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Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 3: Cutting machines

Maschinen und Anlagen für die Herstellung, Be- und Verarbeitung von Flachglas - Sicherheitsanforderungen - Teil 3: Schneidmaschinen

Machines et installations pour la production, le façonnage et la transformation du verre plat - Exigences de sécurité - Partie 3: Machines à découper

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Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 3: Cutting machines

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This European Standard was approved by CEN on 23 May 2003 and includes Amendment 1 approved by CEN on 23 July 2009.

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Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Foreword

This document (EN 13035-3:2003+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of an identical text or by endorsement, at the latest by February 2010, and conflicting national standards shall be withdrawn at the latest by February 2010.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 2009-07-23.

This document supersedes EN 13035-3:2003.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] 〈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 EC Directive(s).

[A1] For relationship with EU Directives, see informative Annexes ZA and ZB, which are integral parts of this document. 〈A1〉

[A1] Annexes A to G and K are normative. Annexes H, I and J are informative. 〈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.

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 machines with one movable bridge for cutting of flat glass, which operate by scoring of the glass placed on a horizontal support. This standard covers the transport of the glass on the machine.

1.2 [A1] This European Standard deals with all significant hazards, hazardous situations and events relevant to flat glass cutting machines, 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. [A1] Hazards from noise are not considered to be significant.

1.3 This standard does not apply to flat glass cutting by abrasive cutting or by the use of high pressure liquid or lasers.

1.4 This standard does not apply to loading and unloading of flat glass on to or from cutting machines and the breaking out (see [A1] EN 13035-5 [A1] and [A1] EN 13035-6 [A1]).

1.5 This standard does not apply to conveyors (see EN 619) and fans as used as integral parts of the machinery. If there are specific risks that arise in connection with flat glass cutting machines, appropriate measures are specified.

1.6 This standard does not apply to cutting of laminated glass (see [A1] EN 13035-7 [A1]).

1.7 This standard does not apply to cutting while the glass is moving.

1.8 This document is not applicable to machinery which is manufactured before the date of publication of this document by CEN.

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.

[A1] *deleted text* [A1]

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

EN 349:1993, *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*

EN 1037:1995, *Safety of machinery - Prevention of unexpected start-up*

[A1] *deleted text* [A1]

[A1] EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 61496-1:2004, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2004, modified)* [A1]

[A1] *deleted text* [A1]

[A1] EN ISO 3744:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane (ISO 3744:1994)*

EN ISO 3746:1995, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

EN ISO 3747:2000, *Acoustics — Determination of sound power levels of noise sources using sound pressure — Comparison method for use in situ (ISO 3747:2000)*

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

EN ISO 11201:1995, *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)*

EN ISO 11202:1995, *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 11204:1995, *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)*

EN ISO 11688-1:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

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)* [A1]

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in [A1] EN ISO 12100-1:2003 [A1] apply. Additional terms and definitions specifically needed for this document are added below:

3.1
cutting tool
component for scoring the surface of flat glass

3.2
cutting head
mounting assembly for moving the cutting tool vertically

3.3
carriage
mounting assembly for moving the cutting head on the axis of the cutting bridge

3.4
(cutting) bridge
movable horizontal guide for the carriage

3.5
cutting table
supporting surface on which the flat glass is placed to be scored

3.6
longitudinal sides (of the table)
edges (of the table) parallel to the direction of the travel of the cutting bridge

3.7
small sides (of the table)
edges (of the table) transverse to the direction of the travel of the cutting bridge

3.8
transport device
equipment for the horizontal moving of the flat glass sheets on the cutting table

3.9
air cushion
bed of air with a pressure higher than atmospheric between the surface of the table and the sheet of glass to lower friction during horizontal transport of the glass

3.10
movable positioning stop
mechanical device which can be brought to a place higher than the surface of the table to hold the flat glass in place for cutting and which can be retracted

3.11
energy chain
composition of links supporting and guarding flexible cables and hoses

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.

In annex I (informative) some danger zones on cutting machines are presented graphically.

