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British Standards

Head Office
389 Chiswick High Road
London W4 4AL

Telephone: +44(0)20 8996 9000
Fax: +44(0)20 8996 7001

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Title: Draft British Standard BS EN 415-5 Packaging machines safety -
Part 5: Wrapping machines

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Responsible Committee Secretary: Mr I Greensmith (BSI) Direct tel: 020 8996 7142

E-mail: ian.greensmith@bsi-global.com

Introduction

This draft standard is based on European discussions in which the UK took an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent British Standard. If no comments are received to the contrary, then the UK will approve this draft and implement it as a British Standard. Comment is particularly welcome on national, legislative or similar deviations that may be necessary.

Even if this draft standard is not approved by the UK, if it receives the necessary support in Europe, the UK will be obliged to publish the official English Language text unchanged as a British Standard and to withdraw any conflicting standard.

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Date	Document

National Committee	Clause/ subclause	Paragraph/ Figure/ Table	Type of comment (General/ technical/editorial)	COMMENTS	Proposed change	OBSERVATIONS OF THE SECRETARIAT
	3.1	1st definition	Editorial	Definition is ambiguous and needs clarifying.	Amend to read '... so that the mains connector to which no connection ...'	
	6.4	§ 2	Technical	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.	

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 415-5

September 2002

ICS

English version

Packaging machines safety - Part 5: Wrapping machines

Sécurité des machines d'emballage - Partie 5: Emballage papier

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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. prEN 415-5:2002 E

Contents

Foreword

This document (prEN 415-5) 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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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

Other standards produced by the Technical Committee are:

EN 415 Packaging machines safety

Part 1: Terminology and classification of packaging machines and associated equipment

Part 2: Pre-formed rigid container packaging machines

Part 3: Form-fill-seal packaging machines

Part 4: Palletizers and depalletizers

Part 6: Unit load securing machines

Part 7: Group and secondary packaging machines

Introduction

Wrapping machines are used extensively in Europe, in an increasingly wide range of industries.

They contain many hazards and have the potential to cause serious injury.

The extent to which hazards are covered is indicated in the scope and clause 4 of this standard.

In addition, machines should comply as appropriate with EN 292 parts 1 , 2 and 2/1A for hazards which are not covered by this standard.

This document is a C standard as described in EN 1070. The machines concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

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

1 Scope

This European Standard specifies safety requirements for wrapping machines; it applies to:

— wrapping machines which partially wrap products (see figures 1-4)

— wrapping machines which form a complete wrap without sealing (see figures 5-7)

— wrapping machines which form a complete wrap with sealing (see figures 8-14)

— shrink tunnels which are connected to wrapping machines covered by this standard (see figures 15-16)

For types of wrapping machines not specifically covered by this standard the general clauses (4.1 and 5.1) can be applied where the equivalent hazard exists.

This standard covers the safety requirements for machine design, construction, installation, commissioning, operation, adjustment, maintenance, cleaning, decommissioning and scrapping as well as in the event of foreseeable misuse, faults or malfunctions which may occur in the equipment. This part of EN 415 is not applicable to wrapping machines manufactured before the date of publication by CEN.

Exclusions

This standard does not apply to larger examples of wrapping machines designed to handle product higher than 400 and wider than 400 mm. These machines are covered by EN 415-6.

This standard does not cover the safety or hygiene hazards associated with the products which may be handled on wrapping machines. For information about the hygienic aspects of wrapping machines designed for use with foodstuff reference should be made to EN 1672-2:1997.

This standard does not cover machines that handle products which may create a potentially explosive atmosphere and machines which have shrink tunnels using flames.

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 292-2/A1-2:1995, *Safety of machinery - 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 prevent crushing of parts of the human body.*

EN 418:1992, *Safety of machinery - Emergency stop equipment, functional aspects - Principles for design.*

EN 563:1994, *Safety of machinery - Temperature of touchable surfaces - Ergonomics data to establish temperature limit values for hot surfaces.*

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

EN 614-1:1995, *Safety of machinery - Ergonomic design principles – Part 1: Terminology and general principles.*

EN 614-2:2000, *Safety of machinery - Ergonomic design principles – Part 2: Interaction between machinery design and work tasks.*

EN 626-1:1994, *Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery – Part 1: Specifications for machinery manufacturers.*

EN 626-2:1994, *Safety of machinery - Reduction of risks to health from hazardous substances emitted by machinery – Part 2: Methodology leading to verification procedures.*

EN 953:1997, *Safety of Machinery – Guard - 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 983:1996, *Safety of machinery - Safety requirements for fluid power systems and components – Pneumatics.*

EN 999:1998, *Safety of machinery - The positioning of protective equipment in respect of approach speed of part of the human body.*

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 1672-2:1997, *Food processing machinery - Basic concepts – Part 2: Hygiene requirements.*

EN 60204-1:1997, *Safety of machinery – Part 1: Electrical equipment of machines*

EN 61310-2-3:1995, *Safety of machinery - Indication marking and actuation – Part 3: Requirements for marking.*

EN 61496-1:1998, *Electro-sensitive protective equipment – Part 1: General requirements.*

EN 61496-2, *Electro-sensitive protective equipment – Part 2: Photo-electric devices.*

EN ISO 14122-1, *Safety of machinery - Permanent means of access to machinery – Part 1: Choice of fixed means of access between two levels.*

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

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

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.*

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.*

EN ISO 3747:2000, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Comparison for use in situ.*

EN ISO 4871:1996, *Acoustics – Declaration and verification of noise emission values of machinery and equipment.*

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 levels at a work station and at other specified positions*

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.*

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.*

EN ISO 11688-1 1998, *Acoustics – Recommended practice for the design of low-noise machinery and equipment - Part 1 : Planning.*

ISO 7000:1989, *Graphical symbols for use on equipment – index and synopsis*

3 Definitions

In addition to those terms defined in EN 292-1, EN 1070 and EN 415-1, the following definitions apply, for the purpose of this standard.

3.1 Definition of terms

3.1.1
band
a strip of packaging material

3.1.2
deformable material
a material which can be formed by the application of pressure only

3.1.3
change parts
parts of the machine which need to be replaced during a set-up depending on the different size of the product or the packaging material

3.1.4
film compensator
a device which maintains tension in the film during the intermittent motion of the wrapping cycle. It is also called "tension roller assembly"

3.1.5
film (packaging material) reel
a continuous sheet of paper, carton board, plastics film, metal foil or flexible laminate wound on a cylindrical core

3.1.6
film web
a continuous sheet of paper, plastic film, metal foil or laminate

3.1.7
fold wrapping
a wrap in which the material, due to its plasticity, keeps the fold

3.1.8
fin seal
a seal in which the two edges of the material are joined together inner surface to inner surface

3.1.9
flexible packaging material
relatively thin paper, film or combination

3.1.10
hand operated
a machine or part of a machine which the only power source is directly applied by manual effort

3.1.11
hot metal adhesive
an adhesive or coating which is solid at room temperature and is melted so that it can be applied

3.1.12
lay flat tubular film
a continuous tube of plastic film usually supplied wound on a core

3.1.13
longitudinal seal
a seal made on a package in line with the direction of material travel in the machine

3.1.14
magazine
a mechanical assembly designed to hold stacks of cartons, carton blanks, leaflets, labels, lids or stackable containers

3.1.15
mandrel
a mechanical assembly around which a bag or carton is formed and also a film reel support

3.1.16
modified atmosphere
when a normal gaseous atmosphere within a package or unit load is replaced by one or more selected gases. The objective is to extent shelf or storage life of the packaged products

3.1.17
overlap seal
a seal in which two edges of the material are joined together inner surface to outer surface

3.1.18
paper laminate
paper that has been coated or bonded to one or a number of other materials e.g. polyethylene or aluminium foil

3.1.19
product
the substance or article being packed in a wrapping machine

3.1.20
roll wrapping
a wrap of cylindrical products with a roll shaped form

3.1.21
shrink wrapping
a process in which a package is wrapped in a thermoplastic film which is then heated so that the film shrinks and closely fits to the package

3.1.22
skin packaging
a packaging process in which a product is covered by a closely fitting usually transparent plastic film. The product is placed on a porous rigid paperboard sheet. Often printed, heated film is draped over it and vacuum is applied to draw the film tightly over the article

3.1.23
stretch film
plastic film which can be pulled tightly around a package. It may be formulated to stick to itself on contact

3.1.24
stretch wrapping
a wrapping process in which the film is wrapped around the product and sealed under tension

3.1.25
tear tape
a plastic tape which is sealed to a packaging material, usually plastic film, to assist opening of the pack

3.1.26
thermoplastic film
a plastic film which shrinks when heated

3.1.27
thermoformable material
a material which when heated can be formed by pressure and/or vacuum

3.1.28
transverse seal
a seal made on a package at right angles to the direction of material travel in the machine

3.1.29
twist wrap
a wrap sealed by twisting the open end

3.1.30
packaging material transport mechanism
a mechanical assembly which transport packaging material through the packaging machine

3.2 Description of wrapping machines

3.2.1 Banding machine

A wrapping machine which wraps a band of material around a product, or group of products, and secures it with adhesive or by application of heat (the machine may have one or two reels).

The characteristic features are:

— a feeding mechanism

— a reel unwind mechanism and film compensator

— a discharge mechanism

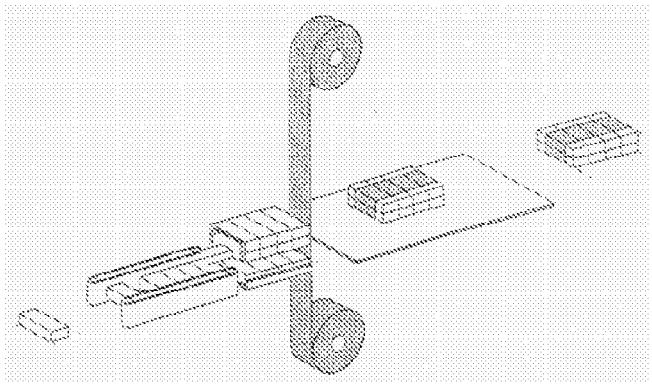


Figure 1 — Banding machine

3.2.2 Sleeve wrapping machines

A wrapping machine which wraps a web of thermoplastic material loosely around a product or group of products before the pack is passed through a shrink tunnel to form a shrink-wrap pack. The web may be formed from one or two reels of film.

The characteristic features are:

— a product feeding device with chain, belt, pusher and/or elevator

— a reel unwind mechanism with film compensator

— a discharge mechanism often connected to a shrink tunnel

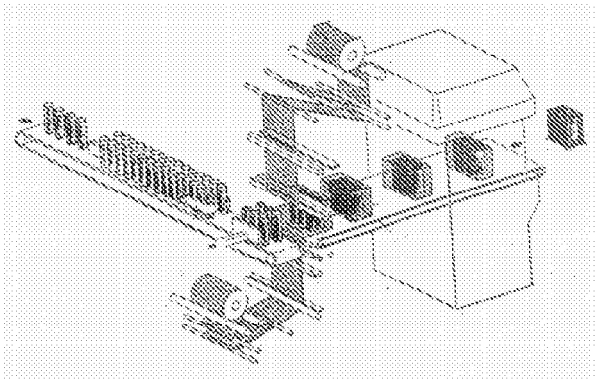


Figure 2 — Sleeve wrapping machines

3.2.3 Stretch banding machine (incorporating stretch film banding machine)

A wrapping machine which wraps a web of film or paper tightly around a product or group of products. The web may be formed from one or two reels of film.

The characteristic features are:

— a product feeding device with chain, belt, pusher and/or elevator

— a reel unwind mechanism with film compensator and two stretching rolls

— a discharge mechanism

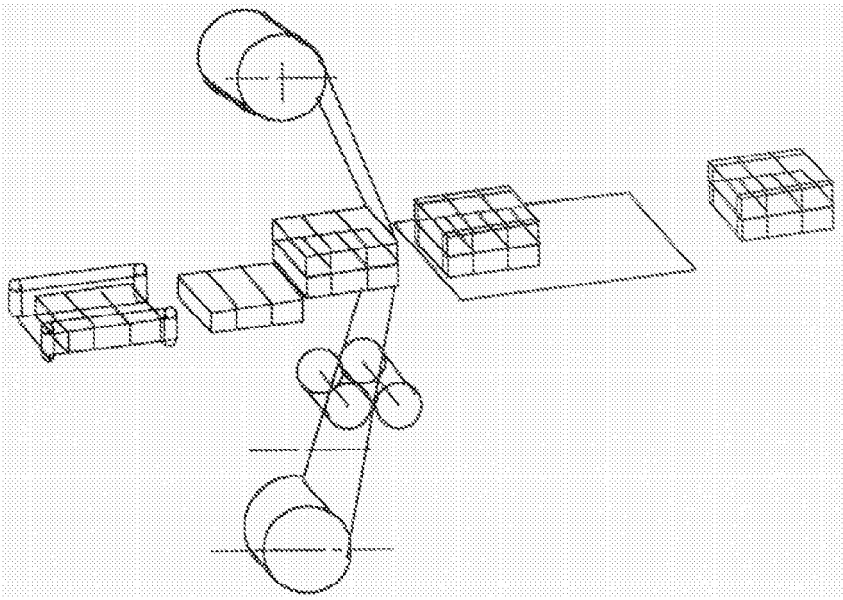


Figure 3 — Stretch banding machine

3.2.4 Spiral wrapping machine (incorporating film bundling machine)

A wrapping machine which wraps a web of thermoplastic film or paper tightly around a product or group of products in a series of turns while the products are conveyed through the machine. This machines makes a primary packaging on long articles/products lower than 400 mm different to the pallet stretch wrapping machines which are dealt in prEN 415-6.

The characteristic features are:

— a feeding group with a horizontal belt often with vertical rolls

— a wrapping head turning around the product

— a discharge conveyor

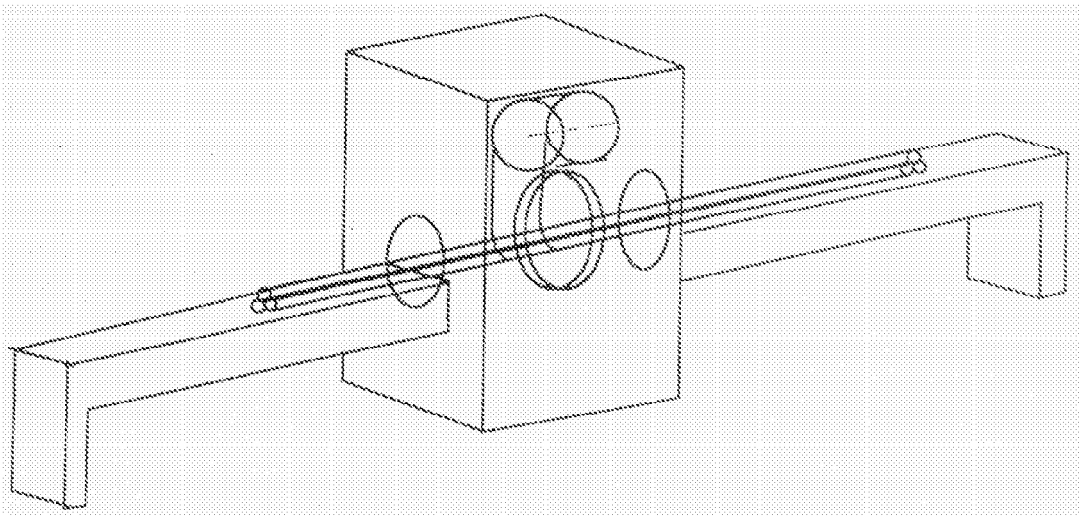


Figure **4** — Spiral wrapping machine

3.2.5 Fold wrapping machine

A wrapping machine which wraps a product in a deformable material e.g. aluminium foil or paper in a series of folding operations.

