



Safety of machinery

Part 3406: Safety of packaging machines—Pallet wrapping machines

This Australia Standard is the identical adoption of EN 415-6:2013, Safety of packaging machines — Part 6: Pallet wrapping machines, with the permission of the European Committee for Standardization - CEN, Avenue Marnix 17, B-1000 Brussels, Belgium



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- NSCA Foundation
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Safety of machinery

Part 3406: Safety of packaging machines—Pallet wrapping machines

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Preface

This Standard was prepared by the Australian members of the Joint Standards Australia/Standards New Zealand Committee SF-041, Safety of Machinery.

The objective of this Standard is to specify the safety requirements for machine design, construction, installation, commissioning, operation, adjustment, maintenance and cleaning of pallet wrapping machines. This applies to the following groups of machines:

- (a) Pallet banding machines.
- (b) Stretch film pallet wrapping machines.
- (c) Stretch film hood application machines.
- (d) Mobile stretch film wrapping machines.
- (e) Semi-automatic self-driving stretch film wrapping machines.
- (f) Shrink film pallet wrapping machines.
- (g) Shrink film hood application machines.
- (h) Film removing machines.
- (i) Shrinking systems.
- (j) Sleeve wrapping machines for product greater than 400 mm in one direction.
- (k) Product centralising machines.

This Standard is identical with, and has been reproduced from, EN 415-6:2013, *Safety of packaging machines, Part 6: Pallet wrapping machines*.

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- (i) In the source text 'this European Standard' should read 'this Australian Standard'.
- (ii) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms 'normative' and 'informative' are used in Standards to define the application of the appendices or annexes to which they apply. A 'normative' appendix or annex is an integral part of a Standard, whereas an 'informative' appendix or annex is only for information and guidance.

NOTES

Contents

Page

Foreword	5
Introduction	6
1 Scope	7
2 Normative references	8
3 Terms and definitions	10
3.1 Definition of terms	10
3.2 Description of pallet wrapping machines	11
4 List of hazards on pallet wrapping machines	25
4.1 General	25
4.2 General pallet wrapping machine hazards	26
4.3 Specific hazards on pallet wrapping machines excluding shrinking systems and auxiliary machines	30
4.4 Specific hazards on pallet shrinking systems	34
4.5 Auxiliary machines	36
5 Safety requirements and measures for pallet wrapping machines	37
5.1 General	37
5.2 General requirements for pallet wrapping machines	37
5.3 Safety requirements for pallet wrapping machines	51
5.4 Safety requirements for shrinking systems	56
5.5 Auxiliary machines	61
6 Verification of safety requirements and measures	61
6.1 General	61
6.2 Visual inspections with the machine stopped	62
6.3 Measurements with the machine stopped	62
6.4 Visual inspections with the machine running	62
6.5 Measurements with the machine running	63
6.6 Verification procedures	63
7 Information for use	65
7.1 Marking	65
7.2 Signals and warning signs	66
7.3 Instruction handbook	66
Annex A (normative) Noise test code for pallet wrapping machines - grade of accuracy 2 and 3	68
Annex B (normative) Methods of safeguarding large apertures	69
B.1 Interlocked guards with guard locking	69
B.2 Fixed and interlocked guards with ESPE	69
B.3 Positioning of ESPE	72
Annex C (normative) ESPE-Muting	74
Annex D (informative) List of possibly helpful standards for gas equipment	76
Annex E (informative) Significant technical changes between this European Standard and the previous edition EN 415-6:2006+A1:2009	77
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	78
Bibliography	79

Figures

Figure 1 — Principle of rotary table machine	12
Figure 2 — Manual rotary table machine	12
Figure 3 — Automatic rotary table machine	12
Figure 4 — Semiautomatic rotary arm machine	13
Figure 5 — Fully automatic rotary arm machine	14
Figure 6 — Ring machine – Principle of operation	15
Figure 7 — Semi automatic self driving pallet stretch wrapping machine	15
Figure 8 — Mobile pallet stretch wrapping machine	16
Figure 9 — Curtain stretching machine – Principle of operation	16
Figure 10 — Hood stretching machine	17
Figure 11 — Spiral pallet wrapping machine	19
Figure 12 — Vertical hood application machine	20
Figure 13 — Parachute hood application machine	20
Figure 14 — Shrinking frame	21
Figure 15 — Chamber shrinking oven with electric heating device	22
Figure 16 — Continuous shrinking oven using thermal combustion heating	23
Figure 17 — Shrinking column using thermal combustion	24
Figure 18 — Product centralizing machine	25
Figure 19 — Semiautomatic or manual rotary table machines: crushing, shearing and drawing-in hazard location	31
Figure 20 — Warning sign "Caution, hot surface"	44
Figure 21 — Semiautomatic or manual rotary table machines with apertures in the table	52
Figure 22 — Methods for safeguarding of film rollers	53
Figure B.1 — Interlocked guards with guard locking	69
Figure B.2 — Example of a combination of fixed and interlocked guards and ESPE	70
Figure B.3 — Dynamic cell positioning	72
Figure B.4 — Positioning of ESPE	73
Figure C.1 — Positioning of muting ESPE	75

