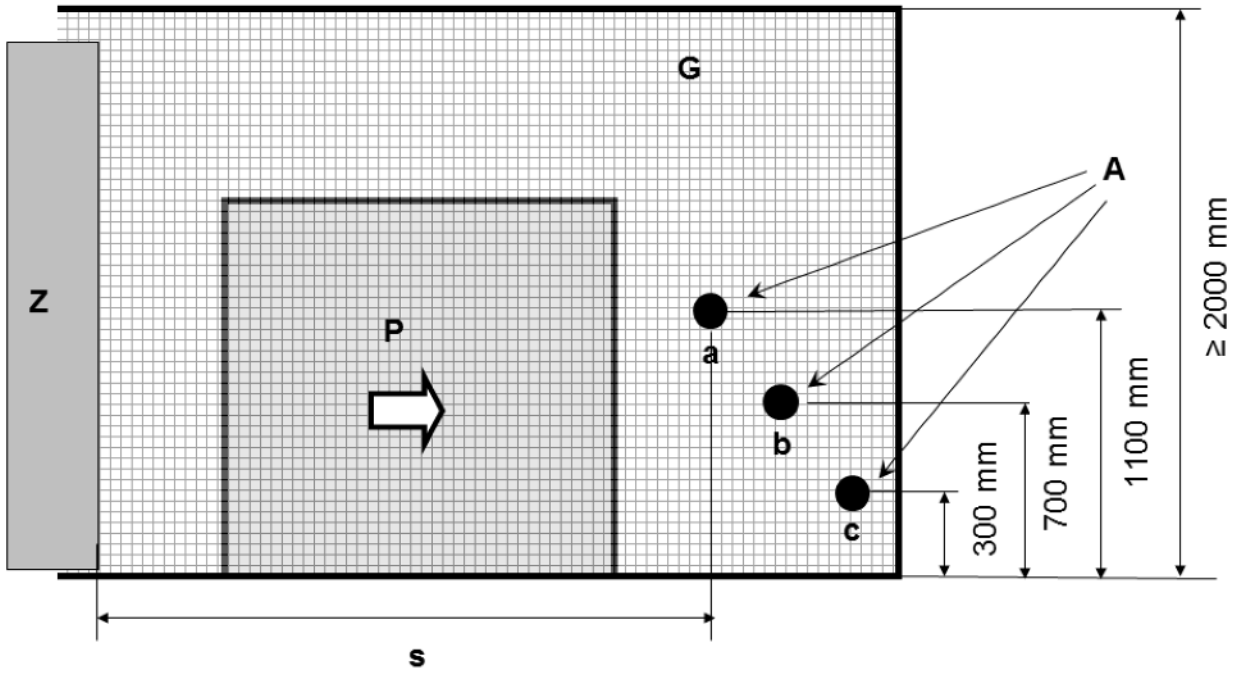
5.2.1.3.16 Large apertures - AOPD with dynamic beam interruption

Dynamic beam interruption as shown in Figure 23 distinguishes between people trying to gain access and the moving load by monitoring the sequence of signals from an AOPD with several beams or an array of single beams AOPD both complying with 5.15. Dynamic beam interruption can be used for discharge apertures.

This system is only suitable when the direction of movement of a person will be opposite to that of the product, because otherwise the sequence of product entry would be the same as the entry of a person.

The horizontal distance to the next beam shall not exceed 400 mm.

The distance between the guard and the outer edge of the product shall not be greater than 230 mm to prevent whole body access while the product is passing.



Key

A	AOPD
G	fixed guard
P	product
Z	hazard zone
a, b, c	beams
s	minimum distance according to 5.2.1.3.18

Figure 23 — AOPD with trip sequence detection

At least three beams shall be used for dynamic beam interruption. Using three AOPD beams complying with 5.15, designated a, b and c, the following sequence is created during the movement of the discharged load:

$$abc\ ;\ \overline{a}\,bc\ ;\ \overline{ab}\,c\ ;\ \overline{abc}\ ;\ a\,\overline{bc}\ ;\ ab\,\overline{c}\ ;\ abc$$

NOTE A bar above a letter indicates that the sensor so designated is interrupted.

If at a discharge area the AOPD is interrupted in an incorrect sequence the control system shall initiate a safety related stop as stated in 5.14.3.

5.2.1.3.17 Large apertures - automatic selection of active detection fields with laser scanner

When large apertures to machines are designed to allow the passage of goods or packages with different shapes, a risk of persons gaining access to the hazard zones over these goods or packages may arise. Figures 24 and 25 show how the configuration of laser scanners can affect the detection zone . Some types of ESPE (AOPD/Light Curtains and AOPDDR/Laser Scanners complying with 5.15) allow the activation of pre-set protective detection fields depending on external signals. When these external signals correspond to the maximum shape of a specific product, the correct (vertical) protective field of the ESPE can be activated as an alternative to muting of the complete protective device thereby denying undetected access.

The following requirements apply to the automatic change of protective fields:

a) a “maximum“ protective field shall be programmed in such a way that undetected access is impossible when no goods or materials are present in the machine aperture;

b) after a fault detection in the safety related parts of the control system which performs the automatic selecting function the maximum protective field shall be activated automatically;

c) the initiation and maintaining of a protective field shall not rely entirely on logic derived or deduced software signals;

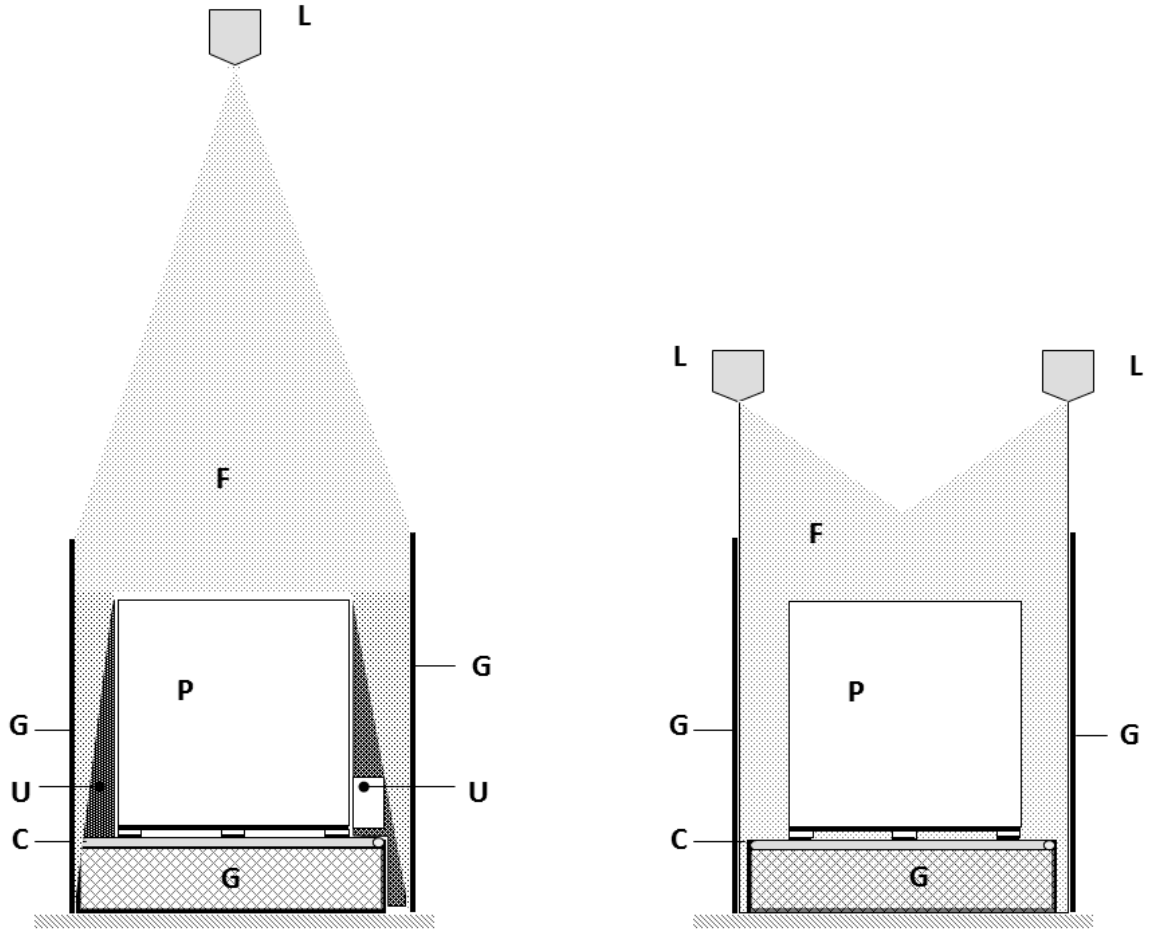
d) the maximum protective field shall be automatically activated immediately following the passage of the recognized product through the detection field of the ESPE;

e) selection of the mode in which the automatic selecting function can be initiated shall require the use of a key, keyword, or tool;

f) if the product stops while passing the ESPE, undetected access of the hazard zone shall not be possible or otherwise the control system shall initiate a safety related stop;

g) the dimensions of the protective fields shall prevent undetected access. The minimum distance between the protective field (vertical plane) and the nearest hazard zone is s (minimum distance according to 5.2.1.3.18).

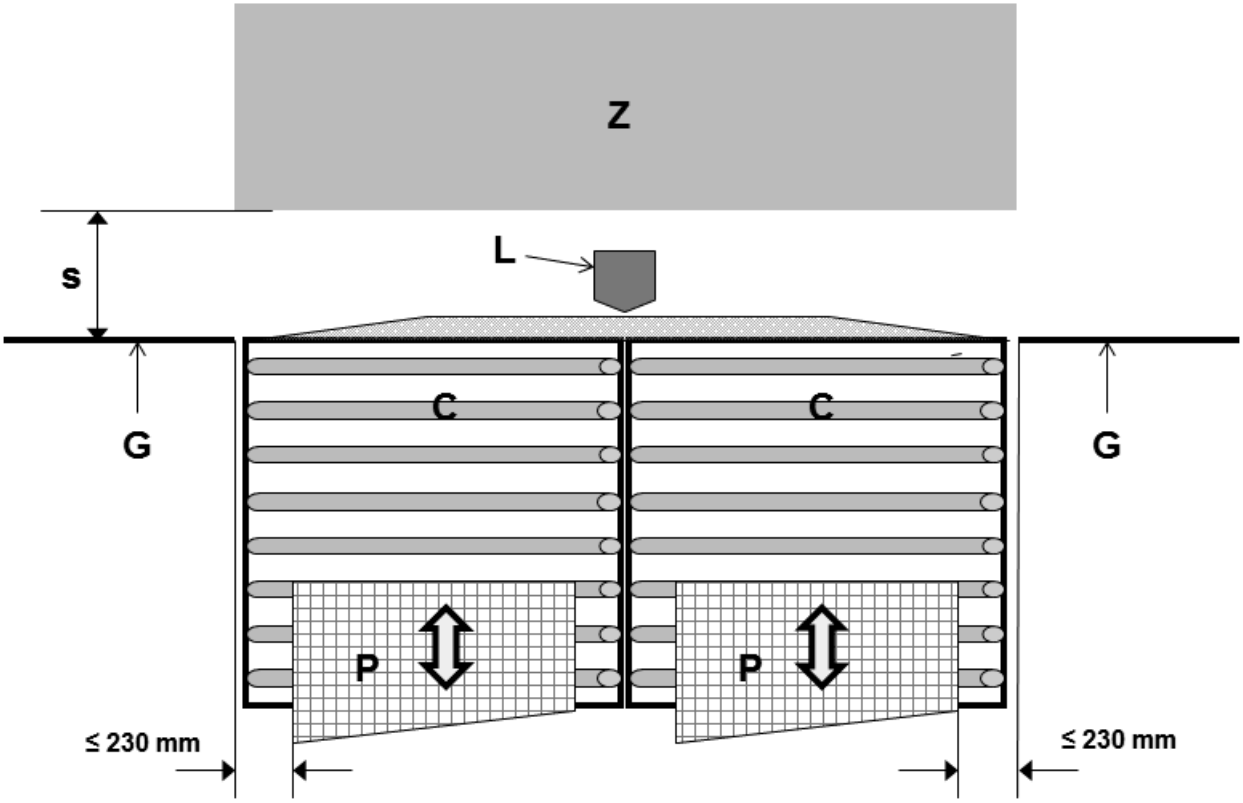
The laser scanner shall detect objects of minimum edge length of 500 mm or with minimum width of 300 mm in case of a slot (see U in Figure 24).



