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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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Foreword

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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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.

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

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.

This fifth edition cancels and replaces the fourth edition (ISO 1496-3:1995) which has been technically revised. It also incorporates the Amendment ISO 1496-3:1995/Amd 1:2006. The main changes compared to the previous edition are as follows:

— the container type codes have been revised in accordance to ISO 6346;

— the ratings and stacking forces have been revised in accordance to ISO 668;

— the load transfer areas of base structure have been referenced to ISO 668;

— the stacking test no. 1 ratings have been revised in accordance with ISO 668;

— the insulation thermal test has been referenced to ISO 1496-2.

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

Series 1 freight containers — Specification and testing —

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

1 Scope

This document 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 can 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.

Except where otherwise stated, the requirements of this document are minimum requirements.

The container types covered by this document are given in Table 1.

Table 1 — Container types (in accordance with ISO 6346:1995/Amd 3:2012, Table E1)

Code	Type designation	Type group code
K	Pressurized tank containers (liquids and gases)	KL
N	Pressurized and non-pressurized tank containers (dry)	NH NN NP

The marking requirements for these containers are given in ISO 6346.

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, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 830, *Freight containers — Vocabulary*

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

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

ISO 6487, *Road vehicles — Measurement techniques in impact tests — Instrumentation*

EN 13374, *Temporary edge protection systems — Product specification — Test methods*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Dimensions and ratings

4.1 External dimensions

The overall external dimensions and tolerances of tank containers covered by this document shall be those established in ISO 668. If tank containers are of reduced height, 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*, being the gross mass of the container, shall be those specified in ISO 668.

5 Design requirements

5.1 General

5.1.1 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.

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

5.1.3 The strength requirements for tank containers are given in diagrammatic form in ISO 668 (these requirements are applicable to all tank containers as complete units except where otherwise stated).

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

5.1.5 The tank container shall be capable of withstanding the test loads and loadings specified in this document.

5.1.6 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 2*Rg* longitudinally, *Rg* laterally and 2*Rg* vertically (see Note in 6.1.1). 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.

5.1.7 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.

5.1.8 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 ISO 668 and demonstrated by the tests described in this document shall not be exceeded in any mode of operation.

5.1.9 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 can be practicable, external indication of the positive securement of that closure in the appropriate operating position.

5.1.10 Fork-lift pockets shall not be provided in tank containers except, if required to container designation 1D, 1DX.

NOTE 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.

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

5.1.12 The design of tank containers designated 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 and ISO 668. 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 (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 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 can have intermediate load-transfer areas as an optional feature. If so, these tank containers shall meet the requirements in 5.3.3, 5.3.4 and ISO 668.

5.3.3 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 350 mm wide zones defined by ISO 668.

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

5.3.4 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 $12{,}5^{+5}_{-1{,}5}$ mm 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 under-structure. Such plates shall not extend more than 550 mm from the outer end and not more than 470 mm from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm above the lower faces of the base plane of the container.

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

5.3.6 Load-transfer area requirements are given in Annex B.

5.3.7 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.

5.3.8 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 above the base plane (bottom faces of the bottom corner fittings).

5.3.9 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 1,8*R*, no part of the base of the tank container shall deflect more than 6 mm below the base plane (bottom faces of the bottom corner fittings).

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.

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.

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 above the internal pressure.

Tanks equipped with vacuum relief devices shall be designed to withstand an external overpressure of 21 kPa 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 way as to minimize the risk of breakage. Protective covers or housings shall be used wherever necessary to comply with this requirement.

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 can 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 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 of standard air (an absolute pressure of 100 kPa 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.

5.6.4.3 Tanks, or a compartment thereof, intended for the carriage of dangerous goods shall be provided with appropriate pressure relief.

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 shall be equipped with a vacuum relief device set to relieve at an absolute pressure of 79 kPa, 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. The use of combination pressure/vacuum relief devices is allowed.

