
**Textile machinery — Safety
requirements —**

**Part 6:
Fabric manufacturing machinery**

*Matériel pour l'industrie textile — Exigences de sécurité —
Partie 6: Machines de production d'étoffes*



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ISO 11111-6:2005(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 11111-6 was prepared by Technical Committee ISO/TC 72, *Textile machinery and machinery for dry-cleaning and industrial laundering*, Subcommittee SC 8, *Safety requirements for textile machinery*.

This first edition of ISO 11111-6, together with ISO 11111-1, ISO 11111-2, ISO 11111-3, ISO 11111-4, ISO 11111-5 and ISO 11111-7, cancels and replaces ISO 11111:1995, which has been technically revised.

ISO 11111 consists of the following parts, under the general title *Textile machinery — Safety requirements*:

- *Part 1: Common requirements*
- *Part 2: Spinning preparatory and spinning machines*
- *Part 3: Nonwoven machinery*
- *Part 4: Yarn processing, cordage and rope manufacturing machinery*
- *Part 5: Preparatory machinery to weaving and knitting*
- *Part 6: Fabric manufacturing machinery*
- *Part 7: Dyeing and finishing machinery*

Introduction

ISO 11111-1 to ISO 11111-7 were prepared simultaneously by ISO/TC 72 and CEN/TC 214 and adopted under the Vienna Agreement in order to obtain identical standards on technical safety requirements for the design and construction of textile machinery.

ISO 11111 as a whole is intended for use by any person concerned with the safety of textile machinery, for example, textile machinery designers, manufacturers and systems integrators. It is also of interest to users of textile machines and safety experts.

This document is a type C standard as stated in ISO 12100-1. The various parts of ISO 11111 deal with frequent and significant hazards generated by machines used in the textile industry. The machinery concerned and the extent to which hazards are covered are indicated in the scope of this standard.

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

For hazards of machines or machine elements not dealt with in the relevant part of ISO 11111, the designer is to perform a risk assessment according to ISO 14121 and evolve means for reducing the risk from significant hazards.

This part of ISO 11111 is intended to be used in conjunction with ISO 11111-1. As far as possible, the requirements of this part of ISO 11111 are treated by way of reference to Clauses 5 and 6 of ISO 11111-1. Clause 5 of ISO 11111-1 contains safety requirements and/or measures for frequently occurring hazards of textile machinery which apply whenever referred to in this part of ISO 11111, while Clause 6 describes significant hazards and corresponding safety requirements and/or measures for certain machine elements and their combinations (e.g. rollers), which also apply whenever referred to in this part of ISO 11111.

Textile machinery — Safety requirements —

Part 6: Fabric manufacturing machinery

1 Scope

This part of ISO 11111 is intended to be used in conjunction with ISO 11111-1. It specifies significant hazards and corresponding safety requirements and/or measures for fabric manufacturing machinery. By taking into account the scope of ISO 11111-1 as far as is relevant, this part of ISO 11111 is applicable to all machinery, plant and related equipment intended to be used for weaving, knitting and tufting, as specified in Clause 5.

2 Normative references

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

ISO 9902-1, *Textile machinery — Noise test code — Part 1: Common requirements*

ISO 9902-6, *Textile machinery — Noise test code — Part 6: Fabric manufacturing machinery*

ISO 11111-1:2005, *Textile machinery — Safety requirements — Part 1: Common requirements*

ISO 13849-1:1999, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850:1996, *Safety of machinery — Emergency stop — Principles for design*

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

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

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

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

IEC 61496-1:1997, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests*

IEC 61496-2:1997, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

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

3 Terms and definitions

For the purposes of this part of ISO 11111, the terms and definitions given in ISO 11111-1 and the following apply.

3.1 two-button-control device
device which requires at least simultaneous actuation using two fingers in order to initiate a machine function

4 List of significant hazards

Significant hazards found in fabric manufacturing machines which are common with those frequently occurring with other textile machines or with machine elements of other textile machines shall be considered in accordance with ISO 11111-1:2005, Clauses 5 and 6, whenever referred to under the heading “General safety requirements” in Clause 5 of this part of ISO 11111. Significant hazards which are particular to fabric manufacturing machines are considered as “Specific hazards” in Clause 5 of this part of ISO 11111.

Before using this part of ISO 11111, it is important to carry out a check to ascertain that the specific machine has the significant hazards identified.

NOTE The significant hazards of fabric manufacturing machines are always considered in conjunction with safety requirements.

5 Significant hazards and corresponding safety requirements and/or measures

5.1 General

Machinery shall conform to the safety requirements of ISO 11111-1:2005, Clauses 5 and 6, whenever referred to under the heading “General safety requirements” of this Clause 5 and shall conform to the additional “Specific safety requirements” of this Clause 5.

5.2 Weaving machines

Shuttle weaving machines, rigid and flexible rapier, projectile, air and water-jet and similar weaving machines, also pile weaving and narrow fabric weaving machines.

