Form 36

DPC: 21/30430540 DC

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Date: 14 June 2021
Origin: European

Latest date for receipt of comments: 03 August 2021

Project No. 2020/03225

Responsible committee: MCE/3/3 Packaging machines

Interested committees:

Title: Draft BS EN 415-4 Safety of packaging machines. Part 4: Palletizers and depalletizers and associated equipment.

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Introduction

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

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

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

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx

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

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 415-4

June 2021

ICS 55.200

Will supersede EN 415-4:1997

English Version

Safety of packaging machines - Part 4: Palletizers and depalletizers and associated equipment

Sécurité des machines d'emballage - Partie 4 : Palettiseurs et dépalettiseurs et équipement associé

Sicherheit von Verpackungsmachinen - Teil 4: Palettierer und Depalettierer und zugehörige Ausrüstungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 146.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European foreword

This document (prEN 415-4:2021) has been prepared by Technical Committee CEN/TC 146 “Packaging machines - Safety”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 415-4:1997.

The main changes compared to the previous edition are listed below:

— palletizers and depalletizers that incorporates industrial robots and multi-stations palletizing systems have been added to the scope;

— safety requirements have been rewritten so they are in line with EN 415-10:2014;

— normative references have been changed to reflect the current B1 and B2 standards;

— the performance level required PLr (defined by EN ISO 13849-1:2015) is specified for the safety related parts of control system.

This document has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2006/42/EC.

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

This document is part of the series EN 415, *Safety of packaging machines*, which consists of the following parts:

— *Part 1: Terminology and classification of packaging machines and associated equipment*;

— *Part 2: Pre-formed rigid container packaging machines*;

— *Part 3: Form, fill and seal machines; fill and seal machines*;

— *Part 5: Wrapping machines*;

— *Part 6: Pallet wrapping machines*;

— *Part 7: Group and secondary packaging machines*[1];

— *Part 8: Strapping machines*;

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

— *Part 10: General requirements*.

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1 EN 415-7:2006+A1:2008 is currently being revised with a new title: “Cartooning and Case-packing machines”.

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Introduction

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

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

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

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

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

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

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

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

The full set of requirements for machines in the scope of this document are those given in this document EN 415-4 applicable to that type, together with the relevant requirements from EN 415-10:2014.

As far as possible in EN 415-4 safety requirements are referenced to the relevant clauses of EN 415-10:2014 to avoid repetition and reduce their length.

EN 415-10:2014 applies when this document does not provide requirements.

Therefore, this document EN 415-4 is intended to be used in conjunction with EN 415-10:2014.

When a requirement of EN 415-4 differs from a requirement of EN 415-10:2014, the requirement of EN 415-4 will prevail.

When a machine covered by EN 415-4 incorporates functions described by other standards of the EN 415 series, those functions are expected to comply with those standards.

EXAMPLE 1 In the case of a palletizer which incorporates cartooning mechanisms, the palletizing mechanisms are expected to comply with EN 415-4 and the cartoning mechanisms are expected to comply with EN 415-7:2006+A1:2008.

EXAMPLE 2 In the case of a palletizer which incorporates a pallet wrapping mechanism, the palletizing mechanisms are expected to comply with EN 415-4 and the pallet wrapping mechanisms are expected to comply with EN 415-6.

Annex ZA of this document will not list the EHSR of Annex I of the Machinery Directive which are completely covered by EN 415-10:2014.

Annex ZA of this document will not list the EHSR which are not relevant for this kind of machines or are not covered for any other reason.

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1 Scope

This document applies to the following groups of machines, auxiliary equipment and their combinations:

— palletizers;

— depalletizers;

— auxiliary equipment incorporated in or linked to the operations of palletizers and depalletizers;

— conveying systems which are part of palletizers or depalletizers;

— palletizers combined with functions of machines which are covered by other parts of EN 415, but detailed requirements are only provided for palletizing functions.

The individual machines are described in 3.2. Auxiliary equipment is described in 3.3.

This document deals with safety requirements for machine design, transport, installation, commissioning, operation, adjustment, maintenance and cleaning of palletizers, depalletizers, auxiliary equipment and conveying systems which are part of palletizer or depalletizer. The extent to which hazards, hazardous situations and events are covered is indicated in Annex B.

Exclusions:

This document is not applicable to the following machines:

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

— conveyors that connect palletizers and depalletizers with machines that are not in the scope of this document.

Conveyors in the scope of this document also fall in the scope of EN 619:2002+A1:2010, however, this document describes the additional or specific hazards for conveyors fitted into palletizers and depalletizers and so the requirements of this document take precedence over the requirements of EN 619:2002+A1:2010.

This document does not consider the following hazards:

— the use of palletizers and depalletizers in a potentially explosive atmosphere;

— the health, safety or hygiene hazards associated with the products that are contained in the unit load handled by palletizers and depalletizers except for the spillage of hazardous substances caused by the malfunction of as machine.