Before using the 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.

〚A1〛 Table 1 – List of significant hazards 〚A1〛

Hazards		Danger zone – Dangerous item	Preventive measures see clause
4.1	**Mechanical**		
4.1.1	Crushing		〚A1〛 5.2.5 〚A1〛
4.1.1.1	Crushing of the body	bridge/fixed parts outside the table, e.g. control panel	5.1.1; 7.1.8, 〚A1〛 5.2.5 〚A1〛
4.1.1.2	Crushing of the arm	bridge or its drive shaft/table with or without glass for a gap < 120 mm	5.2-5.3.1; 5.3.3, 〚A1〛 5.2.5 〚A1〛
4.1.1.3	Crushing of the arm	bridge with energy chain/energy chain support	5.1.2, 〚A1〛 5.2.5 〚A1〛
4.1.1.4	Crushing of the hand or of the fingers	mechanical stop/cutting bridge	5.1.3, 〚A1〛 5.2.5 〚A1〛
4.1.1.5	Crushing of the fingers	carriage/bridge and stop	5.1.4, 〚A1〛 5.2.5 〚A1〛
4.1.1.6	Crushing of the fingers	wheels/guide rails and their mountings	5.1.5; 5.1.6, 〚A1〛 5.2.5 〚A1〛
4.1.1.7	Crushing of the fingers	limit switch/operating means	5.1.7, 〚A1〛 5.2.5 〚A1〛
4.1.1.8	Crushing of the finger (-tip)	positioning stop/table platform	5.1.8, 〚A1〛 5.2.5 〚A1〛
4.1.2	Cutting	flat glass	7.1.5
4.1.3	Entanglement	drive shaft of the bridge	5.1.9, 〚A1〛 5.2.5 〚A1〛
4.1.4	Drawing-in of the arm	bridge or its drive shaft/table with or without glass for a gap < 120 mm	5.2-5.3.1; 5.3.3, 〚A1〛 5.2.5 〚A1〛
4.1.5	Impact	bridge	5.2-5.3.2, 〚A1〛 5.2.5 〚A1〛
4.2	**Electrical**	direct or indirect contact	5.1.21
4.3	**Neglected use of personal protective equipment**	cuts from sharp glass	7.1.5
4.4	**Unexpected start-up (or malfunction) from:**		
4.4.1	Failure of the control system	all dangerous movements	5.1.16; 5.1.17; 7.1.9
4.4.2	Disorder of the control sequence	glass being pushed off the table	5.1.11; 5.1.12
4.4.3	Restoration of energy supply after interruption	all dangerous movements	5.1.15
4.4.4	Errors made by the operator	all dangerous movements	5.1.14; 5.1.17; 7.1.9
4.5	**Impossibility of stopping in the best possible conditions**	all dangerous movements	5.1.13; 5.1.18; 5.1.19; 7.1.10
4.6	**Slip, trip, fall of persons**		
4.6.1	Slip	glass bits	7.1.7
4.6.2	Trip	cables between control panel and table	5.1.10

Hazards		Danger zone – Dangerous item	Preventive measures see clause
[A1⟩ 4.7	Hazards by noise may result in hearing damage, tinnitus, stress, in accidents due to interference with speech communication and with the perception of acoustic signals	drive mechanism, fan	5.4, 7.1.1, Annex K ⟨A1]

5 Safety requirements and/or protective measures

[A1⟩ 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 ISO 12100 for relevant but not significant hazards which are not dealt with by this document. ⟨A1]

NOTE For hazards not covered by this European standard which are to be reduced by the applications of a B-level standard such as EN 294, [A1⟩ EN ISO 13850 ⟨A1], EN 953, EN 983, EN 999, EN 1037, EN 1088, EN 60204-1, the manufacturer should carry out an adequate risk assessment to establish the requirements of the B standard to be applied. This specific risk assessment should be part of the general risk assessment of the machine.

