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Series 1 freight containers — Specification and testing —

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

Conteneurs de la série 1 — Spécifications et essais —

Partie 3: Conteneurs-citernes pour les liquides, les gaz et les produits solides en vrac pressurisés

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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 1496-3 was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 2, *Specific purpose containers*.

This fourth edition cancels and replaces the third edition (ISO 1496-3:1991), of which it constitutes a technical revision by the addition of types 1AAA and 1BBB as well as a load-transfer area test (see 6.10 and figure A.19) and by the suppression of grappler-arm lifting areas and attendant tests and requirements.

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*

Annexes A, B and C form an integral part of this part of ISO 1496. Annex D is for information only.

Introduction

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

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NOTE 1 Container 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 3:
Tank containers for liquids, gases and pressurized dry bulk

1 Scope

1.1 This part of ISO 1496 specifies the basic specifications and testing requirements for ISO series 1 tank containers suitable for the carriage of gases, liquids and solid substances (dry bulk) which may be loaded or unloaded as liquids by gravity or pressure discharge, for international exchange and for conveyance by road, rail and sea, including interchange between these forms of transport.

1.2 Except where otherwise stated, the requirements of this part of ISO 1496 are minimum requirements. Tank 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.

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.*

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

ISO 6346:1984, *Freight containers — Coding, identification and marking.*

Table 1 — Container types

Type of cargo and ISO type code designation[1]					Minimum test pressure[2] bar gauge [3]	Code basis			
Liquids		Gases	Dry bulk			UN MM	IMO/IMDG tank type		
Non-dangerous	Dangerous		Horizontal discharge	Tipping discharge			2	1	5
70 [4]					0,45				
71	73		85	87	1,5	+	+		
72	74		86	88	2,65	+	+	+	
	75				4	+		+	
	76				6	+		+	
		77			10 (10,5)	+		+	(+)
		78			22				
		79			Open				

NOTE — For all containers, other than 1D and 1DX, it is essential that the design requirements of 5.1.5 are also taken into consideration.

1) The ISO type code designation does not imply the approval of any competent authority for the transport of specific goods or products the tank container may carry. The type code depends only on the test pressure (see 6.13).

2) The test pressure given is the minimum value of the respective class. Any tank container with a test pressure in the range between a given minimum pressure and the next higher minimum pressure belongs to the lower class.

3) 1 bar = 100 kPa. Test pressure is expressed in bars since relevant intergovernmental codes, often implemented by national legislation, retain this unit of pressure.

4) The number 70 may, in addition, be used to designate tank containers for which the type code relevant to the test pressure is not used.

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 tank container: Freight container which includes two basic elements, the tank or tanks and the framework and complies with the requirements of this part of ISO 1496.

3.2 framework: Tank mountings, end structure and all load-bearing elements not present for the purposes of containing cargo, which transmit static and dynamic forces arising out of the lifting, handling, securement and transporting of the tank container as a whole.

3.3 tank(s): Vessel(s) and associated piping and fittings which are designed to contain the cargo carried.

3.4 compartment: A section of the tank formed by the shell, ends or complete bulkheads.

NOTE 2 Baffles, surge plates or other perforated plates do not form tank compartments within the meaning of this definition.

3.5 gas: Fluid substance having a vapour pressure greater than an absolute pressure of 300 kPa [1] at 50 °C or as otherwise defined by the competent authority.

3.6 liquid: Fluid substance having a vapour pressure not greater than an absolute pressure of 300 kPa [1] at 50 °C.

3.7 dry bulk: Assemblies of separate solid particles normally substantially in contact with one another which are, or may be rendered, capable of fluid flow.

3.8 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 3.9.

3.9 competent authority: The authority or authorities designated as such in each country or in each specific case by the governments concerned for the approval of tank containers.

3.10 maximum allowable working pressure: That pressure assigned for operation by either a competent authority or other responsible person to a particular tank, above which that tank is not intended to be operated.

