INTERNATIONAL STANDARD

ISO 3874

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Series 1 freight containers — Handling and securing

Conteneurs de la série 1 — Manutention et fixation

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International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet iso@iso.ch

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 3874 was prepared by Technical Committee ISO/TC 104, *Freight containers,* Subcommittee SC 1, *General purpose containers.*

This fifth edition cancels and replaces the fourth edition (ISO 3874:1988), of which it constitutes a technical revision. It is planned that the physical and functional requirements for the securing devices will be attached as amendments to this International Standard, whereas the rationale for these requirements will be given in a type 3 Technical Report.

Annex A of this International Standard is for information only.

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Series 1 freight containers — Handling and securing

1 Scope

This International Standard specifies methods of handling and securing series 1 freight containers built and tested to comply with the latest editions of ISO 1496-1 to ISO 1496-5.

NOTE — Freight containers built according to specifications contained in earlier editions of ISO 1496 may not possess the same capabilities.

This International Standard defines basic principles and procedures to ensure safe operation of containers in all surface modes of transport.

Methods of handling and securing are described for both loaded and empty containers. The conditions for lifting different types of loaded and empty containers are laid down in clause 6.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of the publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on the International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 668:1995, *Series 1 freight containers — Classification, dimensions and ratings.*

ISO 830:—[1], *Freight containers — Vocabulary.*

ISO 1161:1984, *Series 1 freight containers — Corner fittings — Specification.*

ISO 1496-1:1990, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes.*

ISO 1496-2:1998, *Series 1 freight containers — Specification and testing — Part 2: Thermal containers.*

ISO 1496-3:1995, *Series 1 freight containers — Specification and testing — Part 3: Tank containers for liquids, gases and pressurized dry bulk.*

ISO 1496-4:1991, *Series 1 freight containers — Specification and testing — Part 4: Non-pressurized containers for dry bulk.*

ISO 1496-5:1991, *Series 1 freight containers — Specification and testing — Part 5: Platform and platform-based containers.*

ISO 6346:1995, *Freight containers — Coding, identification and marking.*

1) To be published. (Revision of ISO 830:1981)

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3 Definitions

For the purposes of this International Standard, the definitions given in ISO 830 and the following apply.

3.1
empty container
container in the tare condition

3.2
loaded container
container in other than tare condition

3.3
eccentricity of the centre of gravity
longitudinal and/or lateral horizontal differences between the centre of gravity of any container (empty or loaded, with or without fittings and appliances) and the geometric centre of the diagonals of the centres of the four bottom corner fittings

3.4
mobile centre of gravity
centre of gravity of a container loaded with liquid, bulk, hanging or similar cargo which is liable to move under dynamic conditions

3.5
securing device
device used to secure containers

NOTE — They are in direct contact with the corner fittings of the container or between the transportation means and corner fittings of the container.

4 Basic requirements

4.1 General

Users of this International Standard should use caution regarding conditions which may place loads on the containers or on the handling or securing devices. These include deterioration of the container or devices, loosening and over-tightening of devices, slackness of cargo within containers, eccentric loading and excessive environmental conditions such as high wind, ice, wave action, etc.

NOTE — Slackness is a general term which includes shifting of cartons, shifting and settlement of bulk cargoes, liquids having a free surface, etc.

4.1.1 The requirements of all relevant national and international regulations shall be complied with.

4.1.2 The container and any equipment which may be used in its operation shall be adequately maintained.

4.1.3 Doors, lids, closures, removable or foldable parts and any loose equipment shall be properly secured.

4.1.4 All personnel engaged in handling and securing operations shall have received proper instructions, especially with regard to safety matters.

4.1.5 It is necessary to know whether the container is empty or loaded; unless otherwise ascertained, a container shall be treated as loaded.

4.1.6 Strong winds and other environmental conditions can have an effect on handling equipment and additional care shall be taken when operating in such conditions.

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4.2 Packing, loading and emptying

4.2.1 When a cargo is packed, loaded, and secured where necessary, this shall be carried out in accordance with good and recommended practices so that the cargo does not impose on the container forces in the excess of those for which it has been designed and so that the fundamental requirements specified in 4.2.2 to 4.2.4 are complied with.

4.2.2 The equipment used for loading and emptying the container shall only impose loads which are not in excess of those for which the container was designed.

4.2.3 The total mass of all items packed and loaded into the container, including dunnage, securing equipment and similar equipment, shall not exceed the maximum permitted payload, i.e. the maximum permissible operating gross mass minus the tare.

4.2.4 The cargo shall be distributed throughout the container to ensure that the centre of gravity is kept as central and as low as possible

- to avoid excessive tilting;

- to avoid overstressing either the container or the handling equipment;

- to avoid unacceptable vehicle axle loading;

- to avoid lack of vehicle stability;

- to avoid unacceptable load concentrations.

Eccentricity of the centre of gravity for the loaded container varies with the distribution of load within the container; designers of containers and handling equipment should take this fact into account. As an example, when 60 % of the load by mass is distributed in 50 % of the container length measured from one end (see figure 1), the eccentricity corresponds to 5 %.

4.3 Stowage and securing of cargo

The cargo shall be stowed and secured to prevent damage which might otherwise result from dynamic conditions encountered during handling and transportation.

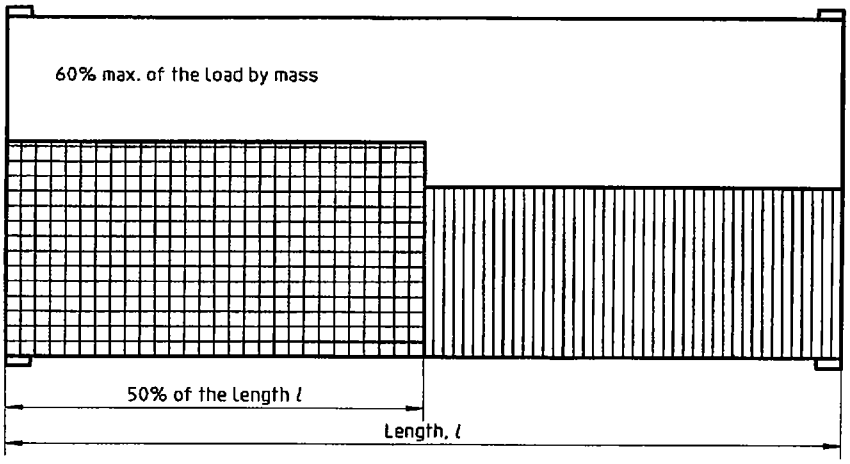

Figure 1 — Load distribution

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5 Handling

5.1 Handling by specified lifting methods

(See clause 6.)

5.1.1 Care shall be taken to ensure that the equipment used is suitable for the load and is safely attached to the container and that the container is free to be handled.

5.1.2 In the case of a single-point lift, special attention should be paid to the risk of the container tilting owing to eccentricity of the centre of gravity.

5.1.3 Care shall be taken when lifting a container whose centre of gravity is mobile or eccentric, e.g. a tank container, a bulk container, a container with a liquid bulk bag, a container with hanging cargo or a thermal container with a refrigerating unit (integral or clip-on).

5.2 Handling by unspecified lifting methods

Containers may be handled by methods other than those specified in clause 6 but only after careful evaluation of the equipment by means of which the container is to be handled and of the methods of operation envisaged, with respect to international container standards.

6 Specified lifting methods

6.1 General

6.1.1 The lifting methods specified in 6.2 to 6.10 are summarized in table 1.

6.1.2 The headings "Allowed" and "Not allowed" used in tables 3 to 5 and tables 7 to 12 refer to the specified lifting methods applied to differing types and sizes of containers and take into account the stresses on containers of differing types of design, their loads, where applicable, and the safety of the operation.

NOTE — There could be exceptions in cases when combinations of container types, size, load, design and operating condition could not be taken into account in tables 3 to 5 and tables 7 to 12. Such situations should be carefully evaluated by those competent to do so in order to decide whether a safe and satisfactory operation can be ensured. An explanation of the size designations referred to in tables 3 to 12 is given in table 2.

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Table 1 — Summary of specified lifting methods

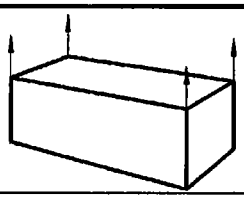
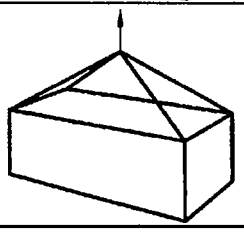
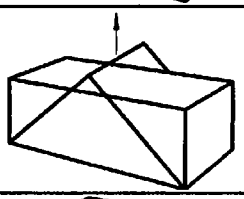
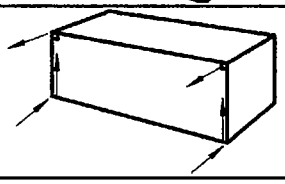
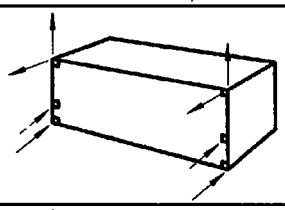
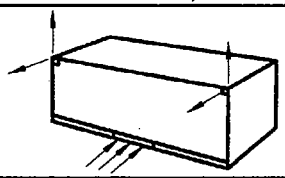
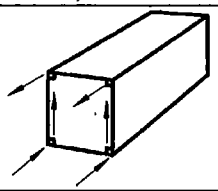
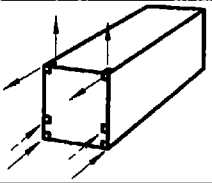
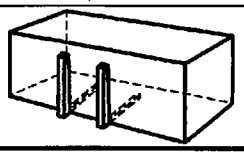
Subclause	Description	Illustration
6.2	Top lift spreader	
6.3	Top lift sling	
6.4	Bottom lift sling	
6.5	Side lift : method 1	
6.6	Side lift : method 2	
6.7	Side lift : method 3	
6.8	End lift : method 1	
6.9	End lift : method 2	
6.10	Fork-lift	

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Table 2 — Size designations referred to in tables 3 to 12

Nominal length		External height			
m	ft	< 2 438 mm (8 ft 0 in)	2 438 mm (8 ft 0 in)	2 591 mm (8 ft 6 in)	2 896 mm (9 ft 6 in)
12	40	1AX	1A	1AA	1AAA
9	30	1BX	1B	1BB	1BBB
6	20	1CX	1C	1CC	-
3	10	1DX	1D	-	-
NOTE — All units have a nominal width of 2 438 mm (8 ft 0 in).					