Tables

Table 1 —Degree of protection for dusty environments	42
Table 2 — Degree of protection for different cleaning methods using water	42
Table 3 — Verification procedures for safety requirements identified in 5.2 and 5.3.....	64
Table 3 (<i>continued</i>)	65

Foreword

This document (EN 415-6:2013) has been prepared by Technical Committee CEN/TC 146 "Packaging Machines Safety", the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2013, and conflicting national standards shall be withdrawn at the latest by November 2013.

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

This document supersedes EN 415-6:2006+A1:2009.

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.

Annex E provides details of significant technical changes between this European Standard and the previous edition: EN 415-6:2006+A1:2009.

EN 415 "Safety of packaging machines" consists of the following parts:

- *Part 1: Terminology and classification of packaging machines and associated equipment*
- *Part 2: Pre-formed rigid container packaging machines*
- *Part 3: Form, fill and seal machines*
- *Part 4: Palletisers and depalletisers*
- *Part 5: Wrapping machines*
- *Part 6: Pallet wrapping machines*
- *Part 7: Group and secondary packaging machines*
- *Part 8: Strapping machines*
- *Part 9: Noise measurement methods for packaging machines, packaging lines and associated equipment, grade of accuracy 2 and 3*

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

Introduction

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

Pallet wrapping machines fulfil the following major tasks:

- securing of palletised or unpalletised loads to prevent them collapsing and displacing during transport, handling, storage;
- pooling of loads and parts to form loads suitable for transport;
- protection against external influences;
- conditional protection against theft.

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

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

When provisions of this type C standard are different from those, which are stated in type A or B standards, the provisions of this type C standard take precedence.

1 Scope

This European Standard applies to the following groups of machines:

- pallet banding machines;
- stretch film pallet wrapping machines;
- stretch film hood application machines;
- mobile stretch film wrapping machines;
- semi automatic self driving stretch film wrapping machines;
- shrink film pallet wrapping machines;
- shrink film hood application machines;
- film removing machines;
- shrinking systems;
- sleeve wrapping machines for product greater than 400 mm in one direction;
- product centralising machines.

The individual machines are described in 3.2.

This standard deals with safety requirements for machine design, construction, installation, commissioning, operation, adjustment, maintenance and cleaning of pallet wrapping machines.

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

Exclusions

This European Standard is not applicable to the following machines:

- machines that were manufactured before the date of publication of this document by CEN;
- pallet strapping machines and destrapping machines. These machines are within the scope of EN 415-8;
- conveying systems that connect packaging machines with each other, but includes conveying systems that are part of the machines.

This standard does not consider the following hazards:

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

2 Normative references

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

EN 203-1:2005+A1:2008 *Gas heated catering equipment — Part 1: General safety rules*

EN 349:1993+A1:2008, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 415-1:2000+A1:2009, *Packaging machines safety — Part 1: Terminology and classification of packaging machines and associated equipment*

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

EN 574:1996+A1:2008, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

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

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

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

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

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

EN 894-1, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

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

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

EN 1088:1995+A2:2008, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

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

EN 1760-1, *Safety of machinery — Pressure sensitive protective devices — Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors*

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

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

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

EN 61310-1:2008, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

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

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

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

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

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

EN 61508-3, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements*

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

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

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

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

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

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

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

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

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

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

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

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

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

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

3 Terms and definitions

For the purposes of this document the terms and definitions given in Clause 3 of EN ISO 12100:2010, and EN 415-1:2000+A1:2009 and the following apply.

