



SLOVENSKI STANDARD
oSIST prEN 13035-1:2020
01-julij-2020

Stroji in obrati za proizvodnjo, obdelavo in predelavo ravnega stekla - Varnostne zahteve - 1. del: Oprema za skladiščenje, ravnanje in transport znotraj tovarne

Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 1: Storage, handling and transportation equipment inside the factory

Maschinen und Anlagen für die Herstellung, Be- und Verarbeitung von Flachglas - Sicherheitsanforderungen - Teil 1: Einrichtungen zum Lagern, Handhaben und Transportieren innerhalb des Werks

Machines et installations pour la production, le façonnage et la transformation du verre plat - Exigences de sécurité - Partie 1: Stockage, manutention et transport à l'intérieur de l'usine

Ta slovenski standard je istoveten z: prEN 13035-1

ICS:

81.100	Oprema za steklarsko in keramično industrijo	Equipment for the glass and ceramics industries
--------	--	---

oSIST prEN 13035-1:2020

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[oSIST prEN 13035-1:2020](https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020)

<https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 13035-1

May 2020

ICS 81.100

Will supersede EN 13035-1:2008

English Version

**Machines and plants for the manufacture, treatment and
processing of flat glass - Safety requirements - Part 1:
Storage, handling and transportation equipment inside the
factory**

Machines et installations pour la production, le
façonnage et la transformation du verre plat -
Exigences de sécurité - Partie 1 : Stockage,
manutention et transport à l'intérieur de l'usine

Maschinen und Anlagen für die Herstellung, Be- und
Verarbeitung von Flachglas - Sicherheitsanforderungen
- Teil 1: Einrichtungen zum Lagern, Handhaben und
Transportieren innerhalb des Werks

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 151.

iTeh STANDARD PREVIEW

If this draft becomes a European Standard, 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.

This draft European Standard was established by CEN 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 CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	7
3 Terms and definitions	8
4 Safety requirements and/or protective measures	12
4.1 General.....	12
4.2 Mechanical strength.....	12
4.3 Angle of lean.....	12
4.3.1 Storage equipment and systems.....	12
4.3.2 Handling equipment	12
4.4 Cladding materials.....	12
4.4.1 Cladding materials (see Figure E.2).....	12
4.4.2 Back bearers (see Figure E.2)	12
4.4.3 Base bearers (see Figure E.2)	13
4.5 Handling equipment	13
4.5.1 Loading grabs	13
4.5.2 Vacuum lifting devices	14
4.5.3 Gripping devices (e.g. glass transport pincers (see Figure E.33))	15
4.5.4 Beam-strap sling.....	15
4.5.5 Over-the-top grab.....	15
4.6 Stationary equipment with mobile frame.....	16
4.7 Other hazards	16
5 Verification of compliance with safety requirements and/or protective measures.....	16
6 Information for use	17
6.1 General.....	17
6.2 Signals and warning devices	17
6.3 Accompanying documents.....	17
6.4 Marking.....	19
Annex A (normative) Requirements for stationary, movable and mobile storage equipment	20
A.1 Mechanical strength.....	20
A.2 Angle of lean.....	20
A.3 Cladding materials.....	20
A.3.1 Cladding materials (see Figure E.2).....	20
A.3.2 Back bearers (see Figure E.2)	20
A.3.3 Base bearers (see Figure E.2)	20
A.4 Stability of storage equipment.....	20
A.4.1 Storage equipment	20
A.4.2 Movable and mobile equipment	21
A.5 Verification of compliance with safety requirements and/or protective measures.....	25

A.6	Information for use	25
Annex B	(informative) List of significant hazards	26
Annex C	(informative) Overview over the equipment for the storage, handling and transportation of glass	29
Annex D	(informative) Minimum clearances for interfacing equipment	30
D.1	Loading grab and vertical bearers	30
D.2	Loading grab and horizontal base bearers	30
D.3	Loading grab and horizontal back bearers	31
D.4	Interfacing of structural (non-supporting) parts with fingers of lifting device	33
D.5	Beam strap sling and over the top grab	34
Annex E	(informative) Terminology and figures	35
E.1	Terms and definitions relating to the glass	35
E.2	Terms and definitions relating to the storage equipment	36
E.2.1	Orientation (positioning) of glass in any type of equipment	36
E.2.2	Type of storage equipment	38
E.2.2.1	Stationary equipment	38
E.2.2.2	Stationary equipment with mobile supporting frame	40
E.2.2.3	Movable equipment	42
E.2.2.4	Mobile storage equipment	47
E.2.3	Type of handling equipment	49
E.2.3.1	Manual devices	49
E.2.3.2	Mechanical devices	50
E.2.3.3	Vacuum devices	58
E.2.4	Type of transportation equipment	60
E.2.4.1	Equipment by lifting prior to transportation	60
Annex ZA	(informative) Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered	64
Bibliography	74

