

Safety of packaging machines —

Part 2: Pre-formed rigid container packaging machines

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- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
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Summary of pages

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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FOREWORD

This European Standard 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of an identical text or by endorsement, at the latest by June 2000, and conflicting national standards shall be withdrawn at the latest by June 2000.

This European Standard 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 standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0. INTRODUCTION

This European Standard is a type “C” standard as stated in EN 1070:1998. The machinery concerned and the extent to which hazards are covered are indicated in the scope of this standard.

It is the intention of this standard to allow innovative safety systems which can provide the equivalent or a greater degree of protection.

This standard is one of a series of “C” standards relating to the safety of packaging machines. These standards include:

- EN 415-1: Packaging machines safety - Terminology and classification of packaging machines and associated equipment
- EN 415-3: Packaging machines safety - Form, fill and seal machines
- EN 415-4: Packaging machines safety - Palletizers and depalletizers

1. SCOPE

This standard specifies the safety requirements for the design and manufacture of pre-formed rigid container packaging machinery and the information that should be made available to the user of these machines.

All the significant hazards (see clause 4) arising from the machines included in this part of the standard are covered except for hazards associated with ancillary equipment for evacuating gases, cooling/refrigeration equipment associated with packaging machines, steam services supplying packaging machines, substances being filled (see Annex C for guidance), hygiene principles (see Annex D for guidance) and substances for cleaning/sterilizing (see Annex E for guidance).

The following machines are included:

- Filling machines (other than cask, keg and barrel filling machines)
- Capping, closing and sealing/seaming machines
- Container cleaning machines (other than cask, keg and barrel cleaning machines)
- In-line and rotary rinsing and air cleaning machines
- Labelling, decorating, coding and marking machines
- Decapping/unscrewing machines
- Inspection and ejection machines
- Machines that apply wiring to secure stoppers in bottles
- Machines which rinse, inspect, fill, seal and label containers
- Keg and cask turning, pushing, cleaning and filling machines (but not multi-lane plants)
- Packing, unpacking and unscrambling machines
- Unpressurized pasteurizers and back-cooling machines
- Vertical and horizontal sterilizing machines

For information, schematic drawings showing typical combinations of rigid container packaging machines for beverages are included (see Figures 1, 2 and 3).

The following machines are not included:

- Aerosol filling and sealing
- Multi-lane kegging plants
- Conveyor systems which link packaging machines (these are dealt with by prEN 617, prEN 618, prEN 619, prEN 620 and prEN 741)

Before this standard is used a hazard identification and risk assessment shall be carried out to check that the hazards for the machine to be designed are the same as those identified in this standard.

This standard applies to machines which are manufactured after the date of issue of this standard.

2. NORMATIVE REFERENCES

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references subsequent amendments to, or revisions of, any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1:1991	Safety of machinery Basic concepts, general principles for design Part 1: Basic terminology, methodology
EN 292-2:1991	Safety of machinery Basic concepts, general principles for design Part 2: Technical principles and specifications
EN 294:1992	Safety of machinery Safety distances to prevent danger zones being reached by the upper limbs
EN 349:1993	Safety of machinery Minimum gaps to avoid crushing of parts of the human body
EN 415-1:1999	Packaging machines safety Part 1: Terminology and classification of packaging machines and associated equipment
EN 418:1992	Safety of machinery Emergency stop equipment; functional aspects - Principles for design
EN 457:1992	Safety of machinery Auditory danger signals - General requirements, design and testing
EN 563:1994	Safety of machinery Temperature of touchable surfaces - Ergonomic data to establish temperature limit values for hot surfaces
EN 574:1996	Safety of machinery Two hand control devices – Functional aspects – Principles for design
EN 614-1:1995	Safety of machinery Ergonomic design principles. Part 1: Terminology and general principles.
EN 626-1:1994	Safety of machinery Reduction of risks to health from hazardous substances emitted by machinery - Part 1: Principles and specifications for machinery manufacturers
EN 626-2:1996	Safety of machinery Reduction of risks to health from hazardous substances emitted by machinery - Part 2: Methodology leading to verification procedures
EN 811:1996	Safety of machinery Safety distances to prevent danger zones being reached by the lower limbs
EN 842:1996	Safety of machinery Visual danger signals - General requirements, design and testing

