INTERNATIONAL STANDARD

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Series 1 freight containers — Specification and testing —

Part 2: Thermal containers

Conteneurs de la série 1 — Spécifications et essais —

Partie 2: Conteneurs à caractéristiques thermiques

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Contents

Page

Foreword ... iv
Introduction ... v
1 Scope ... 1
2 Normative references ... 1
3 Terms and definitions ... 1
4 Classification ... 3
5 Marking ... 3
6 Dimensions and ratings ... 3
7 Design requirements ... 5
8 Testing ... 9
9 Electrical aspects of thermal containers ... 24
Annex A (normative) Diagrammatic representation of capabilities appropriate to all types and sizes of thermal containers, except where otherwise stated ... 27
Annex B (normative) Details of requirements for load-transfer areas in base structures of containers ... 33
Annex C (normative) Dimensions of fork-lift pockets (where provided) ... 40
Annex D (normative) Dimensions of gooseneck tunnels (where provided) ... 42
Annex E (normative) Cooling water connections ... 43
Annex F (normative) Air inlets and outlets ... 46
Annex G (normative) Mounting of clip-on units ... 51
Annex H (normative) Air temperature measurement points ... 54
Annex I (normative) Steady-state conditions for heat leakage test (Test No. 14) ... 56
Annex J (normative) Phase connections to container plugs and sockets ... 57
Annex K (normative) Electric plug and socket, four-pin, 380/440 V, 50/60 Hz, 32 A ... 58
Annex L (normative) Electrical power supplies for thermal containers (9.2) ... 62
Annex M (normative) General requirements for 220 volt and dual voltage equipment ... 63
Annex N (informative) Conversion of SI units to non-SI units ... 64
Bibliography ... 65

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

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

This fifth edition cancels and replaces the fourth edition (1996) which has been technically revised. It also incorporates the Amendment ISO 1496-2:1996/Amd. 1:2006 and the Technical Corrigendum ISO 1496-2:1996/Cor. 1:1997. The main changes are:

— ISO 1496-2:1996/Amd. 1:2006 has been incorporated;

— 1EE and 1EEE containers have been added to Table 1;

— ventilation control and humidity control have been added as 7.9.9 and 7.9.10;

— a new test, 8.17 Test No. 15 b) Functional test of a thermal container at high ambient temperatures while being cooled by a mechanical refrigeration unit (MRU), has been added and the following tests have been renumbered;

— in 8.14.3, the air leakage rate requirement has been revised to not exceed 5 m^3/h;

— clarification has been given in 8.16.1.1, 8.16.2.1, 8.12.1 and in a note to 9.4;

— the requirements given in Table 4 have been corrected.

The opportunity was also taken for an editorial revision to update the style.

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*

Introduction

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

Part 1	
General purpose	00 to 09
Specific purpose	
closed, vented/ventilated	10 to 19
open top	50 to 59
Part 2	
Thermal	30 to 49
Part 3	
Tank	70 to 79
Bulk, pressurized	85 to 89
Part 4	
Bulk, non-pressurized (box type)	20 to 24
Bulk, non-pressurized (hopper type)	80 to 84
Part 5	
Platform (container)	60
Platform-based, with incomplete superstructure and fixed ends	61 and 62
Platform-based, with incomplete superstructure and folding ends	63 and 64
Platform-based, with complete superstructure	65 to 69

NOTE Container groupings for parts 1 and 3 to 5 inclusive are described in detail in the relevant parts of ISO 1496.

Series 1 freight containers — Specification and testing —

Part 2: Thermal containers

1 Scope

This part of ISO 1496 gives the basic specifications and testing requirements for ISO series 1 thermal containers for international exchange and for conveyance of goods by road, rail and sea, including interchange between these forms of transport.

NOTE For the convenience of users of this part of ISO 1496, the conversion of values expressed in SI units to values expressed in non-SI units is given in Annex N.

2 Normative references

The following referenced documents are indispensable for the application 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 668:1995, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 830:1981, *Freight containers — Vocabulary*

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

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

ISO 10368:2006, *Freight thermal containers — Remote condition monitoring*

IEC 60947-1, *Low-voltage switchgear and controlgear — Part 1: General rules*

3 Terms and definitions

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

3.1
thermal container
freight container having insulating walls, doors, floor and roof designed to retard the rate of heat transmission between the inside and the outside of the container

3.2
insulated container
thermal container having no devices for cooling and/or heating, either permanently installed or attached

3.3
refrigerated container (expendable refrigerant)
thermal container using a means of cooling such as liquefied gases, with or without evaporation control

NOTE It is implicit in this definition that such a container requires no external power or fuel supply.

3.4
mechanically refrigerated container
thermal container served by a refrigerating appliance (mechanical compressor unit, absorption unit, etc.)