2 Normative references

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

EN 415-1:2014, *Safety of packaging machines - Part 1: Terminology and classification of packaging machines and associated equipment*

EN 415-7:2006+A1:2008, *Safety of packaging machines - Part 7: Group and secondary packaging machines*

EN 415-9:2009, *Safety of packaging machines - Part 9: Noise measurement methods for packaging machines, packaging lines and associated equipment, grade of accuracy 2 and 3*

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EN 415-10:2014, *Safety of packaging machines - Part 10: General Requirements*

EN 795:2012, *Personal fall protection equipment - Anchor devices*

EN 1005-3:2002+A1:2008, *Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation*

EN 13155:2020, *Crane - Safety - Non-fixed load lifting attachments*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

EN 61496-1:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests*

EN 61496-2:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

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 7010:2020, *Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2019, Corrected version 2020-06)*

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

EN ISO 10218-2:2011, *Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration (ISO 10218-2:2011)*

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

EN ISO 13849-1:2015, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

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

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

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

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 415-1:2014, EN 415-10:2014, Clause 3, EN ISO 12100:2010, Clause 3 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Definitions

3.1.1
palletize
place one or more products on a pallet, a similar support or on the floor

3.1.2
depalletize
separate a palletized load into individual products

3.1.3
layer
arrangement of products in a horizontal plane

3.1.4
layer pad
layer sheet
intermediate layer
sheet of material used to stabilize a pallet load

[SOURCE: EN 415-1:2014, 3.15.39]

3.1.5
layer pattern
disposition of the products in a layer

3.1.6
pallet
rigid horizontal platform designed to be handled by pallet trucks, fork-lift trucks or other appropriate handling equipment, and used as a base for assembling, loading, storing, handling, stacking, transporting, or displaying goods and loads

Note 1 to entry: The pallet may be constructed with, or fitted with, a superstructure.

3.1.7
pallet load
arrangement of products placed on a pallet or slip sheet

3.1.8
porous vacuum plate
plate made of porous material which holds a product by means of a vacuum

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3.1.9
row
horizontal line of products

3.1.10
slip sheet
thin flat piece of material used to support a pallet load

3.1.11
stack
vertical column of products or pallets

3.1.12
integrator
entity who designs, provides, manufactures or assembles an integrated manufacturing system and is in charge of the safety strategy, including the protective measures, control interfaces and interconnections of the control system

Note 1 to entry: The integrator may be a manufacturer, engineering company or the user.

3.1.13
integrated palletizing system
assembly of machines designed to palletize or depalletize pallet loads

3.1.14
ESPE
electro-sensitive protective equipment
assembly of devices and/or components working together for protective tripping or presence-sensing purposes and comprising as a minimum:

— a sensing device

— controlling/monitoring device

— output signal switching device and/or a safety-related data interface

3.1.15
AOPD
active opto-electronic protective device
device whose sensing function is performed by opto-electronic emitting and receiving elements detecting the interruption of optical radiation generated, within device, by an opaque object present in the specified detection zone for a light beam device, on the axis of the light beam

3.1.16
AOPDDR
active opto-electronic protective device responsive to diffuse radiation
device, whose sensing function is performed by optoelectronic emitting and receiving elements, that detect the diffuse reflection of optical radiation generated within the device by an object present in a detection zone specified in two dimensions

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3.2 Definitions of palletizers and depalletizers

3.2.1 General

This clause describes the working principles of typical configurations of palletizers and depalletizers. Variations of these typical assemblies also exist.

3.2.2
semi-automatic stripper plate palletizer
palletizer in which an operator forms the products into the layer pattern on a stripper plate manually and then presses a start button

3.2.3
automatic low-level stripper plate palletizer or depalletizer
palletizer in which layers of products are formed at low or high level, is then transferred onto a stripper plate which raises or lowers to the appropriate level and transfers the layers onto the pallet

3.2.4
automatic high-level palletizer or depalletizer
palletizer in which layers of packages are formed at one level usually a high level and transferred onto the pallet which is raised and then lowered as the pallet load forms

Note 1 to entry: A depalletizer operates in reverse.

3.2.5
pick and place palletizer or depalletizer (gantry type)
palletizer in which products are gripped, lifted, transferred to the loading position and then lowered onto the pallet load with linear movements and a rotation of the end effector

3.2.6
pick and place palletizer or depalletizer (column type)
pick-and-place palletizer in which the product lifting device is supported on a column and can move up and down the column or rotate around the column

Note 1 to entry: A rotation of the end effector may also exist.

Note 2 to entry: Column palletizers can pick up products one at a time, or in groups. Products are typically conveyed to the machine at low level but sometimes at high level.

3.2.7
stack palletizer
palletizer which creates stacks of packages, e.g. crates which are then transferred to the pallet as a group

3.2.8
robot palletizer and depalletizer
palletizer or depalletizer which uses an industrial robot to perform some or all sequential operations for palletizing or depalletizing products

Note 1 to entry: Robot palletizers can pick up products one at a time, or in groups. In some installations the robot also positions the pallet or the layer pads.

3.2.9
case-packer-palletizer
machine which combines the operations of case-packing and palletizing in one machine

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3.2.10
linear multi-station palletizing system
palletizer in which two or more pallet or pallet loads are positioned in a row on the ground for palletizing or depalletizing and pallets and pallets loads are delivered to and removed from the machine using an industrial truck

Note 1 to entry: The industrial truck can be a conventional fork-lift truck, a manually operated pallet truck or remote-controlled self-propelled work equipment.

3.3 Definition of auxiliary equipment

3.3.1 General

This clause describes the working principle of typical types of auxiliary equipment used in palletizers and depalletizers.

3.3.2
mechanical gripping head
assembly of mechanical components which hold products, a set of products, an empty pallet or layer pads using one of the following methods:

a) positive support, e.g. the product is supported by a plate or hooks

b) friction between fingers or plates and the load

c) friction between the products that make up the load

d) friction or positive support by inflatable elements

3.3.3
vacuum gripping head
gripping head which uses vacuum to hold products or layer pads

Note 1 to entry: The mechanism will typically comprise several suction cups or a porous vacuum plate.