The characteristic features are:

— a feeding group with belt conveyor pusher and/or pincers

— a reel unwind mechanism with film compensator

— a discharge mechanism with belt, chain or wheel some times connecting to another machine.

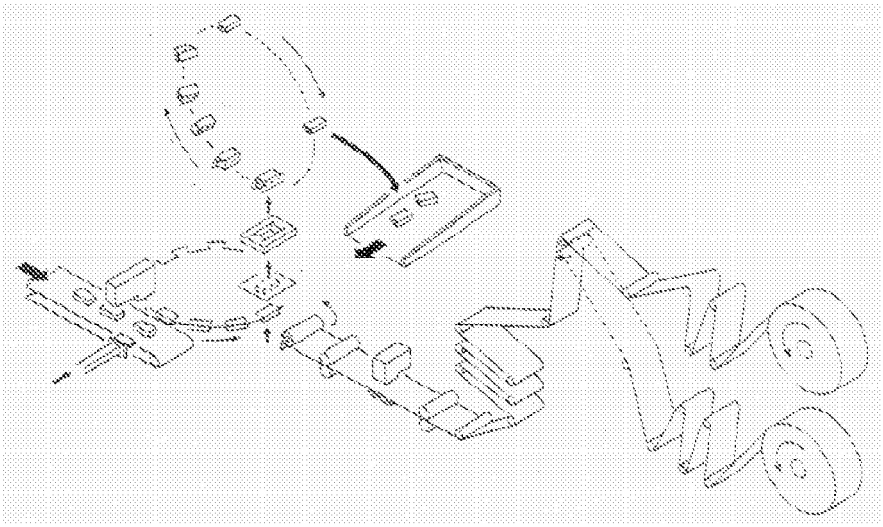


Figure **5** — Fold wrapping machine

3.2.6 Extruded product wrapping machine (incorporating fat/butter wrapping machine)

A fold wrapping machine in which the product is extruded, cut to size and then wrapped in a deformable material.

The characteristic features are:

— a feeding group with rolls

— a reel unwind mechanism with film compensator

— a discharge mechanism with belt

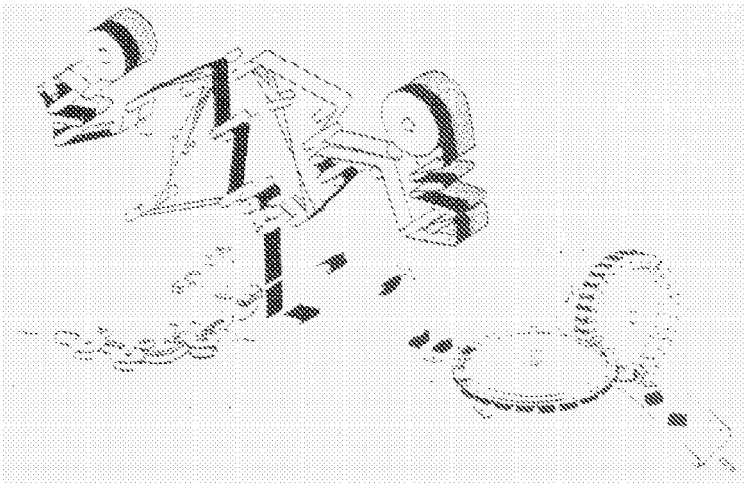


Figure 6 — Extruded product wrapping machine

3.2.7 Twist wrapping machine

A wrapping machine which seals the open ends of the wrap by twisting.

The characteristic features are:

— a feeding group with rotating disk

— a reel unwind mechanism with film compensator and often an automatic splicing mechanism

— a discharge mechanism with belt conveyor

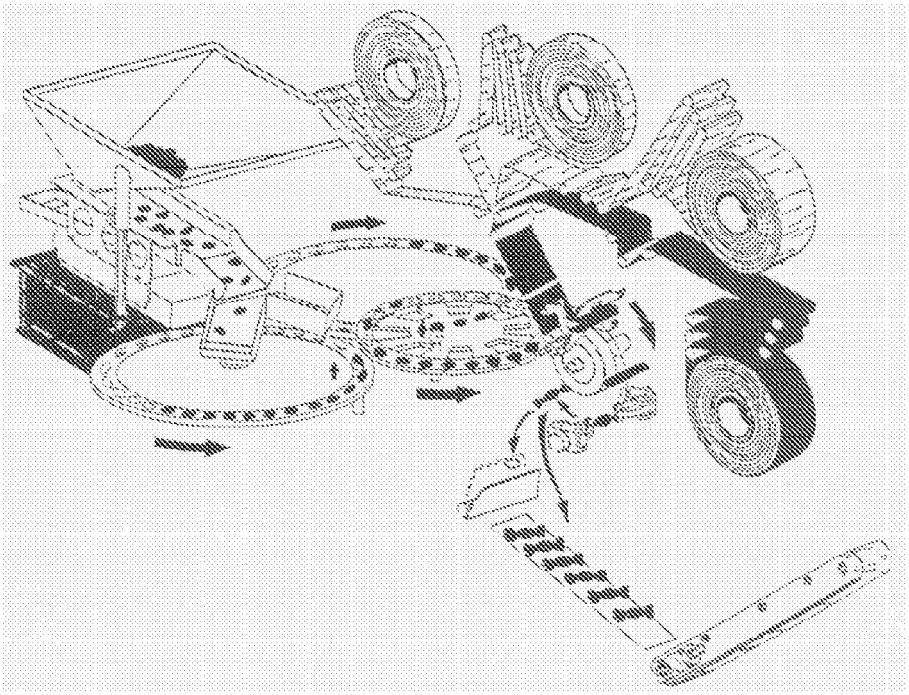


Figure 7 — Twist wrapping machine

3.2.8 Over-wrapping machine

A wrapping machine which wraps a product or group of products in flexible packaging material with a series of folding, heat sealing or glueing operations.

The characteristic features are:

— a product feed conveyor

— often a tear tape application group and an automatic splicing group

— a reel unwind mechanism with film compensator and often automatic splicing group

— a discharge mechanism with belt.

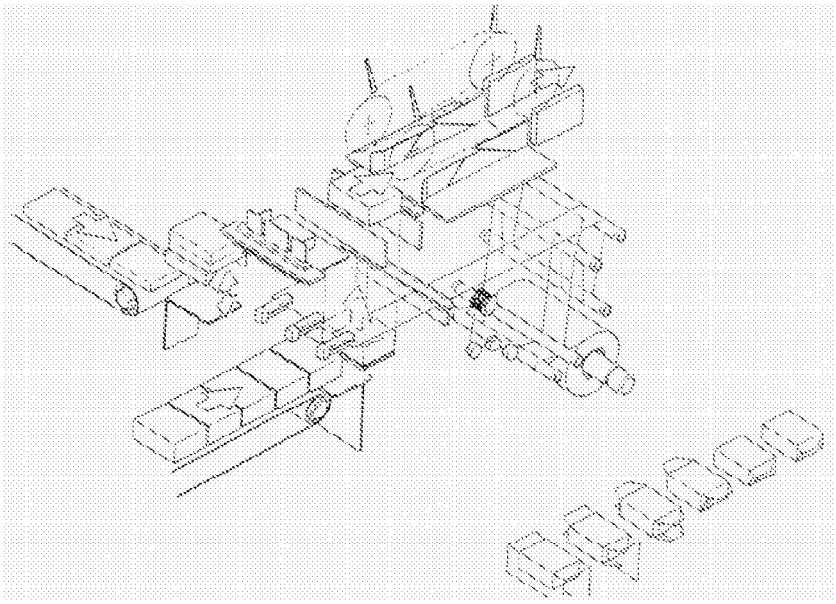


Figure 8 — Over-wrapping machine

3.2.9 Roll wrapping machine

A wrapping machine which wraps a cylindrical product or group of products in a series of folding heat sealing or glueing operation to form a roll shaped pack.

The characteristic features are:

— a conveyor feed

— an automatic product feed mechanism usually using vibration

— a reel unwind mechanism with film compensator and often automatic splicing group

— a discharge mechanism with belt

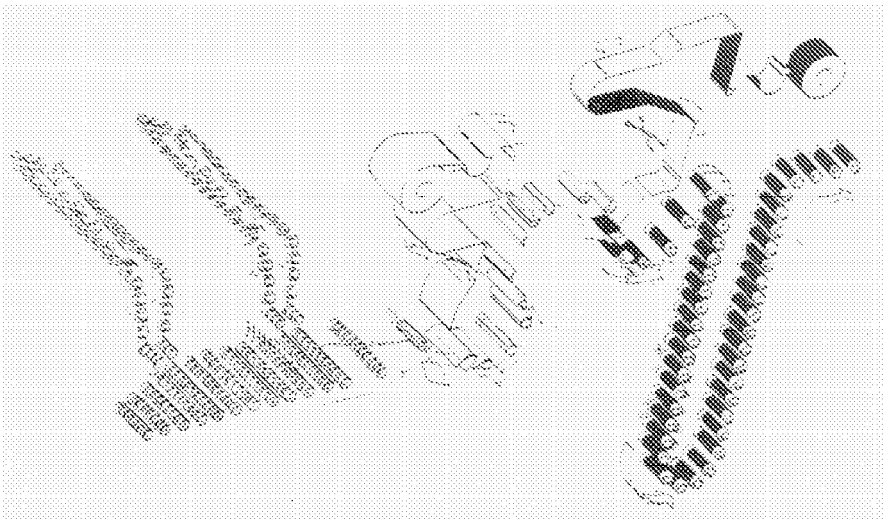


Figure 9 — Roll wrapping machine

3.2.10 Foil and band wrapping machine

A wrapping machine which wraps a product in aluminium foil, before applying a paper band (simultaneously or intermittent) to complete the pack.

The characteristic features are:

— a product feed with belt conveyor, pusher and elevator

— a reel unwind mechanism with film compensator

— a discharge mechanism with belt

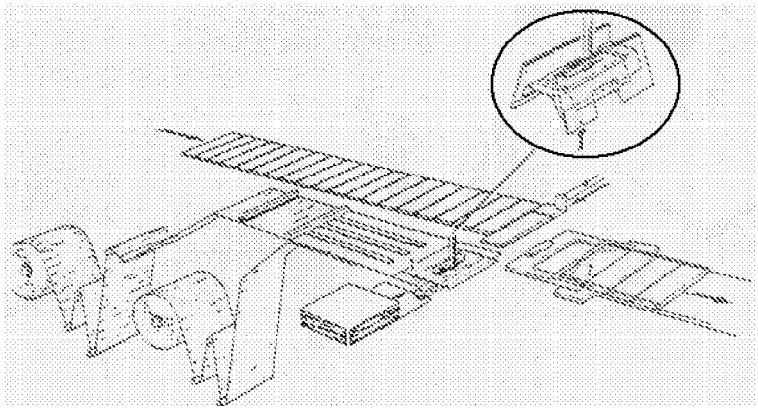


Figure 10 — Foil and band wrapping machine

3.2.11 Pleat wrapping machine

A wrapping machine which gathers and folds flexible material around a product and seals it at one point by applying a label.

The characteristic features are:

— a product feed with belt conveyor, pusher and elevator

— a reel unwind mechanism with film compensator

— a discharge mechanism with belt

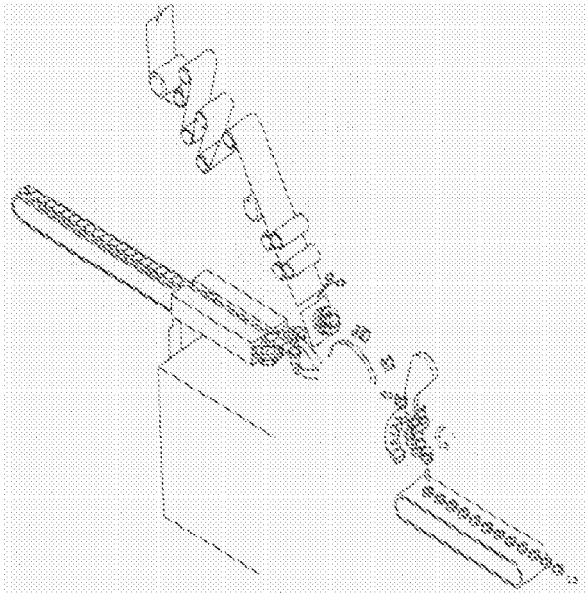


Figure 11 — Pleat wrapping machine

3.2.12 Stretch film wrapping machine

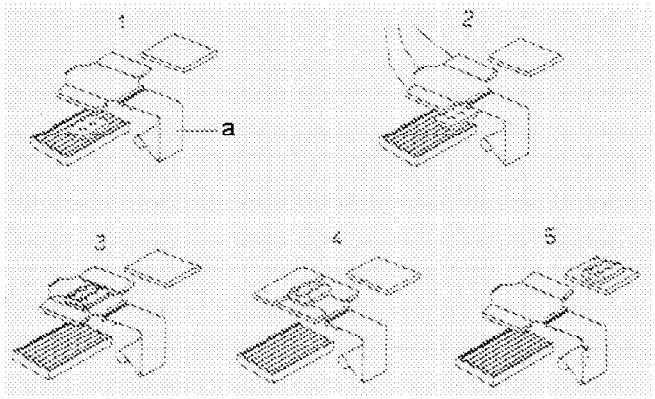
A wrapping machine which pulls a web of stretch film around a product, before gathering and heat sealing the film edges below the product.