5.2.1 Common requirements of weaving machines

NOTE For some weaving machines, e.g. air jet weaving machines, projectile weaving machines or shuttle type narrow fabric weaving machines, the requirements of this subclause are the only ones, and for that reason are not mentioned specifically later.

General safety requirements

The safety requirements and/or measures shall be in accordance with Table 1.

Specific hazards

Mechanical, from the sley and associated moving parts including the reed, and from the gears of the let-off motion device, and from the Jacquard machine or shedding machine, in particular, crushing and shearing.

Specific risks

Low probability of moderate-to-severe injury, particularly when a machine is accidentally started up (inadvertent or unintended start) and when mending a broken end (thread).

Table 1 — General safety requirements relating to weaving machines

Application	Reference ISO 11111-1:2005
All machines:	
Electrical equipment in general	5.4.2.1 and 5.4.2.2
Electrical control systems	5.4.2.3
Starting and stopping	5.4.2.4
Reduction of risks by design	5.3.2
Reduction of risks by safeguarding	5.3.3
— with guards	Table 2
— with safety devices	Table 3
Static electricity	5.4.4
Fluid power systems and components	5.4.5
Hot surfaces (heat setting of selvage)	5.4.6.1
Noise	5.4.7, 7, 8.2
Emission of dust and fly	5.4.10
Fire	5.4.11
Ergonomics	5.4.13
Devices for special operation	5.5
Fitting of parts	5.8
Particular machine elements:	
Drive and transmission enclosures	6.2
Rollers	6.5
Rotating shafts	6.6
Handwheels	6.7.2
Cutting devices	6.12
Batchers	6.18
Automatic machines and equipment	6.21
Automatic guards	6.21.2
Mobile machines, handling devices, operational parts	6.21.3
	This part of ISO 11111
Other items:	
Jacquard machines	5.2.9

