

Safety requirements for textile machinery

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- British Interior Textiles Association
- British Textile Machinery Association
- Confederation of British Wool Textiles Limited
- Fabric Care Research Association Ltd.
- Health and Safety Executive
- Knitting Industries' Federation Ltd.
- Society of Laundry Engineers and Allied Trades Limited
- Textile Institute
- Textile Services Association Ltd.
- University of Manchester (Institute of Science and Technology)
- Coopted member

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National foreword

This British Standard has been prepared by Technical Committee TCI/33 and is the English language version of EN ISO 11111 : 1995 *Safety requirements for textile machinery* published by the European Committee for Standardization (CEN). It is identical with ISO 11111 : 1995 published by the International Organization for Standardization (ISO).

Cross-references

Publication referred to	Corresponding British Standard
ISO 9902 : 1993	BS ISO 9902 : 1993 <i>Textile machinery acoustics — Determination of sound pressure levels and sound power levels emitted by textile machines — Engineering and survey methods</i>
IEC 519-1 : 1984	BS EN 60519 <i>Safety in electroheat installations</i> Part 1 : 1993 <i>General requirements</i>
IEC 519-9 : 1987	BS 7699 <i>Specification for safety in electroheat installations</i> Part 9 : 1993 <i>Particular requirements for high-frequency dielectric heating installations</i>
EN 292-1 : 1991	BS EN 292 <i>Safety of machinery — Basic concepts, general principles for design</i> Part 1 : 1991 <i>Basic terminology, methodology</i>
EN 292-2 : 1991	Part 2 : 1991 <i>Technical principles and specifications</i>
EN 294 : 1992	BS EN 294 : 1992 <i>Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs</i>
EN 349 : 1993	BS EN 349 : 1993 <i>Safety of machinery — Minimum gaps to avoid crushing of parts of the human body</i>
EN 418 : 1992	BS EN 418 : 1992 <i>Safety of machinery — Emergency stop equipment, functional aspects — Principles for design</i>
EN 563 : 1994	BS EN 563 : 1994 <i>Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces</i>
EN 626-1 : 1994	BS EN 626 <i>Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery</i> Part 1 : 1995 <i>Principles and specifications for machinery manufacturers</i>
EN 60204-1 : 1992	BS EN 60204 <i>Safety of machinery — Electrical equipment of machines</i> Part 1 : 1993 <i>Specification for general requirements</i>
EN 60447 : 1993	BS EN 60447 : 1994 <i>Man-machine interface (MMI) — Actuating principles</i>

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English version

Safety requirements for textile machinery

(ISO 11111 : 1995)

Exigences de sécurité pour le matériel textile
(ISO 11111 : 1995)

Sicherheitsanforderungen an Textilmaschinen
(ISO 11111 : 1995)

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Foreword

The text of the international standard ISO 11111 : 1995 has been prepared by the Technical Committee ISO/TC 72, Textile machinery and allied machinery and accessories, in collaboration with the Technical Committee CEN/TC 214, Textile machinery and allied machinery.

The 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 March 1996 and conflicting national standards shall be withdrawn at the latest by March 1996.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports the following essential requirements of EC Directives:

Council Directive of 14 June 1989 on the approximation of the laws of the Member States relating to machinery (89/392/EEC);

Amending Council Directive 89/392/EEC of 20 June 1991 on the approximation of the laws of the Member States relating to machinery (91/368/EEC);

Amending Council Directive 89/392/EEC of 14 June 1993 on the approximation of the laws of the Member States relating to machinery (93/44/EEC).

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

Introduction

This International Standard was prepared simultaneously by ISO/TC 72 and CEN/TC 214 and adopted under the Vienna Agreement in order to obtain identical standards on safety requirements for textile machinery.

This International Standard deals with the hazards generated by machines used in the textile industry. The great number and variety of such machines render impractical the preparation of individual standards.

Clause 5 contains a summary of frequently occurring safety requirements and/or measures for textile machines which apply whenever referred to in later clauses.

Clause 6 describes significant hazards and corresponding safety requirements and/or measures for certain prevalent component items (e.g. rollers).

Clauses 7 to 12 contain significant hazards and corresponding safety requirements and/or measures for all types of textile machines. As far as possible these are treated by way of references to clauses 5 and 6 and other cross-references, thus reducing considerably the volume of this International Standard by avoiding many repetitions.

The examples given in clauses 6 to 12 are proven solutions, representing the state of the art with respect to safety at the time of standard preparation. To enable further technical progress, other solutions are also allowed, provided they attain at least the same safety level.

Safety requirements for textile machinery

1 Scope

This International Standard is intended for use by any person concerned with the safety of textile machinery, for example, textile machinery designers, manufacturers, users, systems integrators, safety experts.

1.1 This International Standard is applicable to all machinery plant and related equipment intended to be used in the textile industry for the following:

- the opening, cleaning, blending, carding, preparation subsequent to carding, spinning and other processing of fibres (staple and filament) and other materials to form yarn or nonwoven material (including felts);
- the winding, doubling, twisting, texturing, etc. of yarns and the processing of yarns preparatory to weaving and knitting;
- the weaving, knitting, lace-making and similar utilization of yarn, etc., to form fabric;
- the formation of braid, cord, strand, rope, twine, net, etc., except take-up reels of stranding and laying machinery;
- processes including the preparation, bleaching, dyeing, printing and finishing of fibre, yarn, fabric, braid, cord, etc., and final assembly for despatch;
- the piece dyeing of made-up goods;
- finishing of warp and weft knitting, including hosiery, other than assembly of the finished product (e.g. sewing);
- carpet manufacture, by weaving, tufting and other processes.

1.2 This International Standard is not applicable to machinery, plant and related equipment used for:

- the manufacture of continuous filament man-made fibres up to and including the formation of the first textile package (e.g. continuous filament cheese, staple fibre bale);
- the formation and making up of garments, household and industrial textile goods, and the die punching and pressing of nonwoven fabric;
- the laundering and drycleaning of made-up textile goods;
- machines used for servicing of textile machines (e.g. cardwire servicing);
- certain cutting devices in 6.11.

1.3 This International Standard applies to the generality of textile machinery, particularly all the machinery plant and equipment which is used during the processes listed in 1.1, and including equipment to enable automated operation of the machines and processes in either free-standing or complex installations, but excluding transportation between the interfaces of the machines.

1.4 This International Standard does not give specific technical advice about:

- the phases of “life” of the machine other than use;
- electric shock;
- fluid power systems and components;
- noise;
- laser;
- ionizing radiation;
- fire;
- gas;
- explosion;
- ergonomics;
- isolation of energy sources;
- intervention during normal operation;
- pressure-sensitive safety devices;

and it does not cover the hazards and technical measures dealing with the containment of pressure in 6.7.2, 12.1.10, 12.1.11, 12.2.2, 12.2.6, 12.2.8, 12.2.9, 12.2.10 and 12.2.11, for high temperature dyeing machines.

1.5 This International Standard applies primarily to machines which are manufactured after the date of publication of this International Standard.

1.6 The guidance contained in this International Standard is based on the presumption that the designer has completed a risk analysis of the machine under consideration. This will enable him to identify and fulfil the significant requirements for his machine as stipulated by this International Standard.

In that very limited number of applications where the requirements seem excessive, deviation from those requirements should be fully justified by detailed risk assessment, comparison with this International Standard and design evaluation. All this information should be recorded in the technical construction file and kept available for external assessment.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 5232:1988, *Graphical symbols for textile machinery.*

ISO 9902:1993, *Textile machinery acoustics — Determination of sound pressure levels and sound power levels emitted by textile machines — Engineering and survey methods.*

ISO 11688-1:1995, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning.*

ISO 11690-1:—¹⁾, *Acoustics — Recommended practice for the design of low-noise workplaces — Part 1: Noise control strategies.*

ISO 11690-2:—¹⁾, *Acoustics — Recommended practice for the design of low-noise workplaces — Part 2: Noise control measures.*

IEC 519-1:1984, *Safety in electroheat installations — Part 1: General requirements.*

IEC 519-9:1987, *Safety in electroheat installations — Part 9: Particular requirements for high-frequency dielectric heating installations.*

EN 292-1:1991, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

EN 292-2:1991, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

EN 294:1992, *Safety of machinery — Safety distances to prevent danger zones from being reached by the upper limbs.*

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of the 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 — Temperatures of touchable surfaces; Ergonomics data to establish temperature limit values for hot surfaces.*

EN 574:—¹⁾, *Safety of machinery — Two-hand control devices.*

EN 626-1:1994, *Safety of machinery — Part 1: Reduction of risk to health from hazardous substances emitted by machinery — Principles and specifications for machinery manufacturers.*

EN 811:—¹⁾, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs.*

EN 953:—¹⁾, *Safety of machinery — General requirements for the design and construction of guards (fixed, movable).*

EN 954-1:—¹⁾, *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design.*

EN 982:—¹⁾, *Safety requirements for fluid power systems and components — Hydraulics.*

EN 983:—¹⁾, *Safety requirements for fluid power systems and components — Pneumatics.*

EN 999:—¹⁾, *Safety of machinery — Hand/arm speed — Approach speed of parts of the body for the position of safety devices.*

EN 1037:—¹⁾, *Safety of machinery — Isolation and energy dissipation — Prevention of unexpected start-up.*

1) To be published.

EN 1050:—¹⁾, *Safety of machinery — Risk assessment.*

EN 1088:—¹⁾, *Safety of machinery — Interlocking devices with and without guard locking — General principles and provisions for design.*

EN 1127-1:—¹⁾, *Safety of machinery — Fire and explosions — Part 1: Explosion prevention and protection.*

EN 50100-1:—¹⁾, *Safety of machinery — Electro-sensitive protective devices — Part 1: General requirements and tests.*

EN 50100-2:—¹⁾, *Safety of machinery — Electro-sensitive protective devices — Part 2: Particular requirements for equipment using active opto-electronic protective devices.*

EN 60204-1:1992, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements.*

EN 60447:1993, *Man-machine interface (MMI) — Actuating principles.* [IEC 447:1993]

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

3 Definitions

For the purposes of this International Standard, the definitions given in EN 292-1 and EN 953, and the following definitions apply.

NOTE 1 Where values are applicable to terms defined in this clause, these values are indicated in annex A.

3.1 stopping time: Time taken by a machine or machine part to reach a stand-still after the signal to stop has been given.

3.2 access time: Time required to reach a dangerous part from first exposure to that part.

3.3 crawl speed: Linear or tangential speed of machine elements or process material which is substantially below the normal speed. It occurs during special operations, is measured at the danger point and is characterized by a speed limit and a maximum stopping distance (see annex A).

3.4 reduced running speed: Linear or tangential speed of machine elements or process material which is substantially below the normal speed. It occurs during special operations, is measured at the danger point and is characterized by a maximum stopping distance (see annex A).

3.5 fence guard: Fixed guard to provide a barrier at a distance which prevents access to a danger zone. It can be either fixed directly to the machine or free-standing and fixed to the floor. Access to the space between the fence guard and the machine is controlled by interlocked doors (see annex A).

3.6 lap (wrap): Undesired wrapping of the process material around a rotating part of the machine.

3.7 normal operation: Entire sequence of the production process, including start-up, incidental cleaning and elimination of routine process faults (e.g. feeding and removal of process material, start-up, threading up, process surveillance, quality tests, removal of fibre fly, mending of broken ends).

3.8 special operation: Every procedure and action not included in normal operation, such as setting, tuning, major cleaning, elimination of substantial process faults and maintenance (e.g. removal of blockages, laps except on spinning, twisting and texturizing machines, resewing broken cloth, elimination of rope loops).

3.9 complex installation: Combination of textile machines and service equipment, arranged to work as one integrated production unit, subject to overall control either from a central system or from distributed communication systems.

3.10 automatic machinery and equipment: Machinery and equipment for which systems are employed to govern their operation without further intervention from the operator once the start control has been activated.

Such machines may be either free-standing or included in a complex installation. Automatic control can apply to the operational sequence of a machine and its integrated equipment located in a permanent place, and equipment which is mobile, including handling devices (e.g. piecing devices, knotters).

4 List of hazards

The significant hazards for selected machine elements are listed in clause 6, and for individual textile machines in clauses 7 to 12, together with the corresponding safety requirements and/or measures.

Annex D gives a survey and description of typical hazards in the field of textile machinery.

5 Summary of frequently occurring safety requirements and/or measures for textile machines

This clause contains a summary of frequently occurring safety requirements and/or measures for textile machines, mainly in the form of references to fundamental safety standards. These safety requirements and/or measures apply whenever reference is made to them in clauses 6 to 12.