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

5.6.5 Inspection and maintenance openings

Tank containers shall be provided with openings to allow for complete internal inspection. The openings shall be fitted with pressure tight closures.

The size of openings shall be a minimum of 500 mm in diameter and shall be determined by the need for personnel and machines to enter the tank to inspect, maintain or repair the inside.

5.6.6 Gauging devices

Gauging devices which can be in direct communication with the contents of the tank shall be made of a material that is compatible with the tank and its contents.

5.6.7 Sealing (customs requirements)

Adequate provision shall be made for the sealing of the tank.

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 ISO 668; 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 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 tank container walkway, the guard rail, when not in use, shall be designed to be stored and adequately secured for transport, within the tank ISO dimensions and tested to applicable provisions of EN 13374 temporary edge protection systems.

5.7.3 Ladders

Where provided, ladders shall be designed to withstand a load of 200 kg on any rung. The ladder shall be constructed with two stiles and a minimum width of 300 mm. Rungs shall be uniformly spaced between 280 mm to 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.

5.7.4 Tank insulation

When thermal insulation is provided, the design and construction shall be such that the insulation does in no way impinge on the specified requirements nor interfere with the proper function of the tank fittings. Insulation, adhesives and fittings in contact with the tank shall be of compatible materials and designed not to cause any detrimental condition to the tank such as stress corrosion, corrosion pitting or electrolytic action.

Where required, a heat leakage test should be carried out to establish the heat leakage for the thermal tank container. The test should be in accordance with ISO 1496-2:2018, 8.3.

Due regard shall be given to the requirements of 5.1.11.

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

6.1.1 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 and Annex A. The pressure test (test No. 12) shall be applied to every tank container and shall, where practicable, be carried out last if other tests are to be performed.

Dynamic tests in 6.6 shall be conducted in accordance with the procedure specified in Annex B.

6.1.2 The symbol *P* denotes the maximum payload of the container to be tested [see Formula (1)]:

$$P = R - T \tag{1}$$

where

R is the rating;

T is the tare.

The symbol *W* denotes the container payload with the total capacity filled with water.

NOTE *R*, *P*, *T* and *W*, 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*, *Wg* 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 attributed, implies mass. The word "loading", for example, as in "internal loading", implies force.

6.1.3 The tank 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 tank 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 diagrams of the uniformly loaded tank container shall be considered acceptable.

6.1.4 The test loads and loadings specified for all the following tests are minimum requirements.

6.1.5 The dimensional requirements to which reference is made in the requirements clause after each test are those specified in:

a) the dimensional and design requirements of Clauses 4 and 5;

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 tank container to support a superimposed mass of containers, taking into account conditions aboard ships at sea and the relative eccentricities between superimposed containers.

Table 2 specifies the force to be applied as a test to each pair of corner fittings and the superimposed mass that the test force represents.

6.2.2 Procedure

The tank container, filled completely with water, 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 tank container shall be subjected to test forces applied either to all four corner fittings simultaneously, or to each pair of end corner 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 bottom 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 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 fitting shall be offset in the same direction by 25,4 mm laterally and 38 mm longitudinally.

In the case of tank containers with identical ends, only one end need be tested.

Table 2 — Forces to be a 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
1 EEE 1EE	3 767	846 854	1 883	423 317	213 360	470 380
1AAA, 1AA, 1A and 1AX	3 767	846 854	1 883	423 317	213 360	470 380
1BBB, 1BB, 1B and 1BX	3 767	846 854	1 883	423 317	213 360	470 380
1CC, 1C and 1CX	3 767	846 854	1 883	423 317	213 360	470 380
1D and 1DX	896	201 600	448	100 800	50 800	112 000

NOTE See ISO 1496-1 for the specification of stacking loads for 1EE/1EE containers in different modes.

6.2.3 Requirements

On completion of the test, the tank container shall neither show leakage or permanent deformation which will render it unsuitable for use or 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 tank 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 1DX tank container to withstand being lifted from the four 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 tank containers by the four top corner liftings.

