

Safety of packaging machines

Part 8: Strapping machines

ICS 55.200

National foreword

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

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Foreword

This document (EN 415-8:2008) has been prepared by Technical Committee CEN/TC 146 “Packaging machines – Safety”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2008, and conflicting national standards shall be withdrawn at the latest by July 2008.

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

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

For the relationship with EU Directives, see informative Annexes ZA and ZB, which are an integral part of this document.

Other standards produced by this Technical Committee are:

EN 415 Safety of packaging machines;

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.

Part 4: Palletizers and depalletizers.

Part 5: Wrapping machines.

Part 6: Pallet wrapping machines.

Part 7: Group and secondary packaging machines.

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

Introduction

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

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

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

1 Scope

This European Standard applies to the following groups of machines:

- powered hand strapping tools;
- semi-automatic strapping machines;
- automatic strapping machines;
- horizontal pallet strapping machines;
- vertical pallet strapping machines.

The individual machines are described in 3.3.

This European Standard deals with safety requirements for machine design, construction, installation, commissioning, operation, adjustment, maintenance and cleaning of strapping machines.

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

Exclusions

This European Standard is not applicable to the following machines:

- strapping tools that are powered exclusively by manual effort;
- strapping machines that were manufactured before the date of publication of this document by CEN.

This European Standard does not consider the following hazards:

- the use of strapping machines in potentially explosive atmospheres;
- the health, safety or hygiene hazards associated with the products that may be handled by the machines, but does include general advice on this subject;
- hazards that can be associated with electromagnetic emissions from strapping machines;
- hazards that can be associated with decommissioning strapping machines.

2 Normative references

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

EN 294:1992, *Safety of machinery — Safety distance 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 415-1:2000, *Packaging machines safety — Part 1: Terminology and classification of packaging machines and associated equipment*

EN 574:1996, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

EN 614-1:2006, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 619:2002, *Continuous handling equipment and systems — Safety and EMC requirements for equipment for mechanical handling of unit loads*

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 894-1:1997, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principals 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 894-3:2000, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and moveable guards*

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 speeds of parts of the human body*

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

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up*

EN 1050:1996, *Safety of machinery — Principles of risk assessment*

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1672-2:2005, *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*

EN 1760-2:2001, *Safety of machinery — Pressure sensitive protective devices — Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars*

EN 13478:2001, *Safety of machinery — Fire prevention and protection*

EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

EN ISO 3747:2000, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method for use in situ (ISO 3747:2000)*

EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

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

EN ISO 11201:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflective plane (ISO 11201:1995)*

EN ISO 11202:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ (ISO 11202:1995)*

EN ISO 11204:1995, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Method requiring environmental corrections (ISO 11204:1995)*

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

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

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

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

EN ISO 13850:2006, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

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

EN ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001)*

EN ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

EN ISO 14122-4:2004, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders* (ISO 14122-4:2004)

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements* (IEC 60204-1:2005, modified)

EN 60529:1991, *Degrees of protection provided by enclosures (IP code)* (IEC 60529:1989)

EN 61310-1:1995, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals* (ISO 61310-1:1995)

EN 61310-3:1999, *Safety of machinery — Indication marking and actuation — Part 3: Requirements for the location and operation of actuators* (ISO 61310-3:1999)

EN 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests* (ISO 61496-1:2004, modified)

CLC/TS 61496-3:2003, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)* (IEC 61496-3:2001)

EN 61508-1:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements* (IEC 61508-1:1998 + Corrigendum 1999)

EN 61508-2:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems* (IEC 61508-2:2000)

EN 61508-3:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements* (IEC 61508-3:1998 + Corrigendum 1999)

EN 62061:2005 *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems* (IEC 62061:2005)

ISO 7000:1989, *Graphical symbols for use on equipment — Index and synopsis*

IEC 60417:2002, *Graphical symbols for use on equipment*

3 Terms and definitions

3.1 General

For the purposes of this document, the terms and definitions given in Clause 3 of EN ISO 12100-1:2003, EN 415-1:2000 and the following apply.

