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British Standard

Freight containers

Part 2. Specification and testing of series 1 freight containers

Section 2.2 Thermal containers

Conteneurs pour le transport des marchandises
Partie 2. Spécification et essais des conteneurs de la série 1
Section 2.2 Conteneurs à caractéristiques thermiques

Frachtbeforderungsbehälter
Teil 2. Bestimmungen und Prüfungen der Behälter der Serie 1
Abschnitt 2.2 Behälter mit Wärme-Eigenschaften

British Standards Institution

Contents

National foreword

This Section of BS 3951, which is one of a series relating to freight containers, has been prepared under the direction of the Packaging and Freight Containers Standards Policy Committee and supersedes BS 3951 : Section 2.2 : 1978, which is withdrawn.

This Section is identical with ISO 1496-2 : 1988 'Series 1 freight containers–Specification and testing–Part 2 : Thermal containers' published by the International Organization for Standardization (ISO).

The main changes from the previous edition are as follows:

(a) alignment of the text, etc. with BS 3951 : Section 2.1

(b) introduction of *U* values instead of *K* factors;

(c) specification of internal height and width dimensions;

(d) revision of air leakage rates;

(e) revision of the heat leakage test;

(f) revision of the performance test under refrigeration;

(g) revision of annex F;

(h) introduction of an annex giving information on intermediate sockets for clip-on units;

(i) introduction of an annex giving a diagrammatic representation of steady-state conditions.

Cross-references

International standard	Corresponding British Standard
	BS 3951 Freight containers Part 1 General
ISO 668 : 1988	Section 1.1 : 1989 Specification for series 1 freight containers : Classification, dimensions and ratings (Identical)
ISO 830 : 1981	Section 1.4 : 1983 Glossary of terminology (Identical)
ISO 1161 : 1984	Section 1.2 : 1985 Specification for corner fittings for series 1 freight containers (Identical)
ISO 6346 : 1984	Section 1.6 : 1985 Specification for coding, identification and marking (Identical)

IEC 144 : 1963	BS 5420 : 1977 Specification for degrees of protection of enclosures of switchgear and controlgear for voltages up to and including 1000 V a.c. and 1200 V a.c. (Identical)

Other British Standards giving information related to the handling of freight containers are BS 5073 : 1982 'Guide to stowage of goods in freight containers' and BS 5237 : 1985 'Specification for lifting twistlocks'.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Series 1 freight containers — Specification and testing —

Part 2 : Thermal containers

0 Introduction

Grouping of container types for specification purposes:

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— closed, vented/ventilated	10 to 19
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NOTE — Container groupings for parts 1 and 3 to 6 inclusive are set forth in detail in the relevant parts of this International Standard.

1 Scope and field of application

1.1 This part of ISO 1496 lays down the basic specifications and testing requirements for ISO series 1 thermal containers which are suitable for international exchange and for conveyance by road, rail and sea, including interchange between these forms of transport.

1.2 The container types covered by this part of ISO 1496 are given in table 1.

1.3 The marking requirements for these containers are in accordance with the principles embodied in ISO 6346.

The load-bearing capabilities of equipment installed for hanging cargo shall be clearly marked on the inside of the container.

If containers are given an atmosphere which could be injurious to health until appropriately vented, suitable marks should be placed alongside each point of access.

2 References

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

ISO 830, *Freight containers — Terminology.*

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

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

IEC Publication 144, *Degrees of protection of enclosures for low-voltage switchgear and controlgear.*

3 Definitions

For the purposes of this part of ISO 1496, the definitions given in ISO 830 apply. The following definitions correspond to those given in ISO 830, but they have been included, for convenience, in this part of ISO 1496.

3.1 thermal container: Freight container built with 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.

Table 1 — Classification of thermal containers

Type code designation	Type	Maximum heat leakage[1)], U_{max} (W/K), for freight containers				Design temperatures[2)]			
		1D	1C, 1CC	1B, 1BB	1A, 1AA	Inside K	Inside °C	Outside K	Outside °C
30	Refrigerated, expendable refrigerant	15	26	37	48	255	−18	311	+38
31	Mechanically refrigerated	15	26	37	48	255	−18	311	+38
32	Refrigerated and heated	15	26	37	48	289 255	+16 −18	311 253	+38 −20
33	Heated	15	26	37	48	289	+16	253	−20
34 35	Spare								
36	Mechanically refrigerated, self-powered	15	26	37	48	255	−18	311	+38
37	Refrigerated and heated, self-powered	15	26	37	48	289 255	+16 −18	311 253	+38 −20
38	Heated, self-powered	15	26	37	48	289	+16	253	−20
39	Spare								
40	Refrigerated and/or heated, with removable equipment, appliance located externally	15	26	37	48	3)		3)	
41	Refrigerated and/or heated, with removable equipment, appliance located internally	15	26	37	48	3)		3)	
42	Refrigerated and/or heated, with removable equipment, appliance located externally	26	46	66	86	3)		3)	
43 44	Spare								
45	Insulated	15	26	37	48	—		—	
46	Insulated	26	46	66	86	—		—	
47 48 49	Spare								

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/(m²·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/(m²·K).

2) A conversion table for kelvins/degrees Celsius is given for convenience in 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[1)]

Kelvin, K	Degrees Celsius, °C
0	− 273,15
273,15	0
253	− 20
255	− 18
288	+ 15
289	+ 16
293	+ 20
298	+ 25
305	+ 32
311	+ 38

1) In the case of temperature differences: 1 K = 1 °C

3.3 refrigerated container (expendable refrigerant): Thermal container using a means of cooling such as

- ice, or
- dry ice, with or without sublimation control, or
- liquefied gases, with or without evaporation control.

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

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

3.5 heated container: Thermal container served by heat-producing appliance.

3.6 refrigerated and heated container: Thermal container served by refrigerating appliance (mechanical or expendable refrigerant) and heat-producing appliance.

3.7 removable equipment; clip-on unit: Refrigerating and/or heating appliance which is designed primarily for attaching to or detaching from the container when transferring between different modes of transportation.

3.8 located internally: Totally within the external dimensional envelope of the container as defined in ISO 668.

3.9 located externally: Partially or totally outside the external dimensional envelope of the container as defined in ISO 668.

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

3.10 battens: Members protruding from the inside walls of the container to hold the cargo away from the walls to provide an air passage. They may be integral with the walls, fastened to the walls or added during cargo loading.

3.11 bulkhead: A partition providing a plenum chamber and/or air passage for either return or supply air. It may be an integral part of the appliance or a separate member.

3.12 ceiling air duct: A passage or passages located in proximity to the ceiling to direct air flow.

3.13 floor air duct: A passage or passages located beneath the cargo support surface to direct air flow.

4 Dimensions and ratings

4.1 External dimensions

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

4.2 Internal dimensions

Internal dimensions of 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.

4.3 Minimum internal dimensions

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

4.4 Ratings

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

5 Design requirements

5.1 General

All containers shall be capable of fulfilling the following requirements.

The strength requirements for containers are given in diagrammatic form in annex A (these requirements are applicable to all containers except where otherwise stated). They apply to containers as complete units, except as envisaged in 6.1.

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

The container shall be capable of withstanding the loads and loadings detailed in clause 6.

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

Table 3 — Minimum internal dimensions[1)]

Dimensions in millimetres

Freight container designation	Types	Length[2)]	Width	Height[2)]
1C	38, 40, 45	5 650	2 220	2 000
	30, 31, 32, 41	5 300[3)]	2 220	2 000
	42, 46	5 770	2 300	2 125
1CC	38, 40, 45	5 650	2 220	2 150
	30, 31, 32, 41	5 300[3)]	2 220	2 150
	42, 46	5 770	2 300	2 275
1A	38, 40, 45	11 750	2 220	2 000
	30, 31, 32, 41	11 140[3)]	2 220	2 000
	42, 46	11 870	2 300	2 125
1AA	38, 40, 45	11 750	2 220	2 150
	30, 31, 32, 41	11 140[3)]	2 220	2 150
	42, 46	11 870	2 300	2 275

1) Minimum internal dimensions for 1B, 1BB and 1D containers are being studied.

2) Some of the height and length specified will be required for air circulation or other special arrangements.

3) Some refrigerated containers built to conform with earlier editions of this part of ISO 1496 are significantly shorter, particularly where a diesel generator is fitted.

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 operating 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.

5.2 Corner fittings

All containers shall be equipped with top and bottom corner fittings. The requirements and positioning of the corner fittings are given in ISO 1161. The upper faces of the top corner fittings shall protrude above the top of the container by a minimum of 6 mm[1)] (see 5.3.4). 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[1)] from either end of the container but may extend the full width.

5.3 Base structure

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

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

5.3.2.1 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 member of a carrying vehicle. Such longitudinal members are assumed to lie within the two 250 mm[1)] wide zones defined by the broken lines in figure 24.

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

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

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[1)] from the outer end and not more than 470 mm[1)] from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm[1)] above the lower faces of the bottom corner fittings of the container.

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

5.3.2.3 The transfer of load between the underside of the bottom side rails and carrying vehicles is not envisaged. The transfer of load between side rails and handling equipment should only occur when provisions have been made in accordance with 5.9.1 and 5.9.2.

5.3.2.4 Containers having all their intermediate transverse members spaced 1 000 mm[1)] apart or less (or having a flat underside) shall be deemed to comply with the requirements laid down in 5.3.2.1.

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

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

5.3.4 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[1)] below the base plane (lower faces of the bottom corner fittings).

5.3.5 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.

5.4 End structure

For all 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[1)].

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.

5.5 Side structure

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

5.6 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.

5.7 Door opening

Each 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.

5.8 Sanitary and taint-free requirements

Attention is drawn to the need for the proper choice of materials for the container and 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.

5.9 Requirements — Optional features

5.9.1 Fork-lift pockets

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

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

1) 1 000 mm = 39 3/8 in
6 mm = 1/4 in
60 mm = 2 3/8 in
25 mm = 1 in

5.9.1.2 Where a set of fork-lift pockets has been fitted as in 5.9.1.1, 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 5.9.1.1, should be centred as closely as possible about the centre of gravity of the empty container.

5.9.1.3 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 provided in the vicinity of each end of the fork pockets.

5.9.2 Grappler arms or similar devices

Fixtures for handling all containers by means of grappler arms or similar devices may be provided as optional features. The dimensional requirements for such fixtures are specified in annex D.

5.9.3 Gooseneck tunnels

Gooseneck tunnels may be provided as optional features in containers 1AA and 1A. The dimensional requirements are specified in annex E and, in addition, all other parts of the base structure shall be as specified in 5.3.

5.9.4 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.

5.9.5 Water connections

For appliances requiring water connections, the inlet and outlet interfaces shall conform to annex F.

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.

5.9.6 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 G.1, G.2 and G.3, respectively, in annex G.

5.9.7 Intermediate sockets for clip-on units

Where intermediate sockets are provided for use of clip-on units, they shall be located and designed as shown in annex H.

6 Testing

6.1 General

6.1.1 Unless otherwise stated, containers complying with the design requirements specified in clause 5 shall, in addition, be capable of withstanding the tests specified in 6.2 to 6.18 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 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. 15) shall be used to measure the heat leakage rate from the container, which determines its class. The tests described in 6.17 and 6.18 (test Nos. 16a and 16b) establish a standard method for testing the performance of mechanical and liquid expendable refrigeration units respectively, when used in conjunction with a container of known class.

The tests for weather-proofness (test No. 13), for airtightness (test No. 14), for heat leakage (test No. 15) and for performance under refrigeration (test No. 16) shall be carried out in sequence after completion of tests Nos. 1 to 12.

6.1.2 The symbol P denotes the maximum payload of the container to be tested, that is,

$$P = R - T$$

where

R is the rating;

T is the tare.

NOTE — R, P and T, 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

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 ascribed, implies mass.

The word "loading", for example as in "internal loading", implies force.

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

6.1.4 The test load or loading specified in all of the following tests are the minimum requirements.

6.1.5 The dimensional requirements to which reference is made in the requirements sub-clause 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.

6.2 Test No. 1 — Stacking

6.2.1 General

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

The test force to be applied to each pair of corner fittings and the superimposed mass that the test force represents are specified in table 4.

6.2.2 Procedure

The 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 substantially 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 1,8 R.

The 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 value 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 fitting 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[1)] laterally and 38 mm[1)] longitudinally.

Table 4 — Forces to be applied in stacking test

Freight 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 and 1AA	3 392	763 200	1 696	381 600	192 000	423 320
1B and 1BB	3 392	763 200	1 696	381 600	192 000	423 320
1C and 1CC	3 392	763 200	1 696	381 600	192 000	423 320
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 of which being rated to 24 000 kg (52 920 lb) and an acceleration force of 1,8 g. [The corner posts of such containers are known as having been tested to 86 400 kg (190 480 lb).]

6.2.3 Requirements

On completion of the test, the 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.

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 container, other than a 1D container, to withstand being lifted, from the four top corner fittings, with the lifting forces applied vertically, and the ability of a 1D 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 being the only recognized methods of lifting these containers by the four top corner fittings.

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

1) 25,4 mm = 1 in
38 mm = 1 1/2 in

6.3.2 Procedure

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

For a 1D 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.

6.3.3 Requirements

On completion of the test, the 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.

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 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 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 1AA and 1A containers;

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

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

60° to the horizontal for 1D containers.

In each case, the line of action of the lifting force and the outer face of the corner fitting shall be no farther apart than 38 mm[1]. 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.

6.4.3 Requirements

On completion of the test, the 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.

6.5 Test No. 4 — Restraint (longitudinal)

6.5.1 General

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

6.5.2 Procedure

The 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 container.

A force of $2Rg$ shall be applied horizontally to the 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 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.

6.6 Test No. 5 — Strength of end walls

6.6.1 General

This test shall be carried out to prove the ability of a container to withstand forces under the dynamic conditions referred to in 6.5.1.

6.6.2 Procedure

The 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 $0{,}4\,Pg$. The internal loading shall be uniformly distributed over the wall under test and arranged to allow free deflection of the wall.

6.6.3 Requirements

On completion of the test, the 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.

1) 38 mm = 1 1/2 in

6.7 Test No. 6 — Strength of side walls

6.7.1 General

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

6.7.2 Procedure

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

Each side wall of the container shall be subjected to an internal loading of 0,6 Pg. The internal loading shall be uniformly distributed, applied to each wall separately and arranged to allow free deflection of the side wall and its longitudinal members.

6.7.3 Requirements

On completion of the test, the 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.

6.8 Test No. 7 — Strength of the roof

6.8.1 General

This test shall be carried out to prove the ability of the roof of a container to withstand the loads imposed by persons working on it.

If the roof is intended to carry a hanging cargo, a test shall be carried out to prove the ability of the container to carry a minimum total hanging load of 1 490 kg/m[1)] of usable inside container length. A vertical acceleration of 2 g shall be taken into account.

6.8.2 Procedure

A load of 300 kg[1)] shall be uniformly distributed over an area of 600 mm × 300 mm[1)] located at the weakest area of the roof of the container.

If the roof is intended to carry a hanging cargo, a load of twice the service load or twice 1 490 kg/m[1)], whichever is greater, shall be attached to the roof in a manner simulating normal service loadings, while the container is supported by its four bottom corner fittings only.

6.8.3 Requirements

On completion of the test, the 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.

6.9 Test No. 8 — Floor strength

6.9.1 General

This test shall be carried out to prove the ability of a container floor to withstand the concentrated dynamic loading imposed during cargo operations involving powered industrial trucks or similar devices.

6.9.2 Procedure

The test shall be performed using a test vehicle equipped with tyres, with an axle load of 5 460 kg[1)] [i.e. 2 730 kg[1)] on each of two wheels]. It is to be so arranged that all points of contact between each wheel and a flat continuous surface lie within a rectangular envelope measuring 185 mm[1)] (in a direction parallel to the axle of the wheel) by 100 mm[1)] and that each wheel makes physical contact over an area within this envelope of not more than 142 cm^2 [1)]. The wheel width shall be nominally 180 mm[1)] and the wheel centres shall be nominally 760 mm[1)]. The test vehicle shall be manœuvred over the entire floor area of the container. The test shall be made with the container resting on four level supports under its four bottom corner fittings, with its base structure free to deflect.

6.9.3 Requirements

On completion of the test, the 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.

6.10 Test No. 9 — Rigidity (transverse)

6.10.1 General

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

6.10.2 Procedure

The 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 shall be applied only at the end frame under test.

1) 1 490 kg/m = 1 000 lb/ft
300 kg = 660 lb
600 mm × 300 mm = 24 in × 12 in
5 460 kg = 12 000 lb
2 730 kg = 6 000 lb
185 mm = 7 1/4 in
100 mm = 4 in
142 cm^2 = 22 in^2
180 mm = 7 in
760 mm = 30 in

Forces of 150 kN[1] shall be applied either separately or simultaneously to each of the top corner fittings on one side of the container in lines parallel both to the base and to the planes of the ends of the container. The forces shall be applied first towards and then away from the top corner fittings.

In the case of a container 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 deflections under full test loading, see 5.4.

6.10.3 Requirements

On completion of the test, the 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.

6.11 Test No. 10 — Rigidity (longitudinal)

6.11.1 General

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

6.11.2 Procedure

The 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 to and in the same side frame as a top corner fitting to which force is applied.

Forces of 75 kN[1] shall be applied either separately or simultaneously to each of the top corner fittings on one end of the container in lines parallel both to the base of the container and to the planes of the sides of the container. The forces shall be applied first towards and then away from the top corner fitting.

In the case of a 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 loading, see 5.5.

6.11.3 Requirements

On completion of the test, the 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.

6.12 Test No. 11 — Lifting from fork-lift pockets (where fitted)

6.12.1 General

This test shall be carried out on any 1CC, 1C or 1D container which is fitted with fork-lift pockets.

6.12.2 Procedure

6.12.2.1 1CC, 1C or 1D containers fitted with one set of fork-lift pockets

The 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 1,6 R and it shall be supported on two horizontal bars, each 200 mm[1] wide, projecting 1 828 ± 3 mm[1] into the fork-lift pockets, measured from the outside face of the side of the container. The bars shall be centred within the pockets.

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

6.12.2.2 1CC or 1C containers fitted with two sets of fork-lift pockets

The test described in 6.12.2.1 shall be applied to the outer pockets.

A second test shall be applied to the (additional) inner pockets. The procedure for this second test shall be as required in 6.12.2.1 except that in this case the combined mass of the container and test load shall be equal to 0,625 R, and the bars shall be placed in the inner pockets.

6.12.3 Requirements

On completion of the test, the 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.

1) 150 kN = 33 700 lbf
75 kN = 16 850 lbf
200 mm = 8 in
1 828 ± 3 mm = 72 ± 1/8 in

6.13 Test No. 12 — Lifting from the base at grappler arm positions (where fitted)

6.13.1 General

This test shall be carried out on any container which is fitted with fixtures for being lifted by grappler arms or similar devices with lifting positions as detailed in annex D.

6.13.2 Procedure

The 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 1,25 R, and it shall be supported at the four positions where provision has been made for the equipment envisaged in 6.13.1, over an area of 32 mm × 254 mm[1)] centrally located at each of the four positions, clear of the safety lips.

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

6.13.3 Requirements

On completion of the test, the 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.

6.14 Test No. 13 — Weatherproofness

6.14.1 General

This test shall be carried out on door seals, exterior gasketed joints and other openings which are fitted with closing devices. If a refrigeration unit is fitted, all electrical and other enclosures and exposed components on the unit shall be tested.

6.14.2 Procedure

A stream of water shall be applied to the area being tested from a nozzle of 12,5 mm[1)] inside diameter, at a pressure of about 100 kPa[1)] (corresponding to a head of about 10 m[1)] of water) on the upstream side of the nozzle. The nozzle shall be held at a distance of 1,5 m[1)] from the container under test, and the stream shall be traversed at a speed of 100 mm/s[1)].

Procedures involving the use of several nozzles are acceptable provided that each joint or seam is subjected to a water loading no less than that which would be given by a single nozzle.

6.14.3 Requirements

On completion of the test, no water shall have leaked into the container or into any electrical enclosures, and the refrigeration unit shall function properly (see 7.3.11).

6.15 Test No. 14 — Airtightness test

6.15.1 General

This test shall be carried out after all structural tests have been completed and prior to the heat leakage test (test No. 15). The temperatures inside and outside the container shall be stabilized within 3 K of each other and shall both be within the range of 288 to 298 K (see table 2 for conversion to degrees Celsius).

6.15.2 Procedure

The container shall be in its normal operating condition and shall be closed in the normal manner. The refrigeration and/or heating equipment shall be in place, except that, where the container is designed for use with removable equipment and the container has closures at the interface(s), the equipment shall not be in position and the closures shall be shut. All drain openings shall be closed. An air supply through a metering device and a suitable manometer shall be connected to the container by a leakproof connection. The manometer shall not be part of the air supply system. The flow-measuring device shall be accurate to ± 3 % of the measured flow rate, and the manometer on the container shall be accurate to ± 5 %.