3.5
heated container
thermal container served by a heat-producing appliance

3.6
refrigerated and heated container
thermal container served by a refrigerating appliance (mechanical or using expendable refrigerant) and a heat-producing appliance

3.7
refrigerated and heated container with controlled or modified atmosphere
thermal container served by a refrigerating and heat-producing appliance, initially loaded with a modified atmosphere and/or capable of generating and/or maintaining a modified atmosphere

3.8
removable equipment
refrigerating and/or heating appliance, power-generating unit or other equipment designed to be attached or detached from a freight container

3.9
located internally
totally within the external dimensional envelope of the freight container as defined in ISO 668

3.10
located externally
partially or totally outside the external dimensional envelope of the container as defined in ISO 668

NOTE It is implicit in this definition that an appliance located externally has to be removable or retractable to facilitate transport in certain modes.

3.11
batten
member protruding from the inside walls of the container to hold the cargo away from the wall to provide an air passage

NOTE The member may be integral with the wall, fastened to the wall or added during cargo loading.

3.12
bulkhead
partition providing a plenum chamber and/or air passage for either return or supply air

NOTE The partition may be an integral part of the appliance or a separate member.

3.13
ceiling air duct
passage or passages located in proximity to the ceiling to direct air flow

3.14
floor air duct
passage or passages located beneath the cargo support surface to direct air flow

3.15
pin mounting
mounting system using two vertical pins engaging mating sockets built into the top end transverse member such that the entire mass of the removable equipment is supported by the top end transverse member

3.16
lower mounting points
threaded receptacles to which the lower two corners of the removable equipment are fastened

4 Classification

The container types covered by this part of ISO 1496 are classified as shown in Table 1, in which the maximum allowable heat-leakage rates are specified.

A conversion table for kelvins to degrees Celsius is given for convenience in Table 2.

5 Marking

The marking of thermal containers shall be in accordance with ISO 6346.

In addition, thermal containers intended to carry hanging cargo and thermal containers given a modified atmosphere shall be marked in accordance with 7.9.7 and 7.9.8.

6 Dimensions and ratings

6.1 External dimensions

The overall external dimensions and tolerances of the freight containers covered by this part of ISO 1496 shall be in accordance with ISO 668. No part of the container shall project beyond these specified overall external dimensions.

6.2 Internal dimensions

Internal dimensions of thermal containers shall be measured from inner faces of battens, bulkheads, ceiling air ducts, floor air ducts, etc., where fitted.

The minimum internal dimensions for ISO series 1 thermal freight containers are specified in Table 3.

Internal dimensions of thermal containers should be as large as possible.

6.3 Ratings

The values of the rating R, where R is the maximum gross mass of the container, are those given in ISO 668.

Table 1 — Classification of thermal containers

Type, code designation	Description	Maximum heat-leakage rate [1], U_{max}, for freight containers W/K								Design temperatures [2]			
										Inside		Outside	
		1D	1C, 1CC	1B, 1BB	1BBB	1A, 1AA	1AAA	1EE	1EEE	K	°C	K	°C
30	Refrigerated (expendable refrigerant)	13	22	31	33	40	42	44	46	255	−18	318	+45
31	Mechanically refrigerated	13	22	31	33	40	42	44	46	255	−18	318	+45
32	Refrigerated and heated	13	22	31	33	40	42	44	46	289 255	+16 −18	253 318	−20 +45
33	Heated	13	22	31	33	40	42	44	46	289	+16	253	−20
34, 35	Unassigned												
36	Mechanically refrigerated, self-powered	13	22	31	33	40	42	44	46	255	−18	318	+45
37	Refrigerated and heated, self-powered	13	22	31	33	40	42	44	46	289 255	+16 −18	253 318	−20 +45
38	Heated, self-powered	13	22	31	33	40	42	44	46	289	+16	253	−20
39	Unassigned												
40	Refrigerated and/or heated, with removable equipment, appliance located externally	13	22	31	33	40	42	44	46				
41	Refrigerated and/or heated, with removable equipment, appliance located internally	13	22	31	33	40	42	44	46				
42	Refrigerated and/or heated, with removable equipment, appliance located externally	26	46	66	71	86	92						
43, 44	Unassigned												
45	Insulated [3] [4]	13	22	31	33	40	42	44	46				
46	Insulated [3] [4]	26	46	66	71	86	92						
47, 48, 49	Unassigned												

1) The values of U_{max} for heavily insulated containers (types 30, 31, 32, 33, 36, 37, 40, 41 and 45) are better than a coefficient of heat transfer, K, of 0,4 W/(m^2·K). The values of U_{max} for lightly insulated containers (types 42 and 46) are related to an approximate coefficient of heat transfer, K, of 0,7 W/(m^2·K).

2) See Table 2.

3) This category does not have design temperatures; the actual performance is dependent on the capability of the equipment attached in any transport mode.