Key

C	conveyor
G	fixed guard
F	detected field
L	laser scanner
P	product
U	undetected object

Figure 24 — Different configurations of fixed guards and laser scanner(s) — front view



Key

C conveyor
G fixed guard
L laser scanner
P product
Z hazard zone
s minimum distance according to 5.2.1.3.18

Figure 25— Fixed guards with a laser scanner — Top view

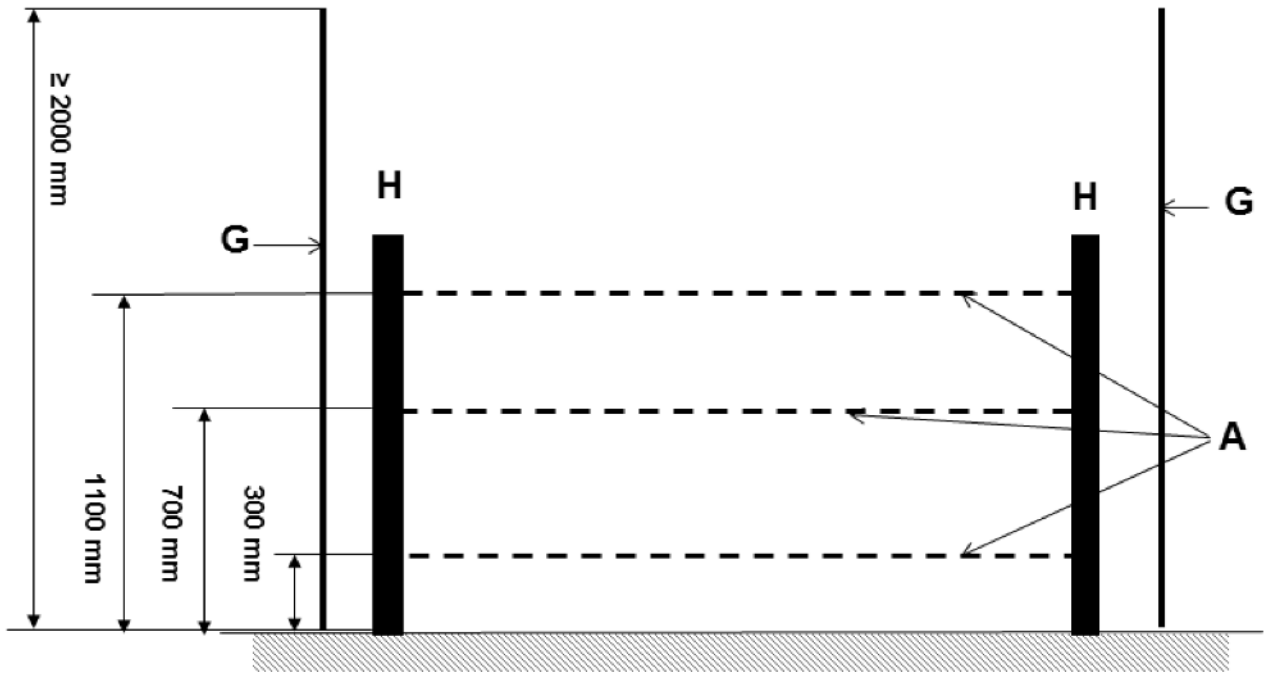
5.2.1.3.18 Large apertures - requirements for positioning of AOPD

The AOPD shall be positioned as follows.

The minimum distance shall comply with EN ISO 13855:2010, 6.2.

Where apertures extend from floor or other even plane of access the AOPD shall comprise at least three beams in a vertical plane, positioned at a distance of 300 mm, 700 mm and 1 100 mm from the access platform. See Figure 26.

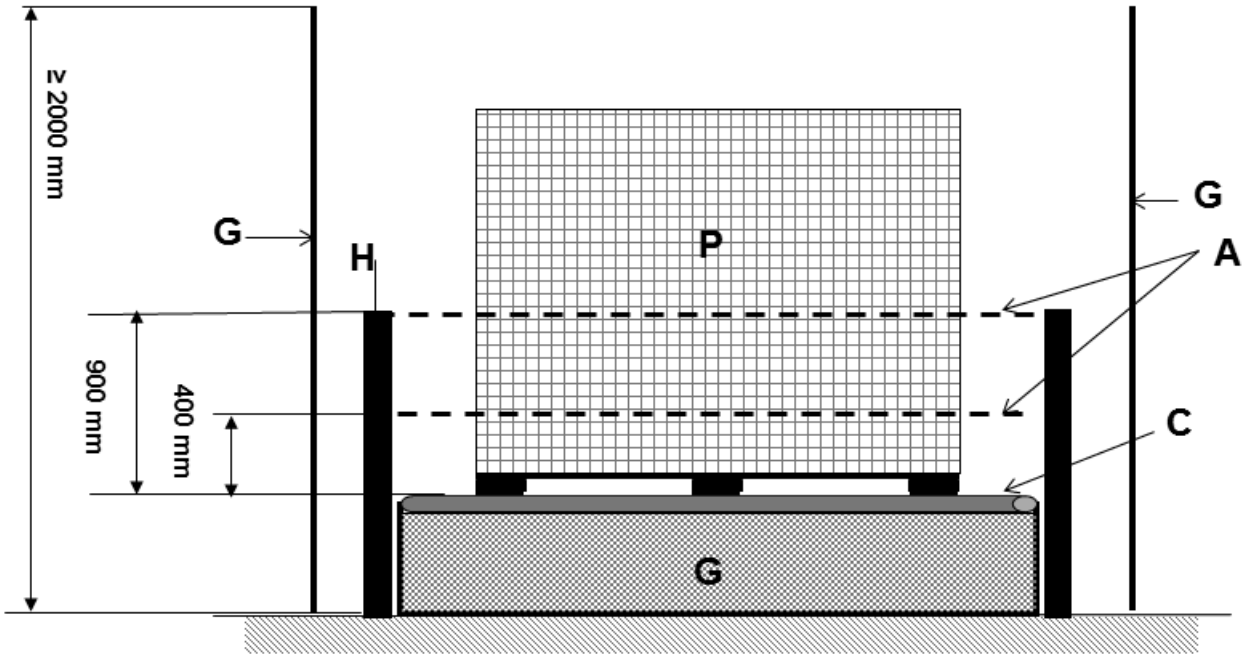
Where apertures extend above a roller conveyor, the AOPD shall comprise at least two light beams positioned at a distance of 400 mm and 900 mm from the upper edge of the conveyor. See Figure 27.



Key

A AOPD with 3 beams
G fixed guard
H column of AOPD

Figure 26 — Positioning of AOPD from floor or other even plane of access



Key

A AOPD with 2 beams
C conveyor
G fixed guard
H column of AOPD
Z hazard zone
P product

Figure 27— Positioning of AOPD above roller conveyor

5.2.1.4 Muting or blanking of ESPE

The signals from electro-sensitive protection equipment (ESPE) may have to be blanked as described in EN 61496-1:2004+A1:2008, 3.1 or muted as described in EN ISO 13849-1:2008, 5.2.5 and in this clause to allow product or material to enter or exit the machine.

Muting is a feature of the control system that disables the safety function of an ESPE during the time a product is passing the ESPE. The muting function shall be initiated and terminated automatically. This may be achieved by the use of a combination of appropriately selected and placed sensors and by signals from the safety related control system. Incorrect signals, sequence, or timing of the muting sensors or signals shall not allow a mute condition. Muting shall comply with the following:

a) muting shall be limited to a period that is only sufficient for the product to pass through the detection zone. When this time is exceeded, the muting function shall be cancelled and all hazardous movements stopped;

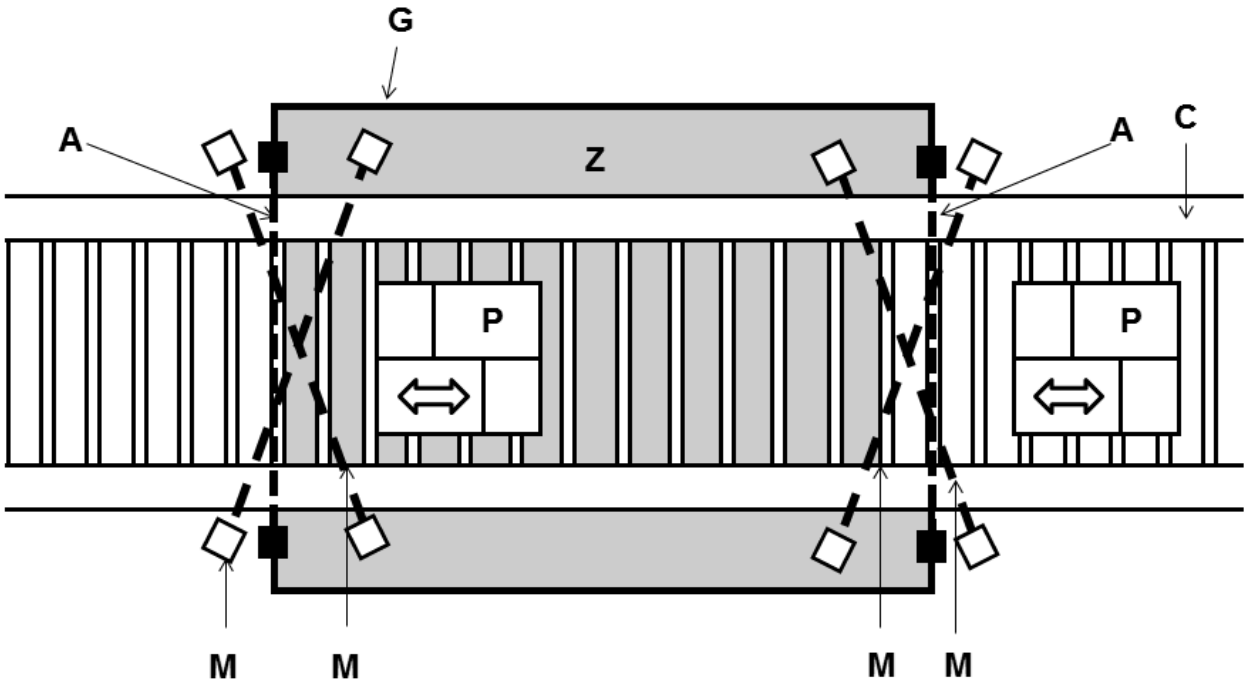
b) configuration of the muting sensors shall distinguish a person from the material that is allowed to pass through the detection zone;

c) any muting function that is part of the safety-related control system that performs the safety function that is muted shall have the same performance level;

d) no operational waiting position of a product shall be within the muted area.

An example of a muting assembly is shown in Figure 28.

NOTE See CLC/TS 62046:2008 (general requirements) for further information on the blanking function.



Key

A	AOPD
C	conveyor
G	fixed guard
M	muting beams
P	product
Z	area within guards

Figure 28 — Positioning of AOPD and muting devices

5.2.1.5 Release from trapping

Where there is a risk that persons or parts of the body could be trapped by mechanisms e.g. by drawing-in, entanglement or crushing the manufacturer shall provide the machine with means to release the person or part of the body. The following list gives a hierarchy of measures to be taken:

a) powered reverse movement or release of power with the same effect, both initiated automatically by automatic detection of trapping;

b) powered reverse movement or release of power with the same effect, both initiated by an emergency stop actuator which can be reached and operated by the trapped person;

c) automatic release of energy and means for reverse movement by manual effort;

d) manual release of energy and means for reverse movement by manual effort;

e) means of quick dismounting or removing of machine parts. If these parts are guards this requirement shall not contradict the requirements for guards stated in 5.2.1.2.

The measures shall be detailed in the instructions and the actuators and means for manual action shall be readily visible, marked and easily accessible.

5.2.2 Requirements to prevent slip, trip and fall hazards

5.2.2.1 Measures to minimize slip hazards

The design of the machine shall minimize the risk of liquids or solids spilling onto traffic routes, work stations or means of access around the machine. Where spills cannot be prevented the manufacturer shall supply a means of containment for the spill e.g. drip trays and describe the most appropriate method for removing the spillage in the instructions.

5.2.2.2 Measures to minimize trip hazards

The design of the machine shall avoid assemblies at low level that are likely to pose a trip hazard. Where this is not possible, the manufacturer shall provide railings or some other form of barrier, which guides people away from the trip hazard.

The manufacturer shall describe, in the instructions, how cables and pipes associated with the machine shall be supported and laid so they do not create a trip hazard.

5.2.2.3 Measures to minimize fall hazards – means of access

The design of the machine shall allow that it is operated, cleaned and maintained from floor level. If this is not reasonably practicable the following requirements shall apply:

a) where access above floor level is required for operation the manufacturer shall provide a permanent means for safe access;

b) where access above floor level is required for routine cleaning or maintenance the manufacturer shall provide a suitable means for safe access. This shall be preferably a permanent means of access. Non-permanent means of access are allowed if permanent means would increase risks e.g. for hygiene or if necessary access to other parts of the machine would be made very difficult.