Air shall be admitted to the container to raise the internal pressure to 250 ± 10 Pa[1)] and the air supply regulated to maintain this pressure.

Once steady test conditions have been established, the air flow required to maintain this pressure shall be recorded.

6.15.3 Requirements

For all containers other than those with additional door openings, the air leakage rate, expressed in standard atmospheric conditions, shall not exceed 10 m^3/h[1)]. For each additional door opening (e.g. side doors) provided, an extra rate of 5 m^3/h[1)] shall be granted.

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1) 32 mm × 254 mm = 1,25 in × 10 in
12,5 mm = 0,5 in
100 kPa = 14,5 psi
10 m = 33 ft
1,5 m = 5 ft
100 mm/s = 4 in/s
250 ± 10 Pa = 25 ± 1 mmH_2O = 1 ± 3/64 inH_2O
10 m^3/h = 355 ft^3/h
5 m^3/h = 180 ft^3/h

NOTE — The pressure-decay method may be used as an alternative, but in this case a correlation should be established between the constant pressure method and the pressure-decay method during prototype testing.

6.16 Test No. 15 — Heat leakage test

6.16.1 General

6.16.1.1 This test shall be carried out to establish the heat leakage for the container. It shall be carried out after successful completion of the airtightness test (test No. 14). It shall be performed with the refrigeration and/or heating equipment in place, with all openings closed. Where the container is designed for use with removable equipment and the container has closures at the interface(s), the equipment shall not be in position and the closures shall be shut.

6.16.1.2 The inner heating method only shall be used. This test requires the establishment of a heat balance. A heating device shall be placed inside the (insulated) body of the container and thermal equilibrium shall be established between the power of the heating device(s) and associated fan(s), and the heat flowing out through the insulation. All instruments and devices shall be selected and calibrated as follows:

- temperature-measuring devices: ± 0,5 K
- power-measuring device: ± 2 % of quantity measured
- flowmeter system: ± 3 %

6.16.1.3 The heat leakage shall be expressed by the total heat leakage rate, U_θ, which is given by the following formula:

$$U_\theta = \frac{Q}{\theta_i - \theta_e}$$

where

U_θ is the total heat leakage rate, in watts per kelvin;

Q is the power, in watts, dissipated by the internal heater(s) and fan(s);

θ_i is the average inside temperature, in kelvins, which shall be the arithmetic mean of the temperatures recorded at the end of each test interval (see 6.16.2.5) and measured 100 mm[1] from the walls, at least at the twelve points shown in annex I;

θ_e is the average outside temperature, in kelvins, which shall be the arithmetic mean of the temperatures recorded at the end of each test interval (see 6.16.2.5) and measured 100 mm[1] from the walls, at least at the twelve points shown in annex I;

θ is the mean wall temperature, in kelvins; by convention:

$$\theta = \frac{\theta_i + \theta_e}{2}$$

6.16.2 Procedure

6.16.2.1 Test data for determining the heat leakage of the container shall be taken for a continuous period of not less than 8 h during which the following conditions shall be satisfied:

a) the test shall be performed with a mean wall temperature chosen between 293 K and 305 K (see table 2 for conversion to degrees Celsius) and a temperature difference between inside and outside of not less than 20 K;

b) the maximum difference between the warmest and coldest inside points at any one time shall be 3 K;

c) the maximum difference between the warmest and coldest outside points at any one time shall be 3 K;

d) the maximum difference between any two average inside air temperatures, θ_i, at different times shall be 1,5 K;

e) the maximum difference between any two average outside air temperatures, θ_e, at different times shall be 1,5 K;

f) the maximum percentage between the lowest and the highest power dissipation $\frac{W - h}{h}$ shall not exceed 3 % of the lowest figure.

NOTE — The requirements specified above, which define the steady-state conditions or the degree of equilibrium, are illustrated in annex J.

6.16.2.2 The electric heating element(s) shall be operated at temperatures sufficiently low to minimize radiation effects. The heat from the element(s) shall be distributed by a fan or fans delivering a quantity of air sufficient, but not exceeding the level necessary, to ensure that the temperature distribution inside the body of the container is within the limits laid down in 6.16.2.1. The fan(s) should be in the body of the container. If the test is run with a mechanical refrigeration unit (MRU) installed, no action should be taken to prevent the movement of small quantities of air through the MRU. Such fans as the MRU may contain shall not be run.

If it is required that this test be performed with the fan(s) of the MRU running, the test report shall draw attention to this fact. The heat leakage value, U, measured — which in this case shall include the power consumption of the evaporator fan(s) — should not be expected to conform to the classification given in table 1.

6.16.2.3 Air should be circulated over the exterior surfaces of the container at a velocity not exceeding 2 m/s[1] at points approximately 100 mm[1] from the mid-length of the side walls and the roof of the container.

6.16.2.4 All of the temperature-measuring instruments placed inside and outside the container shall be protected against radiation.

1) 100 mm = 4 in
2 m/s = 6 ft/s

6.16.2.5 Sets of readings shall be recorded at intervals of not more than 30 min.

6.16.3 The heat leakage, U, in watts per kelvin, shall be calculated from the average of the 17 or more sets of readings taken during the continuous period of not less than 8 h for which steady-state conditions were maintained, using the following formula:

$$U = \frac{1}{n} \sum_{1}^{n} U_\theta$$

where $n \geqslant 17$.

The value of U obtained from this formula shall be recorded together with the mean of the mean wall temperature(s) which were maintained during the test period. The value of U, corrected to the standard mean wall temperature of 293 K, should also be recorded. The correction should be made using a curve relating U to mean wall temperature.

NOTE — Since the test described in this clause may be carried out under conditions different from those at which the unit may operate and since the refrigeration and/or heating equipment will not be running during the test, care should be taken when using the value of U obtained from this test to calculate performance under service conditions.

6.17 Test No. 16a) — Test of the performance of a container under refrigeration by a mechanical refrigeration unit (MRU)

6.17.1 General

6.17.1.1 This test shall measure the ability of a container when fitted with a particular MRU, either an "integral" or "clip-on" unit, to maintain a given inside temperature, θ_i, at a given outside temperature, θ_e,

— for a period of 8 h without additional heat load above that leaking through the walls of the container, and

— for a further period of 4 h during which electrical heater(s) and fan(s) inside the container provide an additional heat load equal to at least 25 % of the total heat leakage rate for the containers as determined in the heat leakage test (test No. 15), i.e.

Additional heat load = $0{,}25 \times U(\theta_e - \theta_i)$

6.17.1.2 This test shall be carried out on a container which has already been subjected to the heat leakage test (test No. 15).

6.17.1.3 The container shall be equipped with instruments for the measurement of

a) outside and inside air temperatures as envisaged in 6.16.1.3 and annex I;

b) the power supplied to heater(s) and fan(s).

The outside air flow at a point adjacent to the mid-point of one of the sides of the container shall be determined.

The container under test shall be equipped with instruments for the measurement of

a) the energy consumption of heater(s) and fan(s) inside the container;

b) return and supply air temperatures (dry bulb) inside the container — a mininimum of two sensors shall be used for each of these (i.e. four in all);

c) the temperature of the air at the inlet to the condenser, where an air-cooled condenser is used.

6.17.2 Test conditions

6.17.2.1 The outside temperature shall be as specified for the class of container under test (see table 1).

6.17.2.2 The inside temperature shall not exceed the specified temperature for the class of container under test (see table 1); this is understood to be the average of the temperature measured by the 12 sensors inside the container.

6.17.2.3 The outside air velocity shall not exceed 2 m/s[1] at a distance of 100 mm[1] from the side of the container.

6.17.2.4 The inside air velocity shall be as produced by the evaporator fans and fans associated with heaters.

6.17.3 Test procedure

6.17.3.1 The required inside and outside temperatures shall be established. Floor drains, defrost drains (where fitted) and relief valves shall be in their normal operational states, and doors and vent devices shall be closed in the normal manner.

6.17.3.2 At this point the unit may be defrosted; if this is done, steady-state conditions shall be re-established prior to continuing the test.

1) 2 m/s = 6 ft/s
100 mm = 4 in

6.17.3.3 The unit shall be run (after steady-state conditions have been established) for a period of 8 h with the temperature cycling about a constant level. After this period of operation, the heater(s) and fan(s) described in 6.17.1.1 shall be turned on. After steady-state conditions have been re-established, the test shall continue for a further 4 h.

6.17.3.4 During the periods of 8 h and 4 h of steady-state operation, the inside and outside temperatures and the power consumed by the heater(s) and fan(s) shall be recorded at intervals not exceeding 30 min.

6.17.4 Requirements

The equipment shall be capable of maintaining the average inside temperature at the level specified (see table 1) for a period of at least 8 h and then for a further period of at least 4 h with additional heat load provided as specified in 6.17.1.1.

NOTES

1 If desired, the energy consumption of the MRU may be measured during this test by means of an electric power-metering device and, if appropriate, a fuel-metering device.

2 It may also be advisable to measure temperatures at evaporator outlet and at compressor suction, and discharge and pressure at compressor inlet and outlet (especially where a prototype MRU is involved), so that in the event of a shortfall in performance there may be sufficient data to allow the fault to be diagnosed.

6.18 Test No. 16b) — Test of the performance of a container with refrigerating equipment which uses a liquid expendable refrigerant (LER)

6.18.1 General

6.18.1.1 This test shall measure the ability of a container when fitted with a particular LER, either an "integral" or "clip-on" unit, to maintain a given inside temperature, θ_i, at a given outside temperature, θ_e,

— for a period of 8 h without additional heat load above that leaking through the walls of the container, and

— for a further period of 4 h during which electrical heater(s) and fan(s) inside the container provide an additional heat load equal to at least 25 % of the total heat leakage rate for the containers as determined in the heat leakage test (test No. 15), i.e.

$$\text{Additional heat load} = 0{,}25 \times U\,(\theta_e - \theta_i)$$

6.18.1.2 This test shall be carried out on a container which has already been subjected to the heat leakage test (test No. 15).

6.18.1.3 The container shall be equipped with instruments for the measurement of

a) outside and inside air temperatures as envisaged in 6.16.1.3 and annex I — any temperature sensors inside the container directly in the path of the incoming stream of refrigerant shall be moved out of this stream;

b) the power supplied to heater(s) and fan(s).

The outside air flow at a point adjacent to the mid-point of one of the sides of the container shall be determined.

6.18.2 Test conditions

6.18.2.1 The outside temperature shall be as specified for the class of container under test (see table 1).

6.18.2.2 The inside temperature shall not exceed the specified temperature for the class of container under test (see table 1); this is understood to be the average of the temperatures measured by the 12 sensors inside the container.

6.18.2.3 The outside air velocity shall not exceed 2 m/s[1] at a distance of 100 mm[1] from the side of the container.

6.18.2.4 This inside air velocity shall be as produced by the refrigerating equipment and fans associated with heaters.

6.18.3 Test procedure

WARNING — All personnel shall be made aware of the likely hazard of the accumulation of concentrations of nitrogen or carbon dioxide within the container, test chamber or adjacent confined spaces, and shall not be allowed to enter until the spaces are declared safe.

6.18.3.1 The container shall be placed in the environment specified for the relevant level of testing, and the temperature shall be allowed to stabilize. The test shall not commence until inside, wall and outside temperatures are within 3 K of each other. Floor drains, defrost drains (where fitted) and relief valves shall be in their normal operational states, and doors and vent devices shall be closed in the normal manner.

6.18.3.2 The refrigerant vessels shall be charged to their design capacities, but shall be left in a stand-by state while the container is brought into temperature equilibrium with its surroundings. The refrigerating system shall then be started to cool the container under test to the operational temperature. The refrigerant vessels shall then be topped-up to their design capacity and the container shall be maintained at or below the operational temperature for 8 h using only those temperature-control devices fitted as normal equipment.

1) 2 m/s = 6 ft/s
100 mm = 4 in

6.18.3.3 After the temperature has reached the operating level, the heater(s) and fan(s) described in 6.18.1.1 shall be turned on. After steady-state conditions have been re-established, the test shall be continued for a further 4 h.

6.18.3.4 Throughout the test, the inside and outside temperatures shall be recorded at intervals not exceeding 30 min.

6.18.4 Requirements

The equipment shall be capable of maintaining the average inside temperature at the specified level (see table 1) for a period of at least 8 h and then for a further period of at least 4 h with additional heat load provided as specified in 6.18.1.1.

If desired, the refrigerant consumption of the LER may be measured; this shall be done at the end of the test.

7 Electrical aspects of thermal containers

7.1 General

The requirements which follow are only intended to govern those aspects of electrically-powered thermal containers which affect interchange. They do not constitute a detailed electrical specification. Reference should be made to appropriate national and international standards and regulations.

7.2 Classification

Electrically-powered temperature control equipment for thermal containers shall be designed for operation in accordance with the following classification:

a) Type 1

b) Type 2

c) Type 3

The range of supply voltage appropriate to each of these types is defined below in 7.4, 7.5 and 7.6.

It should be noted that the voltage ranges specified have been made as wide as practicable in order that containers built in accordance with this part of ISO 1496 may be capable of being operated in as many countries as possible, without modification or adjustment, using the electrical supply normally available in each country. It is not expected that standard electric motors and control gear will necessarily satisfy the requirements set out in 7.3.

7.3 General requirements

NOTE — See annex K for information concerning electrical power supplies for thermal containers.

7.3.1 Equipment shall be designed to operate from three-phase, three-wire a.c. supply sources having nominal frequencies of 50 Hz and 60 Hz each with a tolerance of ± 2,5 %.

7.3.2 Equipment shall have a maximum electrical loading, under rated operating conditions, not exceeding 18,75 kV·A. The power consumption shall not exceed 15 kW.

7.3.3 Equipment shall operate in the proper direction of rotation when connected to a supply system having standard phase rotation through a plug and socket connector wired as shown in annex L. Standard phase rotation shall be taken to mean a three-phase a.c. power system in which the line voltages attain their maximum positive values in the sequence A (or R), B (or S), C (or T).

7.3.4 Total starting current shall be as low as possible and shall in any case not exceed 300 A on type 1 equipment or 150 A on type 2 equipment. The total starting current shall be taken to mean the sum of the locked rotor (standstill) currents of all motors starting up at the instant of switch-on plus the current taken by non-rotating elements.

It is permissible for the total starting current of an equipment to be limited to the specified value by sequence controls permitting only one of the motors in a multimotor equipment to start at any one instant.

The starting current shall decay to 125 % of the normal full load operating current in not more than 1 s when tested on a mains supply.

7.3.5 Equipment shall be provided with means for protecting the temperature-control apparatus against electrical overloads. Automatic reset devices may be used, provided component temperatures are not allowed to exceed safe levels.

7.3.6 A continuous equipment earthing conductor shall be provided at the plug and through the "powercord" to the equipment. Metallic parts of electrical fittings within the equipment which do not carry electric current shall be connected to this earthing conductor. All parts which are electrically alive at voltages in excess of 42 V shall be shielded against accidental contact. The insulation resistance of the equipment shall be at least 1 MΩ.

7.3.7 A flexible power cable of adequate electrical capacity shall be permanently attached to the refrigeration and/or heating unit at one end and shall have a male plug at the other end. The cable shall have a minimum length equal to the length of the container plus 6 m[1)] or 15 m[1)], whichever is greater.

7.3.8 The plug shall be sealed to the power cable by a suitable means so as to prevent the entry of water under service conditions.

1) 6 m = 20 ft
15 m = 50 ft

7.3.9 The container or refrigeration equipment shall include a storage space large enough to securely stow the power cable. If a portion of the cable is intended to be stored in the compartment during operation, the storage space shall be ventilated.

7.3.10 Controls shall include an easily accessible and clearly marked ON/OFF switch on the outside of the equipment which prevents operation of the unit when in the OFF position.

The unit shall operate automatically on its own control system when in the ON position.

An indicating light shall be provided, which shall be illuminated whenever the switch is in the ON position.

7.3.11 All electrical motors and other electrical apparatus forming part of the equipment shall be adequately protected against harmful deposits of dust and entry of water from heavy seas or other sources. (Compliance with class IP 56 in IEC Publication 144 shall be deemed to satisfy this requirement.)

7.3.12 A wiring diagram shall be mounted on an easily accessible door of the appliance. All wires shall be identified by marking or colour coding to correspond with information on the wiring diagram.

7.3.13 The equipment nameplate details shall include the following data as minimum requirement:

Type: .... (1, 2 or 3)

Volts: .... three-phase .... Hz

Full load current: .... A

Total starting current: .... A

7.4 Type 1 equipment

7.4.1 Type 1 equipment shall be designed to operate on any electrical power supply when the nominal voltage measured between phases at the receptacle is as follows:

a) 50 Hz: 180 V min., 230 V max.;

b) 60 Hz: 200 V min., 250 V max.

7.4.2 The equipment shall be provided with a male plug of one of the following types.

a) A 60 A four-pin (three poles plus earth) male plug with screwed retaining ring as shown in annex M;

b) A 50 A four-pin (three poles plus earth) male plug with screwed retaining ring as shown in annex N.

In view of the large variety of plugs in current use, it has been considered unreasonable to require, for the purposes of this part of ISO 1496, acceptance of any one plug. The two types included above are those most commonly employed, and it is hoped that other types will be quickly phased out. It is further hoped that the need for interchange of containers will eventually lead to the adoption of a single type as a universal standard for type 1 equipment.

7.5 Type 2 equipment

7.5.1 Type 2 equipment shall be designed to operate on any electrical power supply when the nominal voltage measured between phases at the receptacle is as follows:

a) 50 Hz: 360 V min., 460 V max.;

b) 60 Hz: 400 V min., 500 V max.

7.5.2 The equipment shall be provided with a male plug of one of the following types:

a) A 32 A four-pin (three poles plus earth) male plug with bayonet retaining ring as shown in annex O;

b) A 30 A four-pin (three poles plus earth) male plug with screwed retaining ring as shown in annex P.

In view of the large variety of plugs in current use, it has been considered unreasonable to require, for the purposes of this part of ISO 1496, acceptance of any one plug. The two types included above are those most commonly employed, and it is hoped that other types will be quickly phased out. It is further hoped that the need for interchange of containers will eventually lead to the adoption of a single type as a universal standard for type 2 equipment.

7.6 Type 3 dual voltage equipment

7.6.1 Type 3 equipment shall be designed to operate on both type 1 electrical power supplies in accordance with 7.4.1 and type 2 electrical power supplies in accordance with 7.5.1.

7.6.2 The equipment shall be provided with two separate flexible power cables of adequate electrical capacity, one to be used when operating from type 1 electrical power supplies and the other to be used for type 2 electrical power supplies. The former shall be fitted with a male plug as described in 7.4.2 and the latter with a male plug as described in 7.5.2.

Both power cables shall be permanently attached to the refrigeration and/or heating unit, and both shall have a minimum length equal to either the container length plus 6 m[1] or 15 m[1], whichever is greater.

Type 3 equipment shall include storage space(s) large enough to securely stow both power cables. If a portion of the cables is intended to be stored in a compartment during operation, the storage space(s) shall be ventilated.

7.6.3 The electrical circuit design shall be such that when the controls are set for one voltage range, the power cable for the other voltage range shall be electrically disconnected at the equipment.

1) 6 m = 20 ft
15 m = 50 ft

Annex A

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

(This annex forms an integral part of the standard.)

NOTES

1 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.