5.1 Safety requirements for the different phases of “life” of a machine

The safety requirements given in this International Standard apply to the use of the machine. For the other phases of “life” of a machine, such as

- a) transport and commissioning
 - assembly, installation
 - adjustment
- b) decommissioning, dismantling and, as far as safety is concerned, disposal,

safety measures should be selected according to EN 292-1:1991, clause 5, and information for use should be given according to EN 292-2:1991, 5.5.1 a), b) and f).

5.2 Electrical equipment

5.2.1 General safety requirements

The safety requirements of EN 60204-1:1992, option 1, shall apply, as detailed in table 1.

Table 1 — Safety requirements for electrical equipment of machines

Safety requirements concerning	See EN 60204-1:1992, clause
Electric shock	6, 7, 8, 15 and 18
Overcurrent, overspeed and overload	7 and 8
Environmental influences	4, 13 and 16
Electromagnetic compatibility	4, 8 and 9
Restart after voltage drop or supply interruption	7.5
Accessibility, layout and identification of control equipment	10, 13 and 18
Ergonomics for manual operation	10 and 13
Cabling and wiring	14 and 15
Accessories and lighting	17
Documentation and instruction handbook	19
Testing	20

5.2.2 Specific safety requirements for control systems and devices

The safety requirements given in table 2 shall apply.

Table 2 — Safety requirements for control systems

Application	Reference
Design of control system	EN 292-2:1991, 3.7
Control circuits and functions	EN 60204-1:1992, clause 9
Control interfaces	EN 60204-1:1992, clauses 10 and 11
Programmable electronic equipment	EN 60204-1:1992, clause 12
Control gear	EN 60204-1:1992, clause 13
Categories of resistance to faults	EN 954-1:—, clause 6
Control devices	EN 60204-1:1992, clause 10
Safety signals, symbols and signs	EN 61310-1:—, clauses 5 to 8
Arrangement of control devices	EN 292-2:1991, 3.6.7 and 3.7.8
Actuating principles	EN 60447

- All components of safety-related parts of control systems for textile machines shall, from the emitter of the signal to the element which interrupts the hazardous energy supply, be selected in accordance with category 1 of EN 954-1:—, clause 6, and the safety-related part of the control system itself shall conform with category 2, 3 or 4; where necessary, further constraints upon category are specified in clauses 6 to 12;

This requirement should be understood within the environmental and technological limits of textile machines designed, installed and used in accordance with the state of the art. If other technologies for the control system are considered, the choice of the category shall be reevaluated in order to achieve an equivalent level of safety.

- The control system shall be checked at suitable intervals which for textile machines shall be at the start of a production cycle, however initiated, unless the production cycle exceeds 24 h, in which case the control system shall be checked within every 24 h interval. This applies also to category 3. In those cases where the check is to be initiated by the machine operator, this shall be stated in the instruction handbook.

Control devices shall be arranged according to EN 292-2:1991, 3.6.7 and 3.7.8.

- To afford visibility of the danger zones from the main control position, mirrors, TV monitors and such viewing aids may be used, or the position may be elevated to afford an unobscured view;
- In order to allow sufficient time for exposed persons to move to a safe place, the interval between activation of any warning signal and actual start-up should be not less than 3 s and not more than 6 s unless otherwise stated in clauses 6 to 12, and an emergency stop control shall be provided at the danger points.

5.2.3 Starting and stopping

The safety requirements and/or measures for starting and stopping given in table 3 shall apply.

Table 3 — Safety requirements for starting and stopping

Application	Reference
Starting	EN 292-2:1991, A.1.2.3
Unexpected start-up	EN 1037:—, clauses 5 to 7
Isolation from energy sources	EN 292-2:1991, 6.2.2 EN 60204-1:1992, 5.3, 5.4
Start-up by inadvertent actuation	5.2.3 a) EN 60204-1:1992, 10.6
Observation of danger zones from main control position	5.2.3 b)
Start-up by unauthorized persons	Note 2 in 5.2.3 b)
Automatic restart after process interruption	5.2.3 c)
Start-up after interruption of power supply	EN 60204-1:1992, 7.5
Emergency stopping	5.2.3 d) EN 292-2:1991, 6.1.1 EN 418 EN 60204-1:1992, 10.7

- a) Requirements concerning start-up by inadvertent actuation are satisfied by any of the following measures:
- control switch button slightly recessed in relation to the surrounding surface;
 - shrouded control switch;
 - control switch requiring more than one operation (e.g. pressing and turning);
 - control switch located beneath a hinged flap;
 - control switch with lock in the off position;
 - two-button start control;
 - other solutions achieving an equivalent level of safety.
- b) Textile machinery plant or systems which cannot be totally observed from the main control position, or in the proximity of which communication is difficult, shall in addition be provided with individual key-operated control switches or similar devices (e.g. lockable isolator switches) to prevent the equipment being started up by unauthorized persons.

NOTE 2 "Start-up by unauthorized persons" means switching on a machine by a person neither deputed nor directed so to do.

Examples of machinery which cannot be totally observed are:

- automated blow room machinery;
- continuous carpet dyeing and finishing lines;
- nonwoven production lines.

Examples of machinery where communication is difficult, due in particular to loud noise, are:

- speed frames;
 - weaving machines;
 - braiding machines.
- c) Where automated process fault elimination devices are fitted to a machine, automatic restart after process interruption shall only be possible when guards and safety devices are in position and activated. Where there is a residual risk, the operator shall be warned by appropriate means before restart. The warning device shall be positioned close to the danger zone.
- d) Where an emergency stop control is used to safeguard against a residual risk it shall be positioned close to the respective danger zone.

5.3 Protection against hazards

Hazards presented by textile machinery shall as far as possible be obviated by adopting a design concept for the machine and/or its mechanisms which does not inherently create a hazard (e.g. use of pneumatic trunking instead of open lattice conveyors, use of pneumatic uncurling devices instead of mechanical uncurling rollers).

5.3.1 Mechanical origin

5.3.1.1 Design

The safety measures given in table 4 shall apply.

Table 4 — Risk reduction by design

Application	Reference EN 292-2:1991, subclause
Avoiding sharp edges and corners, protruding parts etc.	3.1
Making machines inherently safe by virtue of — the shape and the relative location of their mechanical component parts — the limitation of the actuating force (see A.4) — the limitation of the mass and/or velocity (see A.1)	3.2
Taking into account design codes, data about material properties and, generally, all established rules regarding machine design and construction (e.g. calculation rules)	3.3
Applying the principle of the positive mechanical action of a component on another component	3.5

5.3.1.2 Guards and safety devices

The safety requirements and/or measures given in tables 5 and 6 shall apply.

Table 5 — Safety requirements and/or measures for guards

Application	Reference
Guard selection, unless specified in clauses 6 to 12 of this International Standard	EN 292-2:1991, 4.1 EN 953:—, clause 5
Guard design and construction	EN 292-2:1991, 4.2 EN 953:—, clauses 6 and 7
Guard fastening	EN 953:—, 6.4.3 and 7.3
Guard arrangement, unless specified in clauses 6 to 12 of this International Standard ¹⁾	EN 294:1992, tables 1 and 4 EN 811
Guard interlocking, unless specified in clauses 6 to 12 of this International Standard	EN 1088:—, clause 5
Fence guard	A.3
1) The safety distances for guards shall apply to all operating positions for normal operation as well as setting, adjustment, maintenance work and elimination of process faults.	

Table 6 — Safety requirements and/or measures for safety devices

Application	Reference
Selection of safety devices, unless specified in clauses 6 to 12 of this International Standard	EN 292-2:1991, 4.1
Technical characteristics of safety devices	EN 292-2:1991, 4.2.3 EN 50100-1:—, clause 4
Positioning of safety devices, unless specified in clauses 6 to 12 of this International Standard ¹⁾	EN 999:—, clauses 5 to 7
Interlocking of safety devices — selection — design	EN 1088:—, 7.4 EN 1088:—, clauses 5 and 6 EN 50100-1:—, A.5, A.6 and A.8
Electrosensitive protective devices — selection²⁾ — installation — when used for initiation	EN 50100-1:—, clause 4 EN 954-1:—, 6.3, annex E EN 50100-1:—, annex C EN 50100-1:—, A.5
Photoelectric protective devices — selection²⁾ — positioning	EN 50100-1:—, clause 4 EN 50100-2:—, 6.2 and 6.3 EN 954-1:—, annex E A.2 EN 999:—, clause 6 EN 50100-2:—, 6.4 and 6.5
Two-hand controls — selection³⁾	EN 574:—, clause 5 EN 954-1:—, annex F EN 60204-1:1992, 6.2.3.7

Application	Reference
Pressure-sensitive safety devices	This International Standard does not contain specific measures or references about pressure-sensitive safety devices.
Hold-to-run control device	EN 292-1:1991, 3.23.3 EN 60204-1:1992, 9.2.5.6
Limited movement control device	EN 292-1:1991, 3.23.8
1) The safety distances for safety devices shall apply to all operating positions for normal operation as well as setting, adjustment, maintenance work and elimination of process faults. 2) The type selected shall be consistent with the category of the safety-related part of the control system as defined in EN 954-1:—, 6.2; for category 2, type 2 shall be used. 3) The type selected shall be consistent with the category of the safety-related part of the control system as defined in EN 954-1:—, 6.2; for category 2, type II shall be used.	

5.3.2 Other origin

5.3.2.1 Electric shock

Measures to prevent electric shock shall be taken in accordance with 5.2.1.

5.3.2.2 Static electricity

Static electricity can be adventitiously generated in the course of the production process (e.g. carding fibre) and result in the discharge of sparks.

Appropriate safety requirements and/or measures to discharge static electricity are:

- providing an earthed protective conductor of suitable capacity from the conductive parts of the machinery or plant;
- fitting static eliminators in appropriate positions on machinery;
- providing information in the instruction handbook on minimum humidity provided by the air-conditioning system.

5.3.2.3 Fluid power systems and components

The safety requirements and/or measures given in EN 292-2:1991, 3.8, in EN 982:—, clause 5 (hydraulic) and in EN 983:—, clause 5 (pneumatic) shall apply.

5.3.2.4 Extreme temperatures

5.3.2.4.1 Hot surfaces

Machines or vessels with hot surfaces are variously used in the textile industry. These result from the incorporation of purposely heated parts to directly assist and further the production process (i.e. heated rollers or plates), or are generated in the course of the production process, even extending to the entire vessels themselves, due to the hot liquors or steam they contain.

The following safety requirements and/or measures shall apply:

Textile machines shall be designed so as to reduce the risk of burn injury, caused by contact with or proximity to machine parts or process material at high temperatures. This is fulfilled when the surface temperatures of machine parts and process material do not exceed the values specified in annex B. If this is not possible, hot parts in the working area and adjacent passageways shall be insulated, shielded or guarded.

Where, for technical reasons, total protection cannot be provided by design, a warning shall be given on the machine and information shall be given in the instruction handbook concerning instruction and training of operators and the use of personal protective equipment.

5.3.2.4.2 Hot processing materials: liquor or steam

The following safety requirements and/or measures shall apply:

Machines or vessels containing hot liquor or steam shall be designed to prevent any risk of scald injury caused from splashing or spilling, including thermal reactions caused by chemicals (e.g. when hydrosulfite is added to a liquor).

This may be achieved by a selection of the following means, as required:

- limitation of temperature during the addition of chemicals;
- limitation of liquor level during the addition of chemicals;
- indirect steam heating rather than direct steam heating;
- provision of atmospheric vessels with interlocked doors or lids;
- temperature interlocking of doors or lids;
- providing deflection devices, or a catchpan, spillway or similar device;
- locating steam control devices or valves in a safe place.

5.3.2.5 Noise reduction

This International Standard does not contain specific measures about noise reduction. The following information may prove useful as a general guideline.

At an early stage in the design of machinery, full consideration should be given to the noise levels likely to arise from the use of various machine elements and ways in which this can be either avoided, eliminated or minimized. During the development of a machine, the selection of appropriate noise control measures should be based on the latest state of noise control technology (see ISO 11688-1). See also ISO 11690-1 and ISO 11690-2 for the design of low-noise workplaces.

5.3.2.6 Lasers

Hazards associated with laser are not treated in this International Standard.

5.3.2.7 Ionizing radiation

Hazards associated with ionizing radiation are not treated in this International Standard.

5.3.2.8 Materials and substances

Various materials and substances processed, used or liberated in the textile industry can result in a foreseeable risk from contact, inhalation or ingestion. Included are dusts, fluids, gases, mists and fumes having a harmful, toxic, corrosive and/or irritant effect. These are generated for example in spinning preparation, sizing, waxing, bleaching, dyeing and various finishing processes.

To reduce the foreseeable risk, textile machines shall be so equipped that hazardous substances, including dust from fibre, can be contained and/or extracted (e.g. by totally enclosing machines, sealing any doors or covers, and/or including exhaust ventilation systems which provide a negative pressure). Where machinery is not enclosed during normal operation, the devices for containment or extraction shall be as close as possible to the source of emission.