EN 894-1:1997	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
EN 894-2:1997	Safety of machinery Ergonomics requirements for the design of displays and control actuators Part 2: Displays
EN 953:1997	Safety of Machinery – Guards - General requirements for the design and construction of fixed and movable guards
EN 954-1:1996	Safety of machinery Safety related parts of control systems Part 1: General principles for design
EN 982:1996	Safety of machinery Safety requirements for fluid power systems and their components Hydraulics
EN 983:1996	Safety of machinery Safety requirements for fluid power systems and their components Pneumatics
EN 999:1998	Safety of machinery – The positioning of protective equipment in respect of approach speed of parts of the human body
prEN 1005-1:1993	Safety of machinery Human physical performance Part 1: Terms and definitions
prEN 1005-2:1993	Safety of machinery Human physical performance Part 2: Manual handling of machinery and component parts of machinery
EN 1037:1995	Safety of machinery Prevention of unexpected start-up
EN 1050:1996	Safety of machinery Principles for risk assessment
EN 1070:1998	Safety of machinery Terminology
EN 1088:1995	Safety of machinery Interlocking devices associated with guards - Principles for design and selection
EN 1093-1:1998	Safety of machinery Evaluation of the emission of airborne hazardous substances Part 1: Selection of test methods
EN 1127-1:1997	Explosive atmospheres – Explosion prevention and protection Part 1: Basic concepts and methodology
EN 1672-2:1997	Food processing machinery Basic concepts Part 2: Hygiene requirements

EN 1760-1:1997	Safety of machinery - Pressure sensitive protective devices - Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors
prEN 1760-2:1996	Safety of machinery Pressure sensitive protective devices Part 2: General principles for the design and testing of pressure sensing edges and pressure sensitive bars
EN ISO 3746:1995	Acoustics Determination of sound power levels of noise sources using sound pressure. Survey method using an enveloping surface over a reflecting plane (ISO 3746:1995)
EN ISO 4871:1996	Acoustics: Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)
EN ISO 11200:1995	Acoustics Noise emitted by machinery and equipment - Guidelines for the use of basic standards for the determination of emission sound pressure level at the work station and at other specified positions (ISO 11200:1995)
EN ISO 11204:1995	Acoustics Noise emitted by machinery and equipment, measurement of emission sound pressure levels at the work station and at other specified positions – Method requiring environmental corrections (ISO 11204:1995)
EN ISO 11688-1:1998	Acoustics Recommended practice for the design of low noise machinery and equipment Part 1: Planning (ISO TR 11688-1:1995)
ISO EN 11689:1996	Acoustics Procedure for the comparison of noise emission data for machinery and equipment (ISO 11689:1996)
ISO EN 11690-1:1996	Acoustics Recommended practice for the design of low noise workplaces containing machinery Part 1: Noise control strategies (ISO 11690-1:1996)
ISO EN 11690-2:1996	Acoustics Recommended practice for the design of low noise workplaces containing machinery Part 2: Noise control measures (ISO 11690-2:1996)
prEN 12198-1:1995	Safety of machinery Assessment and reduction of risks arising from radiation emitted by machinery Part 1: General principles
prEN 12437-1:1996	Safety of machinery Safety by means of permanent means of access to machines and industrial plant Part 1: Choice of a fixed means of access between two levels
prEN 12437-2:1996	Safety of machinery Safety by means of permanent means of access to machines and industrial plant Part 2: Fixed ladders with or without safety cages and means of barring access to such

