
Stroji in obrati za proizvodnjo, obdelavo in predelavo ravnega stekla - Varnostne zahteve - 2. del: Oprema za skladiščenje, ravnanje s steklom in transport zunaj tovarne

Machines and plants for the manufacture, treatment and processing of flat glass - Safety requirements - Part 2: Storage, handling and transportation equipment outside the factory

Maschinen und Anlagen für die Herstellung, Be- und Verarbeitung von Flachglas - Sicherheitsanforderungen - Teil 2: Einrichtungen zum Lagern, Handhaben und Transportieren außerhalb des Werks

Machines et installations pour la production, le façonnage et la transformation du verre plat - Exigences de sécurité - Partie 2 : Équipements de stockage, de manutention et de transport à l'extérieur de l'usine

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

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European foreword

This document (prEN 13035-2:2020) 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 13035-2:2008.

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.

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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 and equipment 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 document;
- stationary storage equipment with or without mobile support and mechanical handling devices (see EN 13035-1) are not intended for use outside the factory;
- mobile stillages and inloader stillages can only be used on virtually horizontal and sufficiently stable grounds that are free of significant irregularities (see Clause 6).

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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 outside the factory. It applies to machinery within in the scope of EU Directives as well as to equipment that is covered by non-harmonized documents.

1.2 This document specifies safety requirements for the following equipment for storage (see 3.2.1), handling (see 3.2.2) and transportation (see 3.2.3) of flat glass outside the factory (see 3.1.1):

- vehicle-mounted frails with motorized adjustment of the angle of lean for loading and unloading, which are used for road transport;
- inloader vehicles for road transport outside the factory, where loading and unloading is only made on virtually horizontal and sufficiently stable grounds that are free of significant irregularities;
- specific self-propelled equipment for securing the glass (inloader load-securing systems);
- 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.

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

- vehicle-mounted frails without an adjustable angle of lean for loading and unloading, which are used for road transport;
- movable storage equipment designed to transport the glass outside the factory (e.g. inloader stillages, see Figure C.6);
- glass-securing devices or systems for transport stillages (e.g. spring tensioning rods, stanchions).

NOTE Specific hazards due to the use inside the factory are dealt with in EN 13035-1.

1.4 This document deals with road transport as wells as rail transport.

1.5 This document only deals with equipment which is in direct contact with the glass. This document does not apply to manual handling equipment such as carrying straps and manual vacuum lifting devices and to all packaging for glass which always opened and closed in the factory (see EN 13035-1). Tractors, cranes, hoists and forklift trucks as well as elements of self-propelled vehicles, which are not in contact with the glass, are out of the scope. This document does not apply to the transport of glazed windows/frames, neither does it apply to equipment for different transportation than on road or on rail, e.g. by ships.

1.6 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 B). 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.

1.7 This document does not apply to equipment for storage, handling and transportation of flat glass outside the factory, which is manufactured before the date of publication of this document as EN.

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 981:1996+A1:2008, *Safety of machinery — System of auditory and visual danger and information signals*

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

EN 12195-1:2010, *Load restraining on road vehicles — Safety — Part 1: Calculation of securing forces*

prEN 13035-1:2020, *Machines and plants for the manufacture, treatment and processing of flat glass — Safety requirements — Part 1: Storage, handling and transportation equipment inside the factory*

EN 13044-3:2011, *Intermodal Loading Units — Marking — Part 3: Markings of semi-trailers related to rail operation*

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

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

EN ISO 11201:2010, *Acoustics — (Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station 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 work station 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 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)*

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

¹⁾ This document is impacted by EN 1993-1-1:2005/A1:2014.

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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)*

EN ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2016)*

EN ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2016)*

EN ISO 14122-4:2016, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2016)*

prEN ISO 7010:2019, *Graphical symbols — Safety colours and safety signs — Registered safety signs (ISO 7010:2019)*

UIC Leaflet 50596-5, *Transport of road vehicles on wagons — Technical Organization — Conveyance of semi-trailers with P coding or N coding on recess wagons, 1st edition, June 2018*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100, EN 13035-1 and the following apply.

