BRITISH STANDARD

BS EN
13035-4:2003

Machines and plants for the manufacture, treatment and processing of flat glass — Safety requirements —

Part 4: Tilting tables

The European Standard EN 13035-4:2003 has the status of a British Standard

ICS 81.100

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 13035-4:2003.

The UK participation in its preparation was entrusted to Technical Committee MCE/3/13, Glass manufacturing machines — Safety, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

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Maschinen und Anlagen für die Herstellung, Be- und Verarbeitung von Flachglas - Sicherheitsanforderungen - Teil 4: Kipptische

This European Standard was approved by CEN on 23 May 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

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Contents

Foreword

This document (EN 13035-4:2003) has been prepared by Technical Committee CEN/TC 151 “Construction equipment and building material machines – Safety“, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

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

Annexes A to D are normative.

This document is one of a series concerning machinery for the treatment and processing of flat glass.

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

This document includes a Bibliography.

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

0 Introduction

This document is a type-C standard as stated in EN 1070.

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

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

1 Scope

1.1 This standard contains the requirements for safety for the design and installation of tilting tables, where the flat glass is brought from the horizontal almost to the vertical position or vice versa by lying on or – supported at the lower edge – leaning against a supporting surface.

1.2 This standard deals with all significant hazards, hazardous situations and events relevant to tilting tables for flat glass, when they are used as intended and under the conditions foreseeable by the manufacturer (see clause 4). This standard specifies the appropriate technical measures to eliminate or reduce risks which can arise from these significant hazards.

1.3 This standard is not applicable to tilting tables where all movements are done by human power.

1.4 This standard is not applicable to additional equipment, e.g. for cutting (see prEN 13035-3), loading and unloading (see prEN 13035-5), break-out (see prEN 13035-6), transporting (see EN 619) of flat glass as used as integral parts of the machinery. If there are specific risks that arise in connection with tilting tables, appropriate measures are specified.

1.5 This document is not applicable to tilting tables which are manufactured before the date of publication of this document by CEN.

2 Normative references

This European Standard incorporates by dated or undated, reference provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

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

EN 292-2:1991/A1:1995, *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 being reached by the upper limbs.*

EN 349, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body.*

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

EN 953:1997, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards.*

EN 954-1:1996, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.*

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

EN 1050:1996, *Safety of machinery - Principles for risk assessme*nt.

EN 1070:1998, *Safety of machinery - Terminology.*

EN 1760-1:1997, *Safety of machinery - Pressure sensitive protective devices - Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors.*

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

EN 60204-1:1997 , *Safety of machinery - Electrical equipment of machines - Part 1: General requirements - (IEC 60204-1:1997 + Corrigendum 1998)*.

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

3 Terms and definitions – Symbols and abbreviated terms

For the purposes of this European Standard, the terms and definitions given in EN 1070 apply. Additional terms and definitions specifically needed for this document are added below:

3.1
table
supporting surface for the deposit of sheets of flat glass

3.2
supports
mechanical stops that prevent the glass sheet from sliding off during and after the tilting table is raised and that hold the glass sheet at the lower edge

3.3
tip-over safeguard
device that ensures the lifting of the table only to an angle so that the glass sheet is being leant stable against the table

3.4
throw-off safeguard
equipment or the manner of movement that prevents the glass sheet from being thrown off by the dynamic energy caused by the movement to the vertical

3.5
additional equipment
equipment that can be additionally attached, e.g. cutting bridges, feeders, transport devices (conveyor rolls)

3.6
all automatic (tilting tables)
tilting tables which work within a line where all operations including loading and unloading are controlled by a programme and where access for persons is not necessary during normal production

3.7
automatic (tilting tables)
tilting tables where after start by a person, e.g. after loading or unloading of flat-glass dangerous movements are controlled by a programme and not by a hold-to-run control device

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events as far as they are dealt with in this standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

Before using this standard, it is important to carry out a general risk assessment of the machine in question.

NOTE Application of B-level standards see clause 5.

