INTERNATIONAL STANDARD

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Sixth edition
2018-11

Series 1 freight containers — Specification and testing —

Part 2: Thermal containers

Conteneurs de la série 1 — Spécifications et essais —

Partie 2: Conteneurs à caractéristiques thermiques

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Foreword

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

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This sixth edition cancels and replaces the fifth edition (ISO 1496-2:2008) which has been technically revised. The main changes compared to the previous edition are as follows:

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

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

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

— energy consumption tests have been added;

— an airflow requirement has been added;

— integrated front containers has been added;

— a clip on MRU units has been removed;

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

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

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

— new Annexes H and I have been added;

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

— the test procedure for heat leakage has been revised;

— the heat-leakage rate for 1CCC has been included in Table 2.

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

Series 1 freight containers — Specification and testing —

Part 2: Thermal containers

1 Scope

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

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

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

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

3 Terms and definitions

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

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

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

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

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

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

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

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

3.5
heated container
thermal container with a heat producing unit

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.17
defrost drain
orifice for discharging condensate from the cooling coil

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

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

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

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

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

4 Classification

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

5 Marking

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

6 Dimensions and ratings

6.1 External dimensions

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

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

Table 1 — Thermal container reference dimensions

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

6.2 Internal dimensions

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

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

6.3 Ratings

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

Table 2 — Classification of thermal containers

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

1 The values of U_{max} for insulated containers (type 1AAA) are better than a coefficient of heat transfer of 0,4 $W/(m^2 \cdot K)$.

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

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

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

Table 2 *(continued)*

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

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

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

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

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

Table 3 — Minimum internal dimensions

Dimensions in millimetres

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

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

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

7 Design requirements

7.1 General

All thermal containers shall comply with the following requirements.

The strength requirements for containers are given in ISO 1496-1 (these requirements are applicable to all thermal containers except where otherwise stated). They apply to containers as complete units, except as described in 8.1.

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

The thermal container shall be capable of withstanding the loads and loadings specified in Clause 8.

As the effects of loads encountered under any dynamic operating condition should only approach, but not exceed, the effects of the corresponding test loads, it is implicit that the capabilities of thermal containers as indicated in ISO 1496-1 and demonstrated by the tests described in Clause 8 shall not be exceeded in any mode of operation.

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

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

7.2 Corner fittings

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

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

7.3 Base structure

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

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

Consequently, these containers shall have end transverse members and sufficient intermediate load-transfer areas (or a flat underside) of sufficient strength to enable vertical load transfer to or from the longitudinal members of a carrying vehicle. Such longitudinal members are assumed to lie within the two 375 mm wide zones defined by the dashed lines in ISO 668:2013, Figure B.1.

The lower faces of the load-transfer areas, including those of the end transverse members, shall be in one plane located 12,5 mm $^{+5,0}_{-1,5}$ mm above the plane of the lower faces of the bottom corner fittings and bottom side rail. Apart from the bottom corner fittings and bottom side rails, no part of the container shall project below this plane. However, doubler plates may be provided in the vicinity of the bottom corner fittings to afford protection to the understructure.

Such plates shall not extend more than 550 mm from the outer end and not more than 470 mm from the side faces of the bottom corner fittings, and their lower faces shall be at least 5 mm above the lower faces of the bottom corner fittings of the container.

Containers having all their intermediate transverse members spaced 1 000 mm apart or less (or having a flat underside) shall be deemed to comply with the requirements given in 7.3.2.

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

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

7.3.4 For all containers under dynamic conditions, or the static equivalent thereof, with the container having a load uniformly distributed over the floor in such a way that the combined mass of the container and test load is equal to 1,8 R, no part of the base of the container shall deflect more than 6 mm below the base plane (lower faces of the bottom corner fittings).

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

7.4 End structure

For all thermal containers other than 1D, the sideways deflection of the top of the container with respect to the bottom of the container, at the time it is under full transverse rigidity test conditions, shall not cause the sum of the changes in length of the two diagonals to exceed 60 mm.

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

7.5 Side wall structure

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

7.6 Walls

Where openings are provided in end or side walls, the ability of these walls to withstand tests No. 5 and 6 shall not be impaired.

7.7 Door opening

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

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

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

7.8 Sanitary and taint-free requirements

Attention is drawn to the need for the proper choice of materials for the thermal container and any refrigeration/heating units to prevent adverse effects in cargo, especially foodstuffs.

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

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

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

7.9 Requirements for optional features

7.9.1 Fork-lift pockets

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

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

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

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

7.9.1.3 The fork-lift pockets, where provided, shall meet the dimensional requirements specified in ISO 1496-1 and shall pass completely through the base structure of the container so that lifting devices can be inserted from either side. It is not necessary for the base of the fork-lift pockets to be the full width of the container, but it shall be located in the vicinity of each end of the fork pockets.

7.9.2 Gooseneck tunnels

Gooseneck tunnels shall be provided as mandatory features in 1AAA thermal containers and may be provided as optional features in thermal containers 1AA, 1A, 1BB and 1B. The dimensional requirements are specified in ISO 668 and, in addition, all other parts of the base structure shall be as specified in 7.3.

7.9.3 Drains

Cargo space drains which operate when carrying cargo shall be protected by fittings which open automatically above normal internal operating pressure. Drains, when fitted, shall be provided with a sealing mechanism.

7.9.4 Water connections

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

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

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

7.9.5 Picture frames

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

7.9.6 Modified/controlled atmospheres

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

7.9.7 Fresh air ventilation control

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

7.9.8 Humidity control

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

7.9.9 Load line

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

7.9.10 Floor

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

Table 4 — Container floor heights

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

7.9.11 Air circulation

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

Airflow measurement should comply with the provisions of ISO 5801.

8 Testing

8.1 General

8.1.1 Unless otherwise stated, thermal containers conforming to the design requirements specified in Clause 7 shall, in addition, be capable of withstanding the tests specified in 8.2 to 8.7, as applicable.

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

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

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

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

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

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

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

a) ISO 668; and

b) ISO 1161.

8.1.5 Tests No. 1 to 12 shall be carried out in accordance with ISO 1496-1.

8.1.5.1 Test No. 1 — Stacking.

8.1.5.2 Test No. 2 — Lifting from appropriate four top corner and intermediate fittings.

8.1.5.3 Test No. 3 — Lifting from the four bottom corner and intermediate fittings.

8.1.5.4 Test No. 4 — Restraint (longitudinal).

8.1.5.5 Test No. 5 — Strength of end walls.

8.1.5.6 Test No. 6 — Strength of side walls.

8.1.5.7 Test No. 7 — Strength of the roof.

8.1.5.8 Test No. 8 — Floor strength.

8.1.5.9 Test No. 9 — Rigidity (transverse).

8.1.5.10 Test No. 10 — Rigidity (longitudinal).

8.1.5.11 Test No. 11 — Lifting from fork-lift pockets (where provided).

8.1.5.12 Test No. 12 — Weatherproofness.

The MRU is to be included in the weathertight test.

8.2 Test No. 13 — Airtightness test

8.2.1 General

This test shall be carried out after all structural tests have been completed and prior to the heat leakage test (Test No. 14). The temperatures inside and outside the thermal container shall be stabilized within 3 K of each other and shall both be within the range 15 °C to 25 °C.

8.2.2 Procedure

The thermal 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 thermal container by a leak-proof connection. The manometer shall not be part of the air supply system. The flow-measuring device shall be accurate to ±3 % of the measured flowrate, 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 Pa ± 10 Pa and the air supply regulated to maintain this pressure.

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

8.2.3 Requirements

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

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.