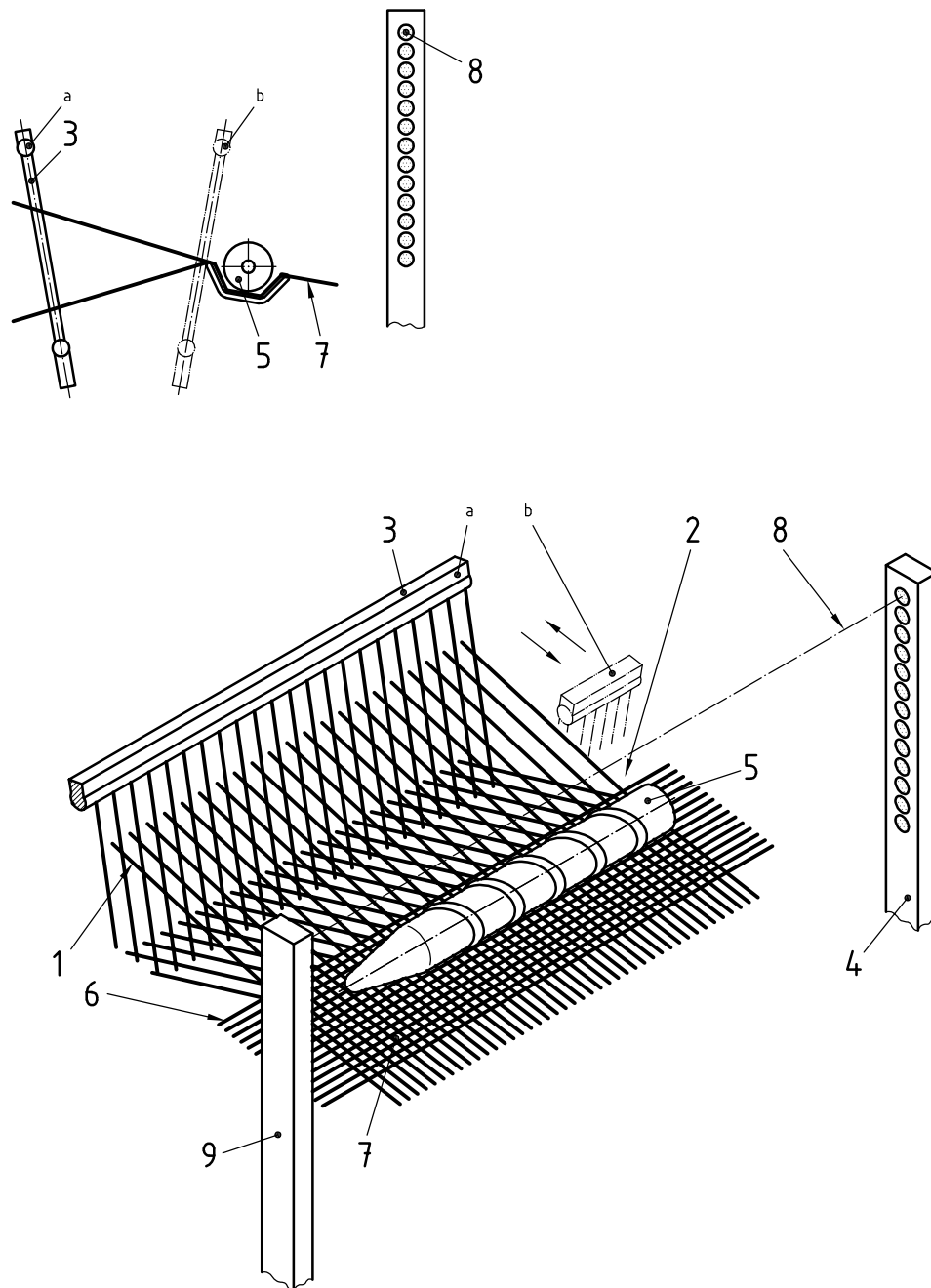
Specific safety requirements

- a) Start-up by unintended or inadvertent actuation shall be prevented by start controls designed so as to reduce the risk of an operator either inadvertently actuating the control (e.g. by leaning on it) or actuating the wrong control (e.g. starting at normal speed instead of reduced running speed), see ISO 11111-1:2005, Table 6. Such controls may be
 - 1) two-button control devices, or
 - 2) control actuators with a movement different from other control actuators (e.g. pull out instead of press).
- b) Guards and/or safety devices shall be provided for the crushing and shearing points between the reed and fixed parts such as temple assembling (including temple cover, temple trough and temple support) or “down-holder” or cloth table in order to prevent the machine starting to move (start-up protection) when the operator's fingers are in the danger zone (see Figure 1). This includes start-up for
 - single pick insertion,
 - normal production speed,
 - reduced running speed, and
 - restart after automatic broken weft removal.

This safe-guarding may be in the form of the following:

- 1) trip device(s), e.g. active-opto-electronic protective devices (AOPD), complying with type 2, as defined in IEC 61496-1 and IEC 61496-2, which, if in the form of AOPD, shall be in accordance with ISO 11111-1:2005, Table 3 — i.e. reaching the hazard zone shall not possible without activating the AOPD (see Figure 1) — and may be deactivated immediately after the machine has reached its normal production speed, unless used additionally to protect the danger zone between the moving sley and fixed machine parts [see 5.2.1 c)];
 - 2) movable interlocked covers, covering the crushing area between the temple and the reed, designed to prevent finger access.
- c) Guards or safety devices shall be provided for the crushing, shearing and impact points to the left and right of the shed between the ends of the moving sley and fixed parts of the machine, during both start-up and normal running. These may be in the form of one of the following:
 - 1) adjustable fixed guards;
 - 2) movable interlocked guards;
 - 3) trip devices so positioned that the danger zones cannot be reached before the machine has stopped and so designed that the machine cannot be restarted as long as parts of the body are inside the danger zone, and which type of safety device may, for example, be fitted to slow-running, wide-width heavy-duty weaving machines, such as paper felt weaving machines.

Dimensions in millimetres



Key

- | | | | |
|---|----------------------------|---|----------------|
| 1 | warp threads | 6 | fell |
| 2 | crushing zone: reed/temple | 7 | fabric |
| 3 | reed | 8 | light beam |
| 4 | AOPD transmitters | 9 | AOPD receivers |
| 5 | temple | | |
- a Reed position during weft insert.
 b Reed position during beat-up.

Figure 1 — Safeguard between temples and reed

d) Automatic restart after the machine has carried out process sequences such as

- broken pick removal,
- weft threading-in on feeder, or
- broken end (thread) repair,

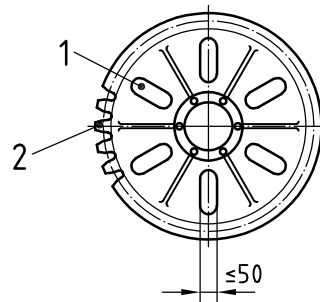
shall only be permitted when

- 1) all guards and safety devices provided for normal operation are in position and/or active, and
- 2) an optical signal device has been activated during the execution of the sequence, with this signal device required to be positioned so as to be visible and attract attention at the normal operating position on the weaving machine, and to provide an unmistakable warning of the imminent automatic restart of the machine.

Information shall be given in the instruction handbook concerning the need to give suitable training to operators changing over to running automated machines.

e) Gear-wheels of warp let-off motions need not be safeguarded, provided that apertures therein are not wider than 50 mm (see Figure 2) and an emergency stop control is provided within reach of the gear-wheel.