The characteristic features are:

— a conveyor feed

— a reel unwind mechanism with film compensator

— a discharge mechanism with belt and heat sealer



Key:
1: feeding
2: film stretching
3: elevating
4: folding
5: sealing
a: film

Figure 12 — Stretch film wrapping machine

3.2.13 L-sealing machine

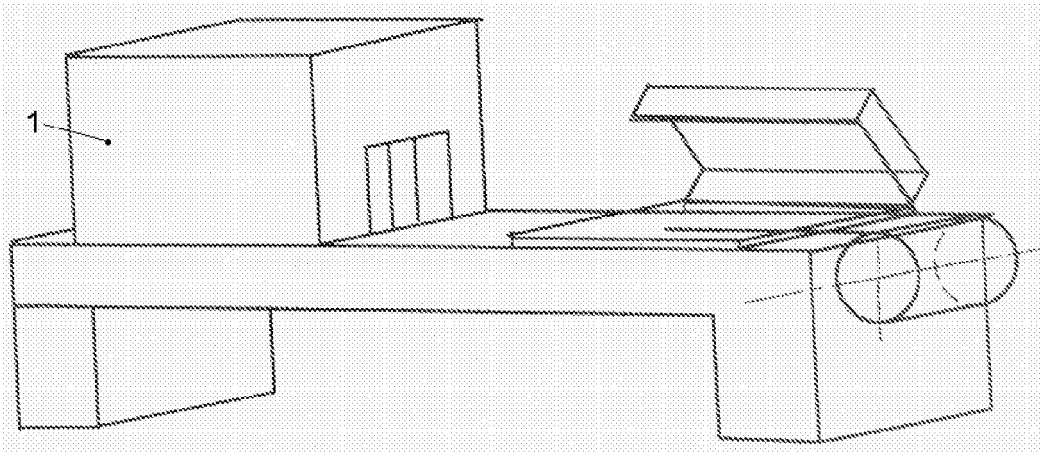
A wrapping machine which uses thermoplastic centre folded film along its length. Products or group of products are placed between the two halves of film before the film is sealed around the product with an L shaped sealing bar to produce a fully enclosed pack sealed on three sides.

The characteristic features are:

— a supporting plane

— a “L shaped” heating device

— a conveyor belt often connected to a shrink tunnel.



Key:
1: tunnel

Figure 13 — L-sealing machine

3.2.14 Skin packaging machine

A wrapping machine which seals products placed on perforated carton or plastic blanks with a web of thermoplastic film.

The characteristic features are:

— a supporting plane

— a vacuum system

— a film reel

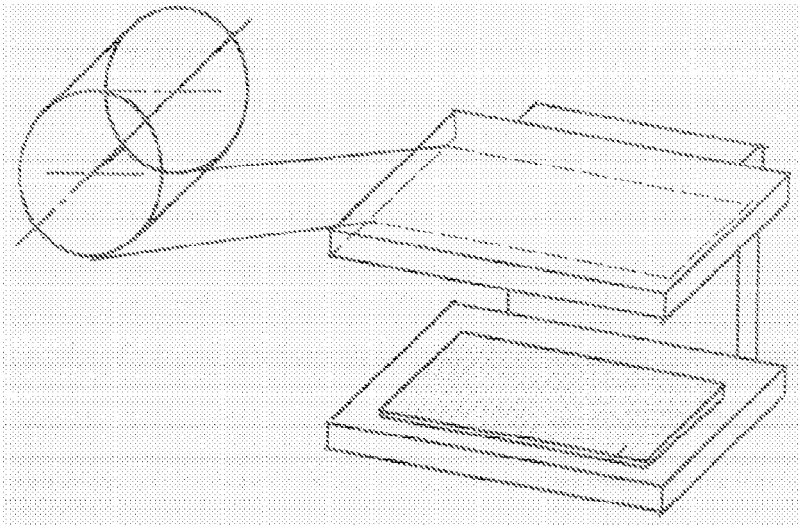


Figure 14 — Skin packaging machine

3.2.15 Shrink tunnel

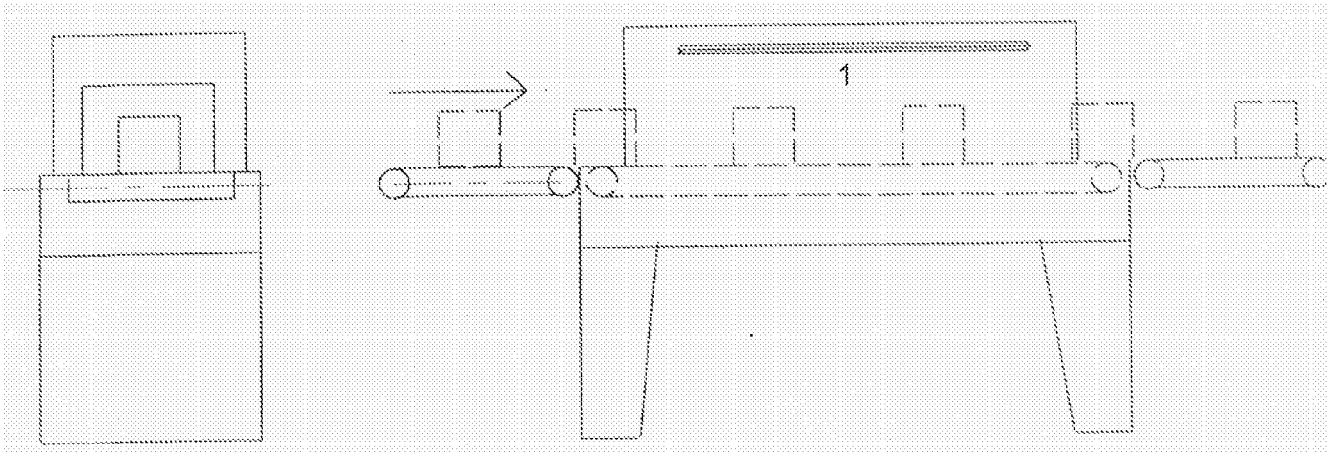
A machine which shrinks thermoplastic film around a product or group of products, as they pass through a heated tunnel. The heating medium may be air, radiant heat, steam or hot water. The machines covered by this standard are suitable to be connected to a wrapping machine by an infeed conveyor or are incorporated into a wrapping machine. Shrink tunnels used for product higher than 400 mm are dealt with in prEN 415-6.

The characteristic features are:

— a feeding conveyor

— a heating chamber

— a discharge conveyor



Key:
1: heater

Figure 15 — Shrink tunnel

3.2.16 Hot water dip tank

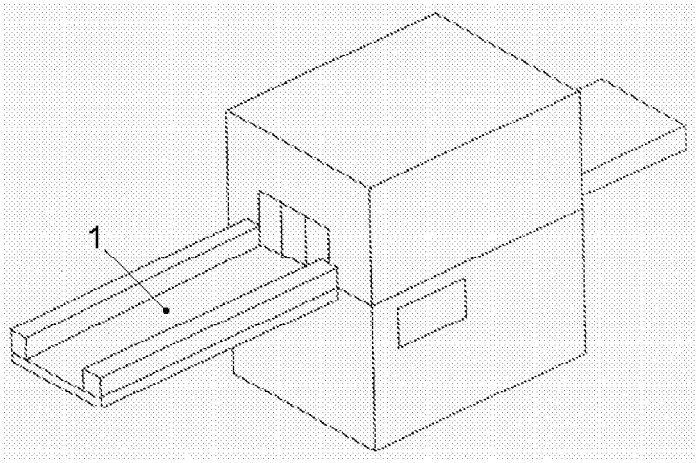
A packaging machine which uses a tank of hot water to shrink thermoplastic packages by dipping them in the water.

The characteristic features are:

— a feeding conveyor

— a supporting plate which plunges into water with the product

— a tank with hot water



Key:
1: conveyor

Figure 16 — Hot water dip tank

4 List of significant hazards on wrapping machines

Wrapping machines and their feed systems can generate a variety of hazards e.g. from their mechanical, electrical, pneumatic equipment and hot surfaces.

An assessment of the foreseeable risk arising from the use of the wrapping machines, covered in this standard, was carried out when this standard was prepared according to EN 1050.

The following clause contains hazards, except product and packaging material related, identified as significant for wrapping machines and which require measures to eliminate or reduce risk.

This clause first identifies the hazards which are common to wrapping machines and then describes hazards which are specific to 13 machines having been selected as being typical of a group of machines and for each of these machines a risk assessment has been carried out and appropriate methods of safeguarding proposed in clause 5. The machines selected are as follows:

— banding machine

— sleeve wrapping and stretch banding machine

— spiral wrapping machine

— fold wrapping machine

— extruded product wrapping machine

— twist wrapping machine

— over-wrapping machine

— roll wrapping machine

— foil and band wrapping machine and pleat wrapping machine

— stretch film wrapping machine

— L-sealing wrapping machine

— skin packaging machine

— shrink tunnel and hot water dip tank

4.1 General wrapping machine hazards

The following hazards occur on most wrapping machines.

4.1.1 Drive system

Wrapping machines may incorporate mechanical, electrical, or pneumatic mechanisms which present a variety of different hazards including crushing, shearing, cutting, drawing-in, friction, entanglement, electric shock and burning.

4.1.2 Handles and handwheels

Handles or spoked hand-wheels are sometimes provided to operate machines manually for adjustment or cleaning. These devices can present impact, friction or entanglement hazards.

During hand operated rotation some machines may become unstable due to eccentric masses or springs which generate a torque. This may cause cutting and crushing hazards e.g. during cleaning or removal of packaging material.

4.1.3 Size changing

Typically, wrapping machines are constructed to handle a range of product and pack sizes.

Changes from size to size may be performed manually or under power.

This may generate shearing and crushing hazard.

Where change parts are involved excessive effort or strain hazards can arise if the mass of the parts is greater than 25 kg or in the case of lower masses if the operator has to assume an unnatural posture to position or remove the parts.

Where size changing is carried out under power shearing and crushing hazards are likely to be present.

4.1.4 Knives for cutting packaging material

Wrapping machines have knives or shears in order to cut packaging material to the right width or into strips. During normal operations, a severe cutting hazard is present. During cleaning or maintenance operations these sharp edges may cause a cutting hazard.

4.1.5 Packaging material reels

When rotating, reels of packaging machines may have a high inertia which may cause the reel to drop if it is suddenly stopped. Under these circumstances, the reel may generate crushing and impact hazards.

When the packaging material on the reel is tensioned as part of the operating cycle, the edges of the material may present a cutting hazard.

4.1.6 Pneumatic equipment

Pneumatic equipment presents crushing, shearing, ejection of parts, explosion and injection of fluids hazards. In addition pneumatic lubricating oil is a potential fire hazard and can contaminate agri-foodstuffs or involve inhalation of hazardous substances by the operators.

4.1.7 Hot surfaces

Wrapping machines often have surfaces or fluid with temperature higher than 65 °C e.g. welding, shrinking systems etc. These components present a burn, scald and fire hazard. Furthermore, hot surfaces or fluid will remain hot and present a hazard for some time after the power has been switched off.

NOTE: Bare metal surfaces which have temperature higher than 65 °C can cause burning after a contact time of only one second. See EN 563 for burn thresholds for other materials and longer contact times.

4.1.8 Electrical equipment

Electrical equipment on the machine is mainly a potential electric shock and burn hazard and, in the presence of combustible materials a potential fire hazard and may act as the ignition source in the presence of flammable and explosive atmospheres, creating an explosion hazard.

Unexpected operation of servo drive system give rise to mechanical hazards if, to maintain syncronization, the power is connected to the drive when machine is stopped.

4.1.9 Packaging materials and products

Wrapping machines are used to pack a wide range of products in many types of packaging materials, some of which are potentially hazardous to persons operating or in the vicinity of the packaging machine.

NOTE the product may be already packed in a primary package and the spillage may be caused by a failure in the wrapping process.

Hazards include:

a) inhalation, ingestion or absorption of harmful substances e.g. insecticides, aggressive or harmful chemicals, pharmaceuticals, fumes from over heated glue or packaging materials;

b) fire or explosion e.g. flammable liquids, explosives, dusty products (dust explosions);

c) biological hazard e.g. vaccines.

4.1.10 Hazards generated by neglecting ergonomic principles in machine design

If work stations, control panels, material loading station, change parts or routine maintenance points are inappropriately designed this can result in, for example:

a) bad posture;

b) excessive effort;

c) unnatural body movements;

d) mental stress;

e) fatigue;

f) mental underload.

4.1.11 Slip, trip and fall

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

Trip hazards may occur if parts of the machine protrude beyond or from the machine frame at low level.

Falls may occur if access for magazine loading, size changing, maintenance or cleaning is required at a level which cannot be reached without climbing from the floor.

4.1.12 Hazards from movable guards

Movable guards may cause crushing, shearing and impact hazards when operated due to their weight and position as they could move under the effect of gravity.

4.1.13 Modified atmosphere packaging

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

a) oxygen - promotion of fire or explosion;

b) nitrogen - asphyxiation;

c) carbon dioxide - asphyxiation and toxic

When an oil lubricated rotary vane vacuum pump is in operation, aerosol are formed in the interior of the pump by the working fluid. The flammability of all combustible liquids in aerosol form is considerably increased. A malfunction of the pump (e.g. a metal splinter being in) could lead to a temperature of 200 °C.

An oxygen content in the surrounding gas of over 21% and the presence of combustible aerosols can lead to possible explosions at temperatures of 200 °C and above.

4.1.14 Noise

The main sources of noise on wrapping machines are:

a) drive mechanisms

b) vacuum pumps

c) compressed air exhaust

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

e) packaging material

leading to the following consequence:

a) permanent hearing losses

b) tinnitus

c) tiredness stress etc.

d) other effect such as loss of balance, loss of awareness

e) interference with speech communication,

f) inability to ear acoustic warning signal

4.2 Hazards associated with a banding machine

4.2.1 Product feed

The product feed typically consists of a horizontal run (or runs) of chain, carrying paddles, pegs or flight bars which push the product along plates between side guides. Sometimes two lateral belts improve the feeding action.

With such feed systems the products are usually fed into the in-feed chain by an automatic feeding device or a conveyor. Alternatively the feed system may consist of flat belt conveyors which are fed automatically or manually. Both types of product feed may present drawing in, pinch or friction burn hazards.

4.2.1.1 Chains and drives

These mechanisms present crushing, shearing and drawing in hazards.

4.2.1.2 Product pushing or elevating devices

Shearing hazards exist:

a) where they emerge from the shroud around the tail sprocket and enter the in-feed slot;

b) where they enter the machine.

4.2.1.3 Belt in feed conveyors

The potential hazards of these mechanisms are drawing-in and friction burn.

4.2.1.4 Automatic product feed mechanisms

Machines may be fitted with a wide variety of product feeding mechanisms, most of which present crushing and shearing hazards.

4.2.2 Reel unwind mechanism

Reel unwind mechanisms typically comprise a mandrel which may either be fixed to the machine frame at one end or loose, in which case the film reel and mandrel are supported on a crane assembly.