Furthermore the safety requirements and/or measures given in EN 626-1:—, clause 6, shall apply.

In the instruction handbook, the machinery manufacturer shall state those materials or substances for which the machine has or has not been specifically prepared.

NOTE 3 The risk is foreseeable when the machine is intended, or could reasonably be expected, to be used for the processing or use of hazardous materials and substances, and overexposure can occur.

5.3.2.9 Fire

This International Standard does not contain specific measures against fire. The following information may prove useful as a general guideline.

Fire can be generated in a variety of textile processes (e.g. in spinning preparation, spinning, weaving, cropping or shearing), caused by combustion of fibre, fly or fibre dust, in particular from cotton or bast fibre, through contact with hot bearings, sparks resulting from metallic impurities, electrical sparks, and in various finishing processes from the overexposure of the process yarn or fabric to hot surfaces, radiators or burners. Fire can result in a risk of burns or of inhalation of toxic fumes.

Textile machines should be designed and constructed to avoid fire and to counter and extinguish fire once generated.

This may be achieved by a selection of the following means, however this International Standard does not contain selection criteria for the application of particular measures to individual machines:

- a) means for avoiding fire:
 - automatic detection and removal of metallic impurities;
 - use of spark-proof materials;
 - information on maintenance procedures to reduce the risk of overheating bearings;
 - separation of the process material from hot surfaces, burners or radiators, shielding of burners or radiators when the machine comes to rest;
- b) means to counter and extinguish fire once generated:
 - provision of flame or smoke detectors together with automatic fire extinguishers as an integral part of the machine;
 - provision of information in the instruction handbook regarding the need to install either fixed automatic fire extinguishers (e.g. sprinkler systems) or hand-operated fire extinguishers in the building.

5.3.2.10 Explosion

This International Standard does not contain specific measures against explosion. The following information may prove useful as a general guideline.

Certain textile processes give rise to the risk of explosion (e.g. a deposit of fine dust from fibre or process additives, the use of flammable solvents either for the conduct of the process or for cleaning, the use of fuel gases, the use of processes involving runaway chemical reactions) which can lead to severe or fatal injury.

Textile machines should be designed and constructed to avoid any foreseeable risk of explosion.

Means to reduce the accumulation of fine dust include:

- enclosures and exhaust ventilation systems which should be as in 5.3.2.8;

- information given in the instruction handbook regarding cleaning schedules to prevent the accumulation of fine dust in dangerous quantities and also precautions which apply when the workroom air-conditioning system is inoperative.

Means to avoid or counter the risks of an explosive atmosphere from flammable liquids are given in EN 1127-1:—, clauses 6 and 7.

5.3.2.11 Ergonomics

Hazards associated with ergonomics are not treated in this International Standard.

The safety requirements for observing ergonomic principles given in EN 292-2:1991, 3.6, should apply.

5.4 Devices for special operation

Special operations (e.g. maintenance, repair, tuning, setting and elimination of substantial process faults) frequently result in risks which deviate from those occurring under normal operation.

The safety requirements given in table 7 shall apply.

Table 7 — Safety requirements for special operations

Application	Reference EN 292-2:1991, subclause
Principles relating to manual control	3.7.8
Selection of control modes	3.7.9
Control mode for special operation	3.7.10
Access to danger zone during special operation	4.1.4

Adjustment, lubrication and maintenance points shall where possible be located outside danger zones.

The machine shall be so designed that, wherever possible, adjustments, maintenance, repair, tuning, setting, cleaning and servicing operations and elimination of process faults are carried out while machinery is at a standstill and totally isolated from all dangerous sources of motive power.

If this work cannot be carried out with the machinery at standstill, the guards and safety devices shall remain activated. If this is not possible one of the following measures shall apply, the order of presentation reflecting the order in which application of the measures shall be attempted:

- devices shall be provided to operate machines or parts by hand with the machines totally isolated (e.g. handwheels, levers); or
- hold-to-run controls or three-stage controls together with a crawl speed (see A.1, table A.1) shall be provided, unless otherwise stated in clauses 6 to 12. The release of the control shall be equivalent to an emergency stop of category 0 or 1 (EN 418). These controls shall be positioned in such a manner that all danger points can be viewed; or

NOTE 4 Three-stage controls operate in a similar manner to hold-to-run controls. The machine is started when the control actuator button is pushed with a light force. The machine is stopped as soon as the button is released or pushed with a hard force.

- limited movement control devices shall be provided which allow limited movement of the machine or part when actuated. Each step shall be of the minimum achievable within a maximum of 100 mm unless otherwise stated in clauses 6 to 12. These devices shall be positioned in such a manner that all danger points can be viewed; or

- d) reduced running speed combined with an emergency stop device which results in a stopping distance according to A.1, table A.2, shall be provided. An emergency stop device shall be positioned within reach of each danger zone; or
- e) temporary guards (e.g. casing, cover, fence guard) which shield the danger zone during adjustment, maintenance, setting and repair shall be provided.

Devices for special operations may only be activated by means of a mode selector (see EN 292-2:1991, A.1.2.5).

Reference shall be made, in the manufacturer's instruction handbook, to the correct procedures and precautions for special operations and to the residual risks and the need for specific training of operators to counter these risks. Reference shall also be made to the fact that special operations shall only be carried out by authorized and specially trained personnel.

5.5 Access to operating position and servicing points

The safety requirements and/or measures given in EN 292-2:1991, 6.2.4, shall apply.

Where access to an elevated position is required occasionally, i.e. less than once per week, information shall be given in the instruction handbook concerning the need for movable platforms or ladders to be provided by the user. Where access is required more frequently than once per week, stationary platforms and/or walkways shall be provided.

Means shall be provided to secure a ladder to a machine. The use of ladders shall not be advised if this increases the risk from the operation which has to be carried out.

5.6 Measures for the escape and rescue of trapped persons

The safety requirements and/or measures given in EN 292-2:1991, 6.1.2 shall apply.

Where there is a residual risk of additional injury being imparted when securing release, information shall be included in the instruction handbook on the precise method of rescue to be followed (e.g. the use of specially provided equipment such as easily removable bearings, means to reverse the normal working direction, means to move components apart, pressure-release devices or hand-operated valves for hydraulic or pneumatic systems).

5.7 Residual risk

The user shall be informed and warned about the residual risks mentioned in clauses 6 to 12.

The safety measures given in table 8 shall apply.

Table 8 — Safety measures for residual risks

Application	Reference
Informing and warning users	EN 292-1:1991, 5.5
General requirements	EN 292-2:1991, 5.1 and 5.2
Information on the machine	14.2 EN 292-2:1991, 5.3 and 5.4
Accompanying documents, instruction handbook	14.1 EN 292-2:1991, 5.5

6 Significant hazards and corresponding safety requirements and/or measures for certain machine elements and their combinations

6.1 Drive and transmission enclosures

Drive and transmission enclosures are normally used to house the primary and/or transmission drives of a machine when these are grouped together to serve a multiplicity of identical production points (e.g. spinning machines), or to serve a series of related processing elements (e.g. raising machines). They are normally located at the ends or sides of textile machines.

Hazards:

Mechanical, from drives including belts, chains and sprockets, pulleys and gears, in particular entanglement, drawing-in or trapping.

Risks:

Occasional access during special operation leading to high probability of severe injury.

Safety requirements:

Drives shall be provided with fixed or movable enclosing guards (see 5.3.1.2). All the following measures appropriate to the machine shall apply:

- a) fixed guards for drive and transmission enclosures shall be fastened in accordance with 5.3.1.2; and
- b) where special operations are necessary (e.g. checking and adjusting process controls), the machine shall be designed such that operations can be carried out without opening the drive and transmission enclosures; otherwise c), d) and e) shall be complied with; and
- c) where b) cannot be complied with and/or where doors of drive and transmission enclosures have to be opened on a regular basis, these shall be interlocked; and
- d) where a device (e.g. a mode selector) is provided to override the interlock to enable certain special operations to take place with the guard or door open, additional measures shall be taken (see 5.4).
 - Where a hold-to-run control is provided in accordance with 5.4, this shall be located in a position from which all dangerous parts can be viewed but not reached within the stopping time; and
 - Where a reduced running speed is provided, its actuator shall be located in a position from which all dangerous parts can be viewed and an emergency stop control shall be provided near dangerous parts within the drive enclosure.

Alternatively, a hand-operated handle or crank may be provided to enable machines to be driven by hand for special operations; and

- e) reference shall be made in the instruction handbook to the type of special operation for which the override device has been provided. See also final paragraph of 5.4.

6.2 Particularly dangerous machine elements

Machine parts which are fitted with cutting blades, metallic wire, flexible card clothing, needles, pins, spikes, pegs (including beaters, rollers, cylinders, lattices or similar particularly dangerous elements) are found on machines such as bale breakers, hopper feeders and other fibre-opening units, cleaning and feeding machines, carding machines, teasers, rag teasers, hard waste breakers, rag beaters, willows, raising machines, shearing and cropping machines and other similar machines.

In addition, feed rollers, whether smooth, fluted or covered with teeth, are included where they are located upstream of the above-mentioned particularly dangerous elements.

Hazards:

Mechanical, from such beaters, rollers, cylinders, lattices, etc., in particular entanglement, drawing-in or trapping, severe abrasion, especially when such elements have a long stopping time.

Risks:

Occasional access during normal and special operation, in particular to remove laps and blockages, leading to high probability of severe or fatal injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) to prevent contact with dangerous machine elements, enclosing guards (e.g. casings, covers) shall be provided (see 5.3.1.2). For distances, table 2 in EN 294:1992 shall be used instead of table 1.

Fixed enclosing guards shall only be used where access is necessary exclusively for major repair.

Movable enclosing guards shall be interlocked. Where the longest stopping time (usually when empty of process material) exceeds the access time, means shall be provided to ensure that the movable enclosing guards cannot be opened or removed until all rotating dangerous elements have been brought to a standstill. For example, an interlocking device with guard locking in conjunction with a motion sensor may be used for this purpose. The guard locking device shall operate even when the control system or power supply fails. A brake is a useful aid for reducing stopping time, but shall not be used to replace the guard locking system; and

- b) feed hoppers as well as inlet, discharge, observation, cleaning and other openings shall be:
- so positioned that access to dangerous moving parts is prevented (i.e. the distance from the edge of the opening to the moving part shall comply with table 2 in EN 294:1992; or
 - fitted with a lattice of bars or similar items within the openings allowing access by operating tools. The distances between the bars shall be such that hand or finger access to the danger zone is prevented, see table 4 in EN 294:1992; or
 - fitted with an interlocking guard with guard locking to cover those openings, unless the access time always exceeds the stopping time, in which case an interlocking guard without locking may be used; and
- c) feed rollers upstream of and close to particularly dangerous machine elements (e.g. on rag-pulling machines) shall be safeguarded by means of enclosing guards (e.g. fixed tunnel guards). The opening of the tunnel shall be in accordance with table 4 of EN 294:1992. Movable panels or doors in the enclosing guard (e.g. tunnel) shall be interlocked with guard locking unless they are interlocked and the access time exceeds the stopping time of the feed roller; and
- d) for starting up particularly dangerous machine elements during special operations (e.g. maintenance, adjustment, setting, elimination of process faults) see 5.4; and
- e) where a mode selector is provided in accordance with 5.4 it shall not be possible to alter the mode before the machine has come to a standstill; and
- f) regarding the safety-related part of the control system (see 5.2.2), category 3 or 4 shall be selected for interlocking devices of guards on particularly dangerous machine elements.

6.3 Machine elements which normally do not require safeguarding

On textile machinery many machine elements are found which normally are designed such that there is a low probability of light injury (see also A.4).

EXAMPLES

- spindles on spinning and twisting machines;
- feed rollers on open-end spinning, twisting and texturing machines;
- false twist devices on texturizing machines;
- feed arrangements of combing and spinning preparatory machines subsequent to carding;
- flyers on flyer spinning machines (but not speed frames), gill spinning frames or twisting frames;
- ring frame and speed frame drafting systems, including delivery rollers;
- feed and furnishing devices on warp knitting machines and circular knitting machines;
- needles and sinkers on knitting machines;
- yarn feeding devices, thread guide control, pattern and counting device mechanisms on circular knitting machines;
- thread guides on winding, doubling, twisting and texturizing machines;
- other similar machine elements.

Hazards:

Mechanical, from the machine elements referred to above, in particular entanglement, drawing-in or trapping, impact, friction or abrasion.

Risks:

Frequent access during normal operation, leading to low probability of light injury provided the actuating force and/or mass and velocity of the moving machine elements can be countered by the physical power of the operator (e.g. where the operator can stop the moving part by hand, or withdraw the hand without effort, or where the crushing force is small).

