INTERNATIONAL STANDARD

ISO 1496-2

Sixth edition
2018-11

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

Reference number
ISO 1496-2:2018(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO 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*, 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 sixth edition cancels and replaces the fifth edition (ISO 1496-2:2008) which has been technically revised. The main changes compared to the previous edition are as follows:

— an easy reference for containers dimensions has been included in Table 1;

— the –18 °C/+38 °C cooling capacity test has been reinstated;

— the 50 °C ambient functionality test has been added;

— energy consumption tests have been added;

— an airflow requirement has been added;

— integrated front containers has been added;

— a clip on MRU units has been removed;

— a floor height and load line requirement has been added;

— design temperatures have been changed to reflect modern MRU's;

— tests described in ISO 1496-1 have been removed and referenced;

— new Annexes H and I have been added;

— the old annex D has been removed and referenced to ISO 668;

— the test procedure for heat leakage has been revised;

— the heat-leakage rate for 1CCC has been included in Table 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 2: Thermal containers

1 Scope

This document 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.

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 1496-1, *Series 1 freight containers — Specification and testing*

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

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

ISO Guide 51, *Safety aspects — Guidelines for their inclusion in standards*

IEC 60309-2, *Plugs, socket-outlets and couplers for industrial purposes — Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO Guide 51, ISO 668, ISO 1161, ISO 6346, ISO 1496-1, IEC-60309-2 and the following 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/

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

3.2
refrigeration container
<expendable refrigerant> thermal container served by a unit using a means of cooling such as liquefied gases, with or without evaporation control (ERU)

3.3
picture frame
opening in one end of a thermal container to accommodate an integral refrigeration unit

3.4
built-in front mechanically refrigerating and heated container
thermal container with built-in recess for a refrigeration and heating unit

3.5
heated container
thermal container with a heat producing unit

3.6
controlled atmosphere
modified atmosphere
system installed in a thermal container served by a refrigeration unit, capable of generating and/or maintaining gas concentration levels different to those of the air outside the container

3.7
removable equipment
power-generating unit or other equipment designed to be attached or detached from a thermal container

3.8
internally
<location> totally within the external dimensional envelope of the container as defined in ISO 668

3.9
externally
<location> partially or totally outside the external dimensional envelope of the container as defined in ISO 668

Note 1 to entry: It is implicit in this definition that a unit located externally needs to be removable or retractable to facilitate transport in certain modes.

3.10
batten
member protruding from the inside walls of the container to hold the cargo away from the wall to provide an air passage

Note 1 to entry: The member may be integral with the wall, fastened to the wall or added during cargo loading.

3.11
bulkhead
partition providing a plenum chamber and/or air passage for either return or supply air

Note 1 to entry: The partition may be an integral part of the unit or a separate member.

3.12
load line
mark on the interior surface of a thermal container above which cargo should not be stowed

3.13
T-floor
section of floor, usually in aluminium, in the profile of the letter “T” for supporting cargo and distributing air

3.14
fresh air vent
adjustable orifice to allow a supply of outside air into a mechanical refrigeration container

Note 1 to entry: A mechanical refrigeration container is a thermal container served by a mechanical refrigeration unit (MRU).

3.15
floor drain
self-sealing floor orifice to allow the expulsion of condensate

3.16
vacuum valve
valve to prevent the development of excessive air pressure differential between inside and outside of the thermal container

3.17
defrost drain
orifice for discharging condensate from the cooling coil

3.18
pin mounting
mounting system using two vertical pins engaging in sockets built into the front header

3.19
lower mounting point
threaded receptacle to which the lower two corners of the removable equipment are fastened

3.20
new thermal container
new insulated container
freight container having insulating walls, doors, floor and roof that has been manufactured within the previous 7 days and with maximum heat-leakage rate, U_{max}, following Table 2

3.21
high ambient temperature
temperature above 50 °C at which the MRU is expected to operate without functional restrictions

3.22
aged thermal container
thermal container with aged polyurethane foam and with a heat-leakage rate, U value, 20 % higher than the U_{max} value given in Table 2

4 Classification

The container types covered by this document are classified as shown in Table 2, in which the maximum allowable new thermal container heat-leakage rates are specified.

5 Marking

The marking of thermal containers shall be in accordance with ISO 6346. Load line marking shall be in accordance with 7.9.9. In addition, thermal containers given a modified/controlled atmosphere shall be marked in accordance with 7.9.6. Marking symbols can be found in ISO 7010. Thermal containers with fresh air ventilation control shall be marked in accordance with 7.9.7.

6 Dimensions and ratings

6.1 External dimensions

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

For reference purposes, the dimensions are given in Table 1.

Table 1 — Thermal container reference dimensions

Nominal length ft	Nominal height ft			
	9’ 6”	8’ 6”	8’ 0”	<8’ 0”
45	1EEE	1EE	—	—
40	1AAA	1AA	1A	1AX
30	1BBB	1BB	1B	1BX
20	1CCC	1CC	1C	1CX
10	—	1DD	1D	1DX
NOTE All units have a nominal width of 8 ft.				

6.2 Internal dimensions

Internal dimensions of thermal containers shall be measured from inner faces of battens, bulkheads, T-floor, etc., where fitted.

