



SLOVENSKI STANDARD

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Glavni deli strojne opreme za izdelavo, obdelavo in predelavo ravnega stekla - Varnostni zahtevi - Del 1: Shranjevanje, ročno ravnanje in prevoz opreme 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

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ICS 81.100

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
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Verarbeitung von Flachglas - Sicherheitsanforderungen -
Teil 1: Einrichtungen zum Lagern, Handhaben und
Transportieren innerhalb des Werks

This European Standard was approved by CEN on 28 December 2007.

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Foreword

This document (EN 13035-1:2008) 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 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). It is one of a series concerning machinery for the manufacture, treatment and processing of flat glass (see Bibliography).

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

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of an identical text or by endorsement, at the latest by September 2008, and conflicting national standards shall be withdrawn at the latest by September 2008.

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.

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Introduction

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

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.

In this European Standard 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 C – Clearances for interfacing equipment);
- the floors inside the factory used for glass charging and discharging processes are virtually horizontal and without significant asperities.

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1 Scope

1.1 This standard contains the requirements for safety for the design and installation of equipment intended for the storage, handling and transportation of flat glass inside the factory as described in Clause 3. It applies to stationary, movable and mobile storage equipment (see 3.2), mechanical and pneumatic handling equipment (see 3.3) and transportation equipment (see 3.4) (see overview in Annex A).

1.2 Additional requirements for dealing with specific hazards due to the use outside the factory are dealt with in prEN 13035-2.

1.3 This standard only deals with the devices which are directly in contact with the glass. Tractors, cranes, hoists and fork lifts are out of the scope as well as parts of other powered vehicles that are not in contact with the glass (see 3.4.1). This standard does not apply to manual handling equipment as defined in 3.3.1.

1.4 This standard deals with all significant hazards, hazardous situations and events relevant to equipment for the 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 Clause 4). This standard specifies the appropriate technical measures to eliminate or reduce risks arising from the significant hazards during commissioning, the operation and maintenance. Noise has not been considered to be a significant hazard for any type of equipment in the scope of this standard.

1.5 This document is not applicable to storage, handling or transportation equipment for flat glass inside the factory, which is manufactured before the date of its publication as EN.

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.

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*
- EN 811:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*
- 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 983:1996, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*
- 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*
- EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*
- EN 1757-3:2002, *Safety of industrial trucks — Pedestrian controlled manual and semi-manual trucks — Part 3: Platform trucks*
- EN 13155:2003, *Cranes — Safety — Non-fixed load lifting attachments*
- EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*
- 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 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 13850:2006, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*
- EN ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of a fixed means of access between two levels (ISO 14122-1:2001)*
- EN ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001)*
- EN ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, step-ladders and guard-rails (ISO 14122-3:2001)*
- EN ISO 14122-4:2004, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2004)*
- ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1 and the following apply.

3.1 general definitions

3.1.1 inside the factory

all areas within enclosed buildings and company premises for glass manufacturing and processing in which the glass is stored and moved with the exception of building sites

3.1.2 floor structure

structure which is the technical definition of the floor regarding:

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

3.1.3 angle of lean

angle between the plane of the glass plate and the vertical axis when it is either being stored or transported (e.g. Figure B.2)

3.1.4 pack of glass

accumulation of two or more plates of the same size and substance (e.g. B.1.6 and Figure B.1)

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3.1.5 bearer

structural member of equipment that supports the glass. There are two main types:

3.1.5.1 back bearer

fixed construction in the vertical direction which the glass plate or pack leans against (e.g. Figure B.2)

3.1.5.2 base bearer

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

3.1.6 cladding

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

3.1.7 glass-retention device

facilities to secure the glass on stillages and racks

3.1.8 retention finger (top or side)

movable retention device on handling equipment, such as side-loading grabs, which holds the glass pack in the proximity of its edges. It can be of fixed or adjustable length and rotating or non-rotating (e.g. Figures B.25 to B.27 b)

3.1.9 supporting foot (shoe for beam-strap sling)

device that carries the weight of the glass pack. It can be fixed, adjustable or removable depending on the type of device used (e.g. Figures B.25, B.29 and B.43)