6.2 Top lift spreaders

See figure 2.

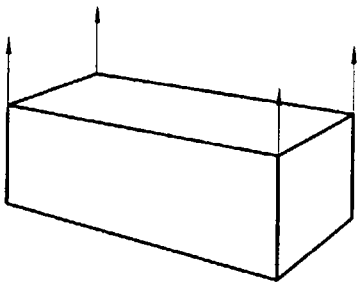

Figure 2 — Lifting by means of a top lift spreader

6.2.1 The container is lifted by means of a spreader designed to lift containers by the top apertures of the four top corner fittings, the lifting forces being applied vertically.

6.2.2 Lifting devices shall be properly engaged. Gathering devices shall impinge on corner fittings only.

6.2.3 The applicability of top lift spreaders is given in table 3.

6.2.4 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

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Table 3 — Applicability of top lift spreaders

Key : ☐ Allowed ▩ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▩				▩			▩		▩	General purpose		GP,VH				▩				▩			▩		▩
													Open top		UT													
													Bulk: non-pressurized/box		BU													
			▩				▩			▩		▩	Thermal		RE,RT RS				▩				▩			▩		▩
													Tank for liquids and gases		TN,TD TG													
													Bulk: non-pressurized/hopper pressurized		BK													
▩	▩	▩		▩	▩	▩		▩	▩		▩		Platform		PL	▩	▩	▩	1)	▩	▩	▩	1)	▩	▩	1)	▩	1)
													Platform -based	complete and fixed ends	PF													
														fixed free standing posts	PF													
														complete and folding ends, erected condition	PC													
														folding free standing posts, erected condition	PC													
														complete and folding ends, folded condition	PC	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩
														folding free standing posts, folded condition	PC	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩
													Platform-based with complete superstructure and open-sided		PS													

1) Top lift possible with extensions only.

6.3 Top lift sling

See figure 3.

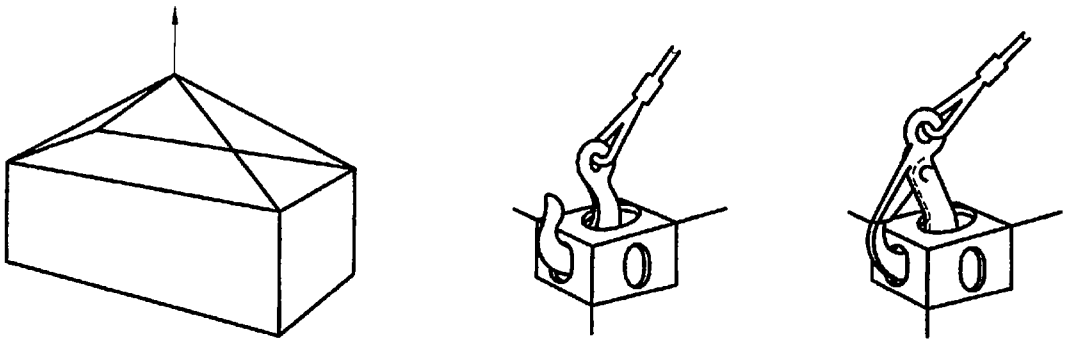

Figure 3 — Lifting by means of a top lift sling

6.3.1 The container is lifted by all four top corner fittings with forces applied other than vertically.

6.3.2 Lifting devices shall be properly engaged. Hooks shall always be placed in an inward to outward direction.

6.3.3 The applicability of top lift slings is given in table 4.

6.3.4 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

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Table 4 — Applicability of top slings

Key : ☐ Allowed ▨ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▨				▨			▨		▨	General purpose		GP,VH	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	▨
													Open top		UT	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	2)
													Bulk: non-pressurized/box		BU	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	2)
1)	1)	1)	▨	1)	1)	1)	▨	1)	1)	▨	1)	▨	Thermal		RE,RT RS	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	▨
													Tank for liquids and gases		TN,TD TG	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	2)
													Bulk: non-pressurized/hopper pressurized		BK	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	2)	2)
▨	▨	▨		▨	▨	▨		▨	▨		▨		Platform		PL	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	Platform-based	complete and fixed ends	PF	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		fixed free standing posts	PF	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		complete and folding ends, erected condition	PC	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		folding free standing posts, erected condition	PC	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
														complete and folding ends, folded condition	PC	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
														folding free standing posts, folded condition	PC	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
													Platform-based with complete superstructure and open-sided		PS	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		

1) Centre of gravity may be eccentric.
2) For 1D and 1DX containers, the lifting forces shall be applied at an angle not less than 60° to the horizontal, see figure 4.

NOTE — Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

Dimensions in metres

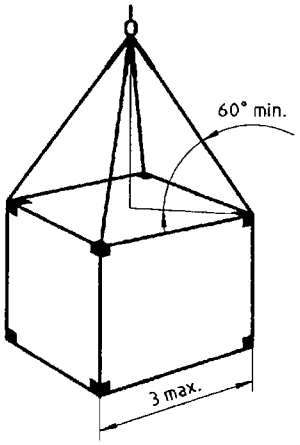

Figure 4 — Application of lifting forces (1D and 1DX containers)

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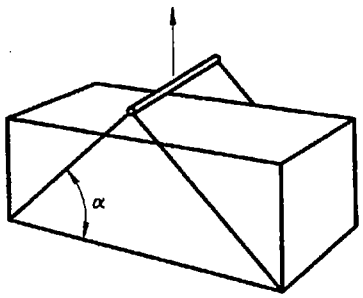
6.4 Bottom lift sling

See figure 5.

6.4.1 The container is lifted from side apertures of four bottom corner fittings by means of slings. The bottom sling attachment shall bear on the corner fittings only and should be such to exert lifting forces not more than 38 mm away from the outer face of the corner fittings (see figure 6).

6.4.2 Lifting devices shall be properly engaged.



NOTE — See footnotes to table 5.

Figure 5 — Lifting by means of a bottom lift sling

Dimensions in millimetres

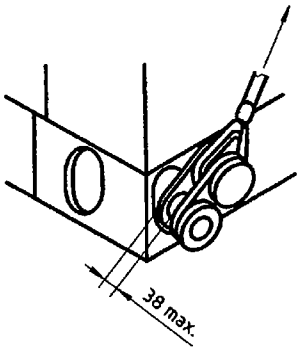


Figure 6 — Bottom sling attachment

6.4.3 The applicability of bottom lift slings is given in table 5.

6.4.4 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

6.4.5 For loaded containers, the lifting angle, α, shown in figure 5, shall not be less than the minimum values shown in table 6.

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Table 5 — Applicability of bottom lift slings

Key : ☐ Allowed ▒ Not allowed (or not applicable)

Empty container												Container type		ISO 6346	Loaded container										
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▒				▒			▒		▒	General purpose		GP,VH				▒				▒			▒		▒
													Open top		UT														
													Bulk: non-pressurized/box		BU	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)
1)	1)	1)	▒	1)	1)	1)	▒	1)	1)	▒	1)	▒	Thermal		RE,RT RS	1) 2)	1)	2)	1) 2)	▒	1) 2)	1) 2)	1) 2)	▒		1) 2)	▒	1) 2)	▒
													Tank for liquids and gases		TN,TD TG	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)
													Bulk: non-pressurized/hopper pressurized		BK	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)	2)
▒	▒	▒		▒	▒	▒		▒	▒		▒		Platform		PL	▒	▒	▒		▒	▒	▒		▒	▒		▒	
													Platform -based	complete and fixed ends	PF												
														fixed free standing posts	PF												
														complete and folding ends, erected condition	PC												
														folding free standing posts, erected condition	PC												
														complete and folding ends, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
														folding free standing posts, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
													Platform-based with complete superstructure and open-sided		PS												

1) Centre of gravity may be eccentric.
2) Centre of gravity may be mobile, e.g. liquid, bulk or hanging load.

Table 6 — Lifting angles for loaded containers

Container size designation	Lifting angle, α, min.
1AAA ; 1AA ; 1A ; 1AX	30°
1BBB ; 1BB ; 1B ; 1BX	37°
1CC ; 1C ; 1CX	45°
1D ; 1DX	60°

6.5 Side lift: Method 1

See figure 7.