3.2 Terms and definition

3.2.1

bayonet; lance; sword

section of strap chute that moves under power, typically to feed strap through a pallet

3.2.2

change parts

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

3.2.3

compression strapping

strapping process in which the product is compressed before straps are applied. Most of the types of strapping machine identified in 3.3 can be equipped with attachments to compress the product and may be termed compression strapping machines

3.2.4

hand operated

machine functions or modes where the only power source is directly applied manual effort

3.2.5

pack, package

assembly of product and packaging materials produced by a packaging machine

3.2.6

product

article or articles that are to be strapped by the strapping machine

3.2.7

strap

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

3.2.8

strap accumulator

mechanism or container located between the strap feed mechanism and the strap sealing mechanism which stores strap between the strap dispenser and the strap feed mechanism

3.2.9

strap arch; strap chute

device that guides the strap around the product

3.2.10

strap coil

length of strap wound around a core or in a container e.g. in a corrugated board box

3.2.11

strap cutting mechanism

device that cuts the strap

3.2.12

strap dispenser

mechanism that holds the strap coil and from which the strap is drawn off or which dispenses strap in a controlled manner

3.2.13

strap feed mechanism

powered mechanism that feeds the strap

3.2.14

strap gripping mechanism

device that grips the end of the strap while the strap is tensioned around the product

3.2.15

strap retraction mechanism

powered mechanism that pulls the strap around the product and applies tension to the strap

3.2.16

strap sealing mechanism

device that joins the strap using a clip, by welding the strap, or by cutting and interlocking the strap

3.2.17

strap tension mechanism

powered mechanism that applies tension to the strap around the product

3.2.18

strapping head

assembly mounted in a strapping machine comprising a strap feed mechanism, a strap retraction mechanism, a strap tensioning mechanism (not fitted to all strapping heads) a strap gripping mechanism and a strap sealing mechanism

3.2.19

strapping machine

packaging machine that applies a strap made from metal, plastic or paper around a product or group of products

3.2.20

strap tension

tension applied to the length of a strap during the strapping process

3.3 Description of machines

3.3.1

general

this European Standard identifies five different groups of strapping machines

3.3.2

powered hand strapping tool

characteristic features of a hand strapping tool are listed below. On a powered hand strapping tool at least one of these mechanisms will be powered e.g. by electricity or compressed air:

- strap gripping device;
- strap retraction mechanism;
- strap tension mechanism (optional);
- strap cutting device;
- strap sealing mechanism

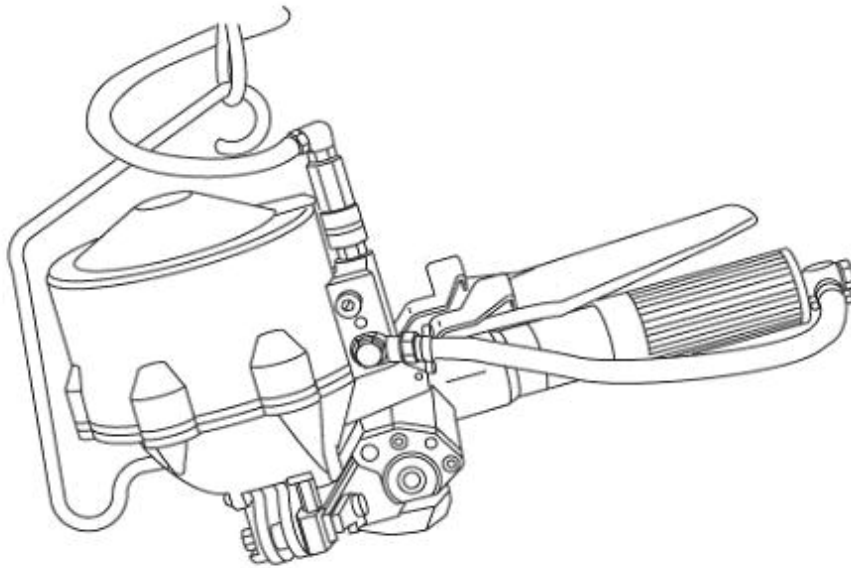


Figure 1 — Powered hand strapping tool

3.3.3

semi-automatic strapping machine

strapping machine that tensions and seals a strap around a product or a group of products, once an operator has placed the strap around the product and inserted the strap back into the machine manually. The strap will typically be made from plastic or paper. The characteristic features are:

- strap dispenser;
- strap feeding mechanism;
- strap gripping device;
- strap retraction mechanism;
- strap tension mechanism;
- strap cutting device;
- strap sealing mechanism;
- compression device (optional)

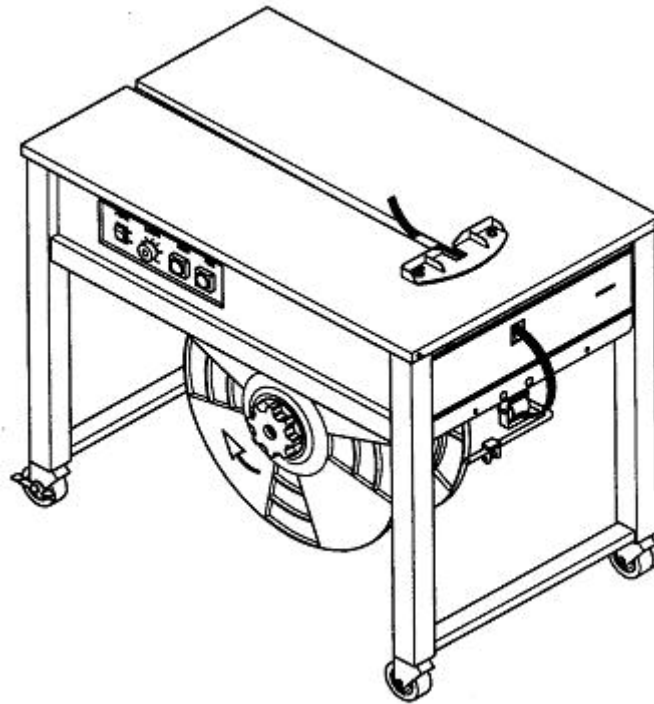


Figure 2 — Semi-automatic strapping machine

3.3.4

automatic strapping machine

strapping machine that applies a strap automatically around a product or a group of products. The product may be positioned under the arch either manually or automatically. The strap will typically be made from plastic, metal or paper. The characteristic features are:

- strap dispenser;
- strap feeding mechanism;
- strap arch or strap chute;
- strap accumulator;
- strap gripping device;
- strap retraction mechanism;
- strap tension mechanism;
- strap cutting device;
- strap sealing mechanism;
- compression device (optional);
- product feeding, discharging or positioning devices (optional);
- turntable to rotate the product (optional)

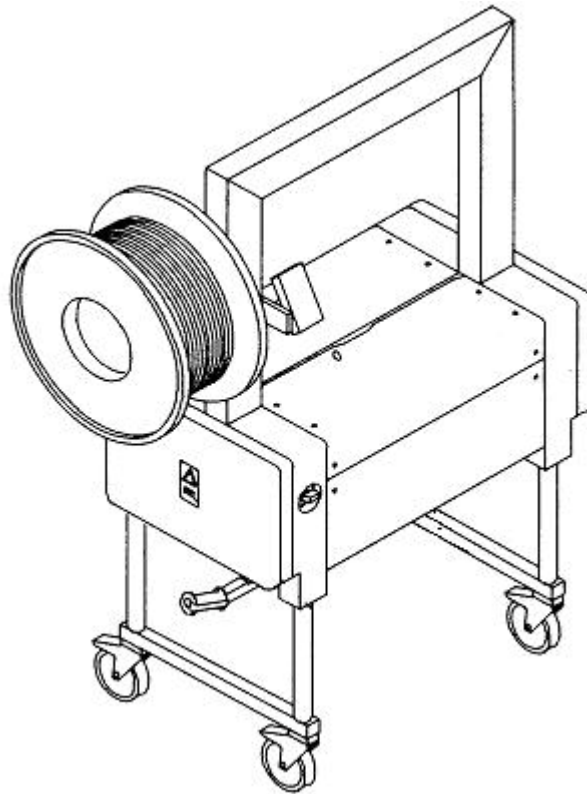


Figure 3 — Automatic strapping machine

3.3.5

horizontal pallet strapping machine

strapping machine that applies one or more straps horizontally around a pallet load. Machines of this type will typically be fully automatic. The strap will typically be made from plastic or metal. The characteristic features are:

- strap dispenser;
- strapping head;
- strap accumulator;
- mechanism to move the strapping head towards and away from the product;
- horizontal strap arch or strap chute;
- mechanism to raise and lower the strap arch or strap chute;
- product positioning device;
- compression device (optional);
- product conveying mechanism (optional)

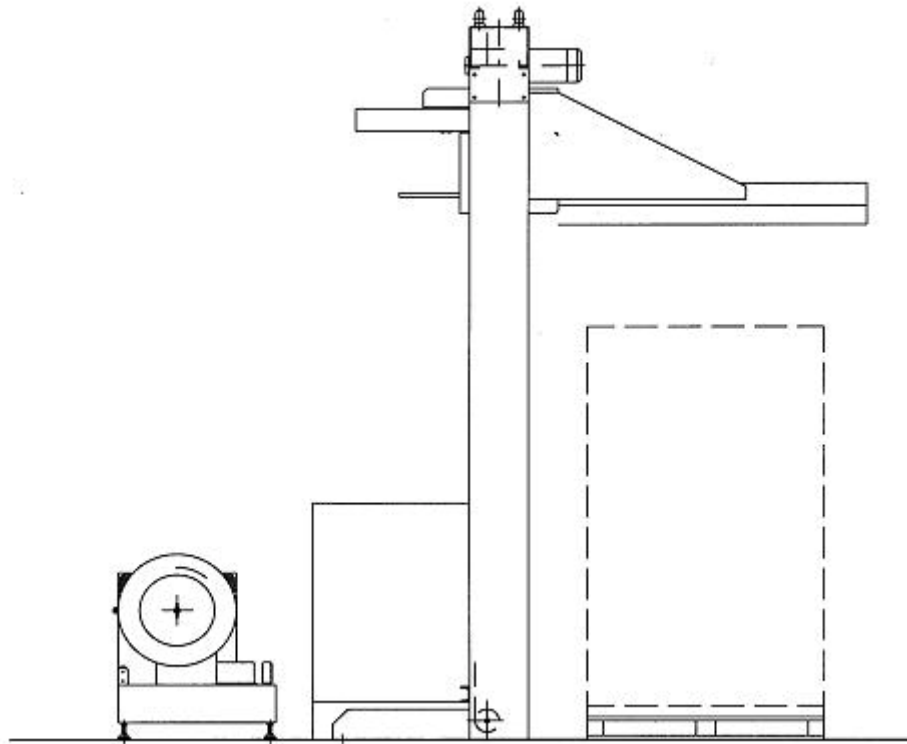


Figure 4 — Horizontal strapping machine

3.3.6

vertical pallet strapping machine

strapping machine that applies one or more straps vertically around a pallet load. The strap will typically be made from plastic or metal. Machines of this type will typically be fully automatic. The strapping head may be located above or to the side of the product being strapped. The characteristic features are:

- strap dispenser;
- strapping head;
- strap accumulator;
- mechanism to move the strapping head and bayonet towards and away from the product;
- vertical strap arch or strap chute;
- mechanism to move the strap arch or strap chute together with the strapping head from side to side (optional);
- compression device (optional);
- product conveying mechanism (optional);
- turntable to rotate the product (optional);
- product positioning devices (optional)