prEN 12437-3:1996	Safety of machinery Safety by means of permanent means of access to machines and industrial plant Part 3: Stairways, stepladders and guard rails
prEN 12437-4:1996	Safety of machinery Safety by means of permanent means of access to machines and industrial plant Part 4: Working platforms and gangways
EN 50014:1998	Electrical apparatus for potentially explosive atmospheres General requirements
EN 61310-1:1995	Safety of machinery Indication, marking and actuation Part 1: Requirements for visual, auditory and tactile signals
EN 61310-2:1995	Safety of machinery Indication, marking and actuation Part 2: Requirements for marking
EN 60079-10:1996	Electrical apparatus for explosive gas atmospheres: Part 10: Classification for hazardous areas
EN 60204-1:1992	Safety of machinery – Electrical equipment of machines – Specification for general requirements
EN 60529:1992	Specification for degrees of protection provided by enclosures (IP code)
EN 60825-1:1994	Safety of laser products Part 1: Equipment classification, requirements and user's guide
EN 61496-1:1996	Safety of machinery Electro-sensitive protective equipment Part 1: General requirements and test
prEN 61496-2:1996	Safety of machinery Electro-sensitive protection equipment Part 2: Opto-electronic devices

3. DEFINITIONS

For the purpose of this standard the following definitions apply, in addition to those given in EN 1070 and clause 6 of EN 415-1:

3.1 pre-formed rigid containers: Pre-formed rigid containers in this standard include bottles, cans, cups, jars, pots, ampoules, vials, kegs, casks and barrels. The containers may be made of glass, metal, plastics, fibreboard, wood, ceramic material or composite materials. The containers are not usually manufactured by the machine itself, but may be, and can be sealed by a seamed end, cap, cork, foil lid or similar, or a combination of these.

3.2 pre-formed rigid container packaging machines: Machines which pack liquid, cream, paste, powder, free flowing solid or thixotropic substances in pre-formed rigid containers and machines which sort, invert, clean, inspect, pasteurize, sterilize and label these containers. These include machines which clean, sort, load and unload filled or empty containers into cases or crates.

3.3 carousel: Rotating machine element which locates and transports containers through one or more processes in a packaging machine (e.g. see Figure 10).

3.4 counterpressure filling: Container filling where the container is presented to a filling nozzle and first filled with gas (usually carbon dioxide or nitrogen) under pressure. The gas is then displaced by the product being filled.

3.5 walking beam: Moving machine element for indexing containers through one or more processes in a packaging machine (e.g. see Figure 9).

3.6 lifting pedestal: Plate or base on which a container temporarily stands during its passage through the processing stations of some types of packaging machine. The lifting pedestal is attached and activated by a lifting cylinder (e.g. see Figure 9).

3.7 lifting cylinder: Mechanically, pneumatically or hydraulically operated cylinder for lifting a container, which stands on the lifting pedestal, up to the processing head of a packaging machine (e.g. see Figure 9)

3.8 linear labeller: Machine on a conveying system so that containers are labelled as they are transported along a packaging line.

3.9 rotary labeller: Machine which places labels onto containers as they are positioned by a carousel.

3.10 oscillating label magazine: Label magazine which oscillates backward and forward about a fixed point or pivot.

3.11 roll through labeller: Machine in which the container is rolled across a flat surface by a moving belt picking up the label as it rotates.

4. LIST OF SIGNIFICANT HAZARDS

There are a wide range of packaging machines and the types of the containers they handle. The hazards on a particular machine can vary depending on the product being packed, the pack size, the packaging materials being used, the use of modified packing atmospheres, the use of sterilizing agents, the environment in which the machine is sited, etc. Consequently, not all of the hazards associated with a particular pre-formed rigid container packaging machine may be covered by this standard (see Scope). It is therefore necessary that the results of the designer's risk assessment are checked against the hazards listed in this clause.

Hazards which are common to more than one type of machine included in this standard are dealt with in 4.1. Hazards which are machine specific are additionally covered in 4.2.