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 Common requirements

5.1.1 To avoid the risk of crushing a person's body by a moving bridge, there shall be a minimum gap of 0,5 m (see Table 1 of EN 349:1993) between the outermost protruding parts of an accessible bridge (see NOTE) and the fixed parts outside the table, such as control panel/console. Where the danger zone can be reached only through interlocked movable guards there shall be a minimum gap of 0,4 m between the outermost protruding parts and the fixed parts of the guards.

NOTE The moving bridge is considered to be accessible when safety measures do not stop the movement before the arrival of a person at the danger zone.

5.1.2 Crushing points within reach of a person[1)] between the energy chain and/or the bridge assembly shall be protected by either:

5.1.2.1 locating the crushing points under the table with a minimum distance between crushing point and the edge of the table of 100 mm, or

5.1.2.2 a guard (cover) which protects against directly reaching the crushing points from outside the table

5.1.3 Crushing points within reach of a person[1)] between the mechanical stop and the bridge shall be avoided by a minimum gap conforming to Table 1 of EN 349:1993 of either:

5.1.3.1 100 mm, when the stop is directly accessible, or

5.1.3.2 25 mm, when the stop is located under the table.

5.1.4 Crushing points within reach of a person[1)] between the carriage and bridge construction and the mechanical stop shall be avoided by a minimum gap of 25 mm according to Table 1 of EN 349:1993.

5.1.5 Wheels within reach of a person[1)] shall be equipped with screens (sweepers) on both sides of each wheel extending down to the surface of the guide rails.

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1) Danger zones are not within reach of a person where measures shown in annexes A, B or D are fulfilled.

5.1.6 The fixing of guide rails within reach of a person[1)] shall be continuously smooth.

5.1.7 The risk of the crushing of fingers between limit switches (position detectors) and operating means within reach of a person[1)] shall be avoided or safeguarded by:

5.1.7.1 limit switches with spring-loaded levers so that a minimum gap of 25 mm is maintained or

5.1.7.2 limit switches which are mounted under the table.

5.1.8 A minimum gap of 15 mm shall be left between the movable positioning stops and the table surface within reach of a person[1)].

5.1.9 To avoid entanglement, the drive shaft within reach of a person[1)] shall have a completely smooth surface or shall be safeguarded, e.g. by fixed enclosing guards (see 3.2.1 of EN 953:1997).

5.1.10 Cable ducts between the control panel and the table shall be located at floor level and be below the floor surface or otherwise covered.

5.1.11 To avoid glass sheets being moved from the table by driving the cutting head against the edge of a sheet of glass, the cutting head shall be constructed in such a way that:

〈A1〉

5.1.11.1 unintended movements are stopped by sensors when the cutting head goes down too deep. The control shall conform to the requirements of EN ISO 13849-1:2008, performance level d, e. g. using dynamic monitoring; the control shall be constructed in such a way that at least after each command to switch on, the cutting head is moved down to the table as a positive check before a start is possible, and, 〈A1〉

5.1.11.2 an intended break of the cutting head occurs, or,

5.1.11.3 a restriction of the power of drive is made in such a way that it is impossible to throw off the sheets, or,

5.1.11.4 installed rollers lift the cutting head.

〈A1〉

5.1.12 The movement of the cutting head in the cutting position shall be interlocked with the transportation system including the air cushion in such a way that the two functions are not possible at the same time. The interlocking shall conform to the requirements of EN ISO 13849-1:2008, performance level b. 〈A1〉

5.1.13 A lockable master switch in accordance with EN 60204-1 for isolating the cutting machine shall be provided at the control station.

5.1.14 Start and stop control devices for the cutting machine shall be separate and shall be positioned in such a way that it is possible to see that there are no exposed persons in the danger zone.

5.1.15 The control of the cutting machine shall be designed in such a way that no part of the machine moves at the switching on of power or on the recovery of power supply and switching the mode selector.

5.1.16 An unexpected start-up (see EN 1037) by one failure shall not be possible by the use of either:

5.1.16.1 a hard-wired circuit, or

5.1.16.2 a standstill monitor using hardware-based logic to cut-off power at the beginning of a miss-start, or,

5.1.16.3 a dual-port electronic control with fail-safe comparator.