1) 300 kPa = 3 bar

3.11 test pressure: The gauge pressure at which the tank is tested (see 6.13.2).

3.12 total capacity: That volume of water which will completely fill the tank at 20 °C.

3.13 ullage: That portion of the total capacity of the tank not occupied by its cargo, expressed as a percentage of the total capacity.

4 Dimensions and ratings

4.1 External dimensions

The overall external dimensions and tolerances of tank containers covered by this part of ISO 1496 shall be those established in ISO 668, except that tank containers may be of reduced height, in which case they shall be designated 1AX, 1BX, 1CX and 1DX. No part of the tank container, its associated fittings and/or equipment shall project beyond these specified overall external dimensions.

4.2 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 1BBB, 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 1AAA, 1AA and 1A containers in ISO 668.

5 Design requirements

5.1 General

All tank containers shall be capable of fulfilling the following requirements for the framework, the design and construction of the tank and any optional provisions.

5.1.1 The ability of the tank container to withstand the specified design loadings shall be established by calculation or test.

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

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

5.1.4 The tank container shall be capable of withstanding the test loads and loadings specified in clause 6.

5.1.5 Each tank container shall be designed to withstand the effects of inertia of the tank contents resulting from transport motions. For design purposes, these effects may be taken to be equivalent to loadings of $2Rg$ longitudinally, Rg laterally and $2Rg$ vertically[2]. These loadings may be considered individually to be evenly distributed and to act through the geometric centre of the tank. Vertical loadings are total loadings including dynamic effects. It should be noted that the above loadings do not give rise to an increase in pressure in the vapour space. For design purposes, an equivalent pressure loading may be used.

5.1.6 Each tank container shall be capable of withstanding the requirements of 5.1.5 and the static head produced in the tank container while loaded to its rating R. Due regard shall be given to the liquid/dry bulk of highest density that is to be carried and to any compartmentation of the tank.

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

5.1.8 Any closure in a tank container, which if unsecured could lead to a dangerous 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.

5.1.9 Fork-lift pockets shall not be provided in tank containers.

NOTE 3 Fork-lift transport of tank containers is considered dangerous because of stability problems with loaded or partly-loaded tanks and the danger of impact damage from the forks of fork-lift trucks.

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

2) See 6.1.1, note 6.

Due regard should be given to the problems of variation in ambient temperature, corrosive atmospheres, the possibility of uncontrolled cargo release in fire, etc.

5.1.11 The design of tank containers of types 1AAA and 1BBB shall take into special account the problems of the dynamic instability of these containers, compared with 1AA and 1BB tank containers, when operating in the road/rail environment in a partially laden condition.

5.2 Corner fittings

5.2.1 General

All tank 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 all other components of the tank container by a minimum of 6 mm[3] (see 5.3.5).

5.2.2 Doubler plates

Whenever reinforced zones or doubler plates are provided to afford protection 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[3] from either end of the container but may extend the full width.

5.3 Base structure

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

5.3.2 All tank containers, other than 1CC, 1C, 1CX, 1D and 1DX, shall be capable of being supported only by load-transfer areas in their base structure.

1CC, 1C and 1CX tank containers may have intermediate load-transfer areas as an optional feature. If so, these tank containers shall meet the requirements in 5.3.2.1, 5.3.2.2 and annex B.

5.3.2.1 Consequently, these tank 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 members of a carrying vehicle, which are assumed to lie within the two 250 mm[3] wide zones defined by the dotted lines in figure B.1.

Special consideration shall be given in the base structure design to the risk of failure from fatigue.

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 lie in one plane located

$$12{,}5\ \text{mm}\ ^{+5}_{-1{,}5}\ \text{mm}^{3)}$$

above the plane of the lower faces of the bottom corner fittings of the tank container (base plane).

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

Such plates shall not extend more than 550 mm[3] from the outer end and not more than 470 mm[3] from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm[3] above the lower faces of the base plane of the container.