	( ) Ref. No. of Table A.1 of annex A of EN 1050:1996	**Hazards**	**Preventive measures see clause**
4.1	(1.1; 1.2)	**Crushing** and **shearing**	
4.1.1		between descending table and fixed supporting structure or floor	5.1-5.1.3; 5.2.2; 5.3.6; 5.3.7
4.1.2		between moving table and adjacent fixed parts, e.g. conveyors	5.2.2; 5.3.6; 5.3.7
4.1.4		of the feet between rising table with additional equipment and floor	5.1-5.1.3; 5.2.3; 5.3.6; 5.3.7
4.1.5		of the finger (tips) between table and moving supports	5.1-5.1.3; 5.3.5-5.3.7
4.2	(1.3) (17)	**Cutting** by glass	7.1.5
4.3	(1.6)	**Impact** by moving table	5.1-5.1.3; 5.2.2; 5.3.6; 5.3.7
4.4	(2.1; 2.2)	**Direct or indirect electrical contact**	5.3.14
4.5	(8)	**Neglecting ergonomic principles e.g. hazards from:**	
4.5.1	(8.1)	excessive effort for access	5.1.1 (NOTE); 5.1.2; 5.1.3
4.5.2	(8.3)	neglected use of personal protection equipment	7.1.5
4.5.3	(8.6)	human behaviour	7.1.4; 7.1.8; 7.1.9; 7.3
4.5.4	(8.7)	inadequate design, location of manual controls	5.2.2.2; 5.3.7; 5.3.12; 5.3.13
4.6	(10)	**Unexpected start-up or malfunction from:**	
4.6.1	(10.1)	failure of the control system	5.1.2; 5.1.3; 5.2.1.4; 5.2.2.2; 5.3.3; 5.3.6.2; 5.3.9; 5.3.11

	( ) Ref. No. of Table A.1 of annex A of EN 1050:1996	Hazards	Preventive measures see clause
4.6.2	(10.3; 10.4)	external influences	5.3.2; 5.3.8
4.7	(11)	**Impossibility of stopping in the best possible conditions**	5.3.3; 7.1.7
4.8	(16)	**Break-up during operation** (pipes)	5.3.4
4.9	(17)	**Falling or ejected objects** (flat glass)	5.3.1; 5.3.9-5.3.11
4.10	(17)	**Loss of stability**	7.1.4

5 Safety requirements and/or protective measures

Machinery shall comply with the safety requirements and/or protective measures of this clause.

In addition, the machine shall be designed according to the principles of EN 292 for hazards relevant but not significant which are not dealt with by this document (e.g. sharp edges).

NOTE For application of a B-level standard such as EN 418, EN 953, EN 954-1, EN 982, EN 983, EN 1037 and EN 60204-1, the manufacturer should carry out an adequate risk assessment for the requirements thereof where choice is necessary. This specific risk assessment is part of the general risk assessment relating to hazards not covered by this standard.

Where the means of reducing the risk is by the arrangement of the installed machine or by a safe system of work, the manufacturer shall include in the Information for use a reference to the reduction means to be provided and to any limiting value of the requirement and, if appropriate, to the means of verification.

5.1 All-automatic tilting tables

5.1.1 Danger zones on all-automatic tilting tables shall be safeguarded by a fixed distance guard (see 3.2.2 of EN 953:1997) not less than 1,4 m high drawn to the floor with dimensions which prevent danger zones being reached according to Table 1 of EN 294:1992. There may be a gap of max. 0,15 m between guard and floor for the purposes of cleaning.

NOTE 1 Possible hazards of crushing between guard and lowering table should be taken into account.

NOTE 2 Between guard and tilting table in lowered horizontal position, there should be a free space of minimum 0,4 m for personnel for maintenance and cleaning.

5.1.2 An access, e.g. movable interlocking guard with or without guard locking in accordance with category 3 of EN 954-1:1996 (see annex A [normative]), shall be provided to all temporary maintenance areas and all areas where broken or dropped glass may lie.

5.1.3 For the purpose of access according to 5.1.2, active opto-electronic protective devices, category 4 of prEN 61496-2:1997, with single light beam devices (see 6.1.5 of EN 999:1998) may be installed if mounted according to Figure B.1 of annex B (normative) or

5.1.3.1 pressure mats category 3 of EN 1760-1:1997 may be used if positioned according to 7.1 of EN 999:1998.

NOTE Restart after actuation of interlocking protective devices (5.1.2, 5.1.3) see 5.3.7.

5.2 Tilting tables where access is intended

5.2.1 Where access by persons is intended to tilting tables for normal operation e.g. loading or unloading of flat glass, crushing points between the most protruding parts of the moving table and adjacent fixed parts shall be avoided or safeguarded by the following measures:

5.2.1.1 safety measures in accordance with 5.1.1 to 5.1.3 or

5.2.1.2 a minimum gap of 0,5 m in accordance with EN 349 (see annex C [normative] and 7.1.2 and 7.1.3 of the Information for use) or

5.2.1.3 a filling-up (lining) of the crushing zone with a smooth, continuous plate (screen) or skirt, thus avoiding crushing (see Figure B.2 of annex B [normative]) or

5.2.1.4 trip devices, e.g. pressure-sensitive edges, category 3 of EN 1760-2:2001 interrupting the movement in time.