8.3 Test No. 14 — Heat leakage test

8.3.1 General

This test shall be carried out to establish the heat leakage for the thermal container. It shall be carried out after successful completion of the airtightness test (Test No. 13). It shall be performed with the refrigeration and/or heating equipment in place, with all openings closed. Where the thermal 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.

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 record automatically. The power measuring device shall be of a continuously integrating type and all instrumentation calibrated for the following accuracy:

— temperature-measuring devices: ±0,5 K;

— power-measuring device: ±2 % of quantity measured.

The heat leakage shall be expressed by the total heat leakage rate, U_θ, in watts per kelvin, as determined using Formula (1):

$$U_\theta = \frac{Q}{\theta_i - \theta_e} \tag{1}$$

where

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

θ_e is the average outside temperature, in kelvin, which shall be the arithmetic mean of the temperatures recorded at the end of each test interval (see 8.3.2.1) and measured 100 mm from the walls, at least at the twelve points shown in Annex C;

θ_i is the average inside temperature, in kelvin, which shall be the arithmetic mean of the temperatures recorded at the end of each test interval (see 8.3.2.1) and measured 100 mm from the walls, at least at the twelve points shown in Annex C;.

8.3.2 Procedure

8.3.2.1 Test data for determining the heat leakage of the thermal container shall be taken for a continuous period of not less than 12 h, during which the following conditions shall be met:

a) the test shall be performed with a mean wall temperature to be at 20 °C ± 0,5 K and the difference between mean inside and mean outside temperature shall be 25 K ± 2 K;

b) the maximum temperature difference between the warmest and the coldest inside measuring points at any one time shall be 2 K;

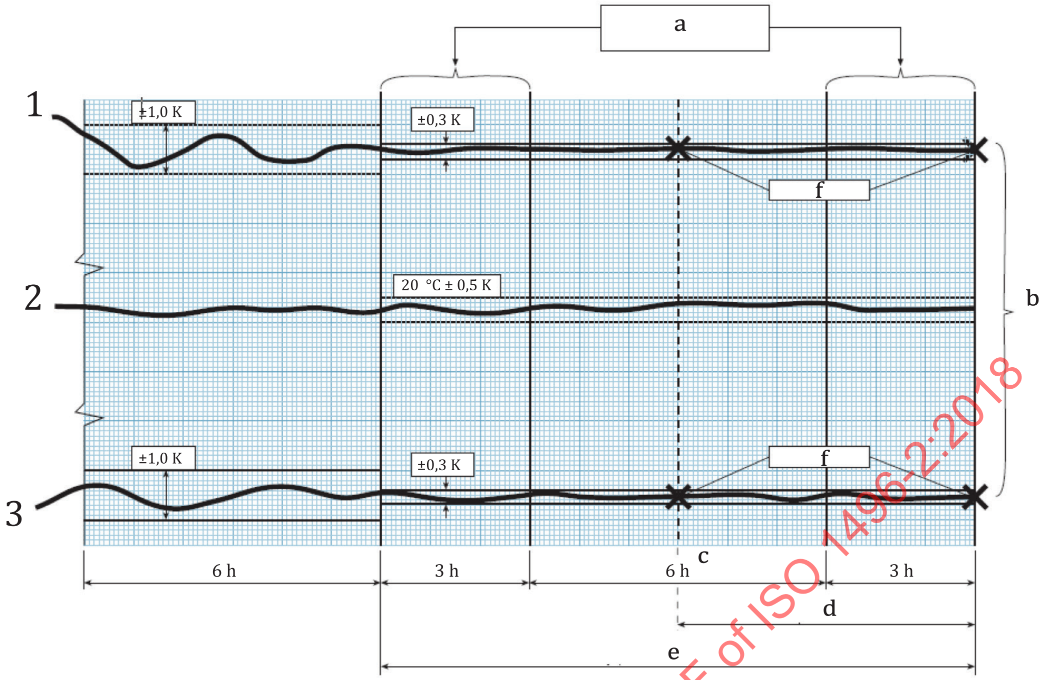
c) the maximum temperature difference between the warmest and the coldest outside measuring points at any one time shall be 2 K;

d) the mean outside temperature and the mean inside temperature of the container, taken over a steady state period of 12 h shall not vary by more than ±0,3 K, and these temperatures shall not vary by more than ±1,0 K during the preceding 6 h;

e) the mean inside and outside temperatures at the beginning and at the end of the calculation period of at least 6 h shall not differ by more than 0,2 K;

f) the difference between heating power measured over two periods of not less than 3 h at the start and at the end of the steady state period, and separated by at least 6 h, shall be less than 3 %.

An example of the steady-state conditions for heat leakage test (Test No. 14) is shown in Figure 1.



Key

1 mean internal temperature

2 mean wall temperature

3 mean external temperature

a Difference of heating power to be within 3 %.

b ΔT to be 25 °C ± 2 K during steady period.

c At least.

d Calculation period at least 6 h.

e Steady period at least 12 h.

f Within 0,2 K.

Figure 1 — Example of steady-state conditions for heat leakage test (Test No. 14)

NOTE 1 Internal airflow 40 to 70 air changes each hour.

NOTE 2 External airflow 1 m/s to 2 m/s.

NOTE 3 Maximum difference between the temperatures at any 2 of the 12 measuring points internally and externally ≤2 K during steady state period.

The heat leakage shall be expressed by the total heat leakage rate, U_θ, in watts per kelvin (W/K), as determined using Formula (1).

8.3.2.2 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 to obtain 40 to 70 air changes per hour relating to the inner volume of the tested container, to ensure that the temperature distribution inside the body of the thermal container is within the limits given in 8.3.2.1. The fan(s) should be in the body of the container. The test shall be 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 can contain shall not run.

If the test is carried out with the fan(s) of the MRU running, the test report shall draw attention to this fact. The heat leakage, 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 2 but may be used for calculating refrigeration capacity.

8.3.2.3 Air should be circulated horizontally and in longitudinal direction over the exterior surfaces of the thermal container at a velocity between 1 m/s to 2 m/s at points approximately 100 mm from the mid-length of the side walls and the roof of the container.

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

8.3.2.5 Sets of readings shall be recorded at intervals of not more than 15 min.

8.3.3 Heat leakage calculation

The calculation of the heat leakage rate shall be based on the measured data taken during the last 6 h of the steady state period, using Formula (2):

$$U = \frac{1}{n}\sum_{1}^{n} U_{\theta} \qquad (2)$$

where $n \geq 25$.

Since the test described in this clause can be carried out under conditions different from those at which the unit can 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.

Taking into account the measurement errors, values of U are expected to have a variance of ±4 %.

8.3.4 Requirements

Requirements for heat leakage are given in Table 2.

8.4 Test No. 15 a) — Test of the performance of a thermal container under refrigeration by a mechanical refrigeration unit (MRU)

8.4.1 General

8.4.1.1 This test shall measure the performance of a particular MRU, whilst maintaining 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;

— 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 MRU cooling capacity.

8.4.1.2 This test shall be carried out on a thermal container which has already been subjected to the heat leakage test (Test No. 14).

8.4.1.3 The thermal container shall be equipped with instruments for the measurement of:

a) outside and inside air temperatures as described in 8.3.1 and Annex C;

b) the total electric power consumption of the MRU, and separately the heater(s) and fan(s) inside the container;

c) return and supply air temperatures (dry bulb) inside the container, where a minimum of four sensors shall be used for each of these (i.e. eight in total);

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

e) the outside air flow at a point adjacent to the midpoint of one of the sides.

8.4.2 Test conditions

8.4.2.1 The outside temperature, air on condenser shall be 38 °C and air on evaporators shall be −18 °C for the thermal container and MRU under test.

8.4.2.2 The inside temperature shall not exceed the specified temperature for the class of thermal container under test; this is understood to be the average of the temperature measured by the 12 sensors inside the container.