Permanent means of access shall comply with EN ISO 14122-1:2001, 5.2 and be selected according to EN ISO 14122-1:2001, 5.3. Working platforms and walkways that form this permanent means of access shall conform to EN ISO 14122-2. Stairs, stepladders and guard-rails that form this permanent means of access shall conform to EN ISO 14122-3. No ladders are allowed where it can be anticipated that people are not able to hold with both hands during access.

Where non-permanent means of access are used they shall be chosen following the criteria and requirements given in EN ISO 14122-1.

Where non-permanent means are to be used the manufacturer shall give general information about the requirements necessary for their safe use. These may include necessary space, dimensions of traffic ways, method to fix or stabilise the means of access at the machine, suitable storage while the means is not in use, possible hazards if the means of access is not used in its intended place.

5.2.3 Stability of machines

5.2.3.1 Stability during operation

The manufacturer shall provide information in the instructions on how to move the machine as well as moveable parts and special equipment delivered with the machine safely.

On machines fitted with wheels, at least two wheels shall be fitted with locking devices to ensure that the machine does not move unexpectedly when it is in use.

If it is foreseeable that someone will stand on the machine, the manufacturer shall design the machine or its fixings to ensure stability in this situation.

5.2.3.2 Stability while being moved

The manufacturer shall provide information in the instructions on how to move the machine safely.

Machines fitted with wheels shall be designed so that they do not move or tilt in a static test while they are placed on a 10° slope independent of its orientation.

5.2.4 Prevention of hazards from movable guards

Moveable guards and guards that move under power, gravity or stored energy shall be designed so that they are safe by design as stated in 5.2.1.1 or they shall be fitted with safety devices which limit the forces which the guards can apply to the values given in 5.2.1.1.

5.3 Supply disconnecting (isolating) device

The machine shall be equipped with a readily identifiable and accessible supply disconnection device for each type of energy. Isolation switches shall be clearly labelled to indicate the method of operation of the switch and shall have the facility to be locked in the off position.

— Electrical energy:

This device shall be selected from those listed in EN 60204-1:2006, 5.3.2 and comply with 5.3.3 and 5.3.4 of that standard. At least one such device shall be attached to the machine.

Devices for isolating the electrical equipment shall be provided in accordance with EN 60204-1:2006, 5.5 and 5.6.

The actuator of the supply disconnection device shall comply with EN 61310-3 and be attached to the machine or located on an adjacent electrical enclosure which is part of the electrical equipment of the machine.

— Pneumatic and hydraulic energy:

The isolation valves shall comply with EN ISO 4414:2010, 5.2.8, and EN ISO 4413:2010, 5.4.7.2.1.

5.4 Pneumatic and hydraulic equipment

All pneumatic components and piping shall conform to the requirements of EN ISO 4413. All hydraulic components and piping shall conform to the requirements of EN ISO 4414.

Where control functions are performed by hydraulic or pneumatic systems, these circuits shall comply with the requirements of 5.14. and 5.15.

Where the machine is designed to pack foodstuffs, cosmetics, pharmaceuticals or other products where contamination is a significant risk, the design shall ensure that hydraulic oil or pneumatic lubricating oil cannot come into contact with the product.

5.5 Electrical equipment

5.5.1 General

Electrical equipment shall comply with EN 60204-1. In the places where EN 60204-1 provides various options, the options stated below shall be used.

5.5.2 Protection against electric shock

Electric shock by direct contact shall be prevented by choosing one of the methods described in EN 60204-1:2006, 6.2 and electric shock by indirect contact shall be prevented by choosing one of the methods described in 6.3 of that standard.

5.5.3 Degree of protection

The protection level for electrical enclosures shall be selected on the basis of the environment in which the machine will be used and the anticipated cleaning method for the machine and its environment. See EN 60204-1:2006, 11.3. Examples of suitable protection levels as defined by EN 60529 are given in Table 2 and Table 3.

Table 2 — Examples for selecting the degree of protection for dusty environments

Dusty Environment	**Required degree of protection** (EN 60529)
Non conducting dusts	IP 5X
Conducting dusts e.g. carbon powder, aluminium powder	IP 6X

NOTE Other measures will be required if the equipment is expected to be working in a potentially explosive atmosphere.

Table 3 — Examples for selecting the degree of protection for different cleaning methods using water

Method of cleaning	**Required degree of protection** (EN 60529)
Cleaning without water	IP X3
Cleaning with damp cloth	IP X4
Cleaning with low pressure water (as defined by EN 60529:1991, Table VIII.8)	IP X5
Cleaning with medium pressure water (as defined by EN 60529:1991, Table VIII.8)	IP X6

The tests for electrical enclosures stipulated by EN 60529 are for when water is used. Therefore, if fluids other than water are used for cleaning or the water contains a detergent, it may be necessary to use a higher IP rating than indicated by EN 60529 and Table 3.

If fluids other than water are used to clean the machine, the level of protection provided by an electrical enclosure may reduce in the course of time. The manufacturer shall take this into account by choice of materials, by construction and in the maintenance instructions.

5.6 Electrostatic phenomena

On packaging machines where hazards may arise from the generation of static electricity, the manufacturer shall provide sufficient earth bonding or static elimination equipment to ensure that hazardous levels of static

electricity do not occur. This equipment shall ensure that electrostatic discharge shall lead neither to any injury nor to the ignition of potentially explosive atmospheres or combustible substances.

5.7 Thermal hazards

5.7.1 Hot surfaces

The external temperature of exposed parts of the machine, e.g. guards, control panels, electric motors, shall not exceed the temperatures that will cause burning according to the burn thresholds depending on materials and contact times stated in EN ISO 13732-1:2008, 4.2.

Where the machine includes parts with a foreseeable temperature greater than the burn thresholds described in EN ISO 13732-1, the manufacturer shall minimize the risk of accidental contact e.g. by fitting insulation or safeguarding against unintentional contact and by fitting the warning sign specified in 7.3.4 on the outside of the machine or adjacent to the hot parts (see Figure 33).

If having taken these measures, there is still a residual risk of touching hot surfaces this shall be stated in the instructions together with the measures which can be taken to avoid burn injuries, e.g. wearing gloves or other personal protection equipment.

5.7.2 Cold surfaces

NOTE This paragraph is relevant especially where surfaces with temperatures less than 5 °C can occur.

The external temperature of exposed parts of the machine, e.g. guards, shall not fall below the temperatures that may cause frostbite according to the thresholds depending on materials and contact times stated in EN ISO 13732-3:2008, Clause 5.

Where the machine includes parts with a foreseeable temperature lower than the frostbite thresholds described in EN ISO 13732-3, the manufacturer shall minimize the risk of accidental contact e.g. by fitting insulation or safeguarding against unintentional contact and by fitting the warning sign specified in 7.3.5 on the outside of the machine or adjacent to the cold parts (see Figure 34).

If having taken these measures, there is still a residual risk or a need of touching cold surfaces this shall be stated in the instructions together with the measures which can be taken to avoid frostbite injuries, e.g. wearing gloves or other personal protection equipment or using insulated tools.

5.8 Noise reduction

The main sources of noise on packaging machines are:

a) drive mechanisms;

b) vacuum pumps;

c) compressed air exhaust;

d) products (e.g. glass bottles and cans) or machine parts hitting against each other;

e) packaging materials, e.g. unreeling strap or film;

f) mechanisms hitting against each other, e.g. during the welding process;

g) conveyors.

Packaging machines shall as far as is reasonably practicable be designed to reduce noise at its source.

Measures to minimize or eliminate noise at source include the following:

h) designing mechanisms so that they do not hit against each other;

i) using rubber rollers;

j) using timing belts instead of chains;

k) using helical instead of straight cut gears;

l) limiting the running speed or pressure or other energy of the machine or auxiliaries;

m) using vibration isolators;

n) fitting air exhausts with silencers;

o) use of damping materials on vibrating or impacted metal surfaces to reduce resonance;

p) installing acoustic absorptive materials on the inside of machinery casings;

q) fitting partial or full acoustic enclosures.

NOTE Additional design measures can be found in EN ISO 11688-1.

The criterion for assessing the efficiency of noise reduction measures is the actual noise emission values of the machine and not the nature of the reduction measure itself.

5.9 Radiation

5.9.1 General

Where machines contain radiation sources or equipment that generates radiation, the manufacturer shall ensure that these radiation hazards are contained so that the effects of this radiation on operators or persons in the vicinity of the machine are non-existent or, if this is not possible, are reduced to a non-hazardous level (see EN 12198-3).

Low frequency, radio frequency and micro-waves should be contained using Faraday cages. Infrared, visible light and ultraviolet light (e.g. for container inspection) should be by the use of light baffles.

Where guards against radiation have to be opened (e.g. for installation, adjustment or maintenance) the manufacturer shall detail the protective measures in the instructions. This includes description of energy disconnection, and dissipation, use of personal protective equipment, measures against hazards for persons in the vicinity of the machine.

The emission of radiation shall be assessed using the principles of EN 12198-1. The assessment shall include all phases of life cycle of the machine. For measuring radiation EN 12198-2 applies.

5.9.2 Laser radiation

Laser equipment on packaging machines shall comply with EN 60825-1.

Lasers (e.g. for marking of products or cutting packaging material) shall be designed so that – even when the laser is misaligned – the emission level of laser radiation during normal use does not exceed the accessible emission level for class 1 lasers as specified in EN 60825-1:2007, Table 1. Detailed information on the laser product (type and power) and instructions for its safe use and maintenance shall be provided in the instructions and the machine shall be marked with the laser class which is emitted from the machine and the laser or its containment shall be marked with the laser class of the laser source.

Where the use of laser radiation generates decomposition products, the machine shall be fitted with automatic means to extract the decomposition products at their source and to conduct them safely into the open or filter them so that no decomposition products are released into the work area. See also 5.10.1.

In addition, EN ISO 11553-1:2008, 5.3.2 applies.

5.10 Measures to control hazards generated by products, substances and materials

5.10.1 Measures to control hazards generated by substances

Where it is intended or foreseeable that hazardous substances are used with the machine (e.g. for cleaning or disinfection) or that such substances may build up (e.g. during operation or cleaning) the manufacturer shall

a) identify the nature of the hazard;

b) provide measures in accordance with EN 626-1 to control the hazard which includes:

   1) minimize hazards by using the least hazardous substance;

   2) minimize hazards by using the least hazardous procedure;

   3) to supply any necessary ancillary equipment e.g. dust, aerosol or fume extraction and monitoring devices;

   4) measures to ensure that no hazardous amounts of hazardous substances build up in the vicinity of the machine;

   5) wherever technically possible measures to ensure that during short time intervention the operator is not exposed to hazardous amounts of hazardous substances;

   6) provide information on how to install the ancillary equipment and operate, clean and maintain the machine without risks to health or safety including detailed information about the use of suitable personal protection equipment where there is a residual risk of hazardous substances.

c) verify the effectiveness of the measures by suitable methods which the manufacturer shall determine following the procedures stated in EN 626-2.

NOTE The hierarchy of and examples for measures are given in EN 626–1:1994+A1:2008, Annex A.

5.10.2 Measures to control hazards generated by products

5.10.2.1 General

Where a machine is designed or specified to pack products that are hazardous to health or safety or if it is foreseeable that such products might be packed with the machine, the manufacturer should

a) identify the nature of the hazard and methods for controlling the hazard;

b) specify clearly in the instructions the characteristics of products which shall not be packed with the machine;

c) design a safe system for handling the product and minimizing the risk of damaging packages of hazardous products e.g. by limiting the force or torque, or by fitting shear pins or sensors;

d) design the machine in accordance with EN 626-1 and EN 626-2 to minimize the loss or spillage of hazardous substances if hazardous substances are likely to be discharged from the machine;

e) design the machine following the principles of EN 13478 if the machine is intended to handle a combustible product;

f) design the machine in accordance with EN 626-1 and EN 626-2 if harmful biological substances are likely to be discharged from the machine;

g) provide guards that will contain these packs or products where the hazard results from falling or ejected packs or products,

h) supply any necessary ancillary equipment, e.g. dust, aerosol or fume extraction or monitoring devices;

i) provide information on how to install the ancillary equipment and operate, clean and maintain the machine without risks to health or safety;

j) verify the effectiveness of the measures by suitable methods which the manufacturer shall choose following the procedures stated in EN 626-2;

k) provide suitable means to evacuate or contain any hazardous substances in the event of failure of the energy supply and give the necessary information to resolve the hazardous situation safely.

5.10.2.2 Requirements to prevent hazards from ejected or falling products

5.10.2.2.1 General

Where there is a risk of impact or crushing by ejected products, e.g. by falling from stacks or by tilting over, the manufacturer shall reduce this risk by a sensor control or alignment of the product before initiating the packing process or by holding the product by support or hold down devices during the packing process or by other measures to this effect.