Film is drawn from the film reel by the machine's film transport mechanism , the tension of the film is usually controlled by a brake mechanism (or a drive operating as a brake) acting on the reel mandrel, operated by a film compensator. Injuries due to bad posture or excessive effort may result if this mechanism is inappropriately located or if the reel is too heavy.

4.2.2.1 Film compensator

The film compensator (tension roller assembly) usually comprise a roller mounted on a pivoted arm which operates as a braking device. A shearing hazard can occur between this arm and the frame to which it is attached.

The film compensator when driven by spring or gravity incorporates potential energy which, in case of breakage of the material, may cause impact or crushing hazards.

4.2.2.2 Coders

Wrapping machines are frequently fitted with coding or printing devices. Reciprocating devices present crushing and, when heated, burning hazards. Rotary devices in addition present a drawing-in hazard.

Laser coding units may be fitted, which present a burn hazard. The ink-jet marking devices may present burn or chemical hazard by inhalation or contact.

4.2.2.3 Powered unwind mechanism

On some machines the weight of the film reel makes it necessary to assist the film transport with a powered unwind mechanism. This may comprise a pair of powered rollers engaging the full width of the material which presents a drawing-in hazard.

4.2.2.4 Automatic splicing mechanism

Some machines incorporate an automatic splicing unit to reduce the reel changeover time. These mechanisms usually present crushing, shearing, cutting, entanglement and, when heated, burn hazards.

When the cutting action is pneumatically actuated, those hazards may arise from the potential energy stored in the compressed air system.

4.2.2.5 Electrostatic phenomena

Certain types of plastic film are particularly prone to the build up of static electricity when being unwound. If allowed to build up unchecked the static charges generated can create an electric shock hazard or damage the machine's control system or be a source of ignition for potentially explosive atmosphere or flammable substances.

4.2.3 Discharge mechanism

The discharge mechanism may be belt conveyors, chain flights or, when connected to another packaging machine, some other mechanism. These may present drawing-in and crushing hazards. When a shrink tunnel is directly connected to the machine, a burn hazard is present (see 4.14).

4.2.4 Noise

Typically the main noise sources are the drive mechanism, folding box, transverse sealing mechanism and the discharge of compressed air from air solenoids. The noise emission from a particular machine may alter depending on the product being packed or the packaging material being used.

4.3 Hazards associated with a sleeve wrapping machine and a stretch banding machine

4.3.1 Product feed

It can consist of a horizontal belt which conveys the product; the potential hazards are drawing-in and friction. Alternatively pneumatic or mechanical pushers are used, these can present crushing, impact drawing-in and shearing hazards.

4.3.1.1 Chain and drives

See 4.2.1.1.

4.3.1.2 Product pushing or elevating devices

See 4.2.1.2.

4.3.1.3 Belt infeed conveyor

See 4.2.1.3.

4.3.2 Reel unwind mechanism

See 4.2.2.

4.3.2.1 Film compensator

See 4.2.2.1.

4.3.2.2 Coders

See 4.2.2.2.

4.3.2.3 Electrostatic phenomena

See 4.2.2.5.

4.3.3 Discharge mechanism

See 4.2.3.

4.3.4 Noise

See 4.2.4.

4.3.5 Shrink tunnel

It is often connected to a sleeve wrapping machine. See 4.14.

4.4 Hazards associated with spiral wrapping machines

4.4.1 Product feed

It can consist of a horizontal belt which pushes the product towards the wrapping devices.

These can present drawing-in and friction hazards.

Alternatively pneumatic or mechanical pushers are used, these can present crushing hazards.

4.4.2 Wrapping head

The film is wrapped around the product with an adjustable tension strong enough to keep the product tight. This may cause trapping of parts of the body (e.g. hands and arms). The rotating reel may cause impact hazard.

4.4.3 Product discharge

A conveyor with powered rollers pushes the product toward the outlet. Drawing-in and trapping hazards may be present.

4.4.4 Ergonomics

When the product to be wrapped is handled by the operator hazards due to the mass and size of the product may be present. The repetition of task may give rise to general or localised muscle fatigue or other health effects.

4.5 Hazards associated with fold wrapping machines

4.5.1 Product feed

Typically consists of a conveyor belt over which the products are fed. Checking or inspection devices for the ejection of faulty products may be present.

Before the product arrives at the wrapping station a device synchronises it with the mechanisms downstream. Otherwise the product is placed in spaces with the right dimension and the belt is timed with the wrapping mechanisms. In both cases crushing, cutting and trapping hazards may be present.

4.5.1.1 Chains and drives

These mechanisms present crushing and shearing hazards.

4.5.1.2 Product pushing devices or pincers

Both mechanisms present crushing and shearing hazards.

4.5.2 Reel unwind mechanisms

See 4.2.2.

4.5.2.1 Film compensator

See 4.2.2.1.

4.5.2.2 Coders

See 4.2.2.2.

4.5.2.3 Powered unwind mechanisms

See 4.2.2.3.

4.5.2.4 Automatic splicing mechanism

See 4.2.2.4.

4.5.3 Discharge mechanism

Discharge mechanism may be belt, conveyors, chain or wheel. Sometime they may be connected with another machine. These may present crushing and drawing-in hazards.

4.5.4 Noise

See 4.2.4.

4.6 Hazards associated with extruded product wrapping machines

4.6.1 Product feed

There is normally a feeding group (not considered in this standard) connected to the wrapping machine having a speed electronically synchronised. Not synchronised speed with the machine may cause build up of the product with the need to provide for a manual cleaning which creates ergonomic hazard.

4.6.2 Reel unwind mechanism

See 4.2.2.

4.6.2.1 Film compensator

See 4.2.2.1.

4.6.2.2 Coders

See 4.2.2.2.

4.6.2.3 Powered unwind mechanism

See 4.2.2.3.

4.6.2.4 Automatic splicing mechanism

See 4.2.2.4.

4.6.3 Discharge mechanism

Discharge mechanism may be a belt or an inclined plane. The discharge aperture may allow access to a dangerous zone. This may present a crushing, cutting and drawing-in hazards.

4.6.4 Noise

See 4.2.4.

4.7 Twist wrapping machine

4.7.1 Product feed

The machine is normally used to wrap confectionery.

The feeding group consists of a disk with vanes of an appropriate size for product to be wrapped which turns with an intermittent motion. A certain quantity of product is fed to the disk by a vibratory feeder.

During rotation the spaces of the disk are filled up with products assisted by a rotating brush which disposes the product in the spaces.

When the disk is stationary a pusher moves the product towards the wrapping station. This may present crushing , cutting and friction (due to the brush) hazards.

4.7.1.1 Feeding belt

It is normally used to feed soft candies to a feeding disk; crushing and trapping hazards may be present.

4.7.2 Reel unwind mechanism

See 4.2.2.

4.7.2.1 Film compensator

See 4.2.2.1.

4.7.2.2 Powered unwind mechanism

See 4.2.2.3.

4.7.2.3 Automatic splicing mechanism

See 4.2.2.4.

4.7.2.4 Electrostatic phenomena

See 4.2.2.5.

4.7.3 Discharge mechanism

Normally wrapped product falls by gravity on to a transport belt which may present a trapping and drawing-in hazard; sometimes the ejection of the product is assisted by a pusher which presents a crushing hazard.

4.7.4 Noise

Usually the machines operate at a very high speed (16 rps and more)

The main sources of noise are:

a) vibrating unit which conveys the products to the feeding disk

b) impacts of the products in the feeding disk (in part it depends on the nature of the products)

c) drives mechanism of the machine (Cams, gears and belts)

d) impact of the pliers used for wrapping (in part it depends on wrapping material).

4.8 Hazards associated with over-wrapping machine

4.8.1 Product feed

The product is typically fed by belt infeed conveyor. An alternative feed system may consist of a horizontal run (or runs) of chain, carrying paddles pegs or flight bars which push the product along plates between side guides. Often two lateral belts improve the feeding action. Product is fed into the in-feed chain by automatic feeding devices.

4.8.1.1 Chains and drives

These mechanisms may present crushing, shearing and drawing-in hazards.

4.8.2 Tear tape application group

Many machines have a device for the application of a tear tape which makes opening the pack easier.

The tear tape consist of an unwinding device, in a cutting unit and a device which sticks the tape to the film. Sometimes the tape is gummed, in other cases the tape is fixed by means of glue or hot melt.

Crushing, trapping, cutting and scalding hazards may be present.

4.8.3 Reel unwind mechanism

See 4.2.2.

4.8.3.1 Film compensator

See 4.2.2.1.

4.8.3.2 Coders

See 4.2.2.2.

4.8.3.3 Power unwind mechanism

See 4.2.2.3.

4.8.3.4 Automatic splicing mechanism

See 4.2.2.4.

4.8.3.5 Electrostatic phenomena

See 4.2.2.5.

4.8.4 Discharge mechanism

The discharge mechanism may be belt conveyors, or chain flights. Heating devices are often used to seal the wrapping material or dry the glue. The discharge aperture may allow access to danger zone.

This may present drawing-in, crushing and burn hazards.

4.8.5 Noise

See 4.2.4.

4.9 Hazards associated with roll wrapping machines

4.9.1 Product feed

4.9.1.1 Conveyor belt

When the feeding group consists of a conveyor belt single products are conveyed towards a stacking station where they are assembled into a predetermined number. From the assembling station a pusher inserts the grouped products into the wrapping station. Crushing, trapping and friction burn hazards may be present.

4.9.1.2 Automatic product feed mechanism (vibration feed)

When the feeding group consists in a vibrating device a noise hazard due to vibration and crushing of products is present.

In the feeding zone, vibration may generate dust which presents an inhalation hazard.

A crushing hazard may be present between the vibration feed and machine frame.

4.9.2 Reel unwind mechanism

See 4.2.2.

4.9.2.1 Film compensator

See 4.2.2.1.

4.9.2.2 Coders

See 4.2.2.2.

4.9.2.3 Powered unwind mechanism

See 4.2.2.3.

4.9.2.4 Automatic splicing mechanism

See 4.2.2.4.

4.9.3 Discharge mechanism

See 4.2.3.

4.9.4 Noise

See 4.2.4.

4.10 Hazards associated with foil and band wrapping machines and pleat wrapping machine

4.10.1 Product feed

See 4.2.1.

4.10.1.1 Chain and drives

See 4.2.1.1.

4.10.1.2 Product pushing and elevating devices

See 4.2.1.2.

4.10.1.3 Belt in-feed conveyors

See 4.2.1.3.

4.10.2 Reel unwind mechanism

See 4.2.2.

4.10.2.1 Film compensator

See 4.2.2.1.

4.10.2.2 Coders

See 4.2.2.2.

4.10.3 Discharge mechanism

The discharge mechanism may be a belt conveyor. These present drawing-in and friction burn hazard.

4.10.4 Noise

See 4.2.4.

4.11 Hazards associated with stretch film wrapping machines

4.11.1 Product feed

Product is fed into the machine by a conveyor belt. Drawing-in, friction burn hazards may be present.

4.11.2 Reel unwind mechanism

See 4.2.2.

4.11.2.1 Film compensator

See 4.2.2.1.

4.11.3 Product pushing and elevating device

See 4.2.1.2.

4.11.4 Electrostatic phenomena

See 4.2.2.5.

4.11.5 Discharge mechanism

The discharge mechanism consists of a conveyor belt which supports the product and two lateral belts which are normally heated in order to seal the film. Trapping, crushing and burning hazards may be present.

4.12 Hazards associated with L-sealing machine

4.12.1 Product feed

Products can be manually inserted between two flaps of film on a supporting plane.

The film is unwound manually or by means of a powered roll which also collects wasted material.

Impact hazards may be present.

4.12.2 L-sealing station

The three flaps are sealed by means of a sealing device/beam having a shape fitting the product to be wrapped which is operated manually or by means of a pneumatic device. The sealing device/beam have a temperature higher than 65 °C. Crushing, and burning hazards may be present.

4.12.3 Shrink tunnel

Sometimes product is fed by a conveyor belt into a shrink tunnel.

A burning hazard may be present. See 4.14.

4.12.4 Stability of the machine

Machines are often mounted on castors. Uncontrollable movements may cause crushing or impact hazards.

4.12.5 Ergonomics

The operator may make hand-operations during the wrapping process.

Hazards due to the uncomfortable position of controls or unsuitable height of the working table for the operator may be present.

4.13 Hazards associated with skin packaging machines

4.13.1 Product feed

Product is fed manually on a perforated carton-board or plastic blanks. The film is fed manually and overlaps the product.

A vacuum system causes the film to stick the product. Impact and trapping hazards may be present.

4.13.2 Product discharge

Wrapped product is removed by hand. This presents ergonomics hazards.

4.13.3 Stability of the machine

See 4.12.4.

4.13.4 Ergonomics

See 4.12.5.

4.14 Hazards associated with a shrink tunnel and hot water dip tank

4.14.1 Product transfer system

Products are usually transferred through the tunnel or tank by a conveyor consisting of woven wire or chain driven rollers. The infeed and discharge aperture allows the flow of products and therefore will have dimensions which may let parts of the body come into contact with the heating medium and mechanical parts. Burning, scalding, drawing-in, cutting, crushing and impact hazards may be present.

4.14.2 Temperature

The heating medium in shrink tunnels and shrink tanks will have a temperature above 65°C which will be transferred to both the conveyor and shrinking film. Since the conveyor usually extends beyond the main body of the machine, operators will be exposed to burning hazards. Some tunnels have hinged covers or removable panels to give access for setting, cleaning and clearing product jams. These features may expose operators to burning hazards.

4.14.3 Product

There is a risk of burning and scalding from the hot packages as they transfer out of the machine.

If the conveyor stops with product inside there is a risk that the product will overheat, even after the power supply has been disconnected. This may damage the product or cause bursts, or spillage of product or damage. In tunnels and tanks where the heating medium is air there may be a risk of fire.

4.14.4 Product discharge

Products are conveyed by a belt (woven wire) which presents drawing-in and crushing hazards.

Furthermore the product and belt may be hot and this causes a burning hazard.

5 Safety requirements for wrapping machines

5.1 General requirements for all wrapping machines

Wrapping machines shall be designed to take into consideration the relevant hazards in clause 4 and the relevant safety requirements and preventive measures in this clause.

Every attempt has been made in this standard to identify the relevant hazards. However manufacturers should ensure through their own risk assessment that there are no additional hazards which are not covered by this standard. When additional hazards are present it is recommended that EN 292 together with relevant A and B standards are used as a basis for dealing with these additional hazards.

5.1.1 Drive Systems

Drive mechanisms of all types shall be safeguarded with fixed or interlocked guards complying with clause 5.1.15.

5.1.2 Handles and hand wheels

Where a handle or spoke hand-wheel is provided to operate a machine manually, the hazards which arise if the hand-wheel moves under power when the machine is in operation shall be eliminated by fitting an interlocking device which prevents the machine from operating under power until the handwheel has been disengaged or removed or, alternatively, by making the hand-wheel solid with no protrusions - this latter option is only applicable for hand-wheels running at less than 0,1 m/s at their circumference.

