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**Series 1 freight containers —  
Specification and testing —**

Part 4:

**Non-pressurized containers for dry  
bulk**

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at [www.iso.org/patents](http://www.iso.org/patents). ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 2, *Specific purpose containers*.

This second edition cancels and replaces the first edition (ISO 1496-4:1991), which has been technically revised. It also incorporates the Amendment(s) ISO 1496-4:1991/Amd 1:1994.

The main changes are as follows:

- ensure that the main structural tests are consistent with those described in ISO 1496-1;
- introduce testing for box-type bulk containers with bottom discharge;
- reflect the forces on end and side walls when the freight container is being discharged by tipping or rotating;
- ensure that the freight container can operate correctly and safely when fully packed with a bulk cargo.

A list of all parts in the ISO 1496 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

This document replaces the first edition published in 1991 and brings it into line with other parts of this document including Part 1 which provides information on those tests that are consistent for all freight containers.

Freight containers built to transport non-pressurised bulk cargoes are considered to be special and therefore not produced in large numbers, and often, freight containers built to meet the requirements of ISO 1496-1 are used in their place. However, when the bulk cargo is classified as a dangerous cargo as identified in the United Nations' Recommendations on the Transport of Dangerous Goods - Model Regulations,<sup>[2]</sup> such cargoes must be transported in a bulk container as described in [6.8](#) of those regulations.

A freight container built and tested according to this document are deemed to meet with the requirements for a BK1 or a BK2 bulk container as described in the Recommendations on the transport of Dangerous Goods – Model Regulations.<sup>[2]</sup> To fully meet these requirements the container will need to be:

- rendered siftproof, either by design or by the addition of a siftproof liner,
- fitted with suitable securing means for service equipment required for packing and unpacking.

Containers to be used for the carriage of dangerous goods can be subject to additional international and national requirements as applied by competent authorities.

Freight containers constructed in accordance with ISO 1496-1 may be used for the transport certain non-packed dry bulk solids only if the end walls are strengthened to meet the test requirements of this document and care be taken to ensure that the design loadings are shall not exceeded under operating conditions.

Bulk cargoes that comprise of large particles that have a density greater than 1 200 kg/m<sup>3</sup> and/or are angular can damage the floor structure if dropped from the height of the roof or higher. Such cargoes require additional strengthening to the floor and/or base structure.

The forces involved with packing dry bulk containers are associated with the container being fully horizontal or inclined to a certain degree as stated in the IMO / ILO / UN ECE Code of Practice for packing cargo transport units (CTU Code).<sup>[3]</sup> Containers tested to this document are not designed for packing with the rear end significantly inclined or at 90° to the horizontal.

The marking requirements for these containers need to be in accordance with the principles embodied in ISO 6346.

# Series 1 freight containers — Specification and testing —

## Part 4: Non-pressurized containers for dry bulk

### 1 Scope

This document specifies the basic specifications and testing requirements for series 1 freight containers of the dry bulk container non-pressurized type which are suitable for international exchange and for conveyance by road, rail and sea, including interchange between these forms of transport.

As the density and flow characteristics of dry bulk cargoes vary widely, containers conforming to this document are not expected to be suitable for the carriage of all such cargoes. Therefore, except where otherwise stated, the requirements of this document are minimum requirements.

The container types covered by this document are given in [Table 1](#).

This document does not apply to BK3 flexible bulk containers.

### 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.

ISO 668:2020, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 830<sup>1)</sup>, *Freight containers — Vocabulary*

ISO 1161, *Series 1 freight containers — Corner and intermediate fittings — Specifications*

ISO 1496-1:2013/Amd 1:2016, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purposes*

ISO 6346, *Freight containers — Coding, identification and marking*

ISO 17712, *Freight containers — Mechanical seals*

EN 13374, *Temporary edge protection*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 830 and the following apply.

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

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

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1) Under preparation. Stage at the time of publication: ISO/DIS 830:2023.

**3.1**  
**dry bulk cargo - non-pressurised, box type**  
container for the transport of dry bulk solids, capable of withstanding the loads resulting from filling, transport motions and discharging of non-packaged dry bulk solids, having filling and discharge apertures and fittings and complying with the requirements of this document

Note 1 to entry: Dry bulk cargo is also known as dry bulk container.

Note 2 to entry: Dry bulk containers are referred to as containers in this document.

**3.1.1**  
**box type 1**  
dry bulk non-pressurized container for tipping discharge having a parallelepiped cargo space and a door opening at least at one end

Note 1 to entry: It may also be used as a general-purpose freight container.

**3.1.2**  
**box type 2**  
dry bulk non-pressurized container for tipping discharge having a parallelepiped cargo space with a door opening in either ends or fitted with one or more access hatches

Note 1 to entry: It cannot be used as a general-purpose freight container.

**3.1.3**  
**hopper type**  
dry bulk non-pressurized container for horizontal or vertical discharge without tipping and having no door opening

Note 1 to entry: It may not be used as a general-purpose freight container.

**3.1.4**  
**bottom discharge type**  
dry bulk non-pressurised container for vertical discharge having no door opening

Note 1 to entry: It may not be used as a general-purpose freight container.

