INTERNATIONAL STANDARD

ISO 1496-2

Fourth edition
1996-10-01

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 1496-2:1996(E)

Content

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

Annexes

Foreword

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

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

This fourth edition cancels and replaces the third edition (ISO 1496-2:1988); the main changes involve:

a) the introduction of 1AAA and 1BBB containers (see ISO 668) and the specification of relevant dimensional and performance requirements;

b) clarification of the requirements relating to the mounting of removable equipment, including the specification of performance requirements for mounting devices;

c) the restriction to only one type of electrical equipment for new containers compared to the three types included as options in the third edition.

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

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

— *Part 2: Thermal containers*

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

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

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

Annexes A to L form an integral part of this part of ISO 1496. Annexes M, N and O are for information only.

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.

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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 which are suitable 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 standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1496. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1496 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 668:1995, *Series 1 freight containers — Classification, dimensions and ratings.*

ISO 830:1981, *Freight containers — Terminology.*

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

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

ISO 10368:1992, *Freight thermal containers — Remote condition monitoring.*

IEC 947-1:1988, *Low voltage switchgear and controlgear — Part 1: General rules.*

3 Definitions

For the purposes of this part of ISO 1496, the general definitions given in ISO 830 and the following definitions 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/degrees Celsius is given for convenience in table 2.

5 Marking

The marking of thermal containers shall be in accordance with the principles embodied in 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 as large as possible. They 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.

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]			
		1D	1C, 1CC	1B, 1BB	1BBB	1A, 1AA	1AAA	Inside K	Inside °C	Outside K	Outside °C
30	Refrigerated (expendable refrigerant)	15	26	37	40	48	51	255	−18	311	+38
31	Mechanically refrigerated	15	26	37	40	48	51	255	−18	311	+38
32	Refrigerated and heated	15	26	37	40	48	51	289 255	+16 −18	253 311	−20 +38
33	Heated	15	26	37	40	48	51	289	+16	253	−20
34 35	Unassigned										
36	Mechanically refrigerated, self-powered	15	26	37	40	48	51	255	−18	311	+38
37	Refrigerated and heated, self-powered	15	26	37	40	48	51	289 255	+16 −18	253 311	−20 +38
38	Heated, self-powered	15	26	37	40	48	51	289	+16	253	−20
39	Unassigned										
40	Refrigerated and/or heated, with removable equipment, appliance located externally	15	26	37	40	48	51	[3]		[3]	
41	Refrigerated and/or heated, with removable equipment, appliance located internally	15	26	37	40	48	51	[3]		[3]	
42	Refrigerated and/or heated, with removable equipment, appliance located externally	26	46	66	71	86	92	[3]		[3]	
43 44	Unassigned										
45	Insulated	15	26	37	40	48	51	—		—	
46	Insulated	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 related to an approximate 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 specified temperature limits; the actual performance is dependent on the capability of the equipment attached in any transport mode.

Table 2 — Kelvins/degrees Celsius conversion table

Kelvins K	Degrees Celsius °C
0 273,15	−273,15 0
253 255 288 289 293 298 305 311	−20 −18 +15 +16 +20 +25 +32 +38
NOTE — For the purposes of temperature differences, 1 K = 1 °C.	

Table 3 — Minimum internal dimensions

Dimensions in millimetres

Type code designation	Minimum length [1] = Nominal container external length minus	Minimum width = Nominal container external width minus	Minimum height [1] (no gooseneck tunnel) = Nominal container external height minus	Minimum height [1] (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.				
1) 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 be capable of fulfilling the following requirements.

7.1.1 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.

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

7.1.3 The thermal container shall be capable of withstanding the loads and loadings detailed in clause 8.

7.1.4 As the effects of loads encountered under any dynamic operating condition should only approach, but not exceed, the effects of the corresponding test loads, it is implicit that the capabilities of 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.

7.1.5 Any closure in a container, which if unsecured could lead to a hazardous situation, shall be provided with an adequate securing system having 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.

7.1.6 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.

7.3.2.1 Consequently, these containers shall have end transverse members and sufficient intermediate load-transfer areas (or a flat underside) of sufficient strength to permit vertical load transfer to or from the longitudinal 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.

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

$$12{,}5\ \text{mm}\ {}^{+5{,}0}_{-1{,}5}\ \text{mm}$$

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.

7.3.2.3 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 7.3.2.1.

7.3.2.4 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 1,8*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.

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, adequate provision shall be made to ensure that cleaning water can drain satisfactorily 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.

NOTE — 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, if required to operate when carrying cargo, should be protected by fittings which open automatically above normal internal operating pressure. If required for cleaning of the interior of the container, they shall be provided with manual closures.

Consideration should be given to applicable customs and health requirements.