If a detachable handle or hand-wheel is used, an interlocking device shall be fitted which prevents the machine being operated under power until the handle or hand-wheel is removed from the machine.

Machine design shall ensure that overrun due to eccentric masses or springs shall be avoided when the machine is hand operated in one of the following ways:

a) balancing of torque

b) breaking of forward and reverse movement

c) anti-reverse motion device

5.1.3 Size changing

The design of the guards shall ensure that hazards on the machine are safeguarded for the entire product and pack sizes for which the machine has been designed.

5.1.3.1 Manual size changing

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

Where manual adjustments have to be made to adjustable guards to prevent danger following a size change, a warning label shall be fitted in a prominent position on the machine stating that the machine should not be used until the guards have been correctly adjusted.

Where guards are supplied as change parts a warning label shall be fitted in a prominent position on the machine stating that the machine should not be used until the appropriate guards have been fitted.

Where change parts are used, their mass and location shall be carefully considered with reference to EN 614. If necessary, provision shall be made for change parts to be lifted and positioned with mechanical handling equipment.

5.1.3.2 Size changing under power

Where parts of the machine are adjusted for a different size under power the risks presented by these powered movements shall be eliminated in one of the two following ways:

a) By design – if the force of all movements exerted by moving parts is less than 75 N and their energy is less than 4 J, and there are no sharp edges which may foreseeable cause injury, no guards are required.

b) By safeguarding – Where the requirements of (a) cannot be satisfied, movement shall only take place behind fixed or interlocked guards complying with 5.1.15.

Where it is not possible to fulfil the requirements of (a) or (b), hazardous movements of parts may take place when initiated by an operator using a hold to run control device, but only if all of the following requirements are fulfilled:

a) The design of the guards and control system shall minimise the risks of injury to the operator and other persons in the vicinity of the machine;

b) The hold to run control device shall be positioned in such a way that the operator has a clear view of all the parts of the machine where movement is taking place;

c) The hold to run function shall only be available when a key operated switch is turned. Operation of this key switch shall prevent the machine from operating in automatic mode;

d) If it is necessary to carry out the powered movements with certain interlocked guards open, all other interlocked guards shall continue to operate as during normal operation;

e) The control system shall ensure that movements initiated by the hold to run control are limited (step by step) or at a reduced speed less than 0,25 m/s;

f) The movement shall stop within 0,5 s after the hold to run control has been released;

g) Safety related parts of the control circuit, implementing the above, shall meet the requirements of category 2 of EN 954-1, with the safety function monitored at initiation and while the hold to run control is activated and there shall be an emergency stop actuator within reach of the hold to run button.

5.1.4 Knives for cutting packaging material

When the machine is working in normal conditions, hazards shall be avoided by fixed or interlocked guards complying with EN 294 table 4.

Fixed guards shall be provided in order to reduce the risk of non intentional contact with the cutting edge during cleaning or maintenance operations or the positioning of the film after a reel change. Where protection is not possible the risk of cutting or abrasion shall be made evident by warning signs complying with EN 61311.

5.1.5 Packaging materials reels

If the risk analysis finds a cutting hazard due to the film edge which is in tension contact shall by avoided by fixed or interlocked guards. If the film brakes, also during maintenance, no hazards shall be caused by unrestrained movement. One of the following solutions is adequate after every machine stop:

a) release of the film compensator after every machine stop so that the potential energy will be dissipated;

b) locking of the film compensators in the position occupied when the machine stops;

c) the use of a brake for reducing the speed of the film compensator to less than 0.2 m/s.

5.1.6 Pneumatic equipment

All pneumatic components and pipe-work shall conform to the requirements of EN 983.

5.1.7 Hot surfaces

When a wrapping machine incorporates a facility for heating packaging materials e.g. for sealing, or has a hot melt adhesive installation, measures shall be installed which minimise the risk of packaging materials or adhesive catching fire.

Where the risk assessment indicates that the combination of power and packaging materials and products creates a significant risk of fire, a high temperature sensor and associated trip devices shall be installed.

The users shall be advised in the instruction for use of the risk of fire or of potentially harmful fumes, if controls are set at an incorrect temperature or if packaging materials or product are changed. This shall also advise of the need to install such a machinery in well ventilated room.

Where the machine generates fumes that produce a hazard to health, an exhaust ventilation facility shall be incorporated. This facility will interface with the user's exhaust ventilation system so close co-operation between the designer and the user is essential. Full information on the machine's exhaust facility and specification shall be included in the instruction manual to enable the interface to be defined.

When the machine stops for more than a pre-determined time the heater shall move away from the product or material, or a barrier will be inserted, in order to avoid over-heating.

Where necessary the instruction manual shall give information to assist the users in the correct setting of the time.

Where the machine includes parts likely to cause burning, a triangular warning sign conforming to ISO 7000: 1989 number 535 shall be fixed on the outside and adjacent to these parts.

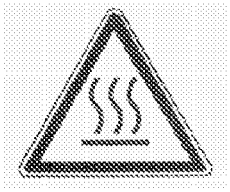


Figure 17 — Hot surface warning sign

5.1.8 Electrical equipment

The electrical equipment shall comply with EN 60204-1:1997. Where EN 60204-1:1997 provides various options, the options stated below shall be used.

5.1.8.1 Electromagnetic compatibility (EMC)

Where electrical/electronic components and apparatus are used the manufacturer shall ensure that the equipment does not generate electromagnetic disturbances above levels that are appropriate for its intended place of use. In addition the equipment shall have an adequate level of immunity to electromagnetic disturbances so that it can operate correctly in its intended place of use. (See EN 60204-1:1997 clause 4.4.2)

The designer shall request from the supplier of the electrical/electronic components and apparatus the detail its electromagnetic compatibility, the manufacturer shall comply with them.

NOTE The European standards EN 50081-2 and EN 61000-6-2 give general EMC emission and immunity limits.

5.1.8.2 Supply disconnecting device

The type of supply disconnecting device listed in clause 5.3.2 of EN 60204-1: 1997 is to be selected by the manufacturer.

5.1.8.3 Excepted circuits

Some circuits e.g. machine lighting, which need not be disconnected by the supply disconnection device shall comply with clause 5.3.5 of EN 60204-1:1997. Local lighting of the machine and equipment shall in addition comply with clause 16.2 of EN 60204-1:1997.

5.1.8.4 Prevention of unexpected start up

Devices for switching off for the prevention of unexpected start up may be selected by the manufacturer from those stated in clause 5.4 of EN 60204-1:1997. The devices selected shall have a mean to be locked.

5.1.8.5 Protection against electric shock

Protection against electric shock from direct and indirect contact by selecting one of the means provided in clauses 6.2 and 6.3 of EN 60204-1:1997 shall be used.

5.1.8.6 Emergency stop

The emergency stop function shall comply with clause 9.2.5.4.2 of EN 60204-1:1997. It shall function as a category 0 stop in clause 9.2.2 of EN 60204-1:1997 unless the immediate removal of power would delay stopping or create an additional hazards, in which case it shall function as a category 1 stop.

The emergency stop devices shall comply with EN 418.

5.1.8.7 Safety related control functions

After a stop, other than one which is part of the automatic cycle, the machine shall start only by an intentional start command. It shall not start unexpectedly e.g. by a start command that is the result of a failure in the control system. Nor shall it start by a start command generated by a sensor, by reclosing or resetting an interlocked guard, or by restoring of the power supply after an interruption where that can result in a hazardous condition. See clause 9.3.1 of EN 60204-1:1997.

Control functions shall comply with EN 1037.

Safety related control circuits shall be designed in accordance with EN 954-1 category 1 (e.g.: electromechanical limit switch, main contactor, emergency stop device, control contactor with forced guiding) Category 2 (e.g. photoelectric trip device, safety PLC) category 3 (e.g.: signal processing, two hand control device) unless otherwise stated in this standard.

Where hazardous motion of machinery is controlled by servo drive systems or systems which have a similar configuration where it may be necessary to maintain power to the drive in order to retain control information (e.g. positional data), precaution shall be taken to prevent the hazardous parts moving unexpectedly while guards are open.

It is preferable to use servo drive motors with two separate supplies, one for power and one for the position feed-back in order to disconnect the power without losing control information.

Where hazardous movement takes place during the synchronization of the drive system, such movement shall only be possible with all guards closed.

The following design option are examples for achieving an adequate level of safety:

a) Galvanic disconnection.

The power supply to the actuators (electrical, pneumatic or hydraulic) that create hazardous movement is removed by hardwired means that achieve galvanic disconnection when the interlocked guards are opened. An example of this is guard inhibited interlocking, where a guard remains locked until the servo motor achieves its set point. Once the set point has been achieved the guard is unlocked by the control system and the motor drive then achieves or maintains a safe condition through galvanic disconnection by the deenergisation of a contactor when the guard is opened. The positioning of the contactor in relation to the servo drive shall take full account of EMC and dc switching constraints as well as the need to ensure the stored energy in the drive may need to be discharged before the safe state is achieved.

b) Electronic disconnection

An electronic mean of inhibiting the drive power to the motor may be used. This may use the same form of interlocking guards with guard locking as described in option (a) but, in this case, the safe condition is achieved by electronic means rather than by galvanic disconnection. The diagnostic capability provided by the monitoring circuits shall be such that any aberrant movement of the motor that occurs is detected and safe condition is maintained .

These types of safety related control function shall be implemented by a safety related electrical or electronic control system (including the monitoring circuits) satisfying the requirement of category 3 of EN 954-1 where non-programmable electronic apparatus is used.

Where the risk assessment indicates that a higher degree of fault tolerance is justified, the safety function shall meet the requirement of Category 4 of EN 954-1.

Where programmable electronic apparatus is used to implement the safety function, the system design shall comply with the requirement of IEC 61508 and shall have a Safety Integrity Level 2, as defined in IEC 61508.

Where the risk assessment indicates that a higher level of safety integrity is required, the system shall have a safety integrity level of 3.

NOTE The term 'safety integrity' refers to the probability of the safety-related system satisfactorily performing the required safety functions under all stated conditions within a stated period of time.

5.1.8.8 Degree of protection

All electrical enclosures shall have a protection level indicated in clause 12.3 of EN 60204-1:1997.

5.1.9 Packaging materials and products

Machines may be designed to pack products which are hazardous. Because of the wide range of such materials it is not possible to give any precise requirements in this standard. Where a machine is designed or specified to pack products which are hazardous to health there is a need to :

a) identify the nature of the hazard;

b) carry out a risk assessment of the product to be packaged and the packaging material at an early stage (e.g. design phase) to anticipate and design out as many hazards as possible and reduce any remaining risk. The validity of the assessment should be checked with product being packaged on the machine and reassessment should be carried out as necessary;

c) design a safe system for packing the product;

d) supply the necessary ancillary equipment e.g. explosion proof electrical equipment, dust or fume extraction or monitoring devices;

e) draft relevant sections for the instructions for use;

f) install the ancillary equipment and check that it is operating safely before the hazardous product is handled.

In most situations it will be the machine user rather than the manufacturer that will have the necessary expertise to carry out (a), (b), (c) and (f) and the wrapping machine manufacturer may only be responsible for part (d) and (e).

Nevertheless the wrapping machine manufacturer shall ensure that the above requirements are carried out by competent persons.

The spilling of dangerous product may be caused by breaking of a package or a faulty operation.

The machine design will take into consideration solutions to avoid or minimise the risk of package failing and the following should be considered:

a) force limiting;

b) torque limiting ;

c) part of the machine with a predetermined failure mode in case of over-stress;

d) sensing devices to check the positioning of the products to be packaged in the critical positions.

5.1.10 Hazards generated by neglecting ergonomic principles in machine design

When designing or specifying a wrapping machine the position of hand feeding stations and reel unwind mechanisms shall be carefully designed to avoid bad posture or excessive efforts which can cause injury. Refer to EN 614.

Where platforms to assist access are provided with the machine, these platforms shall not reduce the standard of safety provided by the guards.(Refer to ISO 14122).

Controls and control panels shall be positioned according to the requirements of EN 614-1-2.

When a machine is to be fed by hand, the design of the hand feeding area shall take into account population and the anatomical limitations of human hands and arms. Refer to EN 614 part 2.

5.1.11 Slip, trip and fall hazard

The design of the machine should avoid liquids or solids spilling onto areas in and around the machine likely to cause a slip accident by elimination (e.g. alternative means of lubrication), containment (e.g. capture trays) and suitable drainage. Instructions should include detail of drainage requirements and any residual spillage risks.

The design of the machine should avoid assemblies at low level which are likely to cause a trip accident.

Where access is required above floor level, to operate, clean or maintain the machine, the manufacturer shall take the following action.

a) If access is required once a week or more – the manufacturer shall provide the necessary safe means of access e.g. stairs, steps ladders or platforms conforming to EN 14122-1, -2, -3.

b) If access is required less than once a week , in this case the manufacturer shall describe in the instruction manual how the task can be carried out in safety.

5.1.12 Hazards from movable guards

Guards which cause an obstruction due to their position shall be made evident by painting or signalling.

In order to avoid uncontrolled movement the movable guards will be counterweighted by a mass, a spring or at least two pneumatic springs.

5.1.13 Modified atmosphere packaging

All vessels, pipeworks and fittings of controlled atmosphere installations shall be designed to safely contain the pressure. The gas supply shall be fitted with a lockable valve and means of safely venting the line downstream so that cleaning and maintenance operation can be carried out in safety.

The design of the gas control system shall ensure that dangerous levels of gas do not build up around the machine. This may be achieved by:

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

b) providing exhausting equipment;

c) fitting a solenoid valve upstream the hoses to shut off the supply of gas if the flow increase to much as this may be caused by the breaking of hoses; the safety related control system shall comply with category 1 of EN 954-1.

d) other measures recommended by EN 626.

For installations using oxygen, the Instructions for use shall stipulate the use of fire resistant piping to connect the machine to the oxygen supply.

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

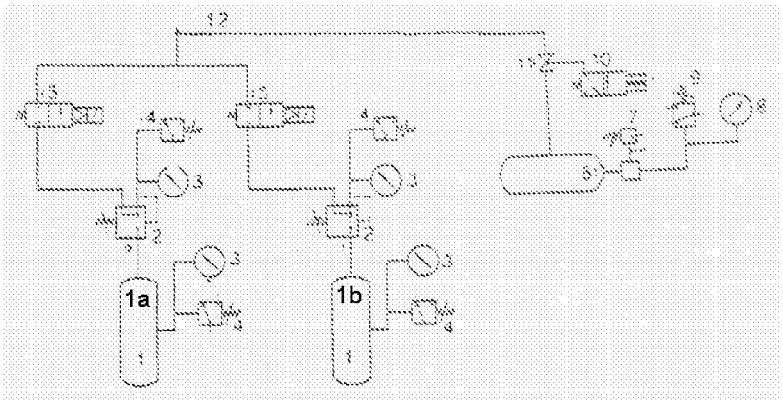
To avoid hazardous situation combined with gas mixture over 21% oxygen entering the vacuum pump the whole system shall be built which prevents that gas mixture enter the vacuum pump system.