Safety requirements:

Precautions are deemed to be sufficient when the correct methods of work are described in the instruction handbook, in particular hair protection and wearing of tight clothes.

6.4 Rollers

Rotating rollers in pairs or stacks, rollers rotating adjacent to fixed parts or rollers with an on-running support blanket or process material, and rough-surfaced rollers, are found on many machines in the textile industry, particularly in the spinning preparatory, weaving preparatory, bleaching, dyeing, printing and finishing industries.

NOTE 5 The term "roller" includes guide rollers, uncurling rollers, padding mangles, drying cylinders, mangle bowls, calender rollers and similar rollers, whether driven directly or by friction between the roller surface and a moving blanket, back cloth or moving process material, which can present a risk to exposed persons unless the movement of the rollers can easily be stopped by hand. For brevity, the term "process material" is used in the rest of this subclause to include support blankets, back cloths and process material.

Hazards:

Mechanical, from rollers, in particular entanglement, drawing-in or trapping, and friction or abrasion.

Risks:

Access during normal operation, particularly on start-up, smoothing process material, uncurling edges, and access during special operation, particularly cleaning, removal of laps of yarn ends or cloth and threading-up, leading to high probability of moderate to severe or fatal injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) prevention of drawing-in of fingers, hands, arms or feet by use of an appropriate spacing (gap) between the rollers;

The gap between any pair of counter-rotating rollers, or between any pair of rollers rotating in the same direction but with different circumferential speeds or surface covering, shall be either between 120 mm and 150 mm, or greater than 500 mm; and

- b) prevention of drawing-in of head and body;

Where the diameters of the rollers are very large (e.g. for drying cylinders in some layouts), there is a risk of the head and body being drawn in for all gaps smaller than 500 mm. In this case a safeguarding by gap shall not be used; and

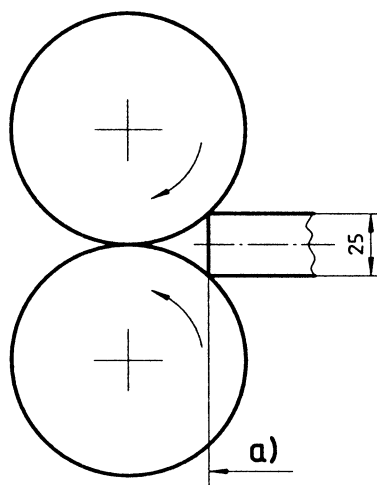
- c) safeguarding of drawing-in points between rollers (see 5.3.1.2);

Where a) cannot be complied with or where b) applies, guards and safety devices shall be provided as follows:

- fixed enclosing guards, openings within these guards for the passage of process material shall comply with the dimensions given in EN 294. See figure 1 for location of danger zone; or
- fixed nip guards close to the drawing-in point (e.g. a nip guard having one of the profiles in figure 2).

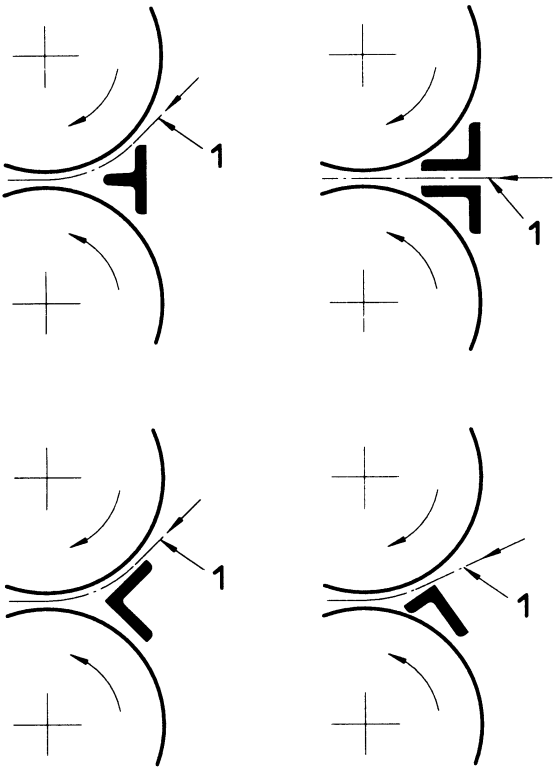
The profile shall be formed such that at the outer edge it runs parallel to the tangent of the roller surface to avoid a wedge effect (see figure 3).

Dimensions in millimetres



a) Beginning of the drawing-in zone

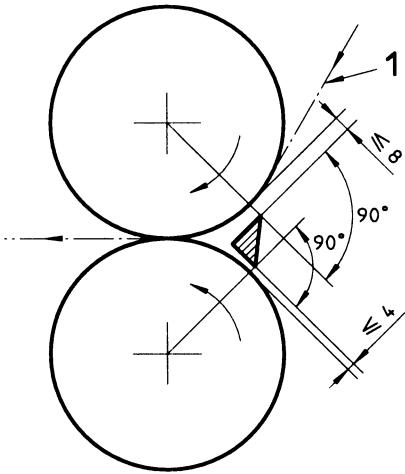
Figure 1 — Location of danger zone



1 Process material

Figure 2 — Profiles of nip guards

Dimensions in millimetres



1 Process material

Figure 3 — Arrangement of nip guard

Round guards shall not be used because they themselves can create a drawing-in point, together with the adjacent roller surface.

When positioning a guard in close proximity to a rotating surface, a new drawing-in point can be created between the edge of the guard itself and the rotating surface. In order to prevent a danger point being thus created, care should be taken to ensure that the gap is as small as technically possible with regard to the process. This shall not exceed 4 mm for those gaps not used for the passage of process material. Where the guard can damage the roller surface (e.g. due to its unavoidable flexibility on wide machines) or where intermittent thickening of the process material occurs (e.g. by sewn joints), a gap ≤ 8 mm may be used, in deviation from the requirements of EN 294; or

- interlocked movable enclosing guards; or
- where guards cannot be fitted then safety devices shall be provided, e.g. trip bars, trip panels (see figure 4) or photoelectric protective devices extending the full width of the drawing-in point. When actuated, such devices shall cause the drive to the rollers to stop and, where the stopping time of the rollers exceeds the access time, cause the rollers to separate immediately to a sufficient distance apart to avoid injury [see 6.4 a) for distances].

Where photoelectric protective devices are fitted in front of the drawing-in point, means shall be provided to increase the access time (e.g. a barrier, see figure 5) so that, when the beam is interrupted, the rollers come to a standstill or move apart before the operator can reach the danger zone; and

d) prevention of drawing-in from reverse side;

Where the rollers during normal operation can run in the reverse direction, precautions are also necessary for the normal outlet side. For special operation see 5.4; and

e) safeguarding of drawing-in points between rollers and fixed machine parts (see 5.3.1.2);

Either gaps of dimensions as in 6.4 a) or guards or safety devices as in 6.4 c) shall be provided for danger zones between a roller and a fixed part of a machine or structure next to the machine which is adjacent to the roller. Alternatively, where there is no danger zone due to a wedge effect, the distance between the surface of the roller and the fixed part may be less than 4 mm [or 8 mm, see 6.4 c)] as shown in figure 6 b); and

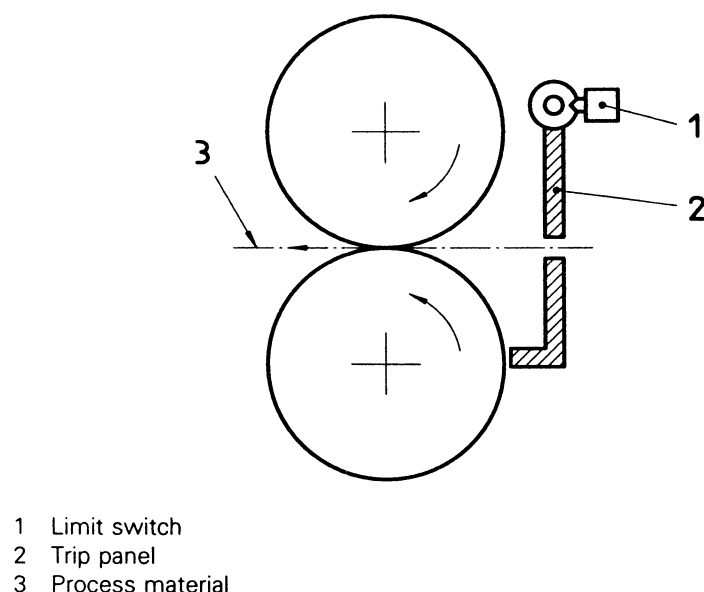


Figure 4 — Protection by trip panel

Dimensions in millimetres

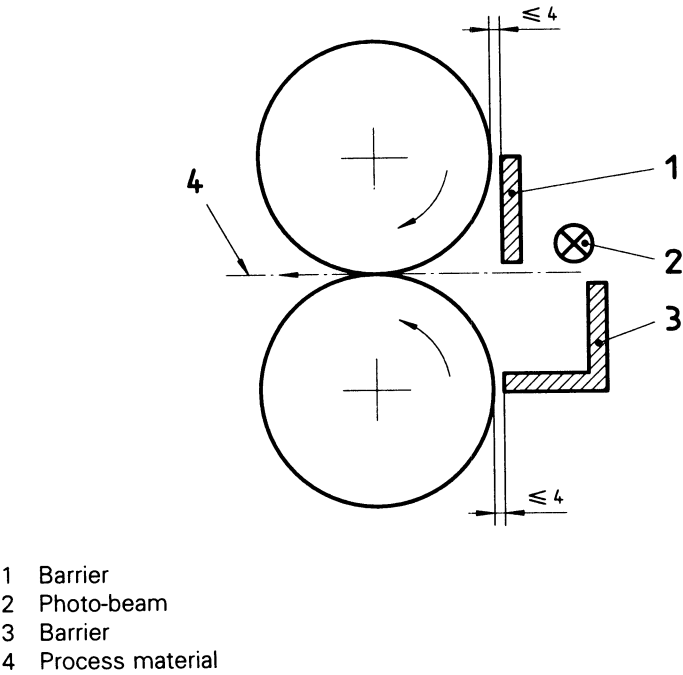


Figure 5 — Protection by photoelectric protective device

Dimensions in millimetres

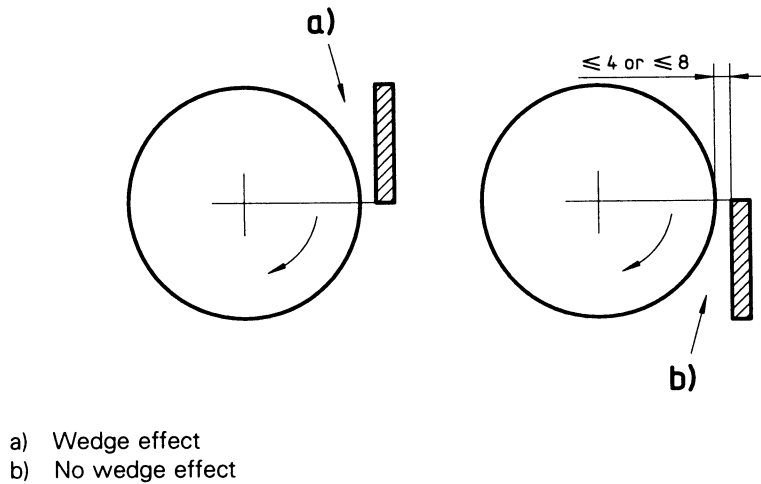


Figure 6 — Distance between roller and fixed machine part

- f) prevention of drawing-in between adjustable rollers (see 5.3.1.2);