3.1 Definition of terms

3.1.1

product

article or articles, with or without pallet, that are handled in the pallet wrapping machine

3.1.2

pack

assembly of product and packaging materials produced by a pallet wrapping machine

3.1.3

packaging material

material used to secure a product, e.g. stretch film

3.1.4

flexible packaging material

relatively thin paper, plastic film or flexible laminate

3.1.5

stretch film

flexible elastic plastic film which can be pulled tightly around a product to form an envelope. It may stick to itself on contact or require heat sealing

3.1.6

stretch wrapping

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

3.1.7

thermoplastic film, shrink film

plastic film which shrinks when heated

3.1.8

film reel, packaging material reel

continuous sheet of paper, plastic film, metal foil or flexible laminate wound on a cylindrical core

3.1.9

film clamp

device to hold the film at the product for the first wrap. Also called film fixture

3.1.10

manual operation

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

3.1.11

top sheet

piece of packaging material which is applied to the top of the product e.g. to achieve water and dust protection

3.2 Description of pallet wrapping machines

3.2.1 General

Pallet wrapping machines are machines listed in Clause 1 that secure product for transport and other purposes e.g. by applying packaging material or shrinking shrink film. Many of the machines deal with palletised products, therefore they are called, e.g.: pallet shrink wrapping machine, pallet shrink oven (see 3.12.3 of EN 415-1:2000+A1:2009). In many cases, however, machines can function without a pallet or with an alternative form of support for the pack.

3.2.2 Spiral stretch wrapping machines

3.2.2.1 General

The stretching method uses film webs that are wound around product according to a given winding pattern (e.g. single or cross bracing). The number of the bottom windings or bottom edge windings or the degree of overlapping of the film webs can be variably adjusted.

Stretch film wrapping machines wind a stretch film spirally around product, thus resulting in an envelope with horizontal and vertical tension forces.

Pallet stretch wrapping machines include:

- Automatic stretch film wrapping machines: The machine is loaded and unloaded automatically by a conveyor. The application of the stretch film, stretching and cutting of the stretch film are done automatically.
- Semiautomatic stretch film wrapping machines: One or more of the following are done manually: loading or unloading of the machine, application or cutting of the stretch film. The wrapping movement is done automatically.
- Manual stretch film wrapping machines: Like semiautomatic stretch film wrapping machines, but additionally the movement of the lifting mechanism is done manually.

The following types of stretch film wrapping machines exist.

3.2.2.2 Rotary table machine

Product, which is positioned on a table that rotates, is wrapped. When used, vertically moveable film carriage and pre-stretching device are fitted to a column. The functional principle of a rotary table machine is shown in Figure 1. On manual rotary machine the vertical movement of the film carriage is done by an operator (see Figure 2). An example of a fully automatic rotary table machine is shown in Figure 3.

The principle components are rotating table and film reel.

Optional assemblies: conveyors, film clamp, film knife, film sealing device, hold-down plate, pre-stretching unit on the film reel assembly, top sheet feeder.

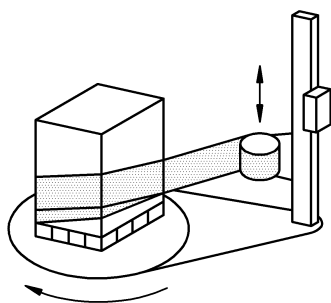


Figure 1 — Principle of rotary table machine

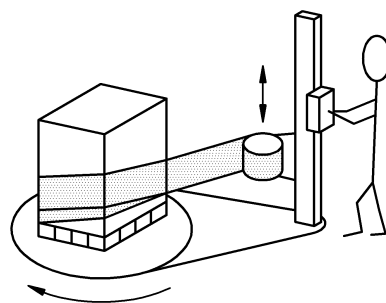
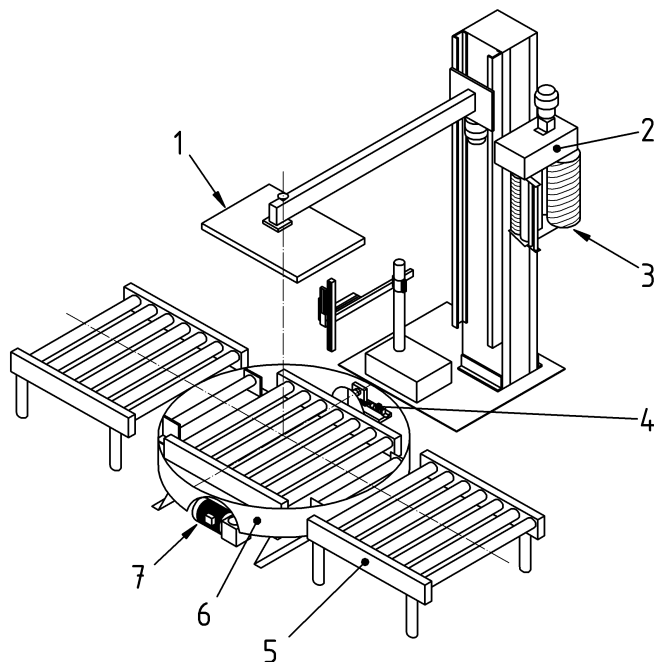