3.3.4
magnetic gripping head
gripping head which uses electromagnetic force to lift products made from magnetic material, e.g. tin-plated mild steel cans

3.3.5
gripping head with roller curtain
mechanism comprising a set of free running rollers supported by two chains which receives and supports a layer of products; the mechanism is then lifted and moved over a pallet where the roller curtain is retracted leaving the products on the pallet

3.3.6
pallet stacker/ unstacker
machine which dispenses empty pallets from a stack or accepts single empty pallets and places them in a stack

3.3.7
pallet changer
machine which removes a pallet load from a pallet so that it can be placed on another pallet

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3.3.8
pallet grouping and ungrouping unit
assembly of pallet conveyors which stores, sorts and delivers pallets or pallet loads to several loading stations

3.3.9
layer pads inserter or remover
machine or attachment which places layer pads onto layers of products or the pallet as the pallet load is formed or removes layer pads as a pallet load is dismantled

Note 1 to entry: The layer pads magazine can be inside the safeguarded zone or in a separate control zone.

3.3.10
pallet checkers
machines which check the quality of used pallets

3.3.10.1
pallet size/weight checker
machine comprising a pallet conveyor fitted with load cells for weighing pallet loads, and/or photoelectric equipment, to check the size of the pallet load

3.3.10.2
pallet condition checker
machine which checks the quality of pallets and rejects pallets that do not meet the quality requirements

4 Safety requirements

4.1 General requirements

4.1.1 Introduction

All machines in the scope of the standard shall comply with the following requirements.

The manufacturer shall ensure that any additional hazards that may arise by combining two or more packaging functions in one machine are identified and appropriate safeguarding measures are adopted, using the relevant clauses of EN 415-10:2014.

4.1.2 Risk from moving parts – inherently safe design – physical aspects

The requirements of 5.2.1.1 of EN 415-10:2014 shall apply.

NOTE Annex B (informative) of EN 415-10:2014 provides maximum values for inherently safe design.

4.1.3 Safeguards

Where hazards from moving parts cannot be eliminated by design, access to these hazards shall be prevented by fixed or interlocked guards.

When there is a risk of falling loads outside the safeguarded area, protection by means of ESPE devices alone is not permitted.

ESPE can be used to protect pallet load infeed or discharge openings in guards or to monitor the interior zone.

4.1.4 Fixed or interlocked movable guards

The requirements of 5.2.1.2, 5.2.1.3 and 5.2.1.4 of EN 415-10:2014 shall apply.

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Where interlocking devices are connected in series, fault masking shall be prevented.

4.1.5 Operator access to hazard zone

4.1.5.1 General

On machines without pallet conveyor where the hazard zone is small enough or simple enough for the operator to check that no one is inside the hazard zone from a single control station outside the guards, it is acceptable for pallet loads and operators to use the same access opening in the guards.

On machines where it is not possible to see the whole of the danger hazard zone from the reset and start command, the requirements of 5.16.2.3 and 5.16.2.4 of EN 415-10:2014 shall apply.

4.1.5.2 Access over a conveyor

Where approach to the hazard zone is foreseeable over a belt or slat band conveyor, the maximum distance between the pallet load and the columns supporting the AOPD or the guards on both sides of the slat band or belt conveyor shall be not greater than 180 mm to prevent an operator from passing through the gap when the AOPD is muted.

Where fixed or interlocking guards extend over a conveyor or a tunnel guard at the entry or exit of the machine, the design shall prevent climbing over the guard, e.g. by an additional guard or measures to prevent standing on the tunnel or conveyor. Additional guards shall be dimensioned by considering the tunnel or conveyor as a plane of access 2000 mm high from the floor or the access platform.

In chain or roller conveyor the clearance between the outer edge of the pallet load to fixed parts shall be no greater than 230 mm as specified in EN 415-10:2014, 5.2.1.3.13.

4.1.5.3 Separation of hazard zones

Where a machine has more than one safeguarded zone, for example separate control zones for the pallet magazine, layer pad mechanism and palletizer, the equipment covered by these different control zones shall be separated by means of one or a combination of the following:

a) fixed guards dimensioned using Table 2 of EN ISO 13857:2019;

b) automatic guards that move into place to separate one safeguarded zone from the other before someone enters one of the control zones,

c) AOPD complying with EN 61496-2:2013 which become active if someone enters one of the safeguarded zones;

d) some other form of ESPE complying with EN 61496-1:2013 that gives equivalent level of safety protection.

Where two or more palletizers or depalletizers are linked together and it is necessary for an operator to enter and work on one machine in the system while the rest of the system continues to operate, the following requirements shall apply:

1) When an operator has entered one zone in the system, this operator shall be protected by automatic guard or AOPD which can stop the equipment in the adjacent zone if this operator moves into an active zone within the system.

   All adjacent safeguarded zones shall be safeguarded by an AOPD which stop all hazardous functions/movements in the adjacent zone which is entered.

   Where falling or ejected items present hazard, interlocked guards shall be used which protect against these hazards.

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2) The control system shall stop movement in either of the zones adjacent to the AOPD.

   A means to reset and activate the adjacent zone which the operator has left from the zone where the operator stays shall be provided.

   The reset controls for these AOPD devices shall be located where there is a clear view of the two zones adjacent to the AOPD. Where there is no one position from which there is a clear view of the hazard zones, two or more reset devices shall be used, so that by moving from one reset button to the next reset button, the operator resetting the system has a view of the two zones. One or more of these reset controls can be located within the hazard zones, however, the last button to complete the resetting sequence shall be located outside the hazard zones where it cannot be reached from inside the hazard zone.