Guards shall be sufficiently robust to retain product or packs that are ejected or fall down and be designed so that fallen or ejected products and packs can be retrieved safely.

The instructions shall explain how the products shall be lowered and released safely, how power supplies shall be isolated and stored energy shall be safely released before a long term intervention e.g. for cleaning or maintenance.

The requirements in 5.10.2.2.2 and 5.10.2.2.3 apply in the following circumstances:

— where the potential energy of a single product falling from the loading mechanism exceeds 10 J; or

— where the products are made from glass; or

— where the shape of the products is likely to cause an injury if they are dropped; or

— where dropping the products is likely to release a hazardous substance contained in the products.

5.10.2.2.2 Interventions during operation with power supplies active

Hazards from falling product shall be prevented by one of the following measures:

a) the products are held and not released during the operator intervention, e.g. by holding them in a positive mode; or

b) the products are deposited safely and energy supplies are isolated and stored energy is dissipated. Access shall be prevented by guard locking until these operations are completed; or

c) the products are prevented from falling by a device which is moved into position automatically or by the operator before entering the hazard zone. This device shall be interlocked in such a way that the operator cannot enter the hazard zone until the device is in position e.g. using guard locking; or

d) other methods to the same effect.

The instructions shall detail the correct use of the devices and additional measures if necessary.

5.10.2.2.3 Partial or total failure of an energy supply

In the event of a failure of an energy supply to the machine e.g. electricity, hydraulic pressure or compressed air, the design of the machine shall ensure that:

a) the products are held for as long as the power is disconnected, e.g. by using springs or pneumatic mechanisms with a compressed air reservoir; or

b) the guards and controls of the machine prevent an operator entering the hazard zone until after the products have been lowered or released, e.g. by using guard locking; or

c) where a) or b) are not technically possible, e.g. because the products are held using vacuum, an audible warning shall be given when the power supplies fail and the products shall be held long enough so that an operator can get out of the hazard zone before the products are released or for 1 min whichever is the longer. The machine shall be fitted with warning signs that alert the operator to the risk of the products falling in the event of a power failure and the importance of exiting the machine quickly when the audible alarm sounds. See also EN ISO 12100:2010, 6.4.3.

Where dropping the products is likely to release a hazardous substance contained in the products, option a) is preferred, option c) shall not be used and option b) shall only be used if the machine is equipped with a safe means for extracting or removing the hazardous substance that does not require the operator to enter the hazard zone.

5.10.2.3 Moving products

Where there is a crushing or shearing hazard created by the product moving past a fixed part of the machine or guard this hazard shall be minimized in one of the following ways:

a) by design using the distances in EN 349, but the required safety distances shall be considered;

b) by fitting a pressure sensitive edge to the fixed part complying with EN ISO 13856-2;

c) by fitting an interlocked hinged interlocking guard complying with 5.2.1.3.9 which opens in the moving direction of the product.

5.10.3 Measures to control hazards generated by packaging materials

Where a machine is designed or specified to use packaging materials that are hazardous to health or safety or if it is foreseeable that such packaging materials might be used with the machine, the manufacturer shall:

a) identify the nature of the hazard and methods for controlling the hazard;

b) specify clearly in the instructions the characteristics of packaging materials which shall not be used with the machine. For excluded packaging materials the requirements c), d) and e) do not apply;

c) design a safe system for handling the packaging material using relevant standards, for example:

   1) on machines using materials that can give off fumes which are hazardous to health, limit the temperature of heating devices so that fumes are not generated. If this cannot be done for technical

reasons the manufacturer shall design the machine in accordance with EN 626-1 and EN 626-2 and provide fume extraction equipment as described in d);

2) on machines using packaging materials that produce excessive amounts of dust design the machine in accordance with EN 626-1 and EN 626-2 and provide dust extraction equipment as described in d);

3) on machines using materials with sharp edges, which can cause cut injuries guard exposed edges on the machine against accidental contact and recommend in the instructions the use of gloves when handling the material;

4) on machines using materials that can ignite if overheated, the design of the control system shall minimize the risk of the packaging material catching fire. This may involve designing the control system so that the heated sealing devices do not remain in contact with the packaging material when the machine is stopped. The principles of EN 13478 apply;

5) on machines handling glass containers the design shall ensure that people are protected from broken or flying glass;

6) on machines using packaging materials that can generate electrostatic charges provide suitable earth bonding and static elimination equipment. See also 5.6.

d) supply any necessary ancillary equipment e.g. dust, or fume extraction equipment designed in accordance with EN 626-1 and EN 626-2;

e) provide information on how to install the ancillary equipment and operate, clean and maintain the machine without risks to health or safety;

f) verify the effectiveness of the measures by suitable methods which the manufacturer shall determine following the procedures stated in EN 626-2.

5.11 Ergonomic design principles

5.11.1 Operating the machine

The design shall follow the principles of EN 614-1 and EN 614-2, EN 1005-2, EN 1005-3 and EN 1005-4.

NOTE Information on the risk assessment for repetitive handling at high frequency is given in EN 1005–5:2007.

5.11.2 Operator interface and machine mounted control devices

Controls and control devices shall comply with EN 60204-1:2006, Clause 10.

For a standing operator looking at a control panel which is fixed in a vertical plane, the distance from floor level to the panel (measured to the median) typically should be between 1,6 m and 1,7 m.

5.11.3 Handling machine parts

Guards and other machine parts shall be designed according the ergonomic principles stated in 5.11.1 so that they can be easily mounted, dismounted and handled (where permitted) without excessive effort.

5.11.4 Loading packaging materials

The position of loading points for packaging materials such as magazines for blanks and mounting points for film reels shall be carefully designed to avoid bad posture or excessive effort that can cause injury. The design shall follow the principles of EN 614-1 and EN 614-2. EN 1005-2, EN 1005-3 and EN 1005-4 apply.

One or more of the following methods shall be used to prevent skeletal or muscular injuries:

— the manufacturer shall design the machine so that it can be loaded from floor level;

— where loading materials at floor level is not possible a platform with suitable means of access shall be provided. Where the platform is higher than 300 mm lifting equipment shall be provided to raise materials to the platform.

— machine assemblies which move to a favourable loading position;

— supply special lifting equipment where necessary for that type of machine;

— facilitate the use of lifting equipment like cranes or fork lift trucks;

— design the machine in such a way that more than one person can lift the weight together.

5.11.5 Loading products or unloading packages

On machines that are fed or unloaded manually, the design of the hand feeding area shall follow the ergonomic design principles indicated in EN 1005-2, EN 1005-3 and EN 1005-4 to minimize the risk of muscular or skeletal injuries.

One or more of the following methods shall be used to prevent skeletal or muscular injuries:

— the manufacturer shall design the machine so that it can be loaded from floor level;

— machine assemblies which move to a favourable loading position;

— supply special lifting equipment where necessary for that type of machine;

— facilitate the use of lifting equipment;

— design the machine in such a way that more than one person can lift the weight together.

NOTE Information on the risk assessment for repetitive handling at high frequency is given in EN 1005–5:2007.

5.11.6 Size or product changes

See 5.20.6.

5.11.7 Cleaning the machine

The parts of the machine, which shall be reached for cleaning or retrieving fallen packs and products, shall be easily accessible. This may involve designing the machine so it can be cycled to a position where cleaning can be carried out without the risk of injury.

5.11.8 Maintenance

The design of the machine shall minimize the risk of physical strain when carrying out maintenance. All maintenance points shall be safely accessible and it shall not be necessary to stand on machine parts which are not intended for access. For prevention of slip, trip or fall hazards see also 5.2.2.

5.11.9 Moving the machine

The manufacturer shall provide instructions on how to move the machine. Where machines are equipped with wheels the manufacturer shall ensure that the machine can be moved without the need for excessive effort and information shall be provided about maintenance to keep the wheels smooth-running.

5.11.10 Lighting

For requirements on integral lighting of machines, see EN 1837.

5.12 Hygienic design requirements

When a packaging machine is designed or specified to pack foodstuffs or other products where hygiene is an issue, the manufacturer shall:

a) identify the level of hygienic design appropriate for the product. When the machine manufacturer is unable to find this information, he shall define the limitation of use for the machine and clearly state this in the instructions, e.g. “This machine has been designed to pack foodstuffs with the following characteristics: ...”;

b) following the requirements of EN 1672-2 design a safe system for handling the product. Design features shall include:

   1) use of contact materials complying with EN 1672-2:2005+A1:2009, 5.2, which are appropriate for the product, the contact time, the temperature, chemical reactions, physical characteristics (such as abrasion) and the cleaning method and substances (this list is not exhaustive);

   2) measures to prevent lubricating oils coming into contact with the product e.g. fitting filters to compressed air exhausts;

   3) food and splash areas (as defined in EN 1672-2:2005+A1:2009, 3.4.1 and 3.4.2) which are free from crevices and ledges;

   4) food and splash areas that can be easily cleaned and inspected for cleanliness.

c) describe appropriate cleaning and disinfecting procedures for the machine in the instructions.

5.13 Failures of power supplies

The design of the machine shall ensure that the interruption and re-establishment after an interruption of the machine’s power supplies does not lead to a hazardous situation.

In the event of a failure of one of the power supplies to the machine, e.g. electricity, compressed air, the design of the machine shall prevent hazardous situations by one or a combination of the following measures:

a) by a self-locking construction;

b) by non-return pneumatic or hydraulic valves;

c) by backup power supplies or compressed air vessels;

d) by mechanisms that are held for as long as the power is disconnected, e.g. by using springs or pneumatic mechanisms with a compressed air reservoir; or

e) by automatically acting fall restraint devices or vessels or other mechanisms that are self-closing in case of loss of power to cut off the supply of hazardous substances, products or energy, etc. These devices shall not open automatically when power is re-established.

For prevention of hazards by falling items see 5.10.2.2.

5.14 Control functions

5.14.1 General

Control functions shall comply with EN 60204-1:2006, 9.2.

The type of stop condition in effect at any time shall be indicated clearly by an optical signal or on the operator panel.

5.14.2 Normal stop

Every machine shall be fitted with a device that initiates a normal stop function. Normal stops shall be stops of category 0 or 1 as defined in EN 60204-1:2006, 9.2.5.3.

Packaging machines shall be fitted with a control device to bring the machine safely to a complete stop. Each workstation shall be fitted with a control device to stop some or all of the functions of the machinery, depending on the existing hazards, so that the machinery is rendered safe. The machinery's stop control shall have priority over the start controls. Once the machinery or its hazardous functions have stopped, the energy supply to the actuators concerned shall be cut off.

NOTE For normal stopping of PDS(SR) (power drive system, safety related), see EN 61800–5-2:2007, 4.2.2.2 “safe torque off (STO)” and 4.2.2.3 “safe stop 1 (SS1)”.

5.14.3 Safety related stop functions

Safety related stop functions shall have precedence to all other commands and it shall not be possible to inhibit a safety related stop by another stop condition of the machine or any other command.

Safety related stops can be stops of category 0, 1 or 2 according to EN 60204-1:2006, 9.2.2.

For category 2 see 5.14.6.2, 5.14.6.3, and 5.14.6.4.

5.14.4 Operational stop

Where it is required that a stop function does not cut off the energy supply to the actuators the machine shall be stopped by an operational stop according to stop category 2 according to EN 60204-1:2006, 9.2.2.

NOTE Corresponding to “safe operating stop” (SS2) of EN 61800–5-2:2007, 4.2.2.4.

The stop condition shall be initiated, monitored and maintained according to 5.14.6.2, 5.14.6.3 and 5.14.6.4.

Operational stop shall not be used as a substitute for normal stop function or emergency stop function or for emergency switching off function.

5.14.5 Emergency stop and emergency switching off

Each control station shall be provided with an emergency stop actuator.

Where in addition to the stopping of hazardous movements it is necessary to cut off energy in cases of emergency, packaging machines shall be provided with an emergency isolation device located on each control station.

Depending on the operational concept and the position of the machine, e.g. within a line, it may be necessary to have a number of emergency stop actuators or emergency switching off actuators outside the hazard zone as well as inside. They should be included in each area of the machine where access is intended and be reachable readily from a person that has to walk not further than 5 m along the external guards. This could mean that, if the machine is likely to be part of a line of machines with possible access from several sides,

there has to be at least an emergency stop button on every different accessible side of the machine. On machines where any dimension is greater than 10 m, it could mean that there is an emergency button at least every 10 m or at every access point. Rope operated emergency stop devices may be used instead of buttons, e.g. along conveyors.

The emergency stop function shall be a stop of category 0 or 1 according to EN 60204-1:2006, 9.2.2 and comply with EN 60204-1:2006, 9.2.5.4.1 and 9.2.5.4.2. The emergency stop shall also comply with EN ISO 13850. Electrical switchgear and control gear shall comply with EN 60947-5-5.