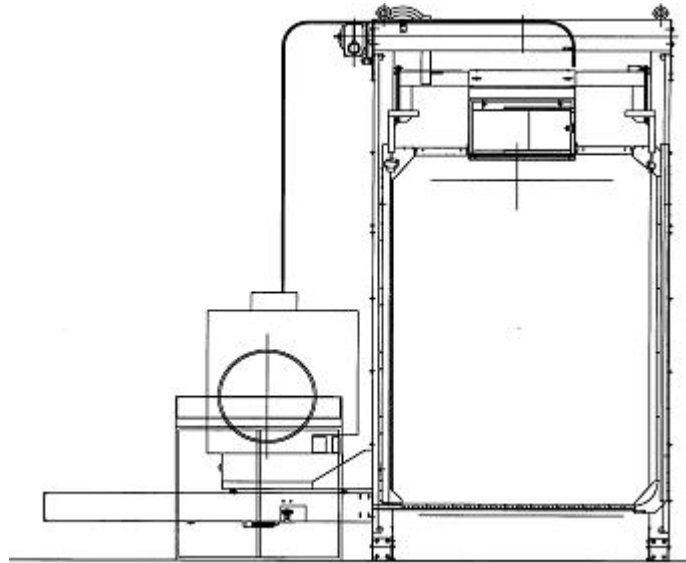


Figure 5 — Vertical strapping machine

4 Hazards on strapping machines

4.1 General

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

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

If the manufacturer identifies hazards that are not listed in this clause, he shall assess these hazards by using the principles detailed in EN 1050.

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

The hazards that occur on most strapping machines are listed in 4.2 and the hazards that are specific to particular types of strapping machine are listed in 4.3 to 4.7.

4.2 General strapping machine hazards

4.2.1 General

The following hazards occur on most strapping machines.

4.2.2 Mechanical hazards

4.2.2.1 Moving parts

Strapping machines incorporate moving parts which present a variety of mechanical hazards including crushing, shearing, cutting, entanglement, friction and drawing-in. Stored energy can cause some of these hazards to persist after the power supply has been cut off.

4.2.2.2 Pneumatic and hydraulic equipment

Pneumatic and hydraulic equipment presents crushing, shearing, ejection of parts, explosion and injection of fluids hazards. Stored energy in pneumatic or hydraulic systems can cause mechanisms to move unexpectedly even when power supplies are disconnected. In addition hydraulic oil and pneumatic lubricating oil present a potential fire hazard and can contaminate agri-foodstuffs.

4.2.2.3 Slip, trip and fall hazards

Slip accidents can occur if waste strap, lubricants or the product are left or spill onto traffic routes, workstations or means of access around the machine.

Trip accidents can occur if parts of the machine protrude beyond the machine frame at low level, or if cables and pipes associated with the machine are incorrectly installed.

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

4.2.2.4 Loss of stability

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

a) While the machine is in operation for example:

- 1) if the centre of gravity of the machine is too high;
- 2) if someone stands on the machine.

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

- 1) if the manufacturers lifting instructions are not followed;
- 2) on machines fitted with wheels if the machine is moved on a slope or uneven surface.

4.2.2.5 Hazards from moveable guards

Moveable guards can present crushing, shearing and impact hazards when they open or close if they have a high mass or move under gravity. If excessive effort is necessary to operate the guard and/or it is positioned in an unfavourable position, the operator can sustain strain injuries or damage to health. Powered guards can present crushing, shearing and impact hazards.

4.2.3 Electrical hazards

4.2.3.1 Electrical equipment

Electrical equipment on the machine generates a potential electric shock and burn hazard and in the presence of combustible materials there is a potential fire hazard. Electrical systems can act as an ignition source in the presence of flammable substances or products that can create explosive atmospheres; this could give rise to an explosion hazard.

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

4.2.3.2 Electrostatic phenomena

Electric shock hazards can arise if parts of the machine or materials become electro statically charged e.g. when running with plastic strap. Electrostatic discharge can be a source of ignition in the presence of flammable substances or explosive atmospheres.

4.2.4 Thermal hazards

Parts of the machine e.g. sealing mechanisms and drive motors, which have high surface temperatures, can cause burning hazards. See EN ISO 13732-1 for details of the burn thresholds for different materials and contact times.

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

4.2.5 Noise

Noise generated by strapping machines can result in:

- a) permanent hearing loss;
- b) tinnitus;
- c) tiredness, stress etc.;
- d) other effects such as loss of balance, loss of awareness;
- e) interference with speech communication;
- f) inability to hear acoustic warning signals.

4.2.6 Hazards from products and materials

4.2.6.1 Hazards generated by products

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

Hazards generated by the product can include:

- a) ingestion of harmful substances e.g. insecticides, aggressive or harmful chemicals, pharmaceuticals;
- b) fire or explosion e.g. flammable liquids, explosives, dusty products;
- c) biological hazards e.g. vaccines;
- d) impact by ejected packaging materials or products e.g. broken glass.