3) Where zones are equipped with interlocking devices which provide a key for the operator to take into a zone, the control system shall ensure that it is not possible to reset the AOPD and restart an adjacent zone unless all guards are closed and the kept key has been used for resetting in the zone of access.

4.1.6 Apertures in guards

4.1.6.1 Minimum distance between ESPE and the near aperture

For the calculation of the minimum distance of an AOPD or AOPDDR for access over a conveyor the approach speed K according to EN ISO 13855:2010 for walking may be reduced to 800 mm/s when all the following conditions are fulfilled:

a) for chain conveyors or a belt conveyor:

   — the minimum distance between the centre of the chains or belts is 550 mm, and

   — the belts or chains are not wider than 100 mm, and

   — impeding elements are used between the chains or belts to slow down the approach speed.

b) for roller conveyors:

   — the minimum clearance between rolls is 120 mm,

   — the frames are not wider than 40 mm,

   — there are no filler plates between the rollers.

4.1.6.2 Alternative safeguarding measures

The following alternative measures to the ones in 5.2.1.3 and 5.2.1.4 of EN 415-10:2014 shall apply:

a) Manual muting of ESPE:

   Where a manual ESPE muting device is provided, the following requirements shall apply:

   1) the device shall be a key actuated hold to run device;

   2) the device shall be mounted outside the hazard zone, in a position where it cannot be reached from inside the hazard zone and in a position where there is a clear view of the hazard zone;

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3) the device shall mute the ESPE but only start the pallet load conveyor and, the muting control system shall have the same performance level as the ESPE control system and shall provide a visual or acoustic signal indicating that the muting function is active;

4) the muting shall stop if the conveyor stops for any reason, if the hold to run device is released or the time taken for the pallet load to move through the ESPE is 2 s longer than the normal time for a pallet load to move this distance;

5) an emergency stop device complying with EN ISO 13850:2015 shall be positioned next to the ESPE muting device.

b) Protecting an aperture using a combination of safeguarding devices

The feeding zone of the product shall be safeguarded by a combination of fixed and interlocked guards and ESPE (see Figure 1) performing the following functions:

1) when the pallet enters the intermediate area the outer safeguard (A) is triggered and switched to off;

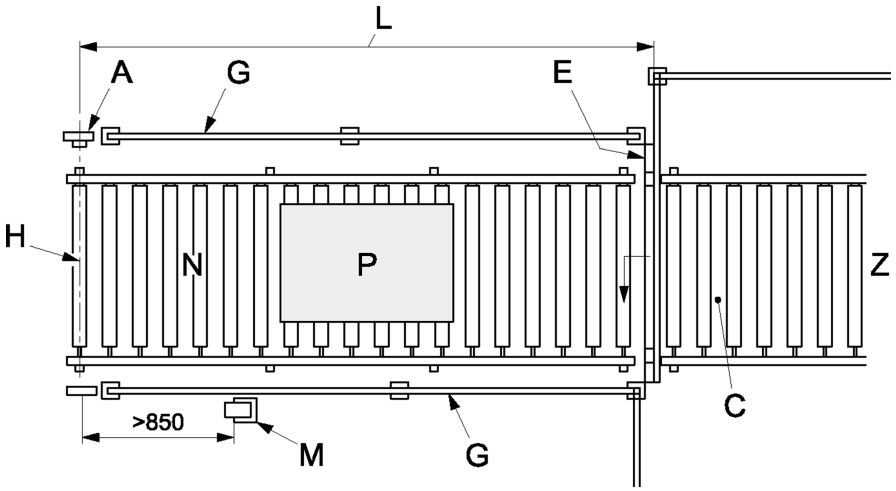
2) before the pallet (P) can get conveyed through the inner safeguard (E), the outer safeguard (A) shall be manually reset and thus release the movement of the pallet. While the pallet (P) is passing the inner safeguard (E) and the outer safeguard (A) is still in the OFF-state or actuated, the palletizer shall stop all hazardous movements. This condition shall be maintained until manually reset;

3) after the passage of the pallet (P), the inner safeguard (E) will be automatically reset only if the outer safeguard (A) has been manually reset;

4) the manual reset device of the outer safeguard shall be mounted outside the hazard zone, in a position where it cannot be reached from the hazard zone or the intermediate area and is in a position where there is a clear view of the hazard zone.

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Key

A outer safeguarding device
C conveying device
E inner safeguarding device
G fixed guard
H light beam
L length of conveyor
M reset device
N intermediate area
P pallet load
Z hazard zone

Figure 1 — Automatic feed

4.1.6.3 Different width of pallet load

Where pallet loads of different width are conveyed through a large aperture, AOPD devices complying with 5.2.1.3.13 of EN 415-10:2014 in combination with additional vertical AOPD or alternatively a laser scanner complying with 5.2.1.3.17 of EN 415-10:2014 shall be applied to prevent whole body access while the product is passing.

a) Where the width of the conveyed pallet loads load differs less than or equal to 600 mm, the following measures shall apply:

   1) vertical AOPD safeguards the aperture while narrow pallet loads are passing

   2) the clearance between the vertical AOPD beams (H) next to the pallet load and the outer edge of the product (see Figure 2) shall not be greater than 300 mm while the product is passing;

   3) the clearance between the supports of the horizontal AOPD and the vertical AOPD (see Figure 2) shall not be greater than 300 mm;

   4) the clearance between a support of the horizontal AOPD (H) and a fixed guard (G) shall not exceed 180 mm.

b) Where the width of the load differs more than 600 mm, a laser scanner or a vertical AOPD with several beams fulfilling the following conditions shall be used.