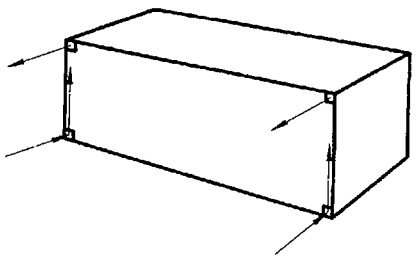

Figure 7 — Lifting by means of a side lift (method 1)

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6.5.1 The container is lifted by means of a side lift frame designed to lift a container by the two bottom corner fittings of one side and to restrain it by the two top corner fittings of the same side.

6.5.2 Lifting and restraining devices shall be properly engaged.

6.5.3 The applicability of side lift (method 1) is given in table 7.

Table 7 — Applicability of side lift (method 1)

Key : Allowed ▒ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container										
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▒				▒			▒		▒	General purpose		GP,VH	▒	▒	▒	▒	▒	▒	▒	▒			▒		▒
													Open top		UT	▒	▒	▒	▒	▒	▒	▒	▒					
													Bulk: non-pressurized/box		BU	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
1)	1)	1)	▒	1)	1)	1)	▒	1)	1)	▒	1)	▒	Thermal		RE,RT RS	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	▒	2)	▒
													Tank for liquids and gases		TN,TD TG	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
													Bulk: non-pressurized/hopper pressurized		BK	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform		PL	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
													Platform -based	complete and fixed ends	PF	▒	▒	▒	▒	▒	▒	▒	▒					
														fixed free standing posts	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
														complete and folding ends, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒					
														folding free standing posts, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
													Platform-based with complete superstructure and open-sided		PS	▒	▒	▒	▒	▒	▒	▒	▒					

1) Centre of gravity may be eccentric.
2) Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

6.6 Side lift: Method 2

See figure 8.

6.6.1 The container is lifted by means of a side lift frame designed to lift a container by the two top corner fittings of one side and to take the reaction forces on the bottom corner fittings of the same side or on suitable corner post areas above those corner fittings (see figure 9).

6.6.2 Lifting devices shall be properly engaged.

6.6.3 The applicability of side lift (method 2) is given in table 8.

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Table 8 — Applicability of side lift (method 2)

Key : ☐ Allowed ▒ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▒				▒			▒		▒	General purpose		GP,VH	▒	▒	▒	▒	▒	▒	▒	▒			▒		▒
													Open top		UT	▒	▒	▒	▒	▒	▒	▒	▒					
													Bulk: non-pressurized/box		BU	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
1)	1)	1)	▒	1)	1)	1)	▒	1)	1)	▒	1)	▒	Thermal		RE,RT RS	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	▒	2)	▒
													Tank for liquids and gases		TN,TD TG	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
													Bulk: non-pressurized/hopper pressurized		BK	▒	▒	▒	▒	▒	▒	▒	▒	2)	2)	2)	2)	2)
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform		PL	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
													Platform -based	complete and fixed ends	PF	▒	▒	▒	▒	▒	▒	▒	▒					
														fixed free standing posts	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
														complete and folding ends, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒					
														folding free standing posts, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
													Platform-based with complete superstructure and open-sided		PS	▒	▒	▒	▒	▒	▒	▒	▒					

1) Centre of gravity may be eccentric.
2) Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

NOTE — When using this method, care should be taken to ensure that under dynamic conditions the container is not subjected to undue deflection or damage.

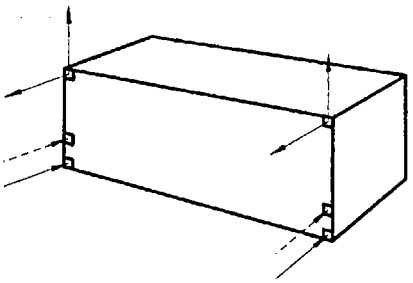
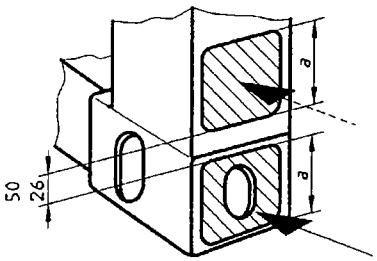


Figure 8 — Lifting by means of side lift (method 2)

Dimensions in millimetres



NOTE — Dimension *a* is shown to indicate that the two bearing areas shall have similar or equal heights

Figure 9 — Arrangement of bottom corner fittings and corner post areas

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6.7 Side lift: Method 3

See figure 10.

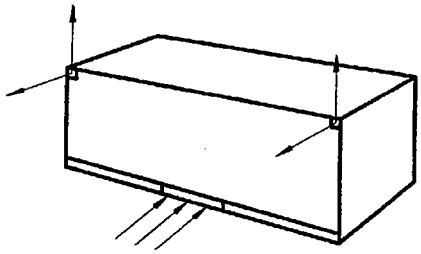

Figure 10 — Lifting by means of side lift (method 3)

6.7.1 The container is lifted by means of a side lift frame designed to lift a container by the two top corner fittings of one side and to take the reaction forces at the bottom side rail of the same side by means of a pad of sufficient size and located so as to prevent deformation and damage to the container.

WARNING 1: Under no circumstances shall the bearing pad be applied to the underside of the container side panel.

WARNING 2: Under no circumstances shall the lifting forces be applied to the underside of the bottom side rail.

6.7.2 Lifting devices shall be properly engaged.

6.7.3 The applicability of side lift (method 3) is given in table 9.

Table 9 — Applicability of side lift (method 3)

Key: ☐ Allowed ▩ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
			▩				▩			▩		▩	General purpose		GP,VH													
													Open top		UT													
													Bulk: non-pressurized/box		BU													
1)	1)	1)	▩	1)	1)	1)	▩	1)	1)	▩	1)	▩	Thermal		RE,RT RS													
▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	Tank for liquids and gases		TN,TD TG													
▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	Bulk: non-pressurized/hopper pressurized		BK													
▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	Platform		PL													
													Platform -based	complete and fixed ends	PF													
														fixed free standing posts	PF													
														complete and folding ends, erected condition	PC													
														folding free standing posts, erected condition	PC													
▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩		complete and folding ends, folded condition	PC													
▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩	▩		folding free standing posts, folded condition	PC													
													Platform-based with complete superstructure and open-sided		PS													

1) Centre of gravity may be eccentric.

NOTE — The use of piggybackers has never been recognized by ISO and may cause damage due to excessive stresses to containers operated in such a way.

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6.8 End lift: Method 1

See figure 11.

6.8.1 The container is lifted by means of an end lift frame designed to lift a container by the two bottom corner fittings of one end and to restrain it by the two top corner fittings of the same end.

6.8.2 Lifting and restraining devices shall be properly engaged.

6.8.3 The applicability of end lift (method 1) is given in table 10.

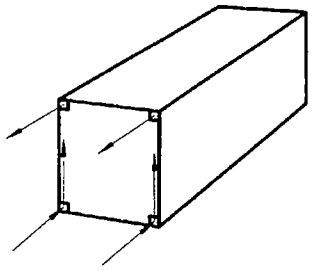

Figure 11 — Lifting by means of an end lift (method 1)

Table 10 — Applicability of end lift (method 1)

Key : ☐ Allowed ▒ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	General purpose		GP,VH	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Open top		UT	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Bulk: non-pressurized/box		BU	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Thermal		RE,RT RS	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Tank for liquids and gases		TN,TD TG	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Bulk: non-pressurized/hopper pressurized		BK	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform		PL	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform -based	complete and fixed ends	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		fixed free standing posts	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Platform-based with complete superstructure and open-sided		PS	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒

NOTE — When using this method, care should be taken to ensure that under dynamic conditions the container is not subjected to undue deflection or damage.

6.9 End lift: Method 2

See figure12.

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6.9.1 The container is lifted by means of an end lift frame designed to lift a container by the two top corner fittings of one end and to take the reaction forces on the bottom corner fittings of the same end or on suitable corner post areas above those corner fittings (see figure 13).

6.9.2 Lifting devices shall be properly engaged.

6.9.3 The applicability of end lift (method 2) is given in table 11.

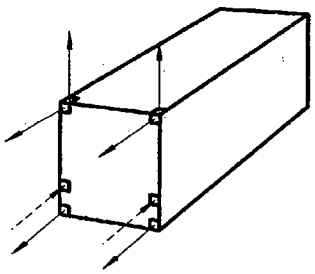
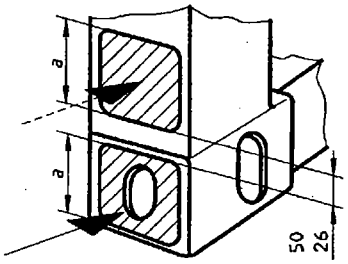


Figure 12 — Lifting by means of an end lift (method 2)

Dimensions in millimetres



NOTE — Dimension *a* is shown to indicate that the two bearing areas shall have similar or equal heights.

Figure 13 — Arrangement of bottom corner fittings and corner post areas

Table 11 — Applicability of end lift (method 2)

Key: ☐ Allowed ▒ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	General purpose		GP,VH	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Open top		UT	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Bulk: non-pressurized/box		BU	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Thermal		RE,RT RS	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Tank for liquids and gases		TN,TD TG	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Bulk: non-pressurized/hopper pressurized		BK	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform		PL	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	Platform -based	complete and fixed ends	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		fixed free standing posts	PF	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, erected condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		complete and folding ends, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒		folding free standing posts, folded condition	PC	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒
▒	▒	▒	▒	▒	▒	▒	▒	☐	☐	▒	☐	▒	Platform-based with complete superstructure and open-sided		PS	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒	▒

NOTE — When using this method, care should be taken to ensure that under dynamic conditions the container is not subjected to undue deflection or damage.