2 The figures in this annex correspond to the tests described in 6.2 to 6.13 only where marked.

3 For definitions of R, P and T, see 6.1.1.

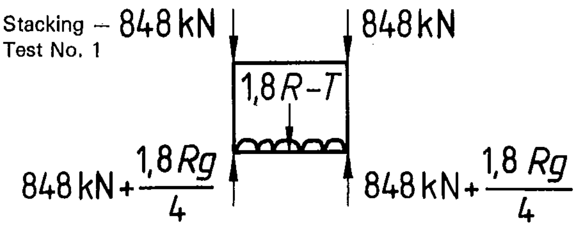
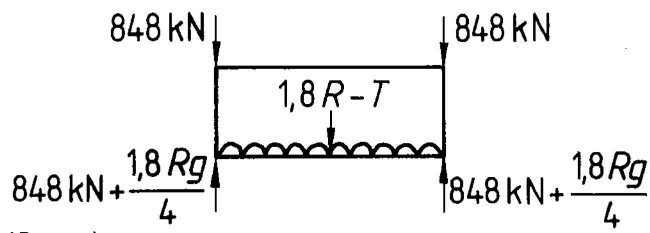
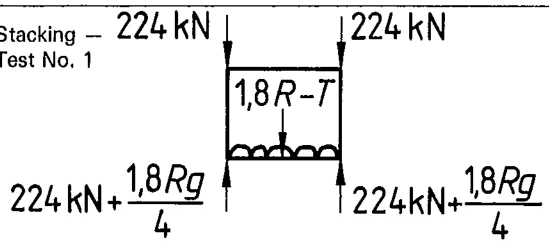
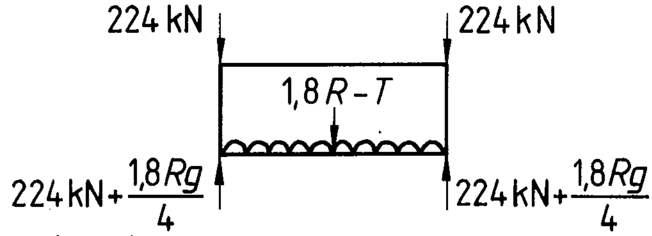
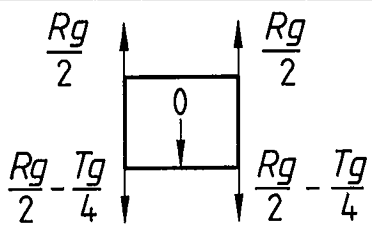
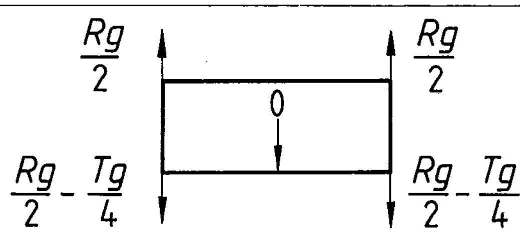
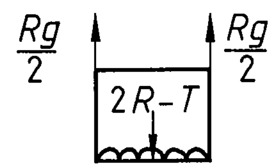
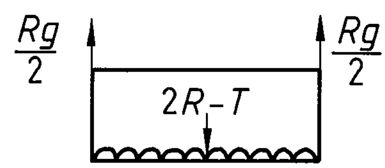
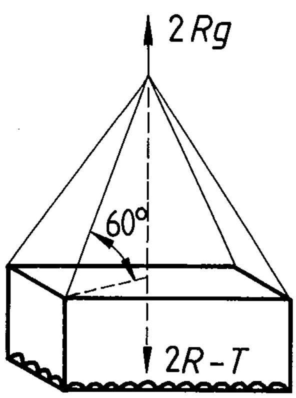
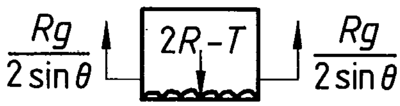
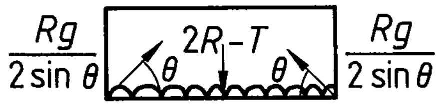
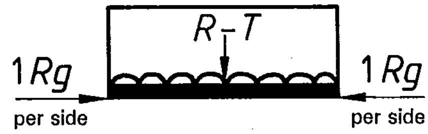
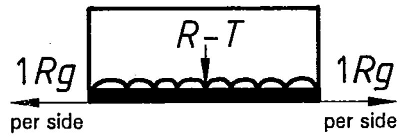
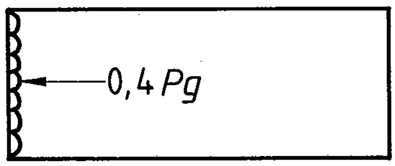
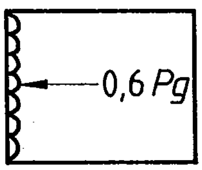
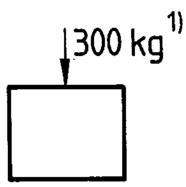
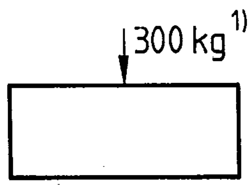
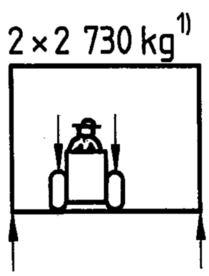
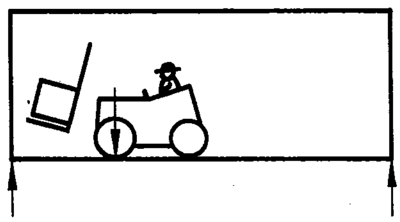
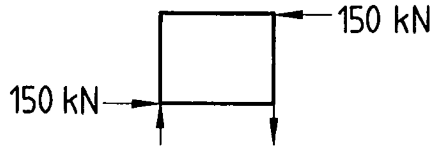
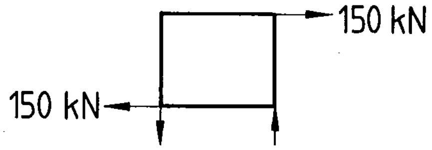
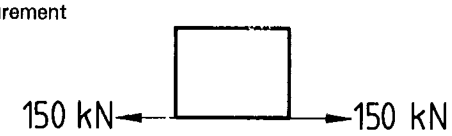
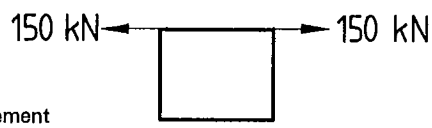
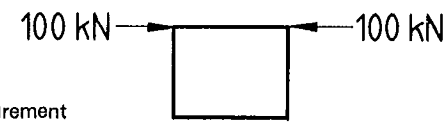
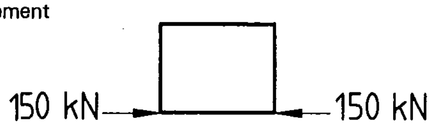
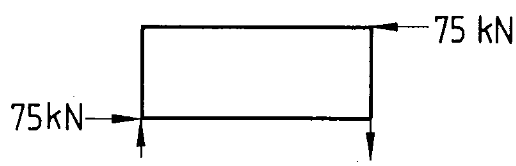
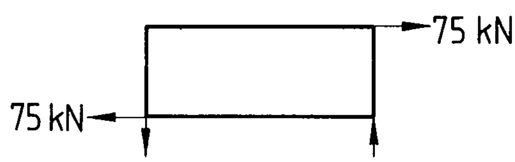
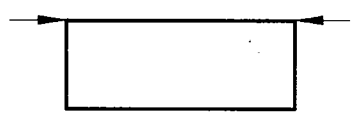
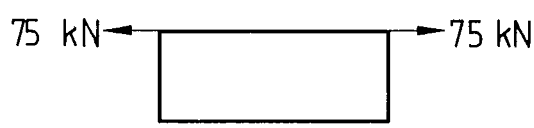
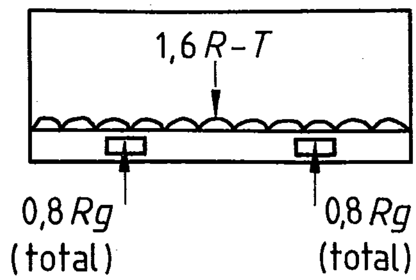
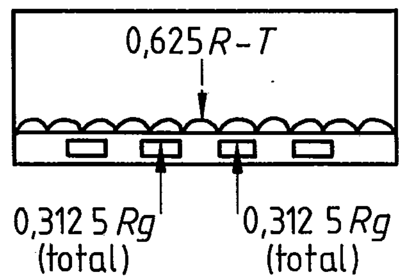
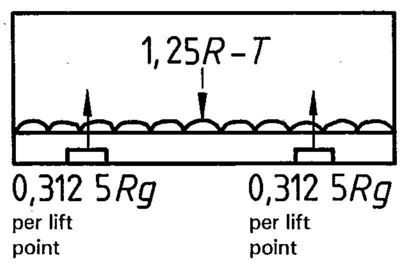
Figure No.	End elevations	Side elevations
1	Stacking — Test No. 1 	
	Not applicable to 1D containers	
1A	Stacking — Test No. 1 	
	Applicable to 1D containers only	
2	Top lift 	
3	Top lift — Test No. 2 	
	Not applicable to 1D containers	
3A	Top lift — Test No. 2  Applicable to 1D containers only	

Figure No.	End elevations	Side elevations
4	Bottom lift — Test No. 3 	
5	Restraint (longitudinal) — Test No. 4	
6		
7	End loading — Test No. 5	
8	Side loading — Test No. 6 	
9	Roof load — Test No. 7 	
10	Wheel loads — Test No. 8 	

1) 300 kg = 660 lb
2 × 2 730 kg = 2 × 6 000 lb

Figure No.	End elevations	Side elevations
11	Rigidity (transverse) — Test No.9 	Not applicable to 1D containers
12	Rigidity (transverse) — Test No. 9 	Not applicable to 1D containers
13	Lashing/securement 	Not applicable to 1D containers
14	 Lashing/securement	Not applicable to 1D containers
15	 Lashing/securement	Not applicable to 1D containers
16	Lashing/securement 	Not applicable to 1D containers
17	Rigidity (longitudinal) — Test No. 10 Not applicable to 1D containers	
18	Not applicable to 1D containers	
19	Lashing/securement (This type of loading is not permissible except as applied in 3A.)	
20	Lashing/securement Not applicable to 1D containers	

Optional features

Figure No.	End elevations	Side elevations
21	Fork-lift pockets — Test No. 11 Applicable to 1CC, 1C and 1D containers when fitted with one set of fork-lift pockets	
22	Fork-lift pockets — Test No. 11 Applicable to 1CC and 1C containers when fitted with a second set of fork-lift pockets	
23	Grappler lift — Test No. 12 Applicable to all sizes when fitted with grappler arm lift positions	

Annex B

Details of requirements for load transfer areas in base structures of containers

(This annex forms an integral part of the standard.)

B.1 The base structures of containers, i.e. the end transverse members and such intermediate members as may be fitted (or such flat underside as may be provided) to constitute load transfer areas, shall be capable of transferring load to or from the longitudinal members of a carrying vehicle which are assumed to lie within the two 250 mm[1] wide zones defined by the broken lines) in figure 24.

B.2 Containers not having transverse members spaced 1 000 mm[1] apart or less (and not having a flat underside) shall have load transfer areas as indicated in figures 25 to 33, capable of meeting the following requirements.

B.2.1 Each pair of load transfer areas associated with an end transverse member shall be capable of transferring loads of not less than 0,5 R, i.e. the loads which may occur when a container is placed onto a carrying vehicle of the kind which does not support the container by its corner fittings.

Furthermore, each pair of intermediate load transfer areas shall be capable of transferring loads of not less than 1,5 R/n, where n is the number of pairs of intermediate load transfer areas, i.e. loads which may occur during transport operations.

B.2.2 The minimum number of pairs of load transfer areas are:

For 1CC and 1C containers	4
For 1BB and 1B containers	5
For 1AA and 1A containers	5
For 1AA and 1A containers fitted with a non-continuous gooseneck tunnel	6

Where a greater number of pairs of load transfer areas are provided, these should be approximately equally spaced along the length of the container.

B.2.3 The spacing between the end transverse member and the nearest intermediate pair of load transfer areas shall be:

- between 1 700 mm and 2 000 mm[2] for containers having the minimum number of pairs of load transfer areas for the container concerned;
- between 1 000 mm and 2 000 mm[2] for containers having one more pair of load transfer areas than the minimum required for the containers concerned.

Dimensions in millimetres

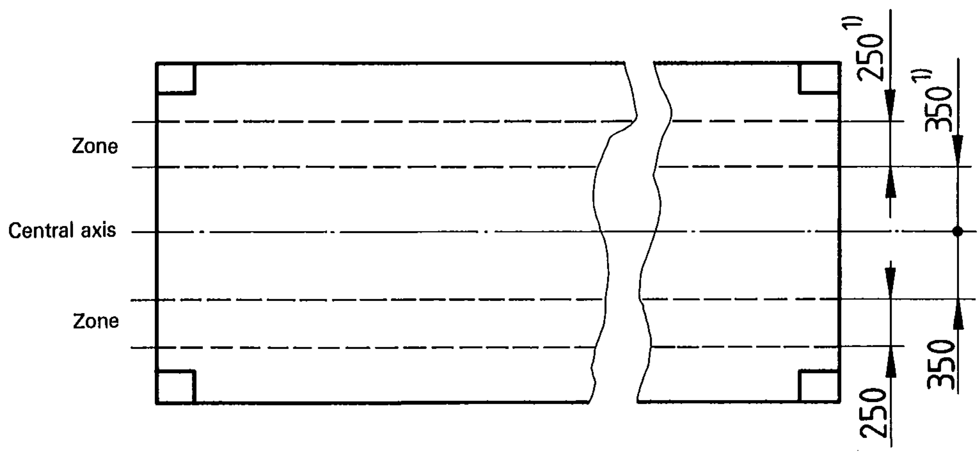


Figure 24

1) 250 mm = 10 in
1 000 mm = 39 3/8 in
350 mm = 14 in

2) 1 700 to 2 000 mm = 66 15/16 to 78 3/4 in
1 000 to 2 000 mm = 39 3/8 to 78 3/4 in

B.2.4 Each load transfer area shall have a longitudinal dimension of at least 25 mm[1].

B.3 Minimum requirements for load transfer areas in the vicinity of the gooseneck tunnel are shown in figure 33.

NOTE — In figures 25 to 32 inclusive, the load transfer areas associated with the container base are shown in black. Gooseneck tunnel transfer areas are shown in black in figure 33.

1C or 1CC containers

Minimum requirements : 4 pairs of load transfer areas
(1 pair at each end plus 2 intermediate pairs)

Dimensions in millimetres[2]

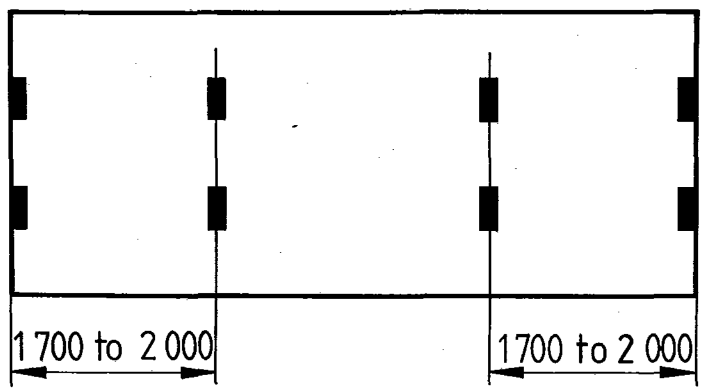


Figure 25

Requirements applicable if 5 pairs of load transfer areas are to be fitted :

Dimensions in millimetres[2]

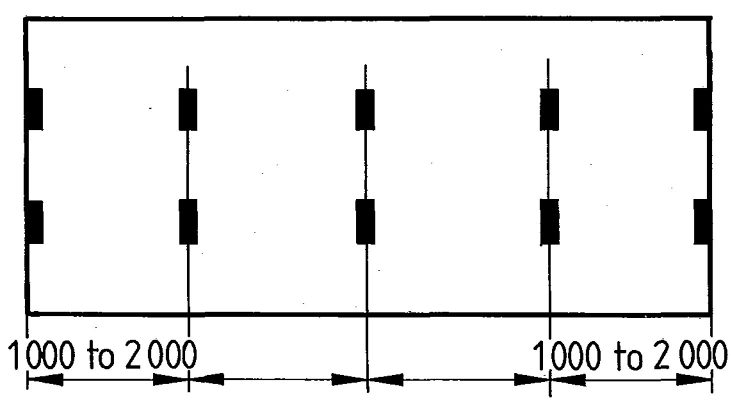


Figure 26

1) 25 mm = 1 in

2) 1 700 to 2 000 mm = 66 15/16 to 78 3/4 in
1 000 to 2 000 mm = 39 3/8 to 78 3/4 in

1B or 1BB containers

Minimum requirements : 5 pairs of load transfer areas
(1 pair at each end plus 3 intermediate pairs)

Dimensions in millimetres[1)]

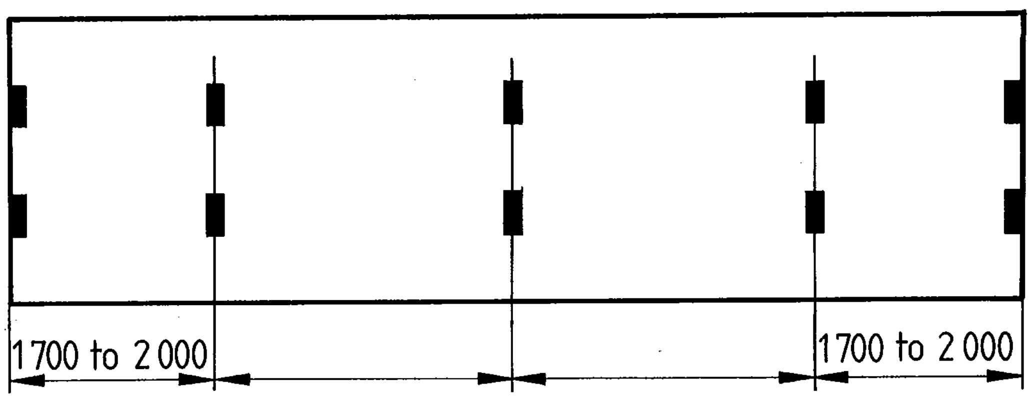


Figure 27

Requirements applicable if 6 pairs of load transfer areas are to be fitted :

Dimensions in millimetres[1)]

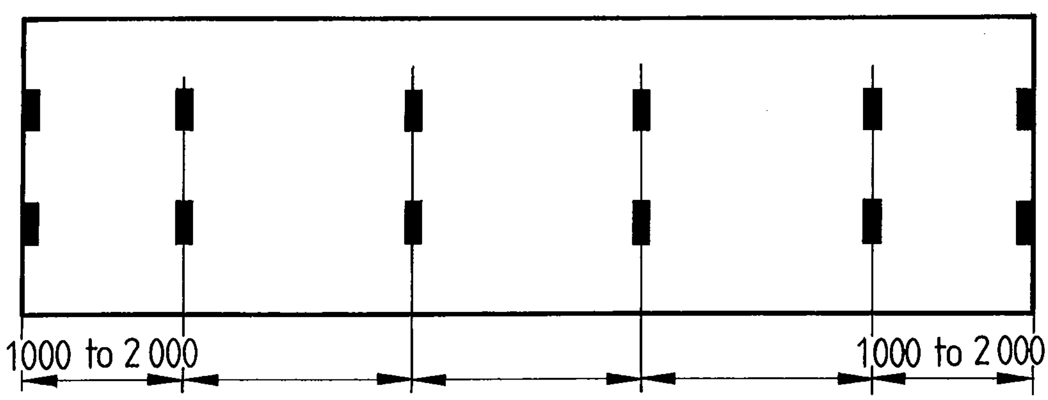


Figure 28

1) 1 700 to 2 000 mm = 66 15/16 to 78 3/4 in ,
1 000 to 2 000 mm = 39 3/8 to 78 3/4 in

1A or 1AA containers — Without gooseneck tunnel

Minimum requirements: 5 pairs of load transfer areas
(1 pair at each end plus 3 intermediate pairs)

Dimensions in millimetres[1)]

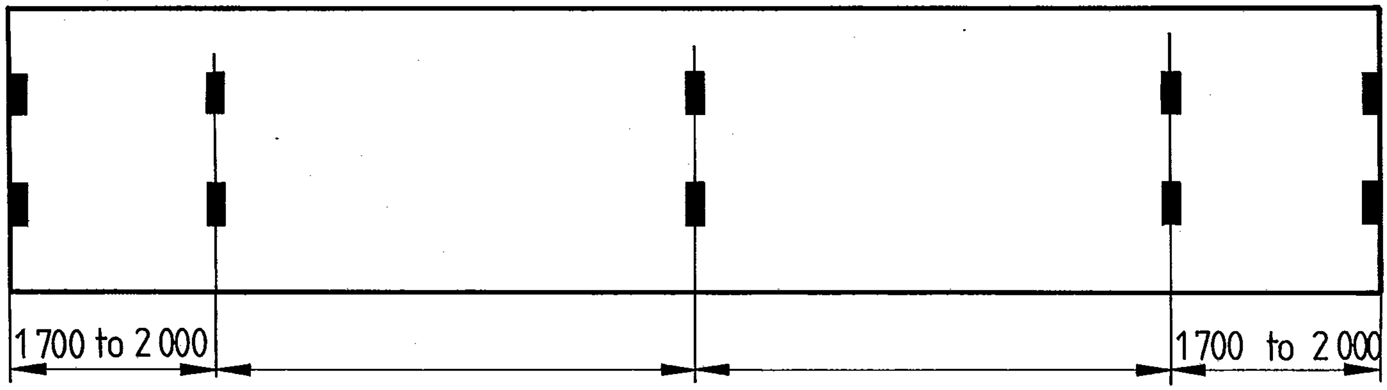


Figure 29

Requirements applicable if 6 pairs of load transfer areas are to be fitted:

Dimensions in millimetres[1)]