NOTE It can also be advisable to measure temperatures at evaporator outlet and at compressor suction and discharge and pressure at compressor inlet and outlet.

8.4.2.3 The outside air velocity shall be maintained between 1 m/s to 2 m/s at a distance of 100 mm from the side of the thermal container.

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

8.4.3 Test procedure

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

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

8.4.3.3 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 8.4.1.1 shall be turned on. After steady-state conditions have been re-established, the test shall continue for a further 4 h. The T-floor shall be covered from the machinery side by at least 2/3 of the T-floor length.

8.4.3.4 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 15 min.

8.4.4 Requirements

The equipment shall be capable of maintaining the average inside temperature of the thermal container at the specified level for a period of at least 8 h and then for a further period of at least 4 h with additional heat load equal to at least 35 % of the total heat leakage rate for the containers as determined in the heat leakage test (Test No. 14), i.e. additional heat load is equal to 0,35 U_θ ($\theta_e - \theta_i$).

8.5 Test No. 15 b) — Functional test of a thermal container at high ambient temperatures while being cooled by a mechanical refrigeration unit (MRU)

8.5.1 General

8.5.1.1 This test shall verify the unrestricted function of a thermal container when fitted with a particular MRU at high ambient air temperature.

8.5.1.2 The test shall be carried out with an aged (or simulated aged) thermal container with a total heat leakage rate, U, of not less than Formula (3):

$$U = 1{,}2 \times U_{max} \qquad (3)$$

where the values of U_{max} are taken from Table 2 for the class of container.

The aged condition of the thermal container under test may be simulated by means of a thermal container with known heat leakage rate plus an additional internal heat load.

8.5.2 The thermal container shall be equipped with instruments for the measurement of:

8.5.2.1 Outside and inside air temperatures as described in 8.3.1 and Annex C.

8.5.2.2 Condenser air inlet temperature: at least 4 sensors evenly distributed.

8.5.2.3 Electric power for the MRU, the internal heater(s) and fan(s).

8.5.3 Test conditions

8.5.3.1 The average air temperature at condenser inlet shall be at least 50 °C for the duration of the test.

8.5.3.2 Outside temperatures of the thermal container during the test may be below +50 °C but shall be compensated to +50 °C by additional internal heat load.

8.5.3.3 The inside temperature shall be set at two temperature levels, +12 °C and −30 °C.

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

8.5.3.4 The inside air velocity shall be as produced by the evaporator fans at the speed designated for the set point temperatures.

8.5.3.5 The T-floor shall be covered from the machinery side by at least 2/3 of the T-floor length.

8.5.3.6 Floor drains, defrost drains (where fitted) and vacuum valves shall be in their normal operational states, vent devices shall be closed in the normal manner.

8.5.4 Test procedure

8.5.4.1 The inside temperature set point shall be +12 °C and the air temperature at condenser inlet shall be maintained at +50 °C. These temperatures shall be maintained at steady state condition for a period of not less than 8 h.

8.5.4.2 During the period of steady state condition the inside and outside temperatures the temperatures at the condenser air inlet side and the power of internal heater(s) and fan(s) shall be recorded at intervals not exceeding 15 min.

8.5.4.3 The inside temperature set point shall then be set to −30 °C (see 8.5.3.3) and the air temperature at condenser inlet shall be maintained at +50 °C. Once these temperatures are established the evaporator shall be defrosted. Thereafter steady state condition shall be re-established and then maintained at steady state condition for a period of not less than 8 h.

8.5.4.4 During the period of steady state condition the inside and outside temperatures, the temperatures at the condenser air inlet side and the power of the MRU, the internal heater(s) and fan(s) shall be recorded at intervals not exceeding 15 min.

8.5.5 Requirements

During the periods of steady state condition the MRU shall be capable of being operated without functional restrictions or disruptions.

8.6 Test No. 15 c) — Energy consumption of a thermal container at defined ambient temperatures while being cooled by a mechanical refrigeration unit (MRU)

8.6.1 General

8.6.1.1 This test shall verify the energy consumption of a thermal container when fitted with a particular MRU at defined ambient air temperature. The test shall be carried out with additional heat load to simulate metabolic activity where appropriate above that leaking through the walls of the container.

8.6.1.2 The test shall be carried out with an aged thermal container with a total heat leakage rate of not less than Formula (4):

$$U = 1{,}2 \times U_{max} \tag{4}$$

where the values of U_{max} are taken from Table 2 for the class of container.

The aged condition of the thermal container under test may be simulated by means of a thermal container with known heat leakage rate plus an additional internal heat load.

8.6.2 The thermal container shall be equipped with instruments for the measurement of:

8.6.2.1 Outside and inside air temperatures as described in 8.3.1 and Annex C.

8.6.2.2 Condenser air inlet temperature: at least 4 sensors evenly distributed.

8.6.2.3 Total power consumption for the MRU and the electric power for the internal heater(s) and fan(s).

8.6.3 Test conditions

8.6.3.1 The average air temperature at condenser inlet shall be 25 °C for the duration of each test.

8.6.3.2 Outside temperatures of the thermal container during the test may be below +25 °C but shall be compensated to +25 °C by additional internal heat load.

8.6.3.3 The inside temperature set points of the refrigeration machinery controller shall be at a setpoint of three different levels, +14 °C, 0 °C, and −18 °C:

— at the inside temperature of +14 °C, an additional heat load of 1 000 W;

— at the inside temperature of 0 °C, an additional heat load of 200 W;

— at the inside temperature of −18 °C, there is no additional heat load.

8.6.3.4 The inside air velocity shall be as produced by the evaporator fans at the speed designated for the set point temperatures.

8.6.3.5 The T-floor where fitted shall be covered from the machinery side by at least 2/3 of the T-floor length.

8.6.3.6 Floor drains, defrost drains (where fitted) and vacuum valves shall be in their normal operational states, vent devices shall be closed in the normal manner.

8.6.4 Test procedure

8.6.4.1 The inside temperature set point shall be as stated above and the air temperature at condenser inlet shall be maintained at 25 °C. These temperatures shall be maintained in steady state condition for a period of not less than 4 h.

8.6.4.2 During the period of steady state condition the power consumed by the MRU, the heater(s) and fan(s) shall be recorded at intervals not exceeding 15 min.

8.6.5 Requirements

There is no requirement for energy consumption, the test is for comparative purposes only.

8.7 Test No. 16 — Strength of mounting devices for removable equipment (where fitted)

8.7.1 General

The tests described in 8.7.2 and 8.7.3 shall be carried out on any thermal container which is fitted with devices for mounting of removable equipment as indicated in Annex B but also applying to built-in front end containers.

8.7.2 Test No. 16 a) — Vertical loading

8.7.2.1 General

This test shall be carried out to prove the ability of the thermal container end frame to support loading in the vertical direction due to the installed mass of the removable equipment, taking into account highway and rail modes of transport.

8.7.2.2 Procedure

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

If the thermal container is equipped with provision for pin mounting of power generator sets, the container shall be subjected to vertical forces, applied to each upper pin-mounting socket. The force shall be applied to each socket through a test fixture equipped with a suitable pin surrounded by a rectangular plate no larger than 150 mm × 150 mm.

Similarly, the container shall be subjected to vertical forces, applied to each upper corner fitting which will carry the load of the installed removable equipment. The force shall be applied first to one corner fitting, and then to the other, through a test fixture equipped with a suitable fitting to engage the front aperture, and impose the load onto the bottom surface of the aperture.

A force of 17,8 kN shall be used for all vertical load tests.

8.7.2.3 Requirements

On completion of the test, the thermal container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and shall meet the dimensional requirements given in ISO 1496-1 affecting handling, securing and interchange.