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 in order 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 clauses F.1, F.2 and F.3, respectively, 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.

8 Testing

8.1 General

8.1.1 Unless otherwise stated, thermal containers complying with the design requirements specified in clause 7 shall, in addition, be capable of withstanding the tests specified in 8.2 to 8.18 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 employed during such testing, provided that such substitute components are secured in the same manner as the equipment itself and do not provide greater strength than the equipment would have provided.

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 and 8.17 [tests Nos. 15 a) and 15 b)] 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.

8.1.2 The maximum payload, P, of the container to be tested is given by:

$$P = R - T$$

where

R is the rating;

T is the tare.

NOTE — P, R and T are expressed 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:

$$Pg, Rg, Tg$$

the units of which are newtons or multiples thereof.

The word "load", when used to described a physical quantity to which units may be ascribed, implies mass. The word "loading", for example as in "internal loading", implies force.

8.1.3 The test loads or loadings within the thermal container shall be uniformly distributed.

8.1.4 The test loads or loadings specified in all of the following tests are minimum requirements.

8.1.5 The dimensional requirements to which reference is made in the requirements subclause after each test are those specified in

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

b) ISO 668;

c) ISO 1161.

8.2 Test No. 1 — Stacking

8.2.1 General

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

Table 4 specifies the test force to be applied to each pair of corner fittings and the superimposed mass that the test force represents.

8.2.2 Procedure

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

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

The thermal container shall be subjected to vertical forces, applied either to all four corner fittings simultaneously or to each pair of end fittings, at the appropriate level specified in table 4. The forces shall be applied through a test fixture equipped with corner fittings as specified in ISO 1161, or equivalent fittings which have imprints of the same geometry (i.e. with the same external dimensions, chamfered aperture

and rounded edges) as the lower face of the bottom corner fittings specified in ISO 1161. If equivalent fittings are used, they shall be designed to produce the same effect on the container under the test loads as when corner fittings are used.

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

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

8.2.3 Requirements

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

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

8.3.1 General

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

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

8.3.2 Procedure

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

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

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

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

8.3.3 Requirements

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

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

8.4.1 General

This test shall be carried out to prove the ability of a thermal 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.

Table 4 — Forces to be applied in stacking test

Container designation	Test force per container (all four corners simultaneously)		Test force per pair of end fittings		Superimposed mass represented by test force	
	kN	lbf	kN	lbf	kg	lb
1A, 1AA and 1AAA	3 392	762 550	1 696	381 275	192 000	423 290
1B, 1BB and 1BBB	3 392	762 550	1 696	381 275	192 000	423 290
1C and 1CC	3 392	762 550	1 696	381 275	192 000	423 290
1D	896	201 600	448	100 800	50 800	112 000

NOTE — The test force of 3 392 kN per container is derived from the superimposed mass of eight containers stacked on top of one container, all being rated to 24 000 kg (52 910 lb), and an acceleration force of 1,8g. [The corner posts of such containers are known as having been tested to 86 400 kg (190 480 lb).]

8.4.2 Procedure

The thermal container shall have a load uniformly distributed over the floor in such a way that the combined mass of container and test load is equal to $2R$, and it 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 and 1A thermal containers;

37° to the horizontal for 1BBB, 1BB and 1B thermal containers;

45° to the horizontal for 1CC and 1C thermal containers;

60° to the horizontal for 1D thermal containers.

In each case, the line of action of the lifting force and the outer face of the corner fitting shall be no 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 container shall be suspended for 5 min and then lowered to the ground.

8.4.3 Requirements

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

8.5 Test No. 4 — External restraint (longitudinal)

8.5.1 General

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

8.5.2 Procedure

The thermal container shall have a load uniformly distributed over the floor in such a way that the combined mass of the container and the uniformly distributed test load is equal to R, and it shall be secured longitudinally to rigid anchor points through the bottom apertures of the bottom corner fittings at one end of the thermal container.

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

8.5.3 Requirements

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

8.6 Test No. 5 — Strength of end walls

8.6.1 General

This test shall be carried out to prove the ability of a thermal container to withstand forces under the dynamic conditions referred to in 8.5.1.

8.6.2 Procedure

The thermal container shall have each end tested when one end is blind and the other equipped with doors. In the case of symmetrical construction, one end only need be tested. The container shall be subjected to an internal loading of $0{,}4Pg$. The internal loading shall be uniformly distributed over the wall under test and arranged to allow free deflection of the wall.

8.6.3 Requirements

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

8.7 Test No. 6 — Strength of side walls

8.7.1 General

This test shall be carried out to prove the ability of a thermal container to withstand the forces resulting from ship movement.

8.7.2 Procedure

The thermal container shall have each side wall tested. In the case of symmetrical construction, one side only need be tested.