The emergency switching off function shall comply with EN 60204-1:2006, 9.2.5.4.1 and 9.2.5.4.3.

Emergency stop actuators and emergency switching off actuators on packaging machines shall not be fitted with any mechanical means for protection against unintended actuation or for other reasons. The actuator shall be readily accessible without any obstacle. Unintentional actuation shall be prevented by the suitable positioning of the actuator.

Emergency stop actuators on packaging machines shall not have any additional function, e.g. means for locking. Because of the risk of injuries no emergency stop actuators with a front key lock shall be used on packaging machines.

NOTE For emergency stop of PDS(SR) see EN 61800–5-2:2007, 4.2.2.2 “safe torque off (STO)” and 4.2.2.3 “safe stop 1 (SS1)”.

5.14.6 Safety related stops of variable speed electrical power drive systems

5.14.6.1 General

Where hazardous movement of machinery is controlled by variable speed electrical power drive systems like servo, rectifier, inverter or similar electronic drive systems, the design of the safety related parts of the control system shall prevent unexpected start up.

Variable speed electrical power drive systems that are included in safety functions shall comply with EN 61800-5-2.

When one of the conditions described in 5.14.6.2, 5.14.6.3 and 5.14.6.4 are fulfilled it is acceptable to open the guards for intervention.

5.14.6.2 Safe operational stop

This is a stop according to 5.14.4 and corresponds to “safe operating stop” (SOS) of EN 61800-5-2:2007, 4.2.3.1. Where all of the actuators of hazardous movements behind a guard are controlled using SOS, it is acceptable to open the guard for intervention.

NOTE Drives with safe operational stop function are safety related parts of the control system.

5.14.6.3 Position monitoring

Where an operational stop according to 5.14.4 of this document is required it shall comply with EN 61800-5-2:2007, 4.2.2.4. Where position monitoring is used to prevent unexpected start-up or uncontrolled movement it shall comply with EN 61800-5-2:2007, 4.2.3.8.

5.14.6.4 Mechanical brake

Where a mechanical brake is used it shall be applied automatically when the interlocking movable guards are opened and prevent the motor from moving even if power is supplied to the motor.

The braking torque of the mechanical brake shall be greater than the maximum torque that the drive can generate.

The manufacturer shall detail in the instructions the requirements for testing and maintenance of the brake system.

5.14.7 Stopping time

The machine controls shall ensure that hazardous functions stop before any hazard zones can be reached after an interlocking movable guard has been opened.

If this requirement cannot be achieved, the guards shall be fitted with guard locking devices which prevent access to the hazard zone until the hazardous function has stopped. The guard locking device shall comply with EN ISO 14119:2013, 5.7 and shall be installed according to 5.2 and 5.3 of that standard.

5.15 Failures of safety related parts of control systems

Where the relevant specific standards of EN 415 do not give detailed values for the performance level required ($PL_{r)}$ for the safety functions, the PL_r shall be determined according to the guidance of EN ISO 13849-1:2008, Annex A.

Electro sensitive protective equipment (ESPE) shall conform to EN 61496-1:2004+A1:2008, CEN/TS 61496-2, and CEN/TS 61496-3.

5.16 Prevention of unexpected start up

5.16.1 General

Measures for prevention of unexpected start-up shall comply with EN 1037. Devices for switching off to prevent unexpected start up shall be provided and selected from EN 60204-1:2006, 5.4. At least one such device shall be attached to the machine and shall be designed so that it can be locked in the off position or disconnected state according to EN 60204-1:2006, 5.6.

The control system shall be designed so that the machine or parts of the machine do not give rise to any hazardous situation e.g. under one of the following conditions:

a) as a result of a signal generated by a sensor (except when in automatic mode);

b) by closing an interlocking movable guard (unless it is a control guard);

c) by restoring the power supply after an interruption.

See also 5.16.3 for operations with open guards.

5.16.2 Requirements for machines where whole body access is possible

5.16.2.1 Application of this requirement

On machines where whole body access is possible and it is not possible to see the whole of the hazard zone from the control panel or the design of the machine or the presence of product allows someone to be inside the hazard zone without being seen by a second operator outside the hazard zone, the control system shall be designed and constructed to prevent the machine from being reset and restarted while someone remains in the hazard zone, using one of the methods described in 5.16.2.2 to 5.16.2.4.

5.16.2.2 Means for good vision of the hazard zone

a) Positioning the machine's controls in a location where there is a clear view of the interior of the machine or if this is not possible;

b) fitting a mirror or other technical device with similar effect which allows clear vision of areas behind obstacles.

5.16.2.3 Measures to prevent a machine starting while an operator is in the hazard zone

One or a combination of the following methods shall be used to prevent a start-up of the machine while an operator is in the hazard zone:

a) one or a number of protective devices or presence sensing devices that continuously monitors the hazard zone and prevents the machine from being reset and restarted if it detects someone in the hazard zone. Such devices include

   1) active optoelectronic protection devices (AOPD) complying with CLC/TS 61496-2,

   2) an active optoelectronic protection device responsive to diffuse reflection (AOPDDR) complying with CLC/TS 61496-3,

   3) pressure sensitive mats or floors complying with EN ISO 13856-1.

   However such devices shall only be used on their own if it has been established that there are no blind spots or areas within the hazard zone where an operator cannot be detected by these devices.

b) two or more control buttons positioned so that by moving from one enabling button to the next enabling or reset button the operator sees the entire hazard zone. One or more enabling buttons may be positioned inside the hazard zone to ensure that the operator has looked inside particular parts of the hazard zone; however the final reset button shall be positioned on the main control panel in a position where it cannot be actuated from inside the hazard zone. This function shall be realised within a limited time before the safety related parts of the control system accept a separate restart command.

c) an interlocking device associated with a personnel access interlocking movable guard, which provides a key for the operator to take with him into the hazard zone and prevents the machine from being reset and restarted while the operator holds the key. The only possible way to enter the hazard zone shall be through the trapped key system guarded door.

5.16.2.4 Additional measures for machines with large apertures

Where a machine has a large aperture in the guards as defined in 5.2.1.3.1, e.g. for the in-feed or discharge of products or packaging components, the machine shall be equipped with

a) one or more interlocking movable guard doors designed specifically for operator access into the hazard zone,

b) a reset device for the ESPE protecting the large aperture which is sited next to the aperture outside the hazard zone. It shall not be possible to reach this device from the hazard zone.

5.16.3 Operations with open guards

The design objective for all machines shall be that adjustments, maintenance, repair, cleaning and servicing can be carried out while the machine is isolated from all power sources or from outside the hazard zones.

However, if this objective cannot be achieved for technical reasons, a special operation mode which permits potentially hazardous operations with open guards under reduced risk conditions shall be provided subject to all of the requirements below:

a) use an enabling device such as a hold-to-run control, an electronic hand wheel or a joy stick complying with EN 60204-1:2006, 9.2.6 and 10.9;

b) hazards, e.g. presented by moving parts, ejected parts or high temperatures, shall be prevented by additional guards within the accessed area wherever possible and the design of all guards and of the control system shall minimize the risks of injury to the operator;

c) where the required performance level PLr is d or e, a three-position hold-to-run control device shall be used. Release of the hold-to-run control button or pressing it further than to the run position shall lead to a safety related stop complying with 5.14.3 and prevent unexpected start up as. If PLr is a, b or c, a two-position hold-to-run control may be used;

d) an emergency stop device shall be placed in the proximity of the hazard. Mobile control devices shall be fitted with an emergency stop device;

e) the hold-to-run function shall only be available after a lockable mode selector complying with EN 60204-1:2006, 9.2.3, e.g. a key operated switch, is operated. The mode selector shall be placed outside the hazard zone and not reachable from there and its activation shall prevent the machine from operating in automatic mode;

f) the control device shall be positioned so that the operator has a clear view of all the parts of the machine where the hazardous functions are possible;

g) if it is necessary to carry out potentially hazardous functions while interlocking movable guards are open, all other interlocking movable guards which would allow access to hazard zones and are not within a clear view of the operator shall continue to be interlocked as during normal operation;

h) the control system shall ensure that hazardous movements or other hazardous functions initiated by the hold-to-run control are limited, e.g. step by step, or at a reduced speed or with reduced power, pressure and energy. Where variable speed electrical power drive systems are used these functions shall comply with 5.14.6 of this document and with EN 61800-5-2:2007, 4.2.3;

i) the hazardous movement or other hazardous functions shall stop in as short a time as possible.

5.17 Stored energy

As a general rule when an interlocking movable guard is opened any stored energy, e.g. compressed air in actuators in the hazard zone, shall be released automatically.

If release of the stored energy cause a hazard e.g. due to products dropping product or uncontrolled movement of mechanisms, it is acceptable for the stored energy to be retained if:

a) there are no risks to operators due to the stored energy during a machine intervention, or

b) a safe procedure such as manual stabilization of lowering parts is specified in the instructions and a means to safely release the stored energy, e.g. for maintenance or to release jammed products is provided and a sign indicating that stored energy is present is placed on or near the mechanism concerned.

5.18 Requirements for remote diagnostics or control

Where the machine is equipped with functions for remote diagnostics or control (teleservice) the manufacturer shall provide technical means and detailed information to reduce the risk that hazards could be initiated during the teleservice mode. This includes the following:

a) the teleservice mode shall only be available when initiated at the operating control panel at the machine by a lockable mode selection device complying with 5.16.3 e) or with a password,

b) initiating of the teleservice function shall only be possible by using this device and not by teleservice functions,

c) if the machine is not connected to a data network the manufacturer shall provide a means for easy connection and disconnection of the teleservice line and the instructions for use shall describe procedures for the prevention of unauthorized use. The link connection shall only be possible by the machine's control, e.g. by an automatic call or call-back function and a password shall be required,

d) any single machine shall be readily identifiable for the teleservice operator,

e) the manufacturer shall provide a means for indicating when the machine is in the teleservice mode,

f) the manufacturer shall ensure that any disturbance or interruption of the line does not lead to a hazardous situation. This may include systems that ensure that transmitted data or programs can be implemented only at the control panel at the machine,

g) all safety stop signals to the machine, e.g. from emergency stop devices or interlocking movable guards shall override any control command given by the teleservice control and it shall not be possible to suspend any safety function of the machine by teleservice functions,

h) operations with open guards (see 5.16.3) shall not be possible while the teleservice mode is active,

i) the manufacturer shall provide a means of documentation of every performed teleservice.

5.19 Reasonably foreseeable misuse

The safety concept of the machine shall consider the path of least resistance and the manufacturer shall design the machine to encourage operators to use the safe ways of access.

Where the machine can operate independently in different zones and the complete stop of the whole machine would reduce the machine’s efficiency, the zones of the machine shall be able to operate separately in a safe way. The machine shall be segregated into clearly identifiable subzones where operators can perform their tasks safely in one subzone while the machine is running in automatic mode in the other subzones.

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 easily and safely.

The manufacturer shall provide a function to clear disturbances either from outside the guards or under safe conditions e.g. as described in 5.16.3.

5.20 Requirements for specific elements or processes of packaging machines

5.20.1 Cutting devices

The hazards presented by cutting devices described in 4.16.1 shall be prevented or reduced by complying with the following requirements:

a) the device shall be safeguarded with fixed or interlocking movable guards complying with 5.2.1.2; and

b) the design shall ensure that the cutting device cannot move unexpectedly due to stored energy (see also 5.17); and

c) the design shall minimize the risk of injury during packaging material threading or size changing, e.g. by designing the cutting mechanism so that the cutting surfaces are protected when the machine stops; and

d) the cutting tools shall be designed or provided with auxiliary devices so that they can be installed and removed from the machine without any danger. Auxiliary devices may include handles, clamping devices, gripping or holding tools.

5.20.2 Sealing devices

The hazards presented by sealing devices described in 4.16.2 shall be prevented or reduced by complying with the following requirements:

a) the device shall be safeguarded with fixed or interlocking movable guards complying with 5.2.1.2; and

b) the design shall ensure that the sealing device cannot move unexpectedly due to stored energy (see also 5.17).

Where sealing mechanisms are heated, the hazards described in 4.16.2 shall be prevented or reduced by complying with the following requirements:

c) thermal hazards shall be reduced as described in 5.7. It is acceptable for power to remain connected to heating elements while guard doors are open provided the instructions detail those circuits that will remain connected and the parts of the machine that can cause burn injuries; and

d) the design of the control system shall minimize the risk of the packaging material catching fire. This may involve designing the control system so that the heated sealing devices do not remain in contact with the packaging material when the machine is stopped; and

e) to minimize the risk of electric shock if the electrical insulation of heating elements breaks down, use one or a combination of the methods indicated in EN 60204-1:2006, 6.3 and 6.4; and

f) where the fumes given off by heated packaging material could be hazardous to health the design shall comply with 5.10.1.