8.7.3 Test No. 16 b) — Horizontal loading

8.7.3.1 General

This test shall be carried out to prove the ability of the thermal container end frame to support loading in the horizontal direction due to the installed mass of the removable equipment, taking into account highway and rail modes of transport.

8.7.3.2 Procedure

The thermal container shall be placed as required for Test No. 16 a).

If the thermal container is equipped with provision for pin mounting of generator sets, the container shall be subjected to horizontal forces, applied to each upper pin-mounting socket in a direction perpendicular to the end plane of the container. The force shall be applied first to one socket, and then to the other, through a test fixture equipped with a suitable pin surrounded by a rectangular plate no larger than 150 mm × 150 mm.

NOTE It is not necessary to carry out a horizontal force test on the upper corner fittings.

The container shall be subjected to horizontal forces applied to each lower mounting point. The force shall be applied first to one lower mounting point, and then to the other, using a fixture equipped with a 3/4-10 UNC Grade 8 bolt threaded into each lower mounting point in turn. The bolt shall be installed such that it engages six, and only six, full threads of the lower mounting point, and the force shall be applied perpendicular to the plane of the end frame in a direction away from the corner post.

A force of 17,8 kN shall be used for all horizontal load tests.

8.7.3.3 Requirements

On completion of the test, the thermal container shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and shall meet the dimensional requirements given in ISO 1496-1 affecting handling, securing and interchange.

9 Electrical aspects of thermal containers

9.1 General

The following requirements are only intended to govern those aspects of electrically-powered thermal containers which affect interchange or are the minimum needed to affect safety. They do not constitute a detailed electrical specification. Reference should be made to IEC 60947-1, IEC 60309-1 and IEC 60309-2 and other appropriate documents.

NOTE 1 See Annex F for information concerning electrical power supplies for thermal containers.

NOTE 2 Commonly available electric motors and control gear do not necessarily satisfy the requirements below, which include wider voltage tolerances than are necessary for stationary equipment.

NOTE 3 See Annex G for general requirements for 220 V and dual voltage equipment.

9.2 General requirements for standard voltage equipment

9.2.1 Equipment shall be designed to operate from three-phase, four-wire a.c. supply sources when the nominal voltage measured between phases at the receptacle is as follows:

a) 50 Hz: 360 V minimum, 460 V maximum;

b) 60 Hz: 400 V minimum, 500 V maximum.

The nominal frequencies of 50 Hz and 60 Hz shall have a tolerance of ±2,5 %. The voltage values in this section are nominal values.

9.2.2 Equipment shall have a maximum electrical loading, under rated operating conditions, not exceeding 18,75 kVA. The power consumption shall not exceed 15 kW.

9.2.3 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 E and as specified in Annex D. 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).

9.2.4 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.

9.2.5 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 live, 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.

9.2.6 Total starting current shall be as low as possible and shall not exceed 150 A. 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 item of equipment to be limited by sequence controls which allow only one of the motors in the 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.

9.2.7 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 or extension cable shall have a minimum length of 18 m.

9.2.8 The equipment shall be provided with a 32 A four-pin (three poles plus earth IEC 60309-2 for ISO standardized refrigeration containers) male plug with bayonet retaining ring as shown in Annex E.

The plug shall be sealed to the power cable to IP67 by a suitable means so as to prevent the entry of water whilst connected to a power outlet.

NOTE For compatibility with landside sockets, the earth pin can rotate relative to the locating lug 90° anticlockwise on release of a locking mechanism.

9.2.9 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.

9.2.10 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.

Whenever the unit's ON/OFF switch is in the ON position, the unit shall operate automatically on its own control system and an indicating light shall be illuminated. Indicating lights shall not interfere with on-board navigation lights.

9.2.11 All electrically live metal parts shall be protected from accidental contact.

9.2.12 All exposed non-current carrying metallic components in a plug assembly which are liable to be energized when in the mated position, and all receptacle box assemblies, shall be grounded.

9.2.13 Cable connections to plugs shall be provided with a cable anchorage (strain relief) such that the conductors are relieved from strain, including twisting, and that their covering is protected from abrasion. Cable anchorages shall be designed in such a way that the conductors cannot touch accessible metal parts.

9.2.14 The plug and receptacle shall be designed in accordance with IEC 60309-2.

Safe working procedures should be established for the use of power connectors. It is possible in some places, that a requirement for the equipment to operate from supplies fitted with a residual current device ("rcd") exists.

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

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

— voltage: V, three-phase; frequency: Hz;

— full load current: A;

— total starting current: A.

9.3 Remote condition monitoring

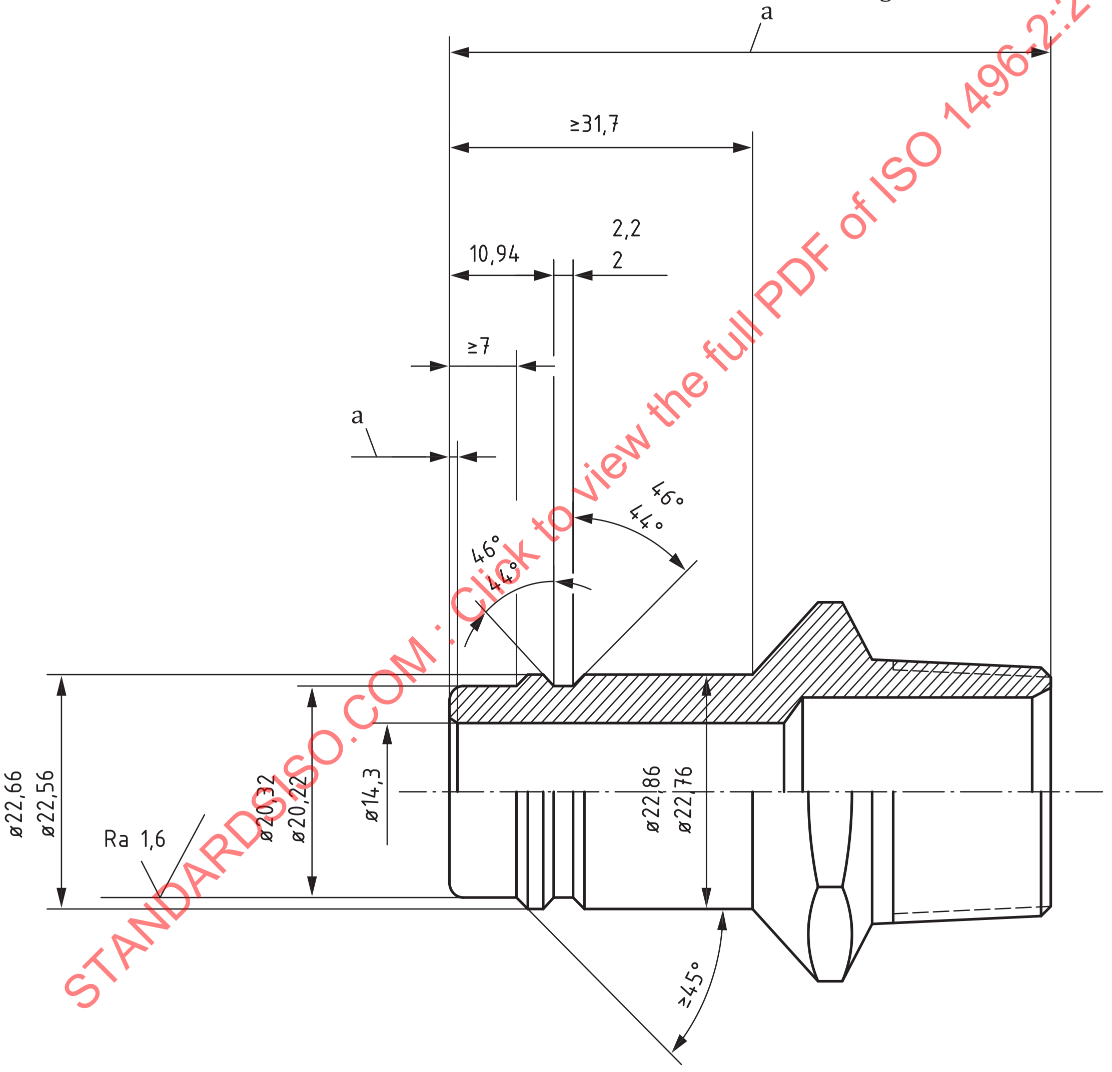
As an option, thermal containers can be equipped to monitor their condition remotely using power line, radio frequency, satellite or other means of data transmission.