Dimensions in millimetres



Key

- 1 aperture
- 2 gear-wheel

Figure 2 — Gear-wheel of warp let-off motion

- f) Information relating to safe methods for insertion and let-off of beams shall be given in the instruction handbook.
- g) The instruction handbook shall contain a warning and a code of practice for operations on drive, transmission and braking systems when an imbalanced load is present on Jacquard machines or dobbies.
- h) For heavy-duty weaving machines of 8 m or more in width, category 3 or 4 according to of ISO 13849-1:1999, Clause 6, shall be selected for the safety-related part of the control system.
- i) Drawing-in points between rollers, rollers and on-running fabrics, and rough-surfaced rollers of weaving machines, wherever the circumferential speed is less than 10 mm/s, need not be guarded if an emergency stopping device is within easy reach over the whole working width.

5.2.2 Shuttle weaving machines

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1.

Specific hazards

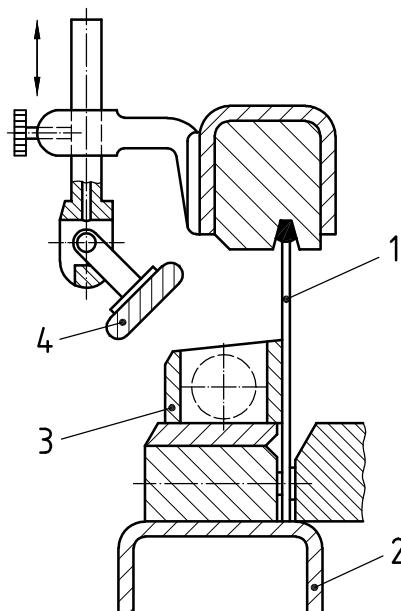
Impact from flying shuttle.

Specific risks

During normal and special operation, low probability of the shuttle flying beyond the machine and leading to severe injury.

Specific safety requirements

- a) A guard shall be provided to prevent the shuttle from leaving the race. This may be an adjustable shuttle guard attached to the sley, covering the full width, which may be raised and which shall automatically return to its working position (see Figure 3).
- b) Where weaving conditions prevent the fitting of shuttle guards to the sley, wing guards shall be provided at each side of the machine to stop a flying shuttle from travelling beyond the extremities of the machine.
- c) Weaving machines of widths greater than 8 m shall be provided with additional guards, at intervals not greater than 4 m, on the path of the shuttle to stop a flying shuttle.



Key

- 1 reed
- 2 sley
- 3 shuttle
- 4 adjustable shuttle guard

Figure 3 — Shuttle guard

5.2.3 Rapier weaving machines

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1.

Specific hazards

Mechanical, from the rapier head, in particular, stabbing or puncture, and from the rapier drives, in particular, shearing and impact.

Specific risks

During normal operation, in particular, on start-up, and during special operation, in particular, when setting, adjusting or carrying out repairs, leading to a low probability of moderate-to-severe injury.

Specific safety requirements

a) On machines where it is possible to reach between the rapier head and the shed, guards or safety devices shall be provided which prevent the machine being started up while the operator's fingers, hand or arm are within the danger zone. This includes start-up for single pick insertion, normal production speed, reduced running speed and restart after automatic broken pick removal. This safeguarding may be in the form of one or the other of the following:

- 1) trip devices (e.g. AOPD in accordance with ISO 11111-1:2005, Table 3) located such that the full width of the rapier path is covered;
- 2) interlocking guards on both sides of the machine covering the rapier path to the left and right of the shed;

These guards and safety devices may also be used to guard other danger zones (e.g. those between the reed and temple support or those of the colour selector needle).

b) The rapier drive (including gears, crank mechanism, linkages, driving arm and, where necessary, rapier bar, etc.), shall be guarded, preferably by close-fitting fixed enclosing guards.

5.2.4 Pile wire weaving machines (Wilton, épinglé, velvet)

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1.

Specific hazards

Mechanical, from the pile wire when ejected, in particular, impact, stabbing or puncture.

Specific risks

During normal operation, possibility of the pile wire being ejected from the track, leading to low probability of moderate-to-severe injury.

Specific safety requirements

The pile wires shall be held down in the tracks. This may be by means of a bridge which lifts automatically to allow the wires to be repositioned. The instruction handbook shall contain a warning concerning the risk of pile wire breakage.

5.2.5 Gripper weaving machines

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1 and 5.2.3.

Specific hazards

Mechanical, between the grippers and heald wires or between the grippers and the warp bed, in particular, crushing and shearing.

Specific risks

During normal operation, when removing fly or attending to broken or pulled ends, leading to low probability of moderate injury to fingers or hands.

Specific safety requirements

Trip devices shall be fitted to protect the danger zones at the healds and at the bed of the carpet. Each device may be muted as the grippers are moving away from the danger zone.

5.2.6 Face-to-face weaving machines (pile, heavy fabric or carpet)

General safety requirements

The safety requirements and/or measures shall be in accordance with 5.2.1 and Table 2.

Table 2 — Additional safety requirements relating to face-to-face weaving machines

Application	Reference ISO 11111-1:2005
Particular machine elements: Work platforms and walkways	6.13

Specific hazards

Mechanical, from the sley after switching off the machine, in particular, crushing, and from warp beams fitted in a raised position, in particular, falling.