This test shall also be regarded as proving the ability of the tank container to withstand the forces arising from acceleration of the payload in lifting operations.

6.3.2 Procedure

The tank container under test shall be loaded in such a way that the combined mass of tank container and test load is equal to 2*R* (see 6.1.2) 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 tank container other than 1D or 1DX, the lifting forces shall be applied vertically.

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

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

6.3.3 Requirements

On completion of the test, the tank 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.

6.4 Test No. 3 — Lifting from the four bottom corner fittings

6.4.1 General

This test shall be carried out to prove the ability of a tank container to withstand being lifted from its four bottom corner fittings by means of lifting devices bearing on the bottom corner fittings only and attached to a single transverse central spreader beam above the container.

6.4.2 Procedure

The tank container under test shall be loaded in such a way that the combined mass of tank container and test load is equal to 2*R* (see 6.1.2), and shall be carefully lifted from the side apertures of all four bottom corner fittings in such a way that no significant acceleration or deceleration forces are applied.

Lifting forces shall be applied at:

— 30° to the horizontal for 1AAA, 1AA, 1A and 1AX tank containers;

— 37° to the horizontal for 1BBB, 1 BB, 1B and 1BX tank containers;

— 45° to the horizontal for 1CC, 1C and 1CX tank containers;

— 60° to the horizontal for 1D and 1DX tank containers.

In each case, the line of action of the lifting force and the outer face of the corner fitting shall not be further apart than 38 mm. The lifting shall be carried out in such a manner that the lifting devices bear on the four bottom corner fittings only.

The tank container shall be suspended for 5 min and then lowered to the ground.

6.4.3 Requirements

On completion of the test, the tank 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.

6.5 Test No. 4 — External restraint (longitudinal)

6.5.1 General

This test shall be carried out to prove the ability of a tank container to withstand longitudinal external restraint under dynamic conditions or railway operation, which implies accelerations of 2 g.

6.5.2 Procedure

The tank container shall be loaded in such a way that the combined mass of tank container and test load is equal to R (see 6.1.2), and shall be secured, longitudinally to rigid anchor points through the bottom apertures of the bottom corner fittings at one end of the tank container.

A force of $2R$, g shall be applied horizontally to the tank container through the bottom apertures of the other bottom corner fittings, first towards and then away from the anchor points.

6.5.3 Requirements

On completion of the test, the tank 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.

6.6 Test No. 5 — Internal restraint (longitudinal) (dynamic)

6.6.1 General

This test shall be carried out to prove the ability of tank containers to withstand longitudinal internal restraint under dynamic conditions of railway operation.

6.6.2 Procedure

This test shall be conducted in accordance with the procedure specified in Annex B.

6.6.3 Requirements

On completion of the test, the tank container shall not show leakage or permanent deformation or abnormality that will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.7 Test No. 6 — Internal restraint (lateral)

6.7.1 General

Separate tests shall be carried out to prove the ability of the tank container to withstand the effects of the inertia of the tank contents both on the tank itself and the tank-to-framework connections under the conditions of lateral acceleration envisaged in 5.1.

NOTE 1 The effects of vertical acceleration are deemed to be covered by tests Nos. 2 and 3.

NOTE 2 Containers without longitudinal frames are deemed to be covered by test No. 4.

6.7.2 Procedure

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

The tank 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 by means of supports either:

a) at the lower end of the base structure of the tank container acting only through the two bottom corner fittings given 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) under the four downward-facing corner fittings.

Procedure b) may be used only for those types of tank containers where the tank is supported solely by the base structure of the container or where, in the opinion of the competent authority, the tank container is adequately tested with respect to tank-to-framework connections by tests Nos. 4 and 8.

6.7.3 Requirements

On completion of the tests, the tank 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.