prEN 13035-1:2020 (E)**European foreword**

This document (prEN 13035-1:2020) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 13035-1:2008.

This document has been prepared under a standardization request 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 Annex ZA, which is an integral part of this document.

The main changes compared to the previous edition are as follows:

- Clarification of machine according to Directive 2006/42/EC or not;
- Controls, PL;
- Vacuum lifting devices have been added to the scope (also devices not used for crane operation).

STANDARD PREVIEW
(standards.iteh.ai)
[oSIST prEN 13035-1:2020](https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020)
<https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020>

Introduction

This document is a type-C standard as stated in EN ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- a) machine manufacturers (small, medium and large enterprises);
- b) health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- a) machine users/employers (small, medium and large enterprises);
- b) machine users/employees (e.g. trade unions, organizations for people with special needs);
- c) service providers, e.g. for maintenance (small, medium and large enterprises);
- d) consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

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

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

In this document it is assumed that:

- negotiation occurs between the manufacturer and the user/purchaser concerning particular conditions of use not dealt with in this standard and specific interfaces consideration (e.g. Annex D - Minimum clearances for interfacing equipment);
- the floors inside the factory, which are used for glass storage and withdrawal processes, are virtually horizontal and free of significant irregularities.

prEN 13035-1:2020 (E)**1 Scope**

1.1 This document includes safety requirements for the design and installation of equipment that is intended for storage, handling and transportation of flat glass inside the factory. It also applies to equipment within the scope of EU Directives as well as to equipment that is covered by non-harmonized documents. Annex E gives an overview of the differentiation.

1.2 This document specifies safety requirements for the following equipment:

- equipment for storage provided with elements that are propelled by a drive system other than directly applied human or animal power (engine power) in order to store or retrieve glass in or from storage shelves or frames (see 3.2.2);
- equipment for picking up single glass plates, firmly-attached glass plates or glass packs for transportation between different locations where the retention force or lifting force is generated by engine power (see 3.3.2, 3.3.3);
- equipment for transportation by special vehicles that are propelled by engine power.

1.3 This document specifies additional requirements for the following equipment that is not covered by EU Directives:

- stationary, movable and mobile storage equipment (see 3.2.1, 3.2.3, 3.2.4, for requirements see Annex A);
- storage equipment that is provided with manually propelled shelves or frames (see 3.2.2, for requirements see Annex B);
- equipment for transportation by special vehicles that are not self-propelled (see 3.4.3, for requirements see Annex C).

NOTE Additional requirements covering specific hazards that are resulting from the use outside the factory are dealt with in EN 13035-2.

1.4 This document only deals with equipment which is in direct contact with the glass, with the exception of wooden packaging. Tractors, cranes, hoists and forklift trucks as well as elements of self-propelled vehicles, which are not in contact with the glass (see 3.4.1), are out of the scope. This document does not apply to equipment for picking up single plates, such as manual vacuum lifting devices, lifting straps or other manual devices. This document does not cover automatic loading or unloading of storage and transportation equipment. This is covered in EN 13035-5.

1.5 This document deals with all significant hazards, hazardous situations and hazardous events, which are relevant to equipment for storage, handling and transportation of flat glass, when they are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex D). This document specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards during commissioning, operation and maintenance. Noise hazards have not been considered significant for any type of equipment within the scope of this document.