6.10 Fork lifts

See figure 14.

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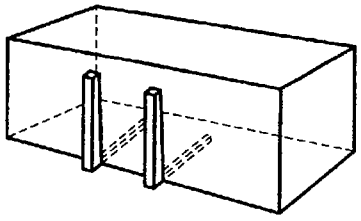

Figure 14 — Lifting by means of forks

6.10.1 The container, if provided with fork-lift pockets as specified in ISO 1496-1, is lifted by means of forks.

WARNING: Under no circumstances shall containers with or without fork-lift pockets be lifted by forks under the base.

6.10.2 Forks should ideally extend the whole width of the container, but under no circumstances should they extend less than 1825 mm into the fork-lift pockets.

When 1CC, 1C and 1CX containers are fitted with a second (inner) set of fork-lift pockets, these pockets shall be used for empty handling only.

6.10.3 The applicability of fork lifts is given in table 12.

Table 12 — Applicability of fork lifts

Key: ☐ Allowed ▒ Not allowed (or not applicable)

Empty container													Container type		ISO 6346	Loaded container											
AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
													General purpose		GP,VH													
													Open top		UT													
													Bulk: non-pressurized/box		BU									2)	2)	2)	2)	2)
								1)	1)		1)		Thermal		RE,RT RS									2)	2)		2)	
													Tank for liquids and gases		TN,TD TG													
													Bulk: non-pressurized/hopper pressurized		BK													
													Platform		PL													
													Platform -based	complete and fixed ends	PF													
														fixed free standing posts	PF													
														complete and folding ends, erected condition	PC													
														folding free standing posts, erected condition	PC													
														complete and folding ends, folded condition	PC													
														folding free standing posts, folded condition	PC													
													Platform-based with complete superstructure and open-sided		PF													

1) Centre of gravity may be eccentric.
2) Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

7 Landing and supporting

7.1 To avoid damage,containers shall be landed carefully.

Containers shall not be dragged or pushed over any surface.

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7.2 On the ground, a firm, flat, drained surface shall be provided, clear of obstructions and projections. On the ground, containers shall be supported by their four bottom corner fittings only.

7.3 On carrying vehicles, containers shall be supported by their corner fittings only, or by the intermediate load transferring areas in the base structure only.

8 Stacking on the ground

8.1 When stacking containers, adequate contact between the top and bottom corner fittings should be ensured.

8.2 Special consideration should be given to the wind conditions which might lead to sliding and tipping of containers; larger and empty containers are more likely to be affected by wind. The critical wind speed is lower for multiple rows than for a single row (stack). Wind effects can be reduced by

- limiting the stacking height;

- block stowage;

- securing of containers to the ground;

- block stowage with loaded containers in the uppermost tier;

- use of stacking fittings or lashings, in particular in exposed rows.

Containers should be stacked so that the longitudinal axis is in line with the predominant wind direction. In the case of a storm warning, the containers at the corners of the block should be secured. The need for such countermeasures should be considered at wind speeds in excess of 15 m/s [1].

For a block of multiple rows of similar containers and for a given wind speed, displacement is likely to occur in the sequence shown in figure 15.

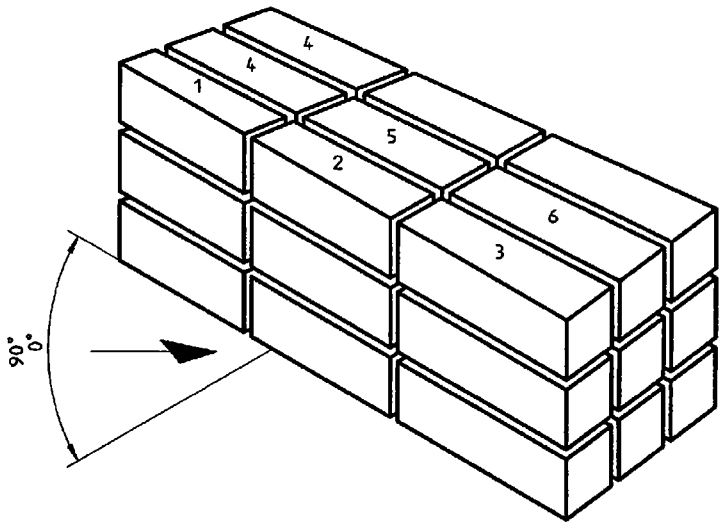

Figure 15 — Wind effects on block stowage of containers

9 Securing during transport

9.1 General

9.1.1 In order to prevent any movement of containers relative to the ship or the carrying vehicle, which might lead to injury to personnel or damage, the containers shall be secured during transport, except as envisaged in 9.3.2.

[1] 15 m/s = 29 knot = Beaufort 7.

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9.1.2 Containers should be restrained from horizontal movement by their bottom fittings as the main strength of a container is derived through its bottom frame.

9.1.3 Methods used for securing containers to a vehicle or ship should ensure that the strength of containers and their ability to withstand securing forces applied are not exceeded.

9.1.4 The correct positioning of all securing devices should be checked before placing containers onto or removing them from ships or carrying vehicles.

9.1.5 The correct application of such devices should be checked before and during transport.

9.2 Securing on board a ship

9.2.1 Forces on board a ship

On board a ship at sea, containers are subjected to forces arising from ship motion, wind and boarding seas (see figure 17).

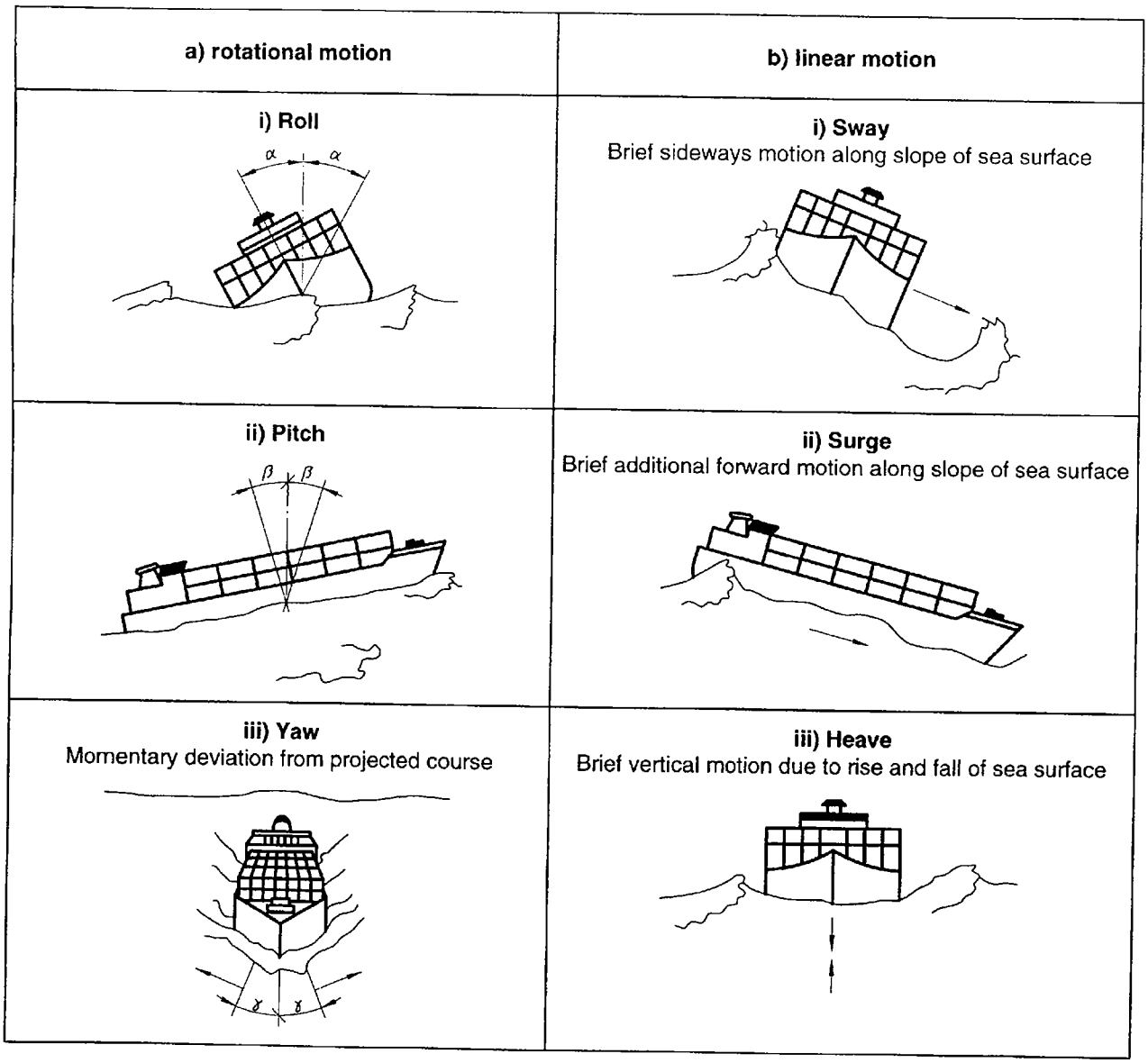

Figure 16 — Examples of motions of a ship at sea

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9.2.2 Effects on container

9.2.2.1 Racking

Racking is the deformation of the container end or side frames as a result of transverse component static and dynamic forces applied to it.