6.8 Test No. 7 — Rigidity (transverse)

6.8.1 General

This test shall be carried out to prove the ability of a tank container, other than a 1D or a 1DX container, to withstand the transversal racking forces resulting from ship movement.

6.8.2 Procedure

The tank container in tare condition, *T*, shall be placed on four level supports, one under each corner fitting, and shall be restrained against lateral and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Lateral restraint shall be provided only at a bottom corner fitting diagonally opposite to and in the same end frame as a top corner fitting to which force is applied.

When testing the two end frames separately, vertical restraint need only be applied at the end frame under test.

Forces of 150 kN shall be applied either separately or simultaneously to each of the top corner fittings on one side of the tank container in lines parallel both to the base and to the planes of the ends of the tank container. The forces shall be applied first towards and then away from the top corner fittings.

In the case of tank containers with identical ends, only one end need be tested. Where an end is not essentially symmetrical about its own vertical centreline, both sides of that end shall be tested.

For allowable deflection under full test loading, see 5.4.

6.8.3 Requirements

On completion of the test, the tank 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.

6.9 Test No. 8 — Rigidity (longitudinal)

6.9.1 General

This test shall be carried out to prove the ability of a tank container, other than a 1D or a 1DX container, to withstand the longitudinal racking forces resulting from ship movement.

6.9.2 Procedure

The tank container in tare condition, *T*, shall be placed on four level supports, one under each corner fitting, and shall be restrained against longitudinal and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Longitudinal restraint shall be provided only at a bottom corner fitting diagonally opposite and in the same side frame as a top corner fitting to which the force is applied.

Forces of 75 kN shall be applied either separately or simultaneously to each of the top corner fittings on one end of the tank container in lines parallel both to the base of the tank container and to the planes of the sides of the tank container. The force shall be applied first towards and then away from the top corner fittings.

In the case of a tank container with identical sides, only one side need be tested. Where a side is not essentially symmetrical about its own vertical centreline, both ends of that side shall be tested.

For allowable deflections under full test loadings, see 5.5.

6.9.3 Requirements

On completion of the test, the tank 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.

6.10 Test No. 9 — Load-transfer area test

6.10.1 General

This test shall be carried out to simulate, statically, the known dynamic condition when the load-transfer areas are only partially in contact with the carrying vehicle, within the space provided between the twist-lock and the bottom corner fitting. This test only confirms the strength of the structure in relation to static load-carrying ability.

6.10.2 Procedure

The tank container shall be loaded in such a way that the combined mass of the tank container and test load is equal to 2*R*, and it shall be supported by means of four supports, each with a supporting area of 150 mm × 150 mm. The supports shall be positioned at the inner ends of the allowable transverse support area.

The tank container shall remain supported in this way for a minimum of 5 min.

Repeat the test with the supports positioned at the outer ends of the allowable transverse support area.

In the case of tank containers with symmetrical load-transfer areas, only one end need be tested. Where the load-transfer areas are not symmetrical, both ends shall be tested.

6.10.3 Requirements

Upon completion of the test, the tank container shall not show leakage, permanent deformation or abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.11 Test No. 10—Walkways (where provided)

6.11.1 General

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

6.11.2 Procedure

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 walk-way.

6.11.3 Requirements

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

6.12 Test No. 11 — Ladders (where provided)

6.12.1 General

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

6.12.2 Procedure

A load of 200 kg shall be positioned at the centre 50 mm of the widest rung.

6.12.3 Requirements

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

6.13 Test No. 12 — Pressure test

6.13.1 General

This test shall be carried out on every tank container to prove the ability of the tank to withstand the specified internal pressure. Where practicable, it shall be carried out last if other tests are to be performed, but before the addition of thermal insulation, if any.

Shot-blasting or other preparation normally required prior to applying lining or insulation do not need to be performed prior to this test.

6.13.2 Procedure

The tank shall be hydraulically tested.

If the liquid/gas tank is provided with compartments, in addition to hydraulic testing, each compartment shall be tested with the adjacent compartments empty and at atmospheric pressure.