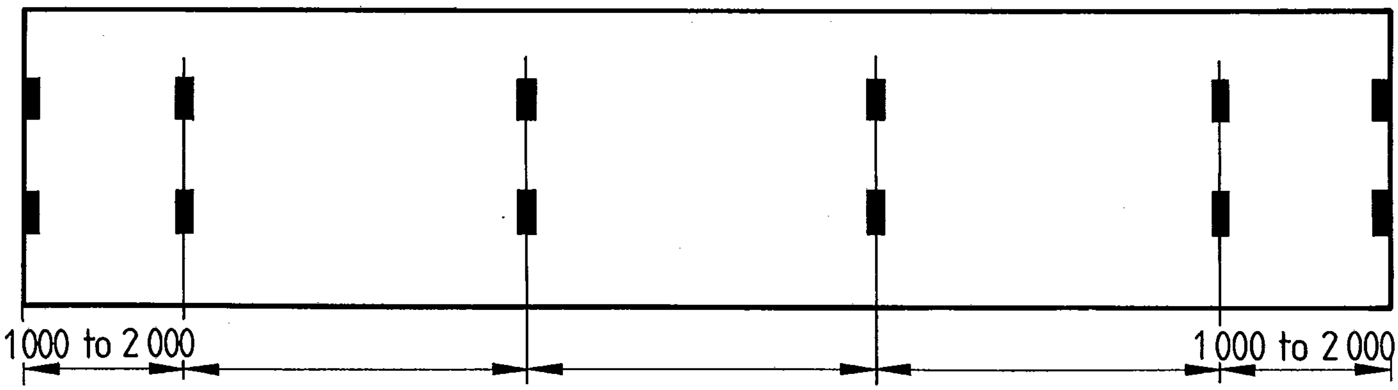


Figure 30

1) 1 700 to 2 000 mm = 66 15/16 to 78 3/4 in
1 000 to 2 000 mm = 39 3/8 to 78 3/4 in

1A or 1AA containers — With gooseneck tunnel (with minimum localized structure)

Minimum requirements: 6 pairs of load transfer areas
(1 pair at each end plus 4 intermediate pairs)

Dimensions in millimetres[1)]

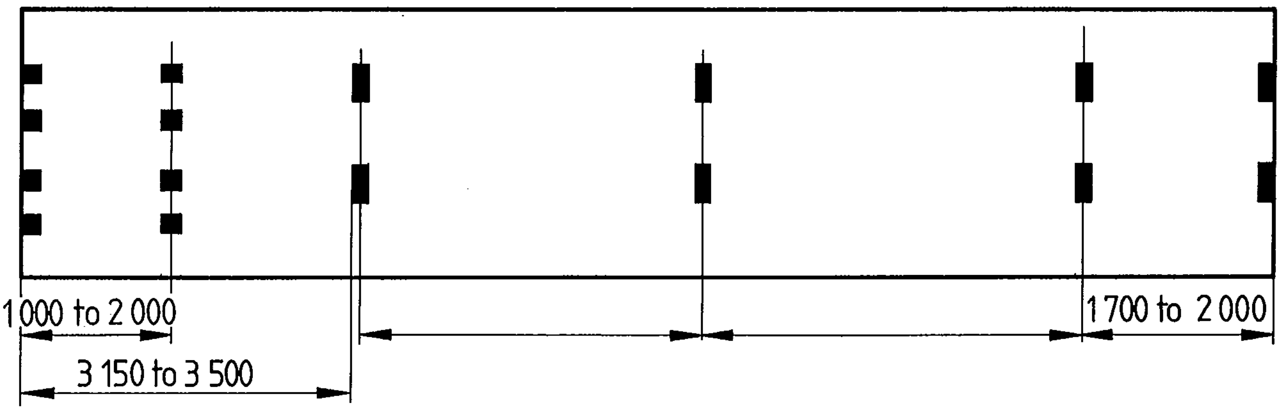


Figure 31

(See also figure 33.)

Requirements applicable if 7 pairs of load transfer areas are to be fitted:

Dimensions in millimetres[1)]

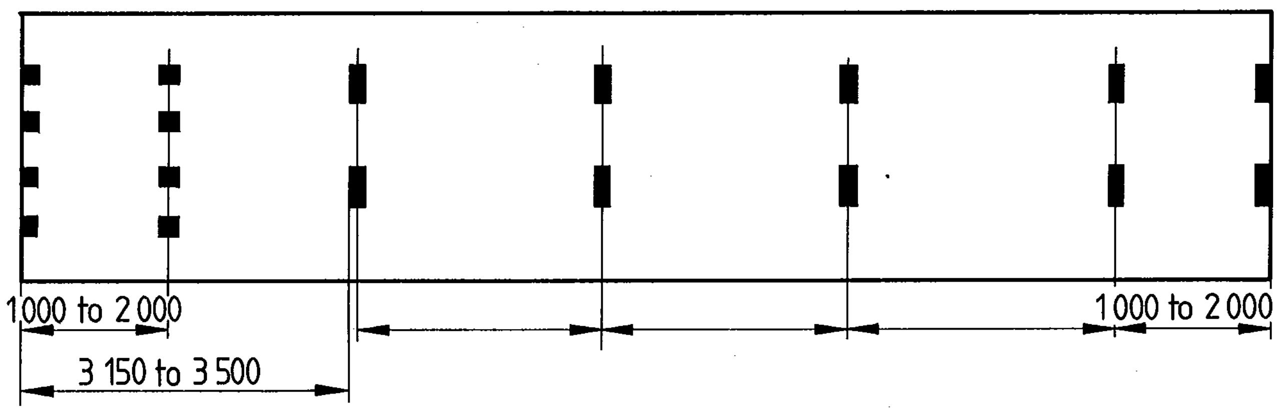


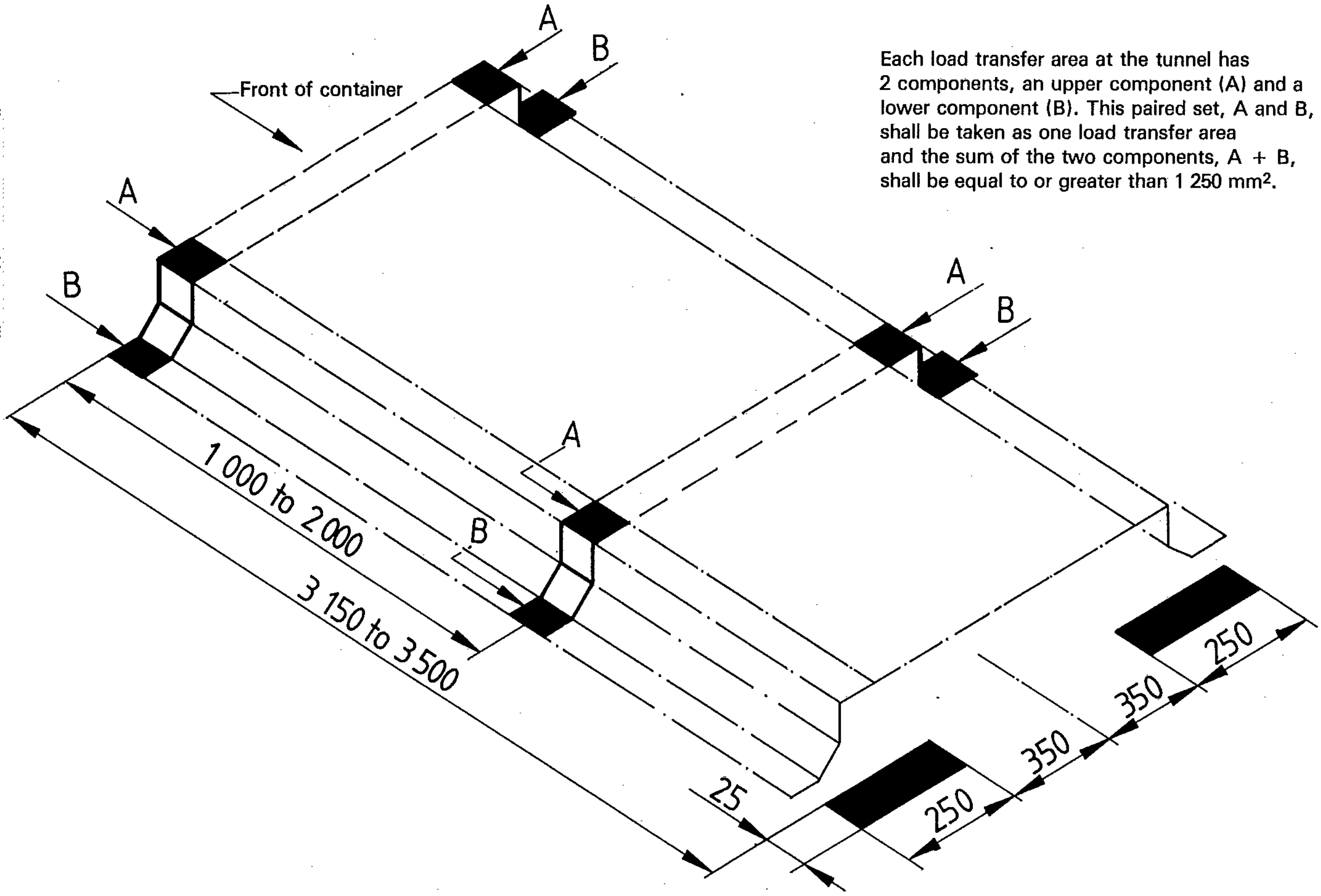
Figure 32

(See also figure 33.)

1) 1 000 to 2 000 mm = 39 3/8 to 78 3/4 in
1 700 to 2 000 mm = 66 15/16 to 78 3/4 in
3 150 to 3 500 mm = 124 1/4 to 137 7/8 in

Minimum requirements for load transfer areas in the vicinity of the gooseneck tunnel

Dimensions in millimetres[1)]



(See annex E for details of tunnel section.)

NOTE — Where continuous tunnel side members are provided, the load transfer areas shown in figure 33 between 3 150 and 3 500 mm from the end of the container may be omitted.

Figure 33

1) 1 250 mm^2 = 2 in^2
1 000 to 2 000 mm = 39 3/8 to 78 3/4 in
3 150 to 3 500 mm = 124 1/4 to 137 7/8 in
25 mm = 1 in
250 mm = 10 in
350 mm = 14 in

Annex C

Dimensions of fork-lift pockets (where provided) (see 5.9.1)

(This annex forms an integral part of the standard.)

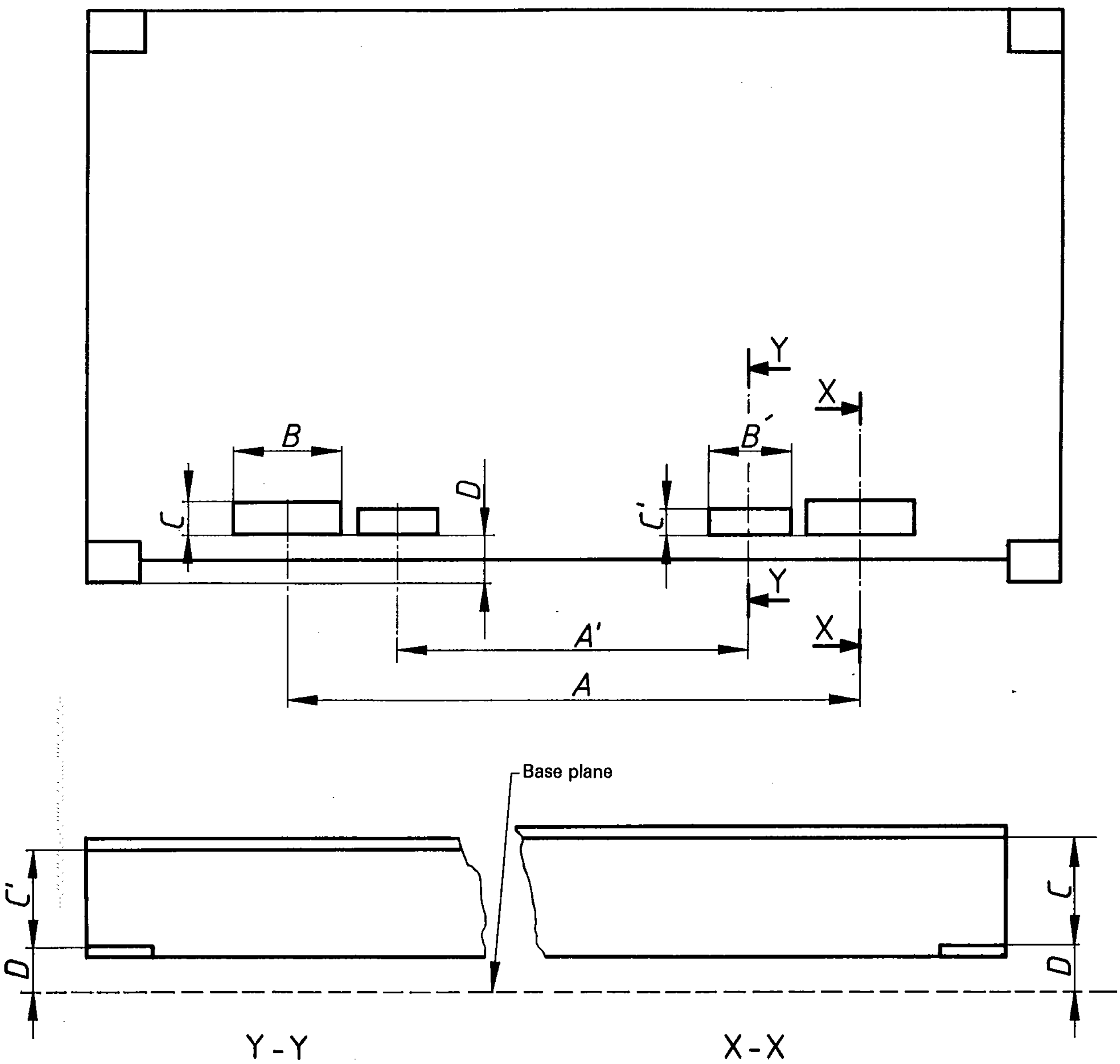


Figure 34

Container	Dimensions													
	Fork-lift pockets for loaded and unloaded containers								Fork-lift pockets for unloaded containers only					
	mm				in				mm			in		
	A	*B*	*C*	*D*	*A*	*B*	*C*	*D*	*A'*	*B'*	*C'*	*A'*	*B'*	*C'*
1C and 1CC	2 050 ± 50	355 min.	115 min.	20 min.	81 ± 2	14 min.	4 1/2 min.	0.8 min.	900 ± 50	305 min.	102 min.	35 1/2 ± 2	12 min.	4 min.
1D	900 ± 50	305 min.	102 min.	20 min.	35 1/2 ± 2	12 min.	4 min.	0.8 min.						

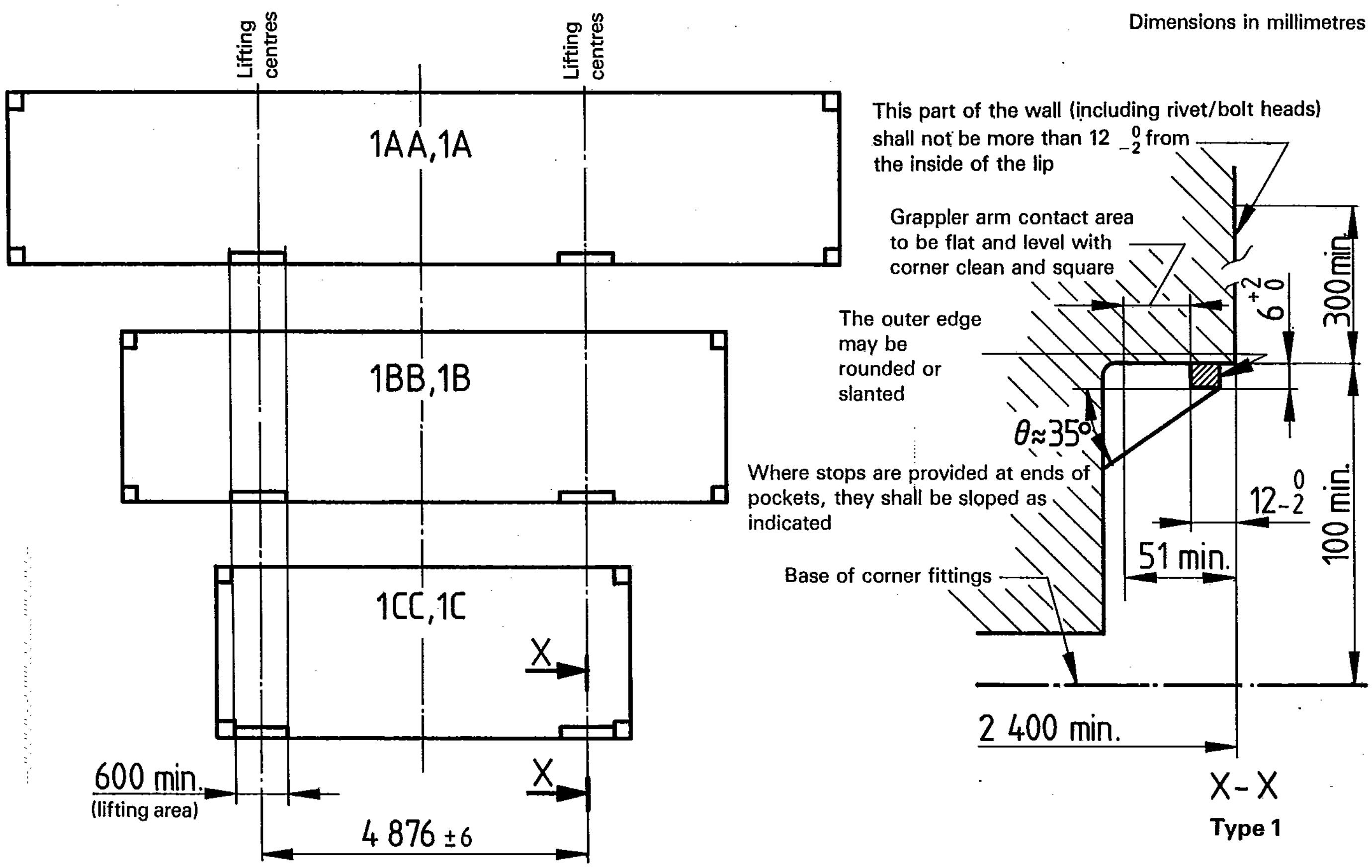
NOTE — *C* = Clear opening

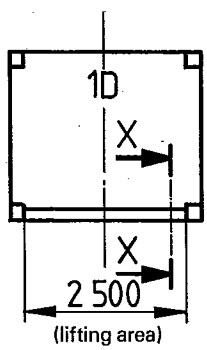
Annex D

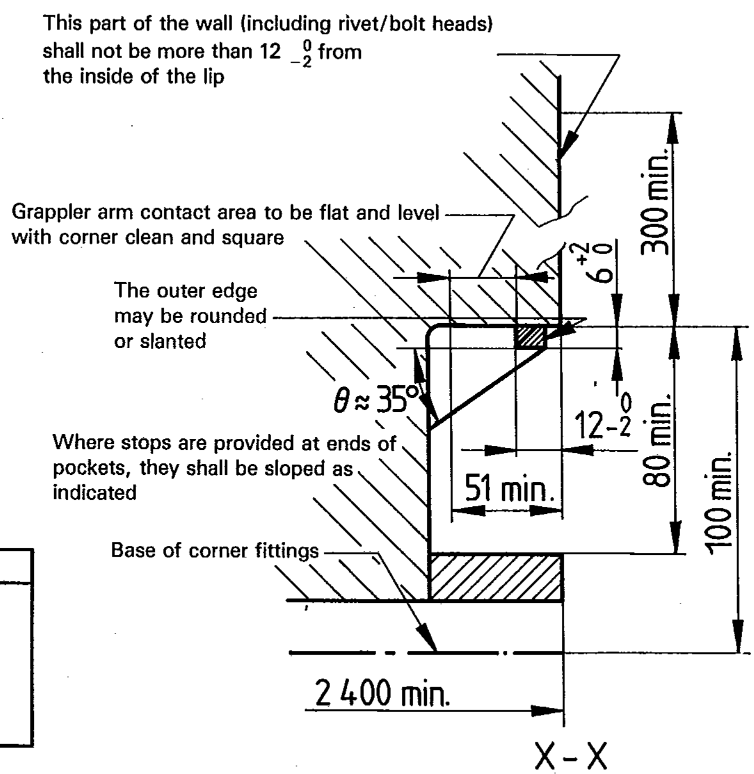
Dimensions of grappler arm lifting areas (where provided) (see 5.9.2)

(This annex forms an integral part of the standard.)