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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/>

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

all areas outside of enclosed buildings and company premises for the manufacture, treatment and processing of glass, where the glass is stored and transported, and outside of storage facilities, e.g. building sites

3.1.2**unattended combined traffic (rail transport)**

transportation of flat glass using inloaders without a tractor unit by means of a rail-bound traffic system (railway) where loading is carried out by lifting operation

3.1.3**gust**

sudden wind speed increase

3.2

Definitions and definitions relating to the equipment

3.2.1

storage equipment

stationary, movable or mobile equipment for storing glass packs, firmly-attached glass plates or single plates; certain equipment is also used for transportation

3.2.2

handling equipment

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

3.2.3

transportation equipment

equipment for the movement of glass or storage equipment in unloaded and loaded condition or for the movement by means of load-lifting attachments (Figure C.7)

3.2.4

frail

equipment for transportation of glass plates in a nearly vertical position which is fixed or mounted to the outside of a vehicle (see Figures C.1, C.2 and C.3)

3.2.5

inloader

transportation equipment (usually a semi-trailer) with a self-loading and self-locking mechanism for stillages according to 3.2.6 with or without glass plates/glass pack(s) (see Figure C.5)

3.2.6

inloader stillage

movable equipment for retaining and supporting glass packs or single glass plates in order to allow transport by semi-trailers according to 3.2.5 (Figure C.6)

3.2.7

thin glass frames

storage and transportation equipment for glass packs with a thickness of usually less than 2,5 mm

3.2.8

gripping edge

lifting points for vertical lifting of the semi-trailer

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, and which are not dealt with by this document (e.g. sharp edges).

For the applications of a type-B document, such as EN 60204-1:2018, 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 and that need to be selected.

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NOTE This specific risk assessment is part of the general risk assessment relating to the hazards that are not covered by this document.

4.2 General requirements

4.2.1 Equipment shall be designed in accordance with EN ISO 12100:2010, 6.2.3, and shall be manufactured using materials complying with EN ISO 12100:2010, 6.2.3.

Equipment shall comply with prEN 13035-1:2020, unless otherwise stated in this clause.

4.2.2 Mechanical strength

Inloaders, inloader load-securing devices and frails with power-driven function shall be capable of resisting a load of at least 1,5 times the maximum permissible load without permanent deformation. For transportation by all types of vehicles, all equipment shall be capable of resisting a force caused by an acceleration of 0,8 *g* in the driving direction (longitudinally) and 0,5 *g* in the perpendicular direction (laterally), which results from the dynamic forces. If the equipment, e.g. stillages, is not able to resist these forces by design, then it is necessary to give information about how to withstand these forces by using a further (additional) retention device.

4.2.3 Mechanical strength for combined transport

If equipment is intended to be also used for rail transport, it shall be designed, in addition to 4.2.2, such that it resists a force resulting from dynamic forces caused by an acceleration of 1,0 *g* longitudinally and 0,5 *g* in perpendicular direction.

4.3 Angle of lean

4.3.1 Frails shall have an angle of lean of at least 4° if the vehicle is parked on horizontal ground under the most unfavourable loading conditions. [oSIST prEN 13035-2:2020](https://standards.iteh.ai/catalog/standards/sist/0e2c06b4-1050-4cfd-af25-04d32ee97579/osist-pr-en-13035-2-2020)

4.3.2 For loading or unloading single plates, the frail shall be provided with an indication device showing to the operator that the angle of lean is maintained correctly (see Figure C.4)).

4.4 Glass-retention devices**4.4.1 General requirements**

Provisions shall be made for retaining the glass. If retention devices are not part of the equipment, appropriate instructions shall be included in the operating manual (see 6.3).

The design of glass-retention devices shall demonstrate sufficient resistance to the glass; the mass of the glass to be transported, the dynamic forces and the friction forces (see A.2 Stillages), which can occur under extreme operating conditions, shall be taken into account for:

- a) prevention of damage to the glass;
- b) prevention of damage by the glass;
- c) measures against failure or unintended deactivation of the retention function.

4.4.2 Appropriate solutions for retaining the glass

Appropriate solutions for retaining the glass are:

- a) hydraulic and pneumatic retention devices;
- b) airbags/cushions;

- c) stanchions;
- d) belts/straps.