4.1 Common Hazards

4.1.1 Mechanical hazards

The machines covered by this standard exhibit a wide range of mechanical hazards (see examples below), many of which occur in combination because of essential functional design.

4.1.1.1 Crushing hazards may exist at container transferring mechanisms,

- e.g.
- between the scroll and the container
 - between the container and fixed guides (e.g. see Figure 4)
 - on gripping heads of packing/unpacking machines

4.1.1.2 Shearing hazards may exist where fixed and moving machine parts run close together,

- e.g.
- cam tracks on filling machines (e.g. see Figure 5)
 - between lifting devices and machine columns

4.1.1.3 Cutting and severing hazards may exist at moving parts with sharp edges,

- e.g.
- cutting tools on labelling and decorating machines

4.1.1.4 Entanglement hazards may exist at rotating machine elements

- e.g.
- rotary carousels of filling and labelling machines
 - starwheels
 - machine drive shafts
 - infeed guides and transferring scrolls

4.1.1.5 Drawing in or trapping hazards may exist on machines where at least one part is movable, creating a situation which can lead to the drawing in of human extremities or parts of clothes,

- e.g.
- rotating machine elements on filling machines (see Figures 4 and 5)
 - between transferring heads of packing/unpacking machines and fixed machine parts

4.1.1.6 Impact hazards may exist where machine parts or containers transferred by the machine come into dangerous contact with the human body,

- e.g.
- ejection devices of inspection machines
 - moving machine elements such as container transferring bars
 - machine transferred containers

4.1.1.7 Stabbing or puncture hazards may exist at filling and cleaning stations where the nozzle enters a container,

- e.g.
- at the filling nozzle and the cleaning nozzle

4.1.1.8 Friction or abrasion hazards may exist wherever a drive belt or a belt conveyor is used, e.g. at a roll through labeller

4.1.1.9 High pressure fluid ejection hazards may exist where liquids, e.g. cleaning agents, are used.

- e.g. on
- the inspection points of cleaning machines
 - the high pressure nozzles of some filling machines
 - Cleaning-in-place (CIP) and/or Sanitizing-in-place (SIP) plants

4.1.1.10 Hazards caused by the ejection of containers or parts of containers may occur at carousels of rotary machines, container lifting devices and where there is a temperature gradient across the container. Examples of these are:

- the filling process, particularly pressurized filling
- the gripping head of packing/unpacking machines
- the outfeed of bottle washers and pasteurizers

4.1.1.11 Hazards due to loss of stability may occur on machines where an emergency stop is activated or due to reciprocating action mechanisms,

- e.g.
- high speed rotary machines
 - packing/unpacking transfer mechanisms

4.1.1.12 Slip, trip and fall hazards may exist where high level access is necessary to packaging machines,

- e.g. - to inspect top sections of container cleaning machines
 - to load feed hoppers of capping and sealing machines

4.1.1.13 Hazards during cleaning, setting and maintenance operations can occur if undertaken when a machine is in motion and/or if undertaken from unsuitable working positions on the machine.

4.1.2 Electrical hazards

Electric shock is a major hazard particularly when electrically powered machines are maintained, cleaned or during fault diagnosis,

- e.g. - as a result of water penetration when using hoses and high pressure jets
 - trouble shooting

4.1.3 Thermal hazards

There is a risk of burns from some machines,

- e.g. - container washing, pasteurizing and disinfection, hot glue labelling and hot foiling machines.

4.1.4 Hazards generated by noise

Noise can be generated during machine use. The greatest noise emissions arise from:

- the motor and drive components of the machine
- contact of containers against each other during the handling process
- contact and impacting of the containers against the machine components
- vibratory feeders, e.g. capping machines
- release of substances under high pressure (e.g. compressed air, carbon dioxide, nitrogen, etc.)