Specific risks

During normal operation, in particular, mending of broken ends (threads) and inspection, leading to low probability of moderate-to-severe injury.

Specific safety requirements

- a) At every stoppage, including that due to failure of the power supply, the machine shall be brought to a standstill in such a way that subsequent uncontrolled movement caused by residual energy, e. g. by warp thread tension of the open shed is prevented.
- b) Information relating to safe methods for insertion of full and removal of empty warp beams shall be given in the instruction handbook.

5.2.7 Water-jet weaving machines

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1.

Specific hazards

Slipping on wet ground.

Specific risks

Very low probability of moderate injury.

Specific safety requirements

Covers or shields shall be provided over the weft insertion area to contain spray and splashes. Where these splash guards are also used to protect a danger zone, they shall be interlocked.

5.2.8 Needle type narrow fabric weaving machines

This applies for machines weaving fabrics ≤ 600 mm wide having one or more curved weft insertion needles.

General safety requirements

The safety requirements and/or measures shall be according to 5.2.1.

Specific hazards

Mechanical, from the weft needle carrier shank and fixed parts of the framework, in particular, crushing or shearing; from the side edges of the heald rail ends, in particular, shearing; from the reed, in particular, crushing.

Specific risks

During normal operation, in particular, on start-up or when drawing in a broken end, and during special operation, in particular, when setting, leading to low probability of moderate injury.

Specific safety requirements

- a) The area through which the pivoted weft needle carrier shank travels shall be guarded. This may be in the form of a fixed cover plate between the fixed parts of the framework or the fabric guide and the pivoting angle of the needle carrier shank, as shown in Figure 4.

An additional fixed guard shall be provided where the travel of the weft needle carrier shank outside the frame creates a shear point with the frame.

- b) The front edge of the upper fabric guide plate shall be chamfered at an angle of 45° or greater in order to minimize the risk of crushing the finger ends during beat-up. The height of the unchamfered face of the guide shall be the minimum possible, as shown in Figure 4.
- c) The side edges of the heald frame ends shall be protected by either a fixed side guard or heald frame guides to prevent access from the side during operation of the machine.
- d) Where possible, handwheels shall be provided for setting.
- e) Where a limited movement control is fitted, this shall be of the two- button-control, or shall be selected by means of an additional switch which isolates the normal machine start switches (e.g. mode selector in accordance with ISO 11111-1:2005, Table 8).

- f) Where the machine can be operated at a reduced speed, in deviation from ISO 11111-1:2005, 5.5, a hold-to-run control shall be used for this operation.
- g) A warning shall be given in the instruction handbook, that the reed width shall not exceed the fabric width at the fell by more than 10 mm on each side, in order to avoid the risk of crushing between the reed assembly and fixed parts of the machine.