3.2

storage equipment

stationary, movable or mobile equipments for storing glass packs or single plates. Some of these equipments are also used for transportation

The different types are:

3.2.1

stationary equipment

racks, either fixed or free-standing on the floor, for single plates or packs. These systems shall not be moved loaded (e.g. Figures B.1 to B.7)

3.2.2

stationary equipment with mobile frame

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

3.2.2.1

drawer type

equipment where all mobile frames stand directly against each other without gaps. Each frame is pulled out longitudinally, either by hand or mechanically, to load or unload the glass (e.g. Figure B.8)

3.2.2.2

movable-compact

equipment where all mobile frames stand directly against each other without gaps. The frames are moved transversely, either by hand or mechanically, to load or unload the glass (e.g. Figures B.9 and B.10)

3.2.3

movable equipment

free-standing devices that are usually used for temporary storage and for transportation. They are intended to be moved loaded with glass. The different types are:

3.2.3.1

pallet

device used both inside the factory for storage and also for transportation to the customer. They are characterised by their ability to be stacked vertically, one upon the other, to form a stable free-standing unit. Normally transported within the factory by a mechanical device that lifts them clear of the ground prior to movement (e.g. Figures B.11 to B.13)

3.2.3.2

stillage

device normally used to transport the glass to the customer. Usually transported within the factory by a mechanical device that lifts it clear of the ground prior to movement. Typically it cannot be stacked, as a pallet, without using special ancillary equipment (e.g. Figures B.14 to B.16)

3.2.3.3

thin glass frames

devices for storing and transporting packs of glass of thickness less than 2,5 mm (e.g. Figure B.24)

3.2.3.4

collier

metallic packaging device used to store as well as to transport the glass to the customer. The glass stays vertically in the collier. The colliers are intended to be opened only in an inclined position, for instance on a stillage (e.g. Figure B.42)

3.2.4

mobile equipment

devices usually used for temporary storage and for transportation normally only within the factory. They are similar to movable stillages, but are characterised by having integral wheels and can be propelled either manually or mechanically (e.g. Figures B.17 to B.21)

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**3.3
handling equipment**

specifically designed devices to support and retain a single plate or pack of glass during transportation from one position to another

**3.3.1
manual equipment**

devices to hold and control the glass plate during movement from one point to another such as carrying straps, vacuum pads etc. (e.g. Figures B.22 and B.23)

**3.3.2
mechanical equipment**

devices to retain and support the glass during movement from one point to another by either manual or powered propulsion. Normally the lifting movement is power-driven. The equipment can include special devices required to handle single plates, pack(s) of thin glass. The device can be also part of the storage device

NOTE Types of device used are shown in Figures B.24 to B.30.

**3.3.2.1
side-loading grab**

mechanical equipment intended for transport of glass packs where the glass stays vertically on supporting feet and is secured by side and top fingers

**3.3.3
vacuum lifting equipment**

devices to retain single plates. The retention force is based on the vacuum of the suction cups being sufficient to support the plate dimension and weight (e.g. Figures B.31 to B.35)

**3.3.4
attachments**

handling devices which are attached to but not an integral part of trucks or cranes. The devices may be fixed or rotating grabs, clamps or vacuum systems

**3.4
transportation equipment**

equipment for the movement of glass-laden storage or handling devices. The different types are:

**3.4.1
by lifting prior to transportation**

equipment for the transportation after freeing the load from the ground by lifting. This may be hand-operated or motor-driven, with or without integrated load-securing systems (e.g. Figures B.38 to B.41)

**3.4.2
by traction only**

equipment for the movement of glass-laden mobile storage devices operated by hand or motor-driven

**3.4.3
by trailers and trolleys**

mobile devices used to carry glass-laden movable equipment. They are propelled either manually or by vehicles (e.g. Figure B.37)

4 List of significant hazards

This clause contains 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.