The test pressure shall be measured at the top of the tank or compartment with the tank container in its normal position. The test pressure shall be maintained for as long as is necessary to enable a complete examination of the tank and its fittings to be made, but in any case for not less than 30 min.

Relief devices, where fitted, shall be rendered inoperative or removed and the apertures suitably closed, for the purpose of this test.

The pressure at which the tank is tested shall be selected with regard to the intended use of the tank, in accordance with the requirements of 5.1.6.

This pressure determines the type code designation of the tank container in accordance with ISO 6346

6.13.3 Requirements

During the test, the tank shall show no leakage. On completion of the test, the tank 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.

7 Identification and marking

7.1 The marking requirements of these tank containers shall be in accordance with the principles presented in ISO 6346 for the identification and marking of freight containers.

7.2 At least the following data allowing tank identification shall be permanently attached to the tank in a readily accessible position. These data shall be permanently marked by stamping, embossing or other means and shall not be painted so as to obscure the markings:

a) date of initial hydraulic test, year and month;

b) test pressure, in kilopascals or bars;

c) maximum allowable working pressure, in kilopascals or bars;

d) total capacity, in litres;

e) date of periodic inspection and test, year and month;

7.3 As far as possible, the data plate shall include the information required by the competent authorities, thus reducing to a minimum the number of separate plates required. All data plates should be located as close to one another as possible.

If any of the required data is included on other data plates, it does not need to be duplicated in order to satisfy the requirements of this document.

Annex A
(normative)

Diagrammatic representation of capabilities appropriate to all types and sizes of tank containers, except where otherwise stated

The externally applied forces shown below are for one end or one side only. The loads shown within the containers represent uniformly distributed internal loads only, and such loads are for the whole container.

The figures in this annex correspond to the tests described in 6.2 to 6.12 only where marked.

NOTE Definitions of *R*, *P*, *T* and *W* are given in 6.1.1.

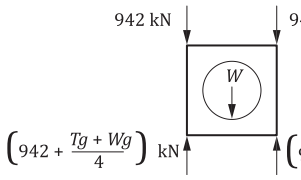
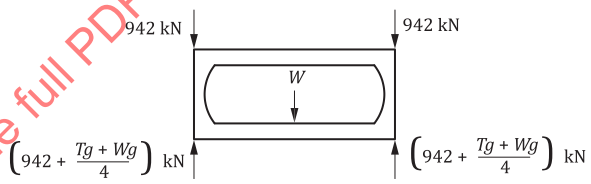
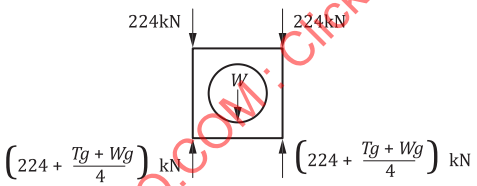
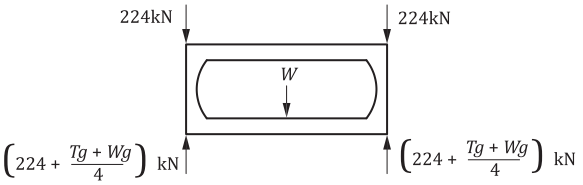
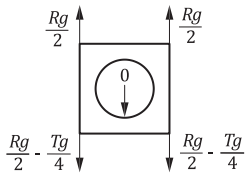
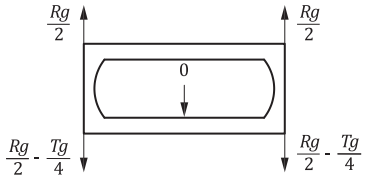
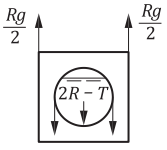
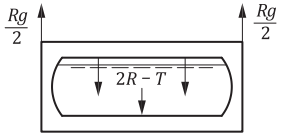
Figure No.	End elevations	Side elevations
A.1	**Stacking** **Test No 1**  Not applicable to 1 D and 1 DX tank containers	
A.1.A	**Stacking** **Test No 1**  Applicable to 1D and 1DX tank containers only	
A.2	**Top lift** 	
A.3	**Top lift** **Test No 2**  Not applicable to 1D and 1DX containers	