Annex A
(normative)

Requirements for cooling water connections

Requirements for cooling water connections are given in 7.9.4. Dimensions are given in Figures A.1 and A.2.

Dimensions in millimetres
Surface roughness value in micrometres



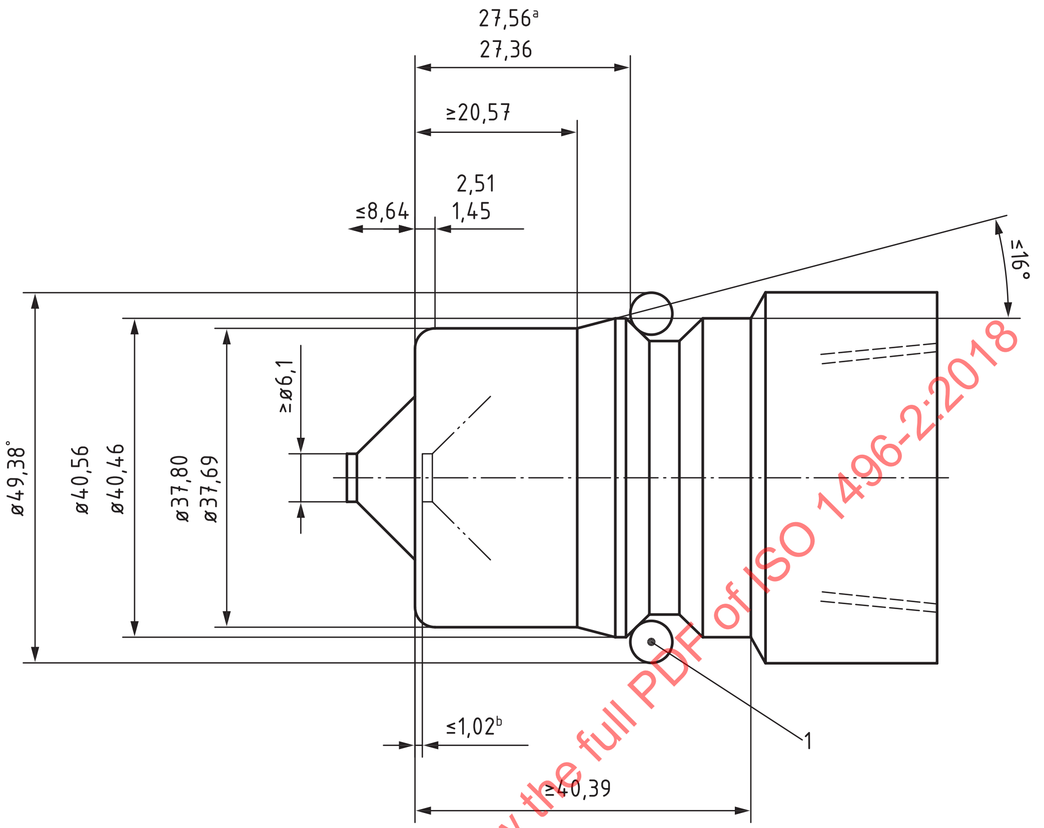
Key

a Detail not specified in this document.

Operating pressure: 1 MPa.

Bursting pressure: 4 MPa.

Figure A.1 — Cooling water connection — Inlet side



Key

1 locking balls

a To ball.

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

c Gauge.

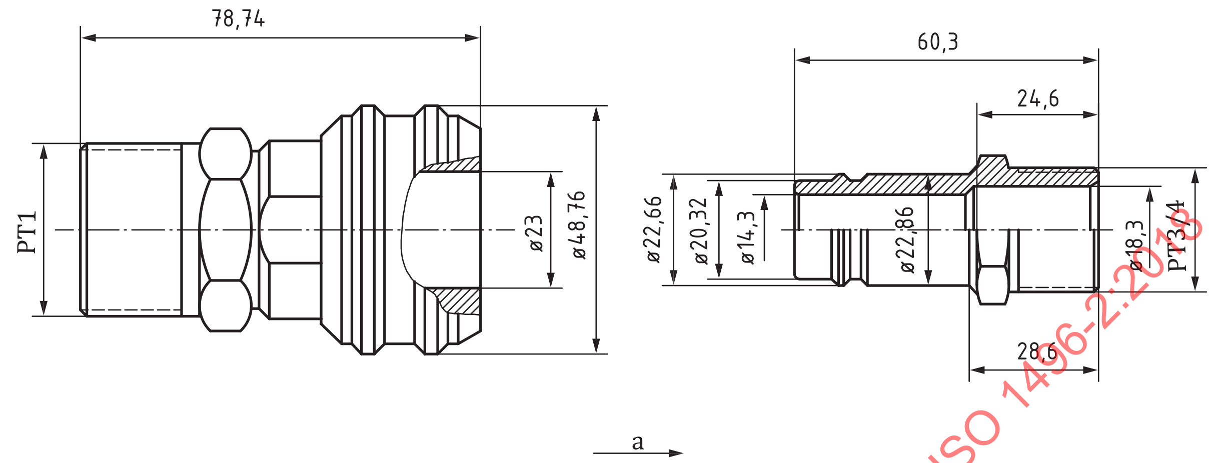
Operating pressure: 1 MPa.

Bursting pressure: 4 MPa.

Figure A.2 — Cooling water connection — Outlet side

Examples of sectional view and profile of cooling water connections are shown in Figure A.3 and A.4:

Dimensions in millimetres

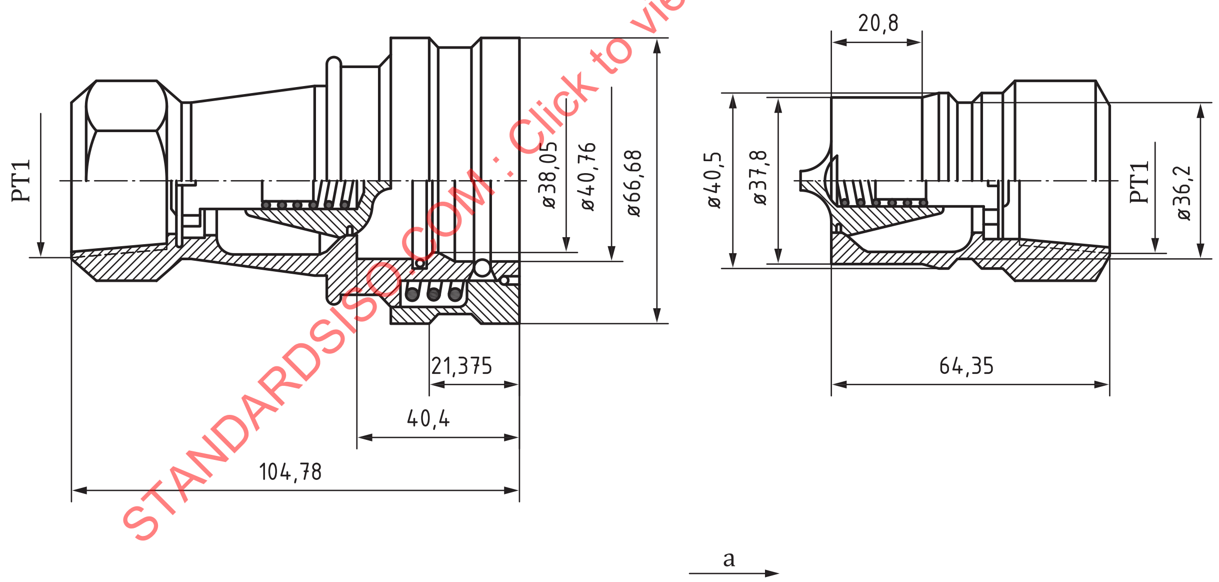


a) Socket with valve (ship side) **b) Plug with valve (container side)**

Key

a Flow of water.