5.3.2.3 The transfer of load between the underside of any bottom side rails which may be fitted and carrying vehicles is not envisaged.

5.3.2.4 Load-transfer area requirements are given in annex B.

5.3.3 For 1D and 1DX tank containers, the level of the underside of the base structure is not specified, except insofar as it is implied in 5.3.4 and 5.3.5.

5.3.4 When the tank container is loaded to its rating R, no part of the tank or its associated shell fittings shall project downwards below a plane situated 25 mm[3] above the base plane (bottom faces of the bottom corner fittings).

5.3.5 For tank containers under dynamic conditions, or the static equivalent thereof, with the tank container loaded in such a way that the combined mass of the tank container and test load is equal to $1{,}8R$, no part of the base of the tank container shall deflect more than 6 mm[3] below the base plane (bottom faces of the bottom corner fittings).

3) 5 mm = 3/16 in; 6 mm = 1/4 in; 12,5 mm $^{+5}_{-1{,}5}$ mm = 1/2 in $^{+3/16}_{-1/16}$ in; 25 mm = 1 in; 250 mm = 10 in; 470 mm = 18 1/2 in; 550 mm = 22 in; 750 mm = 29 1/2 in

5.4 End structure

For tank containers other than 1D and 1DX, the sideways deflection of the top of the tank container with respect to the bottom of the tank container at the time it is under full transverse rigidity test conditions (see 6.8) shall not cause the sum of the changes in length of the two diagonals to exceed 60 mm[4)]

5.5 Side structure

For tank containers other than 1D and 1DX, the longitudinal deflection of the top of the tank container with respect to the bottom of the tank container at the time it is under full longitudinal rigidity test conditions (see 6.9) shall not exceed 25 mm[4)].

5.6 Tank

5.6.1 Design and construction

5.6.1.1 Each tank or compartment thereof shall be designed and constructed to good technical practice.

5.6.1.2 Each tank or tanks shall be firmly secured to structural elements of the tank framework. The tank or tanks shall be capable of being filled and emptied without removal from the framework.

5.6.1.3 Tanks or tank compartments without vacuum relief devices shall be designed to withstand an external pressure of at least 40 kPa[4)] above the internal pressure.

Tanks equipped with vacuum relief valves shall be designed to withstand an external overpressure of 21 kPa[4)] or greater.

5.6.2 Corrosion allowance

In addition to the requirements of 5.1.10 an allowance for corrosion shall be taken into consideration where necessary.

5.6.3 Tank openings

5.6.3.1 All tank openings except those fitted with pressure relief devices shall be provided with adequate closures to prevent accidental escape of the contents.

5.6.3.2 Tank nozzles and outlet fittings shall be substantially made and attached to the tank in such a manner as to minimize the risk of breakage. Protective covers or housings shall be used wherever necessary to comply with this requirement (see 4.1 and 5.3).

Wherever possible, hinged device should be fitted so that they open away from the likely vicinity of any personnel.

5.6.3.3 Any tank opening located below the normal level of the contents and fitted with a valve capable of being operated manually shall be provided with an additional means of closure on the outlet side of the valve. Such additional means of closure may be a contents-tight cap, bolted blank flange, or other suitable protection against accidental escape of the contents.

All valves, whether fitted internally or externally, shall be located as close to the tank shell as practicable.

5.6.3.4 Stop valves with screwed spindles shall be closed by clockwise motion of the handwheel.

5.6.3.5 All tank connections, such as nozzles, outlet fittings and stop valves, shall be clearly marked to indicate their appropriate functions.

5.6.4 Pressure and vacuum relief devices

5.6.4.1 Each tank or compartment thereof intended to carry non-dangerous cargo shall be fitted with a pressure relief device set to be fully open at a pressure not greater than the tank's test pressure, to prevent excessive internal overpressure. Such devices shall be connected to the vapour space of the tank and located as near to the top of the tank and as near to the tank's (or tank compartment's) mid-length as practicable.