1.6 This document is not applicable to equipment for storage, handling and transportation of flat glass inside the factory, which is manufactured before the date of publication of this document by CEN.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 1757-3:2002, *Safety of industrial trucks — Pedestrian controlled manual and semi-manual trucks — Part 3: Platform trucks*

EN 1993-1-1:2005,¹⁾ *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 13035-5:2006+A1:2009, *Machines and plants for the manufacture, treatment and processing of flat glass — Safety requirements — Part 5: Machines and installations for stacking and de-stacking*

EN 13155:2020, *Crane — Safety — Non-fixed load lifting attachments*

EN 13557:2003+A2:2008, *Cranes — Controls and control stations*

EN 60204-1:2018, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2016, modified)*

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a workstation and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11202:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a workstation and at other specified positions applying approximate environmental corrections (ISO 11202:2010)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design (ISO 13850:2015)*

EN ISO 13854:2019, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)*

EN ISO 13855:2010, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)*

EN ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

¹⁾ As impacted by EN 1993-1-1:2005/A1:2014.

prEN 13035-1:2020 (E)

EN ISO 14118:2018, *Safety of machinery — Prevention of unexpected start-up (ISO 14118:2017)*

EN ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection (ISO 14119:2013)*

EN ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

EN ISO 14122-1:2016, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means and general requirements of access (ISO 14122-1:2016)*

ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.1 General terms and definitions**3.1.1 inside the factory**

[oSIST prEN 13035-1:2020
https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020](https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020)

all areas inside of enclosed buildings and company premises for the manufacture, treatment and processing of glass, where the glass is stored and transported, including storage facilities, with the exception of building sites

3.1.2 floor structure

structure including the technical definition of the floor regarding:

- surface tolerance;
- inclination of the floor;
- strength, i.e. load capacity and flexural resistance

3.1.3 angle of lean

difference between the plane of the glass plate and the vertical axis (e.g. Figure E.2)

3.1.4 glass pack

assembly of two or more glass plates of usually the same size (e.g. Figures E.1 and E.16)

3.1.5**bearer**

structural member of a stillage that supports the load of the glass; there are two main types:

3.1.5.1**back bearer**

fixed vertical construction against which the glass plate or glass pack is leant (e.g. Figure E.2)

3.1.5.2**base bearer**

fixed horizontal construction on which the glass plate or glass pack stands (e.g. Figure E.2)

3.1.6**cladding**

material used to prevent the glass plate or glass pack being damaged by the bearers (e.g. Figure E.2)

3.1.7**retention device**

facility to secure the glass on movable or mobile stillages against falling over

3.1.8**clamp (top or side)**

movable means on load lifting attachments, such as side-loading grabs, which retains the glass pack near the outer edges (e.g. Figure E.25)

3.1.9**supporting foot (shoe for beam-strap sling)**

device carrying the weight of the glass pack; it can be fixed, adjustable or removable depending on the type of device used (e.g. Figures E.25, E.31 and E.45)

3.2**storage equipment**

integral, movable or mobile equipment for storing glass packs, firmly-attached glass plates or single plates. Certain equipment is also used for transportation

The different types are:

3.2.1**stationary equipment**

racks, either fixed to the floor or stably freestanding, intended for single glass plates or glass packs; this type of stillage shall not be moved in loaded condition (e.g. Figures E.1 to E.7)

3.2.2**stationary equipment with mobile frame**

equipment designed to save space without loss of accessibility. The main types are:

3.2.2.1**drawer-type storage**

equipment where all movable frames are placed directly side by side without any gaps in between; each frame is pulled out longitudinally, either by hand or by engine power, to load or unload the glass (e.g. Figure E.8)

prEN 13035-1:2020 (E)**3.2.2.2****compact-type storage**

equipment where all movable frames are placed directly side by side without any gaps in between; the frames are moved transversely, either by hand or by engine power, to load or unload the glass (e.g. Figures E.9 a) and E.9 b)

3.2.2.3**shuttle system**

equipment for transportation of storage equipment carrying one or more single glass plates from line transport into a parallel transport route by lateral movement (Figure E.10)

3.2.3**movable equipment**

stable equipment that is usually used for temporary storage and for transportation, intended to be moved when loaded with glass

The different types are:

3.2.3.1**pallet**

device used both inside the factory and for transportation to the customer, characterised by its ability to be stacked vertically, one upon the other, to form a stable free-standing unit, within the factory usually transported by a mechanical device that lifts it off the ground prior to transportation (e.g. Figures E.11 to E.13)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.2.3.2**movable stillage**

device normally used for storage and transportation of glass to the customer, within the factory, usually transported by a mechanical device that lifts it off the ground prior to movement. Typically, it cannot be stacked like a pallet without using special ancillary equipment (e.g. Figures E.14 and E.15)