5.2.2 The following measures shall be provided on tilting tables where access by persons is intended against the risk of crushing between the descending table and the floor and/or the fixed supporting structure and against the risk of impact:

5.2.2.1 safety measures in accordance with 5.1.1 to 5.1.3 or

5.2.2.2 a minimum gap of 0,5 x 0,5 m measured from the edge of the table (see annex C [normative]) in connection with a hold-to-run control device category 1 of EN 954-1:1996 (e.g. hard-wired) while the operator stands at a place with a good view of the danger zone.

5.2.3 Where access by persons is intended for normal operation of the tilting table and where access to the small sides is possible too, there shall be – to avoid crushing of the feet – a minimum gap of 0,12 m (according to EN 349) between the long side of the risen table with additional equipment e.g. cutting bridge and the floor within a distance of 0,15 m from the outer edges of the small sides (see annex C [normative]).

5.3 Additional requirements

5.3.1 Tilting tables shall be built or equipped that glass sheets are not thrown off by dynamic energy e.g. by use of crank motion, final position damping of cylinders or use of sucker cups to hold the sheets.

5.3.2 To avoid damage of electrical parts, especially power cables, they shall be installed or covered so that they cannot be damaged by falling broken glass. This requirement applies also to pipes which contain pressure that keep the tilting table raised.

5.3.3 For stopping dangerous movements by safety measures (see e.g. 5.1.2, 5.1.3, 5.2.1.4, 5.2.2.2) well-tried components according to category 1 of EN 954-1:1996 shall be used, e.g. spring-actuated 4/3 or 5/3 position valves, motors with spring-loaded brakes.

5.3.4 The table-lifting system shall be provided with a device in order to prevent uncontrolled falling in case of hydraulic or pneumatic pipe or tube breakage.

5.3.5 The movement of the supports shall exclude crushing of the finger tips, e.g. by means of a minimum gap of 15 mm against the supporting surface (table).

5.3.6 If trip devices, e.g. pressure-sensitive mats or edges, opto-electronic protective devices for the safeguarding of crushing zones are being used, they shall be constructed in such a way that:

5.3.6.1 they keep their guarding function as long as they are actuated, and

5.3.6.2 after switch-on, a start is only possible after a positive test of the safe function of opto-electronic protective devices (see category 2 in EN 954-1:1996).

5.3.7 After actuation of an interlocking protective device a restart shall be necessary for further movements. If there is no good view of the respective danger zone from the position of the start actuator, additional actuators for a

manual reset (see 5.4 of EN 954-1:1996) shall be installed at a place with a good view of the danger zone. These actuators shall be mounted in such a way that they are not operable by a person in the danger zone.

5.3.8 Tilting tables shall be equipped with mechanical restraint devices which prevent the lifted tables from dropping during repair, maintenance and cleaning underneath the raised table.

5.3.9 The vertical position of tilting tables shall be limited by solid limit stops, e.g. by mechanical limitation of the cylinder or by buffers, in such a way that even if limit switches are used and fail, the highest intended vertical position is not exceeded.

5.3.10 The supports for the flat glass sheet in vertical position shall be interlocked with the tilting motion of the table in such a way, that the table can only be tilted if the supports are active. It shall be impossible to put the supports out of operation as long as the table is tilted. The active function shall remain effective even if there is a loss of energy, e.g. in the pneumatic system.

5.3.11 To prevent unintentional movements and falling of glass sheets, there shall be interlocks which exclude actuation of bridges with cutting equipment, of extendible transport rolls and of break-out bars while the table is tilted. Interlockings shall conform to category B of EN 954-1:1996.

5.3.12 Starting devices shall be mounted in such a way that there is a good view of the tilting area from the starting position.

5.3.13 Starting devices shall be designed in such a way that an inadvertent operation is prevented.

5.3.14 All electrical equipment shall conform to the requirements of EN 60204-1 with regard to the protection against electrical shock (see clause 6 of EN 60204-1:1997).

6 Verification of safety requirements and/or protective measures

This clause indicates the methods of testing for the presence and adequacy of safety requirements stated in clause 5. All safety measures of clause 5 contain self-evident criteria of acceptance.

Safety measures Clause No.	Method of testing		
	Visual	Functional	Measuring
5.1.1	X		X
5.1.2; 5.2.2.2; 5.3.3; 5.3.6.2; 5.3.7; 5.3.9	X[a]	X	
5.1.3; 5.2.1.4; 5.3.14	X[bc]	X	X
5.2.1.2; 5.2.2.2; 5.2.3; 5.3.5			X
5.2.1.3; 5.3.2; 5.3.8; 5.3.12	X		
5.3.1; 5.3.4; 5.3.6.1; 5.3.10; 5.3.11; 5.3.13		X	
[a] see clause 8 of EN 954-1:1996 [b] certificate of the producer [c] see clause 19 of EN 60204-1:1997			

7 Information for use

The information for use shall be prepared in accordance with clause 5 of EN 292-2:1991.