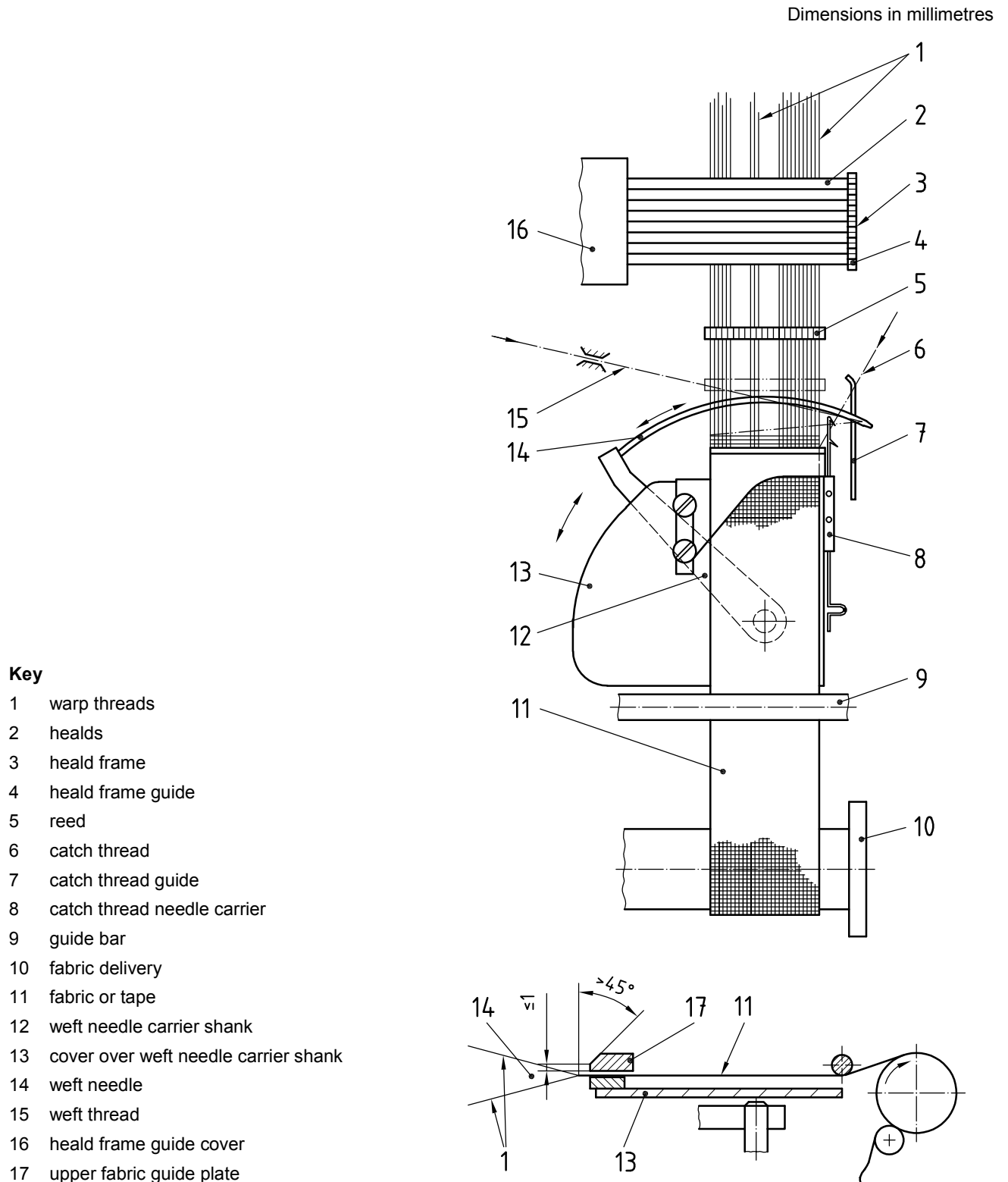


Figure 4 — Safeguarding of needle type narrow fabric weaving machines

5.2.9 Jacquard machines

General safety requirements

The safety requirements and/or measures shall be in accordance with Table 3.

Table 3 — General safety requirements relating to Jacquard machines

Application	Reference ISO 11111-1:2005
All machines:	
Electrical equipment in general	5.4.2.1 and 5.4.2.2
Electrical control systems	5.4.2.3
Starting and stopping	5.4.2.4
Reduction of risks by design	5.3.2
Reduction of risks by safeguarding	5.3.3
— with guards	Table 2
— with safety devices	Table 3
Noise	5.4.7, 7, 8.2
Ergonomics	5.4.13
Devices for special operation	5.5
Elevated servicing positions	5.6
Fitting of parts	5.8
Particular machine elements:	
Drive and transmission enclosures	6.2
Rotating shafts	6.6
Walk platforms and walkways	6.13
Complex installations	6.22

Specific hazards

Mechanical, due to unexpected start-up, in particular, crushing, shearing and entanglement.

Specific risks

During special operation, when work is being carried out on the Jacquard device (e.g. card changing), unexpected start-up can occur, leading to low probability of moderate-to-severe injury.

Specific safety requirements

- a) A start prevention switch shall be provided to stop each Jacquard machine and to prevent it being started by the weaving machine controls at ground level. In deviation from ISO 13850, the emergency stop device may also perform the function of start prevention.

A start prevention switch is not required for narrow-fabric weaving machines with Jacquard machines that have no working platform.

- b) In order to prevent unexpected motion of the machine caused by residual energy, it shall be possible to maintain the machine stationary by means of an appropriate device, e.g. by mechanical brakes.

The instruction handbook shall include recommended work procedures for avoiding work on the drive system of the Jacquard machine when an imbalanced load caused by the warp threads is present.

- c) The drives between the Jacquard machine and the weaving machine shall be guarded.

- d) When several operators are involved in the start-up of a weaving machine and associated Jacquard machine as a result of the type of control, reference shall be made in the instruction handbook regarding the method of communication required between operators and a warning signal shall be given before the start of the machine in accordance with ISO 11111-1:2005, 5.4.2.3.
- e) Work platforms for Jacquard machines shall be in accordance with ISO 11111-1:2005, 6.13. Necessary openings in the work platforms shall be constructed in a manner which prevents operators from falling off the platform.
- f) The instruction handbook of the Jacquard machine shall contain references concerning the safe mounting and dismounting of the harness or parts thereof.

5.3 Knitting (circular, flat and warp knitting) machines

5.3.1 Common requirements of knitting machines

General safety requirements

The safety requirements and/or measures shall be in accordance with Table 4.