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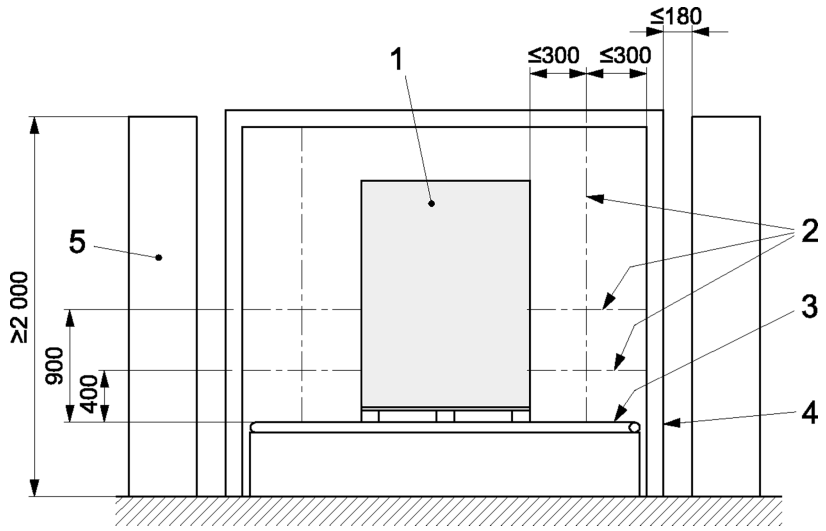
1) the width of the pallet load shall be transmitted to the safety related control system (discharge only) or measured by a separate device. The muting of vertical AOPDs respectively the control of the AOPDDR shall be triggered by this information. If the pallet does not arrive at the guarding at the expected time a safety related stop of the machine shall be initiated;

2) the clearance between the vertical AOPD beams (H) next to the pallet load and the outer edge of the product (see Figure 2) shall not be greater than 300 mm while the product is passing;

3) the clearance between the supports of the horizontal AOPD and the vertical AOPD (see Figure 2) shall not be greater than 300 mm ;

4) the clearance between a support of the horizontal AOPD (H) and a fixed guard (G) shall not exceed 180 mm.

Dimension in millimetres



Key

1 pallet load
2 beams of AOPD
3 conveyor
4 AOPD support
5 fixed guards

Figure 2 — Aperture with additional vertical AOPD

4.1.7 Prevention of unexpected lowering of machine components

4.1.7.1 Strength of mechanical elements

Mechanical elements which support a load shall be designed and constructed in such a way as to withstand the static overload without permanent deformation or patent defect.

A static test coefficient of 1,5 shall apply.

In addition, the following components which support a load shall have the working coefficients as listed below when using only 1 element.

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— rope 5
— chain 4
— belt 5
— textile fibre 7
— toothed belt 5

Other components of lifting mechanisms shall be designed according to good engineering practices.

NOTE EN 13001-1:2015 and EN 13001-2:2014 provide useful information.

The manufacturer of these components may certify the "load limit" which incorporate the safety coefficient. The "load limit" can be used as reference data for the design of the components of the power transmission mechanism. It is preferable to use more than one chain, rope, toothed belt or textile strap.

Where two or more components are used, the minimum working coefficient of each component shall be not less than the factors stated above divided by the number of components the factor shall not be less than 2.

4.1.7.2 Requirements to prevent the unintended lowering of lifting mechanisms

The following measures shall be applied to prevent the unintended lowering of lifting mechanisms during access to all areas where intervention is necessary during operation, adjustment, maintenance of the machinery:

1) Mechanical elements;

   a) Mechanisms using chains, ropes, toothed belts or textile straps shall have a slack rope detection device which stops movement when a slack rope is detected,

   b) An automatic tensioning device shall be fitted which maintains contact between the belt and its pulley or sprockets,

   c) An automatic tensioning device shall be fitted which maintain contact between the belt or chain and its pulley or sprockets.

2) If hydraulic cylinders are used, they shall be equipped with an automatic device to limit unintentional lowering to less than 100 mm even in the event of rupture of the hoses in the hydraulic supply line. Mounting a rupture protection valve directly on each hydraulic cylinder, is one mean of meeting this requirement;

3) If pneumatic cylinders are used, they shall each be equipped with a rod blocking device, a separate blocking device or a pressure blocking valve effective even if the power supply fails.

   The manufacturer shall describe the safe procedures and measures which shall be used following a breakdown of the above components or mechanisms or an activation of the above safety devices. This shall include how to move the lifting assembly, safe access and safe removal of load as well as the necessary maintenance instructions.

4.1.7.3 Mechanical locking system for lifting units

4.1.7.3.1 Application of methods

On machines where whole body access under lifting mechanisms is intended, 4.1.6.3.2 shall apply.

On machines where whole body access is possible, 4.1.6.3.3 or 4.1.6.3.4 shall apply.

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4.1.7.3.2 Mechanical restrain devices

Unexpected lowering of the mechanisms shall be prevented by at least one automatic mechanical restrain device which works in a positive mode. These devices shall be driven into their locking position when a safety related stop has been generated, for example using spring force. And a sensor(s) shall detect that these devices have engaged.

On semi-automatic machines where the lifting assembly is accessible without opening guards the mechanical restrain devices shall be driven into their locking position after every stop.

The mechanical restrain device(s) shall be capable supporting the lifting assembly and 150 % of the maximum load. See Figure 1 for examples of mechanical restrain devices which lock a pallet or layer transfer lifting assembly.

After the mechanical restrain has reached the locking position, the lifting mechanism shall move not more than 100 mm (see Figure 1).