**3.2**  
**dry bulk solids**  
assemblies of separate solid particles normally substantially in contact with one another which are, or which may be rendered, capable of fluid flow

**3.3**  
**openings for cargo loading**  
openings provided in a container for the filling of dry bulk solids

**3.4**  
**openings for cargo discharging**  
openings provided in a container for the discharge of dry bulk solids

**3.5**  
**interface for external fumigation equipment**  
point(s) at which the connection between the container and any external fumigation equipment is made

**3.6**  
**dangerous goods**  
substances classified as dangerous by the United Nations committee of experts on the transport of dangerous goods or by the *competent authority* (3.7)

**3.7****competent authority**

authority or authorities designated as such in each country or in each specified case by the governments concerned, for the approval of dry bulk containers

**3.8****bulk density**

mass per unit volume of a dry bulk solid measured when the dry bulk solid is in a loose or non-compacted condition

**3.9****cargo space**

space bounded by the container walls or shell when all apertures are closed

**3.10****access hatch**

personnel access hatch set into a wall or the roof

**3.11****BK1**

sheeted and open top bulk container with rigid bottom (including hopper-type bottom), side and end walls and a non-rigid covering

[SOURCE: Recommendations on the Transport of Dangerous Goods - Model Regulations, United Nations<sup>[2]</sup>]

**3.12****BK2**

totally closed bulk container with a rigid roof, sidewalls, end and floor walls (including hopper-type bottom)

Note 1 to entry: BK2 includes bulk containers with an opening roof, side or end wall that can be closed during transport. Closed bulk containers may be equipped with openings to allow for the exchange of vapour and gases with air and which prevent under normal conditions of transport the release of solid contents as well as the penetration of rain and splash water.

[SOURCE: Recommendations on the Transport of Dangerous Goods - Model Regulations, United Nations<sup>[2]</sup>]

**3.13****BK3**

flexible bulk container with a capacity not exceeding 15 m<sup>3</sup>

Note 1 to entry: BK3 includes liners, attached handling devices and service equipment.

[SOURCE: Recommendations on the Transport of Dangerous Goods - Model Regulations, United Nations<sup>[2]</sup>]

**3.14****siftproof**

impermeable to dry contents including fine solid materials produced during transport

Note 1 to entry: Where a liner is used to make the container sift proof, it shall be made of a suitable material. The strength of the material used for, and the construction of, the liner shall be appropriate to the capacity of the container and its intended use. Joins made in the liner shall withstand pressures and impacts liable to occur under normal conditions of handling and transport.

Note 2 to entry: For ventilated bulk containers, any liner shall not impair the operation of ventilating devices.

[SOURCE: Recommendations on the Transport of Dangerous Goods - Model Regulations, United Nations<sup>[2]</sup>]

**3.15**

**arching**

tendency of some solids when transported in bulk to form an arch of material clinging to the roof of a bulk container in the shape of an arch especially during discharge

Note 1 to entry: The process is likely to cause instability in the cargo.

**3.16**

**bridging**

tendency of some solids when transported in bulk to form a bridge of material clinging to a bulk container as if a bridge especially during discharge

Note 1 to entry: The process is likely to cause instability in the cargo.

**3.17**

**rat-holing**

tendency of flows of air or other gases to form enclosed channels through the substance especially during discharge

Note 1 to entry: The process can cause instability in the cargo.

**3.18**

**surge**

tendency of substances to start moving suddenly especially during discharge

Note 1 to entry: The process can cause instability in the load.

## **4 Dimensions and ratings**

### **4.1 External dimensions**

The overall external dimensions and tolerances of the freight containers covered by this document shall be in accordance with ISO 668. No part of the container shall project beyond these specified overall external dimensions.

### **4.2 Internal dimensions**

Internal dimensions of containers shall be as large as possible but, in any case, box type 1 containers with full access rear doors shall have a minimum internal width of 2 330 mm. This dimension applies when measured at a temperature of 20 °C.

Measurements taken at other temperatures shall be adjusted accordingly.

### **4.3 Ratings**

The values of the rating  $R$ , being the maximum gross mass of the container, shall be those specified in ISO 668.

## 5 Design requirements

### 5.1 General

**Table 1 — Container types (in accordance with ISO 6346:2022, Table E.1)**

Code	Type designation	Type group code
B	Dry bulk cargo - non-pressurised, box type	BU
N	Pressurised and non-pressurised tank container (dry)	
	Hopper type	NH
	Non-pressurised tank	NN

This document includes all container types shown in [Table 1](#) and shall be capable of fulfilling the following requirements.

**5.1.1** The strength requirements for containers are given in ISO 1496-1 (these requirements are applicable to all bulk containers except where otherwise stated). They apply to containers as complete units, except as described in [6.1](#).

**5.1.2** The strength requirements for corner fittings (see also [5.2](#)) shall be in accordance with ISO 1161.

**5.1.3** As the effects of loads encountered under any dynamic operating condition should only approach, but not exceed, the effects of the corresponding test loads, it is implicit that the capabilities of containers indicated in ISO 1496-1 and demonstrated by those additional tests described in [Clause 6](#) shall not be exceeded in any mode of operation.

**5.1.4** Any closure in a container which, if unsecured, can lead to an unsafe situation, shall be provided with an adequate securing system. Each securing system shall have, in so far as is practicable, an external indication of the positive securing of that closure in the appropriate operating position.