Table 4 — General safety requirements relating to knitting machines

Application	Reference ISO 11111-1:2005
All machines:	
Electrical equipment in general	5.4.2.1 and 5.4.2.2
Electrical control systems	5.4.2.3
Starting and stopping	5.4.2.4
Reduction of risks by design	5.3.2
Reduction of risks by safeguarding	5.3.3
— with guards	Table 2
— with safety devices	Table 3
Noise	5.4.7, 7, 8.2
Static electricity	5.4.4
Materials and substances (waxing)	5.4.10
Ergonomics	5.4.13
Devices for special operation	5.5
Elevated servicing positions	5.6 ^a
Fitting of parts	5.8
Particular machine elements:	
Drive and transmission enclosures	6.2
Machine elements which normally do not require safeguarding	6.4
Rollers	6.5
Rotating shafts	6.6
Handwheels	6.7.2
Walk platforms	6.13 a) ^a
Automatic machines and equipment	6.21
^a The requirements of ISO 11111-1:2005, 5.6 and 6.13 a), do not apply to circular knitting machines.	

5.3.2 Circular knitting machines

General safety requirements

The safety requirements and/or measures shall be according to 5.3.1.

Specific hazards

Mechanical, from the rotating take-down roller assemblies and fixed parts of the machine, in particular, shearing, from rotating cam boxes and fixed parts, in particular, shearing, and from the creels, in particular, impact and shearing.

Specific risks

During normal operation, in particular, insertion of bobbins, mending of broken ends or removing fabric, and during special operation (e.g. cleaning or repair), leading to a low probability of severe injury between the rotating and fixed parts of the machine.

Specific safety requirements

- a) The shear points between the rotating take-down assembly and fixed parts of the machine shall be guarded by a combination of fixed and movable interlocked guards.
- b) On machines fitted with rotating cam boxes, the shear points between the rotating cam box ring and fixed parts of the machine shall be fitted/provided with
 - 1) an interlocked cover, in which case, when the cover is open, the machine shall only run at crawl speed in accordance with ISO 11111-1:2005, Table A.1, by means of a hold-to-run control or shall be turned by hand, or
 - 2) a safety device (e.g. trip edge or bar in accordance with EN 1760-2), or
 - 3) fixed guards where no adjustments and settings are necessary.
- c) The creel shall not have sharp edges. Rotating creels shall not create crush or shear points.

5.3.3 Flat bed knitting machines

General safety requirements

The safety requirements and/or measures of 5.3.1 shall apply.

Specific hazards

Mechanical, from cam slide and other machine elements, in particular, crushing and shearing, from the drive wheel, pulley and chain, in particular, drawing-in or trapping and from ejected needle fragments.

Specific risks

During normal and special operation, low probability of moderate injury.

Specific safety requirements

- a) The crush and shear points between the reciprocating cam slide and fixed parts of the machine shall be protected by a movable interlocked enclosing guard which, when open, shall allow the machine to be run at normal speed only by using a hold-to-run control.

- b) A warning shall be given in the instruction handbook of the risk from ejected needle fragments and the advisability of wearing safety glasses when the guard is open. An appropriate warning notice shall be fitted on the machine.
- c) The intake at sprockets for the chain carriage drive shall be provided with fixed guards.

5.3.4 Warp knitting (including stitch bonding) and Raschel machines

General safety requirements

The safety requirements and/or measures shall be according to 5.3.1.

Specific hazards

Mechanical, from the pattern drive mechanism, in particular, drawing-in and shearing; from the traversing weft insertion device, in particular, crushing and impact; from the intake at the chain and sprocket at the let-off motions for warp beams, in particular, drawing-in and falling from a height while unclamping and lifting the beam and mending yarn breaks and tangles.

Specific risks

During normal and special operation, low probability of severe injury and a moderate risk of falling.

Specific safety requirements

- a) The sprockets for the pattern chains shall be protected with fixed or movable interlocked enclosing guards.
- b) On machines with a traversing weft insertion device, access to the operating area and the crushing points between the traverse and the transport chains shall be prevented, for example, by either
 - 1) a fence guard in accordance with ISO 11111-1:2005, A.3 and ISO 13852:1996, Table 2, or
 - 2) a safety device (e.g. AOPD in accordance with ISO 11111-1:2005, Table 3), located so that the machine will stop before the danger zone is reached.
- c) Where the let-off motions to the warp beams are accessible from floor level, fixed guards shall be provided for the drawing-in points between the chain and sprockets.
- d) Where access to an elevated position is required for operations such as fitting beams or mending yarn breaks or tangles stationary, means of access shall be provided as specified in ISO 14122-1 to ISO 14122-4. The width of the access means may be reduced to the minimum extend given in those International Standards if this is necessary due to technical reasons or available space in an existing knitting room.

Instructions about safe operation when lifting the warp beams into a high position shall be given in the instruction handbook.

If, in an existing knitting room, the available space does not allow the installation of stationary working platforms and walkways for individual new machines, the instruction handbook shall draw attention to the necessity of using mobile working platforms. The manufacturer shall justify the deviation in the documentation.

5.4 Tufting machines

Including tufting machines for manufacturing carpets and towelling and similar type of fabrics, pass (custom tufting) type machines.

General safety requirements

The safety requirements and/or measures shall be in accordance with Table 5.