The principal racking force arises when a stack of containers is subjected to rolling which results in transverse forces being borne by the lower containers in the stack; wind can add to these forces.

Should the forces anticipated from this cause exceed the container racking strength, the affected containers shall be given support; this is usually only necessary with transverse racking (see figure 17).

9.2.2.2 Tipping

Tipping is the tendency for a container or stack to pivot on a bottom edge when subjected to a transverse force such as by rolling or wind; a vertical securing element is required to resist it (see figure 17).

9.2.2.3 Sliding

Sliding is the horizontal movement of a container relative to its bearing surface; it can be prevented by the use of positioning fittings, although small movements within their tolerances may still occur (see figure 17).

9.2.2.4 Collapse

Collapse is the failure of a corner post resulting from excessive compressive load; the force applied by securing devices may increase compression load (see figure 18).

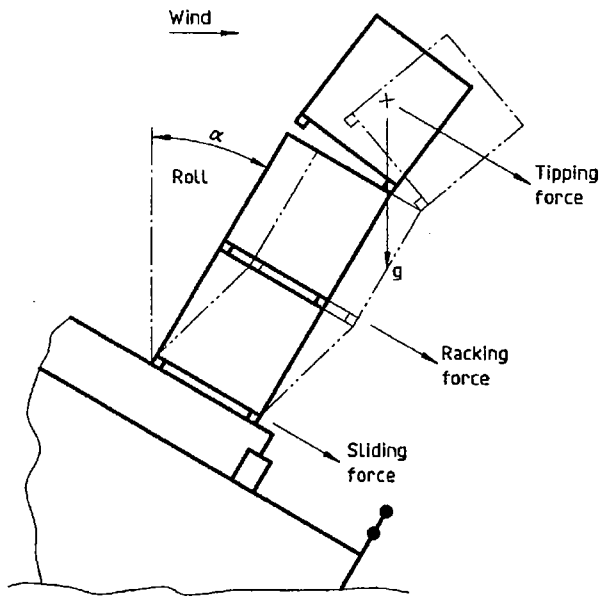

Figure 17 — Racking, tipping and sliding

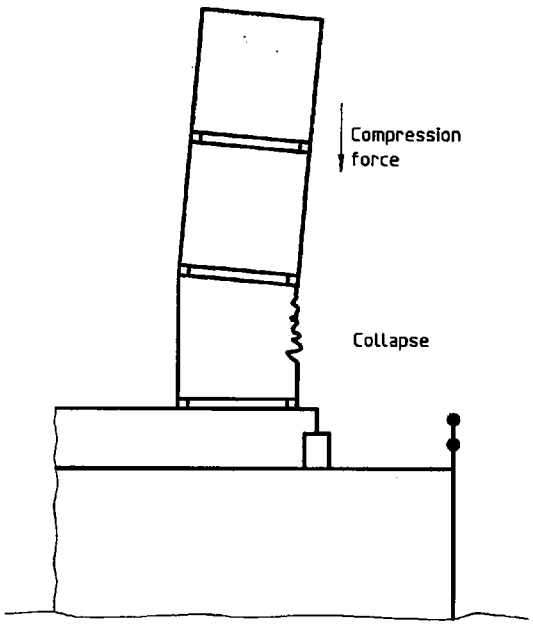

Figure 18 — Compression and collapse

9.2.2.5 Structural failure

Structural failure is the separation or permanent deformation of the structural components of a container due to excessive force. It can be caused by improper use of securing devices or excess compression force, or loose cargo.

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9.2.3 Ship design, stowage and securing of containers

9.2.3.1 Ships intended to carry containers are provided with structures, and fixed and portable fittings for use below and/or above deck, which, when properly used in conjunction with planned stowage, take the factors described in 9.2.1 and 9.2.2 into consideration.

9.2.3.2 A cellular container ship is fitted with vertical guides designed to position and hold containers in vertical stacks below and sometimes above deck. For examples of on-deck cell guides, see figure 19.

NOTE 1: A cell is the space occupied by one container when stowed within the a.m. vertical guide.
NOTE 2: Stowage of 20 ft containers in 40 ft cell guides may cause damage due to unacceptable relevant eccentricities.

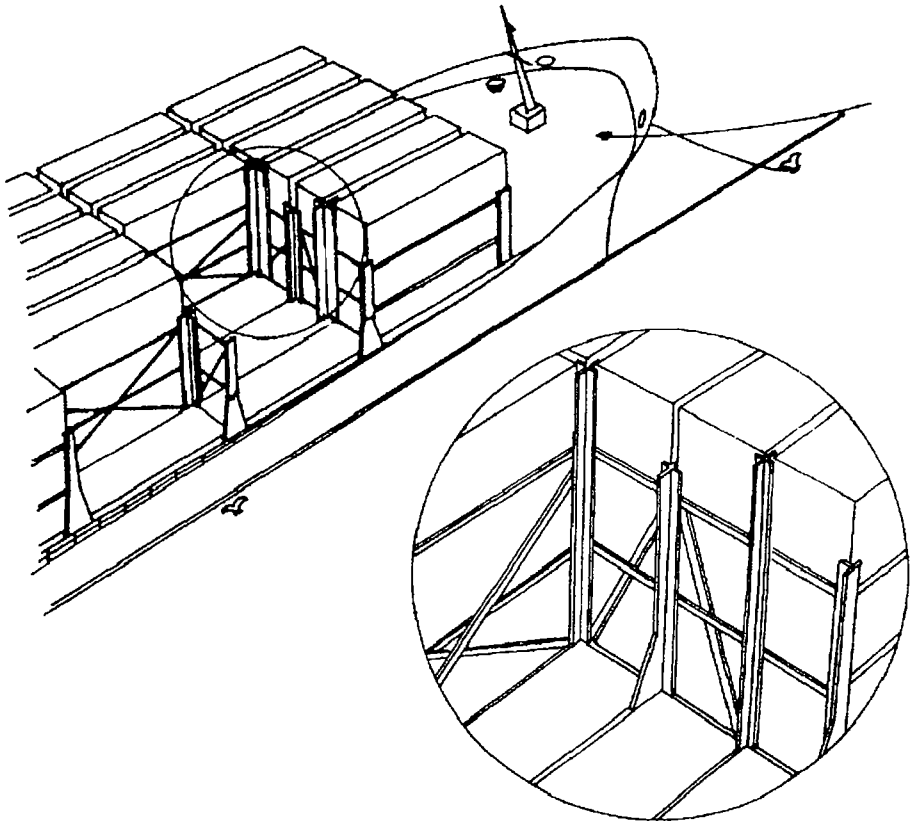

Figure 19 — Example of on-deck cell guides

9.2.3.3 Arrangements to secure containers on deck are based on either of the following two concepts:

- providing restraint of sufficient strength to secure all containers when loaded to their permitted gross mass without exceeding the container strength; or

- providing securing equipment of a certain strength and then selecting and stowing containers, the resulting mass of which does not induce forces exceeding the nominal strength of the containers and or the securing devices.

9.2.3.4 The methods for securing containers below deck in non-cellular container ships are similar to those defined in 9.2.3.3 for use on deck, particularly those to prevent sliding.

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9.2.4 Types of securing and lashing equipment

9.2.4.1 General

For examples of container-carrying ships, see figure 20.

When cellular guides are not provided, various basic types of equipment are used such as

- buttresses;

- deck sockets (see figure 21 and figure 22);

- rods and tensioning devices, e.g. turnbuckles (see figure 21 and figure 22);

- chain and wire and tensioning devices, e.g. turnbuckles (see figure 21 and figure 22);

- twistlocks (see figure 21 and figure 22);

- pinlocks (see figure 21 and figure 22).

Combinations of these are frequently used.

NOTE — Function, dimensions, strength requirements and testing of securing and lashing equipment will be described in future amendments.

9.2.4.2 Buttresses

Buttresses are permanent structures rising above the deck of the ship. At appropriate heights, frames can be slotted to secure a tier of containers, and to provide a bed for the subsequent tier.

9.2.4.3 Rods

Rods are used both to hold containers down against tipping and/or to provide support against racking forces. (See figure 21 and figure 22.)

They are used in conjuction with a suitable variety of stacking cones, which both locate containers and secure them against sliding. Elasticity of rods is low and the correct tension should be applied to avoid over-tensioning and possible structural failure of the container, the fittings or the attachment points on the vehicle or ship. (See figure 21 and figure 22.)

9.2.4.4 Chains and wires

Lashing chains and wires are used like rods but only for relatively low stack weights or for single-tier stowage because of their relatively low allowable working loads.

9.2.4.5 Twistlocks

Twistlocks locate and secure containers to each other, within a stack, or to the transport mode. They act through the corner fittings. (See figure 21 and figure 22).

It is important to be able to identify on a twistlock, even in poor visibility, which is the correct way up or whether or not it is locked. All twistlocks in use on board a ship shall lock by turning in the same direction.

9.2.4.6 Pinlocks

Pinlocks locate and secure containers to the deck or each other, hence they act against sliding and tipping. They provide no support against racking forces. They should only be used for more than one tier when selection and stowage of containers ensure that the racking strength of the lower container will not be exceeded. They can be used in combination with other securing systems, i.e. rods or wires. (See figure 21 and figure 22.)

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9.2.4.7 Stacking cones

Single- or double-stacking cones are used to ensure that containers are located and restrained from sliding in the horizontal plane. (See figure 21 and figure 22.)