5.20.3 Film reel unwind mechanisms

The hazards presented by film reel unwind mechanisms described in 4.16.3 shall be prevented or reduced by complying with the following requirements:

a) the design of the film reel support assembly shall ensure that the film reel does not move uncontrollably during all modes of operation of the machine; and

b) the drawing-in hazard on machines with high mass reels shall be prevented by safeguarding according to 5.2.1.2; and

c) where the film edge presents a cutting hazard the film path shall be enclosed with fixed or interlocking movable guards complying with 5.2.1.2; and

d) where film rollers cannot be made safe by design using the measures indicated in 5.2.1.1 they shall be enclosed in fixed or interlocking movable guards complying with 5.2.1.2; and

e) where the film braking or compensating mechanism cannot be made safe by design using the measures indicated in 5.2.1.1 it shall be safeguarded by fixed or interlocking movable guards complying with 5.2.1.2.

5.20.4 Conveyors

5.20.4.1 General

The following requirements for conveyors as a part of a packaging machine apply in addition to the requirements of EN 618 or EN 619.

Where requirements for conveyors combined with packaging machines subject to this document are different from those which are stated in EN 618 or EN 619 the requirements of this document take precedence.

Drawing in hazards for fingers shall be prevented by a maximum gap of 4 mm between fixed and moving parts of the machine or measures to ensure that the values of 5.2.1.1 are not exceeded. Where this is not possible fixed or interlocking movable guards complying with 5.2.1.2 shall be used to safeguard hazard zones.

Where the clearance under a conveyor is higher than 600 mm but lower than 2100 mm measures shall be taken to protect against reasonably foreseeable drawing-in and entanglement hazards, especially of hair. This includes:

— safeguarding of moving parts so that hair cannot come into contact with them,

— use of physical barriers to prevent crossing under the conveyor and provision of suitable means to cross over the conveyor.

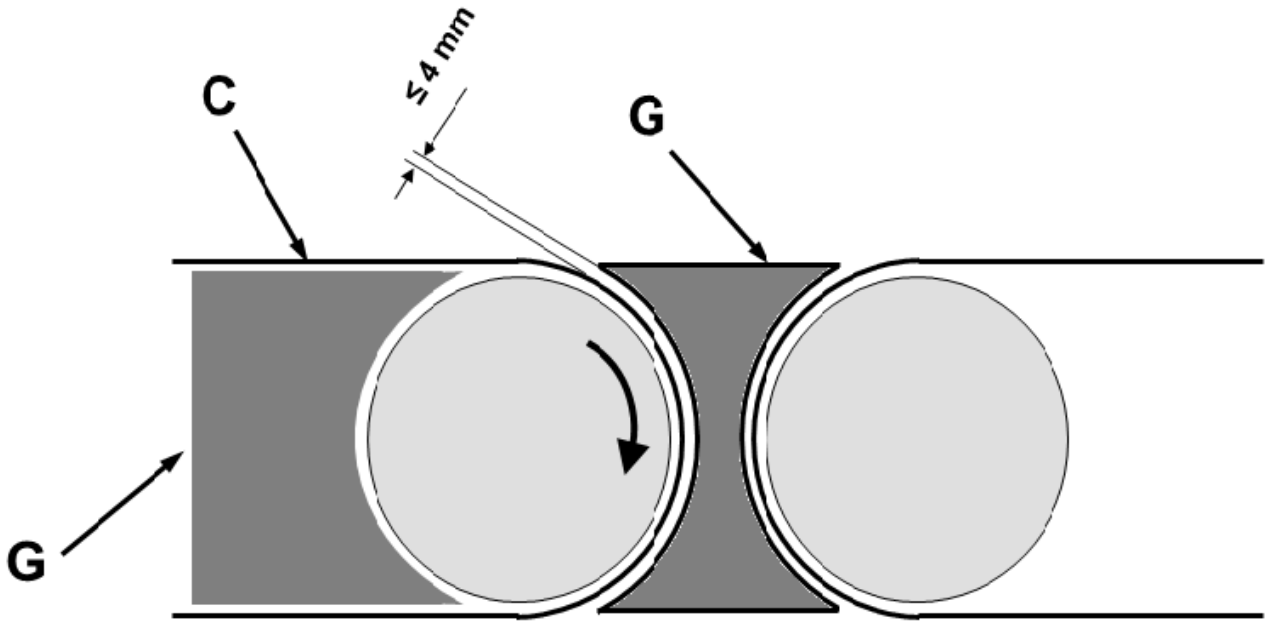
Fixed or interlocking movable guards shall comply with 5.2.1.2.

Any guards or parts of the machine frame at the running-in of the conveyor shall resist the foreseeable load imposed by material or parts of body which could be drawn-in.

For hazards generated by moving products see 5.10.2.3.

5.20.4.2 Belt and slat-band conveyors

Belt and slat-band conveyors shall comply with 5.20.4.1. See Figure 29.



Key

C conveyor

G fixed guard

Figure 29 — Belt conveyors — Example of safeguarding

5.20.4.3 Roller conveyors

Roller conveyors shall comply with 5.20.4.1.

Where conveyors are intended or likely to be crossed or used as a means of access, e.g. for maintenance or cleaning of the machine, the design of the conveyor shall minimize the risk of slipping, tripping or falling, e.g. by fitting non-slip plates between the rollers. The gap between the plates and the in-running rollers shall comply with 5.20.4.1. The width of a traffic way made by filler plates shall be at least 800 mm.

5.20.4.4 Screw conveyors

Screw conveyors shall be safeguarded by fixed guards complying with 5.2.1.2. Where access is necessary e.g. for clearing material jam or cleaning interlocking movable guards shall be used.

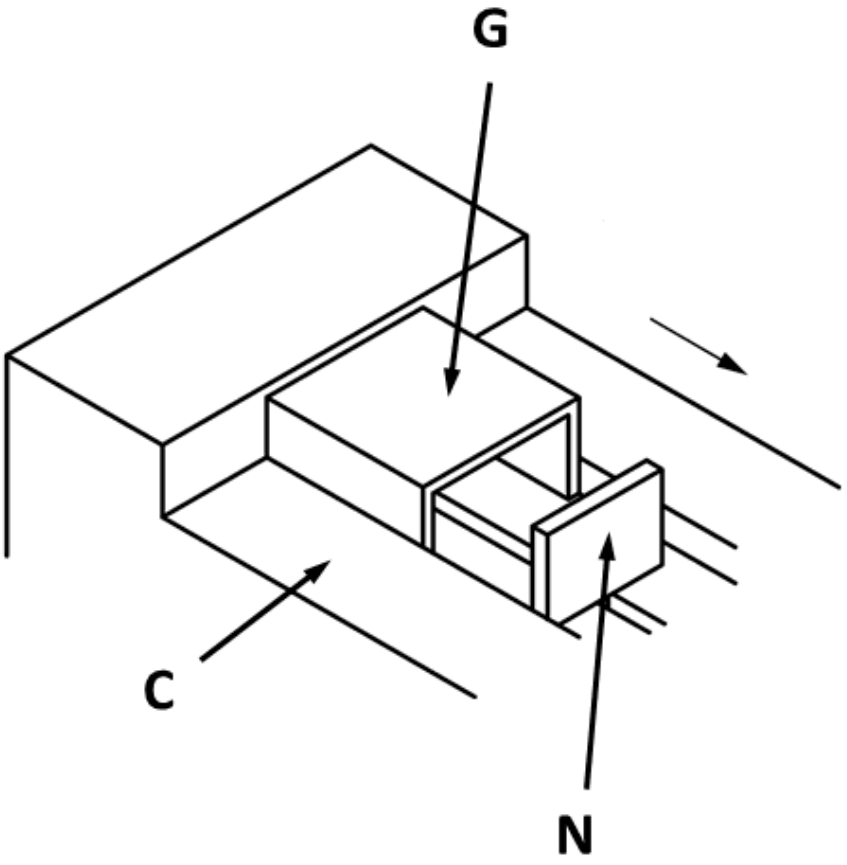
5.20.4.5 Conveyors with carriers

Entanglement, drawing-in, shearing and crushing hazards especially where carriers emerge from or run into the machine frame or pass fixed parts shall be prevented by safe design complying with 5.2.1.1, as shown in Figure 30. The values of 5.2.1.1 can be achieved by using one of the following safety related methods:

— tilting carriers or paddles;

— friction clutch;

— limitation of torque and force.



Key

C conveyor

G fixed guard

N carrier

Figure 30 — Conveyor with carriers — Safeguarding by tunnel shaped fixed guard

5.20.5 Handles and hand-wheels

Handles or hand-wheels shall not be spoked, shall have no projections and be smooth and in addition one of the following methods applies:

a) Measures to prevent injury from handles or hand-wheels moving under power

   1) by design using the principles set out in 5.2.1.1, or

   2) by fitting interlocking movable guards complying with 5.2.1.2, or

   3) by fitting an interlocking device complying with 5.2.1.2 which prevents the machine from operating under power until the handle or hand-wheel has been disengaged or removed.

b) measures to prevent the handle or hand-wheel moving unexpectedly due to stored energy

   1) balancing the torque, or

   2) braking forward and reverse movement, or

   3) fitting a device to prevent reverse motion.

Where handles or hand wheels activate motor drive systems, hazards created by movements of machine parts shall be prevented by either guards, limited speed and movement or by preventing the overrun of the hand-wheel.

5.20.6 Size or product changing

5.20.6.1 General

The hazards presented by size or product changing described in 4.16.6 shall be eliminated or minimized by complying with the following requirements.

5.20.6.2 Design of guards

The design of the machine and its guards shall ensure that hazard zones on the machine are safeguarded for all the product and pack sizes for which the machine has been specified.

Where this is not possible adjustable guards or change-part guards shall be used.

Adjustable guards either:

a) shall be adjusted in a positive mode by adjusting the functional parts either manually or under power, or

b) shall be fitted with interlocking devices which ensure that the machine cannot be started or operated unless the guards are adjusted properly.

Change part guards either:

c) shall be connected to the functional change parts so that the machine cannot function without the appropriate guarding being fitted, or

d) shall be fitted with interlocking devices so that the machine cannot be started or operated without the guards in place.

Where the measures listed above are not reasonably practicable, e.g. if size or product changes are expected to be infrequent, it is acceptable to use guards that have to be adjusted manually or fixed change part guards,

provided a warning label is fitted in a prominent position on the machine stating that the machine shall not be used until the guards have been correctly fitted or adjusted.

5.20.6.3 Change parts

On machines where change parts are used hazards from excessive effort or strain shall be eliminated or reduced by the following measures:

a) change parts shall be designed so that they can be lifted, installed and removed easily following the general requirements stated in 5.11.3; and

b) the mass of change parts shall not exceed 25 kg and the design of the machine and the change parts shall ensure that people do not have to assume awkward postures while carrying, fitting or removing the parts; or

c) where the recommendations described in b) are not possible for technical reasons and where the mass of the change part is greater than 40 kg, the manufacturer shall provide suitable mechanical lifting or handling equipment to move the part; or

d) where the recommendations described in b) are not possible for technical reasons and the mass of the change parts exceeds 25 kg but is no greater than 40 kg, the manufacturer shall either provide suitable mechanical lifting or handling equipment or the design of the machine and the change parts shall allow two people to lift the parts into place. If two persons are required to lift or fit change parts this shall be stated clearly in the instructions.

5.20.6.4 Size or product changing under power

Where parts of the machine are adjusted under power the risks presented by these powered movements shall be eliminated using the following hierarchy of measures:

a) ensuring that the movements are not hazardous by following the principles described in 5.2.1.1;

b) if a) is not possible by ensuring that movements can only take place behind fixed or interlocking movable guards complying with 5.2.1.2;

c) where it is not possible to fulfil the requirements of a) or b), hold-to-run controls may be used which comply with 5.16.3.