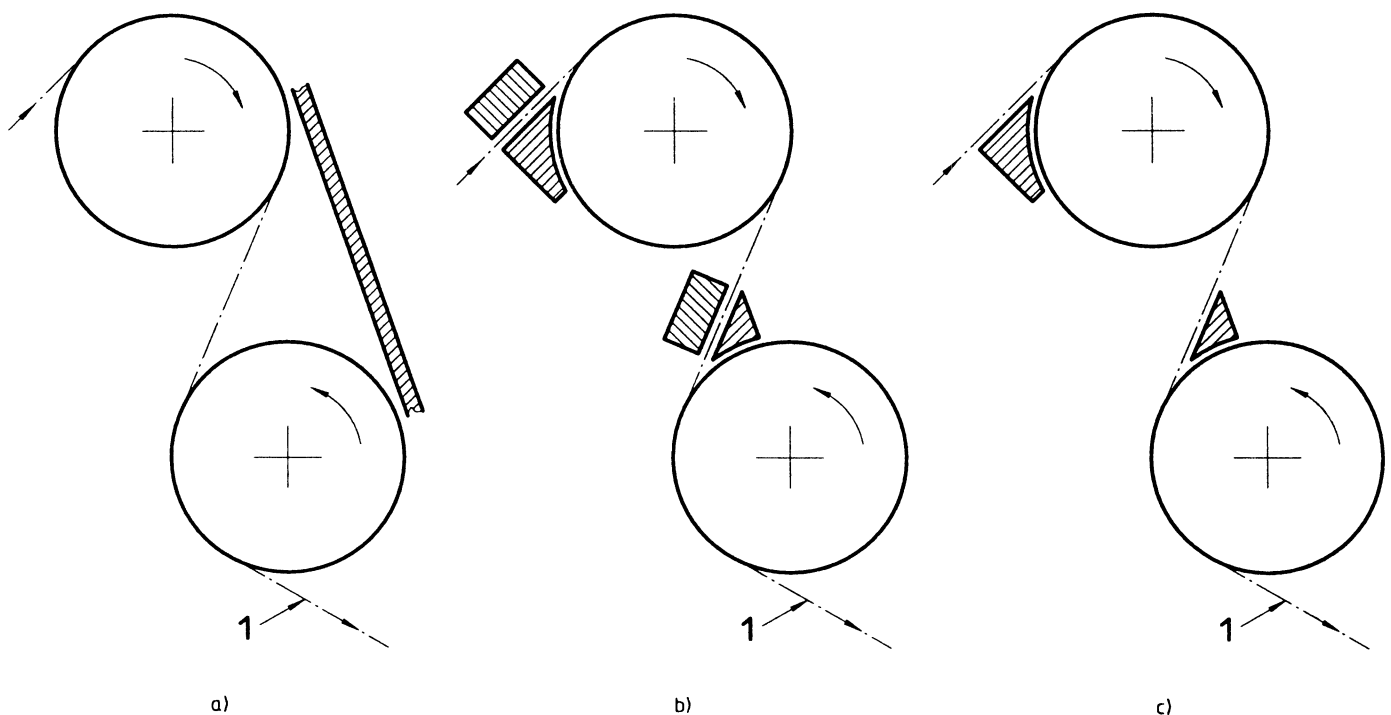
Where rotating rollers in pairs or stacks normally run in direct contact with each other but can also be run with a gap between them, at either production speed or a slower speed, the guard or safety device chosen shall prevent access to the danger point when the rollers are closed. When the rollers are being run in their separated position this shall not give rise to a new danger point between the guard and the moving surface of the rollers. Where such a new danger point cannot be avoided, an additional safety device shall be provided (e.g. a trip device); and

- g) safeguarding of drawing-in points between rollers and on-running process material (see 5.3.1.2);

Drawing-in points between rollers and either process material or blanket or back cloth or printing cloth or similar, where there is a risk to fingers or hands, shall be provided with a suitable guard or safety device.

EXAMPLES

- a fixed or interlocked movable distance guard in accordance with figure 7 a);
- guards covering both the drawing-in point and the top side, in accordance with figure 7 b), the latter preferably interlocked to the drive, where low tension or low-stiffness process material etc. requiring an enlarged gap would otherwise allow encroachment;
- nip guards with profiles in accordance with figure 7 c), where either the tension or stiffness of the process material etc. in itself prevents encroachment. Such nip guards shall prevent access to the drawing-in point between the process material and the roller;
- safety devices such as trip bars or photoelectric protective devices extending the full width of the drawing-in point. Such safety devices shall, when actuated, stop the drive to the rollers before the fingers can be drawn in.

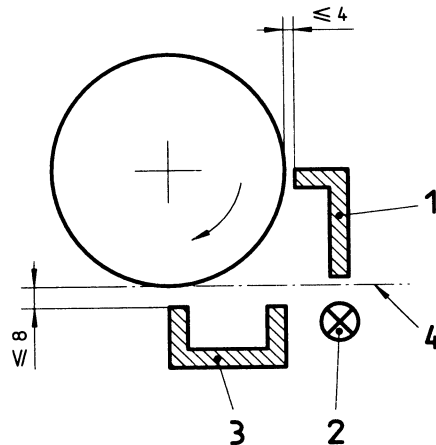


1 Process material

Figure 7 — Guards for on-running process material

Where photoelectric protective devices are used, means (e.g. barriers, (see figure 8) shall be provided to hinder access [see 6.4 c)]; and

Dimensions in millimetres



- 1 Barrier
- 2 Photo-beam
- 3 Barrier
- 4 Process material

Figure 8 — Protection by photoelectric protective device

- h) safeguarding of rough-surfaced rollers (see 5.3.1.2);

Rollers having a surface covering of embossed rubber, abrasive cloth or similar material, which operate with a circumferential speed of more than 2 m/min and which are within reach of the operator, shall be provided with fixed guards, interlocked movable enclosing guards or distance guards over the exposed surface; and

- i) safeguarding several rollers by one guard (see 5.3.1.2);

A series of rollers may be protected by one guard (e.g. fence guard); and

- j) measures relating to special operations;

For starting up rollers during special operations (e.g. maintenance, adjustment, setting, elimination of process faults) see 5.4; and

- k) regarding the safety-related part of the control system (see 5.2.2).

Category 3 or 4 shall be selected for interlocking devices of guards and other safety devices at drawing-in points of rollers or rollers and fixed parts.

6.5 Rotating shafts

Rotating shafts used to transmit drive power are found on spinning, winding, doubling, twisting, texturizing, finishing and similar machines.

Hazards:

Mechanical, from the shafts, in particular entanglement of the hair and clothing.

Risks:

Frequent access during normal and special operation, leading to high probability of severe injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) rotating shafts shall, where possible, be positioned in accordance with EN 294 so that they are not exposed; and
- b) exposed rotating shafts shall be provided with guards (see 5.3.1.2) (e.g. fixed distance guards or tunnel guards). Sleaving is permissible subject to the ends being arranged to prevent the ingress of foreign matter (e.g. yarn between the shaft and the sleeve); and
- c) the precautions shall also apply to shafts at the rear of frames which are accessible during special operations.

6.6 Wheels

6.6.1 Running wheels

Machines or sections of certain machines are mounted on wheels to provide mobility, including automated blending bale openers, cross-folders, moving bin emptiers.

Hazards:

Mechanical, from the wheels, in particular crushing and shearing.

Risks:

Occasional access during normal and special operation, leading to low probability of moderate to severe injury.

Safety requirements:

Where a guided machine or section thereof is equipped with wheels to travel on rails or another running surface along a fixed path, one of the following measures shall be adopted:

- a push-away (cow-catcher) device [see figure 9 a)] shall be mounted to protect the trap point between the wheels and the running surface, or
- a trip device [e.g. a trip panel — see figure 9 b)] shall be provided which, when operated, shall cause the machine to come to a standstill.

When selecting the type of device to be used, the speed and movement of the machine shall be taken into account.

6.6.2 Handwheels

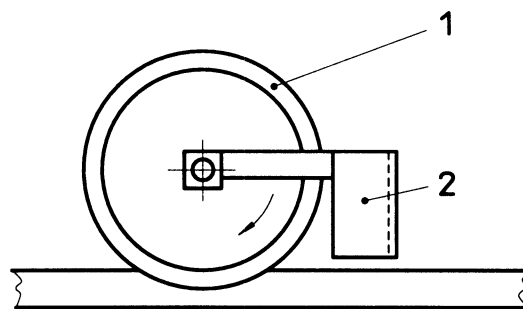
Handwheels are variously used on textile machines (e.g. weaving machines and knitting machines).

Hazards:

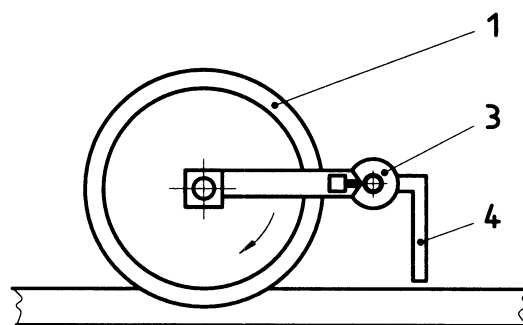
Mechanical, in particular entanglement of clothing on the rotating surface of the handwheel or projecting parts.

Risks:

During normal operation, when the operator is attending the machine, leading to low probability of moderate injury.



a) Wheel with push-away device



b) Wheel with trip panel

- 1 Wheel
- 2 Push-away device
- 3 Limit switch
- 4 Trip panel

Figure 9 — Safeguarding on wheels

Safety requirements:

A handwheel may rotate (i.e. be fixedly coupled to the machine), if at least one of the following conditions is fulfilled:

- it is not located in the immediate maintenance zone;
- it does not protrude out of the machine so that it can be leant on;
- it is discoid and is free of protruding parts.

6.7 Doors and lids

Doors and lids are variously used on textile machines (e.g. on autoclaves, kiers, bleaching and dyeing vessels).

6.7.1 Opening and closing

Hazards:

Mechanical, from edges of the door or lid, in particular impact, crushing and shearing.

Risks:

Access whilst the door or lid is opening or closing, leading to low probability of moderate to severe injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) means shall be provided to prevent suspended doors and lids from falling unintentionally, e.g.:
 - a catch or a stop beyond the hinge, to hold it securely in the open position;
 - an independent hydraulic or pneumatic damping device to prevent overrapid movement when opening or closing the door or lid;
 - chains or ropes which shall always be used in pairs to avoid the risk of parts falling when a chain or rope fails;
- and
- b) for hand-operated doors and lids, the movement of the door or lid shall take into account ergonomic considerations and mass (inertia), see 5.3.2.11; and
- c) for power-operated doors and lids, the requirements of 5.3.2.3 apply. Crushing and shearing by the closing door or lid shall be prevented. This may be achieved by one of the following means:
 - the actuating force and speed of movement shall be in accordance with A.4;
 - the edges of the door or lid shall be fitted with a safety device in accordance with 5.3.1.2 (e.g. trip bars) which, when operated, will arrest the movement of the door or lid;
 - the door or lid shall only be closed by means of a hold-to-run control which is positioned out of reach of the door or lid edges, but at a place where the operator can overlook the door or lid edges.

6.7.2 Locking and unlocking

Hazards:

Mechanical, in particular impact by the door or lid.

Thermal, in particular scalding by hot liquor or steam.

Risks:

High probability of severe or fatal injury caused by:

- the door or lid bursting open, due either to the application of pressure before the door or lid is fully locked, or to residual pressure inside the vessel or chamber when unlocking;
- the escape of hot liquor or steam.

Safety requirements:

Means shall be provided to deflect any discharge of fluid or steam away from the operator (e.g. deflector panels or rings at the edge of the door or lid).

Specific safety requirements for multi-bolted doors and lids:

To facilitate the safe release of any residual pressure, at least one of the bolts on the door or lid which prevent further opening shall only be capable of release when a gap of at least 3 mm exists between the door and seal. Such bolts shall be placed on the edge of the door or lid opposite to hinge or hinges.

Specific safety requirements for quick-locking doors and lids:

All the following measures appropriate to the machine shall apply:

- a) positive fail-safe interlocking shall be provided between the door-locking mechanism, the vent valve and all pressurizing systems (e.g. steam, water, compressed air, pumps, heating, etc.), so that the pressurizing systems are turned off and isolated, and the vent valve is open before beginning to unlock the door. These measures shall remain effective until after the door is fully closed and relocked; and
- b) unlocking shall incorporate two individual stages. In the first stage the door is partially unlocked, but still restrained (it is essential that the restraint is strong enough to withstand any residual forces); the door shall be fully open within the limits of the restraint (until there is a gap of not less than 8 mm between the door and the seal) before the final stage of unlocking can begin and the door can be opened; and
- c) in the case of vessels containing liquid:
 - for vertical vessels, an open-ended drain which may also be the main drain shall be interlocked with the door- or lid-locking mechanism to positively ensure that the liquor level is sufficiently below the bottom of the door or lid before beginning to unlock it;
 - likewise, for horizontal vessels with full-size doors, an interlocked drain shall ensure that no liquid is left in the vessel before beginning to unlock the door;
 - care shall be taken in sizing and positioning of these drains to ensure that they cannot be blocked by the contents of the vessel and that any discharge from the drain is deflected away from the operator.

6.7.3 Entry into machines, vessels or items of plant

Hazards:

Mechanical, when an operator enters or falls into vessels or plant and can become trapped or shut inside.

Risks:

During normal and special operation, low probability of severe or fatal injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) doors shall be interlocked, and when specified in clauses 7 to 12 this shall be with guard locking (see 5.3.1.2); and
- b) the machine shall not be restarted by closing the door but only by actuating the start control at the control panel. Either this shall be a hold-to-run control positioned so that the operator can view the inside of the vessel or item of plant, or it shall not be possible to restart the machine until a reset control positioned near the door has been actuated; and
- c) the door shall be designed so that it can be opened from the inside.

6.8 Observation windows

Observation windows are to be found in the guards or coverings of many textile machines.