Figure 2 — Manual rotary table machine

**Key**

- 1 hold down plate
- 2 pre-stretching device
- 3 film reel
- 4 film fixture system
- 5 conveyor
- 6 rotary table
- 7 film cutting device

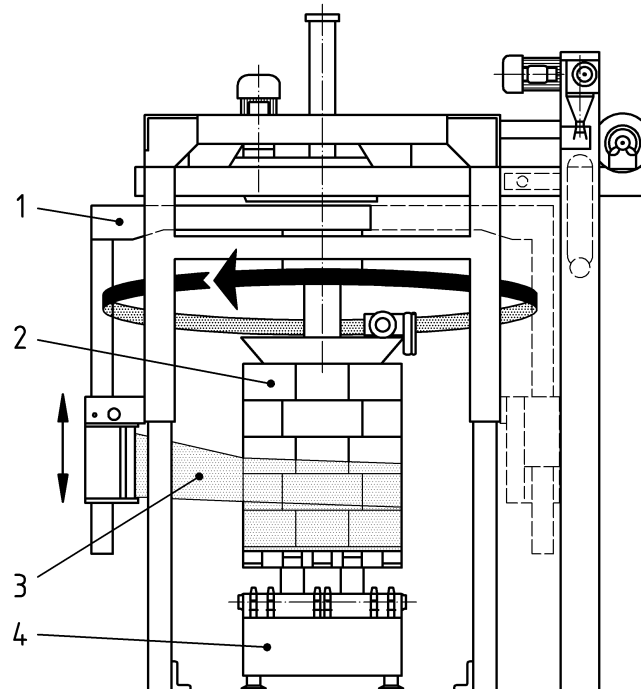
Figure 3 — Automatic rotary table machine

3.2.2.3 Rotary arm machine

Machine which wraps product in film or net, from a reel on an arm which rotates around the stationary product (see Figure 4 and Figure 5).

The principle components are: rotating arm, film reel assembly and lifting mechanism which moves the arm up and down.

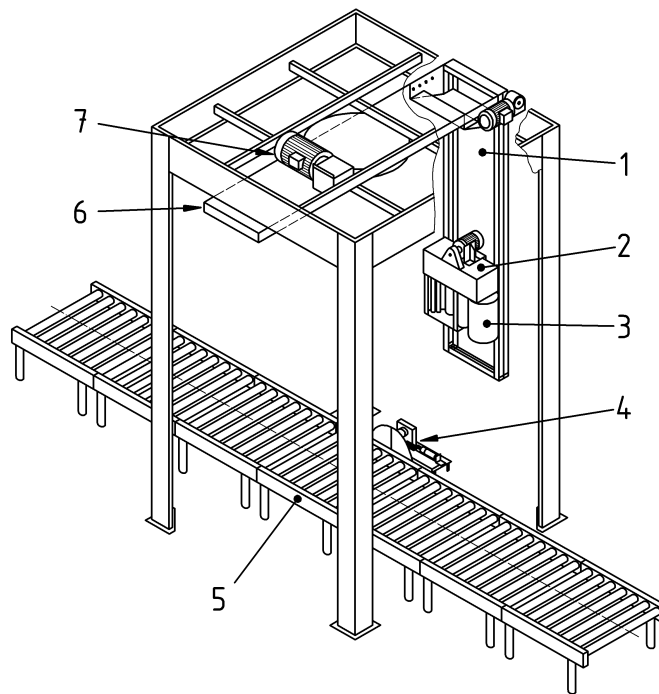
Optional assemblies: conveyors, film clamp, film knife, film sealing device, hold-down plate, pre-stretching unit on the film reel assembly, top sheet feeder.



Key

- 1 rotary arm
- 2 product
- 3 film
- 4 conveying device

Figure 4 — Semiautomatic rotary arm machine



Key

- 1 vertical slide device
- 2 pre-stretching device
- 3 film reel assembly
- 4 film fixture system
- 5 conveying device
- 6 rotary arm
- 7 top sheet feeder

Figure 5 — Fully automatic rotary arm machine

3.2.2.4 Ring machine

In a ring machine a film carriage guided on a ring moves circularly around the stationary product (see Figure 6). Some examples have a tilting ring to apply a diagonal wrap.

The principle components are: rotating mechanism on a ring, film reel assembly and lifting mechanism which moves the ring up and down.