7.1 Accompanying documents (in particular: Instruction handbook)

The written instructions (instruction handbook) shall be drawn up according to 5.5 of EN 292-2:1991/A1:1995. Specifically information is required for:

7.1.1 the sound level according to 1.7.4 (f) of annex A of EN 292-2:1991/A1:1995

7.1.2 installation requirements essential for the reduction of identified risks (see e.g. NOTE 2 of 5.1.1 and 5.2.1.2)

7.1.3 necessity of providing preventive measures e.g. keeping of minimum gaps if the installation is not carried out by the manufacturer or supplier (see e.g. 5.2.1.2)

7.1.4 the recommendation to contact the manufacturer of the tilting table about necessary safety measures if changes are to be made by the user after commissioning

7.1.5 the necessity of use of personal protective equipment

NOTE National and/or user's requirements need to be taken into account.

7.1.6 the maximum load (mass, dimensions)

7.1.7 the need for the emergency stop according to EN 418 to act on all machinery linked to the tilting table

7.1.8 the necessity of marking on floor the danger zone of fixed tilting tables which are protected according to 5.2.2.2 (see annex D [normative])

7.1.9 the necessity to arrange mobile tilting tables in such a way that a minimum gap of 0,5 m between the moving table in horizontal position and fixed parts of the building or other machinery is maintained

7.1.10 the necessity of keeping a zone around the tilting table free of any „fixed" parts, e.g. racks (see 5.2.1.2)

7.2 Marking

Every tilting table for flat glass shall be equipped with a distinctly legible and permanent label containing minimum:

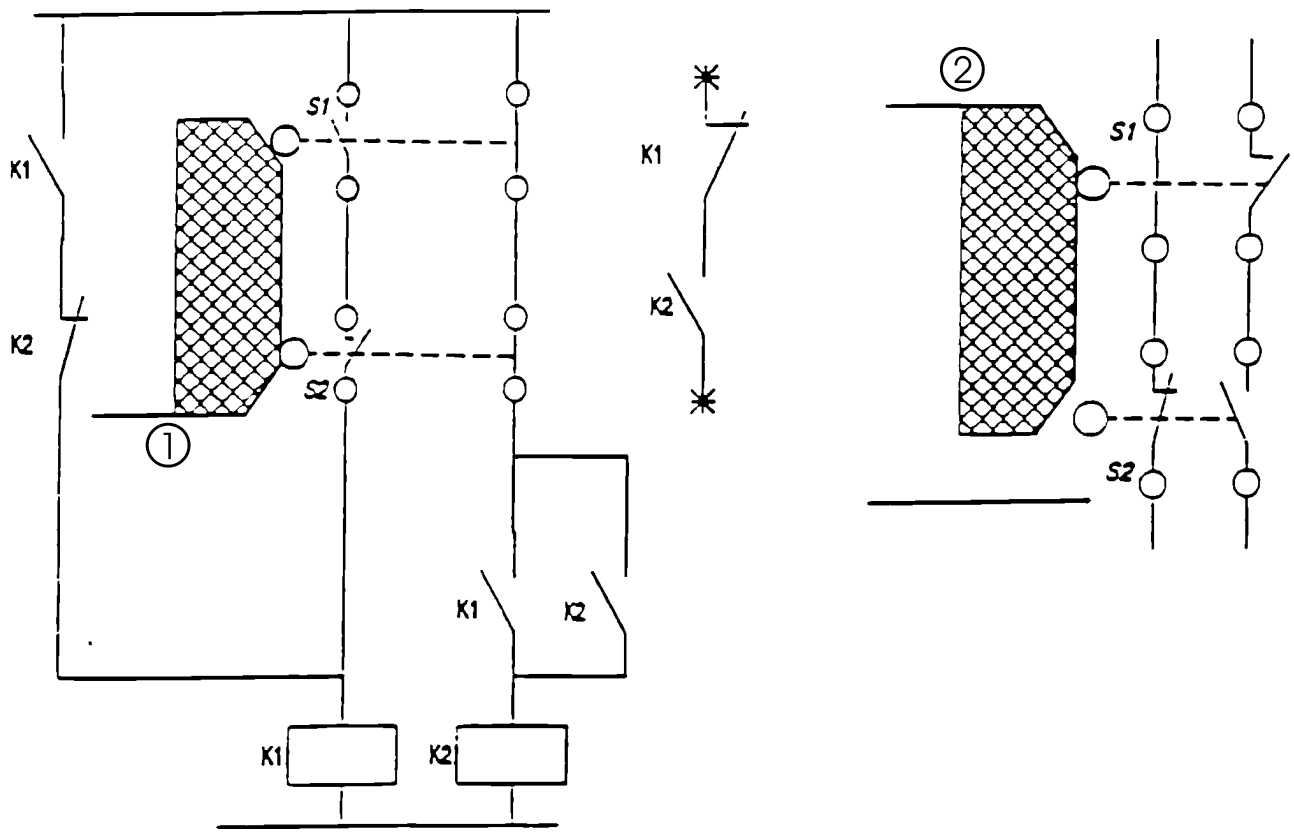
- name and address of the manufacturer;
- legally required marking[1)];
- year of construction;
- designation of series or type, if any;
- serial or identification number, if any;
- rating information, e.g. voltage, frequency, power.