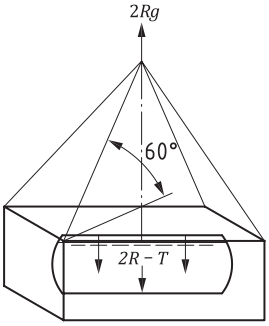
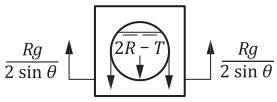
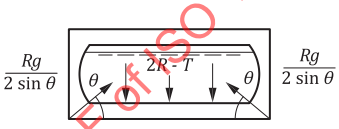
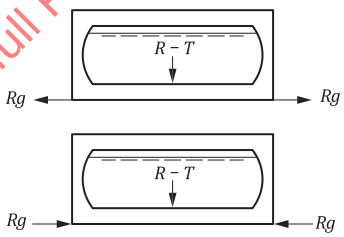
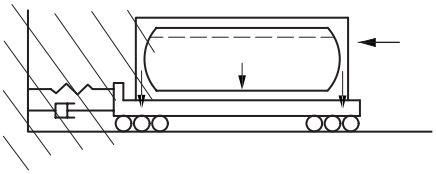
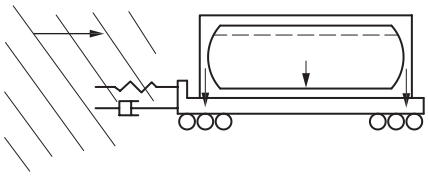
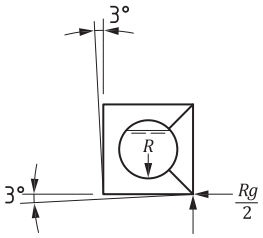
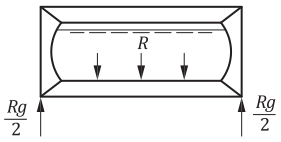
Figure No.	End elevations	Side elevations
A.4	**Top lift** **Test No 2**  Applicable to 1D and 1DX tank containers only	
A.5	Bottom lift Test No 3 	 Applicable to all tank containers
A.6	External restraint (longitudinal) Test No 4 Applicable to all tank containers	
A.7	Internal restraint (longitudinal) dynamic Test No 5	 
A.8	Internal restraint (lateral) Test No 6 [see 6.7.2 a)] 	