Figure A.3 — Cooling water connection — Inlet side (single shut-off)



a) Socket with valve (container side) **b) Plug with valve (ship side)**

Key

a Flow of water.

Figure A.4 — Cooling water connection — Outlet side (double shut-off)

Annex B
(informative)

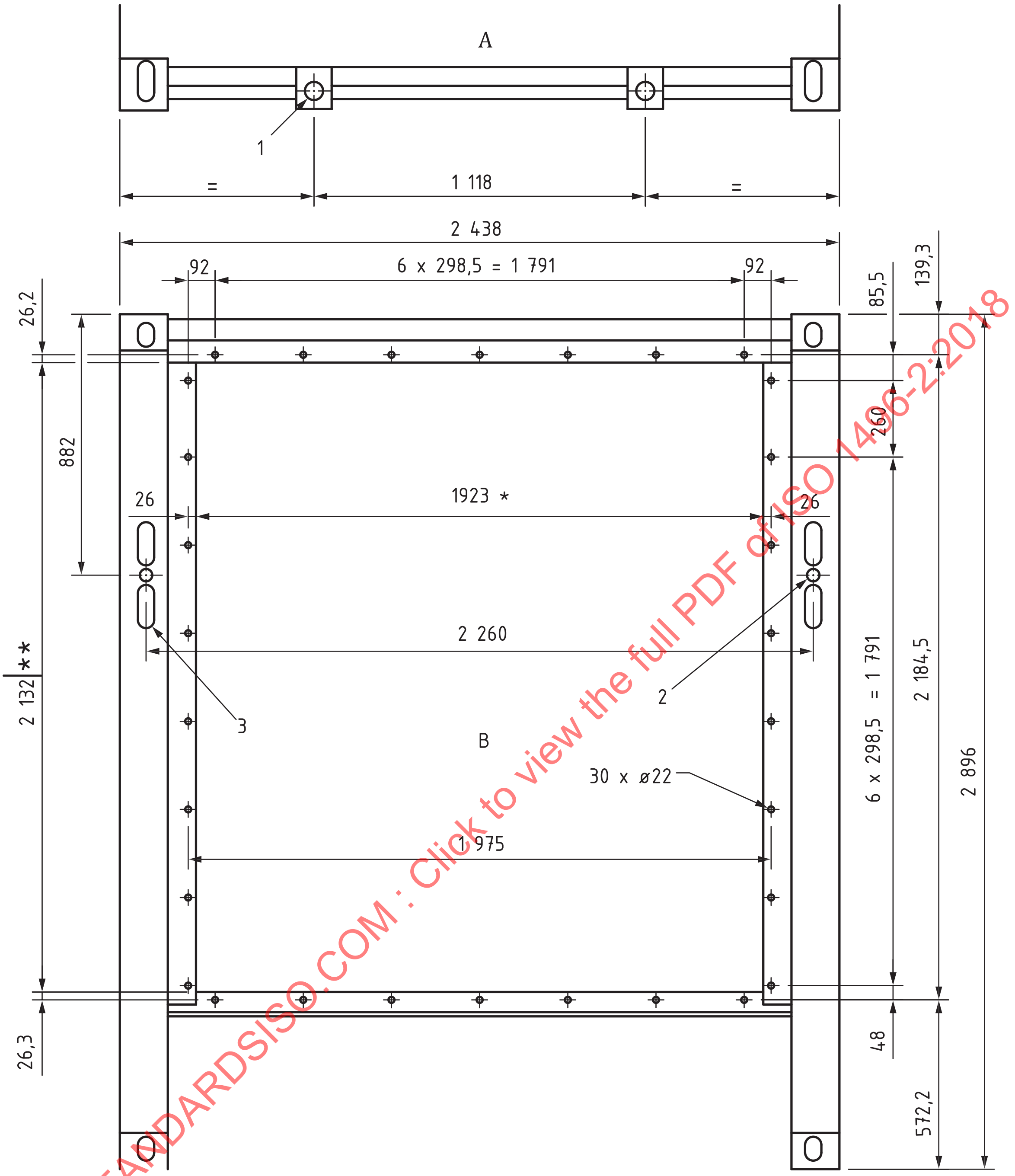
Picture frames

Dimensions of picture frames (see 7.9.5) in end walls of thermal containers are given in Figure B.1 (9'6" example).

Each mounting device shall be capable of carrying a test load of 2 000 kg (4 400 lbs) in both the horizontal and vertical directions.

Top lifting of the container shall not be impaired when a clip-on power generator set is fitted to the container.

Dimensions in millimetres



Key

1 generator set mounts
2 generator set nuts
3 4 raised generator set spacers
A top view
B end view
* Opening width.
** Opening height.

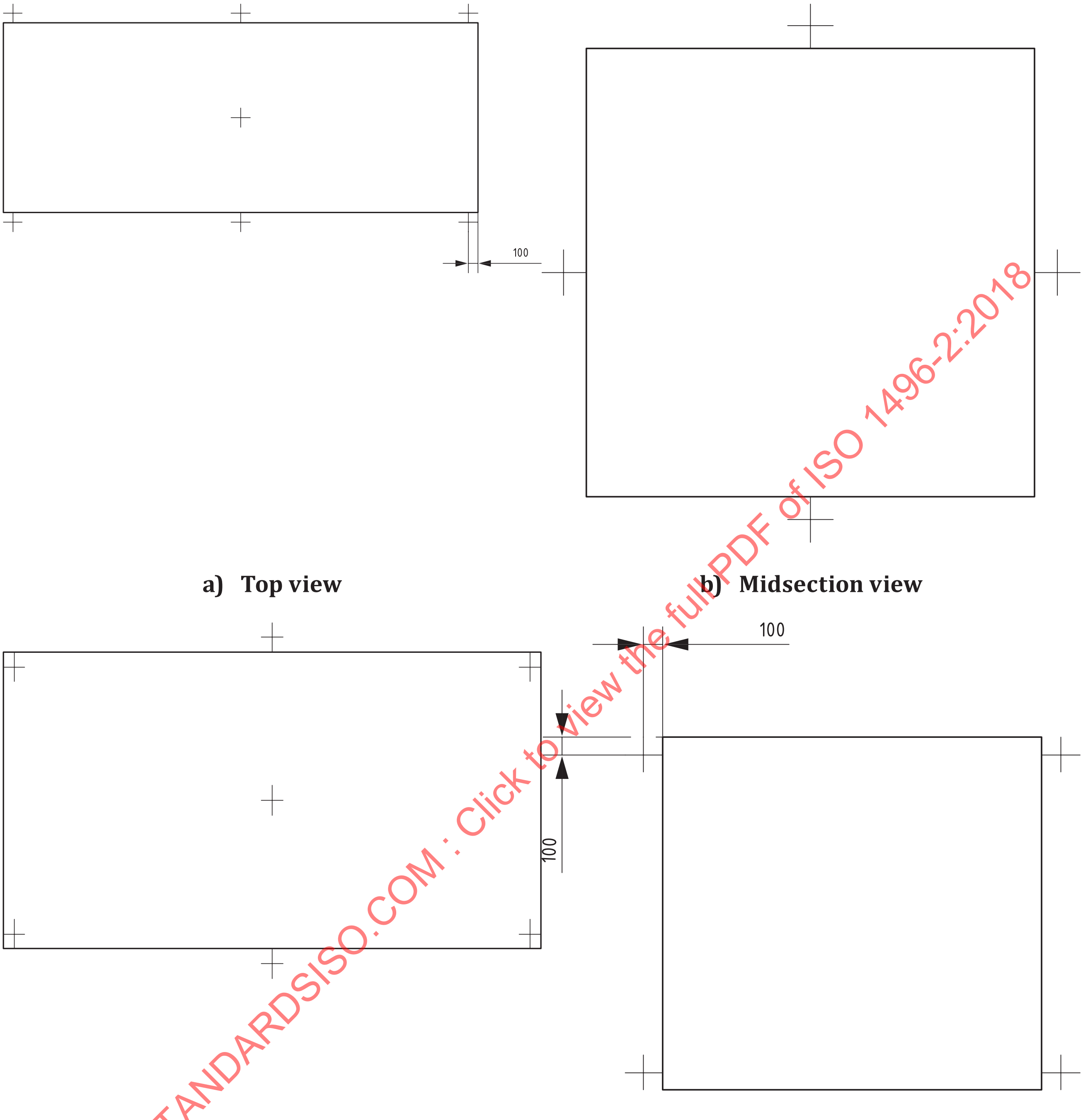
Figure B.1 — Picture frames in end walls of 9'6" thermal container