Additionally, all machines shall be fitted with either:

a) a control system which ensures that the vacuum valve is closed before the gas mixture can enter the vacuum chamber and before the vacuum valve opens again, that no gas mixture remains in the chamber The system shall be made in a way that a single fault in the control system shall not lead to the loss of the safety function (category 2);

b) a vacuum pump compatible with oxygen. Only certified pumps shall be used.

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



Key:
1: gas tank
1a): gas 1
1b): gas 2
2: pressure governor
3: pressure gage
4: pneumatic transducer
5: solenoid valve
6: vacuum tank
7: vacuum control valve
8: vacuum gage
9: vacuum operated cut off switch
10: solenoid valve
11: valve

Figure 18 — Pneumatic scheme

5.1.14 Noise reduction

The design of wrapping machine shall correspond to the state of the art for demand and technical measures to control noise at source.

Preventing or minimising noise at source could be realised e.g. by the following measures:

a) drive mechanisms: fitting acoustic attenuation material to the fixed guards

b) mechanisms: should be designed so that do not hit against each other

c) air solenoid: fit silencers

d) additional design measures con be found in EN ISO 11688 for designing e.g. noise enclosures, screens attached to the machine, silencer etc. refer to EN ISO 11546, EN ISO 11691, EN ISO 11820 and EN ISO 11821.

This list is not exhaustive, alternative technical measures for noise reduction with identical or greater efficiency can be used.

The criterion for assessing the efficiency of these measures is the actual noise emission values and not the nature of the reduction measures themselves.

5.1.15 Guards and guard interlocking

Unless otherwise specified in this standard, mechanisms with forces greater than 75 N or with energy greater than 4 J or with sharp edges or projections shall be protected with fixed or interlocked guards. Guards shall be dimensioned using EN 294 table 4. Where used, perimeter guards shall be dimensioned and positioned in accordance with EN 294 table 2 and shall be at least 1800 mm high. Interlocked guards shall be designed in accordance with EN 953 and shall be interlocked with devices complying with EN 1088 incorporated in a safety control circuit according to 5.1.8.7.

5.1.15.1 Apertures in guards for infeed and discharge conveyors

Apertures in guards for infeed and discharge conveyors shall be positioned and protected to prevent access to danger zones within the machine when standing on the floor next to the conveyor and reaching into the aperture.

For apertures where the width or height are less than or equal to 120 mm, the minimum reach distance to the nearest danger zone through the aperture shall comply with EN 294 table 4.

Where the aperture width or height is greater than 120 mm (see 5.1.15.) the reach distance from the plane of the aperture access to the nearest danger zone shall be at least 850 mm. In addition all of the following requirements shall apply:

a) a prohibition symbol shall be fitted to the guards near the aperture, warning of the risk of injury from leaning into the machine;

b) interlocked guards shall be provided giving access to all the danger zones near the aperture, so that it is unnecessary to reach through the aperture to access these zones;

c) the instructions for use shall explain the means of gaining safe access to the danger zones through the interlocked guards.

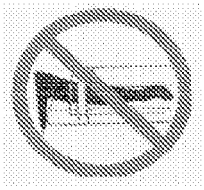


Figure 19 — Prohibition symbol

5.1.15.2 Light sensitive trip device

This comprises one or a number of electro-sensitive protective equipment complying with EN 61496-1 type 2 incorporated in a category 2 (EN 954-1) safety related part of the control system which monitors the whole aperture. The control system shall ensure that the machine stops and/or reverse the hazardous movements if an object is detected in the dangerous area. In this case safety distance will be according to EN 999.

5.2 Safety requirements for a banding machine

The hazards described in clause 4.2 shall be reduced by the following means.

5.2.1 Products feed

Machines fitted with automatic product feeding devices shall be guarded in accordance with 5.2.1.4.

5.2.1.1 Chains and drives

The return chain run, drive and tail sprockets of the infeed conveyor can be safeguarded with fixed guards, with apertures sized in accordance with EN 294 table 4. The tail sprocket guard shall be designed to avoid a shearing hazard. Where machines are equipped with product side guides which are adjustable without the need for tools,

movement of these guides shall not expose any hazard. The lateral belt shall be guarded according to EN 294 table IV.

5.2.1.2 Product pushing and elevating devices

These shall be designed so that they do not present shearing or crushing hazards in the hand loading area and where they enter the folding box. Four alternative strategies can be used.

a) Design the pushing devices so that they come away from the chain in the event of a lateral force greater than 75 N being applied to them;

b) Design the pushing devices so that they can bend when a lateral force greater than 75 N is applied to them;

c) Design the linkage so that the pushing devices are free to bend backwards as they enter the folding box;

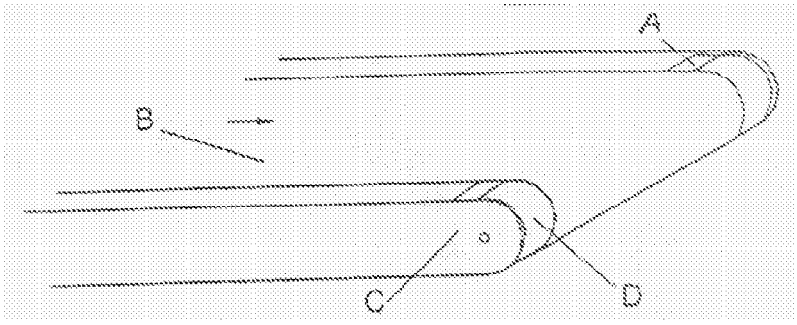
d) Fit the infeed conveyor drive with a torque limiter which removes power from the infeed chain when a lateral force greater than 75 N is applied to it.

5.2.1.3 Belt infeed conveyors

These shall be designed to eliminate the drawing-in hazard presented by in-running nips either by following the design principles shown in figure 18 or by the addition of fixed guards complying with EN 953, with apertures sized in accordance with EN 294 table 4

5.2.1.4 Automatic product feed mechanism

The variety of feeding devices fitted to wrapping machines is such that no specific requirements can be given. However when removing or altering any product feed mechanism provided with the machine presents a hazard, a warning notice shall be fixed in a prominent position on the machine body.



Key:

A: gap between roller and deadplate < 4 mm

B: conveyor belt

C: gap between side frame and roller <4 mm

D: roller

Figure 20 — Method of designing belt conveyor

5.2.2 Reel unwind mechanism

The design of the machine should eliminate the need for manual handling where the mass of the reel exceeds 25 Kg by the use of mechanical reel handling devices which are supplied with the machine.

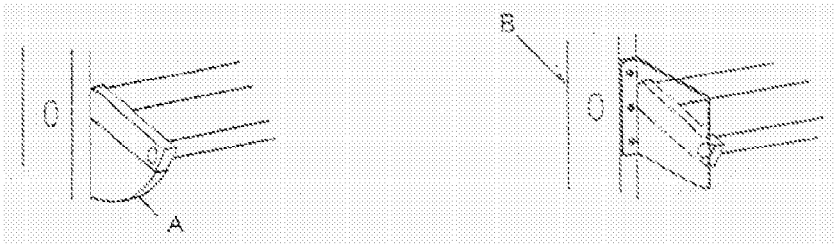
Where the mass of a reel is greater than 15 kg but less than 25 kg the design of the machine shall allow either or:

a) easy access for two people to lift the reel

b) the use of lifting devices specified by the manufacturer

5.2.2.1 Film compensator

The tension hazard between the tension roller assembly and the machine frame shall be eliminated either by ensuring that the assembly is at least 25 mm from the frame or by incorporating one of the devices shown in fig. 21.



Key:

A: solid piece welded on to eliminate trap

B: plate attached to machine frame

Figure 21 — Methods of safeguarding film compensator

5.2.2.2 Coders

The coder manufacturer's instructions for safe mounting shall be followed. These instructions will recommend to fit a guard so that the gap between the coding mechanism and the pressure plate is less than 4 mm. The coder will normally be controlled so that it stops when the wrapping machine stops, however on coders which include heating devices it will be usual for the heater to remain on when the machine is stopped. This creates a residual burning hazard. The heather shall be guarded against non intentional contact and a triangular warning symbol conforming to ISO 7000: 1989 shall be fitted to coders where there is a residual burning hazard. (see figure 17)

A guard shall be fitted where necessary to ensure that the gap between the coding mechanism and the pressure late is no more than 4 mm.

5.2.2.3 Powered unwind mechanism

Drive mechanisms of power unwind devices shall be fitted with fixed guards complying with EN 953 and sized in accordance with EN294 table 4. The in running nips of the film driving rollers shall be safeguarded by one of the methods shown in figure 20.

5.2.2.4 Automatic splicing mechanism

They shall be guarded with interlocking guards complying with 5.1.15 which deny access to the dangerous movements. The interlocking guards shall be interlocked so that the splicer cannot operate when the guards are open, but allow the main machine to continue in operation.

When a pneumatic actuator is used the opening of the guards shall result in isolation and energy dissipation.

The design of the guards shall ensure that hazards on the main machine cannot be reached when the splicer's guards are open. This can usually be achieved with fixed guards sized in accordance with EN 294 table 4.

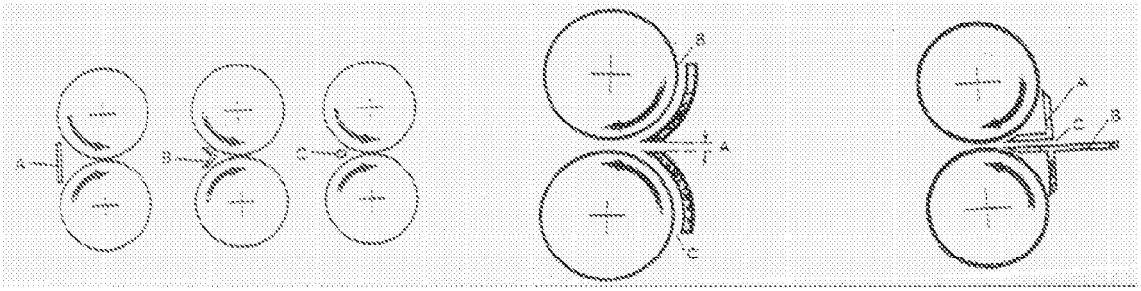


Figure 22 — Methods of safeguarding power unwind mechanism

5.2.2.5 Electrostatic Phenomena

If packaging materials are to be used which give rise to a static electricity hazard, a static elimination device shall be fitted or fittings provided so that the electrostatic charge can be safely discharged to earth before a hazard results.

Where static eliminator generates an electric shock hazard, the static eliminator power supply shall be automatically disconnected when the interlocked guards are opened.

5.2.3 Discharge mechanism

Belt conveyors shall be designed to eliminate the drawing-in and friction hazards presented by in-running nips. See 5.2.1.3. Discharge mechanisms which cannot be safeguarded by design shall be protected by moveable guards complying with 5.1.12

5.2.4 Hazards due to noise emissions

Noise can be prevented or the emission minimised by, for example, the following measures:

a) drive mechanisms: fitting acoustic attenuation material to the fixed guards;

b) folding box: design box to minimise stress to packaging film;

c) air solenoids: fit silencers.

5.2.5 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.3 Safety requirements for a sleeve wrapping machine and a stretch banding machine

The hazards described in clause 4.3 shall be safeguarded by the following methods.

5.3.1 Product feed

See 5.2.1

5.3.1.1 Chain and drives

See 5.2.1.1.

5.3.1.2 Product pushing devices

See 5.2.1.2.

5.3.1.3 Belt infeed conveyor

See 5.2.1.3.

5.3.1.4 Automatic product feed mechanism

See 5.2.1.4.

5.3.2 Reel unwind mechanism

See 5.2.2.

5.3.2.1 Film compensator

See 5.2.2.1.

5.3.2.2 Coders

See 5.2.2.2.

5.3.2.3 Electrostatic phenomena

See 5.2.2.5

5.3.3 Conveyor discharge

Where a conveyor discharge is fitted, the guards shall effectively prevent access to the danger zones by following the requirements of 5.2.3.

Where a flighted belt is fitted, the conveyor drive motor shall be interlocked so that the conveyor cannot run when the machine's guards are open.

Where the conveyor forms part of the guarding, it shall either be fixed in relationship to the machine, or interlocked so that the machine cannot operate unless the conveyor is in place.

5.3.4 Hazards due to noise emissions

See 5.2.4.

5.3.5 Shrink tunnel

See 5.14.

5.3.6 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.4 Safety requirements for a spiral wrapping machine

The hazards described in Clause 4.4 shall be safeguarded by the following methods.

5.4.1 Product feed

Roller drive mechanisms shall be safeguarded with fixed guards. Rollers shall be more than 120 mm away from each other or will be provided with devices against drawing-in or crushing. (see fig. 21)

5.4.2 Wrapping head

The unwinding and wrapping zone shall be safeguarded with interlocked guards. (see 5.1.15)

5.4.3 Discharge mechanism

See 5.2.3.

5.4.4 Ergonomics

Sometime products to be wrapped are kept in position by the operator. The force shall be limited to 200 N.

5.4.5 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.5 Safety requirements for a fold wrapping machine

The hazards described in clause 4.5 shall be safeguarded by the following methods.

5.5.1 Product feed

Machine fitted with automatic product feed shall be guarded in accordance with 5.1.13.

5.5.1.1 Chain and drives

See 5.2.1.1.

5.5.1.2 Products pushing and elevating devices or pincers

See 5.2.1.2.

5.5.2 Reel unwind mechanism

See 5.2.2.

5.5.2.1 Film compensator

See 5.2.2.1.

5.5.2.2 Coders

See 5.2.2.2.

5.5.2.3 Powered unwind mechanism

See 5.2.2.3.

5.5.3 Automatic splicing mechanism

See 5.2.2.4.

5.5.4 Discharge mechanism

See 5.2.3.

5.5.5 Noise

See 5.2.4.

5.5.6 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.6 Safety requirements for an extruded product wrapping machine

The hazards described in clause 4.6 shall be safeguarded by the following methods.

5.6.1 Product feed

Product feeding rolls shall be easily removable for cleaning.

The integration of the feeding group will avoid hazard caused by build up of the product due to not synchronised speed with the machine.

5.6.2 Reel unwind mechanism

See 5.2.2.

5.6.2.1 Film compensator

See 5.2.2.1.

5.6.2.2 Coders

See 5.2.2.2.

5.6.2.3 Powered unwind mechanism

See 5.2.2.3.