Optional assemblies: conveyors, film clamp, film knife, film sealing device, hold-down plate, pre-stretching unit on the film reel assembly, top sheet feeder.

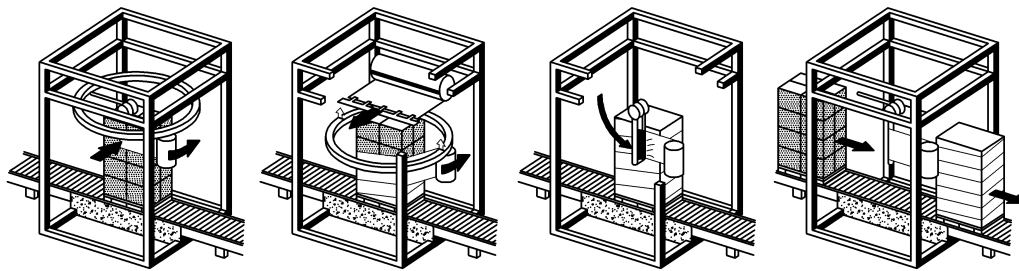
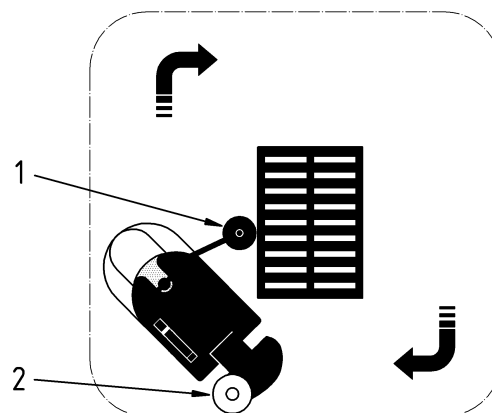


Figure 6 — Ring machine – Principle of operation

3.2.2.5 Semi automatic self driving pallet stretch wrapping machines

Semi automatic self driving pallet stretch wrapping machines apply a stretch film by the whole machine driving around the product (see Figure 7). The machine is guided around the product by a contact wheel which is mounted on a moveable lever.

The principle components are the contact wheel and the film reel assembly.



Key

- 1 contact wheel
- 2 film reel assembly

Figure 7 — Semi automatic self driving pallet stretch wrapping machine

3.2.2.6 Mobile pallet stretch wrapping machines

Mobile stretching machines (see Figure 8) are moved to the pallet manually, usually assisted by a motor drive. Usually the pallet is lifted by a lifting mechanism and so fixed on the stretch wrapping machine. The machine wraps a product in film or net, from a reel on an arm which rotates around the stationary product (rotary arm machine).

The principle components are: pallet support, rotary arm and film reel assembly.

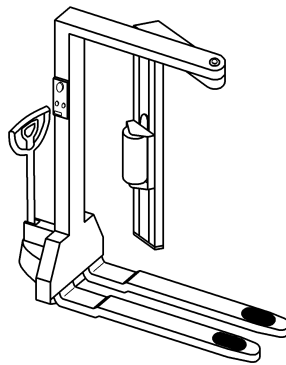


Figure 8 — Mobile pallet stretch wrapping machine

3.2.3 Curtain stretching machine

A conveyor transports the product into a film curtain that is stretched and subsequently welded on the rear side.

Working principle is the so-called passage method according to which the product in the machine bumps against the film web rolling off two rollers and drags this along. In this manner, the stretch film envelopes the advancing product. After this a closing and cutting tool tightens up and separates the film (see Figure 9).

The principle components are: conveyor, film reel assembly, sealing and cutting mechanism.

Optional assemblies: Top sheet assembly.

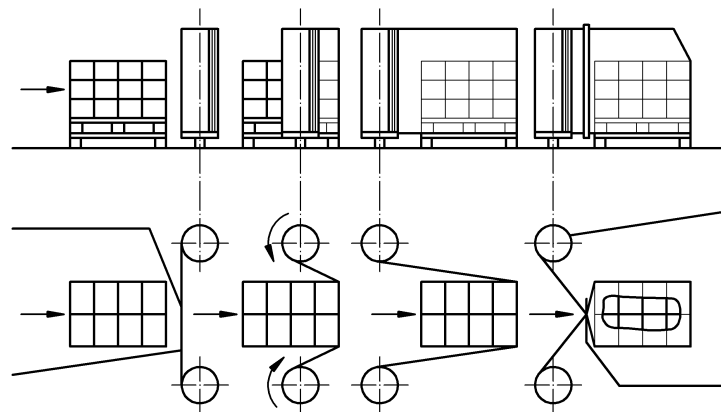


Figure 9 — Curtain stretching machine – Principle of operation

3.2.4 Hood stretching machines

Hood stretching machines apply a stretch film hood which is prefabricated or taken from a film tube roll to a product by stretching it and pulling it over the product. When a film tube is used, the required length of the hood is pulled off the reel then sealed and cut off.