4.2.6.2 Strapping materials

Strap will typically be made from plastic, metal or paper. These materials present the following hazards:

- a) burning hazards from hot plastic or plastic strap;
- b) inhalation of harmful substances from heated or burning plastic e.g. polyester strap (PET);
- c) cuts from strap edges or ends;
- d) cuts from metal clips.

4.2.7 Hazards due to neglecting ergonomic principles

Hazards to safety and health can occur when people are carrying out the following activities on strapping machines:

- a) operation e.g. assuming a bad posture, mental overload or mental underload including the use of manual controls that have inadequate design, location or identification;
- b) operation, cleaning and maintenance of machines under poor lighting conditions;
- c) loading strap coils e.g. assuming a bad posture, using excessive effort, fatigue;
- d) loading products or unloading packages e.g. assuming a bad posture; performing unnatural hand or arm movements, using excessive effort, mental overload or mental underload;
- e) size and product changing, e.g. assuming a bad posture, using excessive effort;
- f) cleaning the machine e.g. assuming a bad posture, using excessive effort;
- g) maintenance e.g. assuming a bad posture, using excessive effort;
- h) moving the machine e.g. using excessive effort, fatigue.

4.2.8 Hazards caused by failures

4.2.8.1 Failure of power supplies

The following hazards can occur on strapping machines if their power supplies fail:

- a) uncontrolled lowering or falling of machine assemblies or product;
- b) unexpected locking of brakes or other components;
- c) failure of the braking function;
- d) unexpected movement of assemblies when power is reconnected or due to stored energy.

4.2.8.2 Failure of safety related parts of control systems

Hazards can arise if components in safety related parts of control systems fail. These failures can occur due to mechanical damage, contact failure, electronic component failure or deliberate defeating by operators. Failures can lead to unexpected start-up of moving parts, incorrect sequencing of machine operations or prevent moving parts from stopping as expected.

4.2.8.3 Failure of motor drive systems

On electronic drive systems where the power supply to a drive motor is not disconnected while the guards are open, there is a risk of unexpected start-up with consequential mechanical hazards if the control system fails or responds to an external disturbance such as electromagnetic interference.

4.2.9 Hazards due to neglecting hygienic design principles

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

4.2.10 Size and product changing

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

- a) danger zones on the machine can be exposed when components are moved;
- b) handling change parts can give rise to ergonomic hazards;

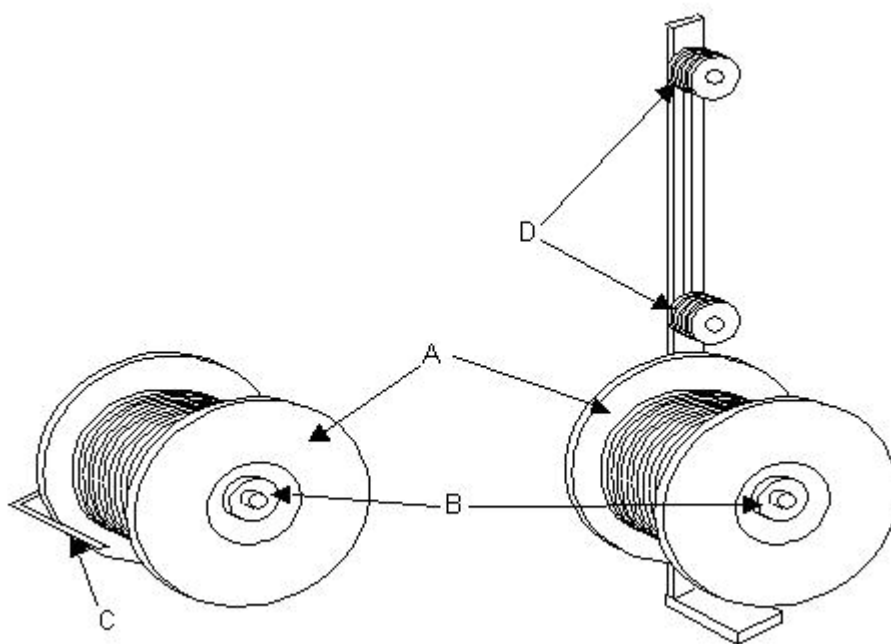
- c) where size or product changing is carried out under power, shearing and crushing hazards are likely to be present.