5.6.2.4 Automatic splicing mechanism

See 5.2.2.4.

5.6.3 Discharge mechanism

See 5.2.3.

5.6.4 Noise

See 5.2.4.

5.6.5 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.7 Safety requirements for a twist wrapping machine

The hazard described in clause 4.7 shall be safeguarded by the following methods

5.7.1 Product feed

Feeding disk shall be safeguarded with movable and interlocked guards. (see 5.1.12 and 5.1.15)

5.7.1.1 Feeding belt

See 5.2.1.3.

5.7.1.2 Product pusher

See 5.2.1.2.

5.7.2 Reel unwind mechanism

See 5.2.2.

5.7.2.1 Film compensator

See 5.2.2.1.

5.7.2.2 Powered unwind mechanism

See 5.2.2.3.

5.7.2.3 Automatic splicing mechanisms

See 5.2.2.4.

5.7.2.4 Electrostatic phenomena

See 5.2.2.5.

5.7.3 Discharge mechanism

See 5.2.3.

5.7.4 Noise

Hopper vibrator shall be mounted on a vibration isolation system in order to reduce the transmission of noise. The hopper shall be made with damped material in order to avoid resonance . The feeding disk and mechanisms shall be designed with care to the noise reduction criteria.

Wrapping pliers shall be made in such a way to avoid noise generated by impact and the product fall shall be controlled by a slide or by devices able to reduce the speed.

As noise can vary depending on the state of maintenance; the instruction handbook shall provide special criteria and value as reference (e.g. noise level of same mechanism measured in a referred mode).

The increase of noise or vibration level can be evaluated in order to prescribe maintenance operations.

5.7.5 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.8 Safety requirements for a over-wrapping machine

The hazards described in clause 4.8 shall be safeguarded by the following methods.

5.8.1 Product feed

See 5.2.1.

5.8.1.1 Chain and drives

See 5.2.1.1.

5.8.2 Tear tape application group

See 5.1.15 and, if a heat source is used (e.g. an hot melt tank), the requirements of 5.1.7.

5.8.3 Reel unwind mechanism

See 5.2.2.

5.8.3.1 Tension roller assembly

See 5.2.2.1.

5.8.3.2 Coders

See 5.2.2.2.

5.8.3.3 Power unwind mechanism

See 5.2.2.3.

5.8.3.4 Automatic splicing mechanism

See 5.2.2.4.

5.8.3.5 Electrostatic phenomena

See 5.2.2.5.

5.8.4 Discharge mechanism

See 5.2.3.

5.8.5 Noise

See 5.2.4.

5.8.6 General wrapping machine hazard

In addition to the above requirement the requirement in 5.1 shall apply where the equivalent hazard exists.

5.9 Safety requirements for a roll wrapping machine

The hazards described in clause 4.9 shall be safeguarded by the following methods.

5.9.1 Product feed

See 5.2.1.

5.9.1.1 Automatic product feed mechanism

All the mechanisms shall be safeguarded with fixed or interlocked guards.

For routine regular access, for example daily, interlocked guards shall be provided. Fixed guards should be considered for infrequent access. Guards shall be soundproofed and designed for easy cleaning.

5.9.2 Reel unwind mechanism

See 5.2.2.

5.9.2.1 Film compensator

See 5.2.2.1.

5.9.2.2 Coders

See 5.2.2.2.

5.9.3 Powered unwind mechanism

See 5.2.2.3.

5.9.4 Automatic splicing mechanism

See 5.2.2.4.

5.9.5 Discharge mechanism

See 5.2.3.

5.9.6 Noise

See 5.2.4.

5.9.7 General wrapping machine hazards

In addition to the above requirements, the requirements in 5.1 shall apply where the equivalent hazard exists.

5.10 Safety requirements for a foil and band wrapping and pleat wrapping machine

The hazards described in clause 4.10 shall be safeguarded by the following methods.

5.10.1 Product feed

See 5.2.1

5.10.1.1 Chain and drives

See 5.2.1.1.

5.10.1.2 Product pushing/elevating devices

See 5.2.1.2.

5.10.1.3 Belt infeed conveyors

See 5.2.1.3.

5.10.2 Reel unwind mechanism

See 5.2.2.

5.10.2.1 Film compensator

See 5.2.2.1.

5.10.2.2 Coders

See 5.2.2.2.

5.10.3 Discharge mechanism

See 5.2.3.

5.10.4 General wrapping machine hazards

In addition to the above requirements, the requirement in 5.1 shall apply where the equivalent hazard exists.

5.11 Safety requirements for a stretch film wrapping machine

The hazards described in clause 4.11 shall be safeguarded by the following methods.

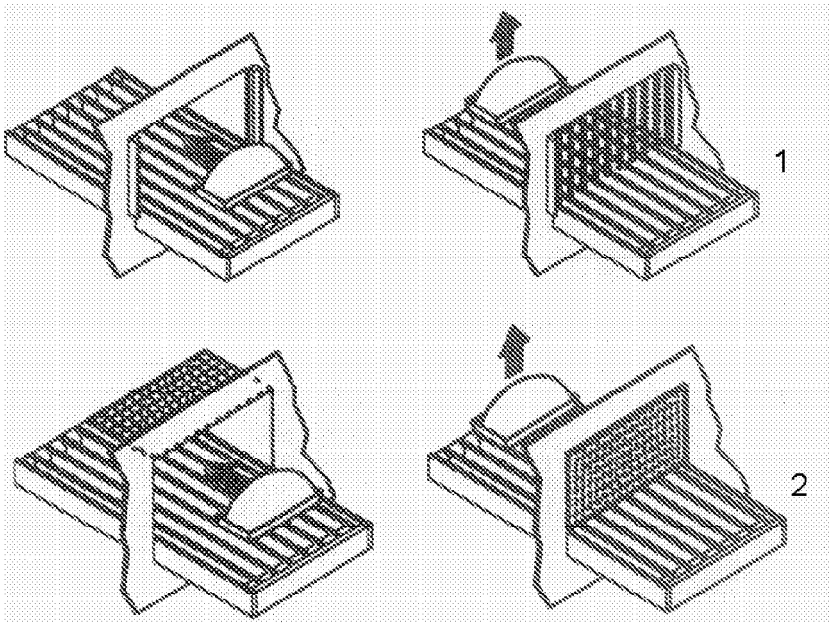
5.11.1 Product feed

See 5.2.1.3.

For small machines when EN294 table IV is practically non applicable the following solution may be adopted:

a) photo electric safety device according to EN574 category 2 with an opening slightly larger than the product, where the hazardous movement can be stopped before the danger zone is reached by an operator, except during the passage of the product; the position and dimension of the PED shall follow EN 999.

b) guards moving in step with the product which do not in themselves create an hazard (e.g. crushing, trapping etc.) by the use of limited force or sensitive edge. Where limited force to a maximum of 75 N is used if the guard is obstructed it shall stop the hazardous movement of the machine before the danger zone could be reached. (see figure 23)



Key:
1: photocell
2: guard moving instep with product

Figure 23 — Photo electric device and guards moving in step with product

5.11.2 Reel unwind mechanism

See 5.2.2.

5.11.2.1 Film compensator

See 5.2.2.1.

5.11.3 Product pushing devices

See 5.2.1.2.

5.11.3.1 Electrostatic phenomena

See 5.2.2.5.

5.11.4 Discharge mechanism

See 5.2.3.

5.11.4.1 Product discharge aperture

See 5.2.3.1. In alternative falling finger may be used movable only in the direction of the outlet of the product not allowing the entrance of part of the body (figure 24):

a) the fingers shall fit the whole aperture;

b) fingers shall fall down to the bottom of the aperture;

c) fingers shall fall down easily during the whole lifetime;

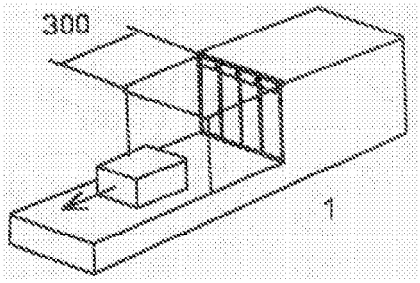
d) fingers shall be designed in a way so that they cannot be lifted;

e) the distance between the fingers shall not exceed 3 mm;

f) an easy access has to be nearby or there shall not be foreseeable need for reaching through the aperture (e.g. no trouble shooting required in this area);

g) a safety distance of 300 mm shall be used (see figure 24).

A prohibition symbol shall be fitted to the guard near the aperture warning the risk of injury from leaning the upper limbs into the machine (figure 19).



Key:
1: falling fingers

Figure 24 — Product discharge aperture

5.11.5 General wrapping machines hazards

In addition to the above requirements the requirements in 5.1 shall apply where the equivalent hazard exists.

5.12 Safety requirements for a L-sealing machine

The hazards described in clause 4.12 shall be safeguarded by the following methods.

5.12.1 Product feed

The feeding zone shall be carefully designed in order to avoid bad posture and limitation to body movement.

5.12.2 L-sealing station

There are three kind of machine: manual, with the closure of the bar under power and automatic; the following requirement apply:

a) When the heater is hand operated an ergonomically designed handle shall by placed on the L shaped sealing bar. A warning notice shall be fitted indicating the burn hazard. The temperature of the handle shall not exceed 43 °C.

b) When the bar is raised and lowered under power, such as by a pneumatic cylinder, the powered movement shall be controlled by synchronous two hand control device according to EN574 category 3. So far as possible, the workstation should be designed so that only one person can stand at the operator's position, Instruction for use shall be provided to advise that the controls shall be used by a single person. In addition, a notice shall be attached to the workstation indicating "Single Operator Only".

c) When the movement of the sealing bar is controlled automatically, guards shall be used according to clause 5.1.15 of this standard.

5.12.3 Shrink tunnel

See 5.14.

5.12.4 Stability of the machine

Two wheels shall be equipped with a brake. Also the wheels shall be safeguarded with fixed bars against crushing height no more than 10 cm from the ground.

5.12.5 Ergonomics

The machine design shall take in consideration the position of manual controls and the height of the working plane (EN 614-1-2).

5.12.6 General wrapping machine hazards

In addition to the above requirement, the requirement in 5.1 shall apply where the equivalent hazard exists.

5.13 Safety requirements for a skin packaging machine

The hazards described in clause 4.13 shall be safeguarded by the following methods.

5.13.1 Product feed

See 5.2.1.

5.13.2 Product discharge

See 5.2.3.

5.13.3 Stability of the machine

See 5.12.4.

5.13.4 Ergonomics

See 5.12.5.

5.13.5 General wrapping machine hazards

In addition to the above requirement the requirement in 5.1 shall apply where the equivalent hazard exists.

5.14 Safety requirements for a shrink tunnel and hot water dip tank

The hazards described in clause 4.14 shall be safeguarded by the following methods.

5.14.1 Product transfer system

The feeding belt shall be safeguarded according to 5.2.1.3.

When the feeding belt of the tunnel and the outlet belt of the wrapping machine are the same, special care shall be given to the integration of the guards. The instruction handbook shall provide suitable information for the correct mounting of the guards.

5.14.2 Temperature

The external temperature of exposed parts of the machine, e.g. guards, control panels, electric motors, shall not exceed a temperature that will cause burning. For bare metal the temperature must be no higher than 65°C for contact times less than one second. See EN 563 for details of the burn thresholds for other materials or longer contact times. Surfaces, where these temperatures are exceeded shall be safeguarded and a triangular warning sign conforming to ISO 7000: 1989 (see figure 17) shall be fitted at the guard adjacent these surfaces.

Surfaces which are designed to be handled shall not exceed 43°C.

If necessary cooling systems shall be incorporated to ensure that this limit is not exceeded.

A hazard warning sign shall be placed near the inlet and outlet aperture .The openings shall be closed by flexible curtain to limit the escape of heat but allow products to pass unhindered. The heaters inside tunnel shall be guarded against unintentional contact (according to EN 294).

Hinged covers which give access to hot parts shall be interlocked by the safety related parts of the control system to cut off all heating and motive power when the cover is open.

Where it is necessary to prevent overheating of the conveyor and possible risk of fire a run-down function shall be incorporated which keeps the conveyor running for a pre-determined period after the heating system has been switched off.

Temperature control shall be performed by an automatic system which in case of failure shall cut off power avoiding over-heating.

The instruction manual shall provide information to enable all setting clearing and maintenance tasks to be performed safely especially in cases where the procedures involve opening hinged covers or removing panels which give access to hot parts.

These instructions may suggest the use of personal protective equipment when it is impractical to avoid exposure to hot parts.

5.14.3 Product

Overheating of flammable and/or explosive products as defined by directives 94/55 EC and 67/548/EEC shall be avoided by the following means:

a) The manufacturer should provide details of the maximum working temperature for the equipment, the maximum thermal output of the heaters, and the minimum conveyor speed. The instructions should include a description of the safe working method for setting up the machine. This should start with setting the belt speed, then running the machine at a low temperature setting, then progressively increasing the temperature until a satisfactory shrink wrap is achieved. This should be done while monitoring the product to ensure that is not overheated such that it may, for example, approach its autoignition temperature;

b) a run out function shall be incorporated to enable all product to be discharged before the conveyor stops;

c) in the event of an emergency e.g. loss of mains power the belt shall move by a power reserve (e.g. pneumatic or electric battery) to enable all products to be discharged before the conveyor stops;

d) alternatively once power has been isolated the tunnel or tank should be capable of being opened to enable removal of product using protective equipment or to allow the rapid dissipation of heat;

e) automatic carbon dioxide sprayers or other suitable fire extinguishing equipment shall be mounted if there is a significant risk of fire;

f) to prevent fire hazard a high temperature sensor and associated trip device shall be installed independently from thermostatic control to minimise the risk of the product catching fire;

g) see also 5.1.7.

5.14.4 Product discharge

The outlet belt shall be safeguarded following the requirements in 5.2.1.3.

If the belt temperature is greater than 65°C cooling devices shall be provided or fixed guards fitted. Contact should only be possible where the temperature is lower than 65 °C. Same requirements apply to product exiting the tunnel.

5.14.5 General wrapping machines hazards

In addition to the above requirement, the requirement 5.1 shall apply where the equivalent hazard exists.

6 Verification of safety requirements

Before despatching a wrapping machine, a manufacturer or supplier who wishes to claim conformity to this standard, shall first verify that the machine fulfils the safety requirements.

The following verification procedures shall be followed.

6.1 Visual inspection with machine stopped

6.1.1 Mechanical parts

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

6.1.2 Pneumatic systems

Check all pneumatic components and pipe-work conform to safety requirements (EN 983) and are correctly installed.

6.1.3 Electrical systems

Check that all electrical components and wiring is in compliance with he technical documentation described in clause 18 of EN 60204-1:1997.