7.3 At the underside of the table a label shall be fastened with a written warning that a person may not work under lifted tables without applying the mechanical restraint device (see 5.3.8).

1) For machines and their related products intended to be put on the market in EEA, CE marking as defined in the European applicable directive(s), e.g. Machinery.

Annex A
(normative)

Electrical interlocking of a movable guard



Key

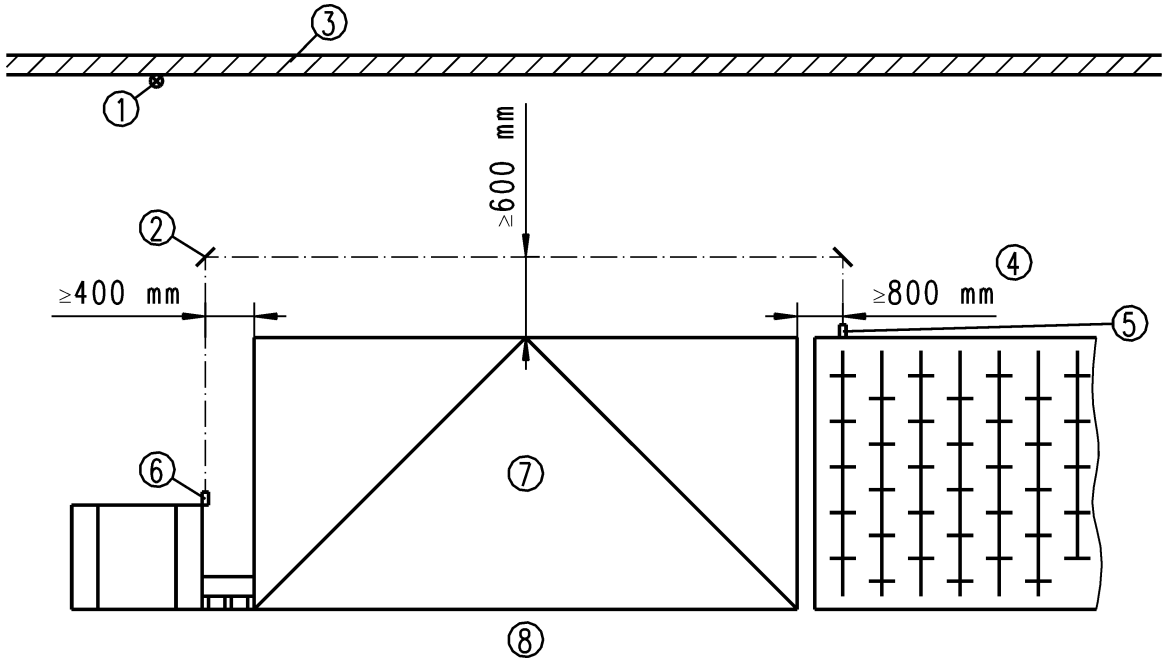
1 closed
2 open

NOTE - The reset shall be sufficiently connected with the machine control

Figure A.1 — Position supervision and signal processing by a control with functional monitoring and start testing

Annex B
(normative)

Tilting table with safeguarding (access intended)



Key
1 reset (blue)
2 mirror
3 e.g. wall
4 with risk of crushing of the hand
5 receiver
6 transmitter
7 tilting table
8 access side

Figure B.1 — Safeguarding with single light beams at the rear side

Use of opto-electronic barriers (single light beam)

1) Opto-electronic barriers have to be used preferably if the area has to be entered frequently

2) Distance between opto-electronic barrier and rear edge of tilting table ≥ 600 mm; at the side 400 mm to prevent crushing and impact of the body, ≥ 800 mm where there is a risk of crushing of the hands