See Annex D (informative) for additional guidance.

4.5 Bearer and cladding materials

4.5.1 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.

4.5.2 Back bearers

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

4.5.3 Base bearers

Cladding materials for base bearers shall be able to resist the weight of the glass.

4.6 Special transportation systems

4.6.1 Inloader vehicle

4.6.1.1 For reversing operation, an automatically acting visual or auditory warning device in accordance with EN 981:1996+A1:2008 is necessary to warn persons outside the viewable area and to indicate to leave the area at the rear of the inloader.

4.6.1.2 All work stations and maintenance locations shall be accessible from floor level, or appropriate means for access in accordance with the EN ISO 14122:2016 series shall be provided.

Integral task-specific lighting with an illuminance of at least 100 lx for work stations and of at least 50 lx for maintenance locations shall be provided

- a) where access is assumed to be frequent (more than once a day);
- b) where it can be assumed that general ambient lighting at the place of use is not sufficient (e.g. inside the load compartment and on the inside of the front platform).

4.6.1.3 Around the vehicle, the design shall provide for a minimum gap of 100 mm between the ground and parts of the vehicle, except inside the load compartment and for those elements which are necessary to pick up the load. In these areas, a minimum distance of 50 mm shall be provided.

Measures against fall (of persons) from platforms from a falling height of more than one meter, e.g. the front platform inside the vehicle, are necessary in form of suitable barriers, e.g. a handrail at a height between 1,00 m and 1,10 m and a knee rail at approximately half the height.

Parts inside the inloader where slipping, tripping or impact hazards are present shall be clearly marked by yellow and contrasting black stripes in accordance with ISO 3864-1.

If a stillage is present inside the load compartment, access to this load compartment inside the vehicle shall be prohibited by a prohibition sign in accordance with Figure E.2, completed by a supplementary sign stating "Access prohibited when stillage inside" in accordance with ISO 3864-1.

A device shall be provided (e.g. a fixing bar) for locking the rear door in each normal open position (e.g. 90° and 270°) to prevent the door being closed due to gust.

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4.6.1.4 For movable kingpin frames, a locking device is necessary in the lifted position. This locking device can be a mechanical or a redundant hydraulic locking device, e.g. with dual releasable non-return check valves on two cylinders. If the unlocked position is possible, it shall be indicated by optical means located close to the locking control device (e.g. by a yellow indicator light). Reaching the driving height shall be indicated by marking, e.g. a pointer.

If the vehicle is equipped with a fixed king pin frame, the requirements for operating heights at the semi-trailer coupling point of the tractor unit shall be indicated near the semi-trailer coupling point. Furthermore, the specification of permissible dimensions of the profile of inloader stillages to be transported is required for these types of vehicles.

4.6.1.5 A device for keeping the load in balance in all directions during lifting and lowering shall be provided. If these devices make use of the inloader wheel-suspension system, this can be achieved by e.g. an electronically controlled air-suspension system.

To avoid unexpected movement during lifting and lowering, an approved brake-release function is necessary.

A device (fail-safe system) is required to avoid contact of the load (stillage) with the ground during transportation (operating manual). The device shall be readily accessible from ground level and be operable even when wearing the required personal protective equipment (e.g. gloves).

4.6.1.6 Control actuators and displays for the rear door, the kingpin frame and the load-securing system (even if only parts of it are activated or deactivated) shall be arranged outside of the area from which the danger zone can be reached, and they shall be clearly and unambiguously marked (e.g. function, operating mode (functionality), preferably by using pictograms).

At the control station for closing and opening the rear door, the unobstructed view of the main closing edge shall be possible. All other edges of the door shall be at a minimum distance of 25 mm to the vehicle body. The free space can be filled with sufficiently soft material, e.g. foam rubber. In addition, a warning sign (see Figure E.1) indicating the danger of finger crushing near the main closing edge is required.