The mechanical restrain devices shall be activated if any of the energy supplies are lost.

4.1.7.3.3 Self-locking gearbox

Lifted machine parts shall safely be held in position by self-locking gearbox e.g. a worm and gear gearbox.

4.1.7.3.4 Holding brakes

Lifting mechanisms shall be fitted with at least one mechanical brakes which hold the lifting assembly with 150 % of the maximum load and one of the following shall apply:

a) Where malfunction of these brakes stops the machine automatically, it shall only be possible to restart the machine after corrective action has been taken and the control system has been reset manually.

b) Where malfunction of these brakes does not stop the machine automatically, these brakes shall be monitored by the machine's control system and any aberrant movement shall lead to a safety related stop of the machine and a visual warning on the machine's control panel that is not safe to go under the lifting assembly.

Reset and restart after these stops shall only be possible in a maintenance mode which is protected by a key or code. The monitoring shall be performed every time when the brakes are used. Where brakes are not used during the process they shall be monitored when they are activated for a safety stop.

The instruction for use shall describe the safe procedures and measures that shall be used following this malfunction or alarm. This shall include how to move the lifting assembly to a safe position, prevention of any movement of the lifting assembly, safe access and save removal of load as well as maintenance of the brakes.

NOTE Accidents by spontaneous malfunction of holding brakes are not known. Usually, malfunction of these brakes leads first to slow lowering of the lifting assembly. Therefore, the goal of the measures is to detect aberrant movement so the brakes can be maintained before a dangerous malfunction of the brakes occurs.

The failure of any sources of power shall not prevent the brakes being activated.

Where holding brakes are used, mechanical locking systems for maintenance and long-term intervention as described in 4.1.6.3.5 shall also be fitted.

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4.1.7.3.5 Locking system for maintenance and long-term interventions

For maintenance or long-term intervention under the lifting mechanism one of the following measures shall be used.

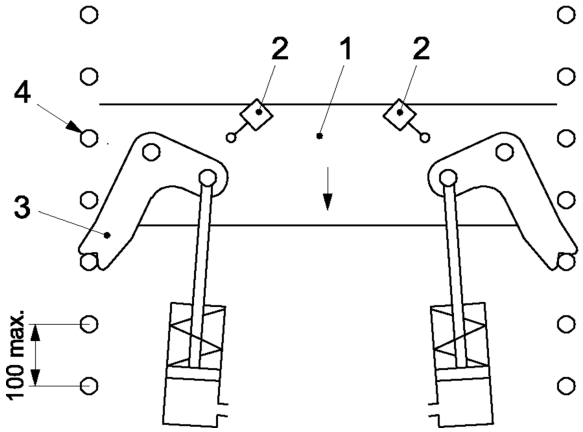
a) An automatic mechanical restrain device that comply with 4.1.6.3.2. Typical devices are back stops, rotating pins or pin and with perforated bar which limit the falling of the mechanism to 100 mm. The devices shall be applied automatically and be effective at least 150 % of the maximum working load of the lifting mechanism and a sensor shall detect that the device has engaged (see Figure 1).

b) One or more manually activated mechanical restrain devices which can be operated from a safe position outside the footprint of the lifting assembly. The manually operated mechanical restrain devices shall be equipped with interlocking devices to prevent the machine from starting while the mechanical restrain devices are supporting the lifting assembly. These mechanical restrain devices shall be capable of supporting the lifting assembly and 150 % of its maximum load.

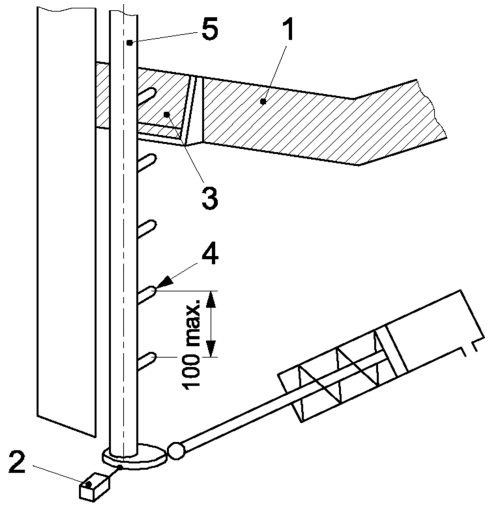
c) One or more mechanical restrain devices e.g. bars, which can be inserted into the assembly without having to work under the lifting assembly and can be locked in position. The instruction shall specify the safe procedure for inserting and removing these devices. These restrain devices shall be capable of supporting the lifting assembly and 150 % of its maximum load.

Examples of locking systems are given in Figure 3.

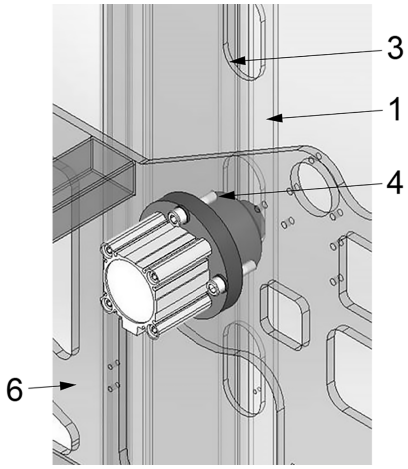
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a) Example for locking system with driven back stops



b) Example of locking system with rotating pin shaft



c) Example of locking system with pin and perforated bar

Key

1 lifting device
2 sensing device detecting the position of teeth
3 backstops
4 pins
5 rotating shaft with pins
6 perforated bar

Figure 3 — Examples of locking systems

4.1.8 Release from trapping

Requirement 5.2.1.5 of EN 415-10:2014 shall apply.