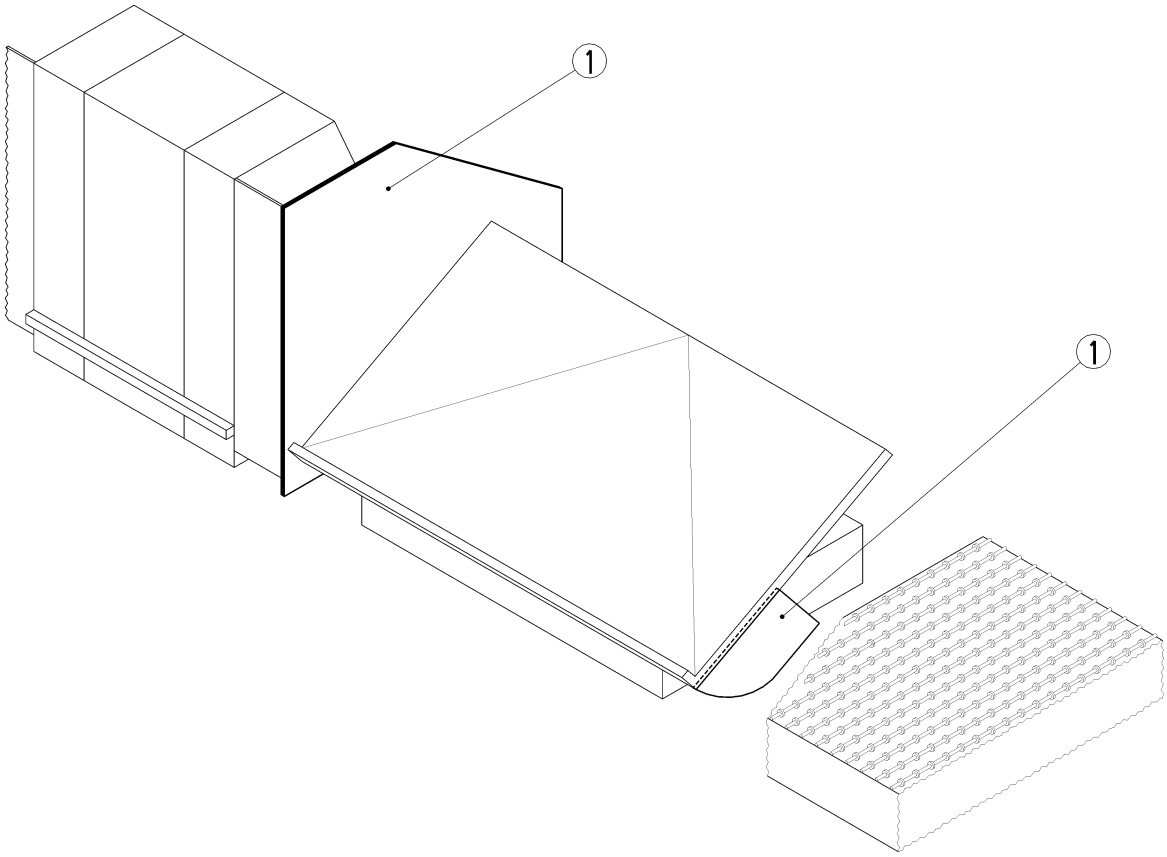
3) Height of the opto-electronic barrier above floor 0,75 m (beam path)

4) Positioning on 3 sides around the tilting table, e.g. by use of mirrors

5) Opto-electronic barrier (category 4 of prEN 61496-2:1997)

6) Reset (additional) if there is no good view of the danger zone at the control desk

7) The use of the reset or of the start actuator respectively from inside the danger zone shall be excluded.