〈A1〉

5.1.17 Latching-in stop control devices (switches) in accordance with EN 1037:1995, 6.3.2, and conforming to the requirements of EN ISO 13849-1:2008, performance level c, shall be provided near to the table to be able to

prevent an unexpected start-up of the cutting machine by other persons or by a failure of the control. A new start shall only be possible after the actuated device is reset manually.

5.1.18 Stopping by means of safety measures shall be achieved either by the immediate disconnection of the energy supply (EN 60204-1:2006, 9.2.2, category 0) or by electronically controlled braking and the subsequent interruption of the energy supply using contacts, e. g. via a timing element after the operation has been stopped (EN 60204-1:2006, 9.2.2, category 1). In this case, the time-dependent cut-out shall be monitored, e. g. electronically according to Annex G (normative). Where category 0 is used, mechanical brakes shall be applied.

5.1.19 At the control panel and at each working side of the cutting table, where the squaring and the take-off is done by operators, emergency-stop equipment in accordance with EN ISO 13850:2008, 4.4.3, shall be provided within reach of the operator. The emergency stop shall function according to 5.1.18. Provisions shall be made to ensure that emergency stopping can also be effected on other machines linked to the operation of the cutting machine when this would otherwise introduce a significant hazard. The emergency stop (manually operated actuator) devices shall be situated at the height of the table.

5.1.20 After a stop command has been initiated by protective devices described in 5.2 and 5.3, a restart shall be possible only after a switch (a manual reset device) conforming to the requirements of EN ISO 13849-1:2008, 5.2.2, has been actuated at a place from where there is a good view of the danger zone. This switch shall be mounted in such a way that its operation from inside the danger zone is impossible.

5.1.21 All electrical equipment shall conform to the requirements of EN 60204-1 with regard to the protection against electrical shock (see EN 60204-1:2006, Clause 6). ⟨A1]

5.2 Additional special safety requirements for flat glass cutting tables where access is not intended

NOTE For a synopsis of possible methods of safeguarding according to 5.2 and 5.3 (in respect of the operation mode and the speed of the cutting bridge) see annex J (informative).

Flat glass cutting machines where under normal operating conditions access by persons is not intended shall be provided with safety measures to avoid the risk of impact and the risk of crushing and drawing-in of the arm by the bridge or its drive shaft. Dangerous movements shall have stopped before the danger zone can be reached by any person.

[A1⟩

5.2.1 A 1,4 m minimum height fixed perimeter fence in accordance with Annex A (normative) shall be provided at each side of the machine. Access shall be provided by movable interlocking guards (see EN 953:1997, 3.3 and 3.5) to both longitudinal sides of the table or photo-electric guarding with one photo-electric sensing unit according to EN 61496-1:2004, type 4, and CLC/TS 61496-2:2006, Annex B (normative) or Annex C (normative). ⟨A1]

5.2.2 However, if there is no free space to use method 5.2.1, fixed distance guards close to the danger zone shall be provided at each side of the machine in accordance with annex D. Access shall be provided by movable interlocking guards with guard locking (see 3.2, 3.2.2, 3.3 and 3.6 of EN 953:1997) to both longitudinal sides of the table in the area of the ground (zero) position of the bridge.

5.2.3 The small sides of the cutting machine shall be guarded by fixed distance guards in conformity to EN 953 or photoelectric guarding, or adjacent bordering components. Where adjacent bordering components are to be used details of proximity and safety attributes shall be included in the Information for use.

[A1⟩

5.2.4 The control system associated with the interlocking of guards shall be in accordance with the requirements of EN ISO 13849-1:2008, performance level d. Annex H (informative) gives an example for an interlocking guard without guard locking incorporating two cam-operated position detectors according to EN 1088:1995, Annex G (informative). ⟨A1]

[A1⟩

5.2.5 Fixed guards