Hazards:

Mechanical, when the window material is broken or damaged, in particular cutting or stabbing, and from various dangerous parts if access is possible through a broken observation window.

Risks:

Low probability of light injury from broken window material and high probability of moderate to severe injury if access to danger zones is possible.

Safety requirements:

Windows shall be of material suitable to withstand mechanical damage and, where necessary, chemical attack (e.g. polycarbonate sheet or toughened glass).

6.9 Conveyors

Conveyors are incorporated in textile machinery in a variety of forms and dimensions.

General safety requirements:

The safety requirements of 5.6 for escape and rescue of trapped persons and of 6.2 for lattices with spikes shall apply.

Specific hazards:

Mechanical

- from the conveyor itself;
- between the conveyor belt and pulley;
- between parts of the conveyor and adjacent machine parts;
- between two conveyors or between a conveyor and a roller;
- from removal of process material.

Specific risks:

Access during normal and special operation, in particular during incidental cleaning or removal of blockages, leading to low probability of moderate to severe injury.

Specific safety requirements:

All the following measures appropriate to the machine shall apply:

- a) for lattice conveyors, the bars of the lattice shall be spaced so that fingers cannot be trapped (see EN 294:1992, table 4); and
- b) for intake points between the conveyor belt and:
 - any driven pulley, or
 - any non-driven pulley where the conveyor belt is tensioned, or
 - any non-driven pulley where the conveyor belt is held such that it is not free to climb,fixed guards or movable interlocked guards (e.g. lateral distance guards or fixed nip guards) shall be provided in accordance with 5.3.1.2. As far as is possible, guards shall be designed so that they can remain in position when adjustments, for example belt tensioning, are carried out; and
- c) for shear points between moving parts of the conveyor and fixed parts of the machine, enclosing or distance guards shall be provided (see 5.3.1.2); and
- d) for the drawing-in points between two conveyors or between a conveyor and a roller, see 6.4 c); and

- e) where conveyors are used in processes where it is likely that materials (e.g. fibres) will accumulate on the surfaces of the conveyor or pulleys, the conveyor shall be designed and constructed to allow, as far as possible, cleaning to be done without removing the guards. Where possible fixed cleaning devices shall be fitted. If guards have to be removed regularly for cleaning purposes they shall be interlocked (see 5.3.1.2).

6.10 Fans

Fans are found on many textile machines including blow room machinery, pneumatic fibre transport systems, spinning preparatory and spinning machines, stenters and other drying machines.

Hazards:

Mechanical, from blades; in particular entanglement of hair and clothing, and impact or cutting.

Risks:

Occasional access during special operation, including removal of blockages of process material and cleaning, leading to high probability of moderate to severe injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) the fans shall either be positioned in accordance with EN 294 so that they are not within reach of the operator or be guarded (see 5.3.1.2); and
- b) where occasional access is necessary for removal of blockages of process material (e.g. in automatic fibre transport systems), openings shall be positioned at a distance from the blades sufficient to prevent access by the fingers, but allowing access by means of a tool to remove a blockage. Alternatively, the openings may be close to the fans provided that each is covered with a movable interlocked guard with guard locking (see 5.3.1.2). A warning shall be given in the instruction handbook concerning the fact that connecting ducts, installed by the user or other person, for a fibre transport system shall not have any openings within reach of the fan.

6.11 Cutting devices

Circular, straight and spiral cutting blades are variously used on machines and processes in the textile industry (e.g. two-cutting, nonwoven production, shearing and cropping of carpet, finishing, stenters, automatic batchers and other machines).

Hazards:

Mechanical, from the cutting device, in particular cutting or severing, or from the blade supports, in particular crushing and shearing.

Thermal, from heated knives or where heat is generated during the course of operation of the cutting device.

Risks:

Occasional access during normal and special operation, leading to high probability of minor cuts and low probability of severed fingers, hands or arms. High probability of moderate to severe injury when handling knife blades.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) fixed position circular blades:

Enclosing guards shall be provided, which enclose the blades as far as is technically possible in relation to the process being carried out (see 5.3.1.2). These may be adjustable guards or self-adjusting guards, and

b) traversing circular blades:

Access shall be prevented to the blades and associated parts including any clamp which, together with fixed machine parts, form crush and shear points when traversing.

This may be achieved by a fixed guard extending the length of the traverse, or trip devices (e.g. photoelectric protective devices), preventing the start of the traversing motion or causing it to be interrupted immediately if an operator reaches into the danger zone (see 5.3.1.2); and

c) guillotine-type blades:

Regarding the safety-related part of the control system (see 5.2.2), category 3 or 4 shall be selected for the interlocking device of guards and safety devices on guillotine-type blades. Means shall be provided to prevent access to the danger zone while the blade is in motion; for example this may be achieved if, on entry and exit sides of the blade, tunnel guards are provided whose dimensions correspond to EN 294. Movable guards (e.g. hinged covers) within the tunnel shall be interlocked with the motion of the blade (see 5.3.1.2).

If such a cutting device is incorporated in a textile installation having fence guards (see 5.3.1.2), doors interlocked with the movement of the blade may be provided to give access to work areas in front of and behind the cutting device (see A.3). Instead of fence guards, the work area may also be secured by means of safety devices (e.g. a system of photoelectric protective devices or pressure-sensitive mats or floors), which prevent movement of the blade as long as a person can reach it (see 5.3.1.2). The stopping time shall be shorter than the access time.

For the protection of the operator during the changing of blades, mechanical restraints shall be provided to prevent the blade carrier from falling; and

d) spiral blades: see 6.2; and

e) log-slitting-type devices; and

f) laser cutting; and

g) high pressure water jets; and

h) ultrasonic devices.

Hazards associated with cutting devices e) to h) are not treated in this International Standard.

6.12 Work platforms and walkways on machines, work areas adjacent to tanks and pits

Work platforms and walkways are provided on various textile machines including filament processing, spinning preparatory processing, weaving (Jacquard), printing, continuous dyeing and finishing lines. Pits are to be found particularly in carding and work areas adjacent to tanks in the bleaching, dyeing and finishing industries.

General safety requirements:

The safety requirements of 5.5 for access to operating positions and servicing points shall apply.

Specific hazards:

For persons:

- falling off platforms and walkways;
- slipping or tripping;
- falling into an adjoining tank or pit;
- injury by items dropping from platforms and walkways.

Specific risks:

Access to work platforms and walkways located in a raised position or to working areas adjacent to tanks and pits, leading to low probability of moderate to severe injury during normal and special operation.

Specific safety requirements:

All the following measures appropriate to the machine shall apply:

- a) where work platforms or walkways are provided in a raised position alongside or over a machine to ensure safe access (height greater than 500 mm), these shall be designed with handrails at a height of at least 1 000 mm together with intermediate horizontal rails at a maximum separation of 500 mm and toeboards of at least 100 mm height. The width of a workplace or walkway shall be a minimum of 500 mm. Where it is necessary to gain access for supervision, fault-finding and rectification, maintenance, etc., suitable fixed access stairways or ladders shall be provided.

Where a door is fitted at the top of a stairway providing access to a work platform or walkway, the direction of opening shall be away from the stairs.

Where a work platform or walkway is provided and access to a danger zone is possible, guards and safety devices shall be provided to prevent such access (see 5.3.1.2); and

- b) work platforms, walkways and stairway or ladder treads shall be provided with non-slip surfaces; and
- c) where there is a possibility of falling into items of plant such as tanks or pits, these shall be designed so that the upper edge will be at least 1 000 mm above the surface of the workplace. Otherwise there shall be a fence or barrier of 1 000 mm height, infilled with sheeting or vertical bars spaced not more than 180 mm apart, around the edge of the tank or pit unless other parts of the machine or plant provide a barrier; and
- d) where there is a risk of items dropping through the mesh of a work platform (e.g. maintenance tools), appropriate precautions shall be taken.

6.13 Radiators or burners for the direct heat treatment of yarn and fabric

Open radiators or burners are found on yarn and fabric treatment machinery (e.g. singeing and baking).

Hazards:

Thermal, in particular burns through contact with flame or radiating heat sources or burning process material.

Risks:

Access during special operation leading to high probability of moderate to severe injury.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) means shall be provided to prevent unintentional access to the radiator(s) or burner(s); and
- b) when the speed at which the process material is being transported decreases or becomes nil, then
 - means shall be provided to separate automatically the heat source and the process material; or
 - shields shall be automatically introduced to form a thermal barrier between the heat source and the process material; or

- on gas-fired plants where radiators or burners are located at a sufficient distance from the process material, fast shut-off valves shall be provided in the gas supply pipe;

NOTE 6 This International Standard does not deal with the safety aspects of gas-firing equipment in general.

and

- c) the instruction handbook shall advise that cleaning is necessary at appropriate intervals.

6.14 Devices for steam heating of liquors

Steam injection tubes are found, for example, in wool scouring, backwashing, bleaching, dyeing and finishing machinery.

Hazards:

Noise caused by direct injection of live steam into liquor. Scalding due to ejection of live steam or hot liquor, particularly when the liquor level is low.

Risks:

A probability, depending upon exposure, of hearing loss (deafness), a low probability of severe injury during heating of the liquor.

Safety requirements:

The following precaution should be taken to reduce the risk of hearing loss:

live steam injection should include low-noise steam injector mechanisms (examples see figure 10);

One of the following precautions shall be taken to reduce the risk of scalding:

- a) indirect heating measures shall be provided where practicable; or
- b) live steam injection tubes shall be designed to avoid ejection of steam from the vessel (see figure 11); or
- c) a lid for the vessel, to prevent scalding, shall be provided (see 6.7).

6.15 Liquor preparatory machinery incorporating stirrers

Liquor preparatory machinery is variously used in the textile industry (e.g. in sizing, dyeing, printing). Stirrers are variously incorporated in machinery for the preparation of size, dyeing and printing liquors.

General safety requirements:

The safety requirements of 5.3.2.4.2 for hot liquor or steam shall apply.

Specific hazards:

Mechanical

- from shaft couplings, in particular entanglement;
- from the blades, in particular impact and crushing;

Thermal

- hazards resulting from ejection of liquor and boiling over of liquor.