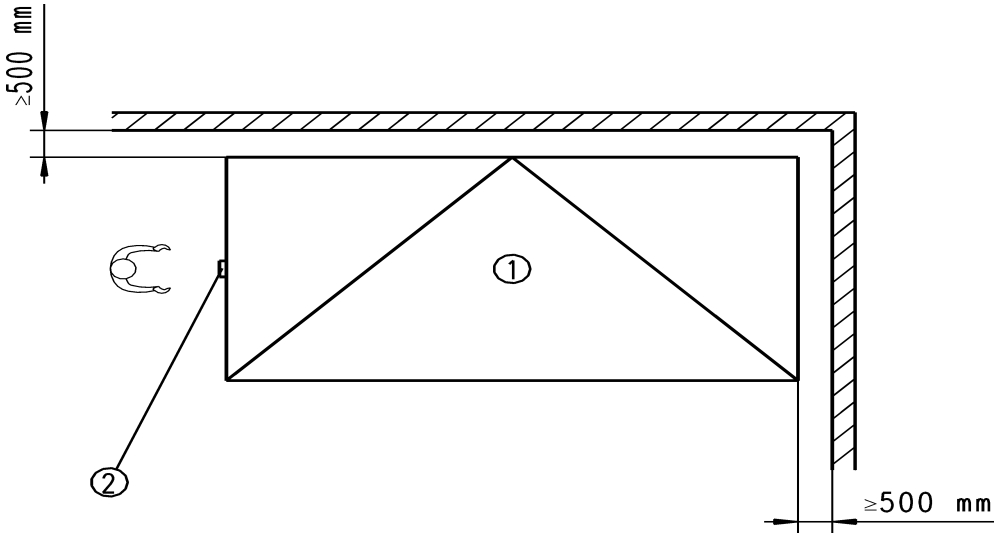
Key

1 lining (plate, skirt)

Figure B.2 — Filling-up at crushing points between moving table and adjacent fixed parts

Annex C
(normative)

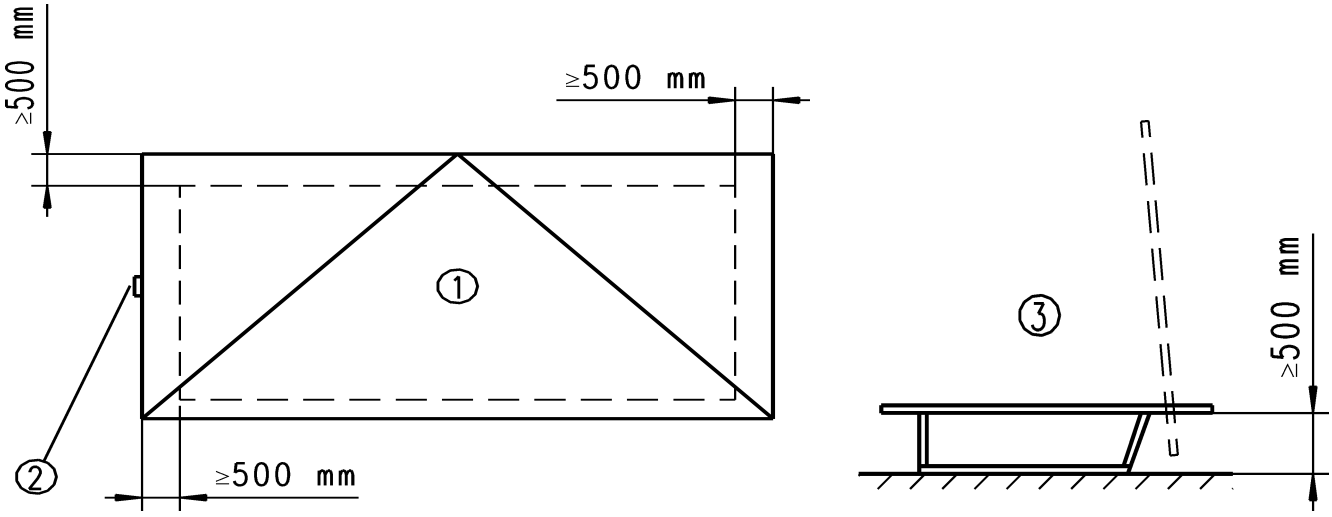
Minimum gaps on tilting tables arranged as single table with free access