In particular, doors and closures for openings for cargo loading or openings for cargo discharging shall be capable of being securely fastened in the open or closed position.

The closures of bulk containers shall be such that they remain effective during testing and operations and dynamic movement of the bulk solid due to its bulk density, drop height, the friability of the substance or to arching, bridging, rat-holing, surge or any other similar effect.

**5.1.5** Any removable roof or roof section (not including hinged hatches) shall be fitted with locking devices such that an observer at ground level can check (when the container is on a rail or highway carrying vehicle) that the roof is secured.

**5.1.6** All closed containers and all open containers fitted with covers which were designed for them shall be weatherproof as required by test no. 12 (see [6.1.5.12](#)).

**5.1.7** Bulk containers shall be capable of being secured to the satisfaction of customs authorities, for example, in order to conform to the TIR convention.<sup>[5]</sup>

### 5.2 Corner fittings

All containers shall be equipped with top and bottom corner fittings according to ISO 1161. 1EEE and 1EE units shall also have intermediate fittings in the 1AAA/1AA/1A position according to ISO 668.

The upper faces of the top corner fittings shall protrude above the top of the container by a minimum of 6 mm. The “top of the container” means the highest level of the top part of the container, e.g. the level of the top of the closure of a cargo-loading opening.

However, if reinforced zones or doubler plates are provided to afford protection to the roof in the vicinity of the top corner fittings, such plates and their securements shall not protrude above the upper faces of the top corner fittings. These plates shall not extend more than 750 mm from either end of the container but may extend the full width.

### 5.3 Base structure

**5.3.1** All containers shall be capable of being supported by their bottom corner fittings only.

**5.3.2** All containers, other than 1D and 1DX as defined in ISO 668, shall be capable of being supported only by load-transfer areas in their base structure.

**5.3.2.1** Consequently, these containers shall have end transverse members and sufficient intermediate load-transfer areas (or a flat underside) of sufficient strength to permit vertical load-transfer to or from the longitudinal member of a carrying vehicle. Such longitudinal members are assumed to lie within the two 375 mm wide zones defined by the broken lines in ISO 668:2020, Figure B.1.

**5.3.2.2** The lower faces of the load-transfer areas, including those of the end transverse members, shall be in one plane located  $12,5 \text{ mm} \begin{matrix} +5 \\ -1,5 \end{matrix}$  mm above the plane of the lower faces of the bottom corner fittings of the container (base plane).

Apart from the bottom corner fittings and bottom side rail, no part of the container shall project below this plane. However, doubler plates may be provided in the vicinity of the bottom corner fittings to afford protection to the understructure.

Such plates shall not extend more than 550 mm from the outer end and 470 mm from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm above the base plane of the container.

**5.3.2.3** The transfer of load between the underside of the bottom side rails and carrying vehicles is not envisaged.

The transfer of load between side rails and handling equipment should only occur when provisions have been made in accordance with [5.11.1](#).

**5.3.2.4** Containers having all their intermediate transverse members spaced 1 000 mm apart or less (or having a flat underside) shall be deemed to conform to these requirements.

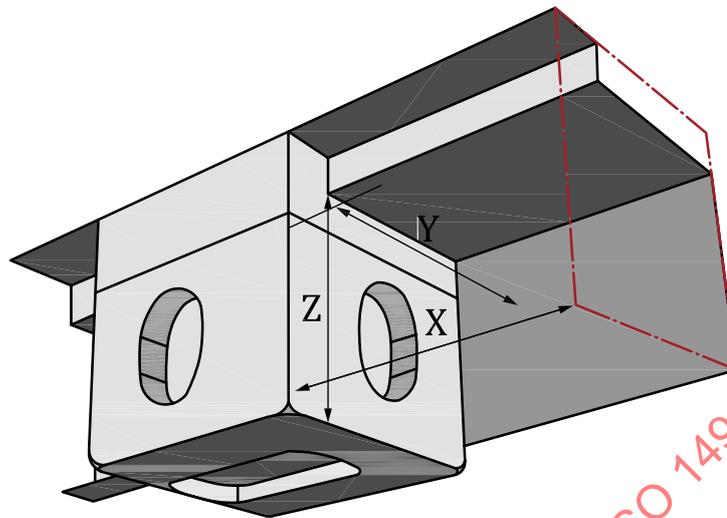
**5.3.2.5** Requirements for containers not having transverse members spaced 1 000 mm apart or less (and not having a flat underside) are given in ISO 668:2020, Annex B.

**5.3.3** For 1D and 1DX containers, the level of the underside of the base structure is not specified, except insofar as it is implied in [5.3.4](#).

**5.3.4** For all containers under dynamic conditions, or the static equivalent thereof, with the container having a load uniformly distributed over the floor in such a way that the combined mass of the container and test load is equal to  $1,8 R$ , and when the container is supported at the corner fittings, no part of the base of the container shall deflect more than 6 mm below the base plane (bottom faces of the lower corner fittings).

**5.3.5** 1EEE and 1EE units shall have recesses longitudinally outboard of each of their fittings in the 1AAA/1AA/1A positions. These recesses shall extend vertically to permit full access to the outboard aperture of the fittings in the 1AAA/1AA/1A position, shall extend longitudinally from the longitudinal outward faces of the fittings in the 1AAA/1AA/1A position outboard, to not less than 150 mm from the outboard face (251 mm from the centrelines of the bottom apertures) of the fittings in the

1AAA/1AA/1A position and shall extend laterally from the external width of the container inboard not less than 154 mm. See [Figure 1](#).