4.1.9 Machine stability

Requirement 5.2.3 of EN 415-10:2014 shall apply.

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4.1.10 Pneumatic and hydraulic equipment

All pneumatic components and piping shall conform to the requirements of EN ISO 4414:2010.

All hydraulic components and piping shall conform to the requirements of EN ISO 4413:2010.

Where control functions are performed by hydraulic or pneumatic systems, these circuits shall comply with the requirements of 5.14 and 5.15 of EN 415-10:2014.

The means of isolation of pneumatic or hydraulic power shall be accessible from outside the hazard zone, provided that it leads to no additional risk and clearly marked and capable of being locked in the off position.

4.1.11 Measures to prevent falls from height

For machines which require regular access to high level, e.g. with product entry, grouping and transfer unit or pallet on high level the following requirements apply:

a) preferably the machine shall be designed so that all parts of the machine that require regular access can be reached from floor or other safe level. Where access on high level is foreseeable, 5.2.2.3 of EN 415-10:2014 shall apply;

b) layer forming and transfer mechanism higher than 1 200 mm from floor level, shall be equipped with guards to prevent a fall from height. Where parts of the machine are designed to prevent falls from height, no additional railing is necessary;

c) where falling cannot be prevented by design or by fixed guards or handrails, automatic movable handrails shall be provided in preference to recommending the use of personal protective equipment. When automatic movable handrails are used, access to this zone shall only be possible through interlocked guards with guard locking which prevent access to the zone until the automatic movable handrails have moved to their guarding position.

NOTE See also 4.4.1.

4.1.12 Electric equipment

Electrical equipment shall comply with 5.5 of EN 415-10:2014. The means of isolation for electric power shall be clearly marked, accessible from outside the hazard zone and capable of being locked in the off position.

4.1.13 Noise reduction

Requirement 5.8 of EN 415-10:2014, EN 415-9:2009 and Annex A (normative) shall apply.

NOTE 1 EN ISO 11688-2:2000 gives useful information to the physics of low-noise design.

NOTE 2 Annex A (normative) provides essential information additional to the noise code described in EN 415-9:2009.

NOTE 3 Annex A (normative) gives information on how to select the measurement positions and the time interval for different kind of palletizers and depalletizers.

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4.1.14 Conveyor crossing points

4.1.14.1 General

The requirements of 5.20.4 of EN 415-10:2014 apply with the following additions:

a) Conveyors within the safeguarded zone shall stop safety related during access, otherwise the following clauses shall apply.

b) For crossing points the following shall apply:

1) where the clearance between the rollers is more than 20 mm, roller conveyors shall be provided with infill plates which fill the whole gap;

2) The clearance between infill plates and rolls shall not exceed 4 mm;

3) where the width of the plates between conveyors rolls is less than mm 75 mm, a safety related sensor shall detect the presence of a person before crossing and stop the conveyor until it is reset re-started by a manual start command. If this is not possible a bridge over the conveyor shall be provided;

4) chain conveyors shall be provided with infill plates between chains;

5) the crossing position shall be properly signed with the pictogram EN ISO 7010:2020, M023 -use footbridge-, shown in Figure 4;

6) waiting positions of pallet loads from where pallet loads start automatically shall be positioned so that the time to reach the crossing point is at least 2 s;

7) if the conveyor is higher than 500 mm the access step shall be provided with handrails complying with EN ISO 14122-3:2016. A one-sided handrail shall only be used where the crossing point area is not higher than 1000 mm. The distance between handrails and pallet loads shall be at least 300 mm to avoid crushing of the head and extremities;

8) where the distance between a moving pallet load and a fixed part is less than 300 mm, one of the following shall be installed to eliminate the shearing hazard between the moving pallet load and the fixed part:

— a deterring device no higher than the conveyor, which prevents someone getting closer than 300 mm to the pallet load;

— an ESPE with a minimum PLr = c, complying with EN 61496-1:2013 which stops the conveyor if someone is detected in the hazard zone. EN ISO 13855:2010 shall be used to determine the position of the ESPE, considering the part of the body exposed to the hazards;

— a pressure sensitive edge complying with EN ISO 13856-2:2013 shall be attached to the fixed part and shall stop the movement of the pallet load before the values stated in Annex B (informative) of EN 415-10:2014 are exceeded.

9) Roller conveyors having a speed higher than 0,3 m/s or a clearance between two rollers lower than 125 mm and any other kind of conveyors having a speed higher than 0,3 m/s shall be provided with a safety device, e. g ESPE, which detects the presence of a person before crossing and stops the conveyor. If the safety devices are AOPDs, the distance from the AOPD support to the edge of the pallet load shall be not less than 300 +-10 mm. and the restart devices for the

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conveyor shall be fixed in positions where the devices are not accessible from the crossing area and where there is a clear view of the crossing point.



Figure 4 — Mandatory crossing point pictogram

4.1.14.2 Work stations on conveyors

Where a workstation is required on a pallet conveyor, e.g. for removing packaging film on a depalletizer or attaching a label on a pallet load, a platform complying with EN ISO 14122-2:2016 and infill plates between rollers of chains shall be provided by the manufacturer, so these tasks can be carried out safely.

The dimensions of the platform and infill plates between rollers or chains shall be at least 600 mm larger than the footprint of the pallet.

The control system shall ensure that the pallet load stops automatically at the work station and only restarts if a manually operated control device is actuated. Unexpected start-up shall be prevented by a control system with PLr = c

4.1.14.3 Interfaces between conveyors and fork lift trucks

Where a fork lift truck (FLT) delivers to or collects a pallet load from a conveyor, the control system shall ensure that the conveyor is stopped while the pallet load is being placed on or removed from the conveyor. This can be achieved using a device to detect the presence of a fork lift truck.