3.2.3.3**thin-glass frame**

device for storage and transportation of glass packs having a sheet thickness of less than 2,5 mm (e.g. Figure E.24)

3.2.3.4**collier**

metallic packaging used for storage and for transportation of the glass to the customer, which is positioned vertically inside the colliers intended to be opened only in an inclined position, e.g. on a stillage (e.g. Figure E.45)

3.2.4**mobile equipment**

device usually used for temporary storage and for transportation normally only inside the factory, similar to movable stillages, but characterised by having integral wheels and the ability to be propelled either manually or powered (e.g. Figures E.17 to E.21)

3.3**handling equipment (load lifting attachment)**

specifically, designed device to support and retain a single glass plate, firmly-attached glass plates or a glass pack during transportation between different locations

3.3.1**manual load lifting attachment**

directly hand-held device for holding and directing the glass plate during transportation between different locations, such as hand carrying straps, manual vacuum lifting devices, etc. (e.g. Figures E.22 and E.23)

3.3.2**mechanical equipment**

device to retain and support the glass during transportation between different locations either manually or powered, the equipment can include special devices that are required for handling single plates or (a) pack(s) of thin glass and can also be part of the storage equipment

Note 1 to entry: Different types of (transportation) devices used are shown in Figures E.24 to E.32.

3.3.2.1**loading grab**

mechanical device intended for transportation of glass packs, where the glass is resting on supporting feet and is secured by top clamps and, if applicable, side clamps (see Figures E.25 to E.27)

3.3.3**vacuum lifting device**

device for holding, retaining and transporting single glass plates or firmly-attached glass plates by means of one or more suction cups operating under a vacuum that is established and maintained by an external energy source (e.g. Figures E.34 to E.38)

3.3.4**ancillary equipment**

handling equipment that is attached to but not an integral part of vehicles or cranes. The (lifting) accessories can be fixed or rotating grabs, pincers, vacuum lifting device or slings (see Figures E.31 to E.36 and Figure E.38)

3.4**transportation equipment**

equipment for the movement of storage or handling equipment that is loaded with glass as different types like:

3.4.1**by lifting prior to transportation**

transportation equipment that picks up the load by lifting it off the ground. It can be manually-operated (bogie) or motor-driven, with or without integrated load-securing systems (e.g. Figure E.39 and Figures E.41 to E.43)

3.4.2**by traction only**

equipment, manually-operated or motor-driven, for the movement of mobile storage equipment (e.g. Figure E.44)

3.4.3**by trailers or trolleys**

mobile equipment used to carry movable equipment that is loaded with glass, moved forward either manually or by vehicles (e.g. Figure E.40)

prEN 13035-1:2020 (E)**4 Safety requirements and/or protective measures****4.1 General**

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 12100:2010 for relevant but not significant hazards which are not dealt with by this document (e.g. sharp edges).

For the application of a type-B standard, such as EN ISO 13854:2019, EN 60204-1:2018, EN ISO 4414:2010, EN ISO 13849-1:2015, EN ISO 13850:2015, EN ISO 13855:2010, EN ISO 13857:2019, EN ISO 14118:2018, EN ISO 14119:2013, EN ISO 14120:2015, the manufacturer shall carry out an adequate risk assessment in relation to the requirements contained in these standards that need to be selected (as far as the choice is not made by the requirements of this clause).

4.2 Mechanical strength

The mechanical strength of load-bearing parts shall comply with the following:

- a) stationary equipment, including equipment with mobile frames, shall be capable of resisting a load corresponding to EN 1993-1-1:2005¹⁾ (Eurocode3);
- b) for all handling equipment intended to be lifted by crane or other mechanical devices or vehicles, the requirements of EN 13155:2020, 5.1.2 apply.

4.3 Angle of lean

iTeh STANDARD PREVIEW

4.3.1 Storage equipment and systems (standards.iteh.ai)

The angle of lean (see 3.1.3) shall be at least 3° for stationary equipment with mobile frame.