#### Key

- X longitudinal (outboard),  $\geq 150$  mm
- Y laterally,  $\geq 154$  mm
- Z vertical, shall allow full access to the aperture

**Figure 1 — Lower intermediate fitting recess for 45-foot container**

## 5.4 Floor strength of bulk containers

### 5.4.1 Floor strength – loading by thrower or conveyor belt – bulk container in the horizontal position through an open end of bulk containers

The floor strength of bulk containers packed in the horizontal position by thrower, conveyor belt or similar methods through open doors or a loading hatch fitted in an end wall shall be proportionate to the cargo to be carried and the impact that the cargo has on the floor during the packing process.

As a minimum, the floor should be capable of withstanding a cargo with a particle size of 2,5 cm and a bulk density of up to  $1,2 \text{ t/m}^3$  delivered from a height at least  $\frac{2}{3}$  of the internal height and at a flow rate of 1,5 t/min.

### 5.4.2 Floor strength of bulk containers – loading through roof hatches

The floor strength of bulk containers packed through two or more roof mounted loading hatches, or through an open roof shall be proportionate to the cargo to be carried and the impact that the cargo has on the floor during the packing process.

As a minimum, the floor should be capable of withstanding a cargo with a particle size of 2,5 cm and a bulk density of up to  $1,2 \text{ t/m}^3$  delivered from a height of 3 m and at a flow rate of 1,0 t/min per loading nozzle.

### 5.4.3 General

**5.4.3.1** Where the bulk container is intended for the transport of substances with a bulk density higher than  $1,2 \text{ t/m}^3$  or from a loading height of more than 3 m or with a substance with larger particle size or any or all of these, the floor strength shall be increased proportionately and approved by the

competent authority or competent authorities. The effects of particle size in determining the required floor strength shall also be taken into account in determining the required floor strength for substances loaded by these methods.

**5.4.3.2** Locking devices necessary to retain the substances in the bulk containers shall remain effective during loading by these methods.

## 5.5 End structure

For all containers other than 1D and 1DX, the sideways deflection of the top of the container with respect to the bottom of the container, at the time it is under full transverse rigidity test conditions, shall not cause the sum of the changes in length of the two diagonals to exceed 60 mm.

## 5.6 Side structure

For all containers other than 1D and 1DX, the longitudinal deflection of the top of the container with respect to the bottom of the container at the time it is under full longitudinal rigidity test conditions shall not exceed 25 mm.

## 5.7 Walls (box type only)

**5.7.1** For all containers under full side wall test conditions, the deflection of the side walls, in relation to the plane formed by the external faces of the four corner fittings of each side, shall be as small as practicable and shall not exceed 40 mm.

**5.7.2** Where openings are provided in end walls, the ability of these walls to withstand test no. 13 (see [6.2](#)) shall not be impaired.

**5.7.3** Where the container is designed for tipping discharge through the rear doors, and the rear doors have to be open to facilitate the discharge, the shoring slot used to retain a false bulkhead shall be tested to simulate a tipping angle of 45°.

**5.7.4** Where the container is designed for side discharge by tipping, the side wall shall be tested to simulate this action. If any component, such as roof bows or top hatches are demountable, these shall be removed before the commencement of the testing. In such cases, test no. 6 shall have the internal loading increased from  $0,6 P_g$  to  $0,7 P_g$ , where  $P$  is the payload and  $g$  is the gravitational acceleration about  $9/81 \text{ m/s}^2$ .

**5.7.5** Where a general-purpose container (conforming to ISO 1496-1) is required to carry a bulk cargo, the front wall shall be braced in order to meet the test criteria detailed in [6.1.5.5](#).

## 5.8 Shell (hopper type only)

**5.8.1** The shell of hopper-type containers shall be designed to withstand the effects of inertia of its content resulting from transport motion. For design purposes, these effects may be taken to be equivalent to a loading of  $2 R_g$  longitudinally,  $R_g$  laterally and  $2 R_g$  vertically, where  $R$  is the rating.

**5.8.2** These loadings can be considered individually to be evenly distributed and to act through the geometric centre of the shell. Vertical loadings are total loadings including dynamic effects.

**5.8.3** The shell of hopper-type containers shall be capable of withstanding the requirements of [5.8.1](#) and the static head produced by upending the container while loaded to its rating  $R$ . Due regard shall be given to the dry bulk of highest density that is to be carried and to any compartmentation of the shell.

**5.8.4** Under the full test conditions for internal lateral restraint, the deflection of any part of the container in relation to the plane formed by the external faces of the four corner fittings of each side shall be as small as practicable and shall not exceed 50 mm.

## 5.9 Openings

### 5.9.1 General

All openings shall be so designed that, when closed, they prevent leakage of cargo.

Container doors should be designed so that entry into the container via either of the doors can be detected by verifying the condition of the seal that has been affixed to the container. All door openings shall be fitted to accept an ISO compliant high security seal in accordance with ISO 17712, in a manner that precludes opening or gapping of doors or hatches without first removing the seal.