Dimensions in millimetres







Dimension conversion

mm	in	mm	in
2	0.08	300	11.8
6	0.24	600	23.64
12	0.48	2 400	94.5
51	2.01	2 500	98.4
80	3.15	4 876	192
100	3.94		

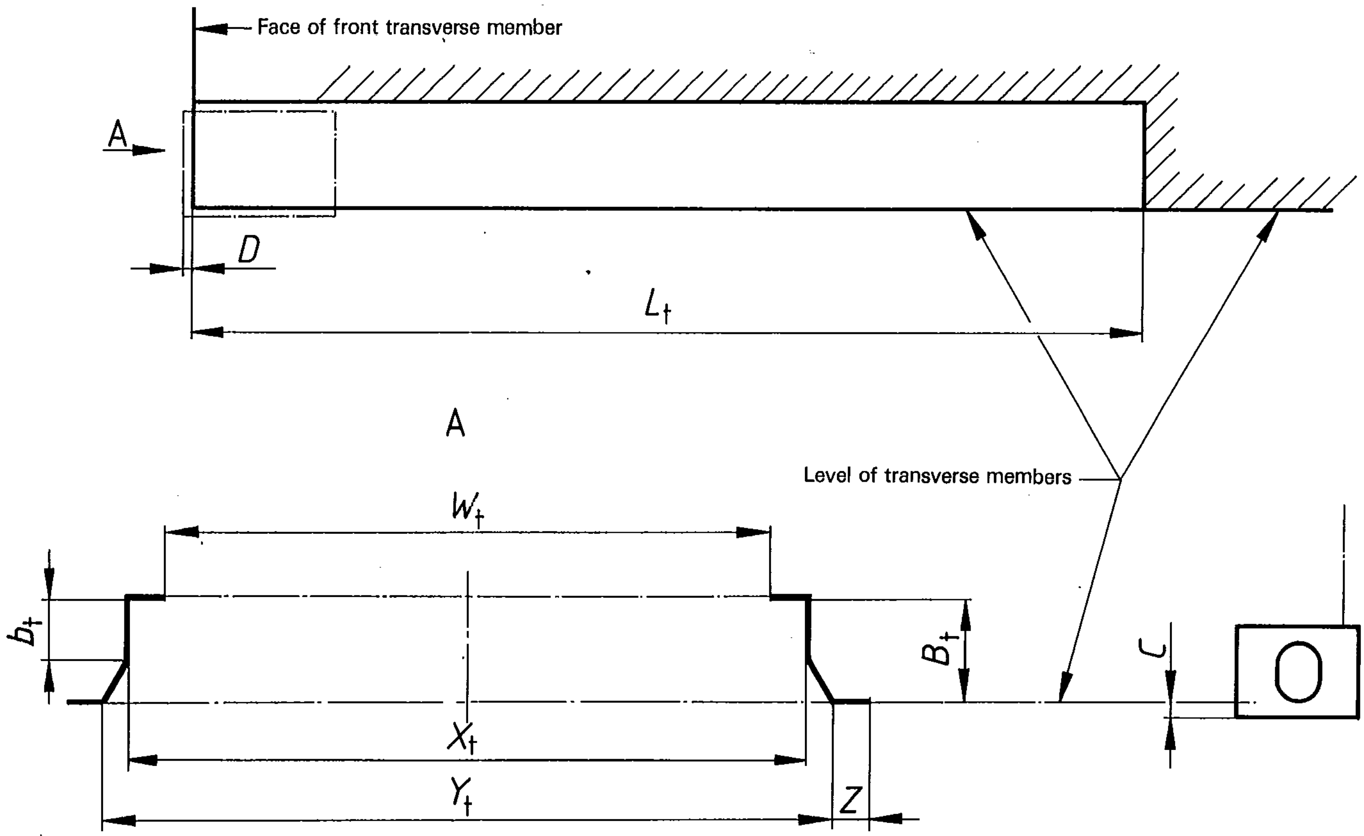
Figure 35

Annex E

Dimensions of gooseneck tunnels (where provided) (see 5.9.3)

(This annex forms an integral part of the standard.)

The space required to constitute a gooseneck tunnel into which the gooseneck of a trailer may fit is shown in figure 36.



		Dimensions	
		mm	in
Length	L_t	3 150 to 3 500	124 1/4 to 137 7/8
	D	6^{+1}_{-2}	$1/4^{+3/64}_{-3/62}$
Width	W_t	930 max.	36 5/8 max.
	X_t	$1\,029^{+3}_{0}$	$40\ 1/2^{+1/8}_{0}$
	Y_t	1 070 min.	42 1/8 min.
		1 130 max.	44 1/2 max.
	Z	25 min.	1 min.
Height	B_t	120^{0}_{-3}	$4\ 23/32^{0}_{-1/8}$
	b_t	35 min.	1 3/8 min.
		70 max.	2 3/4 max.
	C	$12,5^{+5}_{-1,5}$	$1/2^{+3/16}_{-1/16}$

NOTES

1 Tolerance B_t shall be measured in the back part of the tunnel, over a length of about 600 mm (23 5/8 in).

2 The tunnel structure may be formed by continuous members having the minimum length specified in the table and the internal dimensions given for the thick lines in the figure or, alternatively, localized structures may be provided at the positions shown shaded in figure 33 (see annex B).

Figure 36

Annex F

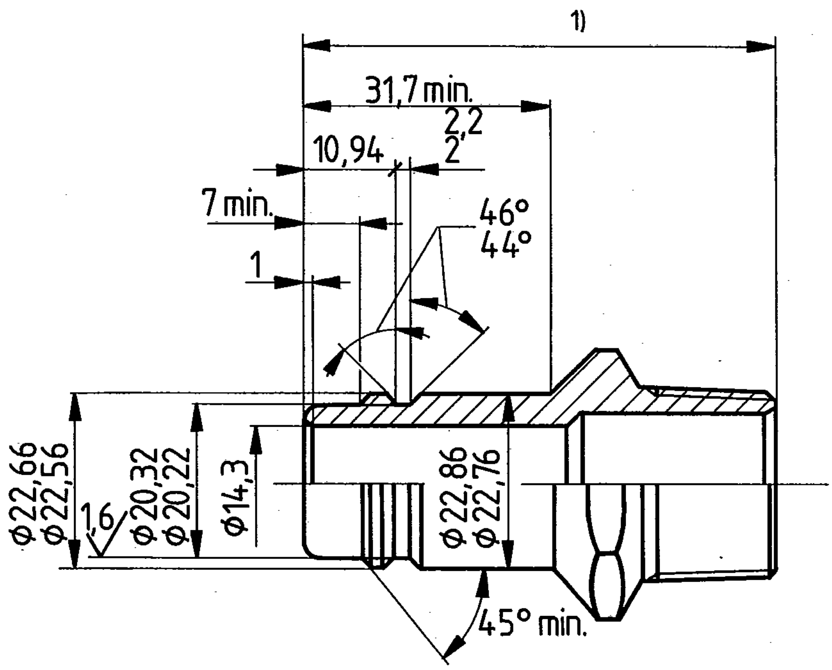
Cooling water connections (see 5.9.5)

(This annex forms an integral part of the standard.)

F.1 Inlet side

Dimensions in millimetres

Surface roughness value in micrometres



Operating pressure: 1 MPa
Bursting pressure: 4 MPa

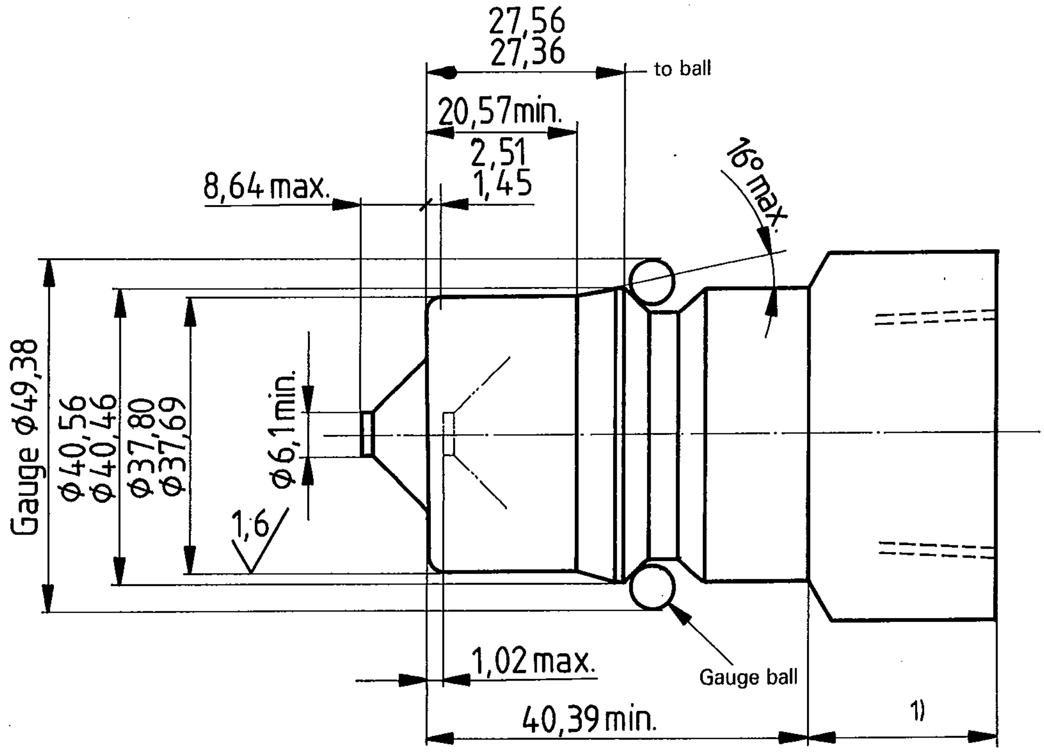
Figure 37a)

1) Detail not specified in this part of ISO 1496.

F.2 Outlet side

Dimensions in millimetres

Surface roughness value in micrometres



NOTE — Valve flush to minus from end of coupler when against stop.

Operating pressure: 1 MPa
Bursting pressure: 4 MPa

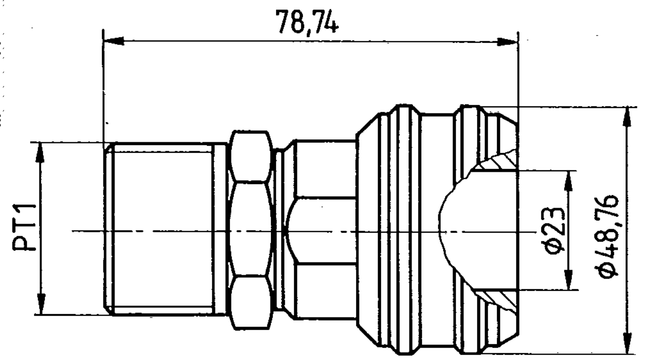
Figure 37b)

1) Detail not specified in this part of ISO 1496.

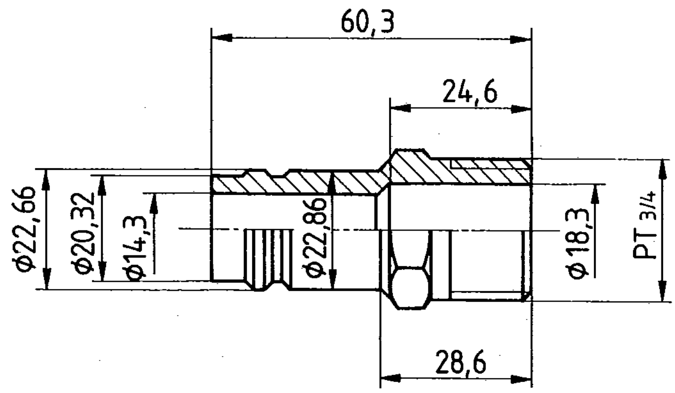
F.3 Examples of sectional view and profile

F.3.1 Cooling water connection — Inlet side (Single shut-off)

Dimensions in millimetres



Socket with valve (ship side)



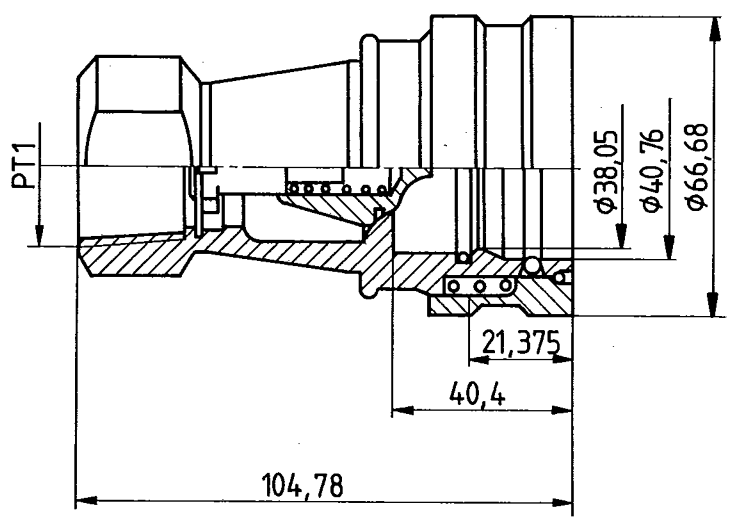
Plug (container side)

Flow of water →

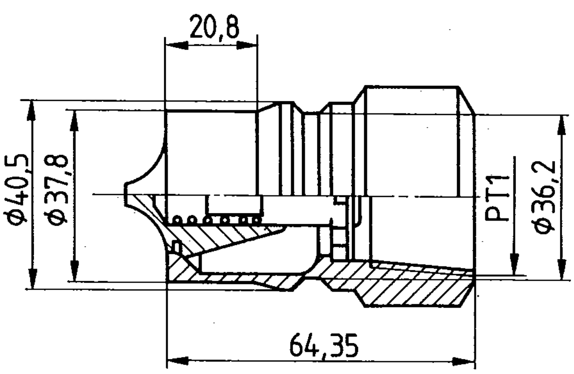
Figure 38a)

F.3.2 Cooling water connection — Outlet side (Double shut-off)

Dimensions in millimetres



Socket with valve (container side)



Plug with valve (ship side)

Flow of water →

Figure 38b)

Annex G

Air inlets and outlets

(This annex forms an integral part of the standard.)

G.1 Air apertures in end wall of 1AA thermal containers (see 5.9.6)

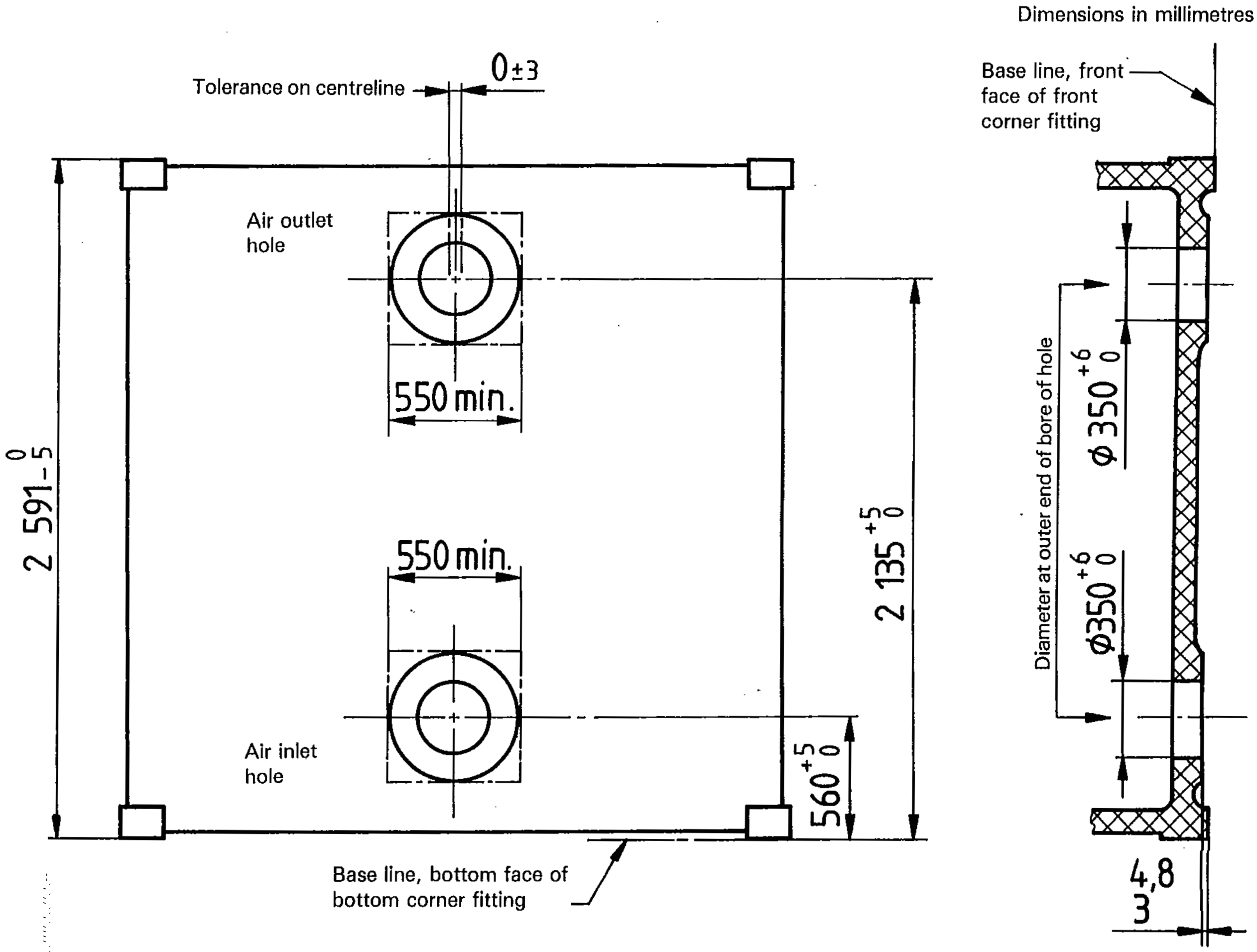


Figure 39

G.1.1 Area about air circulation openings (see figure 39)

G.1.1.1 Bosses shall be 550 mm diameter or square.

G.1.1.2 Face of bosses shall be plane to a tolerance of 0,25 mm and smooth to touch.

G.1.1.3 Faces of bosses shall be parallel to a base plane determined by front faces of the front corner fittings and recessed 3 to 4,8 mm from this plane.

G.1.1.4 Holes may have a mould draw taper but no part of the bore of the hole may have a diameter less than 350 mm.

G.1.2 Closures for apertures

G.1.2.1 Closure devices that are captive to the container should be provided for closing off the air circulation openings when the container is not connected to a cold air supply.

G.1.2.2 Closure devices should be capable of being sealed for customs requirements.

G.2 Air apertures in end wall of 1CC thermal containers (see 5.9.6)

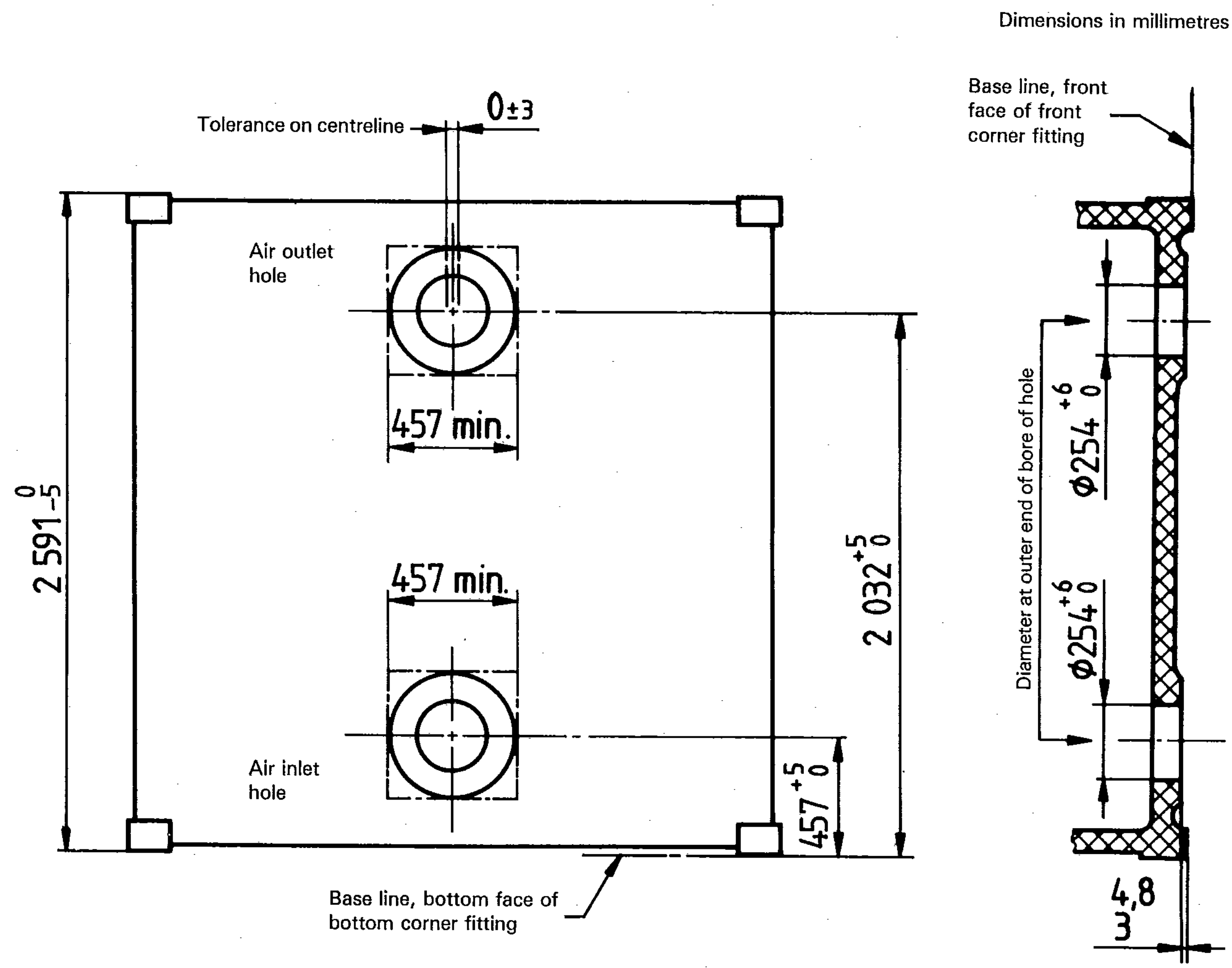


Figure 40

G.2.1 Area about air circulation openings (see figure 40)

G.2.1.1 Bosses shall be 457 mm diameter or square.