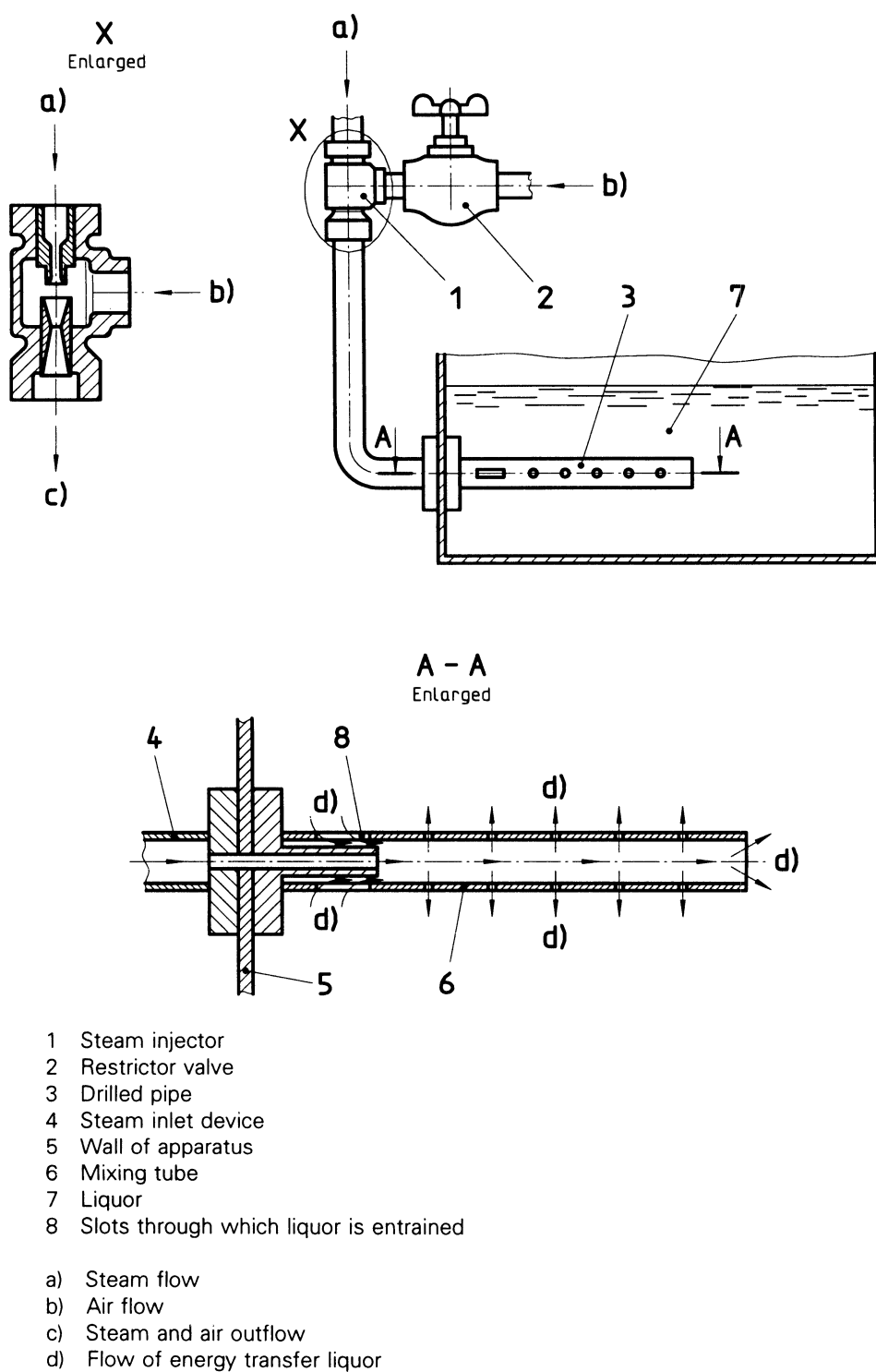


Figure 10 — Low-noise steam injectors

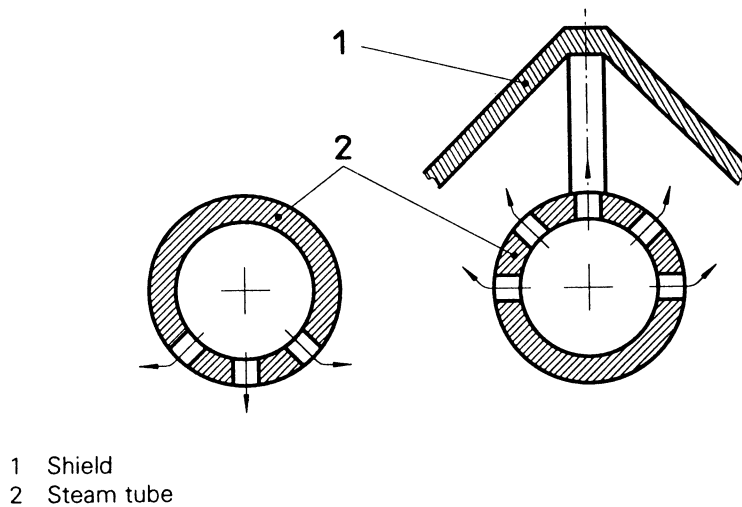


Figure 11 — Examples of low-risk steam injection tubes

Specific risks:

When adjacent to the vessel, particularly when opening the lid for monitoring or cleaning, leading to low probability of severe injury.

Specific safety requirements:

All the following measures appropriate to the machine shall apply:

- a) where access to the stirrer drive-shaft coupling is possible, protrusions at the coupling shall be sunk or guarded (e.g. by a stainless steel mesh); and
- b) where the stirrer can be raised out of the mixing vessel, means shall be provided to:
 - permit stirrer operation only when lowered into position in the mixing vessel; and
 - prevent falling from the raised position;
 and
- c) where there is a risk of hot or otherwise hazardous liquor being ejected because of the high speed of the stirrer, interlocked lids which can be opened only at an appropriate low stirrer speed or at a standstill shall be provided; and
- d) where there is a risk of liquor boiling over, the heat supply shall be interrupted when opening the lid.

6.16 Dancing rollers

This equipment is used to store varying amounts of warp yarn, fabric or carpet during or between processes, or to control speeds (e.g. storage accumulators, compensators, festoons).

Hazards:

Mechanical, from rollers moving past each other or moving past fixed parts of the support framework or falling, in particular crushing, shearing and impact.

Risks:

Low probability of severe to fatal injury during normal operation.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) fixed guards shall be provided which shield the total travel of the rollers (e.g. enclosing guards, distance guards or fence guards) in accordance with 5.3.1.2; and
- b) where provided, access doors shall be interlocked (see 5.3.1.2); and
- c) restraint devices shall be provided to prevent the movable parts from falling.

NOTE 7 Single pivoting rollers with mechanical stop, which do not cause crushing or shearing hazards, do not need the special requirements mentioned above.

6.17 Bachers

Bachers are used to wind fabric or carpet into a batch, particularly in the nonwoven, weaving (except bachers integrated in weaving machines), bleaching, dyeing, printing and finishing industries.

General safety requirements:

The safety requirements of 5.3.2.3 for fluid power supply and 5.6 for escape and rescue of trapped persons shall apply.

Specific hazards:

Mechanical, from machine parts, especially rollers, from the process material in the course of being wound, in particular drawing-in or trapping, and from the lowering of the drive arm, in particular crushing.

Specific risks:

Access during normal operation, particularly start-up of a new batch, and also when the fabric is smoothed and edges are uncurled, leading to low probability of severe or fatal injury (e.g. centre-driven bachers), in other cases high probability of moderate to severe injury (e.g. surface-driven bachers).

Specific safety requirements:

All the following measures appropriate to the machine shall apply:

- a) surface-driven bachers (bachers with a pivoting driven pressure roller) with a circumferential speed greater than 2 m/min shall be provided with an interlocking guard (e.g. a movable interlocked distance guard) or safety device at the drawing-in point created between the driven roller and the batch in accordance with 5.3.1.2).

The interlocking guard or the safety device shall be designed to compensate for the progressively increasing diameter of the batch. Actuating the guard or operating the safety device shall cause the drive to stop and to lift the drive roller immediately to a distance of more than 120 mm from the surface of the cloth batch.

Where access to the drawing-in point is possible from the side of the bacher, side guards shall be provided.

Examples of interlocked guards and trip devices (sensing edges) which incorporate a multi-link compensator mechanism are shown in figure 12 a) and b). Roller-guided or sensor-controlled compensators may also be used. The sensing edges may be replaced by photoelectric protective devices.

Examples of trip devices without a compensator mechanism are shown in figure 12 c) and d). For safety distances see EN 294.

The arm of the drive roller shall be lowered only by means of a hold-to-run control. Otherwise guards or safety devices shall be provided to prevent crushing between arm and batch (see 5.3.1.2); and

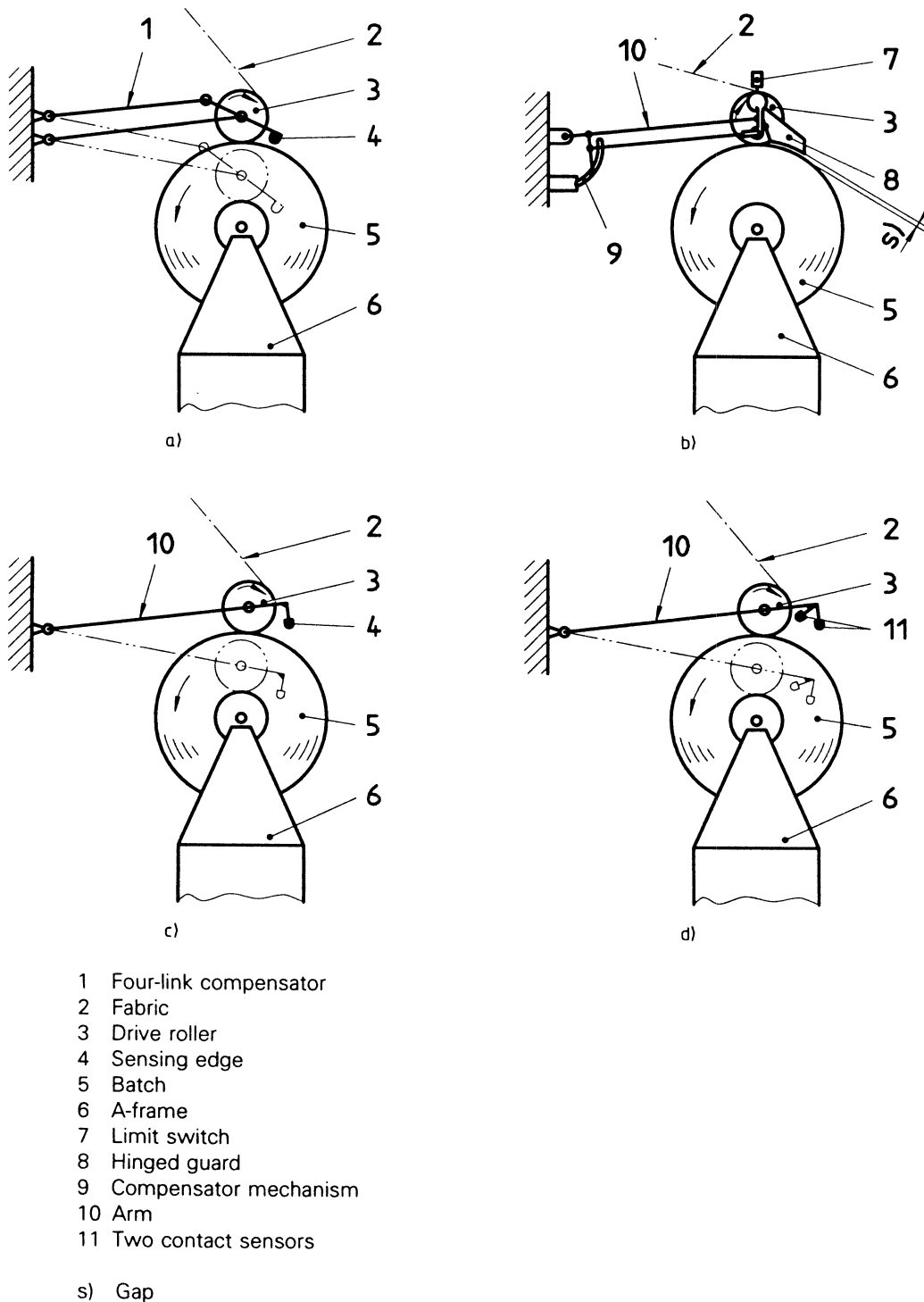


Figure 12 — Safeguarding of surface-driven batchers

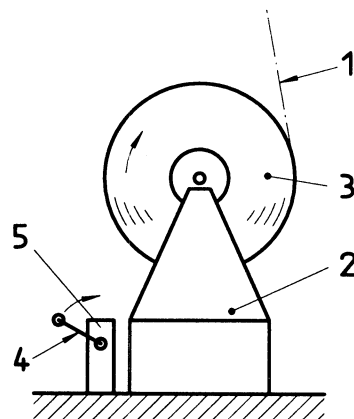
- b) centre-driven batchers with a circumferential speed greater than 2 m/min where guards or safety devices cannot be positioned at the drawing-in point shall be provided with a trip device (see 5.3.1.2). This shall be located on the operating side and so positioned that it can be operated voluntarily and involuntarily by any part of the operator's legs or feet. Operation of the trip device shall result in the batcher stopping in the shortest possible time.

An example of suitable design of a trip device is shown in figure 13. The trip bar may also be attached to the frame. This may also be a trip wire arranged at the same position.

Where the drive is supplied specifically for use with batchers, suitable connections should be provided on the drive controls for the trip device.

Advice concerning installation shall be given in the instruction handbook;

NOTE 8 The type of centre drive used need not be designed or manufactured specifically for use with batching units and may be selected by the installer or user from a range of units, each of which can be used to drive many different machines. Therefore, in the particular case of centre-driven batchers, the responsibility for ensuring that suitable guards or safety devices are provided should rest with the installer.



- 1 Fabric
- 2 A-frame
- 3 Batch
- 4 Trip bar
- 5 Support bracket

Figure 13 — Safeguarding of centre-driven batchers

and

- c) where batchers are fitted with both surface and centre drives, the appropriate guarding for both types of drive shall be installed as in a) and b); and
- d) centre-driven batchers with an undriven pressure roller shall in addition to b) be provided with safeguarding as in a); and
- e) where there is a risk of the operator's fingers or hand being drawn in (e.g. batching carpet), surface batchers consisting of two parallel horizontal-driven rollers rotating in the same direction, upon which the batch is made, and where the drawing-in point is accessible, the batcher shall be provided with a full-width foot-operated emergency stop bar (see 5.2.3).