A movement of the powered load-securing device shall only be possible by means of a hold-to-run control device. The control device shall be accessible only after opening the rear door, and it shall enable the operator to move to a location that is outside the danger zone of falling glass, e.g. by using a cable remote control. The related parts of the control system shall be in accordance with of EN ISO 13849-1:2015, performance level c. Close to the hold-to-run control device, an emergency-stop device for controlling the load-securing system with a control circuit at least in accordance with EN ISO 13849-1:2015, performance level c, is necessary. Devices indicating that the load-securing system has reached the end position shall be provided for the glass-retaining position and the open position, where the glass-retaining position shall be indicated permanently.

Engaging the door-locking device shall not be possible without prior activation of the load-securing device. If no load-securing device is needed or with an empty "L" rack or during empty run, an acknowledgement key shall be actuated which is located on the side of the inloader that is opposite to the control units of the door-closing mechanism and the load-securing mechanism. This key shall be designed as a hold-to-run control.

4.6.1.7 Technical measures shall be taken against the unexpected start of dangerous movements after power return (e.g. when changing the tractor unit). This applies in particular to the load-securing system and the rear door.

Measures are required to prevent the operation by unauthorised persons (e.g. by locking the control actuators).

In order to prevent hydraulic movements during interventions, an isolating device such as a (pump) main switch or a plug connection to the tractor unit (lockable) is required.

4.6.1.8 If the load-securing device is not self-locking, a device is necessary to warn the driver during transportation in case the load-securing device fails. This device shall be visual and/or auditory and directly or indirectly perceivable from the driver's position. Unless the device indicates the normal load-securing condition, the indicator device shall be redundant.

4.6.1.9 For hydraulic load-securing devices (e.g. hydro-push system), a pressure gauge is required. This device shall be visible from the operator's position during the load-securing process. The safe operating range of the load-securing system shall be clearly visible, e.g. by a red/green marking.

4.6.1.10 The stillage inside of the inloader shall be secured rearwards against an acceleration of 0,5 *g*. This can be achieved by e.g. improving the friction value.

4.6.2 Truck and van-mounted frails with motorized adjustment of the angle of lean

4.6.2.1 An indication device is necessary to inform the operator that the angle of lean is adequate for the loading and unloading process. Systems indicating the current angle of lean shall clearly differentiate between the working range and the dangerous range, e.g. by a two-colour system.

4.6.2.2 A device for tilting the frail to an angle $\geq 4^\circ$ for the loading and unloading process is required.

This can be achieved by the following methods:

- a) adjustment of the frail (e.g. Figures C.1 and C.2);
- b) adjustment of the vehicle frame (e.g. Figure C.3).

For adjustment methods that include control functions, the relevant parts of the control system shall be at least in accordance with EN ISO 13849-1:2015, performance level c. For other systems, the adjusted position shall be maintained, e.g. by using automatic self-locking systems.

4.6.2.3 A retention device is necessary in the front and at the back of each load on the frail to prevent the glass plates from sliding out in the travel direction as well as in the opposite direction. In combination with the other load-securing elements, the devices shall comply with the requirements of 4.2.2.

4.6.2.4 Frails shall be mounted on vehicles complying with the requirements specified by the vehicle manufacturer.

4.7 Vacuum-lifting device

Regardless of the type of hoisting mechanism, vacuum-lifting devices for flat glass shall comply with the requirements of EN 13155:2020 and with the additional requirements stated below.

Reliability shall be such that failure of one vacuum circuit has no effect on the rated capacity that is required according to EN 13155:2020.

If vacuum-lifting devices are intended to be used in an area where it is difficult to leave the danger zone or to warn persons within the danger zone, the requirements of EN 13155:2020, 5.2.2.8, only apply to the extent that one single fault (e.g. failure of the largest sub-circuit) shall not lead to the condition that the remaining circuits are not being able to hold twice the rated capacity at the end of the work range. Rating the capacity of the vacuum-lifting device according to EN 13155 (twice the capacity) shall be done independently from the type of the lifting device and its capacity. The plate geometry shall be considered especially for horizontal use. The test according to EN 13155:2020, Annex C, shall be carried out for all single faults.

The safety-related part of the control system should at least comply with EN ISO 13849-1:2015, performance level c. Cableless controls shall comply with EN 60204-1:2018, 9.2.7.