6.1.4 Guards

Check all guards are in place and securely fixed. Check that all interlocking devices are fitted and working correctly.

6.1.5 Design requirements

Check that the design features stipulated in the safety requirements have been incorporated.

6.2 Measurements with machine stopped

6.2.1 Guards

Check the relationship between the size of any apertures in the guards and their distance from the nearest danger zones conform to the requirements of this standards in particular 5.1.15.

6.2.2 Electrical

The following tests shall always be performed for each individual manufactured machine when assembled and finished:

a) continuity of the protective bonding circuit;

b) insulation resistance tests;

c) voltage test;

d) function test;

e) in addition, for the type of machine, protection against residual voltages shall where applicable be tested and it shall be verified that the electrical equipment is in compliance with the technical documentation. See clause 19 of EN 60204-1:1997.

6.3 Visual inspection with machine running

6.3.1 Guards

Check with machine running that the guards conform to the safety requirements.

6.3.2 Interlocks

Check the operation of all emergency stop and interlocking devices. Check that following the operation of an emergency stop or interlocking device, no residual hazards remain in the machine when the guards are opened.

6.3.3 Vibration

Check that there is no excessive vibration transmitted through the machine.

6.4 Measurements with machine running (at a specified machine operating speed and condition)

6.4.1 Noise

Refer to annex A.

6.4.2 Temperature

With the machine fully warmed up, measure the surface temperature of the machine and check that it is below the maximum temperature as stated in clause 5.1.7

6.5 Hazardous product and packaging material related requirements

6.5.1 Visual inspections before delivery

Check that the design requirements for handling the products or packaging materials in question have been followed.

6.6 Verification procedures

Safety requirement	Visual inspection	Functional test	Measurement	Calculation	Safety requirement	Visual inspection	Functional Test	Measurement	Calculation
5.1.1	X	X			5.1.2	X	x	x	
5.1.3	X	X	x		5.1.4	X	x		
5.1.5	X	X	x		5.1.6	X	x	x	x
5.1.7	X	X	x	x	5.1.8	x	x	x	x
5.1.9	X	X	x	x	5.1.10	x	x	x	x

Safety requirement	Visual inspection	Functional test	Measurement	Calculation	Safety requirement	Visual inspection	Functional Test	Measurement	Calculation
5.1.11	X	X	x	x	5.1.12	x	x		
5.1.13	X	X	x	x	5.1.14	x	x	x	x
5.1.15	x	X			5.1.16	x	x	x	x
5.2.1	x	X	x		5.2.2	x	x	x	
5.2.3	x	X	x		5.2.4	x	x	x	
5.2.5	x	X	x	x	5.3.1	x	x	x	
5.3.2	x	X	x		5.3.3	x	x		
5.3.4	x	X	x		5.3.5	x	x	x	x
5.3.6	x	X	x	x	5.4.1	x	x	x	
5.4.2	x	X			5.4.3	x	x		
5.4.4	x	X	x	x	5.4.5	x	x	x	x
5.5.1	x	X	x		5.5.2	x	x	x	
5.5.3	x	X	x		5.5.4	x	x	x	
5.5.5	x	X	x		5.5.6	x	x	x	x
5.6.1	x	X	x		5.6.2	x	x	x	
5.6.3	x	X	x		5.6.4	x	x	x	
5.6.5	x	X	x	x	5.7.1	x	x	x	x
5.7.2	x	X	x		5.7.3	x	x	x	x
5.7.4	x	X	x		5.7.5	x	x	x	
5.7.6	x	X	x	x	5.8.1	x	x	x	
5.8.2	x	X	x		5.8.3	x	x		
5.8.4	x	X			5.8.5	x	x	x	
5.8.6	x	X	x		5.8.7	x	x	x	x
5.9.1	x	X	x		5.9.2	x	x		
5.9.3	x	X	x		5.9.4	x	x	x	
5.9.5	x	X	x		5.9.6	x	x	x	
5.9.7	x	X	x		5.10.1	x	x	x	
5.10.2	x	X	x		5.10.3	x	x		
5.10.4	x	X	x	x	5.11.1	x	x	x	x
5.11.2	x	X	x		5.11.3	x	x	x	
5.11.4	x	X	x		5.11.5	x	x		
5.11.6	x	X	x	x	5.12.1	x	x	x	
5.12.2	x	X	x		5.12.3	x	x	x	x
5.12.4	x	X	x		5.12.5	x	x	x	x
5.12.6	x	X	x	x	5.13.1	x	x	x	
5.13.2	x	X			5.13.3	x	x	x	

Safety requirement	Visual inspection	Functional test	Measurement	Calculation	Safety requirement	Visual inspection	Functional Test	Measurement	Calculation
5.13.4	x	X	x		5.13.5	x	x	x	x
5.14.1	x	X	x		5.14.2	x	x	x	x
5.14.3	x	X	x	x	5.14.4	x	x	x	
5.14.5	x	X	x	x					

Table 1 — Verification procedures for safety requirements identified in clauses

7 Information for use

7.1 Requirements for all wrapping machines

7.1.1 Marking

Machines shall be marked with the following information:

a) name and address of the manufacturer or his authorised representative established in the European Union;

b) designation of series or type;

c) year of construction;

d) serial number (if any);

e) the CE mark (unless the machine is to be integrated);

f) electrical markings as indicated in 18.4 of EN 60204-1;

g) warning notices or signs where specifically required in clause 5 of this standard.

7.1.2 Instructions for use

All machines shall be accompanied by instructions which include at least the following:

a) repeat of the information marked on the machine;

b) a record of the signs and pictograms fixed to the machine, a drawing of their location and an explanation of their significance;

c) description of the foreseen use of the machine which should include details of the product , packaging materials, pack sizes, speed of operation. Safe working method for routine operator tasks (e.g. rethreading, clearing blockages, regular inspection of safety device, cleaning etc.)

d) a drawing indicating the work station to be occupied by operators);

e) information required by section 5;

f) details about transport, setting-up and installation including: lifting instructions, transport weights plant;

g) layout and installation condition (foundation plan, building requirements);

h) details about commissioning an decommissioning including details about the provision of energy (electric and pneumatic) details about starting, operation and shutdown; details about inspection of safety device before commissioning and reference for decommissioning;

i) detail from scrapping e.g. hazardous material;

j) cleaning and size changing including details of the mass of machine parts which must regularly be removed for size changing or cleaning.

k) instruction for safe adjustment;

l) training requirement for machine operators (if necessary);

m) if necessary instruction on how the machine should be installed to minimise noise;

n) noise emission declaration, a record of sound pressure level measurement, an indication of the anticipated sound pressure level when the machine is in use and instruction on how the machine should be installed to minimise noise;

o) a statement indicating whether the machine is suitable or not to be installed in a potentially explosive atmosphere;

p) if necessary instruction on means of access above floor level;

q) instructions for safe use, cleaning and size changing including details of the mass of machine parts which must regularly be removed for size changing or cleaning;

r) noise emission declaration to annex A;

s) on machines for use with agri-foodstuffs or pharmaceuticals, instructions for cleaning and disaffection of the machine, together with details of appropriate and inappropriate cleaning and disinfecting materials.

The instructions shall be written in one of the EC languages. These instructions together with a translated version shall accompany the machine when this is put into service. The translation shall be in the language or languages of the country in which the machine is to be used.

Maintenance instructions to be used by specialised personnel employed by the manufacturer or his authorised representative established in the EEA need not to be translated.

7.2 Instruction for maintenance

Instructions or a safe maintenance and adjustment will be provided with special regards to:

a) on machines for use with agri-foodstuffs or pharmaceuticals for cleaning and disinfecting together with details on appropriate cleaning material;

b) size parts changing;

c) adjustment of safety guards after a size change;

d) a routine preventive maintenance of safety device;

e) where appropriate, on high speed machines, noise and/or vibration level in a referred mode to be compared with present level for a condition based maintenance.

Annex A
(normative)

Rules for determination and declaration of noise emission values - grade 2 or grade 3

A.1 Scope

These rules for the noise determination and declaration of noise emission values are applicable to wrapping machines subject of this standard.

A.2 Definitions

Definitions shall comply with EN ISO 12001 clause 3.

Work cycle: Period between from infeed to outfeed of the product in which the product is handled by the machine.

A.3 Determination of emission sound pressure level at the workstation

The A-weighted emission sound pressure level at the workstation shall be determined according to EN ISO 11204 following the requirements for grade 2. If it is not possible to comply with the requirements of grade 2, EN ISO 11204 grade 3 or EN ISO 11202 grade 3 may be applied.

The measuring time for determination of the emission sound pressure level shall be 30 s and during a minimum of 5 cycles.

For wrapping machines with typical operator positions, the measurement shall be carried out at the usual position of the operator without the operator being present.

The work station of the machine are described and defined in table A1

Machine	Workstations where noise shall be measured	Operating conditions for measurement
Twist wrapping machine	Pos.1 at 1 m from handwheel	Test made at manufacturer's workshop (assembling dept) Machine running at 1000 rpm Original product used (candies) No vibration pads used Time of measurement: 15 s Noise level: dB(A)Leq Background correction not used Environmental correction used
	Pos. 2 at 1 m from infeed on left side	
	Pos. 3 at 1 m from rear side	
	Pos.4 at 1 m from product outfeed	
	(for all points: height 1.6 m from ground)	

Table A.1 — Typical workstation and operation depending on the machine for sound pressure level measurement

A.4 Sound power level determination

The A-weighted sound power level shall be determined according to EN ISO 3744 by using the box shaped measurement surface in a distance of 1 m.

A.5 Installation and mounting conditions

The installation and mounting conditions shall be identical for the determination of both sound power level and emission sound pressure level at specified positions and for declaration purposes.

Care shall be taken to ensure that any electrical conduits, piping or air ducts which are connected to the machine do not radiate significant amounts of sound energy.

For the purpose of measurements, the machine shall be installed on a sound reflecting plane either outside (e.g. a parking space) or in a room providing for the necessary free field above the reflecting plane.

The test environment has to meet the requirements for grade 2 measurements according to EN ISO 11204, and EN ISO 3744 respectively for grade 3 measurements according to EN ISO 11202.

A.6 Operating conditions

The operating conditions have to be the same for the determination of the sound power level and of the emission sound pressure level at specified positions.

Measurements shall be taken during dry cycling and loading with the product and packaging material for which the machine has been specified. In situations where this is not possible e.g. because the product is frozen, the machine shall be tested with a representative product which is likely to produce similar noise emission to the specified product.

Machine	Workstations where noise shall be measured	Operating conditions for measurement
Overwrapping machine	Pos. 1 at 1 m from handwheel	Test made at manufacturer's Workshop (assembling dept) Machine running at 500 rpm Samples of product used Time measurement 15 s
	Pos. 2 at 1 m from infeed	
	Pos. 3 at 1 m from rear side	
	Pos. 4 at 1 m from outlet	
	Pos. 5 at 1 m from top of machine	

Table A.2 — Typical workstation and operation depending on the machine for sound power level measurement

The machine shall run with maximum speed or number of revolutions.

The measuring time for determination of the emission sound pressure level shall be 30 s during 3-5 work cycles.

A.7 Measurement uncertainties

A standard deviation of reproducibility σ_R of 0,5 - 2,5 dB is expected for the A-weighted emission sound pressure level determined according EN ISO 11204 grade 2.

A standard deviation of reproducibility σ_R of up to 5 dB is expected for the A-weighted emission sound pressure level determined according EN ISO 11202 grade 3.

Considering the sound power level determination according to EN ISO 3744 a standard deviation of reproducibility σ_R of 0,5 - 1,5 dB is expected.

A.8 Information to be recorded

The information to be recorded comprises all technical requirements laid down in these rules for noise measurement and shall comply with the requirements stated in clause 12 of EN ISO 11202/11204 respectively clause 9 of EN ISO 3744. Any deviations from the noise test code and/or from the basic noise emission measurement standards used are to be recorded together with the technical justification for such deviation.

A.9 Information to be reported

The information given in the noise declaration shall refer to the requirements of the manufacturer for noise declaration or of the user for verifying the declared values.

The following minimum of information shall be given:

— identification of the manufacturer, machine type, machine model, serial no. and year of manufacture;

— reference to the basic noise emission standards applied;

— description of installation and operating conditions;

— kind and specific characteristics of the product and material used during measurement;

— description of microphone positions;

— determined emission values;

— location of work stations and other specified positions;

— confirmation that all requirements of this noise test code have been fulfilled, or, if this is not the case, any unfulfilled requirements shall be identified. All unfulfilled requirements shall be specified; deviations from requirements shall be stated and technical reasons shall be given.

A.10 Declaration and verification of noise emission values

The declaration of the noise emission values shall be made as a dual number noise emission declaration according to EN ISO 4871:1996. It shall declare the noise emission values L (L_{pA} and L_{WA}) and the respective uncertainty K (K_{pA} and K_{WA} as given in table 1) according to clause 1.7.4 f of Annex A of EN 292-2:1991, and this standard.

The uncertainties K_{pA} and K_{WA} are expected to have values as given in the table A.3.

Standard	Grade 2	grade 3
EN ISO 11204	K_{pA}= 3 dB	K_{pA}= 4 dB
EN ISO 11202		K_{pA}= 6 dB
EN ISO 3744	K_{WA}= 3 dB	

Table A.3 — Uncertainties expected

The noise emission value shall be rounded to the nearest decibel.

The noise emission declaration shall explicitly state that the emission values have been measured according to the specification of this noise test code as well as to EN ISO 11202/11204 and EN ISO 3744. If this statement is not true, the noise declaration shall indicate clearly what the deviations are from this noise test code and/or from the basic standards.

If undertaken, verification shall be done according to EN ISO 4871:1996 by using the same mounting, installation and operating conditions as those used for the initial determination of noise emission values.

The above information has to be given in the instructions of use as well as in the sales documentation.

A noise emission declaration according to annex B.2 of EN ISO 4871:1996 can be given as example in below.

Wrapping machine Type: ..., model: ...serial number……...		
Declared dual-number noise emission values in accordance with EN ISO 4871		
	Load	dry cycling
Measured A-weighted emission sound pressure level L_{pA} (ref. 20 μPa) at the operator's position in dB	92	89
Uncertainty K_{pA} in dB	3	3
Measured A-weighted sound power level L_{WA} (ref. 1 pW) in dB	97	95
Uncertainty K_{WA} in dB	3	3
Values determined according EN ISO 11204, EN ISO 3744		
Note: The sum of a measured noise emission value and its associated uncertainty represents an upper boundary of the range of values which is likely to occur in measurements.		

Table A.4 — Example of a noise emission declaration (the values in this table are examples)

NOTE Additional noise emission values can be given in the declaration.

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives.

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 Directives.

Machines Directive 98/37/EC, amended by Directive 98/79/EC.

Low Voltage Directive 73/23/EEC and its amendments.

WARNING : Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.