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Series 1 freight containers — Specification and testing —

Part 4:
Non-pressurized containers for dry bulk

Conteneurs de la série 1 — Spécifications et essais —

Partie 4: Conteneurs non pressurisés pour produits solides en vrac

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Contents

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Annexes

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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1496-4 was prepared by Technical Committee ISO/TC 104, *Freight containers*, Sub-Committee SC 2, *Specific purpose containers*.

ISO 1496 consists of the following parts, under the general title *Series 1 freight containers — Specification and testing*:

— *Part 1: General cargo containers for general purposes*

— *Part 2: Thermal containers*

— *Part 3: Tank containers for liquids, gases and pressurized dry bulk*

— *Part 4: Non-pressurized containers for dry bulk*

— *Part 5: Platform and platform-based containers*

— *Part 6: International cargo-security devices*

Annexes A, B, C, D and E form an integral part of this part of ISO 1496. Annexes F and G are for information only.

Introduction

The following grouping of container types is used for specification purposes in ISO 1496:

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NOTE 1 Containers types 90 to 99 are reserved for air/surface containers (see ISO 8323).

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Series 1 freight containers — Specification and testing —

Part 4:
Non-pressurized containers for dry bulk

1 Scope

1.1 This part of ISO 1496 specifies the basic specifications and testing requirements for ISO 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.

1.2 As the density and flow characteristics of dry bulk cargoes vary widely, containers complying with this part of ISO 1496 are not expected to be suitable for the carriage of all such cargoes. Therefore, except where otherwise stated, the requirements of this International Standard are minimum requirements.

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

1.3 The container types covered by this part of ISO 1496 are given in table 1.

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

NOTE 2 Some types of freight containers constructed in accordance with ISO 1496-1 may satisfactorily be used for the transport of certain non-packed dry bulk solids. Where such containers are used for this purpose, it is essential that care be taken to ensure that the design loadings are not exceeded under operating conditions.

Table 1 — Container types

Type	Type code designation[1]	
	Box types	Hopper types
Dry bulk non-pressurized,		
closed	20	80
vented	21	81
ventilated	22	82
airtight	23	83
[spare]	24	84

1) In accordance with ISO 6346.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1496. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1496 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 668:1988, *Series 1 freight containers — Classification, dimensions and ratings.*

ISO 830:1981, *Freight containers — Terminology,* and its amendments: ISO 830:1981/Amd.1:1984 and ISO 830:1981/Amd.2:1988.

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

ISO 6346:1984, *Freight containers — Coding, identification and marking,* and its amendment: ISO 6346:1984/Amd.1:1988.

3 Definitions

For the purposes of this part of ISO 1496, the definitions given in ISO 830, together with the following, apply. However, for practical reasons, certain definitions taken and adapted from ISO 830 are given below.

3.1 non-pressurized dry bulk container: 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 part of ISO 1496.

3.1.1 box type: Dry bulk non-pressurized container for tipping discharge having a parallelepiped cargo space and a door opening at least at one end, which therefore may also be used as a general-purpose freight container.

3.1.2 hopper type: Dry bulk non-pressurized container for horizontal discharge having no door opening, which therefore may not be used as a general-purpose freight container.

NOTE 3 For the sake of simplicity, dry bulk containers will be referred to as containers in this part of ISO 1496.

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 device: Point(s) at which the connection between the container and any external fumigation device is connected or disconnected.

3.6 dangerous goods: Those substances classified as dangerous by the United Nations committee of experts on the transport of dangerous goods or by the competent authority as defined in 3.7.

3.7 competent authority: The 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: The 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: The space bounded by the container walls or shell when all apertures are closed.

4 Dimensions and ratings

4.1 External dimensions

The overall external dimensions and tolerances of the freight containers covered by this part of ISO 1496 shall be those establised in ISO 668, except that containers may be of reduced height, in which case they shall be designated 1AX, 1BX, 1CX and 1DX. No part of the container, its associated fittings and/or equipment 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, 1AA, 1A, 1BB, 1B, 1CC, 1C and 1D box type containers (type code 20 to 24) shall have a minimum internal width of 2 330 mm[1]. This dimension applies when measured at a temperature of 20 °C (68 °F). Measurements taken at other temperatures shall be adjusted accordingly.