4.2.11 Hazards specific to common mechanisms on strapping machines

4.2.11.1 Strap dispenser

The strap dispenser comprises the coil holder, which holds the coil of strap and a braking mechanism. The strap dispenser may be powered on machines where the strap coil is large or very heavy. The strap dispenser presents shearing, entanglement, drawing-in and cutting hazards. Back strain or other muscular skeletal problems can occur if ergonomic design principles are neglected when positioning the coil holder or if the mass of the coil of strap is too great for manual handling.

Figure 6 illustrates the components that typically present hazards on a strap dispenser.



Key

- A dispenser flanges
- B dispenser flange nut
- C dispenser brake arm
- D strap wheels or pulleys

Figure 6 — Typical components on a strap dispenser

4.2.11.2 Strap feeding mechanism

The strap feeding mechanism, which on most machines will be contained within the strapping head, pulls strap from the accumulator if fitted, or directly from the strap dispenser. The strap feeding mechanism presents crushing, drawing-in and entanglement hazards.

4.2.11.3 Strap gripping device

The strap gripping device, which on most machines will be contained within the strapping head, creates a crushing or entanglement hazard.

4.2.11.4 Strap retraction mechanism

The strap retraction mechanism, which on most machines will be contained within the strapping head, can present drawing-in or crushing hazards.

4.2.11.5 Strap tension mechanism

The strap tension mechanism, which on most machines will be contained within the strapping head, can present drawing-in or crushing hazards.

4.2.11.6 Strap cutting device

The strap is generally cut by a mechanical assembly, usually in the form of moving and fixed cutters, which on most machines will be contained within the strapping head. These present a shearing and entanglement hazard when they move together, but typically do not present a cutting hazard when handled during maintenance.

4.2.11.7 Strap sealing mechanism

Plastic strap is sealed with a heated surface, friction welding segments or by ultrasonic vibration. These mechanisms, which on most machines will be contained within the strapping head, can present crushing, burning, vibration and noise hazards. If the strap melts and burns on the sealing mechanism fumes can be given off giving rise to an inhalation of unpleasant or harmful substances hazard. This is a significant hazard when heat-sealing polyester (PET) strap.

Metal strap is joined using shearing and cutting tools, with metal clips, or by welding. These mechanisms, which on most machines will be contained within the strapping head, present crushing, shearing, cutting and burning hazards.

4.2.11.8 Strap tension

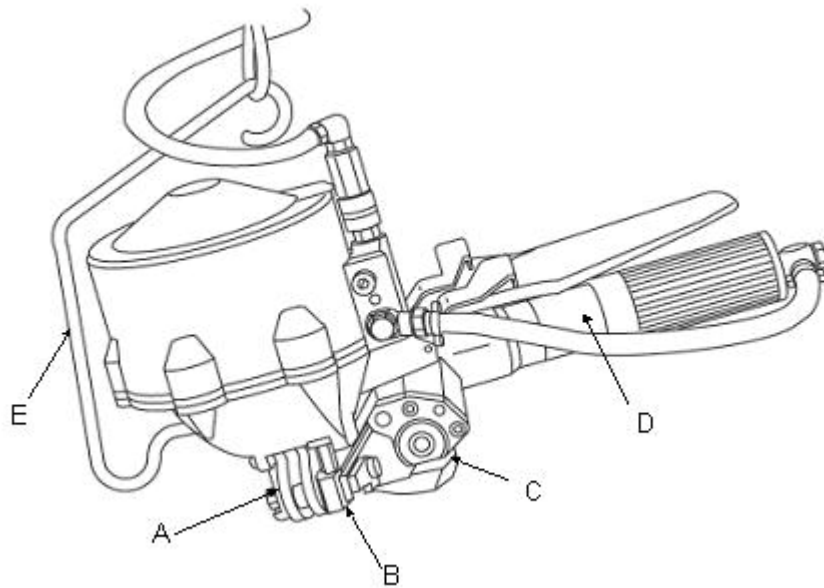
As the strap is tensioned around a product, a crushing and cutting hazard exists if parts of the body e.g. hands, arms, head are between the strap loop and the product, there is also a shearing hazard if the trapped person tries to pull their hand or arm out from under the tensioned strap. This hazard for a given strap tension increases under the following circumstances:

- a) if the product is rigid and not deformable;
- b) at the corners of a rectangular product;
- c) as the strap width decreases;
- d) if the strap edge is sharp e.g. metal strap;
- e) as the tensioning time increases.