4.1.5 Hazards generated by vibration

There may be a hazard from vibration if transmitted to surfaces which have to be touched or held,

- e.g. - due to poorly balanced rotating components
 - reciprocating components
 - vibratory feed equipment on bottle capping machines

Vibration may also result in a noise hazard (see 4.1.4)

4.1.6 Hazards generated by radiation

There may be hazards from lasers, non-ionizing and ionizing radiation,

- e.g.
- coding machines etching bottles with a laser
 - inspection machines (fill level detectors often use a radioactive source)

4.1.7 Hazards caused by materials and substances being filled or used for cleaning or sterilizing

4.1.7.1 Hazards caused by substances being filled

Hazards may exist where the substance or product being filled poses a risk to health or safety, e.g. burns from hot or corrosive substances.

4.1.7.2 Hazards caused by neglecting hygiene principles

There may be a risk of infection, sickness or contagion from the product being processed in the machine.

4.1.7.3 Hazards caused by the presence of pathogenic bacteria

There may be a risk of operator infection if the machinery is inadequately cleaned.

4.1.7.4 Hazards caused by substances used for the cleaning or sterilizing of parts of the machine and/or containers including steam and hot water

Scalding and chemical burn hazards may exist.

4.1.8 Hazards caused by neglecting ergonomic principles

This may result in postural strain and upper limb disorders,

- e.g.
- during manual feeding of containers into a packaging machine
 - poor lighting of machine parts which the operator needs to see
 - inadequate access requiring difficult or awkward posture and/or movement for sight, adjustment, clearing blockages, cleaning or maintenance of parts of a machine
 - access which does not permit (without violating the machine's overall safety integrity by overriding/defeating safety functions) the necessary sight, adjustment, clearing blockages, cleaning or maintenance of parts of a machine

4.1.9 Hazard combinations

The combined effect of pressurized filling of hot product can increase the risk of container breakage leading to the ejection of fragments of containers and product. This is one example of a hazard combination, there may be others.

4.1.10 Hazards caused by failure of energy supply

Hazards can result from the unexpected movement of the machine due to residual energy in the system, or loss of energy from the system

- e.g.
- fall of lifting components or product in a case packer/unpacker
 - the sudden movement of a pneumatic cylinder when an obstruction is removed

4.1.11 Hazards due to guards being removed or incorrectly adjusted on machines which accommodate different sizes of container or label

If a guard is removed (e.g. an interchangeable guard designed for a particular size of container or label magazine), or incorrectly adjusted it may be possible to reach into the danger zone. Incorrectly positioned adjustable guards may also create crushing, shearing, impact, friction or abrasion hazards between the guard and moving containers.

4.1.12 Hazards caused by faults in control systems and controls

Hazards can result from the failure of electrical, hydraulic, pneumatic or mechanical components, and may include.

- unexpected/unintended start-up;
- failure of the control modes for setting, teaching, process changeover, cleaning, maintenance and modification (including programming and re-programming) or fault finding,
- unexpected/unintended speed change;
- failure of safety devices;
- the incorrect or inadvertent selection of controls;
- the lack of suitable stop devices;
- the use of controls which only require a single activation (e.g. a single button allowing the other hand to approach danger).

4.2 Machine Specific Hazards

This section covers those hazards which are unique to the machine described. It shall be used in conjunction with 4.1 "Common Hazards" to ensure that the full range of hazards are identified.

4.2.1 Hazards associated with filling machines (other than cask, keg and barrel filling machines)

- 4.2.1.1 A crushing hazard can exist between the filling nozzle and the container to be filled. There are also crushing, shearing and entanglement hazards where the container is presented to the filling nozzle and scrolls/starwheels, if present, and where the containers are discharged from the machine.
- 4.2.1.2 There can be an impact hazard to the eye and facial injury hazard if a container shatters or parts of a broken container or products being filled are ejected during the filling cycle. There is an increased risk of face and eye injury on pressurizing and in the filling zone (see Figure 5).
- 4.2.1.3 There is a falling hazard when cleaning and maintenance work is being undertaken on large machines, particularly if elevated access is required.
- 4.2.1.4 There can be a hazard when filling flammable products that a potentially explosive/flammable atmosphere is created around the machine.

