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Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 4: Tilting tables

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

Machines et installations pour la production, le façonnage et la transformation du verre plat - Prescriptions de sécurité - Partie 4: Tables basculantes

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ICS:

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Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 4: Tilting tables

Machines et installations pour la production, le façonnage et la transformation du verre plat - Prescriptions de sécurité - Partie 4: Tables basculantes

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 and includes Amendment 1 approved by CEN on 8 November 2009.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Foreword

This document (EN 13035-4:2003+A1:2009) 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of an identical text or by endorsement, at the latest by June 2010, and conflicting national standards shall be withdrawn at the latest by June 2010.

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

This document includes Amendment 1, approved by CEN on 2009-11-08.

This document supersedes EN 13035-4:2003.

The start and finish of text introduced or altered by amendment is indicated in the text by tags \square_{A1} \square_{A1} .

\square_{A1} This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document.

Annexes A to E are normative. \square_{A1}

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

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, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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0 Introduction

This document is a type-C standard as stated in [A1](#) EN ISO 12100-1 [A1](#).

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 [A1](#) 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 of misuse which are reasonably foreseeable by the manufacturer (see Clause 4). This standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards during commissioning, operation and maintenance. Noise is not a significant hazard for this type of machines. [A1](#)

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 [A1](#) EN 13035-3 [A1](#)), loading and unloading (see [A1](#) EN 13035-5 [A1](#)), break-out (see [A1](#) EN 13035-6 [A1](#)), 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

[A1](#) 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. [A1](#)

[A1](#) *deleted text* [A1](#)

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

[A1](#) *deleted text* [A1](#)

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

[A1](#) *deleted text* [A1](#)

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

[A1](#) *deleted text* [A1](#)

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*

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

Ⓐ₁ CLC/TS 61496-2:2006, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs) (IEC 61496-2:2006)* Ⓐ₁

Ⓐ₁ EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995, including Cor 1:1997)*

EN ISO 11202, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Survey method in situ (ISO 11202:1995)*

EN ISO 11204, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Method requiring environmental corrections (ISO 11204:1995, including Cor 1:1997)*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

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

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)* Ⓐ₁

Ⓐ₁ *deleted text* Ⓐ₁

3 Terms and definitions – Symbols and abbreviated terms

For the purposes of this European Standard, the terms and definitions given in Ⓐ₁ EN ISO 12100-1:2003 Ⓐ₁ 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

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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

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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.

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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.

Table 1 – List of significant hazards

Hazards		Preventive measures see clause
4.1	Crushing and shearing	
4.1.1	between descending table and fixed supporting structure or floor	5.1.1-5.1.3; 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
4.1.3	of the feet between rising table with additional equipment and floor	5.1.1-5.1.3; 5.2.3; 5.3.6; 5.3.7
4.1.4	of the finger (tips) between table and moving supports	5.1.1-5.1.3; 5.3.5-5.3.7
4.2	Cutting by glass	7.1.5
4.3	Impact by moving table	5.1.1-5.1.3; 5.2.2; 5.3.6; 5.3.7
4.4	Direct or indirect electrical contact	5.3.14
4.5	Neglecting ergonomic principles e.g. hazards from:	
4.5.1	excessive effort for access	5.1.1 (NOTE); 5.1.2; 5.1.3
4.5.2	neglected use of personal protection equipment	7.1.5
4.5.3	human behaviour	5.3.15; 7.1.4; 7.1.8; 7.1.9; 7.3
4.5.4	inadequate design, location of manual controls	5.2.2.2; 5.3.7; 5.3.12; 5.3.13

Table 1 (continued)

Hazards		Preventive measures see clause
4.6	Unexpected start-up or malfunction from:	
4.6.1	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
4.6.2	external influences	5.3.2; 5.3.8
4.7	Impossibility of stopping in the best possible conditions	5.3.3; 7.1.7
4.8	Break-up during operation (pipes)	5.3.4
4.9	Falling or ejected objects (flat glass)	5.3.1; 5.3.9-5.3.11
4.10	Loss of stability	7.1.4

A1

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 A1 EN ISO 12100 A1 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 A1 EN ISO 13850 A1, EN 953, A1 EN ISO 13849-1 A1, 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. <https://standards.iteh.ai/catalog/standards/sist/7daef7b4-0147-4170-9d68-cb41f5272bf9/sist-en-13035-4-2004a1-2010>

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 A1 Danger zones on all-automatic tilting tables shall be safeguarded by a fixed distance guard (see EN 953:1997, 3.2.2) not less than 1,4 m high drawn to the floor with dimensions which prevent danger zones being reached according to EN ISO 13857:2008, Table 1. A1. 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 A1 Where required for temporary maintenance or removing broken or dropped glass, a safe means of access to the safeguarded zone shall be provided. The access door or movable guard shall be interlocking, with or without guard locking. The part of the control system related to the interlocking shall present a performance level of at least d as defined in EN ISO 13849-1:2008 (see also normative Annex A). A1

5.1.3 For the purpose of access according to 5.1.2, active opto-electronic protective devices, category 4 of A1 CLC/TS 61496-2:2006 A1, 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.

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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_1 a minimum gap of 0,5 m \times 0,5 m measured from the edge of the table (see Annex C [normative]) together with a hold-to-run control device in accordance with EN ISO 13849-1:2008, performance level c (e.g. hard-wired). The operator position shall allow a good view sufficient to allow persons in the danger zone to be detected. A_1

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 A_1 Safety-related parts of control systems associated with guards and protective devices (see e.g. 5.1.2, 5.1.3, 5.2.1.4, 5.2.2.2) for stopping dangerous movement shall comply with performance level c of EN ISO 13849-1:2008. Braking systems shall use well-tried components, e.g. spring-actuated 4/3 or 5/3 position valves, motors with spring-applied power-released brakes. A_1

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 A_1 When for ensuring the appropriate performance level in accordance with EN ISO 13849-1:2008 a category-2 architecture is used, a start following a start command shall only be possible after a positive test of the safety function of opto-electronic protective devices. A_1

5.3.7 A_1 After a stop command initiated by an interlocked guard or protective device, further movement shall require the operation of a manual reset device after the guard is closed or the protective device is reset. The actuator of the manual reset device shall be located at a position where it cannot be operated by a person inside the danger zone while giving the operator a view of the respective danger zone sufficient to detect the presence of persons. When an adequate view of the danger zone cannot be achieved with one manual reset actuator, a system involving additional actuators shall be installed (see EN ISO 13849-1:2008, 5.2.2). A_1

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 A_1 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. Interlocks shall conform to EN ISO 13849-1:2008, performance level b. A_1

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 A_1 All electrical equipment shall conform to the requirements of EN 60204-1 with regard to protection against electrical shock (see EN 60204-1:2006, Clause 6). A_1

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A_1

5.3.15 Fixed guards

If fixed guards are used, their fixing systems shall remain attached to the guards or to the machinery when the guards are removed. A_1

A_1

5.4 Noise

5.4.1 Information on noise emission

Information on noise emission shall be given by the manufacturer in the instruction handbook, see 7.1.1.

5.4.2 Noise-emission measurement, declaration and verification procedures

Measurement, declaration and verification of noise-emission values shall be made according to the noise-test code given in Annex E. A_1

6 Verification of safety requirements and/or protective measures

A_1 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.