4.3 Hazards associated with a powered strapping tool

The hazards described in 4.2 and this subclause are specifically associated with powered strapping tools.

Figure 7 illustrates the components that typically present hazards on a powered strapping tool.



Key

- A sealing and crimping jaws
- B strap cutter
- C tension wheel / assembly
- D handle
- E suspension bow

Figure 7 — Typical components on a powered strapping tool

Powered strapping tools will incorporate most of the mechanisms described in 4.2.11.1 to 4.2.11.8 however some of these mechanisms will be powered by hand or require manual intervention. Where mechanisms are powered, there is the potential for crushing, shearing, drawing-in, entanglement, cutting and burning hazards.

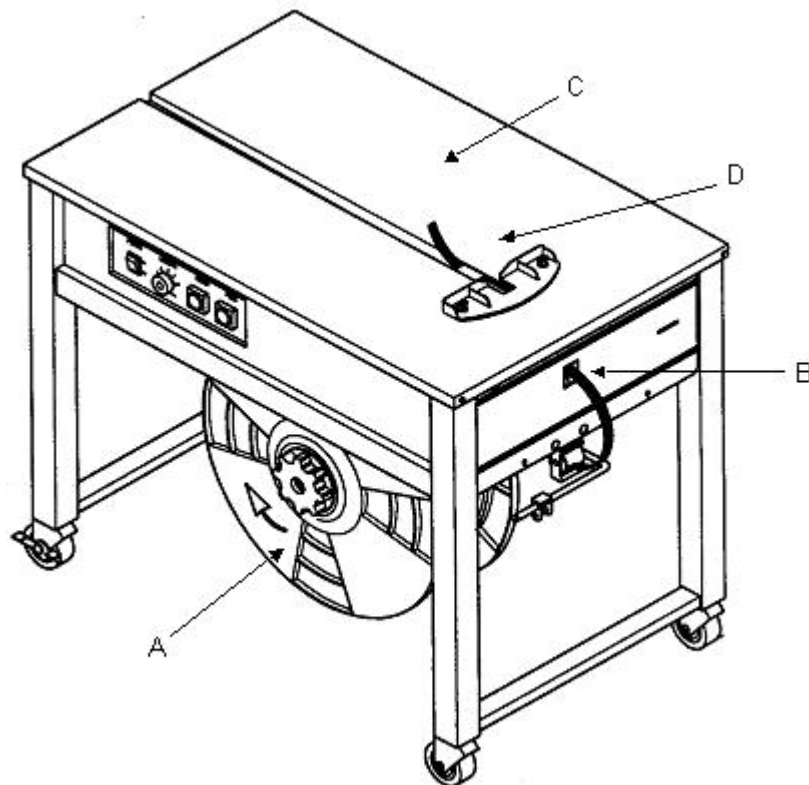
In addition there is the risk of transmitting vibration to the operator's hand and an impact hazard if the operator drops or loses control of the tool. Muscular skeletal injuries can occur if ergonomic design principles are neglected e.g. if the mass of the tool is too great or the work requires repetitive movements or awkward postures.

4.4 Hazards associated with a semi-automatic strapping machine

4.4.1 General

The hazards described in 4.2 and this subclause are specifically associated with semi-automatic strapping machines.

Figure 8 illustrates the components that typically present hazards on semi-automatic strapping machines.



Key

- A strap dispenser
- B strap feeding mechanism
- C product support table
- D strapping head

Figure 8 — Typical components on a semi-automatic strapping machine

4.4.2 Strap dispenser

On semi-automatic strapping machines the strap dispenser may be positioned underneath or to one side of the machine. In addition to the hazards described in 4.2.11.1. Back strain or other muscular skeletal problems can occur if the manufacturer does not take into account ergonomic design principles when positioning the coil holder.