In this situation it is permissible for the conveyor to restart automatically when the FLT has moved away from the loading or unloading position.

An emergency stop device complying with EN ISO 13850:2015 shall be placed near the loading or unloading point.

This can also be achieved using an ESPE complying with EN 61496-1:2013 to detect the presence of the FLT. Restart of the machine or conveyor in this situation shall only be possible if a reset button is pressed by the FLT driver. This reset button shall be located in a position where the FLT driver can be sure that there is no one in the hazard zone. An emergency stop button complying with EN ISO 13850:2015 shall be placed near the loading or unloading point according to EN 415-10:2014, 5.14.5.

4.1.14.4 Interfaces between conveyors and AGVs

Where an automated guided vehicle (AGV) delivers to or collects a pallet load from a conveyor, the control system shall ensure that the conveyor only transfer the pallet load when the AGV is in the correct position for loading or unloading to prevent the falling of pallet. In this situation it is permissible for the conveyor to restart automatically when the AGV has moved away from the loading or unloading position. An emergency stop device complying with EN ISO 13850:2015 shall be placed near the loading or unloading point.

Where there is no hazard by falling load, and the conveyor is designed inherently safe, this requirement shall not apply.

4.1.15 Measures to prevent risks from falling products

EN 415-10:2014, 5.10.2.2 shall apply.

NOTE Annex C (informative) presents a method for evaluating the stability of pallet loads.

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4.1.16 Emergency stop function

The requirement of 5.14.5 of EN 415-10:2014 shall apply.

4.1.17 Control functions

The requirements of 5.14 of EN 415-10:2014 shall apply.

4.1.18 Safety related stop functions

The requirements of 5.14.3 and 5.14.4 of EN 415-10:2014 shall apply.

4.1.19 Safety related stops of variable speed electrical power drive systems

The requirements of 5.14.6 of EN 415-10:2014 shall apply.

4.1.20 Stopping time

The requirements of 5.14.7 of EN 415-10:2014 shall apply. EN ISO 13855:2010 shall be used to calculate the distance from ESPE to the nearest hazard zone.

4.1.21 Unespected start up

The requirement of 5.16 of EN 415-10:2014 shall apply.

4.1.22 Requirements for remote control (teleservice)

Where the machine is provided with equipment that allows remote control of the machine, which may affect the function or the safety of the machine, the manufacturer shall provide the equipment required by 5.18 of EN 415-10:2014.

Where the machine is permanently connected to the internet, the machine shall be identified by a unique address. Access shall be authorized and acknowledged by the user at the machine by a suitable procedure (e.g. using a password which can be set and modified by the user of the machine).

This clause does not apply to collecting data or monitoring the machine.

4.1.23 Size or product changing

The requirements of 5.20.6 of EN 415-10:2014 shall apply.

4.1.24 Ergonomic design principles

The requirements in 5.11 of EN 415-10:2014 shall apply.

4.1.25 Measures to prevent reasonably foreseeable misuse

The requirements in 5.19 of EN 415-10:2014 shall apply.

4.1.26 Operations with open guards

The requirements in 5.16.3 of EN 415-10:2014 shall apply.

4.1.27 Stored energy

The requirements in 5.17 of EN 415-10:2014 shall apply.

4.1.28 Laser radiation

The requirement 5.9.2 of EN 415-10:2014 shall apply.

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4.1.29 Measures to control hazards generated by substances and materials

The requirement of 5.10.1 and 5.10.2 of EN 415-10:2014 shall apply.

4.1.30 Measures to control hazards generated by packaging materials in case of malfunction

The requirement of 5.10.3 of EN 415-10:2014 shall apply.

4.2 Safety requirement for semi-automatic stripper plate palletizer

4.2.1 Ergonomic hazards

The workstation shall be designed according to EN 1005-3:2002+A1:2008 and the force that shall be applied by the operator to push a product on the pattern forming plane shall not exceed 60 N.

The layer forming plane shall be designed so its height can be adjusted to suit the operator, considering the requirements of EN 1005-4:2005+A1:2008. The instructions shall explain how to make this adjustment.

If this is not reasonably practicable, an appropriate platform for the operator shall be provided.

The instruction for use shall explain how to adjust the platform height.

NOTE The force exerted by an operator depends on the weight of the product and the friction coefficient between product and plane. The friction coefficient can be kept as low as possible using a ball table or low friction material.

4.2.2 Moving parts

All moving machine transmission parts which are not in a clear view of the operator shall be safeguarded by fixed or interlocked guards or ESPE complying with 4.1.5.

Moving parts involved in the process like the product infeed and grouping table mechanisms do not need to be safe guarded, provided the operator has a clear view to these mechanisms from the operating position and they can only be operated using a two-hand control device which complies with EN ISO 13851:2019 type III.

4.2.3 Requirement for safety related parts of control system

The safety related control systems shall as a minimum comply with the following performance levels of EN ISO 13849-1:2015.

Safety function	PLr
Stopping machine mechanism when an interlocked guard is opened or an ESPE is activated	d
Stopping the product infeed and grouping table when the two-hand control device is not being activated	d
Preventing unexpected start up	d
Emergency stop function	c

4.3 Safety requirements for an automatic low level palletizer or depalletizer

4.3.1 Safeguarding of the of load lifting device

For mechanical risks, 4.1.5 and 4.1.6 of this document shall apply.

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