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

6.3 Ratings

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

Table 2 — Classification of thermal containers

Detailed type, code (ISO 6346)	Description	Maximum heat-leakage rate[1] for new thermal containers U_{max} W/K								Operational[2,3,4] temperatures	
		1D, 1DD	1C, 1CC	1CCC	1B, 1BB	1BBB	1A, 1AA	1AAA	1EE	1EEE	Inside °C	Outside °C
H5/HM	Refrigerating (expendable refrigerant)	13	22	24	31	33	40	42	44	46	−30	+50
H8/HX	Eutectic, remote mechanical refrigeration	13	22	24	31	33	40	42	44	46	+30 −30	−30 +50
R0/RA	Mechanically refrigerating	13	22	24	31	33	40	42	44	46	−30	+50
R1/RB	Mechanically refrigerating and heated	13	22	24	31	33	40	42	44	46	+30 −30	−30 +50
R7/RW	Heated	13	22	24	31	33	40	42	44	46	+30	−30

1 The values of U_{max} for insulated containers (type 1AAA) are better than a coefficient of heat transfer of 0,4 W/(m²·K).

2 Enclosed electrical components in the control box shall not fail up to temperatures of +85 °C.

3 Materials shall be capable of withstanding surface temperatures −30 °C to +80 °C.

4 In case MRU is not designed for −30 °C, the lowest design temperature specified by the manufacturer may be selected instead

Table 2 *(continued)*

Detailed type, code (ISO 6346)	Description	Maximum heat-leakage rate[1] for new thermal containers U_{max} W/K								Operational[2,3,4] temperatures	
		1D, 1DD	1C, 1CC	1CCC	1B, 1BB	1BBB	1A, 1AA	1AAA	1EE	1EEE	Inside °C	Outside °C
R5/RM	Built-in front mechanically refrigerating and heated	13	22	24	31	33	40	42	44	46	+30 −30	−30 +50
R2/RD	Mechanically refrigerating, self-powered	13	22	24	31	33	40	42	44	46	−30	+50
R3/RG	Refrigerating and heated, self-powered	13	22	24	31	33	40	42	44	46	+30 −30	−30 +50
R8/RX	Heated, self-powered	13	22	24	31	33	40	42	44	46	+30	−30
H0/HA	Refrigerating and/or heated, with removable equipment, unit located externally	13	22	24	31	33	40	42	44	46		
H1/HB	Refrigerating and/or heated, with removable equipment, unit located internally	13	22	24	31	33	40	42	44	46		

1 The values of U_{max} for insulated containers (type 1AAA) are better than a coefficient of heat transfer of 0,4 W/(m²·K).

2 Enclosed electrical components in the control box shall not fail up to temperatures of +85 °C.

3 Materials shall be capable of withstanding surface temperatures −30 °C to +80 °C.

4 In case MRU is not designed for −30 °C, the lowest design temperature specified by the manufacturer may be selected instead

Table 3 — Minimum internal dimensions

Dimensions in millimetres

Detailed type code (ISO 6346)	Minimum length[1,2] = Nominal container external length minus	Minimum width[2] = Nominal container external width minus	Minimum height[1,2] (no gooseneck tunnel) = Nominal container external height minus	Minimum height[1,2] (with gooseneck tunnel) = Nominal container external height minus
H0/HA, R0/RA, R1/RB, R5/RM, R7/RW	690	220	345	385
H1/HB, R2/RD, R3/RG, R8/RX	990			
H0/HA	440			

1 Some of the length and height dimensions specified will necessarily be used for air circulation.

2 Containers internal dimensions can deviate from above minimums due to operational or other requirements.

7 Design requirements

7.1 General

All thermal containers shall comply with the following requirements.

The strength requirements for containers are given in ISO 1496-1 (these requirements are applicable to all thermal containers except where otherwise stated). They apply to containers as complete units, except as described 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 ISO 1496-1 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, can 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 alone.

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

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 375 mm wide zones defined by the dashed lines in ISO 668:2013, 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 7.3.2.

Requirements for containers not having transverse members spaced 1 000 mm apart or less (and not having a flat underside) are given in ISO 1496-1.

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 1,8 *R*, 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.

It should be taken into consideration 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 No. 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.

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 refrigeration/heating units to prevent adverse effects in cargo, especially foodstuffs.

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 may be provided on 1AAA, 1AA, 1A, 1BBB, 1BB and 1B thermal containers for handling in unloaded condition only.

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) provided accordance with 7.9.1.1, which can, in fact, be one pocket paired with an existing pocket, 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 ISO 1496-1 and shall pass completely through the base structure of the container so that lifting devices can be inserted from either side. It is not necessary for the 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 ISO 668 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, when fitted, shall be provided with a sealing mechanism.

7.9.4 Water connections

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

Water-cooled MRU's 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 located at the machinery end of the container so that, to an observer facing that end, they appear in the lower right-hand quarter.

7.9.5 Picture frames

Where containers are designed for bolted in refrigeration unit (integral units), Annex B should be referred to.

7.9.6 Modified/controlled atmospheres

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

7.9.7 Fresh air ventilation control

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

7.9.8 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.

7.9.9 Load line

Thermal containers with an air circulation system should have a load line clearly marked to ensure return of air to the MRU. It is recommended that the load line be at least 100 mm from the roof for 40’ container and 70 mm for a 20’ container.

7.9.10 Floor

Thermal containers with an air circulation system should have a method for distributing air in the floor but not definitively a T-floor. The floor shall have a minimum height as indicated in Table 4.

Table 4 — Container floor heights

Minimum floor height mm	Container designation			
55	1EEE	1EE	—	—
55	1AAA	1AA	1A	1AX
45	1BBB	1BB	1B	1BX
35	1CCC	1CC	1C	1CX
30	—	1DD	1D	1DX

7.9.11 Air circulation

MRU air circulation should be capable of at least 50 container volume air changes each hour whilst operating on a 50 Hz power supply, taking the container volume from Table 3. It is not a requirement for fan operation to be continuous.

Airflow measurement should comply with the provisions of ISO 5801.

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 8.7, 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.