Door and hatch hinges shall either be welded to the door/hatch panel or, if affixed with fasteners, affixed with TIR<sup>[4]</sup> approved fasteners that are further protected from removal by a suitable shield or equivalent design feature. Hinge pins shall be welded in place or otherwise protected to preclude their removal.

### 5.9.2 Door opening(s) (box type 1 only)

Box-type bulk containers which are to be used as general-purpose freight containers shall be provided with a door opening at least at one end.

Box-type containers designated 1EEE, 1AAA and 1BBB (type according to ISO 6346) shall have a door opening preferably having dimensions equal to those of the internal cross-section of the containers and, in any case, not less than 2 566 mm high and 2 286 mm wide.

Box-type containers designated 1EE, 1AA, 1BB and 1CC (type according to ISO 6346) shall have a door opening preferably having dimensions equal to those of the internal cross-section of the containers and, in any case, not less than 2 261 mm high and 2 286 mm wide.

Box-type containers designated 1A, 1B, 1C and 1D (type according to ISO 6346) shall have a door opening preferably having dimensions equal to those of the internal cross-section of the containers and, in any case, not less than 2 134 mm high and 2 286 mm wide.

Box-type containers, where both doors can be opened to gain full access, shall be fitted with a securing plate (also known as customs plate) on the inside above the midpoint of the left-hand door in order to prevent the door from being opened without first opening the right-hand door. This plate shall be painted in a contrasting colour so that it is readily visible when the right-hand door is open. Other design features that form an interlock between the two doors or otherwise preclude manipulation and opening of the unsealed door without breaking the seals are equally acceptable.

An elongated door handle hub (sometimes referred to as a security hub) that extends at least 25 mm below the rivet hole or pivot point, shall be used on the right-hand door to prevent the handle from being removed even if the rivet is removed.

### 5.9.3 Opening(s) for loading

All containers shall be provided with one or more openings for loading. Their design, number and location shall be such as to

- permit an even distribution of the dry bulk solids which are loaded into the container by natural gravity or any other means which do not produce any internal pressure within the cargo space;
- conform to the possible additional requirements of the competent authority.

NOTE Typical examples of arrangements of openings for loading box-type containers 1EEE, 1EE, 1 AAA, 1AA, 1A, 1BBB, 1BB, 1B, 1CCC, 1CC and 1C are shown in [Annex B, Figures B.1 to B.4](#) respectively.

#### 5.9.4 Opening(s) for discharging

All containers shall be provided with at least one opening for discharging, designed and located in such a way as to allow complete discharge by natural gravity or other means which do not produce any internal pressure/vacuum within the cargo space, or by any combination of such means.

The opening(s) for gravity discharging by tilting the container shall have an area sufficient to achieve total discharge.

#### 5.9.5 Inspection and maintenance openings (hopper type only)

Hopper-type containers shall be provided with access hatches or other openings to allow for complete internal inspection, unless exempted by the competent authority. The size of inspection and maintenance openings shall be determined by the need for maintenance staff and machines to enter the container to inspect, maintain or repair its interior, taking into account the requirements of the competent authority. Access openings shall be a minimum of 500 mm in diameter.

When opening(s) for loading or discharging conform to the above size requirements, the provision of access opening(s) is not required.

### 5.10 Construction

**5.10.1** The container materials shall be suitable for, or adequately protected from, the cargo and the environment in which the container can be operated. Due regard should be given to the problems of variations in ambient temperature, corrosive atmospheres, the possibility of uncontrolled cargo release in fire, etc.

An allowance for corrosion shall be taken into consideration where necessary.

**5.10.2** The shell(s) of each hopper-type container shall be firmly secured to the structural elements of the container framework.

**5.10.3** Container types B1/BB, (type according to ISO 6346) shall be manufactured in such a manner as to meet the requirements of test no. 20 — Airtightness (see [6.9](#)).

### 5.11 Requirements — Optional features

#### 5.11.1 Fork-lift pockets

**5.11.1.1** Fork-lift pockets for handling 1CCC, 1CC, 1C, 1CX, 1D and 1DX containers in the loaded or unloaded condition may be provided as optional features.

**5.11.1.2** Fork-lift pockets shall not be provided on 1EEE, 1EE, 1AAA, 1AA, 1A, 1AX, 1BBB, 1BB, 1B and 1BX containers.

**5.11.1.3** Where a set of fork-lift pockets has been fitted as in [5.11.1.1](#), a second set of fork-lift pockets may, in addition, be provided on 1CCC, 1CC, 1C and 1CX containers for empty handling only.

**5.11.1.4** The fork-lift pockets, where provided, shall meet the dimensional requirements specified in ISO 1496-1 and shall pass completely through the base structure of the container so that lifting devices can be inserted from either side. It is not necessary for the bases of the fork-lift pockets to be the full width of the container but they shall be provided near each end of the fork-lift pockets.

### 5.11.2 Gooseneck tunnels

Gooseneck tunnels shall be provided as mandatory features in containers 1EEE and 1AAA (box type 1 and box type 2) and may be provided as optional features in 1EE, 1AA, 1A and 1AX containers. The dimensional requirements are specified in ISO 668:2020, Annex C. The base structure shall be in accordance with ISO 668:2020, Annex B.