5.20.7 Hot melt adhesive equipment

On machines where a hot melt adhesive system is fitted, the following requirements shall be fulfilled:

a) the design of the control system shall ensure that the adhesive cannot ignite in the event of a control failure. Methods of achieving this include a fusible link or fitting a high temperature sensor and associated trip device which is independent from the temperature control circuit or sizing the heating elements so that the adhesive can never reach its ignition temperature; and

b) the user shall be advised in the instructions, of the risk of fire or of unpleasant fumes, if controls are set at an incorrect temperature and advised of the need to install such machines in a well-ventilated room; and

c) the design shall ensure that external surfaces of the adhesive system do not cause burn injuries. Where this is not reasonably practicable, e.g. on exposed surfaces of adhesive application equipment within the machine guards such as glue nozzles, warning signs shall be provided which comply with 5.7.1; and

d) the adhesive system shall be designed in such a way that it can be replenished with adhesive without the risk of splashing the operator with hot adhesive and subjecting the operator to unpleasant fumes. This includes a requirement that the filling point is positioned no higher than 1200 mm above the access level; and

e) on systems where the adhesive is pressurised and jetted or sprayed onto the packaging material, the machine's guards shall be designed to contain any foreseeable overspray of hot melt adhesive. The control system shall ensure that except when purge mode is selected, the system can only discharge adhesive with the guards closed; and

f) pressurised adhesive systems shall be equipped with means to control the pressure, to prevent overpressure and to safely purge and release the pressure from the system. Detailed information about the release of the pressure shall be given in the instructions; and

g) on machines where a hot melt adhesive purging or pressure reduction system is provided, this shall either only operate with the guards closed or by means of a hold-to-run control located next to the applicator unit, which can only be operated via a key operated switch.

5.20.8 Modified atmosphere packaging

All vessels, pipes and fittings of controlled atmosphere installations shall be designed to safely contain the pressure. The gas supply shall be fitted with a lockable valve and means of safely venting the line downstream so that the cleaning and maintenance operation can be carried out safely. The design of the gas control system shall ensure that dangerous levels of gas do not build up around the machine. This may be achieved by:

a) fitting a solenoid valve to shut off the supply of gas when the machine stops,

b) providing extraction equipment to facilitate exhausting to a safe location,

c) fitting a solenoid valve upstream of flexible hoses. This valve shuts off the supply of gas when a hose ruptures and gas flow exceeds normal limits.

For installation in machines using oxygen, fire resisting pipes shall be used and the materials used shall not ignite in the presence of oxygen. The instructions shall give clear information about these requirements.

In machines where mixtures of gases can be selected a display will be installed showing the concentration of the components.

The vacuum system of the machine shall be designed to prevent gas mixtures of oxygen concentration exceeding 21 % entering the vacuum pump. Additionally all machines shall be fitted with:

d) a control system which ensures that the vacuum valve is closed before the gas mixture can enter the vacuum chamber and before the vacuum valve opens again no gas mixture remains in the chamber, or

e) a vacuum pump which operates safely in concentrations of oxygen higher than that found in normal atmospheres.

If solution d) is applied, the machine can be connected to a central vacuum system.

6 Verification of safety requirements and measures

6.1 General

A manufacturer or supplier, who wishes to claim conformity to this document, shall first verify that the machine fulfils the safety requirements and measures.

The following verification procedures shall be adhered to for each machine unless stated otherwise hereafter.

6.2 Visual inspections with the machine stopped

6.2.1 Mechanical parts

Check that mechanical components are securely fixed and all unnecessary sharp edges have been removed.

6.2.2 Pneumatic systems

Check that pneumatic components and piping conform to the safety requirements of EN ISO 4414 and are correctly installed.

6.2.3 Hydraulic systems

Check that hydraulic components and piping conform to the safety requirements of EN ISO 4413 and are correctly installed.

6.2.4 Electrical systems

Check that the electrical equipment and installation is in compliance with the technical documentation described in EN 60204-1:2006, Clause 17.

Check that documentation is in compliance with EN 60204-1:2006, Clause 17.

6.2.5 Guards

Check that all guards are in place and securely fixed and that the guards and their dimensions are suitable for the hazards expected and their dimensions are according to the design. Check that all interlocking devices are fitted. Check that adjustable guards can be properly adjusted to the intended products and pack sizes.

6.2.6 Design requirements

Check for each type of machine, that the design features stipulated in Clause 5 have been incorporated.

Check for each type of machine, that the appropriate design requirements for the packaging materials intended to be used and the product intended to be packed have been followed.

6.2.7 Marking and warning signs

Check that the required markings and warning signs are fitted permanently and at the required position.

6.3 Measurements with the machine stopped

6.3.1 Guards

For every type of machine, check that the dimensions of the guards comply with 5.2.1.2 and that the relationship between the size of any apertures in the guards and their safety distance from the nearest hazard zone comply with the requirements detailed in 5.2.1.3.

6.3.2 Electrical testing

The tests as described in EN 60204-1:2006, Clause 18 shall be performed on every machine

The tests and measurements that can only be carried out at the customer's site, e.g. the earthing, shall be detailed in the instructions.

6.4 Visual inspections with the machine running

6.4.1 Guards

Check with the machine running that the guards conform to the safety requirements and that the interlocking movable guards and ESPE are working correctly.

6.4.2 Safety related functions

Check the operation of all safety related functions. Check that following the operation of an emergency stop or interlocking device all hazardous functions cease within the required stopping time and that the machine does not restart without resetting the emergency stop device or the interlocking devices and without an intentional start command.

6.4.3 Dissipation of stored energy

Check for each type of machine that stored energy, e.g. from pneumatic systems or mechanisms that can move under gravity or spring tensions is either dissipated automatically before accessing hazard zones or can be made safe by the use of a means provided for this purpose.

6.5 Measurements or tests with the machine running

6.5.1 Electrical testing

Carry out the functional tests stated in EN 60204-1:2006, 18.6.

6.5.2 Measurement of noise emission

For every type of machine the noise emission values shall be measured as stated in EN 415-9.

6.5.3 Temperature

For every type of machine, with the machine fully warmed up, check that the external guard temperatures are not higher than the burn threshold limits for the intended contact times and materials as stated in 5.7.1. Identify all areas within the machine's guards which are greater than the burn thresholds so that they can be recorded in the instructions and the warning sign shown in 7.3.4 can be fitted.

6.6 Verification procedures

Verification procedures for each safety requirement detailed in Clause 5 are shown in Table 4.

Table 4 — Verification procedures for safety requirements identified in Clause 5

Safety requirement	Visual inspection	Functional test	Measurement	Calculation	Safety requirement	Visual inspection	Functional test	Measurement	Calculation
General Requirements									
5.2.1.1			X	X	5.18	X	X		
5.2.1.2	X	X	X	X	5.19	X	X		
5.2.1.3	X	X	X	X	5.20.1	X	X	X	
5.2.1.4		X	X	X	5.20.2	X	X	X	
5.2.1.5	X	X			5.20.3	X	X	X	
5.2.2	X	X	X		5.20.4	X		X	
5.2.3	X	X	X		5.20.5	X	X	X	
5.2.4	X	X	X	X	5.20.6	X	X	X	
5.3	X	X	X		5.20.7	X	X		
5.4	X	X	X		5.20.8	X	X	X	
5.5	X	X	X						
5.6	X		X	X					
5.7	X		X						
5.8	X	X	X						
5.9	X	X	X						
5.10	X	X	X						
5.11	X	X	X						
5.12	X	X	X	X					
5.13	X	X	X	X					
5.14	X	X	X						
5.15				X					
5.16	X	X							
5.17	X	X							

7 Information

7.1 General

Information shall comply with EN ISO 12100:2010, 6.4.

7.2 Marking

All machinery shall be marked visibly and at a clearly visible position, legibly and indelibly with the following minimum information:

a) the business name and full address of the manufacturer and, where applicable, his authorized representative;

b) designation of the machinery;

c) mandatory marks if appropriate, for example the CE marking;

d) designation of series or type;

e) serial number, if any;

f) year of construction, that is the year in which the manufacturing process is completed;

g) electrical markings as indicated in EN 60204-1:2006, Clause 16;

h) rating information required for lifting equipment, if appropriate, e.g. carrying capacity, working load limit, centre of gravity, gross weight.

7.3 Signals and warning signs

7.3.1 General

Where required in Clause 5 warning signs shall be fitted to the machine permanently and in such a way that the related hazard is clearly identifiable. These warning signs shall comply with EN ISO 7010, see Figure 31 to Figure 40 below. Shape and colour of the warning signs shall comply with ISO 3864-1, ISO 3864-2 and ISO 3864-3.

7.3.2 Prohibition sign “Do not reach in”

Figure 31 — Prohibition sign ISO 7010-P015 “No reaching in”

7.3.3 Prohibition sign “No access”

Figure 32 — “Not access for unauthorized persons (Directive 92/58/EEC)”

7.3.4 Warning sign “Hot surface”

Figure 33 — Warning sign ISO 7010-W017 “Warning; Hot surface”

7.3.5 Warning sign “Warning; Low temperature/freezing conditions”

Figure 34 — Warning sign ISO 7010-W010 “Warning; Low temperature/freezing conditions”

7.3.6 Warning signs indicating radiation hazards

Figure 35 — Warning sign ISO 7010-W027 “Optical radiation”

Figure 36 — Warning sign ISO 7010-W004 “Warning; Laser beam”

In addition, the laser class shall be indicated. The need of additional information depends on the laser class.

Figure 37 — Warning sign ISO 7010-W005 “Warning; Non-ionizing radiation”

Figure 38 — Warning sign ISO 7010-W006 “Warning; Magnetic field”

Figure 39 — Warning sign ISO 7010-W003 “Warning; Radioactive material or ionizing radiation”

7.3.7 Prohibition sign “Access prohibited for persons with implantable medical devices”

Figure 40 — Prohibition sign ISO 7010-P007 “No access for people with active implanted cardiac devices”

7.4 Instructions

7.4.1 General

The instructions shall contain all of the information listed in EN ISO 12100:2010, 6.4 where the equivalent hazard exists. In addition and in particular the instructions shall contain the information that is specific to packaging machines as stated in 7.4.2 to 7.4.9.

NOTE See also EN 82079–1 for structuring and presentation of information for use.

7.4.2 All packaging machines

Requirements are as follows:

a) a repetition of the markings on the machine as stipulated in 7.2;

b) a description of the intended use for the machine e.g. the function of the machine, the characteristics of products that can be packed, of packaging materials and the pack sizes which shall be used with the machine and speeds including details of the hazards that can arise if the machine is not used in compliance with the intended use and these instructions (see also 7.4.3 and 7.4.4);

c) a drawing indicating the work stations likely to be occupied by operators;

d) the instructions shall explain how the machine can be moved safely;

e) where there is a risk of products or liquids spilling onto the floor around the machine, the instructions shall indicate the importance of clearing these spills to avoid slip hazards;

f) where access is required above floor level to parts of the machine, the instructions shall explain how this can be done safely without the risk of slipping, tripping and falling;

g) details of how to install steps and platforms supplied with the machine;

h) details of temporary means of access that the user is to provide for other purposes than operation, cleaning or routine maintenance;

i) a description of any tests that shall be carried out before the machine is used for the first time;

j) explicit Instructions on the fitting of change parts, the fitting of guards which are change parts and the adjustment of adjustable guards so that the machine is safe to use following a size or product change;

k) a record of and explanation of the significance of all warning devices, signs or pictograms attached to the machine and the warning signals provided by the machine;

l) details of the control systems including circuit diagrams for the electrical, pneumatic and hydraulic systems. The diagrams shall show the interfaces between all permanently wired parts and programmable devices. Wiring diagrams and documentation of the electrical equipment shall comply with EN 60204-1:2006, Clause 17;

m) noise emission declaration according to EN 415-9;

n) where appropriate, instructions on how the machine shall be installed to minimize noise;

o) on machines where it is foreseeable that packaging materials could give rise to significant noise emission the instructions shall detail the kind of packaging material that shall be used on the machine. Users shall be encouraged to use material that minimizes noise emissions;

p) where harmful dusts, smoke, aerosols, gas or fumes may be emitted by the machine, the manufacturer shall provide information on a suitable collection and extraction system for these substances, including the required air speed at the emission point;

q) specifications of fluids to be used in the machine e.g. lubricating oil, hydraulic fluid;

r) details of drainage requirements and any residual spillage risks;

s) a statement indicating whether the machine is or is not suitable for use in a potentially explosive atmosphere;

t) information on radiation according to EN 12198-1 and EN 12198-3;

u) where machinery is likely to emit non-ionizing radiation which may cause harm to persons, in particular persons with active or non-active implantable medical devices, information concerning the radiation emitted for the operator and exposed persons;

v) description of fixed guards which shall be removed by the user for maintenance and cleaning purposes;

w) the specification of the spare parts to be changed by the user, when these affect the health and safety of operators.

7.4.3 Machines for use with foodstuffs or pharmaceuticals

Where the machine is intended for use with foodstuffs, pharmaceuticals or other products which can be contaminated if hygienic design principles are neglected, the instructions shall indicate how the machine shall be cleaned and disinfected, together with details of appropriate and inappropriate cleaning and disinfecting materials. The instructions shall indicate any limitation for use with these products.

7.4.4 Machines for handling hazardous products

Where the machine is intended for packing hazardous products, the instructions shall indicate how these materials can be handled safely and state any limitations for use of the machine with hazardous products.

7.4.5 Machines with hot or cold surfaces

The instructions shall indicate all parts of the machine that are likely to have a temperature higher than the burn thresholds shown in EN ISO 13732-1 or lower than the frostbite thresholds shown in EN ISO 13732-3.