4) Types 42, 45 and 46 are included for information but are no longer produced.

Table 2 — Kelvins to degrees Celsius conversion table

Kelvin K	Degree Celsius °C
0 273,15	−273,15 0
253	−20
255	−18
285	+12
288	+15
289	+16
293	+20
298	+25
305	+32
311	+38
318	+45
323	+50
NOTE For the purposes of temperature differences, 1 K = 1 °C.	

Table 3 — Minimum internal dimensions

Dimensions in millimetres

Type code designation	Minimum length [a] = Nominal container external length minus	Minimum width = Nominal container external width minus	Minimum height [a] (no gooseneck tunnel) = Nominal container external height minus	Minimum height [a] (with gooseneck tunnel) = Nominal container external height minus
30, 31, 32, 33	690	220	345	385
36, 37, 38, 41	990			
40	440			
42	390	180	310	350
45	340	220	285	340
46	290	180	250	290
NOTE Some thermal containers built to conform with earlier editions of this part of ISO 1496 are significantly smaller, particularly if a diesel generator is fitted.				
[a] Some of the length and height dimensions specified will necessarily be used for air circulation.				

7 Design requirements

7.1 General

All thermal containers shall comply with the following requirements.

The strength requirements for containers are given in diagrammatic form in Annex A (these requirements are applicable to all thermal containers except where otherwise stated). They apply to containers as complete units, except as envisaged in 8.1.

The strength requirements for corner fittings (see also 7.2) are specified in ISO 1161.

The thermal container shall be capable of withstanding the loads and loadings specified in Clause 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 thermal containers as indicated in Annex A and demonstrated by the tests described in Clause 8 shall not be exceeded in any mode of operation.

Any closure in a container, which if unsecured could lead to a hazardous situation, shall be provided with an adequate securing system having external indication of the positive securement of that closure in the appropriate operation position. In particular, doors should be capable of being securely fastened in the open or closed position.

The walls, doors, floors and roof of the thermal container shall be insulated in such a manner as to balance, as far as is practicable, the heat transfer through each of them, although the roof insulation may be increased to compensate for solar radiation.

7.2 Corner fittings

All containers shall be equipped with top and bottom corner fittings. The requirements and positioning of the corner fittings shall be in accordance with ISO 1161. The upper faces of the top corner fittings shall protrude above the top of the container by a minimum of 6 mm (see 7.3.4). The “top of the container” means the highest level of the cover of the container.

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

7.3 Base structure

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

7.3.2 All containers, other than 1D, shall also be capable of being supported only by load-transfer areas in their base structure.

Consequently, these containers shall have end transverse members and sufficient intermediate load-transfer areas (or a flat underside) of sufficient strength to enable vertical load transfer to or from the longitudinal members of a carrying vehicle. Such longitudinal members are assumed to lie within the two 250 mm wide zones defined by the dashed lines in Figure B.1.

The lower faces of the load-transfer areas, including those of the end transverse members, shall be in one plane located 12,5 mm $^{+5,0}_{-1,5}$ mm above the plane of the lower faces of the bottom corner fittings and bottom side rail. 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 fittings to afford protection to the understructure.

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 bottom corner fittings of the container.

Containers having all their intermediate transverse members spaced 1 000 mm apart or less (or having a flat underside) shall be deemed to comply with the requirements given in the second paragraph of this sub-clause.

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

7.3.3 For 1D containers, the level of the underside of the base structure is not specified, except as implied in 7.3.4.

7.3.4 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, no part of the base of the container shall deflect more than 6 mm below the base plane (lower faces of the bottom corner fittings).

7.3.5 The base structure shall be designed to withstand all forces, particularly lateral forces, induced by the cargo in service. This is particularly important where provisions are made for securing the cargo to the base structure of the container.

7.4 End structure

For all thermal containers other than 1D, 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.

NOTE It should be noted that the rigidity of the end structure of a container fitted with an internally located refrigeration unit is not necessarily equal to the sum of rigidities of container and unit, but is also dependent on the way in which the unit is fitted.

7.5 Side wall structure

For all thermal containers other than 1D, the longitudinal deflection of the top of the container with respect to the bottom of the container when under full longitudinal rigidity test conditions shall not exceed 25 mm.

7.6 Walls

Where openings are provided in end or side walls, the ability of these walls to withstand tests Nos. 5 and 6 shall not be impaired.

7.7 Door opening

Each thermal container shall be provided with a door opening at least at one end.

All door openings and end openings shall be as large as possible.

The usable width shall correspond with the appropriate minimum internal dimension given in Table 3.

The usable height shall be as close as practicable to the appropriate minimum internal dimension given in Table 3.

7.8 Sanitary and taint-free requirements

Attention is drawn to the need for the proper choice of materials for the thermal container and any refrigerator/heating appliances to prevent adverse effects in cargo, especially foodstuffs. Any relevant national or international requirements should also be considered.