4.2.2 Hazards associated with capping, closing and sealing/seaming machines

4.2.2.1 Rotating closing heads

There are trapping and shearing hazards in the rotating closing heads and also between these and the non-moving parts of the machine.
(Similar to the hazard described in 4.1.1.5.)

4.2.2.2 Cap presses

Reciprocating heads which press out cap foils and apply caps to containers can produce trapping and shearing hazards.

4.2.2.3 Corking machines

Shearing, trapping and crushing hazards exist between the corking head and the containers to be closed.

4.2.2.4 Hoppers

There is a falling hazard where access to the hopper is necessary during loading.

4.2.3 Hazards associated with container cleaning machines (other than cask, keg and barrel cleaning machines)

4.2.3.1 Feed and discharge of washing and rinsing machines

At the feed and discharge stations, hazards are caused by trapping, crushing, and shearing points (Figures 6 and 7). There are other container transport mechanisms which create a similar hazard.

4.2.3.2 Inspection points

There may be access to trapping and shearing hazards due to moving machinery at inspection points.

4.2.3.3 Chemical cleaning solutions

Contact with solutions which can be at a high temperature or under pressure, and may be toxic, irritant or corrosive, can be hazardous.

4.2.3.4 Filling, topping-up and sampling

Filling, topping up or sampling of a cleaning agent can produce a chemical splash hazard.

4.2.3.5 Hazards caused by the generation of toxic and flammable gases

Chemical reactions within the machine can produce toxic or flammable gases, e.g. between aluminium and sodium hydroxide producing hydrogen.

4.2.3.6 Hazards due to label residue (presses and scrapers)

There are crushing, trapping and potential burn hazards at the residue discharge.

4.2.3.7 Microbiological hazards from water

There can be microbiological hazards associated with re-cycled water, re-circulated water and stagnant water.

4.2.3.8 Hazards associated with double-ended container cleaning machines

Where the container feed and discharge stations are at opposite ends of the machine, there can exist the hazard of unexpected start-up of the machinery at one of the stations if the machine is started by an operator at the other station.

4.2.4 Hazards associated with linear and rotary rinsing and air cleaning machines

4.2.4.1 There are cutting, crushing and entanglement hazards at the transport mechanism (see 4.1.1).

4.2.4.2 There is an additional hazard associated with air cleaning machines of the possible discharge of compressed air, or debris causing eye and facial injury.

4.2.5 Hazards associated with labelling, decorating, coding and marking machines

4.2.5.1 Linear and rotary labelling machines

These machines have many “common” hazards from parts such as scrolls, starwheels and other rotating components (see Figure 4). Trapping, shearing and entanglement hazards may also be present at non-operational heads of multi-position labelling machines.

4.2.5.2 Oscillating label magazines

Trapping and shearing hazards may exist between the oscillating magazine and the fixed parts of the machine (see Figure 8).

4.2.5.3 “Roll through” can labelling machines

Trapping and shearing hazards exist between the moving containers and the fixed guide rails and between the moving containers and the accelerator drive belts.

4.2.5.4 Labelling machines using hot melt adhesive

The high temperature of the nozzle and the adhesive can cause burns and there is a potential hazard from the ejection of hot melt glue from the machine (see also 4.1.3).

4.2.5.5 Hot foil coding units

There may be both mechanical and burn hazards at this operation (see 4.1.1.5 and 4.1.3).

4.2.5.6 Laser coding

Contact with collimated high intensity laser light can cause burns. The etching of labels leads to the creation of dust and fumes.

4.2.5.7 Ink jet coding machines

The solvents used in many inks and for cleaning may be flammable and/or toxic. There is the risk of a flammable/explosive concentration of vapours forming if the emissions are not adequately controlled.