Table 1

Hazards		Dangerous items	Preventive measures
4.1	Mechanical		
4.1.1	Crushing		
4.1.1.1	Crushing of the body	Pack of glass falls from all types of racks or handling equipment because of:	
		a) insufficient angle of lean	5.3.1
		b) glass not secured	5.4.1
		c) glass not supported correctly	7.3.1
		d) damage to glass by bearers	5.5
		e) collapse of wheels on mobile racks	5.7.7
		f) loss of stability	5.7
		g) lack of positive location for stacking one pallet on another	5.7.4
		h) break-up of the device by insufficient strength	5.2
		Pack of glass and handling device are out of control because of:	
		a) top fingers of side-loading grab lift up ceasing to retain pack of glass	5.4.2.2, 5.4.2.3 and 7.3.5
		b) pack of glass falls out of straps of beam-strap sling	5.4.3.1 and 7.3.5
		c) base bearer becomes detached from vertical members of over the top-type grabs	5.4.4 and 7.3.5
		d) insufficient clearance between base bearers of storage equipment and handling device foot	7.3.6
e) incorrect angle of lean of side-loading grab	5.3.2		
equipment falls from a transportation system	7.3.8		
movement of powered parts of equipment	5.8.4		
4.1.1.2	Impact with the body	by handling or transportation equipment	7.3.3
4.1.1.3	Crushing of feet	a) wheels of mobile equipment	5.7.5 and 5.7.7
		b) tow bar of mobile equipment	5.6
4.1.2	Cutting, severing or puncturing	Single plate falls from stationary, movable or mobile racks because of:	
		a) insufficient angle of lean	5.3.1
		b) glass not secured	5.4.1
		c) glass not supported correctly	7.3.1
		d) damage to glass by supporting bearers	5.5
		single plate falls from handling equipment because of:	
		a) damage to glass by contact points of handling equipment	5.5
		b) falling sideways out of side-loading grab	5.4.2

Table 1 (continued)

Hazards		Dangerous items	Preventive measures
		c) falling sideways out of over-the-top grab	5.4.4
		d) falling sideways out of a beam-strap sling	5.4.3
		e) falling sideways out of a pincer	5.4.5
		f) falling sideways out of a vacuum-lifting device	5.8.3
		g) loss of sucker-device vacuum	5.8.2
		h) insufficient length of foot on a side-loading grab	5.4.2.5
4.1.3	Slip, trip and fall		
4.1.3.1		trip over the tow bar or base bearers	5.9.1
4.1.3.2		falling from elevated position	5.9.2
4.1.4	Neglected ergonomic considerations		
4.1.4.1	Unhealthy postures or excessive effort	manual movement of mobile equipment	5.9.3 and 7.3.2
4.1.4.2	Neglected use of personal protective equipment	injuries from glass	7.3.10
4.1.4.3	Inadequate design, location or identification of manual controls	foreseeable misuse	5.9.4
4.2	Unexpected start or movement	movement of vacuum-lifting device	5.8.1, 5.8.4
4.3	Electrical	vacuum-lifting device	5.8.4

5 Safety requirements and/or protective measures

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

For applications of type B standards such as EN 294, EN 349, EN 811, EN 953, EN 983, EN 999, EN 1037, EN 1088, EN 60204-1, EN ISO 13850, the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary (as far as the choice is not made in the requirements of this clause).

5.2 Mechanical strength

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

- stationary equipment shall be capable of withstanding a load of at least 1,25 times the maximum permissible load without permanent deformation;
- for movable and mobile equipment and all handling devices intended to be lifted from the top the requirements from EN 13155:2003, 5.1.1.1;

- c) when intended for transportation by all forms of truck for speeds less than 15 km/h whether carried on forks or pulled, the movable and mobile equipment and all handling devices shall be capable of withstanding a load of at least 1,5 times the maximum permissible load or the load resulting from satisfying 5.7.5, whichever is the greater without permanent deformation. For intended speeds greater than 15 km/h, the loads resulting from the dynamic forces of 0,8 g longitudinally and 0,5 g laterally shall be taken in account.