In those cases where the tank container is used with both dangerous and non-dangerous cargo, the relief devices shall be set in accordance with 5.6.4.3.

5.6.4.2 Pressure relief devices, installed as required in 5.6.4.1, should have a minimum relief capacity of 0,05 m^3/s[4)] of standard air [an absolute pressure of 100 kPa[4)] at 15 °C].

This may be considered as providing overpressure protection under non-emergency conditions, but should not be considered as adequate protection for a tank container, or compartment thereof, against excessive overpressure under full fire exposure conditions, dry bulk dust explosion or higher dry bulk pressurization.

4) 25 mm = 1 in; 60 mm = 2 3/8 in; 21 kPa = 0,21 bar; 40 kPa = 0,4 bar; 100 kPa = 1 bar; 0,05 m^3/s = 106 ft^3/min

5.6.4.3 Tanks, or a compartment thereof, intended for the carriage of dangerous goods shall be provided with pressure relief devices meeting the relevant regulations to the satisfaction of the competent authority.

5.6.4.4 Each pressure relief device shall be plainly and permanently marked with the pressure at which it is set to operate.

5.6.4.5 A tank container, or a compartment thereof, with an external design pressure of less than 40 kPa [5] shall be equipped with a vacuum relief device set to relieve at an absolute pressure of 79 kPa [5], except that a lower absolute setting may be used, provided that the external design pressure is not exceeded. The vacuum relief device shall have a minimum through area of 284 mm^2 [5] and shall conform to the requirements of the competent authority. The use of combination pressure/vacuum relief devices is allowed.

NOTE 4 The above requirements are intended to protect against collapse of the tank or compartment thereof, during conditions of normal ambient temperature variations. They will not necessarily prevent collapse if a tank, or a compartment thereof, is, for example, closed tightly immediately after steam cleaning or discharged without opening the manhole covers.

5.6.5 Inspection and maintenance openings

Tank containers shall be provided with manholes or other openings to allow for complete internal inspection, unless exempted by the competent authority.

The size of manholes shall be a minimum of 500 mm [5] in diameter and shall be determined by the need for men and machines to enter the tank to inspect, maintain or repair the inside, taking into account the requirements of the governing competent authority.

5.6.6 Gauging devices

Gauging devices which may be in direct communication with the contents of the tank shall not be made of easily destructible material.

5.6.7 Sealing (customs requirements)

Adequate provision shall be made for the sealing of the tank in accordance with international customs agreements.

5.7 Optional features

5.7.1 Gooseneck tunnels

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

5.7.2 Walkways

Where provided, walkways shall be designed to withstand a loading of not less than 3 kN [5] uniformly distributed over an area of 600 mm × 300 mm [5].

Longitudinal walkways shall have a minimum width of 400 mm [5].

5.7.3 Ladders

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

5.7.4 Tank insulation

When insulation is provided, the design and construction shall be such that the insulation will in no way impinge on the specified requirements nor interfere with the proper function of the tank fittings.

Due regard shall be given to the requirements of 5.1.10.

5.7.5 Tank heating and refrigeration

When heating or refrigeration is provided, due consideration shall be given to the safety of the tank and its contents. Suitable safeguards shall be provided to avoid the development of excessive temperature and stresses.

6 Testing

6.1 General

Unless otherwise stated, tank containers complying with the design and construction requirements specified in clause 5 shall, in addition, be capable of withstanding the tests specified in 6.2 to 6.11. The pressure test (test No. 12) shall be applied to every

5) 40 kPa = 0,4 bar; 79 kPa = 0,79 bar; 284 mm^2 = 0,44 in^2; 400 mm = 16 in; 500 mm = 19 3/4 in; 600 mm × 300 mm = = 24 in × 12 in; 3 kN = 675 Pbf; 200 kg = 440 lb