G.2.1.2 Face of bosses shall be plane to a tolerance of 0,25 mm and smooth to touch.

G.2.1.3 Faces of bosses shall be parallel to a base plane determined by front faces of the front corner fittings and recessed 3 to 4,8 mm from this plane.

G.2.1.4 Holes may have a mould draw taper but no part of the bore of the hole may have a diameter less than 254 mm.

G.2.2 Closures for apertures

G.2.2.1 Closure devices that are captive to the container should be provided for closing off the air circulation openings when the container is not connected to a cold air supply.

G.2.2.2 Closure devices should be capable of being sealed for customs requirements.

G.3 Air apertures in end wall of 1C thermal containers (see 5.9.6)

Dimensions in millimetres

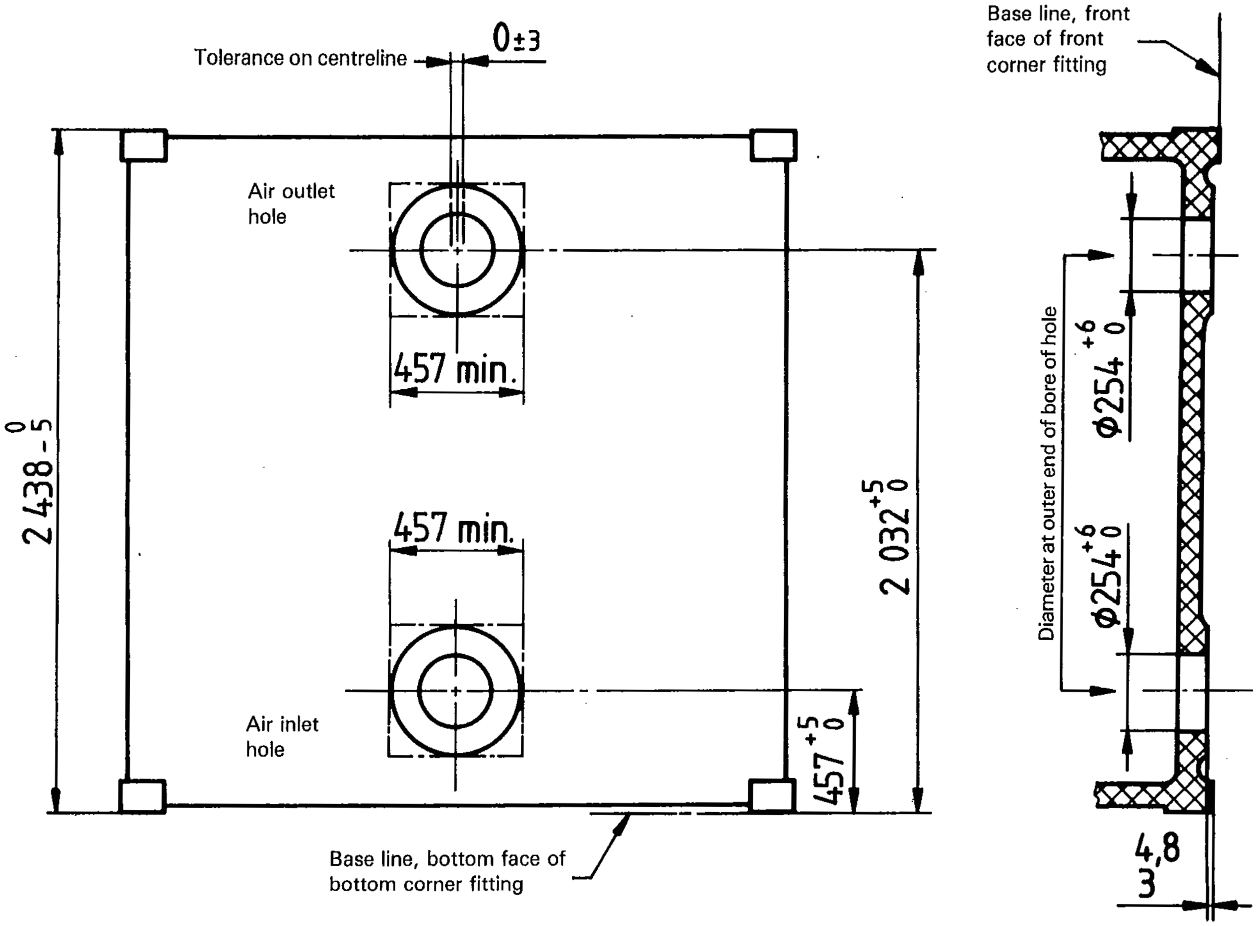


Figure 41

G.3.1 Area about air circulation openings (see figure 41)

G.3.1.1 Bosses shall be 457 mm diameter or square.

G.3.1.2 Face of bosses shall be plane to a tolerance of 0,25 mm and smooth to touch.

G.3.1.3 Faces of bosses shall be parallel to a base plane determined by front faces of the front corner fittings and recessed 3 to 4,8 mm from this plane.

G.3.1.4 Holes may have a mould draw taper but no part of the bore of the hole may have a diameter less than 254 mm.

G.3.2 Closures for apertures

G.3.2.1 Closure devices that are captive to the container should be provided for closing off the air circulation openings when the container is not connected to a cold air supply.

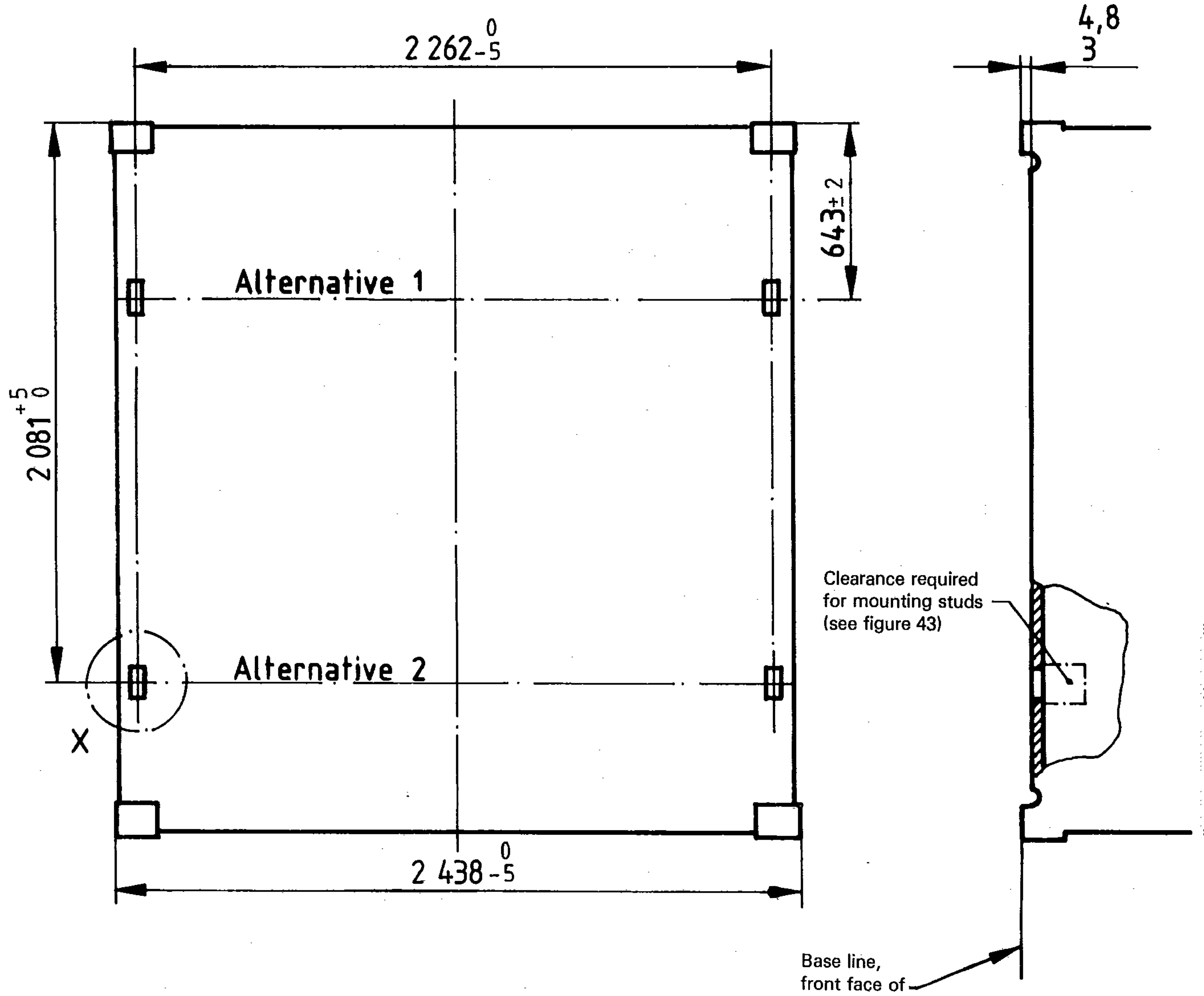
G.3.2.2 Closure devices should be capable of being sealed for customs requirements.

Annex H

Intermediate sockets for clip-on units (where provided) (see 5.9.7)

(This annex forms an integral part of the standard.)

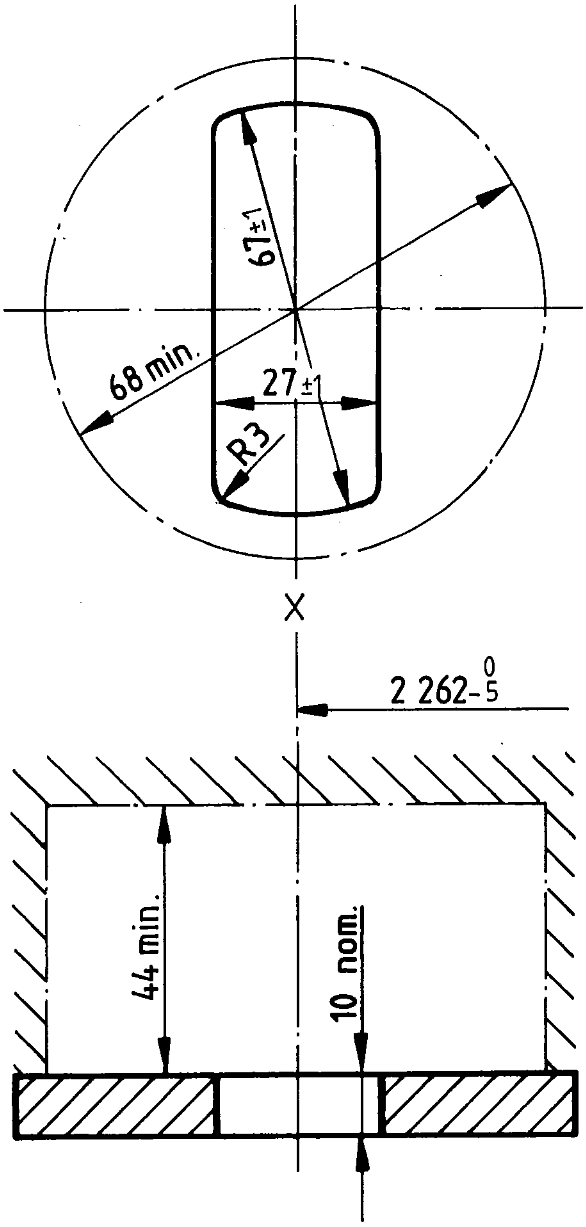
Dimensions in millimetres



NOTE — Detail X given in figure 43.

Figure 42

Dimensions in millimetres



NOTE — Detail X refers to figure 42.

Figure 43

Annex I

Air temperature measurement points (see 6.16.3)

(This annex forms an integral part of the standard.)

I.1 Outside air temperature measurement points

Dimensions in millimetres

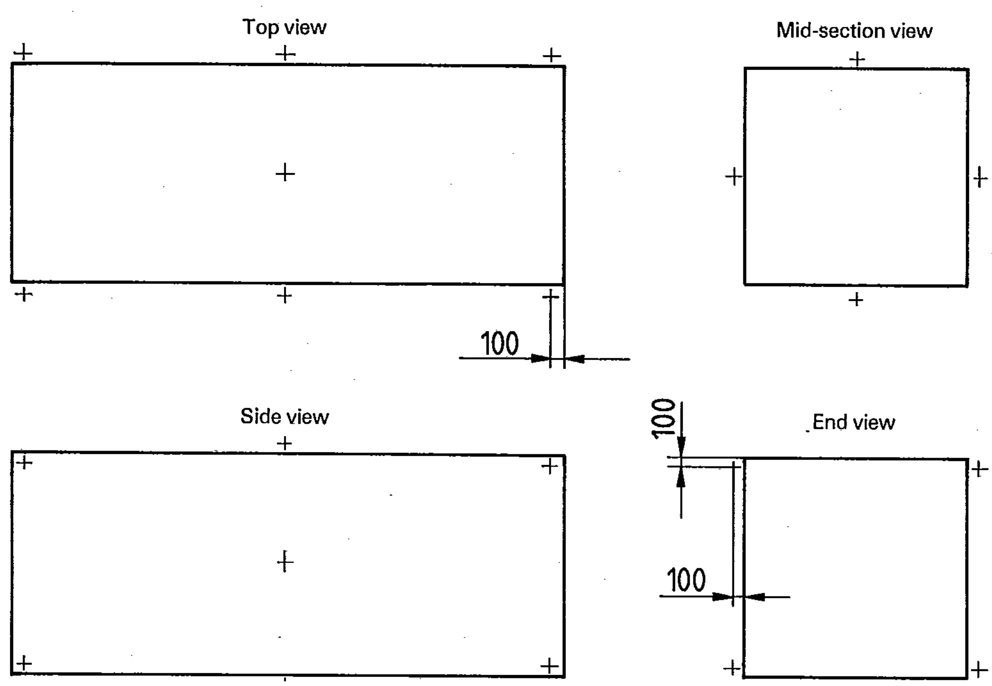


Figure 44

I.2 Inside air temperature measurement points

Dimensions in millimetres

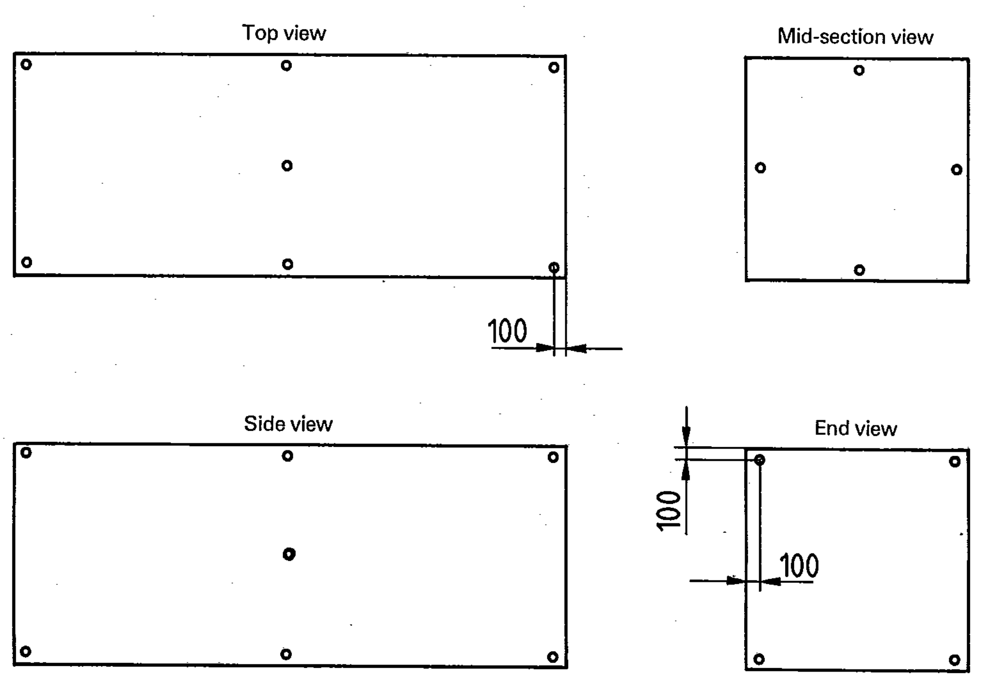


Figure 45

Annex J

Diagrammatic representation of steady-state conditions for heat leakage test (test No. 15) (see 6.16.2.1)

(This annex forms an integral part of the standard.)

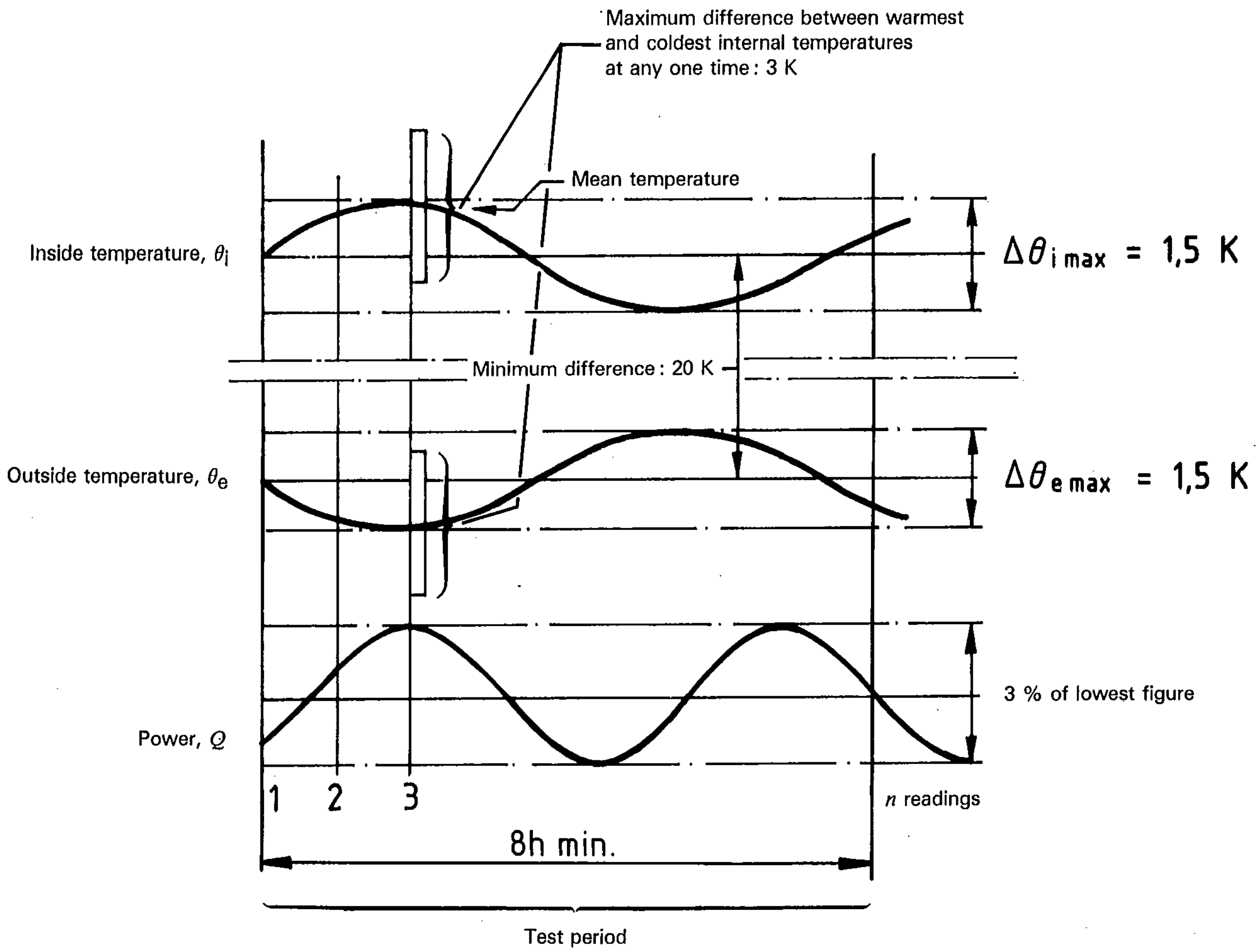


Figure 46

Annex K

Electrical power supplies for thermal containers (see 7.3)

(This annex does not form an integral part of the standard.)