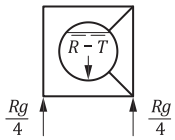
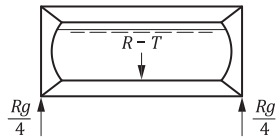
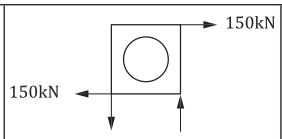
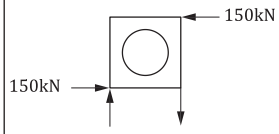
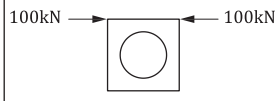
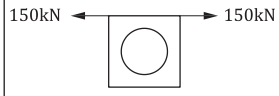
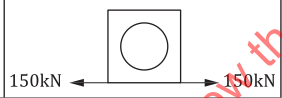
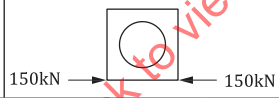
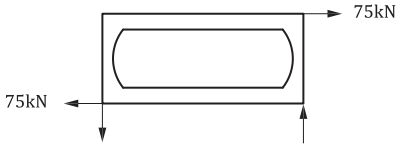
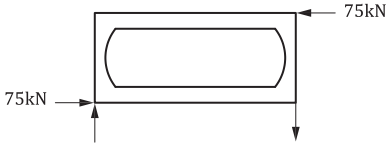
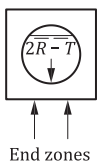
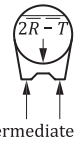
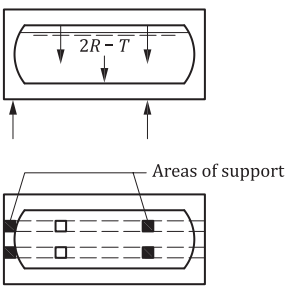
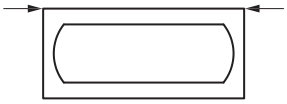
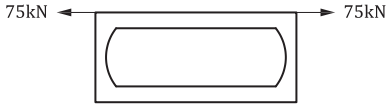
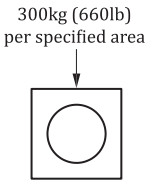
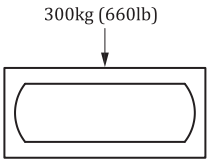
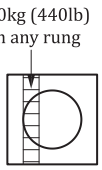
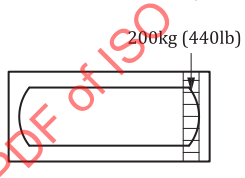
Figure No.	End elevations	Side elevations
A.9	Internal restraint (lateral) Test No 6 [see 6.7.2 b)] 	
	Tank-frame connections through bottom structure only	
A.10	Rigidity (transverse) Test No 7 	Applicable to all tank containers except 1D and 1DX
A.11	Rigidity (transverse) Test No 7 	
A.12	Lashing/securement 	
A.13	Lashing/securement 	
A.14	Lashing/securement 	
A.15	Lashing/securement 	
A.16	Rigidity (longitudinal) Test No 8 Applicable to all tank containers except 1D and 1DX	
A.17		
A.18	Load-transfer area tests  	
A.19	Lashing/securement (This type of leading is not permissible except as applied in Clause 4).	

Figure No.	End elevations	Side elevations
A.20	Lashing/securement	
	Optional features	
A.21	Walkways Test No 10 	
	Applies to all tank containers (where walkways are provided)	
A.22	Ladders Test No 11 	
	Applies to all tank containers (where ladders are provided)	

Annex B
(normative)

Dynamic longitudinal impact test

B.1 Test sample

Ensure the tank container under test (hereafter referred to as container-under-test) is representative of the tank container design for which conformity confirmation is being sought (design type). Permitted design variations are:

a) a reduction of 10 % or an increase of 20 % in capacity (resulting from variations in diameter and length);

b) a decrease in maximum gross mass;

c) an equal or greater thickness, independent of design pressure and temperature;

d) a change to the grade of material of construction provided that the permitted yield strength meets or exceeds that of the tested container;

e) a change of location or a modification to nozzles and manways.

B.2 Test apparatus

B.2.1 Test platform

The test platform may be any suitable structure having securing devices in accordance with ISO 1161, which is capable of achieving and sustaining without permanent damage the prescribed shock severity with the container-under-test mounted securely in place. The test platform shall be:

a) configured so as to allow the container-under-test to be mounted as close as possible to the impacting end;

b) fitted with four securing devices in good condition;

c) equipped with a cushioning device for the purpose of achieving a suitable duration of impact.

B.2.2 Impact creation

The impact may be created by:

a) the test platform striking a stationary mass; or

b) the test platform being struck by a moving mass.

When the stationary mass consists of two or more railway vehicles connected together, each railway vehicle shall be equipped with cushioning devices. Free play between the vehicles shall be eliminated and the brakes on each of the railway vehicles shall be applied.

B.2.3 Measuring/recording system

B.2.3.1 General

Unless otherwise specified in this document, the measuring system shall comply with ISO 6487.