There is also a risk of flexible hoses failing during use and releasing flammable ink.

4.2.6 Hazards associated with decapping/unscrewing machines

The rotary motion of the unscrewing tools produces a trapping, entanglement and shearing hazard.

4.2.7 Hazards associated with machines which inspect and reject containers

Impact, stabbing and trapping hazards exist at ejection points when full or broken containers are ejected (see 4.1.1.6).

4.2.8 Hazards associated with machines that apply wiring to secure stoppers in bottles

There are trapping, shearing and entanglement hazards at the wire brace handover station and the wire twisting station.

4.2.9 Hazards associated with machines which combine rinsing, inspecting, filling, sealing and labelling containers

See 4.2.2, 4.2.3 and 4.2.5 for machine specific hazards and 4.1 for common hazards.

4.2.10 Hazards associated with barrel, keg and cask pushing, turning, cleaning and filling machines (excluding multi-lane plants)

- 4.2.10.1 On automatic installations there are trapping, crushing, impact and shearing hazards between the moving containers and fixed/moving parts of the machine and also the fixed and moving parts of the machine itself.
- 4.2.10.2 On semi-automatic machines there are trapping, crushing and shearing hazards created at the clamping head (see Figures 9 and 10).
- 4.2.10.3 Impact and crushing etc. hazards may exist from parts of the machine situated either side of manual work stations.
- 4.2.10.4 There is a chemical burn hazard due to contact with the cleaning solution which can be toxic, irritant or corrosive. Burns and scalds can be caused by the escape of hot cleaning fluid or steam from the machine.

4.2.11 Hazards associated with packing, unpacking and unscrambling machines

Trapping and shearing hazards occur between container gripper heads and transfer mechanisms and the machine frame and between the containers and also the crates.

Containers may fall from the gripper heads giving rise to impact, splashing or cutting hazards.

4.2.12 Hazards associated with unpressurized pasteurizers and back-cooling machines

There are hazards caused by hot water or surfaces and steam. Other “common” hazards are present including mechanical traps, container breakages and hot pipework (see 4.1).

4.2.13 Hazards associated with continuous vertical and horizontal sterilizing machines

Trapping, shearing and crushing hazards exist at container infeed and discharge mechanisms, e.g. sweep bars, moving carrier chains, etc.

5. SAFETY REQUIREMENTS AND MEASURES

Machinery shall comply with the safety requirements and/or measures of this clause. In addition, the machine shall be designed according to the principles of EN 292 for hazards which are not dealt with by this standard.

Because there are a wide range of pre-formed container filling machines, and the types and size of containers they handle, the designer shall carry out a risk assessment for his machine in accordance with EN 1050 and check the results of that assessment against the hazards listed in clause 4.

Safety requirements for hazards which are common to more than one type of machine included in this standard are dealt with in 5.1. Safety requirements for hazards which are machine specific are **additionally** covered in 5.2.

5.1 Common Safety Requirements

5.1.1 Safety Requirements for Mechanical Hazards

All mechanical hazards shall where possible be avoided by design (see clause 3 of EN 292-2:1991). Where it is not possible to avoid a hazard by design one or more of the protective measures (see 5.1.1.1) shall be taken, unless the standard requires a specific protective measure, or an alternative. Any residual hazards shall be indicated by warning labels positioned adjacent to the hazard and included in the instructions for use. If personnel protective equipment is required this shall be stated in the instructions for use.

5.1.1.1 General protective measures

Safety requirements for the protective measures referred to in 5.1.1 are given in 5.1.1.1.1 to 5.1.1.1.5. In addition, information shall be supplied to the user on the recommendations for the adjustment, maintenance and performance testing of these protective measures.