4.3.2 Handling equipment

<https://standards.iteh.ai/catalog/standards/sist/536d8140-904f-484a-9594-72ecf8e6feb4/osist-pren-13035-1-2020>

Loading grabs shall lean in direction to the glass between 0° and 3° in empty conditions (see Figure E.26 c). In glass-loaded condition, the inclination of back structure shall be between 0 to 3° to the real vertical for glass height up to 2,55 m. For glass height bigger than 2,55 m the angle shall be 2. The angle between the glass support (supporting feet) and the back structure can vary from 85° to 90° and depends on the specific application. The objective is to minimize or avoid slipping from the feet.

NOTE 1 State of the art is the use of counterbalances to comply with the specified angle of lean.

NOTE 2 For loading grabs with completely retractable feet, the angle between the back structure and the real vertical can be bigger than 3° in empty conditions.

4.4 Cladding materials**4.4.1 Cladding materials (see Figure E.2)**

Cladding materials shall be used in order to prevent contact with any substance harder than the glass. It shall be softer than the glass. All fixing materials shall be sufficiently countersunk below any surface likely to come in contact with the glass in order to avoid such contact even at maximum load.

4.4.2 Back bearers (see Figure E.2)

Cladding materials for back bearers shall be sufficiently resilient to cushion the glass.

4.4.3 Base bearers (see Figure E.2)

Cladding materials for base bearers shall be able to resist the weight of the glass. Wear due to the cutting effect of glass shall be taken into account.

4.5 Handling equipment

4.5.1 Loading grabs

4.5.1.1 For all types of glass, except laminated glass, suitable means shall be provided, such as fixed guards on the rear of the side-loading grab positioned in the area between the supporting feet over their maximum distance to each other, in order to prevent glass falling towards the operator. The guard shall extend from the maximum height of the glass during transport up to 0,5 m above the upper edge of the supporting feet. For example, this can be achieved by a protective grid with a maximum grid size of 0,05 m × 0,05 m. Openings that are necessary for operation are not taken into account (see Figures E.26, E.27 and E.28 toe).

4.5.1.2 For all types of glass, except laminated glass, suitable means shall be provided, such as a guard at the lateral side of the side-loading grab, in order to prevent glass falling towards the operator. The guard shall extend from the maximum height of the glass during transport up to 1,5 m above the upper edge of the supporting feet. The guard width shall correspond to at least half the maximum thickness of the glass pack to be transported. For example, this can be achieved by a protective grid with a maximum grid size of 0,05 m × 0,05 m. Openings that are necessary for operation are not taken into account.

If this is not possible for technical reasons (e.g. limited space in existing operation areas), other safety means shall be taken into account like clearly marked safe zone, using with a special motor-driven crane hook, using a remote control. Technical measures like remote control shall be given priority. A checklist is given in Annex F (informative). The measures taken into account from the checklist should be a part of the instruction manual. To ensure that everybody is out of the danger zone it is strongly recommended to use a remote control.

4.5.1.3 Top clamps shall be in a positive position on top of the pack to secure the glass. The top clamps of an unloaded loading grab shall be mechanically fixed in an upper position. An acceptable solution is provided e.g. by a key at the fingers, resting by gravity in a groove of the finger support. For rotating grabs (landscape to portrait), a fixed locking system for all clamps shall be installed.

4.5.1.4 For glass height of more than 2,6 m, side clamps shall be provided if glass thicknesses are less than 4 mm to prevent deflection of the glass plates (see Figure E.26).

4.5.1.5 A means shall be provided to enable the operator to identify the position of the clamps at all times from the normal operator positions (e.g. by direct view or by means of an indicator).

4.5.1.6 The (supporting) feet shall protrude at least 10 mm beyond the maximum thickness of the glass pack to be handled.

4.5.1.7 Handle bars on both sides outside the dangerous area (see Figure E.26b) to guide during transport are necessary. These elements shall be adjustable to the glass size. By mechanical means has to be ensured that the handle bars are in a correct position.

4.5.1.8 Additional requirements for side-loading grabs with motor-driven elements

Movements are operated by a hold-to-run control. The safety-related part of the control system shall comply with EN ISO 13849-1:2015, performance level b. The drive system shall not exert any stress onto the glass which could damage or move the glass.

4.5.1.9 Requirements for indicators and safety-related crane control interconnections.