7.4.6 Machines incorporating hot melt and other adhesive systems

The instructions shall describe how the hot melt system can be filled, cleaned and maintained without the risk of injury or harm to health.

The instructions shall advise the user of the importance of setting the temperature controls at an appropriate level for the adhesive being used.

The instructions shall advise the user of the importance of effective ventilation in the area where the machine is located.

The instructions shall advise operators of the need to wear gloves and eye protection when refilling the system.

7.4.7 Information on stability of the machine

7.4.7.1 General

The instructions shall define how stability of the machine and its parts can be achieved during all relevant activities e.g. transport, installation, use and maintenance.

7.4.7.2 Moveable machines

The instructions shall explain how the machine can be moved safely.

7.4.7.3 Machines fitted with wheels

On machines fitted with wheels, the instructions shall state how the machine can be moved safely and how it can be stabilised.

7.4.8 Machines incorporating lifting equipment

For machines incorporating lifting equipment, the instructions shall include a statement of the load for which the equipment has been designed, including the maximum working load limit and the maximum mass of lifting accessories.

NOTE See also 5.2.3 and the relevant standard for the lifting equipment

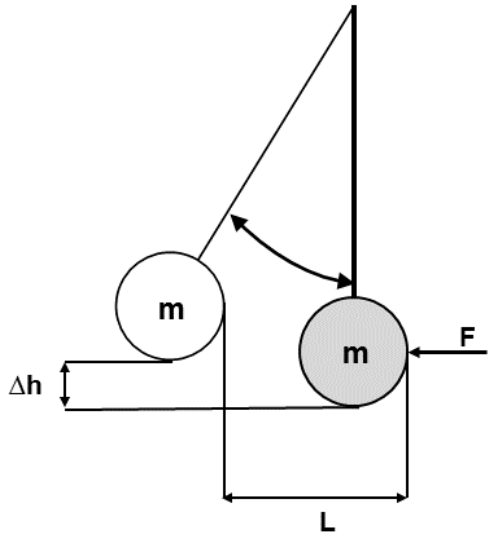
7.4.9 Assemblies of machines

Where the safety measures cannot be completed by the manufacturer because the machine is intended to be incorporated with other machinery the manufacturer shall define how the safety measures shall be completed when the machine is installed.

Annex A
(informative)

Evaluation of energy or force

A method to evaluate the energy or force applied to a part of the body is to measure the displacement of a pendulum having a concentrated mass at its lower end (see Figure A.1). It can be assumed that the force applied is constant during the displacement. The mass used shall be similar to the one of the part of the body in question. The energy is E = m*g*Δh, the force is Energy/L.



Key

m	mass
Δh	vertical displacement
L	horizontal displacement
g	gravity constant
F	Force

Figure A.1 — Simple measurement method for energy and force

Annex B
(informative)

Maximum values for inherently safe design

The hazards presented by moving parts can be considered as eliminated if the static values of force and pressure applied to the body are within the limits set in this annex. The manufacturer should identify the parts of the body that could reach the hazard zone and use the lowest value of the table below. A method for determining the energy or the force is described in Annex A.

Table B.1 — Maximum values to avoid injuries to the body

Body region		Parts of body in detail	Crushing force	Impact force	Static pressure on body surface
			[N]	[N]	[N/cm^2]
1. Head with neck	1.1	Skull / forehead	130	175	30
	1.2	Face	65	90	20
	1.3	Neck (sides / neck)	145	190	50
	1.4	Neck (front / larynx)	35	35	10
2. Trunk	2.1	Back / shoulders	210	250	70
	2.2	Chest	140	210	45
	2.3	Belly	110	160	35
	2.4	Pelvis	180	250	75
	2.5	Buttocks	210	250	80
3. Upper extremities	3.1	Upper arm / elbow joint	150	190	50
	3.2	Lower arm / hand joint	160	220	50
	3.3	Hand / finger	135	180	60
4. Lower extremities	4.1	Thigh / knee	220	250	80
	4.2	Lower leg	140	170	45
	4.3	Feet / toes / joint	125	160	45

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EG.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 – Correspondence between this European Standard and Directive 2006/42/EC

Clause(s)/subclause(s) of EN 415–10	**ERs Numbers**	**Essential Requirements (ERs) of Directive 2006/42/EC**
General		
Not covered by this standard	*1.1.1.*	*Definitions*
5.1	*1.1.2.*	*Principles of safety integration*
5.10	*1.1.3.*	*Materials and products*
5.11.10	*1.1.4.*	*Lighting*
5.11.3	*1.1.5.*	*Design of machinery to facilitate its handling*
5.11	*1.1.6.*	*Ergonomics*
5.10	*1.1.7.*	*Operating positions*
Not covered by this standard	*1.1.8.*	*Seating*
Control systems		
5.15	*1.2.1.*	*Safety and reliability of control systems*
5.11.2	*1.2.2.*	*Control devices*
5.16	*1.2.3.*	*Starting*
5.14.2	*1.2.4.1.*	*Normal stop*
5.14.4	*1.2.4.2.*	*Operational stop*
5.14.5	*1.2.4.3.*	*Emergency stop*
7.4.9	*1.2.4.4.*	*Assembly of machinery*
5.16.3	*1.2.5.*	*Selection of control or operating modes*
5.13	*1.2.6.*	*Failure of the power supply*
Protection against mechanical hazards		
5.2.3 - 7.4.7	*1.3.1.*	*Risk of loss of stability*

Clause(s)/subclause(s) of EN 415–10	**ERs Numbers**	**Essential Requirements (ERs) of Directive 2006/42/EC**
Not covered by this standard	*1.3.2.*	*Risk of break-up during operation*
5.10.2.2	*1.3.3.*	*Risks due to falling or ejected objects*
6.2.1	*1.3.4.*	*Risks due to surfaces, edges or angles*
Not covered by this standard	*1.3.5.*	*Risks related to combined machinery*
Not covered by this standard	*1.3.6.*	*Risks related to variations in operating conditions*
5.2.1	*1.3.7.*	*Risks related to moving parts*
5.2.1	*1.3.8.*	*Choice of protection against risks arising from moving parts*
5.2.1	*1.3.8.1.*	*Moving transmission parts*
5.2.1	*1.3.8.2.*	*Moving parts involved in the process*
5.14.6.2	*1.3.9.*	*Risks of uncontrolled movements*
Required characteristics of guards and protective devices		
5.2.1	*1.4.1.*	*General requirements*
5.2.1.2	*1.4.2.1.*	*Fixed guards*
5.2.1.2	*1.4.2.2.*	*Interlocking movable guards*
5.20.6.2	*1.4.2.3.*	*Adjustable guards restricting access*
5.15	*1.4.3.*	*Special requirements for protective devices*
Risks due to other hazards		
5.5	*1.5.1.*	*Electricity supply*
5.6	*1.5.2.*	*Static electricity*
5.4	*1.5.3.*	*Energy supply other than electricity*
Not covered by this standard	*1.5.4.*	*Errors of fitting*
5.7	*1.5.5.*	*Extreme temperatures*
Not covered by this standard	*1.5.6.*	*Fire*
Not covered by this standard	*1.5.7.*	*Explosion*
5.8	*1.5.8.*	*Noise*
Not covered by this standard	*1.5.9.*	*Vibrations*
5.9	*1.5.10.*	*Radiation*
5.9	*1.5.11.*	*External radiation*
5.9.2	*1.5.12.*	*Laser radiation*
5.10	*1.5.13.*	*Emissions of hazardous materi-*

Clause(s)/subclause(s) of EN 415–10	**ERs Numbers**	**Essential Requirements (ERs) of Directive 2006/42/EC**
		als and substances
5.2.1.5	*1.5.14.*	*Risk of being trapped in a machine*
5.2.2	*1.5.15.*	*Risk of slipping, tripping or falling*
Not covered by this standard	*1.5.16.*	*Lightning*
Maintenance		
5.11.8	*1.6.1.*	*Machinery maintenance*
5.2.2.3	*1.6.2.*	*Access to operating positions and servicing points*
5.3	*1.6.3.*	*Isolation of energy sources*
5.10.2.2.2	*1.6.4.*	*Operator intervention*
5.16.2	*1.6.5.*	*Cleaning of internal parts*
Information		
7.3	*1.7.1.*	*Information and warnings on the machinery*
7	*1.7.1.1.*	*Information and information devices*
7.3	*1.7.1.2.*	*Warning devices*
5.1	*1.7.2*	*Warning of residual risks*
7.2	*1.7.3.*	*Marking of machinery*
7.4	*1.7.4.*	*Instructions*
7.4.1	*1.7.4.1.*	*General principles for the drafting of instructions*
7.4.1	*1.7.4.2.*	*Contents of the instructions*
Not covered by this standard	*1.7.4.3.*	*Sales literature*
Foodstuffs machinery and machinery for cosmetics or pharmaceutical products		
5.12	*2.1.1*	*General*
7.4.3	*2.1.2*	*Instructions*
Requirements to offset hazards due to the mobility of machinery		
5.2.3	*3.4.1*	*Uncontrolled movements*
7.4.7.2	*3.6.3*	*Instructions*
Requirements to offset hazards due to the mobility of machinery lifting operations		
7.4.8	*4.4*	*Instructions*

NOTE Compliance with EN 415-10 and a relevant machine specific part of EN 415 is required to achieve presumption of conformity with the corresponding Essential Requirements of the Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 842:1996+A1:2008, *Safety of machinery - Visual danger signals - General requirements, design and testing*

[2] EN 894-1:1997+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 1: General principles for human interactions with displays and control actuators*

[3] EN 894-2:1997+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 2: Displays*

[4] EN 894-3:2000+A1:2008, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators*

[5] EN 1005-5:2007, *Safety of machinery - Human physical performance - Part 5: Risk assessment for repetitive handling at high frequency*

[6] EN 60947-5-1:2004, *Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:2003)*

[7] EN 61000-6-1:2007, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards; Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1:2005)*

[8] EN 61000-6-2:2005, *Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:2005)*

[9] EN 61000-6-3:2007, *Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3:2006)*

[10] EN 61000-6-4:2007, *Electromagnetic compatibility (EMC) - Part 6-4: Generic standards; Emission standard for industrial environments (IEC 61000-6-4:2006)*

[11] EN 61310-2:2008, *Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (IEC 61310-2:1995)*

[12] EN 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1:2010)*

[13] EN 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2:2010)*

[14] EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 3: Software requirements (IEC 61508-3:2010)*

[15] EN 82079-1, *Preparation of instructions for use - Structuring, content and presentation - Part 1: General principles and detailed requirements (IEC 82079-1)*

[16] EN 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 3744:2010)*

[17] EN 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 3746:2010)*

[18] EN ISO 3747:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment (ISO 3747:2010)*

[19] EN ISO 4871:2009, *Acoustics - Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

[20] EN ISO 7731:2008, *Ergonomics - Danger signals for public and work areas - Auditory danger signals (ISO 7731:2003)*

[21] EN ISO 9614-2:1996, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning (ISO 9614-2:1996)*

[22] EN ISO 10218-1:2011, *Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots (ISO 10218-1:2011)*

[23] EN ISO 11161:2007, *Safety of machinery - Integrated manufacturing systems - Basic requirements (EN ISO 11161:2007)*

[24] EN ISO 11200:2009, *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 11200:1995, including Cor 1:1997)*

[25] EN 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 11201:2010)*

[26] EN ISO 11202:2010, *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 11202:2010)*

[27] EN ISO 11203:2009, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level (ISO 11203:1995)*

[28] EN 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 11204:2010)*

[29] EN ISO 11688-1:2009, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)*

[30] EN ISO 12001:2009, *Acoustics - Noise emitted by machinery and equipment - Rules for the drafting and presentation of a noise test code (ISO 12001:1996)*

[31] EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012*)

[32] EN ISO 13856-3:2013, *Safety of machinery - Pressure sensitive protective devices - Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices (ISO 13856-3:2013)*

[33] EN ISO 14163:1998, *Acoustics - Guidelines for noise control by silencers (ISO 14163:1998)*

[34] EN ISO 15667:2000, *Acoustics - Guidelines for noise control by enclosures and cabins (ISO 15667:2000)*

[35] CLC/TS 62046:2008, *Safety of machinery - Application of protective equipment to detect the presence of persons (IEC/TS 62046:2008)*

Choice of ATEX Standards

[36] EN 1127-1:2011, *Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology*

[37] EN 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres - Part 1: Basic method and requirements*

[38] EN 14373:2005, *Explosion suppression systems*

[39] EN 14491:2012, *Dust explosion venting protective systems*

[40] EN 60079-0:2009, *Explosive atmospheres - Part 0: Equipment - General requirements (IEC 60079-0:2007)*

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