4.3 Ratings

The values of the rating R, the maximum gross mass of the container, shall be those specified in ISO 668. However, taking account of the high density of many fluid cargoes, the values of the rating R chosen for the design and testing of 1BB, 1B, 1CC and 1C tank containers may be higher than those specified in ISO 668. For all containers in operation, such values shall in no case exceed the rating allowed for 1AA and 1A containers in ISO 668.

5 Design requirements

5.1 General

All containers shall be capable of fulfilling the following requirements.

5.1.1 The strength requirements for containers are given in diagrammatic form in annex A (these requirements are applicable to all containers as complete units except where otherwise stated).

1) 2 330 mm = 91 3/4 in

5.1.2 The strength requirements for corner fittings (see also 5.2) are specified in ISO 1161.

5.1.3 The container shall be capable of withstanding the loads and test forces specified in clause 6.

5.1.4 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 annex A and demonstrated by the tests described in clause 6 shall not be exceeded in any mode of operation.

5.1.5 Any closure in a container which, if unsecured, could lead to a hazardous situation, shall be provided with an adequate securing system having, so far as may be practicable, external indication of the positive securement of that closure in the appropriate operating position.

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

5.1.6 Any removable roof or roof section 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.

5.1.7 All containers shall be weatherproof as required by test No. 13 (see 6.14).

5.2 Corner fittings

5.2.1 General

All containers shall be equipped with top and bottom corner fittings. The requirements and positioning of the corner fittings are given in ISO 1161. The upper faces of the top corner fittings shall protrude above the top of the container by a minimum of 6 mm[2] (see 5.3.4). By "top of the container" is understood the highest level of the top part of the container, for example the level of the top of the closure of a cargo-loading opening.

5.2.2 Reinforcing zones or doubler plates

Whenever 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[2] 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, 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 250 mm[2] wide zones defined by the broken lines in figure B.1.

5.3.2.2 The lower faces of the load-transfer areas in the container base structure, including those of the end transverse members, shall be in one plane located

$12{,}5\ \text{mm}\ ^{+5}_{-1{,}5}\ \text{mm}$[2]

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[2] from the outer end and 470 mm[2] from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm[2] 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 5.10.1 and 5.10.2.

5.3.2.4 Containers having all their intermediate transverse members spaced 1 000 mm[2] apart or less (or having a flat underside) shall be deemed to comply with the requirements of 5.3.2.1.

5.3.2.5 Requirements for containers not having transverse members spaced 1 000 mm[2] apart or less (and not having a flat underside) are given in annex B.

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2) 5 mm = 3/16 in; 6 mm = 1/4 in; $12{,}5\ \text{mm}\ ^{+5}_{-1{,}5}\ \text{mm}$ = 1/2 in $^{+3/16}_{-1/16}$ in; 250 mm = 10 in; 470 mm = 18 1/2 in; 550 mm = 22 in; 750 mm = 29 1/2 in; 1 000 mm = 39 3/8 in

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 $1{,}8R$, and when the container is supported at the corner fittings, no part of the base of the container shall deflect more than 6 mm[3] below the plane of the lower faces of the bottom corner fittings of the container (base plane).

5.4 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[3].

5.5 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[3].

5.6 Walls (box type only)

5.6.1 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[3].

5.6.2 Where openings are provided in end or side walls, the ability of these walls to withstand test No. 5 and No. 6 (see 6.6 and 6.7) shall not be impaired.

5.7 Shell (hopper type only)

5.7.1 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 $2Rg$ longitudinally, Rg laterally and $2Rg$ vertically[4].

These loadings may 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.

5.7.2 The shell of hopper-type containers shall be capable of withstanding the requirements of 5.7.1 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.

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[3].