Annex C
(normative)

Air temperature measurement points

Requirements for the measurement of air temperature are given in 8.3.1. The provision of air temperature measurement points in the eight corners and the centre of the 4 largest faces, as shown in Figures C.1 and C.2.

Dimensions in millimetres

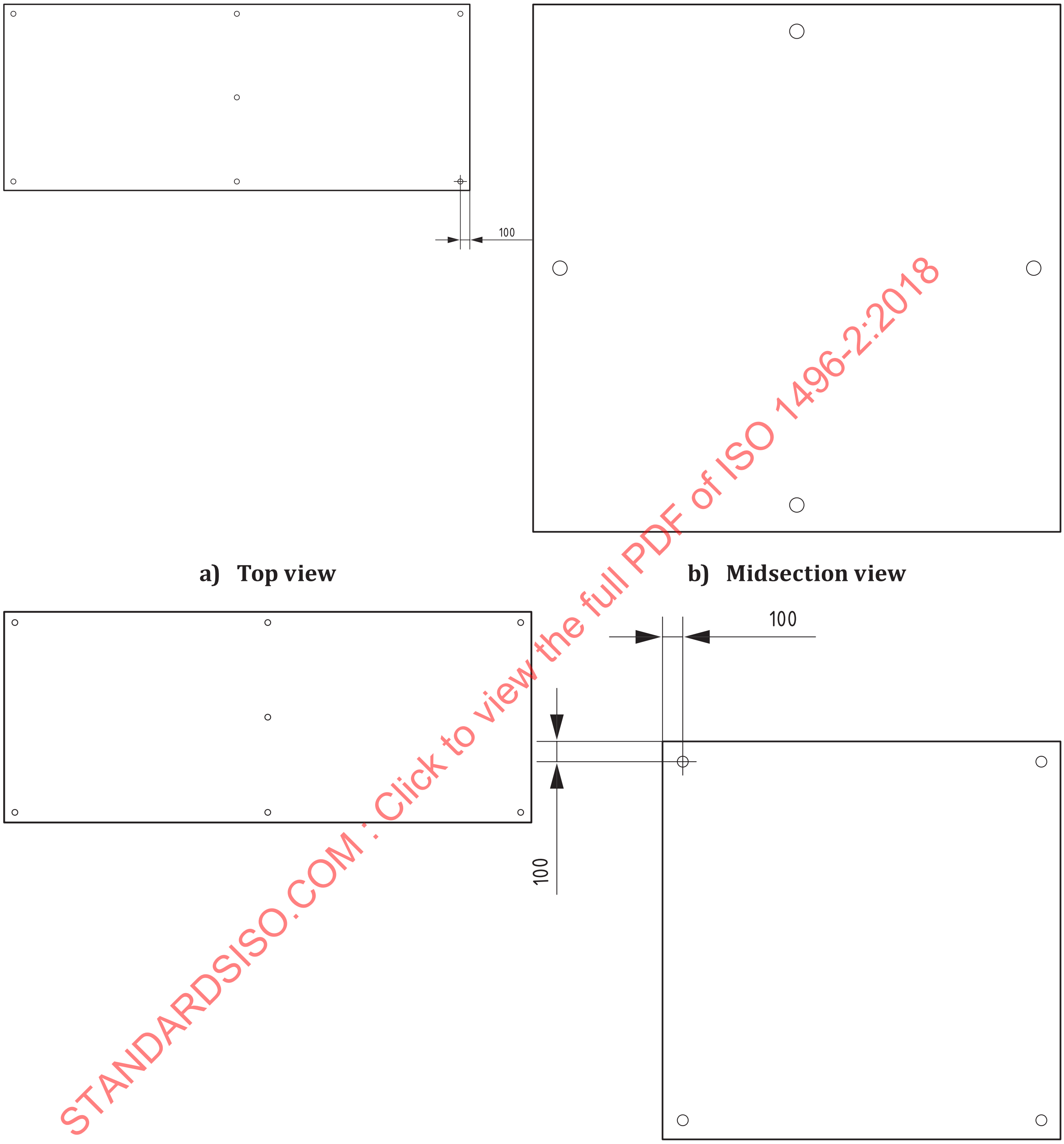


a) **Top view** b) **Midsection view**

c) **Side view** d) **End view**

Figure C.1 — Outside air temperature measurement points

Dimensions in millimetres



a) **Top view**

b) **Midsection view**

c) **Side view**

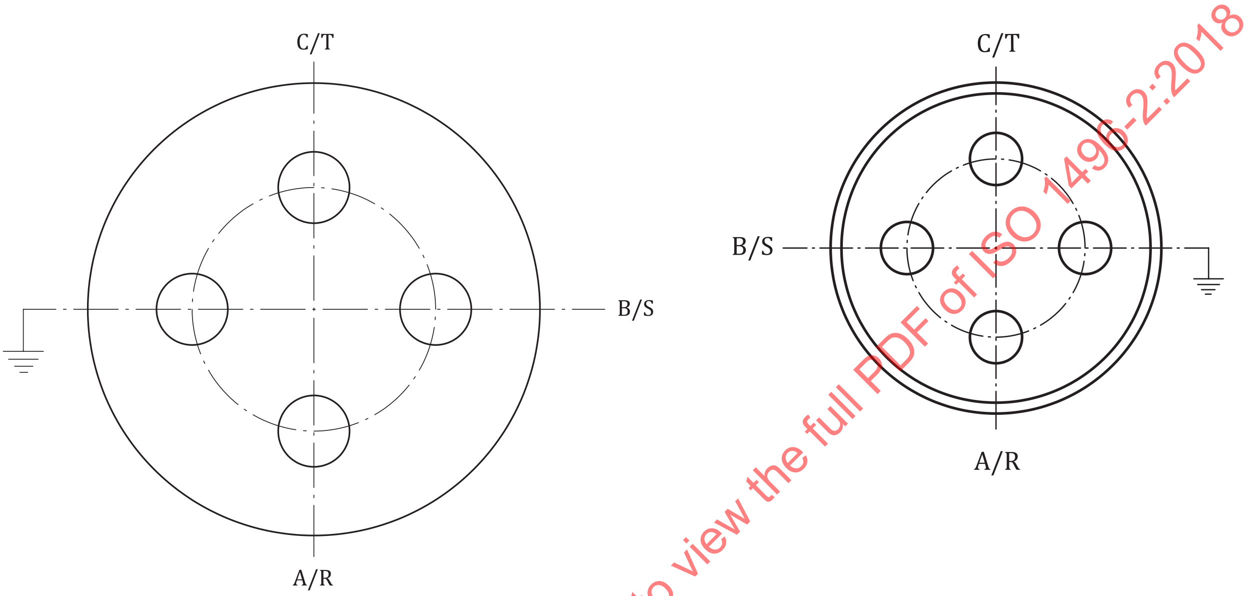
d) **End view**

Figure C.2 — Inside air temperature measurement points

Annex D
(normative)