Hood stretching can be either semiautomatic or fully automatic. In case of semiautomatic hood stretching, the essential automatic operations are only gathering and stretching. The hood is loaded manually. Prefabricated hoods or hoods on reels with perforated separation seam are used.

A hood stretching machine and the stretching procedure is shown in Figure 10.

The principle components are: tube film reel assembly, tube opening mechanism, tube placement mechanism, tube cutting.

Optional assemblies: conveyors, edge protection feeders.

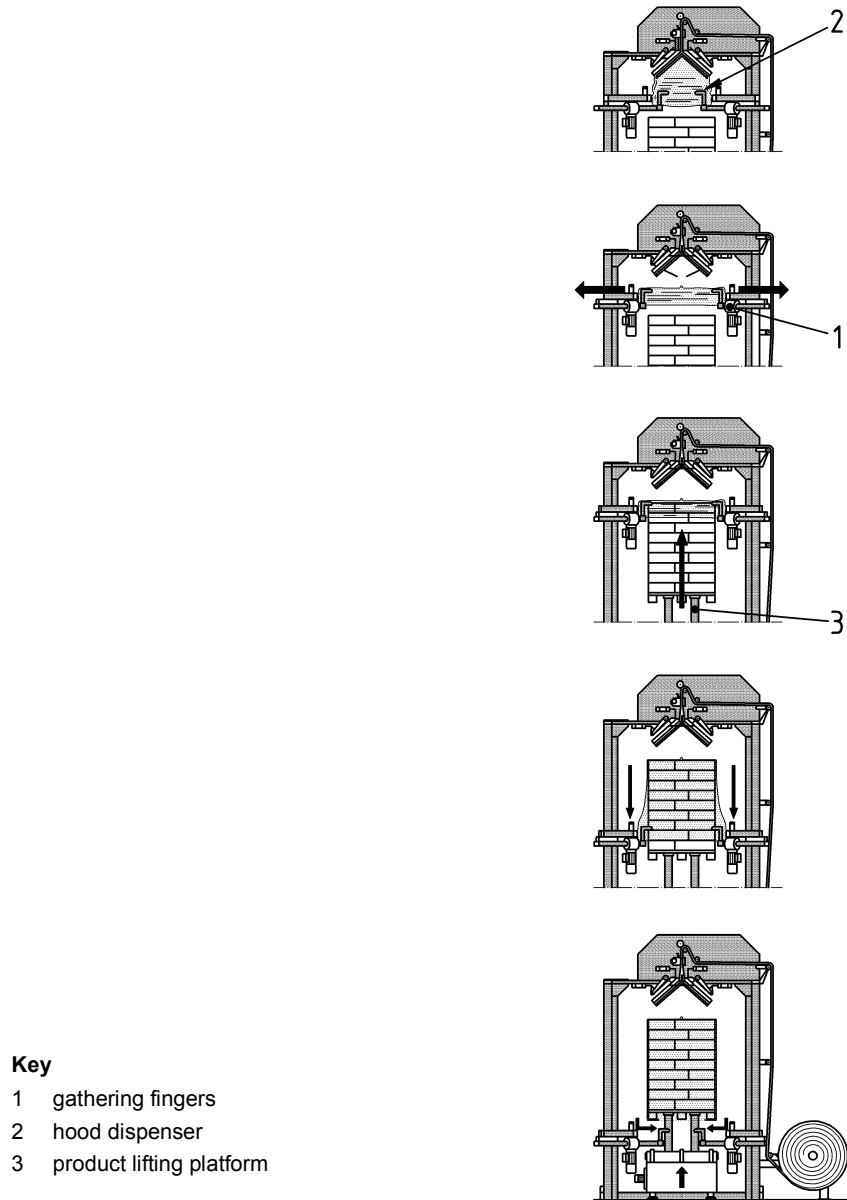


Figure 10 — Hood stretching machine

Fully automatic machines use reels of square tubes with gussets or of flat tubes. The film web to be uncoiled is guided via deviation or dancer rolls into the head of the machine operating according to the vertical principle.

Mechanically, pneumatically or vacuum driven opening devices open the tube to a rectangular format and put it into the gathering device. Similar to the case with the semiautomatic version this device consists of

gathering fingers. In one version, transfer of the forward end of the hood to the gathering fingers is made from top while it is made from the bottom in another version.