A suitable design is shown in figure 14 a). This may also be applied to surface batchers with a single driven roller, as shown in figure 14 b); and

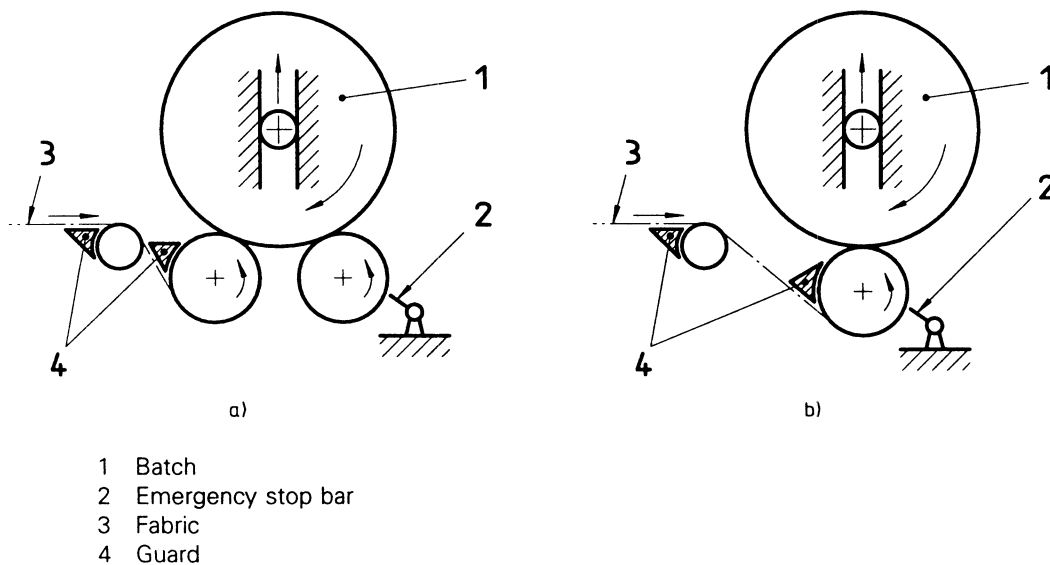


Figure 14 — Safeguarding of surface batchers

- f) as an alternative to all of the above safeguarding methods, the batching area may be enclosed with a fence guard in accordance with A.3.

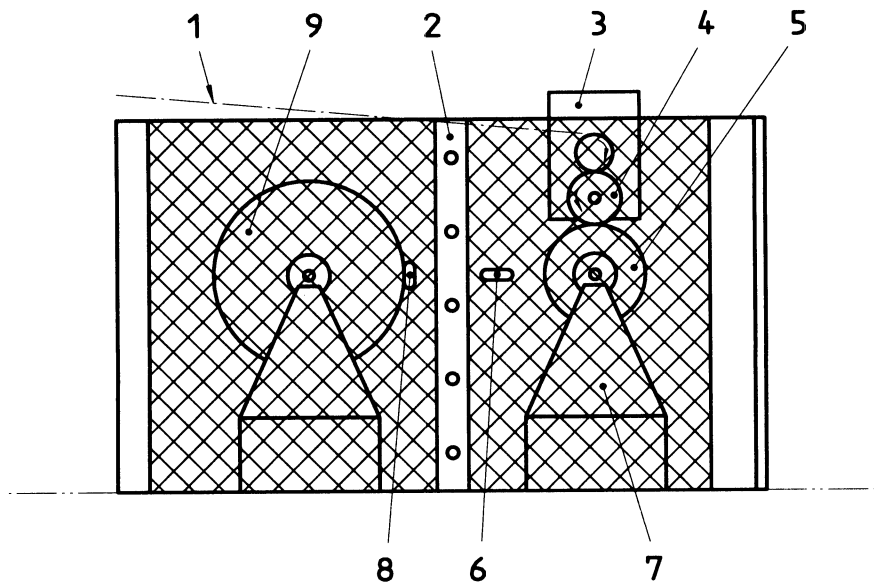
The fence guard shall be fitted with an interlocked access door. To enable the batch to be threaded up, the interlocking device may be fitted with either an override control permitting the batch to be driven at crawl speed by means of a hold-to-run control or with a limited movement control device. These controls may be leg- or foot-operated; and

- g) batchers with automated change of process material.

On batchers referred to in a), b), c), d) and e) with automated changing units for process material, precautions shall be taken to prevent access to the changing units, including the cutting and threading-up devices and the area traversed by the arm of the drive roller, during the changing operation.

The safety requirement may be satisfied by installing a visual or acoustic warning signal to warn that batch changeover is about to occur, and:

- surrounding the entire batcher unit by a fence guard (see figure 15 and A.3). Doors provided in the fence guard shall be interlocked with the changing unit control so that the changing operation cannot be started as long as the door is open or will be interrupted as soon as the door is opened. It shall not be possible to restart the changing operation from outside before a reset control installed inside the door has been actuated.



- 1 Fabric
- 2 Lattice of photoelectric protective devices
- 3 Changing unit for cloth
- 4 Mobile drive roller
- 5 Batch in operation
- 6 Door, interlocked at present
- 7 A-frame
- 8 Door, unlocked
- 9 Batch (finished)

Figure 15 — Safeguarding of automatic batcher units

Additionally, the fence guard may safeguard the drawing-in and winding-on zone of the batcher provided that the drive to the batcher is interlocked with the doors. Otherwise every danger point on the batcher shall be secured effectively in accordance with a), b), c) and d).

At a batcher unit with two A-frames when the fence guard protects the drawing-in and winding-on points, the interlock on the door of the currently non-operational side may be muted when changing A-frames. During the change, access to the operating batcher shall be prevented using either a fence guard or a lattice of photoelectric protective devices installed between the two A-frames. The lattice shall be activated immediately when one of the doors is opened; or

- protecting the unit in part by a fence guard and in part by photoelectric protective devices according to A.2;
or
- equipping the work area with trip devices such as pressure-sensitive mats or floors which provide protection equivalent to fence enclosure. Where the drawing-in and winding-on points of the individual batcher are effectively protected, it is sufficient to activate the pressure-sensitive mats or floors immediately before changing the process material; or
- protecting each danger zone by guards and safety devices (see 5.3.1.2);

and

- h) for the safety-related part of the control system (see 5.2.2) of all batchers, category 3 or 4 shall be selected for interlocking devices of guards and safety devices.

3.18 Mangles

Mangles are variously used on dyeing and finishing machines to squeeze the process fabric.

General safety requirements:

The safety requirements of 5.6 for escape and rescue of trapped persons shall apply.

Specific hazards:

Mechanical, from the mangle bowls (rollers) when running, when they are apart and when they are being moved together, in particular crushing, drawing-in or trapping.

Specific risks:

Occasional access during normal operation and special operation, particularly threading up and cleaning, leading to high probability of severe injury.

Specific safety requirements:

All the following measures appropriate to the machine shall apply:

- a) guards shall be provided to prevent access to the running bowls which may, for example, be in the form of
 - fixed nip guards in accordance with 6.4 c); or
 - interlocking guards with guard locking unless the access time exceeds the stopping time, in which case interlocking guards without guard locking may be used (see 5.3.1.2);and
- b) means shall be provided to hold the mangle bowls apart (e.g. during threading up), which may be in the form of
 - an electropneumatic restraint device; or
 - a hydraulic restraint device; or
 - a mechanical restraint device;and
- c) when the bowls are moving together, one of the following precautions shall be taken:
 - access to the bowls shall be prevented by a guard; or if this is not possible
 - a hold-to-run control shall control movement of the bowls, providing they can be viewed from the operating position; or if this is not possible
 - a visual or acoustic warning signal shall be given before the bowls move together and a hand- or foot-operated emergency trip device which can be actuated from both sides (e.g. a trip-wire) shall be provided for every mangle;and
- d) regarding the safety-related part of the control system, category 3 or 4 shall be selected for interlocking devices of guards at the drawing-in points of the rollers.

6.19 Pilers and plaiters

Pilers and plaiters are variously used on dyeing and finishing machines to deposit process fabric into the recipient container or pit.

Hazards:

Mechanical, from the traversing mechanism, in particular crushing and shearing.

Risks:

Occasional access during normal and special operation, leading to low probability of severe injury.

Safety requirements:

Piler and plaiter mechanisms shall be designed so that crush and shear points are eliminated. Where this is not practicable, guards or safety devices shall be provided (see 5.3.1.2).

6.20 Automatic machines and equipment

Automatic textile machines and equipment are those for which control systems are employed to govern their operation, without further intervention from the operator, once the start control has been activated. Such machines may be free-standing or included in a complex installation. Automatic control can apply to the operational sequence of a machine and its integrated equipment located in a permanent situ, and to equipment which is mobile, including handling devices (e.g. piecing devices, automatic doffers).

General safety requirements:

Safety requirements and/or measures given in table 9 shall apply.

Table 9 — General safety requirements relating to automatic machines and equipment

Application	Reference
All machines:	
Electrical equipment in general	5.2.1
Electrical control systems	5.2.2
Starting and stopping	5.2.3
Reduction of mechanical risks by design	5.3.1.1
Reduction of mechanical risks by safeguarding	5.3.1.2
— with guards	— Table 5
— with safety devices	— Table 6
Risks due to fluid power	5.3.2.3
Risks specific to special operation	5.4
Escape and rescue of trapped persons	5.6
Residual risks	5.7
Particular machine elements:	
Drive and transmission enclosures	6.1
Rollers	6.4
Rotating shafts	6.5
Running wheels	6.6.1
Conveyors	6.9

6.20.1 Automatic guards

Guards which can open and close automatically are fitted to automatic machines and equipment.

General safety requirements:

The safety requirements given in table 9 for automatic machines and equipment (except 6.4 and 6.9) shall apply.

Specific hazards:

Mechanical, from the moving guards, in particular crushing, shearing, drawing-in or trapping.

Specific risks:

Intervention by exposed persons, particularly during special operations, leading to low probability of light to severe injury.

Specific safety requirements:

In addition to the requirements given in table 9, one of the following measures shall be adopted:

- a) guards shall open or close with a force which can be resisted by the operator without injury. This may be achieved by limiting the drive power to the guards (for pressure and force see A.4); or
- b) all edges of the guards which may give rise to the identified hazards shall be protected by trip devices (e.g. pressure-sensitive edges) which, when operated, stop the movement of the guard; or
- c) the danger zone around the guards shall be protected by safety devices (e.g. pressure-sensitive mats and floors, photoelectric protective devices, etc.) which prevent movement of the guards when an exposed person is present.

6.20.2 Mobile machines, handling devices, operational parts

Machines or sections of machines and handling devices which can move from one location to another automatically, generally along a defined track, or which can rotate, are found in many modern textile mills. Operational parts thereof move under automatic control.

General safety requirements:

The safety requirements given in table 9 for automatic machines and equipment shall apply.

Specific hazards:

Mechanical, in particular crushing, shearing and impact between moving machines and fixed parts of adjacent machinery, plant or premises, etc., between moving handling devices or operational parts and adjacent fixed or moving machine parts, machinery, plant or premises.

Specific risks:

Intentional or unintentional access by exposed persons during automatic operation and access during special operation, leading to high probability of light to severe injury.

Specific safety requirements:

One of the following measures appropriate to the machine shall apply:

- a) the machine or handling device or operational parts shall be designed to conform to EN 349; or
- b) the pressure or force caused by the movement of a machine, handling device or operational parts shall not exceed the power of an exposed person in its path to resist the movement (see A.4), or

- c) fence guards or safety devices shall be provided for moving machines. Fixed or movable enclosing guards or safety devices shall be provided for handling devices and operational parts to prevent access to the danger zones; or
- d) those sides of the machine, handling device or operational parts facing the direction of travel shall be protected by fullface trip devices (e.g. trip plates, trip bars, pressure-sensitive edges, photoelectric protective devices, etc.) designed to arrest the movement of the machine or handling device on contact or impact before injury can occur.

When a safety device has been operated, the machine, handling device or operational parts shall only be re-started by a deliberate act of the operator. Where the operator cannot view all the danger zones from the start control position, restart shall only be possible after the operation of a reset control.

Alternatively, operation of a safety device may cause the direction of motion to reverse, if this in itself does not create a new hazard.

6.20.3 Mobile machines and handling devices which could leave their defined path

General safety requirements:

The safety requirements of 6.20.2 for mobile machines, handling devices and operational parts shall apply.

Specific hazards:

Mechanical, in particular crushing and impact when a moving machine or moving handling device leaves its defined path, due for example to failure of the control system, excessive speed or inadequate braking.

Specific risks:

Unpredictable collision with exposed persons, leading to high probability of severe injury.

Specific safety requirements:

One of the following measures appropriate to the machine shall apply:

- a) stops (buffers) shall be provided at the ends of paths. The stops shall have sufficient absorption properties to counter the energy/velocity of the machine/handling device; or
- b) the defined path (rail) shall extend beyond the working length to allow the moving machine or handling device to come to rest following braking or removal of drive power.

6.20.4 Floor-mounted and overhead rails (tracks)

Hazards:

Mechanical, in particular tripping over floor-mounted rails and impact from walking into floor-mounted rails/tracks or overhead rails.

Risks:

High probability of moderate injury at all times when access is needed to those areas beneath which or over which the rails/tracks are located.

Safety requirements:

All the following measures appropriate to the machine shall apply:

- a) floor-mounted rails shall be recessed in work areas and passageways; and
- b) the rails/tracks shall have permanent high-visibility markings at all possible impact/tripping points.