9.2.4.8 Bridge fittings

Bridge fittings are designed to hold adjacent containers together by the upper corner fittings. (See figure 21 and figure 22.)

9.2.4.9 Tensioning devices

Varying tensioning devices used include

- turnbuckles;
- hydraulic or pneumatic devices;
- overcentre tensioners;
- lever arms;
- lever hooks and chains.

Turnbuckles are usually necessary to provide sufficient strength to support containers fully against racking forces. (See figure 21 and figure 22).

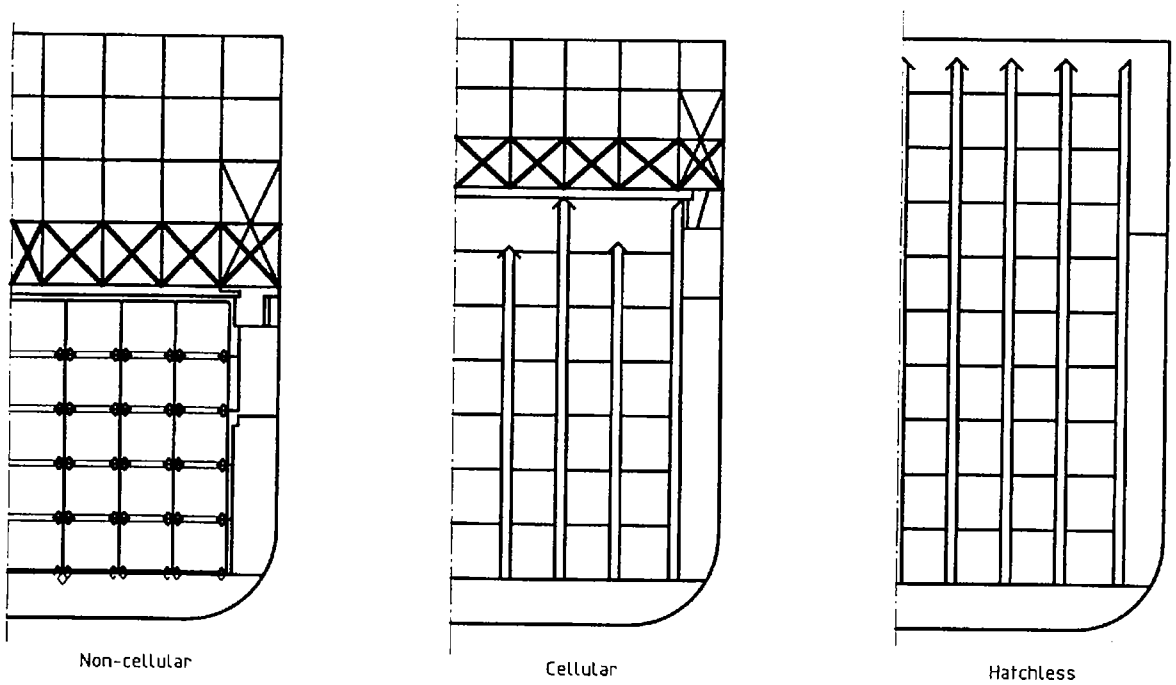

Figure 20 — Examples of container-carrying ships

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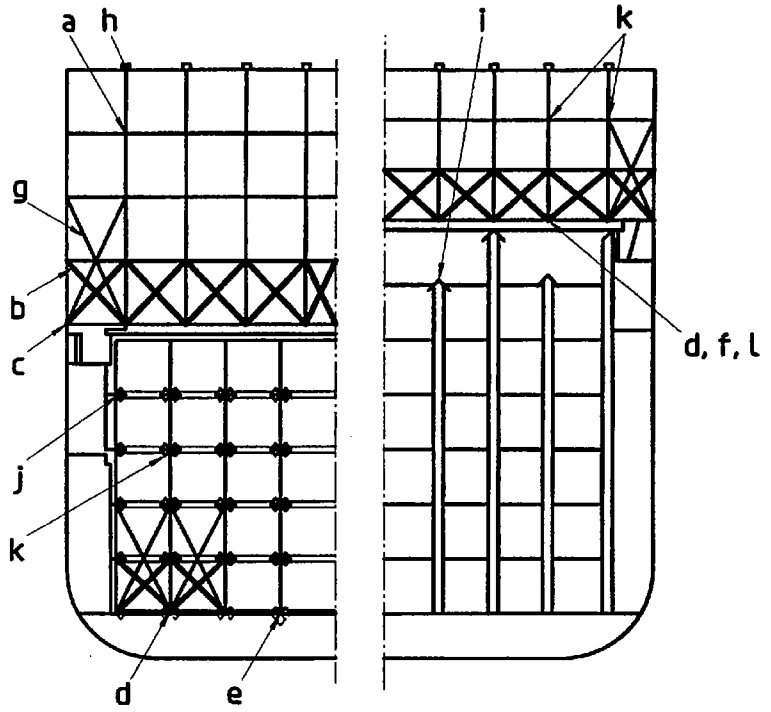

Figure 21 — Example of typical securing, lashing and handling equipment (see figure 22)