5.3 Angle of lean

5.3.1 Storage equipment and systems

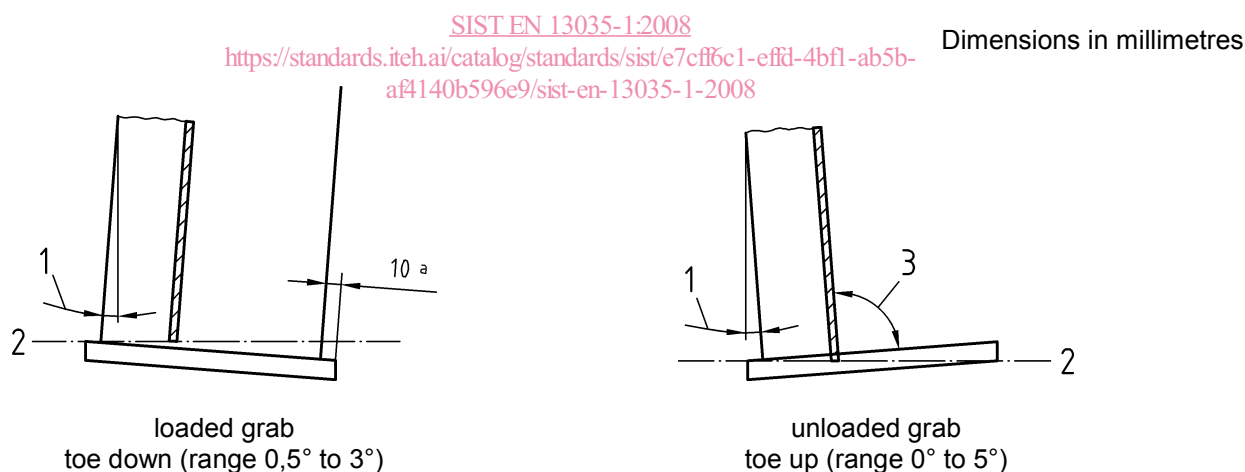
The angle of lean shall be 3° minimum for all stationary systems (see 3.2.1) and 4° for all other systems described in 3.2.2 to 3.2.4, as far as they do not have a glass-retention device. If the equipment has an inherent glass-retention function, such as "colliers", the glass can be stored and transported in a vertical position.

5.3.2 Handling devices

Side-loading grabs shall lean "toe down" between 0,5° and 3° when loaded with glass. The empty grab "toe up" inclination shall be kept to a minimum and shall never exceed 5° (see Figure 1).

NOTE

- i) This is important for both the loaded and empty condition. Side-loading grabs with an automatic device for controlling the angle of lean are recommended.
- ii) For glass higher than 2 440 mm, the angle of grab (toe down) should not be more than 2°.
- iii) The foot angle can vary from 85° to 90°, and it is dependent on the specific application. The objective is to minimise or avoid relative movement of plates in a vertical position.
- iv) In relation to the vertical axis, the angle of lean for position "toe down" is negative and for position "toe up" positive.



Key

- 1 angle of lean
- 2 horizontal
- 3 foot angle
- a 10 mm minimum protrusion

Figure 1

5.4 Retention of glass

5.4.1 Movable and mobile equipment

Provisions shall be made for glass-retention. If retention equipment is not part of the storage equipment, appropriate instructions shall be included in the instruction handbook.

NOTE The factors to be taken into account are:

- i) force effecting the retention force;
- ii) dynamic forces involved under maximum operating conditions;
- iii) fragility of the glass in terms of local stresses generated by the retention device(s);
- iv) minimum and maximum glass size.

5.4.2 Side-loading grab

5.4.2.1 Side fingers shall be provided and used for glass substances less than 4 mm to prevent a deflection of the glass panes (see Figure B.27 a) and Figure B.27 b)).

5.4.2.2 A suitable means such as a fixed guard on the rear of the grab, to retain the glass and prevent it falling sideways and backwards towards the operator shall be provided. It can be a protection guard with a maximum mesh width of 0,05 m (square pattern) and of the maximum height of glass sheets during transfer.