5.8 Openings

5.8.1 General

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

5.8.2 Door opening(s) (box type only)

Box-type containers shall be provided with a door opening at least at one end, to enable them to be used as general-purpose freight containers.

Box-type containers designated 1A, 1B, 1C and 1D 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[3] high and 2 286 mm[3] wide.

Box-type containers designated 1AA, 1BB and 1CC 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[3] high and 2 286 mm[3] wide.

5.8.3 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 proper 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;

— comply with the possible additional requirements of the competent authority.

NOTE 4 Typical examples of arrangements of openings for loading box-type containers 1AA, 1A, 1BB, 1B, 1CC and 1C are given in annex F.

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3) 6 mm = 1/4 in; 25 mm = 1 in; 40 mm = 1 9/16 in; 50 mm = 2 in; 60 mm = 2 3/8 in; 2 134mm = 7 ft; 2 261 mm = 7 ft 5 in; 2 286 mm = 7 ft 6 in

4) See 6.1.1, note 5.

5.8.4 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.

5.8.5 Inspection and maintenance openings (hopper type only)

5.8.5.1 Hopper-type containers shall be provided with manholes 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 men and machines to enter the container to inspect, maintain or repair its interior, taking into account the requirements of the competent authority. Manholes shall be a minimum of 500 mm[5] in diameter.

5.8.5.2 When opening(s) for loading or discharging comply with the size requirements of 5.8.5.1, the provision of access opening(s) is not required.

5.9 Construction

5.9.1 The container materials shall be suitable for, or adequately protected from, the cargo and the environment in which the container may 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.

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

5.9.3 Adequate provision shall be made for the sealing of the container in accordance with international customs requirements.

5.9.4 Container types 23 and 83 shall be manufactured in such a manner as to meet the requirements of test No. 18 — Airtightness (see 6.19).

5.10 Requirements — Optional features

5.10.1 Fork-lift pockets

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

Fork-lift pockets shall not be provided on 1AA, 1A, 1AX, 1BB, 1B and 1BX containers.

5.10.1.2 Where a set of fork-lift pockets has been fitted as in 5.10.1.1, a second set of fork-lift pockets may, in addition, be provided on 1CC, 1C and 1CX containers for empty handling only.

5.10.1.3 The fork-lift pockets, where provided, shall meet the dimensional requirements specified in annex C and shall pass completely through the base structure of the container so that lifting devices may be inserted from either side. The bases of the fork-lift pockets need not be the full width of the container but shall be provided near each end of the fork-lift pockets.

5.10.2 Grappler arms or similar devices

Fixtures for handling all containers by means of grappler arms or similar devices may be provided as optional features. The dimensional requirements for such fixtures are specified in annex D.

5.10.3 Gooseneck tunnels

Gooseneck tunnels may be provided as optional features in 1AA, 1A and 1AX containers. The dimensional requirements are specified in annex E and, in addition, all other parts of the base structure shall be as specified in 5.3.

5.10.4 Walkways

Where provided, walkways shall be designed to withstand a load of 300 kg[5] uniformly distributed over an area of 600 mm × 300 mm[5].

5.10.5 Ladders

Where provided, ladders or equivalent devices shall be designed to withstand a load of 200 kg[5] on any rung.

5.10.6 Interface for external fumigation equipment

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

5) 200 kg = 440 lb; 300 kg = 660 lb; 500 mm = 20 in; 600 mm × 300 mm = 24 in × 12 in

5.10.7 Sanitation (where required)

5.10.7.1 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 may be subject to additional international or national requirements as applied by competent authorities.

5.10.7.2 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.

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

6 Testing

6.1 General

Unless otherwise stated, containers complying with the design requirements specified in clause 5 shall, in addition, be capable of withstanding the tests specified in 6.2 to 6.19 as applicable.

The test for weatherproofness (test No. 13) shall be made after the structural tests No. 1 to No. 12, No. 14, No. 15 and No. 16, with the airtightness test No. 18, when required, being carried out last.