The hood length needed is pulled off a roll in accordance with the stack height in each case, then welded and cut off. Once the hood has been gathered, the gathering devices move diagonally outward and stretch the hood film in horizontal direction. After the head area of the hood is put on the uppermost stack layer during the downward movement, the gathered hood is pulled off the gathering fingers so that different values for stretching in vertical position can be achieved.

3.2.5 Shrink film pallet wrapping machines

3.2.5.1 General

When using the shrinking method, the product is first wrapped with thermoplastic film. Subsequently, the thermoplastic film is shrunk under the effect of heat around the pack. See 3.2.6 for descriptions of shrinking systems.

3.2.5.2 Banding, curtain and sleeve wrapping machines

A conveyor transports product into a curtain of thermoplastic or non elastic film that is welded on the rear side.

Working principle is the so-called passage method according to which, the product in the machine bumps against the film web rolling off two rollers and drags this along. In this manner, the film wraps the advancing product. Working principle see Figure 9.

Differentiation is made between horizontal and vertical machines.

In the horizontal machine the film reels are arranged in vertical position next to the product conveying system.

In the vertical machine one film reel is positioned above and another one below the conveying system.

The principle components are: conveyor, film reel assembly, film closing/fixing mechanism, cutting mechanism.

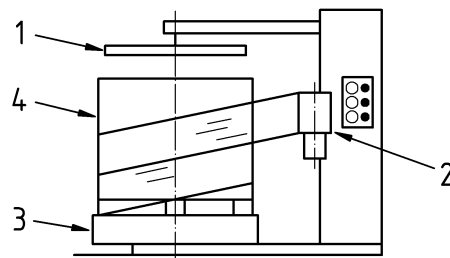
Optional assemblies: Top sheet assembly, sealing mechanism.

3.2.5.3 Spiral pallet wrapping machines

A spiral pallet wrapping machine processes a shrink film that is wound spirally around product and product carrier in the same way as by a pallet stretching machine, but without sufficient tension to stretch the film. This method allows packaging of product which varies in height or base, using one machine and one film width. See Figure 11.

The principle components are: rotating table, film reel assembly and lifting mechanism which moves the film reel assembly vertically thus producing a spiral wrap.

Optional assemblies: conveyors, film clamp, film knife, film sealing device, hold-down plate, pre-stretching unit on the film reel assembly, top sheet feeder.

**Key**

- 1 hold down plate
- 2 film reel assembly

- 3 rotary table
- 4 product

Figure 11 — Spiral pallet wrapping machine

3.2.5.4 Hood application machines

3.2.5.4.1 General

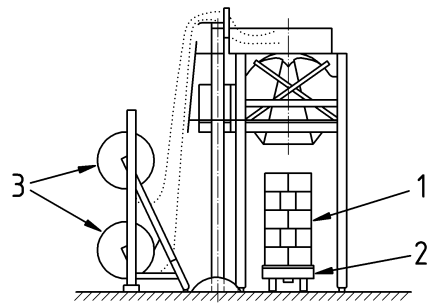
Hood application machines generally use a square profile tube with gussets. The machine detects the height of the product and forms the hood length accordingly. There are two principle operating types between two versions: vertical hood and parachute hood application, which are described below.

3.2.5.4.2 Vertical hood application machine

The film hood is formed above the product and put on vertically, i.e. opening, welding and cutting device are located above the product (see Figure 12). Opening of the hood is usually assisted by a blower. After the hood has been put on, the product is fed to a shrinking device.

The principle components are: tube film reel assembly, tube opening mechanism, tube placement mechanism, tube cutting device, hood application mechanism

Optional assemblies: conveyors, edge protection feeding device, blower.

**Key**

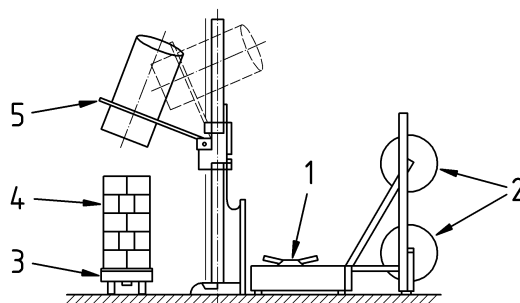
- 1 product
- 2 conveyor
- 3 film reels (two formats)

Figure 12 — Vertical hood application machine**3.2.5.4.3 Parachute hood application machine**

In the case of parachute hood application machines, the assembling unit is located at floor level, at the side of the application machine. The film is withdrawn from the assembling unit, the hood welded and cut off. The so assembled hood is turned and put on the product standing next to the assembling unit (see Figure 13).