This part of ISO 1496 has been drawn up, insofar as the electrical aspects (clause 7) are concerned, on the assumption that the containers will be used in conjunction with electrical power supply installations which meet certain basic requirements. In order to ensure that containers built in accordance with this part of ISO 1496 can be relied upon to function safely and satisfactorily wherever they are required to operate, the desirable basic requirements for electrical supply installations are set out in clauses K.1 to K.7.

K.1 Electrical power supply systems intended for use with thermal containers should be designed and constructed in accordance with appropriate national standards and/or legislation where such exists. Where no such national standards or legislation exist, design and construction should be in accordance with the relevant recommendations of the International Electrotechnical Commission.

K.2 Power supply systems should be provided with outlet sockets (receptacles) suitable for use with the plugs described in either 7.4.2 or 7.5.2 according to the voltage and frequency of the local electricity supply. These sockets are depicted in annexes M, N, O and P alongside the corresponding plug.

K.3 Where the voltage of the local electricity supply does not fall within the ranges covered by 7.4.1 and 7.5.1, suitable means of transformation should be employed to change the voltage to an acceptable value.

K.4 Each power supply outlet socket should be fitted with a suitable isolating switch or circuit breaker, preferably interlocked so that the plug cannot be inserted or withdrawn while the switch or circuit breaker is in the ON position.

K.5 Each power supply outlet socket should be provided with fuses or, preferably, a linked three-phase circuit breaker of suitable rating which will give protection against the effects of short circuit but which will not be caused to operate by the starting current of the container machinery up to the limits specified in 7.3.4. Circuit breakers in supplies for type 1 or type 2 equipment shall have characteristics which should be in accordance with the following:

	A	Tripping time
For type 1 equipment	200	3 s min.
	360	10 s max.
	600	0,2 s max.
For type 2 equipment	100	3 s min.
	180	10 s max.
	300	0,2 s max.

K.6 Each power supply outlet socket should be capable of supplying individually a current consistent with the requirements of 7.3.2 and either 7.4.2 or 7.5.2. However, in assessing the load to be supplied by groups of outlet sockets, an appropriate diversity factor may be taken into account.

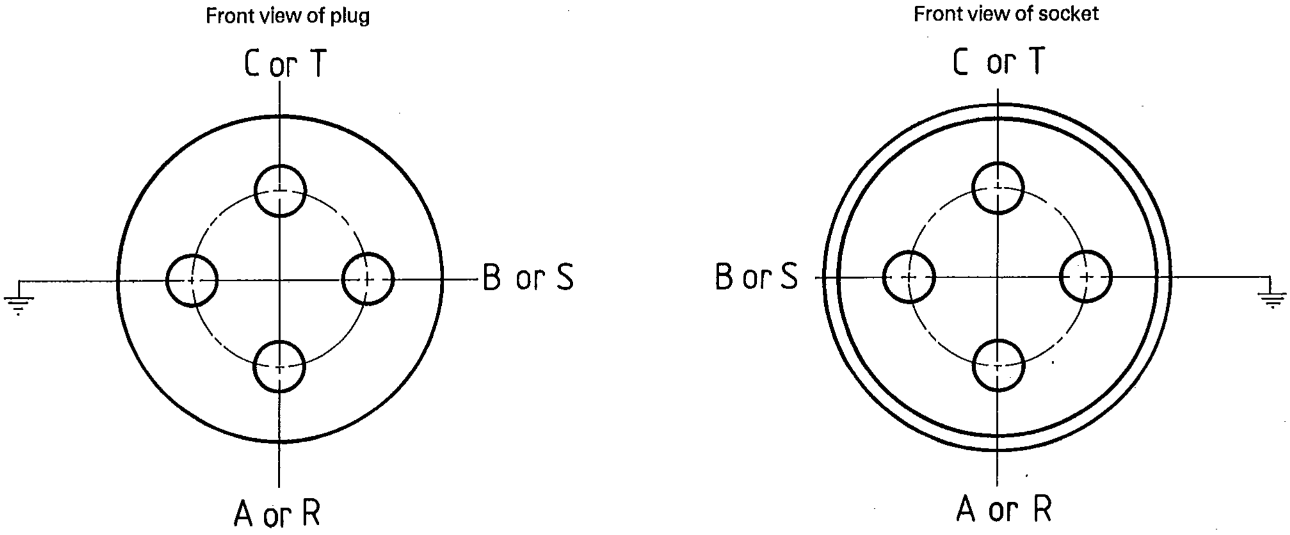
K.7 Three-phase power supply systems should be connected for standard phase rotation, as defined in 7.3.3. Outlet sockets should be connected as shown in annex L.

Annex L

Phase connections to container plugs and sockets (see 7.3.3)

(This annex forms an integral part of the standard.)

L.1 Plug and socket (front view)



NOTE — Dimensions of plugs and sockets, see annexes M, N, O and P.

Figure 47

L.2 Phase relationship detail

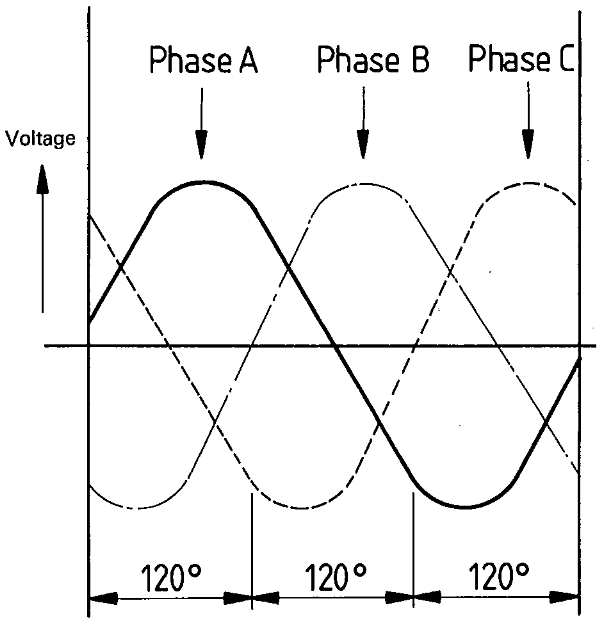


Figure 48

Annex M

Electric plug and socket, four-pin, 250 V, 60 A [see 7.4.2a)]

(This annex forms an integral part of the standard.)

M.1 Plug

Dimensions in millimetres

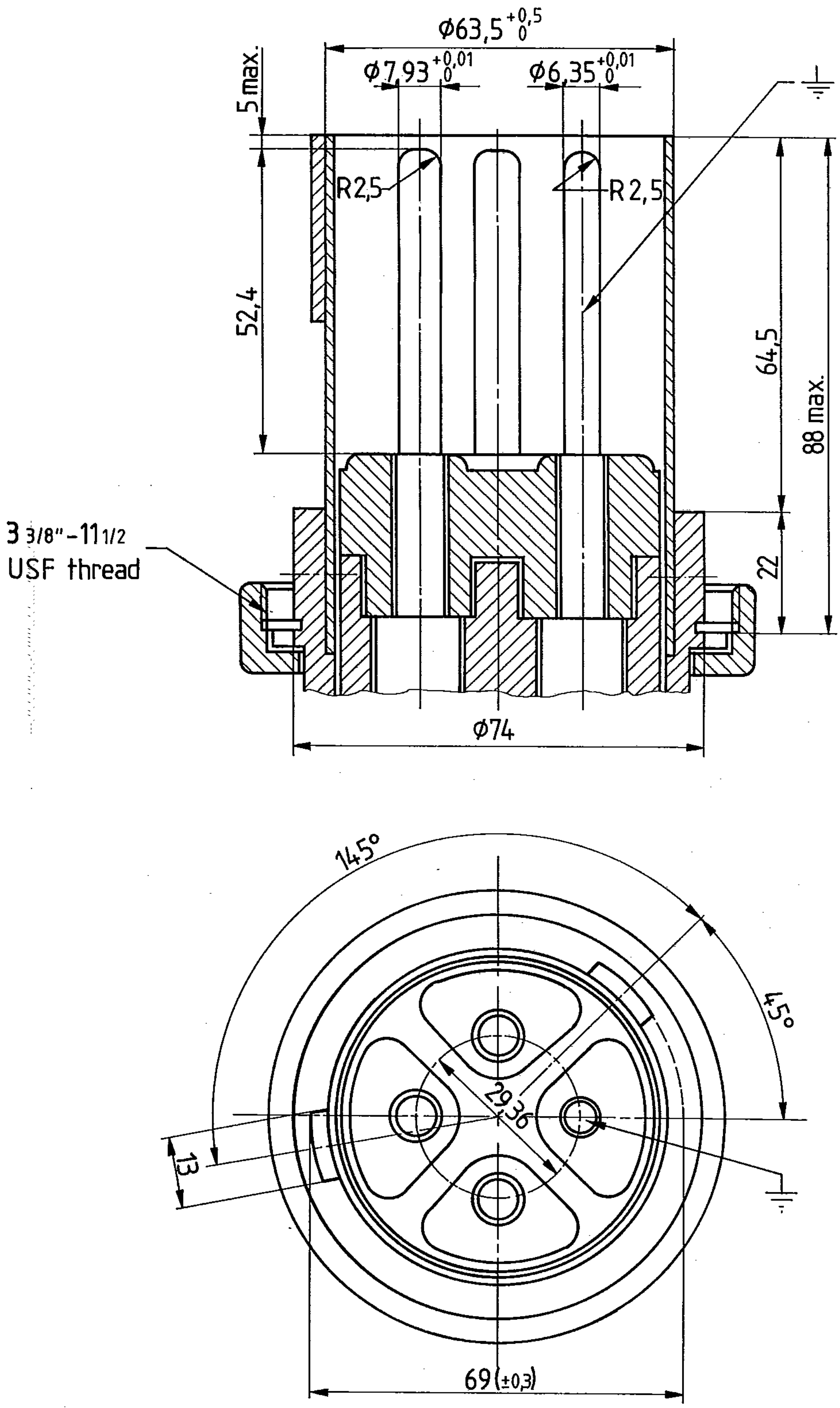


Figure 49

Dimension conversion

mm	in
63,5 $^{+0,5}_{0}$	2.5 $^{+0.02}_{0}$
7,93 $^{+0,01}_{0}$	0.312 $^{+0.004}_{0}$
6,35 $^{+0,01}_{0}$	0.25 $^{+0.004}_{0}$
74	2.9
69 ± 0,3	2.716 ± 0.012
2,5	0.09
29,36	1.155
13	0.51
52,4	2 1/16
64,5	2.54
88	3 15/32
22	0.87
5	0.196

M.2 Socket

Dimensions in millimetres

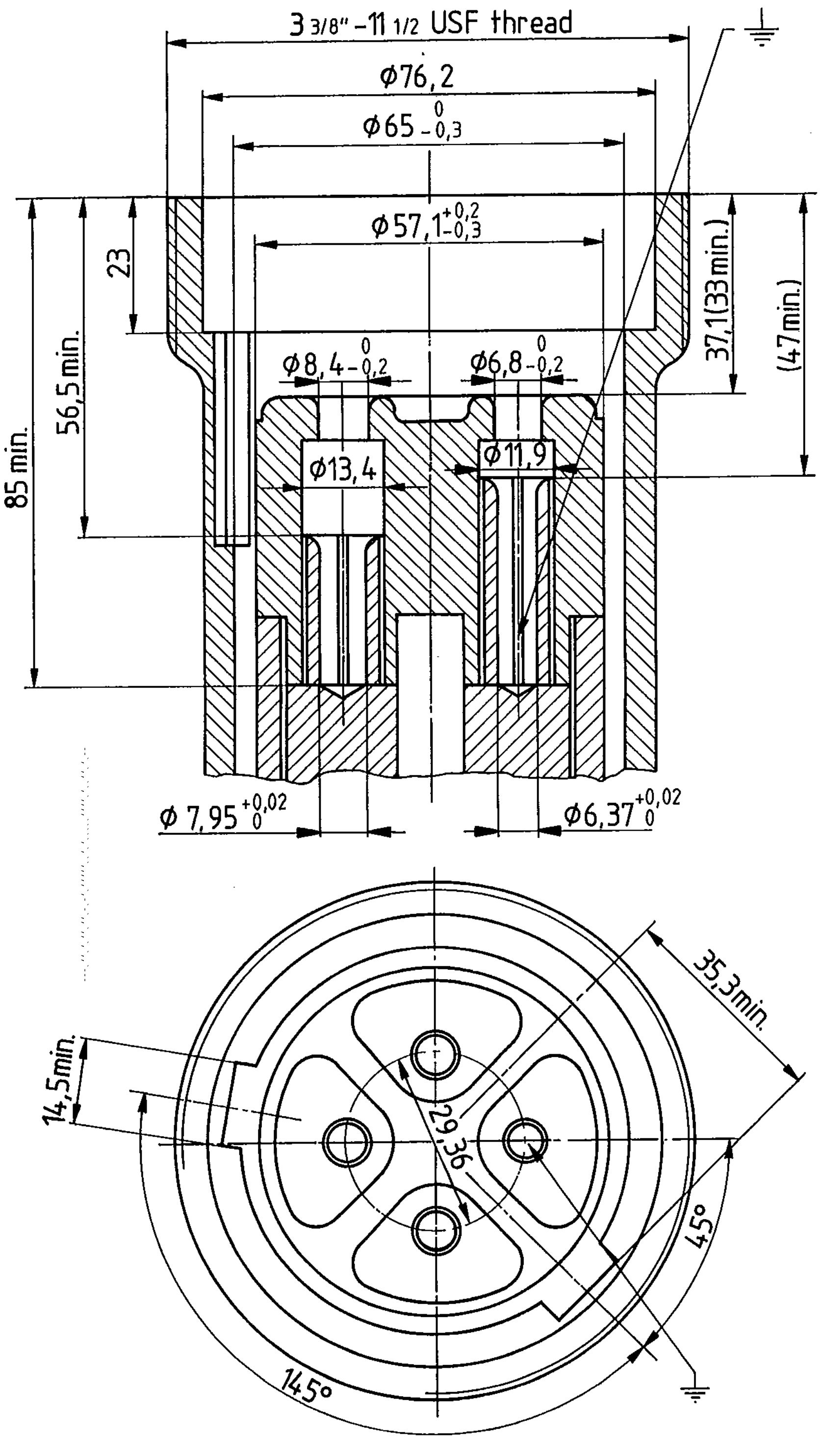


Figure 50

Dimension conversion

mm	in
76,2	3
65 $^{0}_{-0,3}$	2.56 $^{0}_{-0.012}$
57,1 $^{+0,2}_{-0,3}$	2.25 $^{+0.008}_{-0.012}$
8,4 $^{0}_{-0,2}$	0.33 $^{0}_{-0.008}$
6,8 $^{0}_{-0,2}$	0.267 $^{0}_{-0.008}$
11,9	0.468
13,4	0.527
7,95 $^{+0,02}_{0}$	0.312 $^{+0.008}_{0}$
6,37 $^{+0,02}_{0}$	0.25 $^{+0.008}_{0}$
14,5	0.57
35,3	1.39
29,36	1.156
85	3 11/32
56,5	2.22
23	0.91
37,1	1.46
33	1.3
47	1.85

Annex N

Electric plug and socket, four-pin, 230 V, 50 A [see 7.4.2b)]

(This annex forms an integral part of the standard.)

N.1 Plug

Dimensions in millimetres

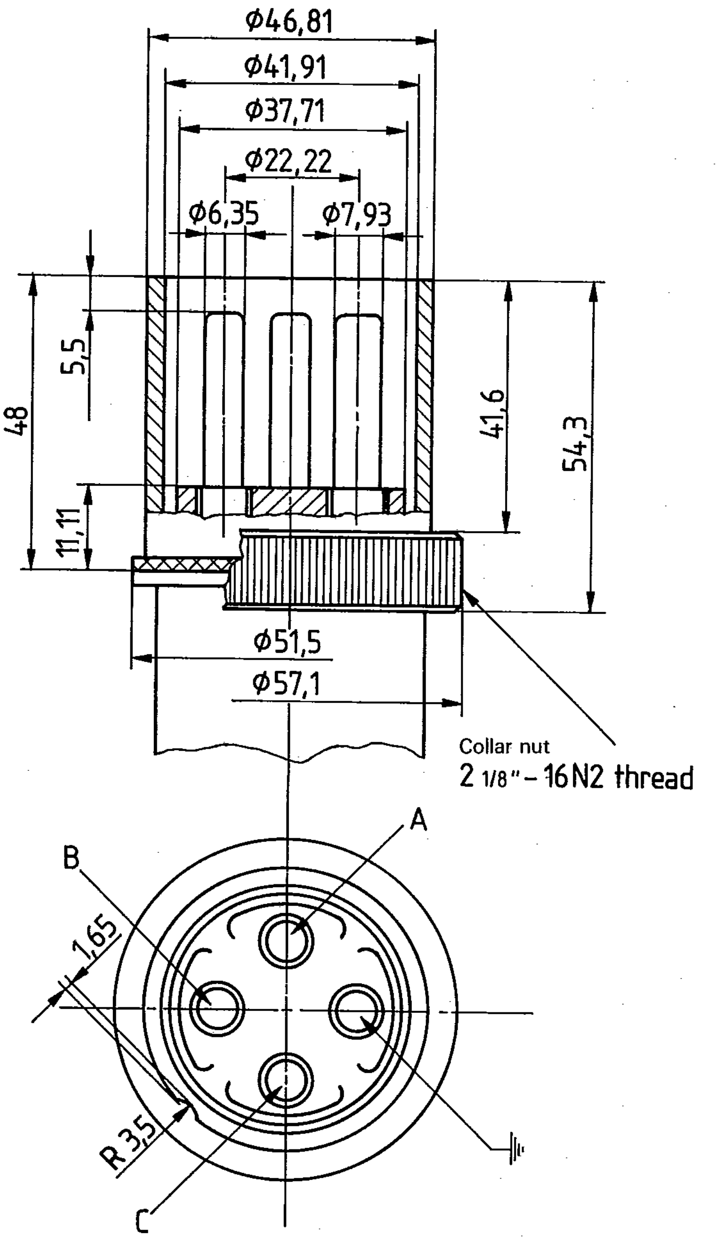


Figure 51

Dimension conversion

mm	in
46,81	1.843
41,91	1.65
37,71	1.485
22,22	7/8
6,35	0.25
7,93	0.312
51,5	2 1/32
57,1	2 1/4
48	1.891
11,11	0.438
5,5	0.218
41,6	1.64
54,3	2.14
1,65	0.065
3,5	9/64

N.2 Socket

Dimensions in millimetres

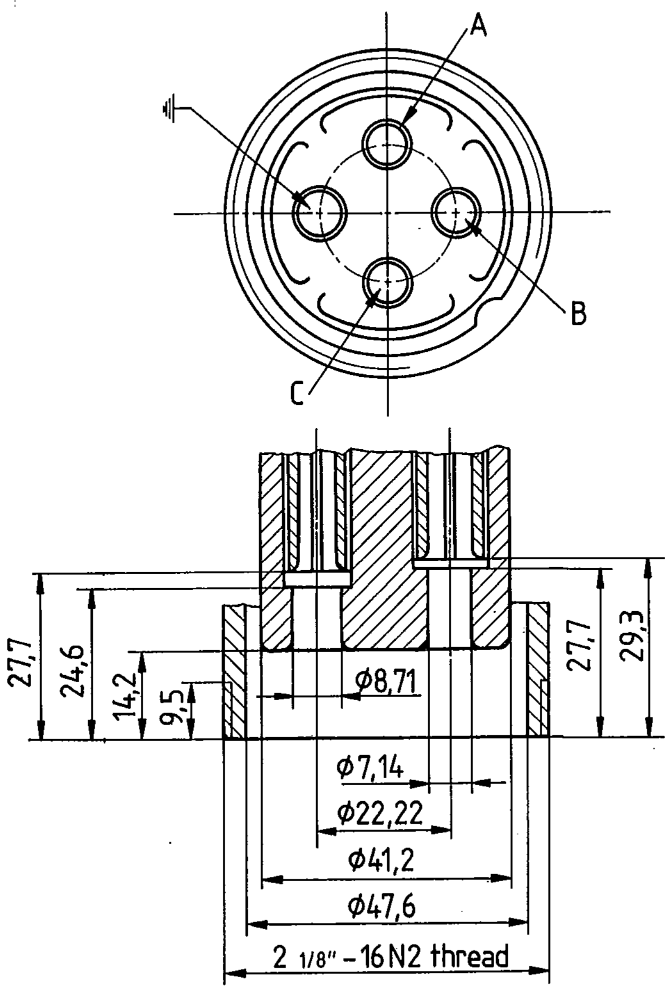


Figure 52

Dimension conversion

mm	in
47,6	1.875
41,2	1.625
22,22	7/8
7,14	0.375
8,71	0.406
27,7	1 3/32
24,6	3 1/32
9,5	3/8
14,2	9/16
29,3	1 5/32

Annex O

Electric plug and socket, four-pin, 380/440 V, 50/60 Hz, 32 A [see 7.5.2a)]

(This annex forms an integral part of the standard.)