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

No pockets shall exist inside the container that cannot be reached by conventional cleaning methods.

If drains are fitted, provision shall be made to ensure that cleaning water can drain from the inside of the container.

7.9 Requirements for optional features

7.9.1 Fork-lift pockets

7.9.1.1 Fork-lift pockets used for handling 1CC, 1C and 1D thermal containers in the loaded or unloaded condition may be provided as optional features.

Fork-lift pockets shall not be provided on 1AAA, 1AA, 1A, 1BBB, 1BB and 1B thermal containers.

7.9.1.2 Where a set of fork-lift pockets has been fitted as in 7.9.1.1, a second set of fork-lift pockets may, in addition, be provided on 1CC and 1C containers for empty handling only.

The(se) additional pocket(s) which may in fact be one pocket paired with an existing pocket, provided in accordance with 7.9.1.1, should be centred as closely as possible about the centre of gravity of the empty container.

7.9.1.3 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. It is not necessary for the base of the fork-lift pockets to be the full width of the container, but it shall be located in the vicinity of each end of the fork pockets.

7.9.2 Gooseneck tunnels

Gooseneck tunnels shall be provided as mandatory features in 1AAA thermal containers and may be provided as optional features in thermal containers 1AA, 1A, 1BB and 1B. The dimensional requirements are specified in Annex D and, in addition, all other parts of the base structure shall be as specified in 7.3.

7.9.3 Drains

Cargo space drains which operate when carrying cargo, shall be protected by fittings which open automatically above normal internal operating pressure. Drains required for cleaning of the interior of the container shall be provided with manual closures.

Local customs and health requirements may place additional requirements on drains, which should be adhered to.

7.9.4 Water connections

For appliances requiring water connections, the inlet and outlet interfaces shall be in accordance with Annex E.

Water-cooled appliances shall either be self-draining or incorporate the facility to drain the unit to prevent the water from freezing.

The water inlet and outlet connections shall be so located at the machinery end of the container that, to an observer facing that end, they appear in the lower right-hand quarter.

7.9.5 Air inlets and outlets

Where series 1AA, 1CC and 1C containers are designed for ducted air systems and for use with externally located removable equipment, the air inlet and outlet openings shall conform to the requirements given in Annex F.

7.9.6 Intermediate sockets for clip-on units

Where intermediate sockets are provided for use of clip-on units, they shall be located and designed in accordance with Annex G.

7.9.7 Hanging cargo facilities

The roof of containers may be designed to carry hanging cargo. Such containers shall meet the test requirements specified in 8.8. Specific marking shall be placed on the inside of the container to indicate the maximum hanging load.

7.9.8 Modified atmospheres

Thermal containers that are manufactured to operate with a modified atmosphere, which could be injurious to health until appropriately vented, shall be so marked alongside each point of access.

7.9.9 Ventilation control

Where automated ventilation control is provided, this fact shall be clearly marked near the ventilation inlet(s).

7.9.10 Humidity control

Where humidity control to provide reduced humidity is provided by means of reheating only, there are no additional requirements. Where humidity control incorporates addition of water as liquid or vapour, instructions shall be provided for cleaning and disinfecting all water reservoirs.

8 Testing

8.1 General

8.1.1 Unless otherwise stated, thermal containers conforming to the design requirements specified in Clause 7 shall, in addition, be capable of withstanding the tests specified in 8.2 to 8.19 inclusive, as applicable.

The refrigeration and/or heating equipment (for example components, framework, panelling, battens, ductwork, bulkheads) need not necessarily be in place when the container is tested, except where so specified for a particular test. But if any of the main parts or frameworks of the refrigeration and/or heating equipment is not in position for any structural test, the ability of that part or framework to withstand the appropriate proportion of any relevant cargo loading and/or the forces or accelerations to which the container and equipment may be subjected in the service for which it was designed shall be established independently.

If parts of the refrigeration and/or heating equipment which contribute to the strength or integrity of the container in service are not in position for structural testing, substitute framework and/or panelling may be used, provided that it is secured in the same manner as the equipment and does not provide greater strength than the original parts.

The test for heat leakage (Test No. 14) shall be used to measure the heat leakage rate from the container, which determines its class. The tests described in 8.16. 8.17 and 8.18 [Tests Nos. 15 a), 15b) and 15 c)] establish a standard method for testing the performance of mechanical and expendable liquid refrigeration units respectively, when used in conjunction with a container of known class.

The tests for weatherproofness (Test No. 12), for airtightness (Test No. 13), for heat leakage (Test No. 14) and for performance under refrigeration (Test No. 15) shall be carried out in sequence after completion of Tests Nos. 1 to 11.

NOTE Annex A gives examples of forces applied in the tests described in 8.2 to 8.12.