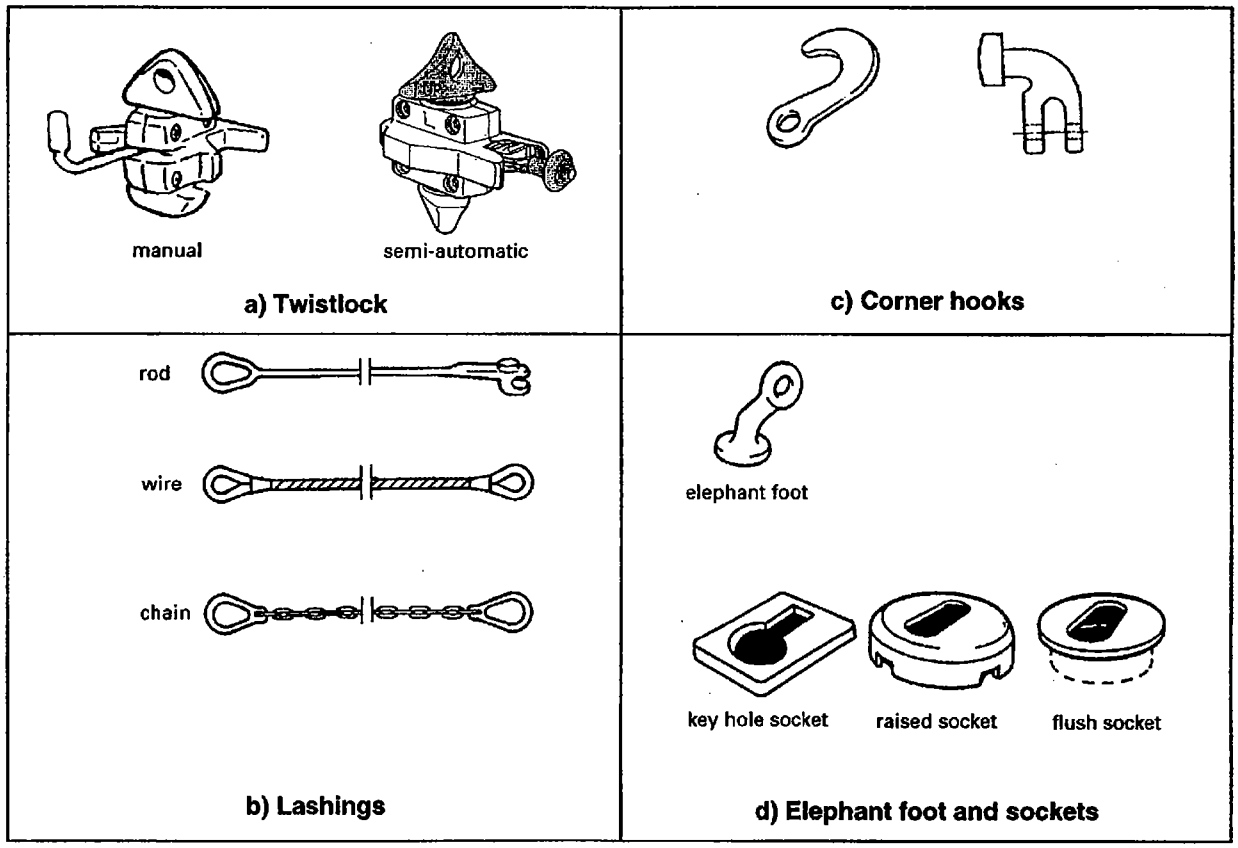

Figure 22 — Examples of typical securing, lashing and handling equipment

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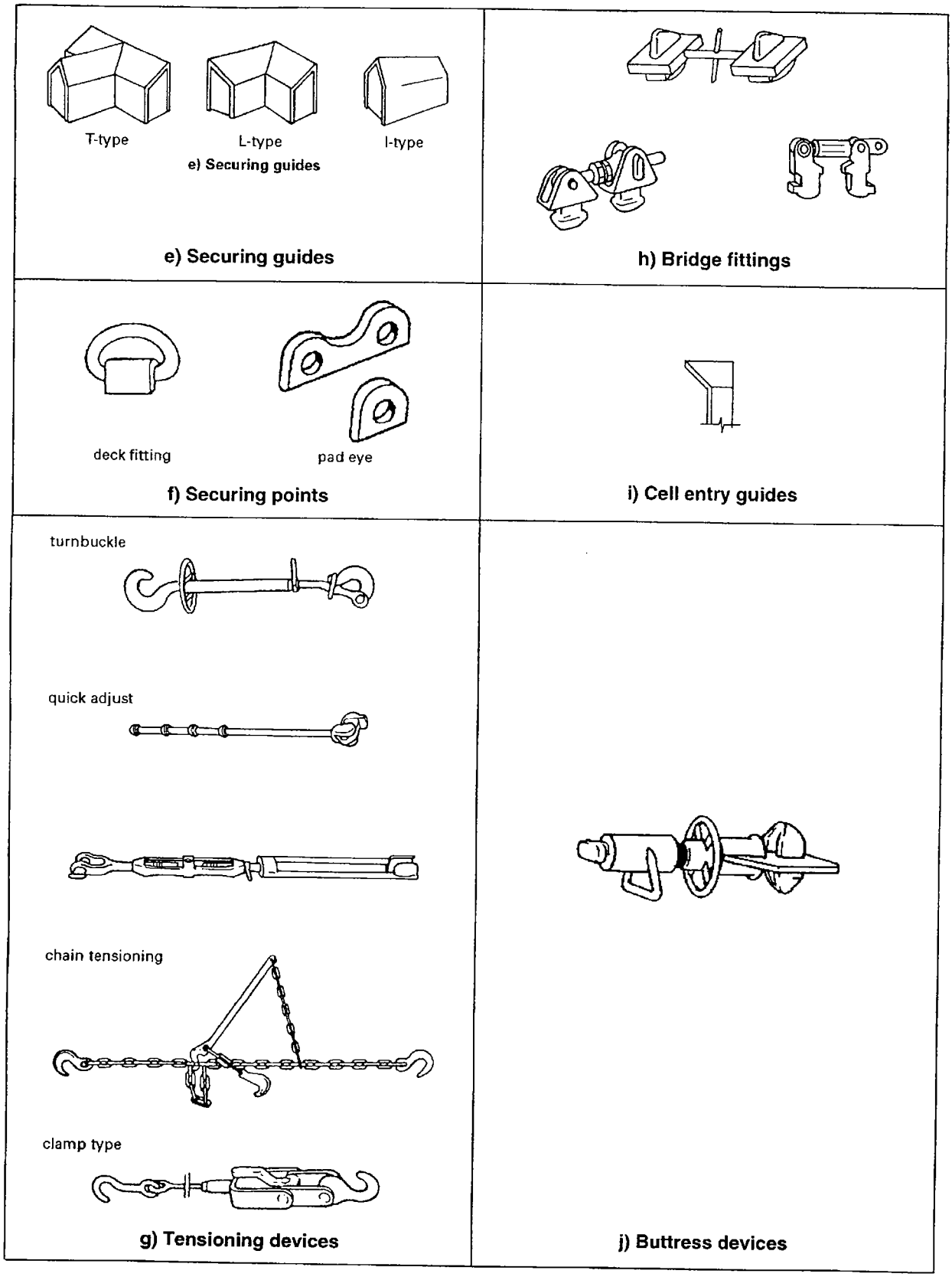

Figure 22 — Examples of typical securing, lashing and handling equipment (*continued*)

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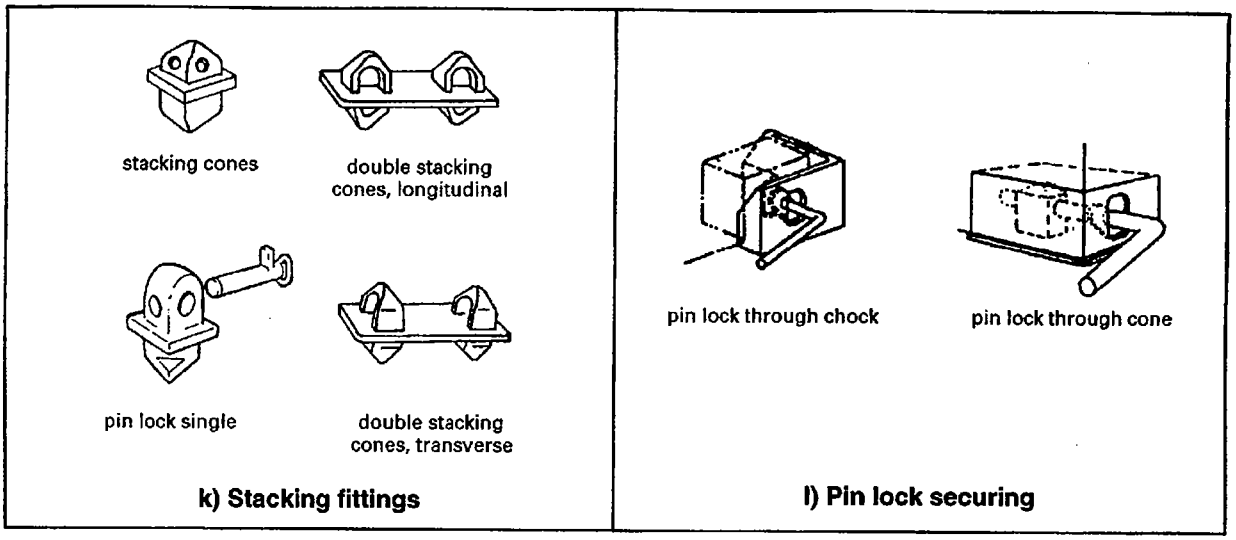

Figure 22 — Examples of typical securing, lashing and handling equipment (*concluded*)

9.3 Securing of container for road and rail transport

9.3.1 General

When being transported by road or rail, containers are subjected to forces and vibrations arising from braking, shunting, cornering, acceleration, road surface and wind.

Securing methods should take these factors and those factors identified in 9.1 into account.

For road and rail transport, the container shall not project beyond the front or rear of the carrying vehicle.

9.3.2 Terminal trailer operation

Terminal operation in this context is container movement on terminal trailers at low speed over short distances within designated areas.

For such an operation, tie-down devices are not required but the container shall be correctly located on the trailer and prevented from moving horizontally; that is generally achieved by gathering guides or similar devices (see figure 23).

9.3.3 Public road operation

To ensure safe operation over public roads, the container shall be supported on the road vehicle by all four bottom corner fittings only or by the intermediate load transfer areas in the base structure only. The container shall also be secured to the road vehicle by all four bottom corner fittings (see figure 24).

The most usual method of securement is by twistlocks (see figure 25), which may be either fixed or retractable and, in some cases, adjustable in height. Alternative methods are securing cones (see figure 26) or securing guides (see figure 27) to give location and to resist horizontal forces with pins through the side or end apertures to resist upward vertical forces.