For side-loading grabs with a maximum permissible load of 6 000 kg, this guarding is necessary in the area between the feet to their maximum width (see Figures B.26 a) and B.26 b)).

For side-loading grabs with a permissible load greater than 6 000 kg, the dimension of the guard on the rear shall be greater than the maximum size of the glass pack to be transported. Suitable means shall be provided to protect the area on top of the side-grab fingers (see Figures B.27 a) and B.27 b)).

5.4.2.3 Top fingers shall be provided with means for a positive locking stop in position on top of the pack. Similarly the fingers shall be positive locking in the parked position. An acceptable solution for non-rotating grabs is providing a key at the fingers, resting by gravity in a groove of the finger support,

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

5.4.2.5 Length of the feet

The feet shall protrude at least 10 mm beyond the maximum block thickness to be handled (see Figure 1).

5.4.3 Beam-strap sling

5.4.3.1 For a device lifting from the bottom corners of a pack of glass, the strap angle shall be at least 7° (see Figure C.5.1).

5.4.3.2 A suitable means to retain the glass and prevent it falling sideways shall be provided (see Figure B.29).

5.4.4 Over-the-top grab

5.4.4.1 The base bearer shall be positive locking and secured against unintentional unlocking.

5.4.4.2 A suitable means to retain the glass and prevent it falling sideways shall be provided (see also 5.4.3.2).

5.4.5 Gripping devices (e.g. pincers)

Gripping devices shall only be used for the handling of single sheets of laminated glass. The requirements of EN 13155:2003, 5.2.1 and 5.2.7, shall be fulfilled.

5.5 Cladding materials

5.5.1 Cladding materials (see Figure B.2)

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

5.5.2 Back bearers (see Figure B.2)

Cladding materials for back bearers shall be sufficiently resilient to cushion the glass like rubber with shore hardness 40° to 50° A.

NOTE Other materials may be used, but timber on its own is not recommended.

5.5.3 Base bearers (see Figure B.2)

Cladding materials for base bearers shall be sufficient to resist the weight like rubber with shore hardness 70° to 80° A. To determine the area of glass support, 10 mm of support width/m² of glass-surface area shall be the minimum for glass of 2,5 mm or more. A higher value of glass support width/m² of glass area may be necessary for glass less than 2,5 mm and shall be determined by the manufacturer.

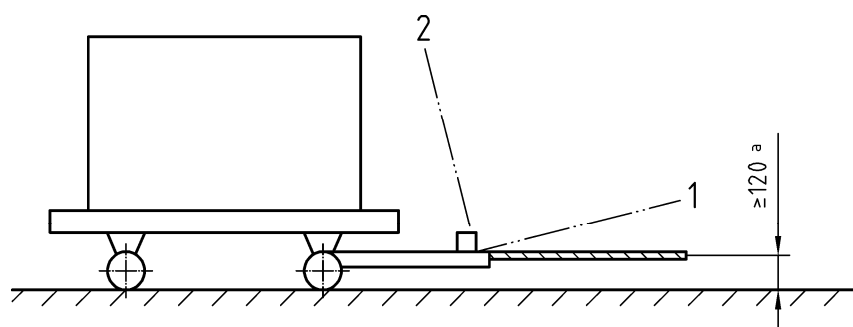
NOTE

- i) Other materials are used too, but generally they are harder;
- ii) EXAMPLE If the glass to be stored is 6,2 m × 3,21 m and at least 2,5 mm, the bearer width required is 200 mm (6,2 m × 3,21 m × 10 mm/m²); so if two bearers are used, each should be 100 mm wide.

5.6 Tow bars

Tow bars shall be positive locking in a parked position, and a stop shall be provided to give a 120 mm clearance from the ground.

Dimensions in millimetres



Key

- 1 normal operation
 2 parked (i.e. when not in use)
^a 120 mm minimum clearance in lowest position

Figure 2 – Tow bar

5.7 Stability of storage equipment

5.7.1 Storage equipment

Storage equipment shall be designed to be stable under conditions of intended use. If stationary equipment is not stable enough by itself, it shall be fixed to the floor (see 7.3.1).