Key

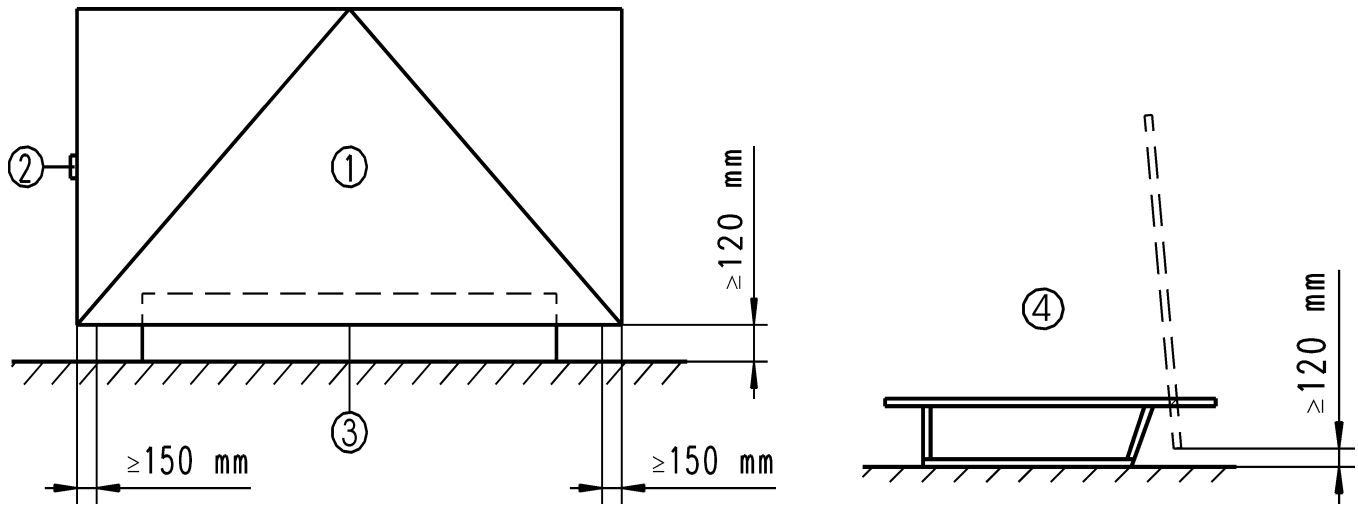
1 Top view
2 Tilt operation

Figure C.1 — Topview with minimum gaps



Key
1 Top view
2 Tilt operation
3 Side view

Figure C.2 — Top and side view



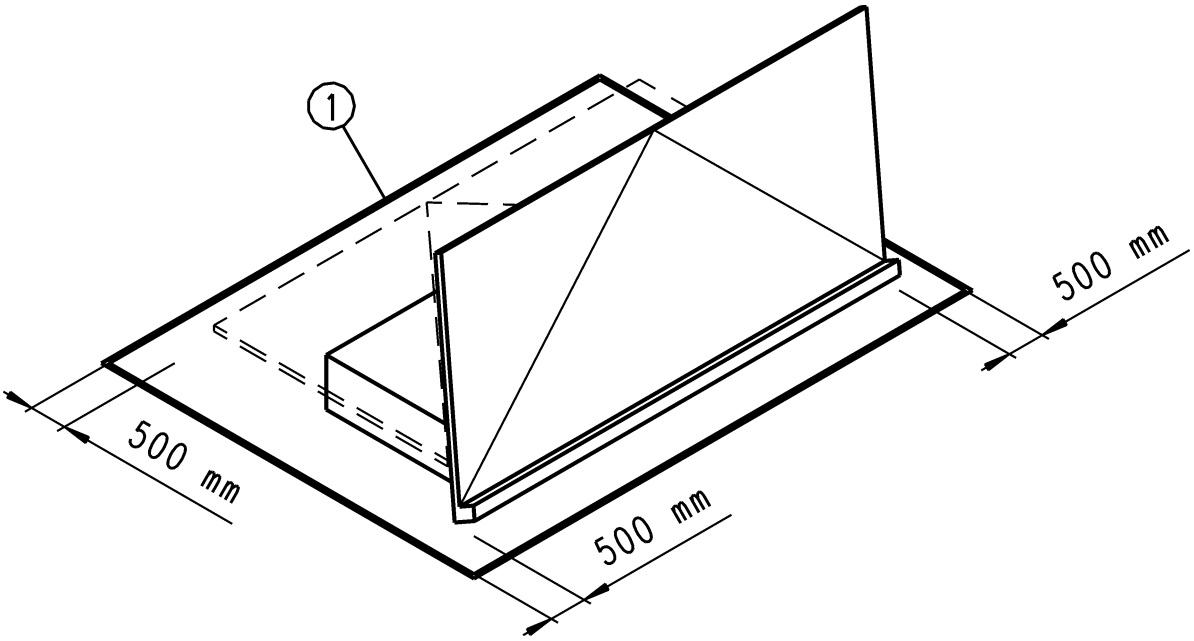
Key

1 Front view of risen table
2 Small side (accessible)
3 Long side
4 side view

Figure C.3 — Front and side view of the small side with minimum gap between edge of the long side and floor

Annex D
(normative)

Fixed single tilting table controlled by a hold-to-run device with marking of the danger zone on floor



Key
1 Marking

Annex ZA
(informative)

Relationship of this document with EC Directives

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EC Directive(s) :

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

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

WARNING: Other requirements and EC Directives may be applicable to the product(s) falling within the scope of this document.

Bibliography

[1] EN 619, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of unit loads.*

[2] EN 982, *Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics.*

[3] EN 983, *Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics.*

[4] EN 1037, *Safety of machinery - Prevention of unexpected start-up.*

[5] EN 13035-3, *Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 3: Cutting machines.*

[6] prEN 13035-5, *Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 5: Machines and installations for stacking and destacking.*

[7] prEN 13035-6, *Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 6: Machines for break-out.*

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