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Dimensions in millimetres

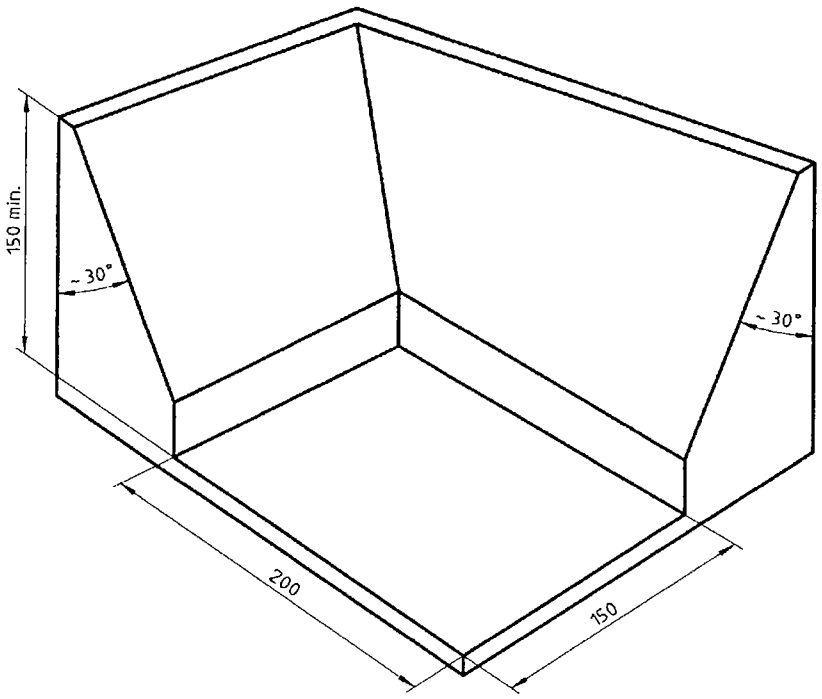

Figure 23 — Example of gathering guide

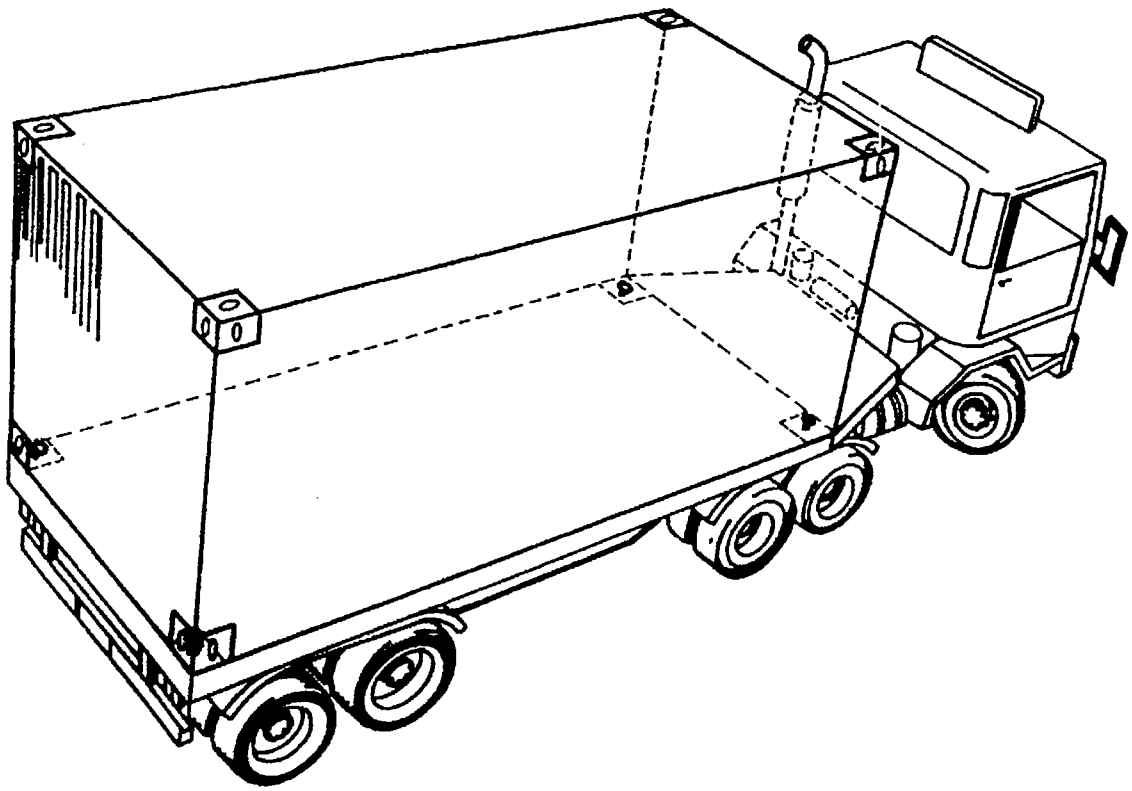

Figure 24 — Tractor/semi-trailer with twistlock chassis

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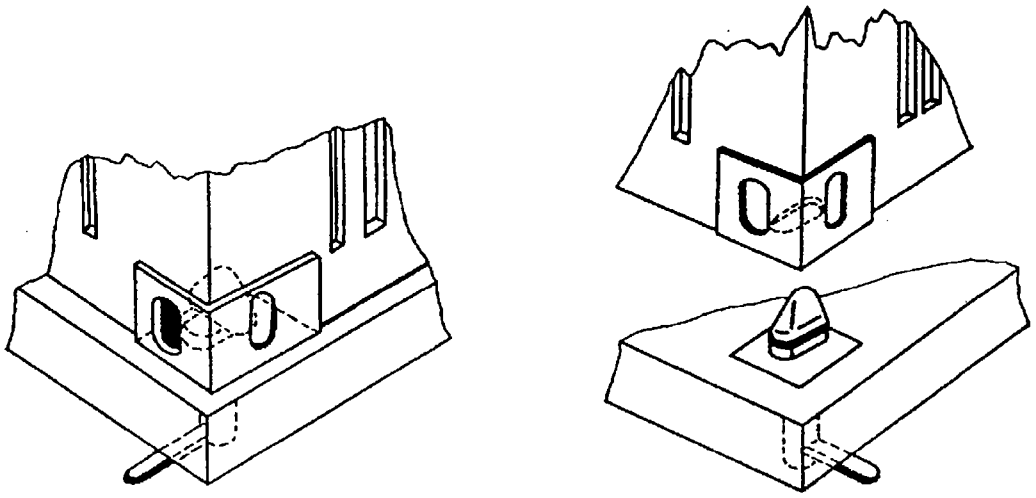
To ensure safe operation

- the position of the securing devices shall be readily apparent;
- any intermediate securing devices shall be retracted or removed;
- before the vehicle is moved, the securing of the container shall be checked;
- before the container is lifted, any locking device shall be released.



a) Locked

b) Unlocked

Figure 25 — Twistlock (retractable)

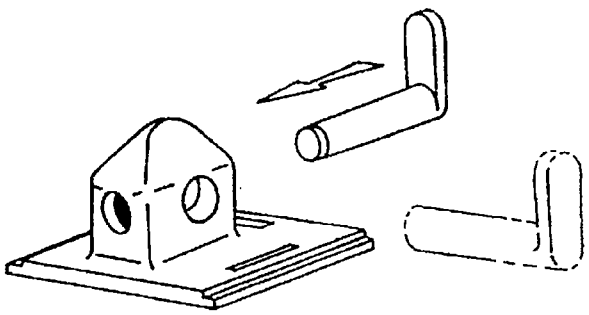


Figure 26 — Securing cone with pinlock

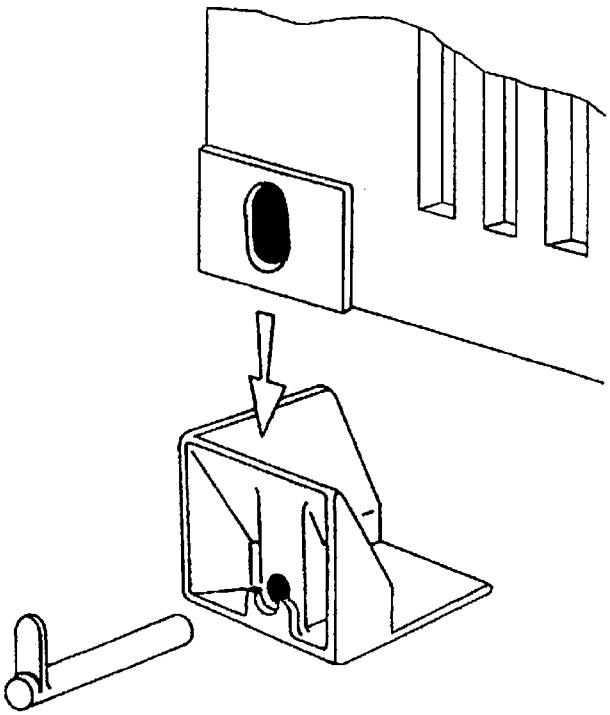


Figure 27 — Securing guide with pinlock

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9.3.4 Rail vehicle operation

To ensure safe operation by rail, the container shall be supported on the rail vehicle by all four bottom corner fittings only or by the intermediate load transfer areas in the base structure only. The container should also be secured to the rail vehicle by all four bottom corner fittings either by twistlocks or by other means which will ensure compliance with 9.1. An example of a securing fitting used for transport by rail is shown in figure 28.

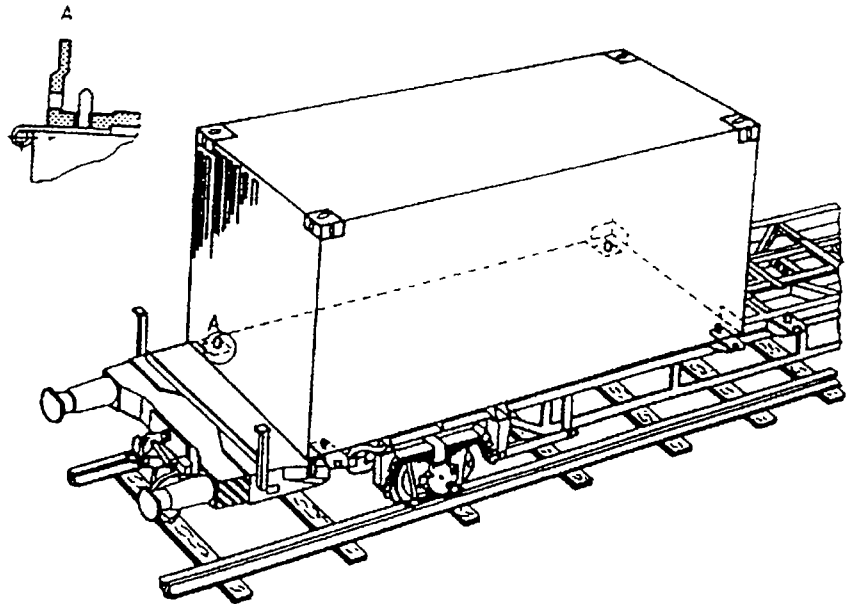
To ensure safe operation

- the position of the securing devices shall be readily apparent;

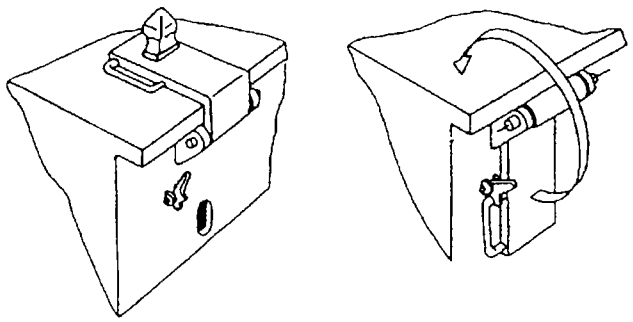
- any intermediate securing devices shall be retracted or removed;

- before the vehicle is moved, the securing of the container shall be checked;

- before the container is lifted, any locking device shall be released.



a) Overall view of a typical railway wagon



b) Detail of securing fitting

Figure 28 — Example of railway wagon with securing fittings in common use

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Annex A
(informative)

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Descriptors: containers, freight containers, handling, hoisting, fastenings, specifications, safety requirements, safety measures, lashing devices.

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