### 5.11.3 Walkways

Where provided, walkways shall be designed to withstand a load of 300 kg uniformly distributed over an area of 600 mm × 300 mm. Longitudinal walkways shall have a minimum width of 460 mm.

Walkway guard rails are not recommended as an alternative to installed on-site working at height fall protection systems. If a guard rail is fitted to the bulk container walkway, the guard rail, when not in use, shall be designed to be stored and adequately secured for transport, within the ISO dimensions and tested to the applicable provisions of EN 13374 temporary edge protection.

### 5.11.4 Ladders

Where provided, ladders or equivalent devices shall be designed to withstand a load of 200 kg on any rung. Ladder rungs shall have a minimum width of 300 mm. Rungs shall be uniformly spaced between 280 mm and 300 mm apart and the top surface shall be designed to be non-slip. A hand-hold shall be fitted adjacent to the top of the ladder to allow for easier transition from ladder to walkway and vice-versa.

### 5.11.5 Interface for external fumigation equipment

Fittings may be provided on the container for the connection of external fumigation equipment.

### 5.11.6 Sanitation (where required)

Attention shall be given to the need for the proper choice of materials for container construction to prevent adverse effects on the bulk cargo.

Sanitation of containers can be subject to additional international or national requirements as applied by competent authorities.

The interior surface and the container structure shall be so constructed as to facilitate thorough cleaning, and the surface shall not be functionally affected by cleaning methods normally used, such as wet steam cleaning and detergents.

The interior surface of the container structure shall be so constructed that there are no crevices or unsealed seams that can become a source of infestation.

## 6 Testing

### 6.1 General

Unless otherwise stated, containers conforming to the design requirements specified in [Clause 5](#) shall, in addition, be capable of withstanding the tests specified in [6.2](#) to [6.9](#) as applicable.

The test for weatherproofness (test no. 12) shall be made after the structural tests no. 1 to no. 11, no. 13 to no. 19, with the airtightness test no. 20, when required, being carried out last.

A container intended for the carriage of dangerous goods shall, in addition, conform to the testing requirements of the relevant regulations to the satisfaction of the competent authority.

**6.1.1** The symbol  $P$  denotes the maximum payload of the container to be tested, that is

$$P = R - T$$

where

$R$  is the rating;

$T$  is the tare.

NOTE  $R$ ,  $P$  and  $T$ , by definition, are in units of mass. Where test requirements are based on the gravitational forces derived from these values, those forces, which are inertial forces, are indicated as follows:

$R_g$ ,  $P_g$ ,  $T_g$ , the units of which are in newtons or multiples thereof.

The word "load", when used to describe a physical quantity to which units may be ascribed, implies mass.

The word "loading", for example as in "internal loading", implies force.

**6.1.2** The test loads or loadings within the container shall be uniformly distributed.

The hopper-type container under test, unless otherwise stated, shall be loaded with a suitable fluid/dry bulk to achieve the test load or loading specified.

If the test load or loading cannot readily be met by the above method, or if such a method is undesirable, the hopper-type container shall be loaded with a suitable fluid/dry bulk and a supplementary load or loading shall be applied. The total load or loading thus applied shall be such as to simulate uniform loading.

Variations of 20 % of the calculated bending moment of the uniformly loaded hopper-type container shall be considered acceptable.

NOTE 1 Other alternative test loads or loadings (e.g. for longitudinal and lateral internal restraint tests) can be used, provided that they achieve the specified test loading.

NOTE 2 Variations of up to 20 % are only acceptable in case the container is tested using a supplementary load achieved by fitting straps and the tank has excessive bending due to the load created by the straps.

**6.1.3** The test loads and loadings specified in all of the following tests are minimum requirements.

**6.1.4** The requirements subclause for each of the tests (e.g. [6.2.3](#)) references dimensional constraints detailed in either:

- a) ISO 668; or
- b) ISO 1161.

**6.1.5** Tests no. 1 to no. 12 shall be carried out in accordance with ISO 1496-1 except otherwise noted.

**6.1.5.1** Test no. 1 — Stacking

**6.1.5.2** Test no. 2 — Lifting from the four top corner fittings

**6.1.5.3** Test no. 3 — Lifting from the four bottom corner fittings

**6.1.5.4** Test no. 4 — External restraint (longitudinal)

**6.1.5.5** Test no. 5 — Strength of end walls (box type only)

The test procedure shall be modified as follows:

The front wall (blind or blind wall with an opening for cargo loading) shall be subjected to an internal loading of 0,6 *P*<sub>g</sub>.

**6.1.5.6** Test no. 6 — Strength of side walls (box type only)

The test procedure shall be modified as follows:

Where the container is designed for side discharge (tipping), the side wall shall be subjected to an internal loading of 0,7 *P*<sub>g</sub>. The test shall be carried out with all demountable components (roof bows etc.) removed.

**6.1.5.7** Test no. 7 — Strength of the roof (where provided) (box type only)**6.1.5.8** Test no. 8 — Floor strength (box type with full height rear doors only)**6.1.5.9** Test no. 9 — Rigidity (transverse)**6.1.5.10** Test no. 10 — Rigidity (longitudinal)**6.1.5.11** Test no. 11 — Lifting from fork-lift pockets (where provided)**6.1.5.12** Test no. 12 — Weatherproofness**6.2 Test no. 13 — Strength of end wall with fitted discharge hatch****6.2.1 General**

This test shall be carried out to prove the ability of the container to withstand forces associated with tipping the container to an angle of 45°.