A container intended for the carriage of dangerous goods shall, in addition, comply with 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 5 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 thus:

Rg, Pg, Tg

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 6 Other alternative test loads or loadings (for example for longitudinal and lateral internal restraint tests) may be used, provided that they achieve the specified test loading.

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

6.1.4 The dimensional requirements to which reference is made in the requirements sub-clause after each test are those specified in

a) the dimensional and design requirement clauses 4 and 5 of this part of ISO 1496;

b) ISO 668;

c) ISO 1161.

6.2 Test No. 1 — Stacking

6.2.1 General

This test shall be carried out to prove the ability of a fully loaded container to support a superimposed mass of containers, taking into account conditions aboard ships at sea and the relative eccentricities between superimposed containers.

The test force to be applied to each pair of corner fittings and the superimposed mass that the test force represents are specified in table 2.

6.2.2 Procedure

The container shall be placed on four level pads, one under each bottom corner fitting. The pads shall be centralized under the fittings, and shall be substantially of the same plan dimensions as the fittings.

The container shall have a load uniformly distributed in such a way that the combined mass of the container and the test load is equal to 1,8R.

The container shall be subjected to vertical forces applied either to all four corner fittings simultaneously or to each pair of end fittings, at the appropriate level specified in table 2.

The forces shall be applied through a test fixture equipped with corner fittings as specified in ISO 1161, or equivalent fittings which have imprints of the same geometry (i.e. with the same external dimensions, chamfered aperture and rounded edges) as the lower face of the bottom corner fitting specified in ISO 1161. If equivalent fittings are used, they shall be designed to produce the same effect on the container under the test loads, as when corner fittings are used.

In all cases, the forces shall be applied in such a manner that rotation of the planes through which the forces are applied and on which the container is supported is minimized.

Each corner fitting or equivalent test fitting shall be offset in the same direction by 25,4 mm[6] laterally and 38 mm[6] longitudinally.

6.2.3 Requirements

On completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.3 Test No. 2 — Lifting from the four top corner fittings

6.3.1 General

This test shall be carried out to prove the ability of a container, other than a 1D or a 1DX container, to withstand being lifted from the four top corner fittings, with the lifting forces applied vertically, and the ability of a 1D or a 1DX container to withstand being lifted from the top corner fittings with the lifting forces applied at any angle between the vertical and 60° to the horizontal. These are the only recognized ways of lifting these containers by the four top corner fittings.

This test shall also be regarded as proving the ability of the floor and the base structure to withstand the forces arising from the acceleration of the payload in lifting operations.

6.3.2 Procedure

The container shall have a load uniformly distributed over the floor in such a way that the combined mass of the container and test load is equal to 2R, and it shall be carefully lifted from all four top corners in such a way that no significant acceleration or deceleration forces are applied.

For a container other than 1D or 1DX, the lifting forces shall be applied vertically.

For a 1D or a 1DX container, lifting shall be carried out by means of slings, the angle of each leg being at 60° to the horizontal.

After lifting, the container shall be suspended for 5 min and then lowered to the ground.

6.3.3 Requirements

On completion of the test, the container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

Table 2 — Forces to be applied in stacking test

Container designation	Test force per container (all four corners simultaneously)		Test force per pair of end fittings		Superimposed mass represented by test force	
	kN	lbf	kN	lbf	kg	lb
1AA, 1A and 1AX	3 392	763 200	1 696	381 600	192 000	423 320
1BB, 1B and 1BX	3 392	763 200	1 696	381 600	192 000	423 320
1CC, 1C and 1CX	3 392	763 200	1 696	381 600	192 000	423 320
1D and 1DX	896	201 600	448	100 800	50 800	112 000

NOTE — The test force of 3 392 kN per container is derived from the superimposed mass of nine-high stacking, i.e. eight containers stacked on top of one container, all being rated to 24 000 kg, and an acceleration of 1,8g. [The corner posts of such containers are known to have been tested to 86 400 kg (190 480 lb).]

6) 25,4 mm = 1 in; 38 mm = 1 1/2 in