5.1.1.1.1 Fixed guards

Fixed guards (3.25.1 of EN 1070:1998) and interchangeable guards (5.1.11), shall be dimensioned using the safety distances of EN 294 Tables 3 or 4 and designed in accordance with EN 953, so as to prevent access to the hazard.

5.1.1.1.2 **Interlocking guards**

Interlocking guards (3.25.4 of EN 1070:1998) shall be designed in accordance with EN 953, employing the techniques specified in EN 1088, in a control system complying with EN 954-1 Category 1 (see 5.1.12.2), such that the hazard from dangerous parts (including containers) is rendered safe before contact with those parts can be made. This may require the use of a braked motor or guard locking (see clause 5.5 of EN 1088:1995).

5.1.1.1.3 **Electrosensitive protective equipment (ESPE)**

Electrosensitive protective equipment shall be designed in accordance with 5.1.12.3 and positioned in accordance with prEN 999, such that the hazard from dangerous parts (including containers) is rendered safe before contact with those parts can be made.

5.1.1.1.4 **Adjustable guards**

Adjustable guards (3.25.3 of EN 1070:1998) shall be designed in accordance with EN 953, so that when correctly adjusted (see also 5.1.11) can achieve the safety distances of EN 294:1994 Table 4 and prevent access to the hazard.

5.1.1.1.5 **Protective structures**

Protective structures (3.1 of EN 294:1994) shall be designed and positioned according to the safety distances in EN 294:1992 Tables 1 or 2, or EN 811, so as to restrict access to the hazard.

5.1.1.2 **Protective measures for specific hazards**

The following protective measures shall be taken for the specific hazards listed in this clause.

5.1.1.2.1 **Safety Requirements for crushing hazards**

Either one or a combination of the protective measures (see 5.1.1.1), or, where appropriate, safety gaps complying with Table 1 of EN 349:1993 shall be used.

5.1.1.2.2 **Safety Requirements for cutting and severing hazards**

In addition to one or a combination of the protective measures (see 5.1.1.1), cutting tools shall be designed so that they can be removed or replaced safely. This may require the provision of handholds, jigs or attachments to provide a safe handhold.

5.1.1.2.3 Safety Requirements for friction or abrasion hazards

Where this risk is low and other mechanical hazards are not present, protective structures dimensioned using EN 294:1992 Table 1 may be used.

5.1.1.2.4 Safety Requirements for high pressure fluid ejection hazards

The guarding provided in accordance with 5.1.1.1 shall be designed to prevent splashing of the operator by containing the fluid within the machine and of sufficient strength and size to prevent injury. Where the fluid under pressure is hazardous, hot or very cold, or flammable, the guards shall be constructed of a material suitable to withstand the chemical and physical effects of the fluid.

5.1.1.2.5 Safety Requirements to prevent the ejection of containers or parts of containers

The guarding provided in accordance with 5.1.1.1 shall be of sufficient height and strength to contain ejected parts and prevent injury. This may require enclosure of the part of the machine where the risk exists.

5.1.1.2.6 Safety Requirements for the loss of stability hazard

The machine shall be designed and constructed to avoid this hazard (e.g. balancing rotating parts or the provision of suitable anchorage points, to prevent unwanted movement which may pose a hazard).

5.1.1.2.7 Safety Requirements for slip, trip and fall hazards

Where there is the risk of falls from the machine a safe place of work shall be provided in accordance with prEN 12437-3:1996. Where access is provided on machinery over 500 mm above floor level safety rails according to clause 7 of prEN 12437-3 shall be provided to prevent falls.

Means of access on machines shall wherever possible be designed to be free from tripping hazards. If a tripping hazard is unavoidable it shall be marked (e.g. using black and yellow stripes) so that it can easily be identified whilst access is gained.

Where spillage of product or cleaning materials on means of access or place of work may create a risk of slips, steps shall be taken to prevent spillage (e.g. see 5.1.1.2.4), or where that is not possible, mitigate the consequences of such spillage (e.g. the provision of non-slip surfaces and drainage).