The principle components are:

- Film reels
- Film transport mechanism
- Turning arm
- Assembling unit (sealing and opening unit)
- Conveyor

**Key**

- 1 film assembling unit
- 2 film reels (2No)
- 3 conveyor
- 4 product
- 5 turning arm

Figure 13 — Parachute hood application machine

3.2.6 Shrinking systems

3.2.6.1 Shrinking frame, shrinking hood

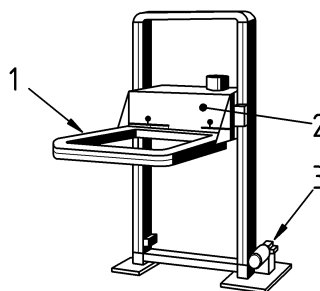
The shrinking frame (see Figure 14) shrinks a thermoplastic film around the product while the frame is guided over the surface of the product. Shrinking frames either have a single continuous heat outlet (e.g. slot along the frame) or multiple heat outlets (e.g. a number of air nozzles positioned along the frame). The heat source usually is electric energy or gas.

Shrinking hoods are rectangular containers with open bottom that are guided over a product enveloped with a thermoplastic film. They exist both with central heating device and continuously arranged heating elements.

In both cases the product is fed either manually or by a conveyor.

The principle components are: frame or hood with a source of heat, lifting mechanism which moves the hood or frame up and down, heating system.

Optional assemblies: conveyors.



Key

- 1 shrinking frame
- 2 moving frame mechanism
- 3 moving drive

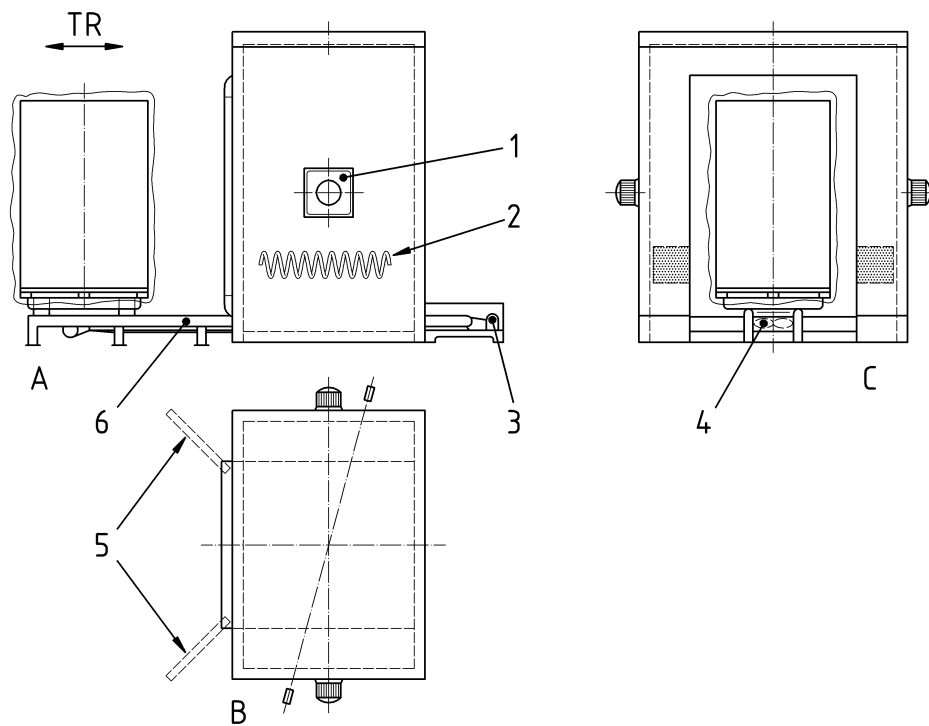
Figure 14 — Shrinking frame

3.2.6.2 Shrinking oven

A shrinking oven is a heated space in which the thermoplastic film put around a product is shrunk. Shrinking ovens are available as chamber ovens (see Figure 15) or as continuous ovens (see Figure 16) as well. They can use direct gas heating, indirect oil heating or also be fitted with electrical heater coils.

The principle components are: conveyors, source of heat, automatic doors.

Optional assemblies: fans.

**Key**

- 1 fan circulating air
- 2 electric heating unit
- 3 bogie drive unit
- 4 bottom shrink device
- 5 automatic doors
- 6 conveyor
- A side view
- B plan view
- C end view
- TR product transport direction

Figure 15 — Chamber shrinking oven with electric heating device