**6.2.2 Procedure**

The container shall have the end wall fitted with a discharge hatch tested. The container shall be subjected to an internal loading of 0,7 *P*<sub>g</sub>.

Where the rear doors need to be opened to facilitate the discharge of the cargo, a false bulkhead shall be fitted and tested in accordance with ISO 1496-1:2013/AMD1:2016, Annex D except the shoring slot that shall be tested to 0,7 *P*<sub>g</sub>. The test shall be accrued out with the doors open.

The internal loading shall be uniformly distributed over the wall or false bulkhead under test and arranged to allow free deflection of the wall or bulkhead.

**6.2.3 Requirements**

Upon completion of the test, the container shall show neither permanent deformation nor abnormality which would render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied (see ISO 668).

### 6.3 Test no. 14 — Bottom hatch operation test

#### 6.3.1 General

This test shall be carried out on bottom discharge type bulk containers to prove the bulk container's bottom discharge hatch(es) operation.

#### 6.3.2 Procedure (see Figure A.14)

The container shall be loaded in such a way that the combined mass of the container and test load is equal to  $1,6 R$ .

The container shall be lifted and remain supported by its top corner fittings. It shall be held in this position for 5 min.

On completion of the period of hold, the bottom discharge hatch(es) shall be opened and the cargo released, after which the hatch(es) will be closed again.

#### 6.3.3 Requirements

On completion of the tests, the full contents of the container will have been discharged and the bottom hatch(es) fully closed. The discharged cargo shall not fall outside of the envelope formed by the side and end walls (see ISO 668).

There shall be no leakage or permanent deformation or abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

### 6.4 Test no. 15 — Floor test - Box type 2 with roof or end wall cargo loading openings

#### 6.4.1 General

This test shall be carried out on box containers in lieu of test no. 8 and is to prove the carrying capacity of the container under dynamic conditions.

#### 6.4.2 Procedure (see Figure A.15)

Three test loads, each with a floor area measuring  $1\text{ m} \times 1\text{ m}$  and with a mass of  $2,6\text{ t} \times 3\text{ t}$  (7,8 t) shall be positioned equidistance along the centre line of the container.

The container shall be lifted and remain supported by its top corner fittings. It shall be held in this position for 5 min.

NOTE The mass of the test load is based on the floor test load (calculated by a floor load of  $2,6\text{ t per m}^2 \times 3\text{ m}$  to represent the force produced by dropping the cargo load from 3 m)

#### 6.4.3 Requirements

On completion of the tests, the container shall not show leakage or permanent deformation or abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied (see ISO 668).

For containers with bottom discharge, the bottom opening doors should show no signs of distortion and should operate fully.

## 6.5 Test no. 16 — Internal longitudinal restraint (hopper type only)

### 6.5.1 General

Separate tests shall be carried out to prove the ability of the container to withstand the effects of the inertia of the contents resulting from longitudinal acceleration encountered during normal transport and handling operations.

NOTE 1 It is not necessary to perform the internal longitudinal restraint test no. 16 if dynamic testing has been conducted so that end loads equal to or exceeding the static test load  $R$  were achieved.

NOTE 2 The effects of vertical acceleration are deemed to be covered by tests no. 2 and no. 3.

NOTE 3 Containers without longitudinal connecting members between end frames are deemed to be covered by test no. 4.

### 6.5.2 Procedure [see Figure A.16 a) and A.16 b)]

The container shall be loaded in such a way that the combined mass of the container and test load is equal to  $R$ .

The container shall be positioned with its longitudinal axis vertical (a tolerance of  $3^\circ$  is acceptable). It shall be held in this position for 5 min either

- a) by means of supports at the lower end of the base structure of the container acting only through the two bottom corner fittings giving both vertical and horizontal securement, and by means of anchor devices acting through the corner fittings at the upper end of the base structure in such a manner as to provide horizontal restraint only; or
- b) by means of supports under the four downward-facing corner fittings.

Alternative procedure b) may be used only for those types of containers where the hopper is supported solely by the base structure of the container or where, in the opinion of the competent authority, the container is adequately tested with respect to hopper-to-framework connections by tests no. 4 and no. 10.

Containers which are not structurally symmetrical shall have both ends tested.

### 6.5.3 Requirements

On completion of the tests, the container shall not show leakage or permanent deformation or abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied (see ISO 668 and ISO 1161).

## 6.6 Test no. 17 — Internal lateral restraint (hopper type only)

### 6.6.1 General

Separate tests shall be carried out to prove the ability of the container to withstand the effects of the inertia of the contents resulting from lateral acceleration encountered during normal transport and handling operations.

### 6.6.2 Procedure [see Figure A.17 a) and A.17 b)]

The container shall be loaded in such a way that the combined mass of the container and test load is equal to  $R$ .

The container shall be positioned with its transverse axis vertical (a tolerance of 3° is acceptable). It shall be held in this position for 5 min either

- a) by means of supports at the lower end of the base structure of the container acting only through the two bottom corner fittings giving both vertical and horizontal securement, and by means of anchor devices acting through the corner fittings at the upper end of the base structure in such a manner as to provide horizontal restraint only; or
- b) by means of supports under the four downward-facing corner fittings.