O.1 Plug

Dimensions in millimetres

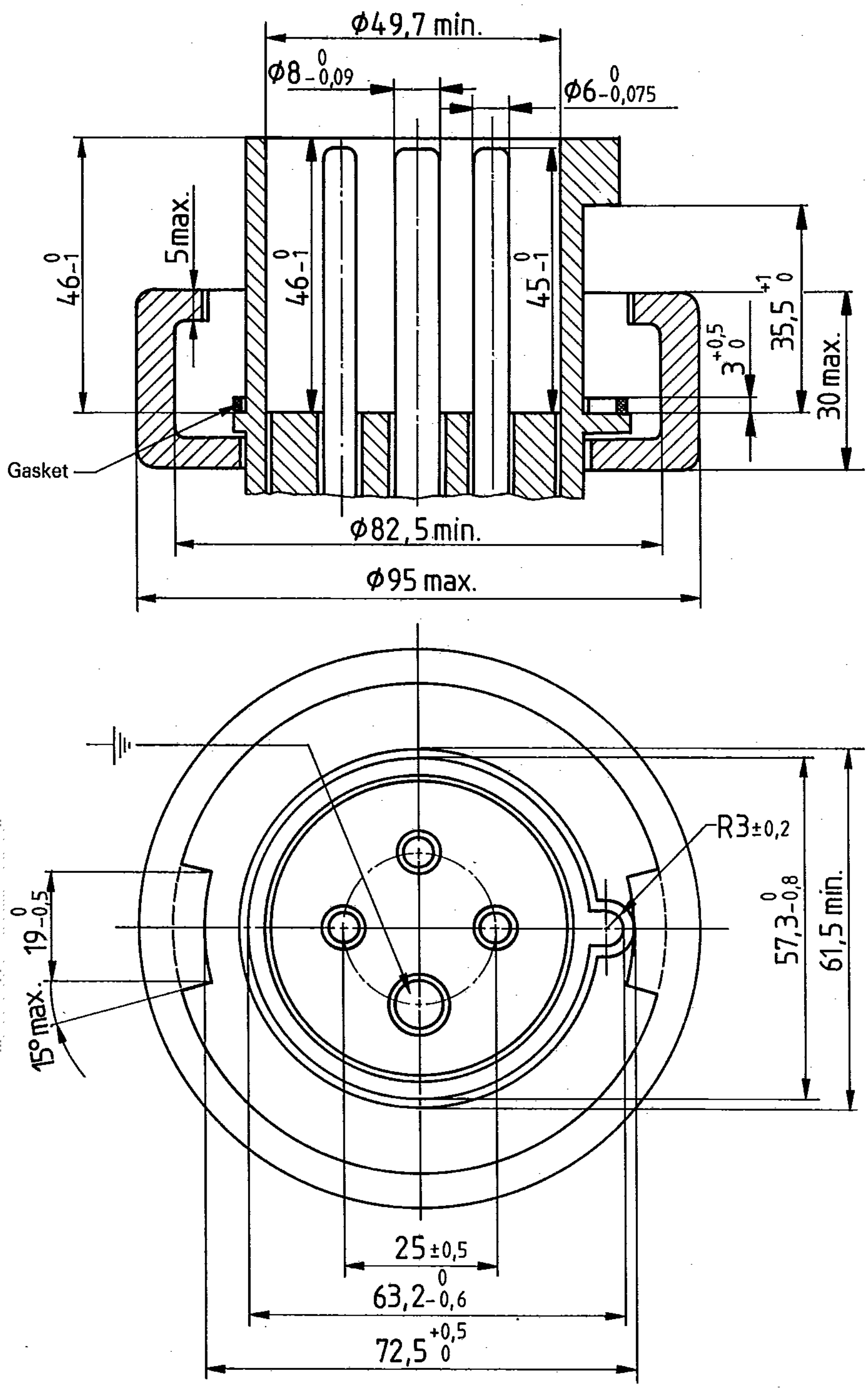


Figure 53

Dimension conversion

mm	in
49,7	1.956
8 $^{0}_{-0,09}$	0.315 $^{0}_{-0.004}$
6 $^{0}_{-0,075}$	0.236 $^{0}_{-0.003}$
82,5	3 1/4
95	3 3/4
25 ±0,5	0.984 ±0.02
63,2 $^{0}_{-0,6}$	2.488 $^{0}_{-0.023}$
72,5 $^{+0,5}_{0}$	2.85 $^{+0.02}_{0}$
3 ±0,2	0.12 ±0.008
46 $^{0}_{-1}$	1.81 $^{0}_{-0.04}$
5	0.196
45 $^{0}_{-1}$	1.77 $^{0}_{-0.04}$
3 $^{+0,5}_{0}$	0.12 $^{+0.02}_{0}$
30	1.18
35,5 $^{+1}_{0}$	1.4 $^{+0.04}_{0}$
19 $^{0}_{-0,5}$	0.75 $^{0}_{-0.02}$
57,3 $^{0}_{-0,8}$	2.25 $^{0}_{-0.03}$
61,5	2.42

O.2 Socket

Dimensions in millimetres

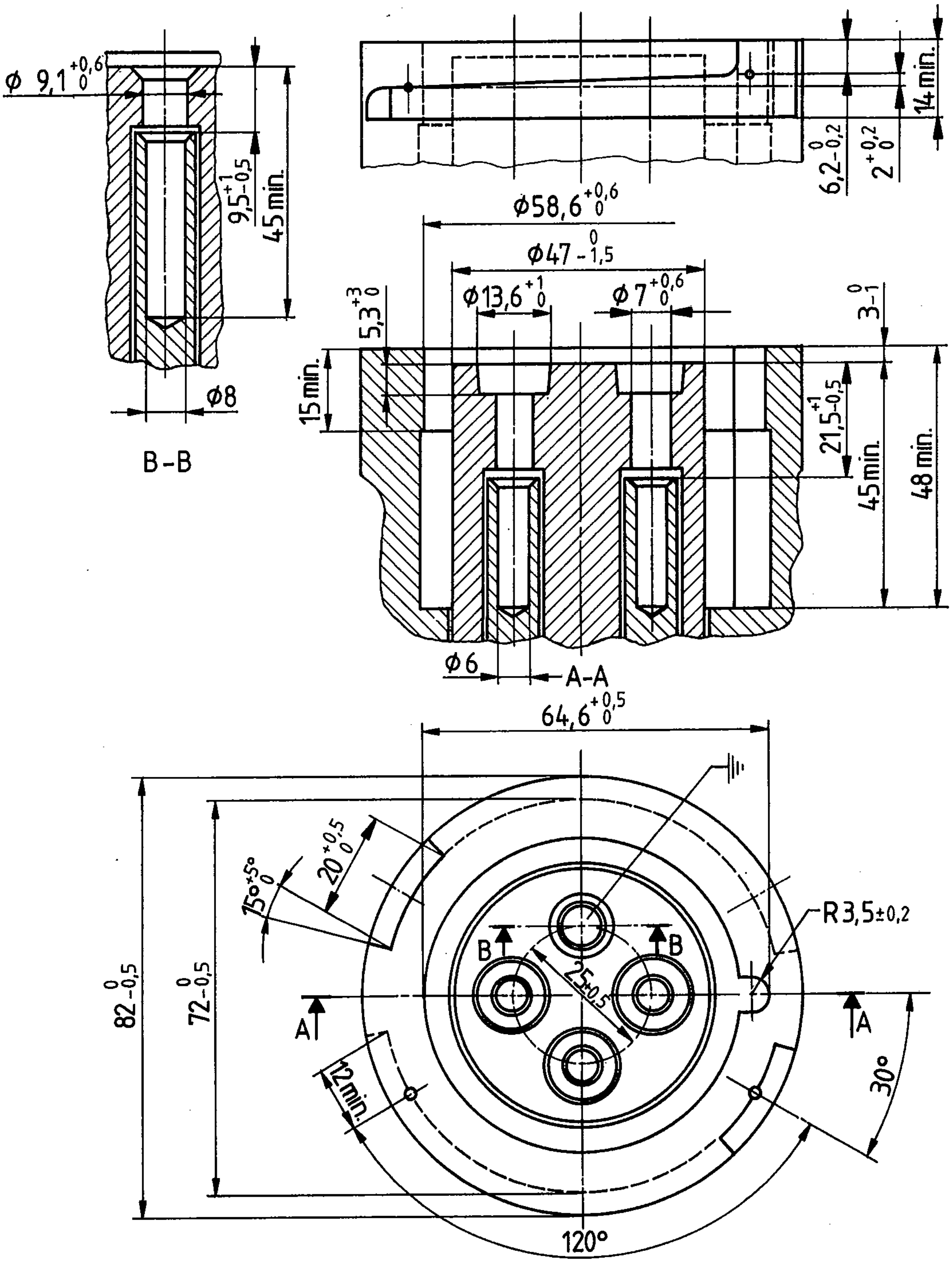


Figure 54

Dimension conversion

mm	in
58,6 $^{+0,6}_{0}$	2.307 $^{+0.023}_{0}$
47 $^{0}_{-1,5}$	1.85 $^{0}_{-0.06}$
13,6 $^{+1}_{0}$	0.535 $^{+0.004}_{0}$
7 $^{+0,6}_{0}$	0.275 $^{+0.023}_{0}$
6	0.236
64,6 $^{+0,5}_{0}$	2.54 $^{+0.02}_{0}$
25 ±0,5	0.984 ±0.02
12	0.47
3,5 ±0,2	0.137 ±0.009
20 $^{+0,5}_{0}$	0.787 $^{+0.02}_{0}$
15	0.60
5,3 $^{+3}_{0}$	0.208 $^{+0.012}_{0}$
21,5 $^{+1}_{-0,5}$	0.846 $^{+0.04}_{-0.02}$
45	1.77
48	1.89
3 $^{0}_{-1}$	0.12 $^{0}_{-0.04}$
2 $^{+0,2}_{0}$	0.08 $^{+0.008}_{0}$
14	0.55
6,2 $^{0}_{-0,2}$	0.244 $^{0}_{-0.008}$
82 $^{0}_{-0,5}$	3.23 $^{0}_{-0.02}$
72 $^{0}_{-0,5}$	2.83 $^{0}_{-0.02}$
9,5 $^{+1}_{-0,5}$	0.374 $^{+0.04}_{-0.02}$
9,1 $^{+0,6}_{0}$	0.358 $^{+0.023}_{0}$
8	0.315

Annex P

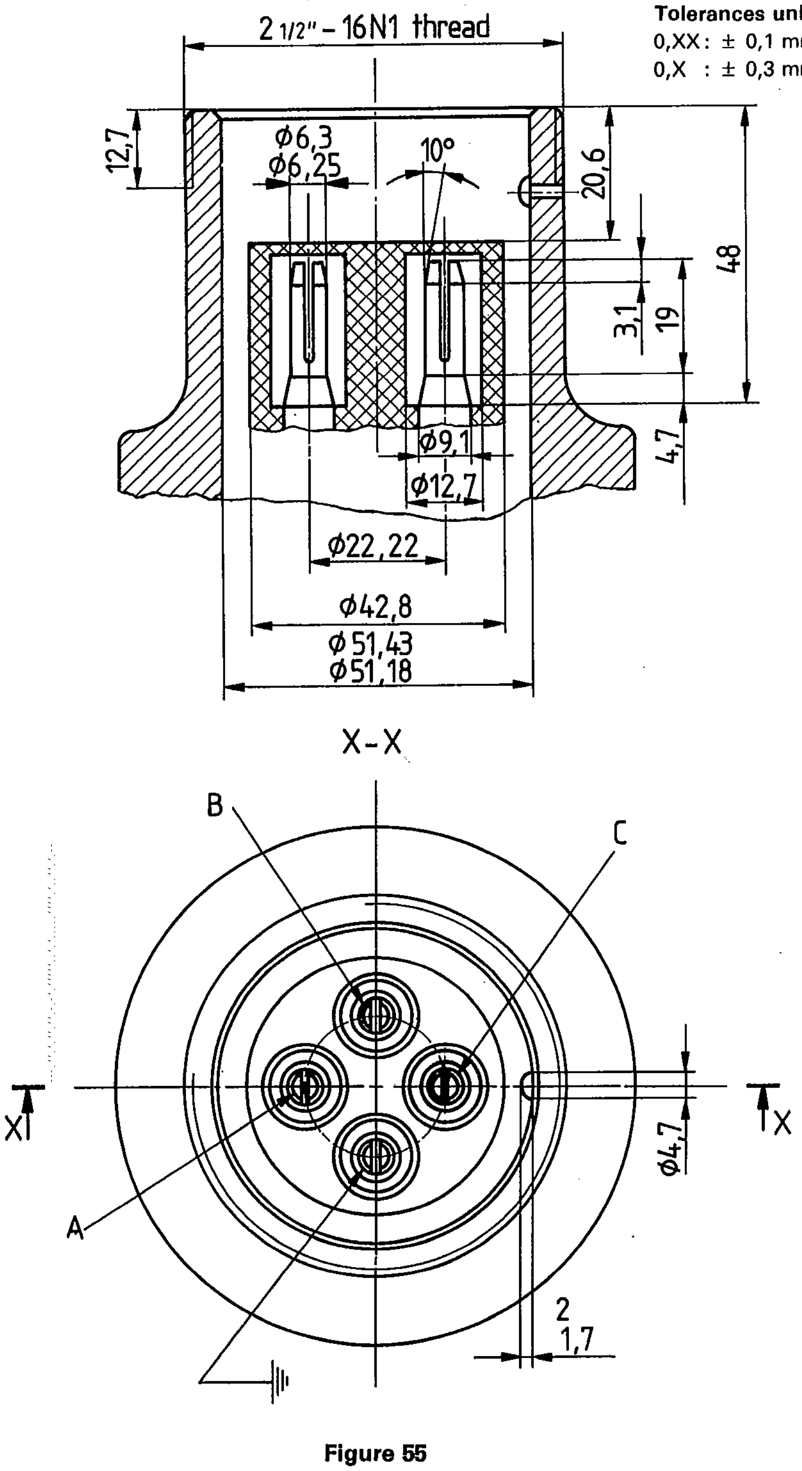
Electric plug and socket, four-pin, 460 V, 30 A [see 7.5.2b)]

(This annex forms an integral part of the standard.)

P.1 Plug

Dimensions in millimetres

Tolerances unless specified
0,XX : ± 0,1 mm (0.003 94 in)
0,X : ± 0,3 mm (0.011 81 in)



Dimension conversion

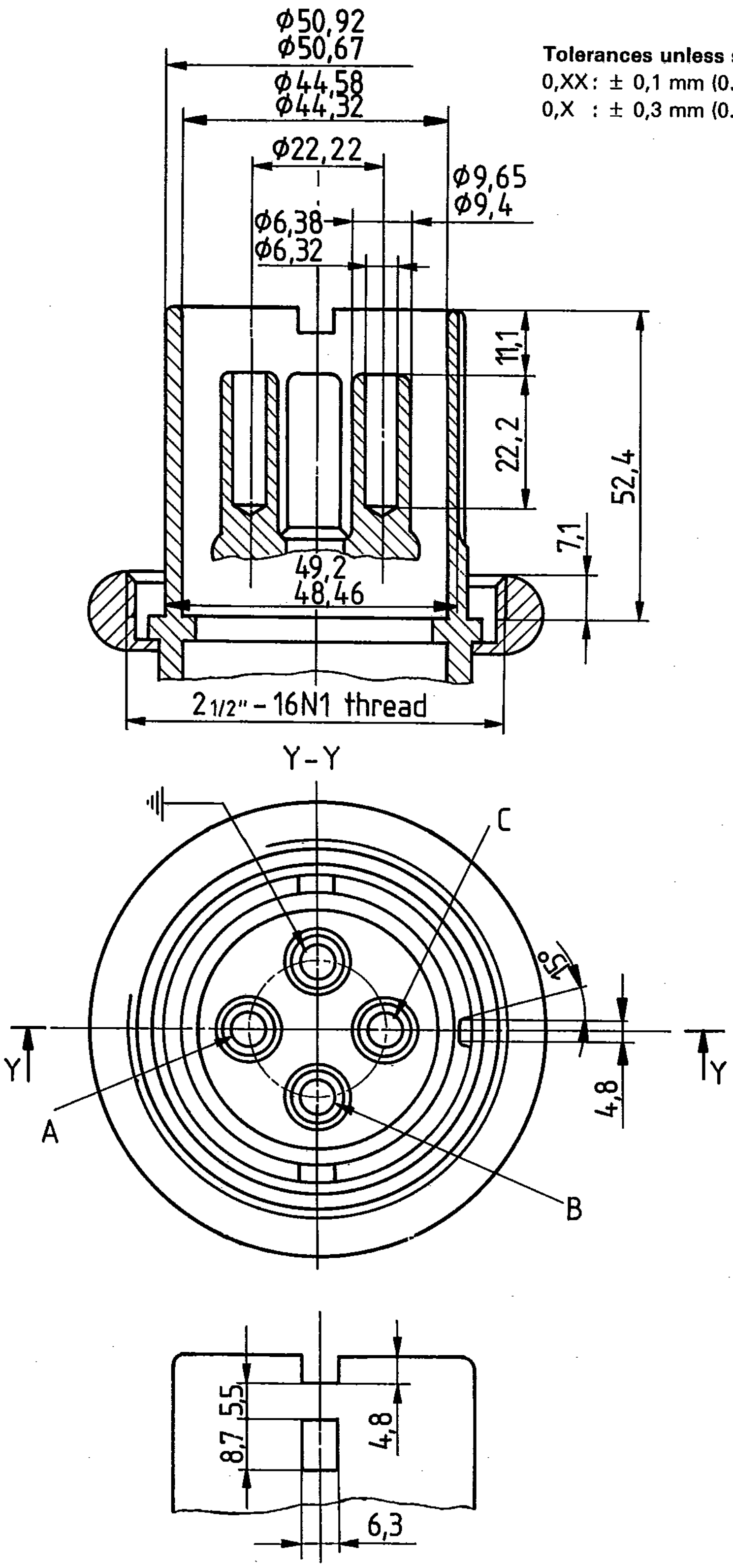
mm	in
3,1	1/8
4,7	3/16
12,7	1/2
19	3/4
20,6	1 3/16
48	1 57/64
1,7	0.068
2	0.076
6,25	0.246
6,3	0.248
9,1	0.359
12,7	0.5
22,22	0.875
42,8	1.687
51,18 51,43	2.015 $^{+0.01}_{0}$

Figure 55

P.2 Socket

Dimensions in millimetres

Tolerances unless specified
0,XX : ± 0,1 mm (0.003 94 in)
0,X : ± 0,3 mm (0.011 81 in)



Dimension conversion

mm	in
4,8	3/16
5,5	7/32
6,3	1/4
7,1	9/32
8,7	11/32
11,1	7/16
52,4	2 1/16
6,32	0.249
6,38	0.251
9,4	0.37
9,65	0.38
22,22	0.875
44,32	1.745
44,58	1.755
49,2	1.937
48,46	1.908
50,67	1.985
50,92	2.005

Figure 56

Publications referred to

See national foreword.

BS 3951 : Part 2 : Section 2.2 : 1989
ISO 1496-2 : 1988

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Associated Offices Technical Committee
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British Industrial Truck Association
British Ports Federation and the National Association of Ports Employers
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Freight Transport Association
General Council of British Shipping
Health and Safety Executive
Institute of Freight Forwarders Ltd.
Institute of Materials Management
Lloyds Register of Shipping
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