Specific hazards

Mechanical, due to unintended or unexpected start-up of the upper yarn-feed rollers and other rollers (spiked rollers, tension rollers), in particular, drawing-in or entanglement.

Specific risks

During normal operation, when the operator could have to approach various parts of the machine, and during special operation (e.g. setting, threading-up or removing laps), leading to low probability of severe injury.

Table 5 — General safety requirements relating to tufting machines

Application	Reference ISO 11111-1:2005
All machines:	
Electrical equipment in general	5.4.2.1 and 5.4.2.2
Electrical control systems	5.4.2.3
Starting and stopping	5.4.2.4
Reduction of risks by design	5.3.2
Reduction of risks by safeguarding	5.3.3
— with guards	Table 2
— with safety devices	Table 3
Fluid power systems and components	5.4.5
Noise	5.4.7, 7, 8.2
Materials and substances	5.4.10
Fire	5.4.11
Ergonomics	5.4.13
Devices for special operation	5.5
Elevated servicing positions	5.6
Escape and rescue of trapped persons	5.7
Fitting of parts	5.8
Particular machine elements:	
Drive and transmission enclosures	6.2
Rollers	6.5
Rotating shafts	6.6
Handwheels	6.7.2
Walk platforms and walkways	6.13
Automatic machines and equipment	6.21
Floor-mounted and overhead rails (tracks)	6.21.5
Overhead transport of process material	6.21.6
Complex installations	6.22

Specific safety requirements

- a) Controls shall be designed so as to reduce the risk of unintended or unexpected start-up, see ISO 11111-1:2005, Table 6. This may take the form of a portable control station (hand-held control) which is the only control for the machine and which may have start, stop, hold-to-run and limited movement controls.

On pass machines (custom tufting machines), a covered foot-operated hold-to-run control shall be provided;

- b) The upper and lower yarn feed rollers shall be in accordance with ISO 11111-1:2005, 6.5. In deviation, the upper yarn feed rollers may be positioned 100 mm apart. Rough surfaced rollers shall be safeguarded in accordance with ISO 11111-1:2005, 6.5 h), e.g. by AOPD in accordance with ISO 11111-1:2005, Table 3, that stop the rollers immediately.
- c) For the backing cloth feed mechanism, rear take-off tension rollers and spiked rollers, see ISO 11111-1:2005, 6.5. Protection, preferably in the form of fixed guards, shall be provided for the surface of the spiked roller and the intake between the backing cloth and the spiked roller.
- d) Items a) to c) do not apply to pass machinery. For the needle bar and draw rollers of pass machines (custom tufting), a guide roller shall be positioned up-stream of the needle bar to warn the operator of approach to the danger zone.

5.5 Storage equipment for beams

Stands for holding beams of warp yarn for weaving, knitting and tufting machines and for holding cloth beams.

General safety requirements

The safety requirements and/or measures shall be in accordance with Table 6.

Table 6 — General safety requirements relating to storage equipment for beams

Application	Reference ISO 11111-1:2005
All machines:	
Electrical equipment in general	5.4.2.1 and 5.4.2.2
Electrical control systems	5.4.2.3
Starting and stopping	5.4.2.4
Reduction of risks by design	5.3.2
Reduction of risks by safeguarding	5.3.3
— with guards	Table 2
— with safety devices	Table 3
Ergonomics	5.4.13
Elevated servicing positions	5.6
Fitting of parts	5.8
Particular machine elements:	
Drive and transmission enclosures	6.2
Handwheels	6.7.2
Conveyors	6.10

Specific hazards

Mechanical, from the beam falling, in particular, crushing and impact, and from the drive, in particular, drawing-in.

Specific risks

During normal operation and also after loading, leading to low probability of severe or fatal injury if a beam falls out of the stand.

Specific safety requirements

- a) The beam support brackets on the stands shall be sufficient in size and strength to carry the maximum beam load and so designed as to retain the beams in position.
- b) The beam stands shall be designed so as to prevent beams falling out (e.g. by means of a series of vertical bars along the beam stand).
- c) Any drawing-in points between drive chain and sprockets shall be guarded (e.g. by fixed covers).

6 Verification of the safety requirements and/or measures

Final verification shall be carried out when the machine is in a fully commissioned condition, in accordance with ISO 11111-1:2005, Clause 7 and Annex C.

Noise emission values shall be determined for all machines covered by this part of ISO 11111 in accordance with ISO 9902-1 and ISO 9902-6, whether or not noise is a significant hazard.

7 Information concerning machine use

Information for use of the machine shall be provided in accordance with ISO 11111-1:2005, Clause 8. It shall include all elements in Clause 5.

Noise emission values shall be declared for all machines covered by this part of ISO 11111 in accordance with ISO 9902-1 and ISO 9902-6, whether or not noise is a significant hazard.

Bibliography

- [1] ISO 14121, *Safety machinery — Principles of risk assessment*
- [2] ISO 12100-1, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

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