Alternative procedure b) may be used only for those types of containers where the hopper is supported solely by the base structure of the container or where, in the opinion of the competent authority, the container is adequately tested with respect to container-to-framework connections by tests no. 4 and no. 9.

### 6.6.3 Requirements

On completion of the tests, the container shall not show leakage or permanent deformation or abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied (see ISO 668).

## 6.7 Test no. 18 — Walkways (where provided)

### 6.7.1 General

This test shall be carried out on all walkways, where provided on a container, to prove the ability of the walkway to withstand the loads imposed by persons working thereon.

### 6.7.2 Procedure (see Figure A.18)

A concentrated load of not less than 300 kg shall be uniformly distributed over an area of 600 mm × 300 mm located at the weakest area of the walkway.

### 6.7.3 Requirements

On completion of the test, the walkways shall show neither undue deformation nor any abnormality which renders them unsuitable for use.

## 6.8 Test no. 19 — Ladders (where provided)

### 6.8.1 General

This test shall be carried out on all ladders, where provided on a container, to prove the ability of the ladder to withstand the loads imposed by persons working thereon.

### 6.8.2 Procedure (see Figure A.19)

A load of 200 kg shall be positioned at the centre of the widest rung.

### 6.8.3 Requirements

On completion of the test, the ladders shall show neither undue deformation nor abnormality which would render them unsuitable for use.

## 6.9 Test no. 20 — Airtightness test types B1/BB according to ISO 6346

### 6.9.1 General

This test, when required, shall be carried out after all structural tests have been completed.

### 6.9.2 Procedure

The container shall be in its normal operating condition and shall be closed in the normal manner. An air supply through a metering device and a suitable manometer shall be connected to the container by a leak-proof connection. The manometer shall not be part of the air supply system. The flow-measuring device shall be accurate to  $\pm 3\%$  of the measured flow rate, and the manometer on the container shall be accurate to  $\pm 5\%$ .

Air shall be admitted to the container to raise the internal pressure to  $250 \text{ Pa} \pm 10 \text{ Pa}$  and the air supply regulated to maintain this pressure. Once steady test conditions have been established, the air flow required to maintain this pressure shall be recorded.

### 6.9.3 Requirements

The air leakage rate, under standard atmospheric conditions, shall be no more than the values specified in [Table 2](#).

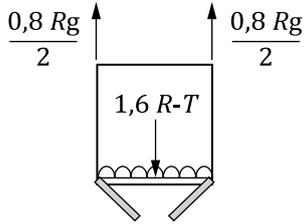
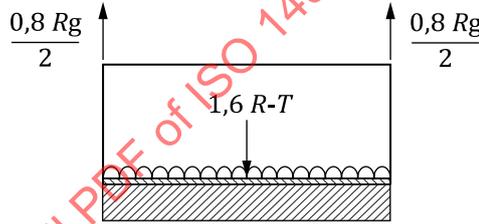
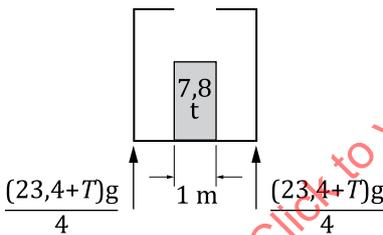
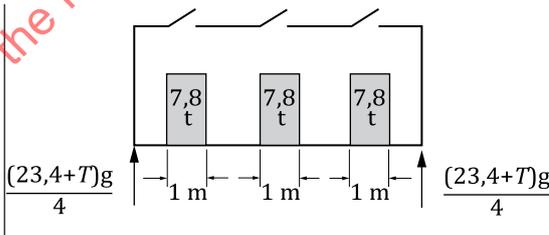
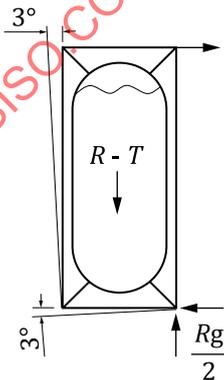
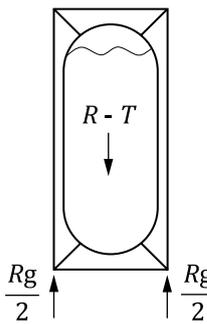
Table 2 — Air leakage rates

Freight container designation	1EEE and 1EE	1AAA, 1AA, 1A and 1AX	1BBB, 1BB, 1B and 1BX	1CCC, 1CC, 1C and 1CX	1D and 1DX
Air leakage rate, m <sup>3</sup> /h	32,5	30	25	20	15

## Annex A (informative)

### Diagrammatic representation of capabilities appropriate to specific types and sizes of dry bulk non-pressurised containers, except where otherwise stated

NOTE For definitions of *R*, *P* and *T* see [6.1.1](#).

Figure no.	End elevation	Side elevation
Figure A.14	Test no. 14 - Bottom hatch operation test 	
Figure A.15	Test no. 15 - Box type 2 floor test 	
Figure A.16 a)	Test no. 16 - Internal longitudinal restraint [see <a href="#">6.5.2</a> a)] 	

Frame connection through bottom corner fittings