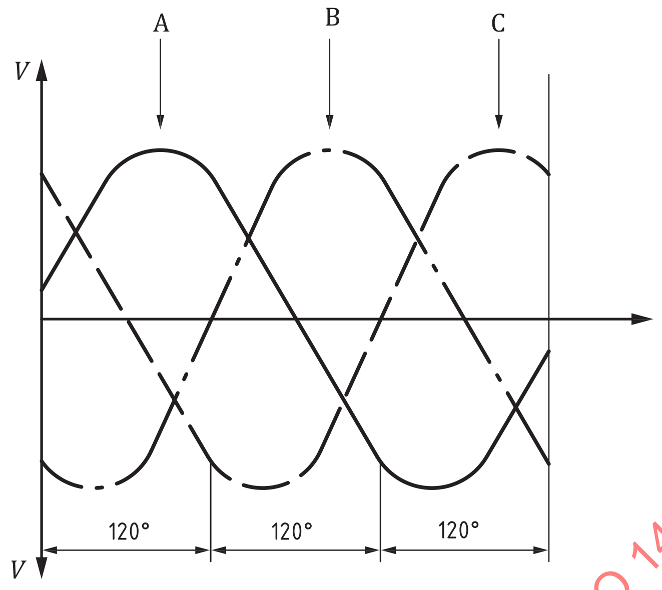
Phase connections to container plugs and sockets

Requirements for wiring plugs and sockets for standard voltage equipment are given in 9.2.3 and shown in Figures D.1 and D.2.



a) **Front view of plug** b) **Front view of socket**

Figure D.1 — Plug and socket (front view)



Key

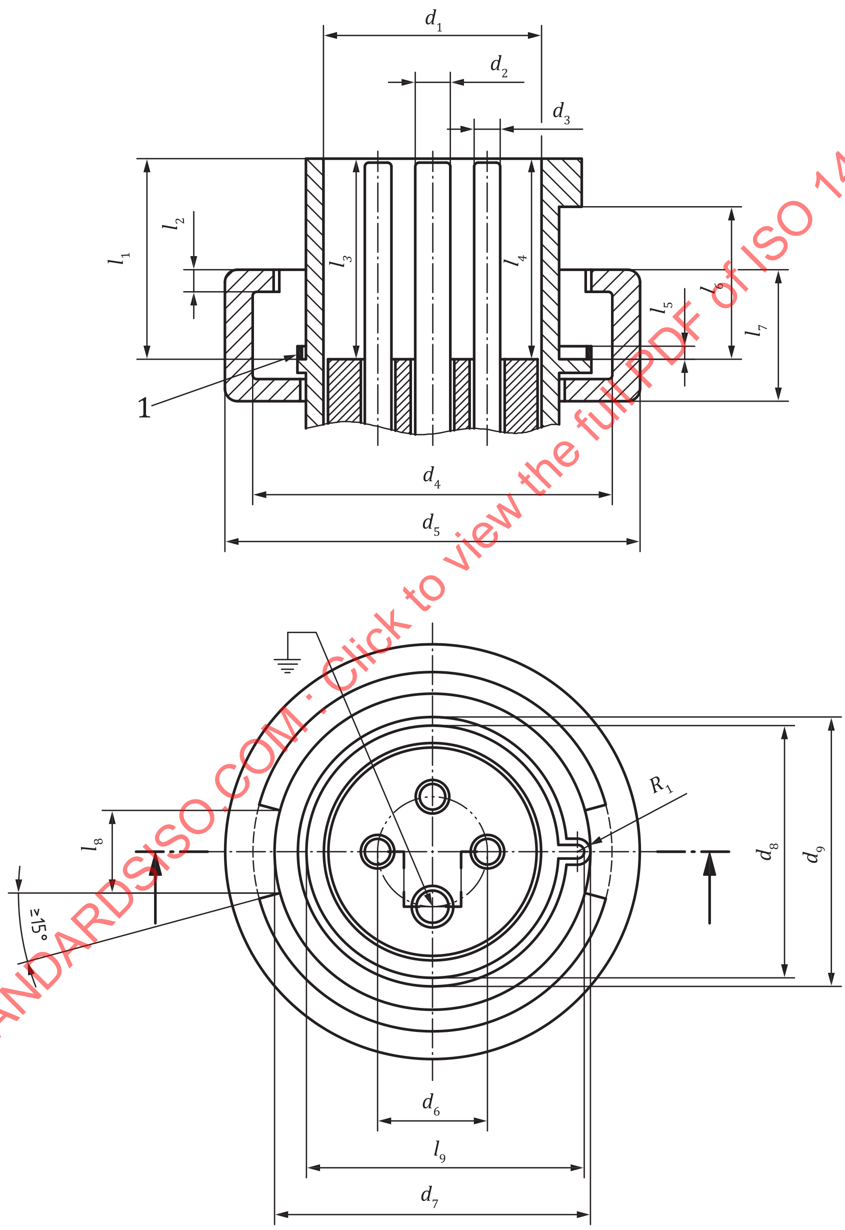
t time
V voltage
A phase A
B phase B
C phase C

Figure D.2 — Phase relationship

Annex E
(normative)

Electric plug and socket, four-pin, 380/440 V, 50/60 Hz, 32 A

Requirements for electric plug and socket, four-pin, 380 V/440 V, 50 Hz/60 Hz, 32 A are given in Figures E.1 and E.2. Dimensions are given in Tables E.1 and E.2.



Key

1 gasket

Figure E.1 — Electric plug, four-pin, 380 V/440 V, 50 Hz/60 Hz, 32 A

Table E.1 — Dimensions for Figure E.1

Dimension	Value	
	mm	in
d_1	49,7 minimum	1,956 minimum
d_2	$8_{-0,09}^{\ 0}$	$0,315_{-0,04}^{\ 0}$
d_3	$6_{-0,075}^{\ 0}$	$0,236_{-0,003}^{\ 0}$
d_4	82,5 minimum	3 1/4 minimum
d_5	95 maximum	3 3/4 maximum
d_6	25 ± 0,5	0,984 ± 0,02
d_7	$72,5_{\ 0}^{+0,5}$	$2,85_{\ 0}^{+0,02}$
d_8	$57,3_{-0,8}^{\ 0}$	$2,25_{-0,03}^{\ 0}$
d_9	61,5 minimum	2,42 minimum
l_1	$46_{-1}^{\ 0}$	$1,81_{-0,04}^{\ 0}$
l_2	5 maximum	0,196 maximum
l_3	$46_{-1}^{\ 0}$	$1,81_{-0,04}^{\ 0}$
l_4	$45_{-1}^{\ 0}$	$1,77_{-0,04}^{\ 0}$
l_5	$3_{\ 0}^{+0,5}$	$0,12_{\ 0}^{+0,02}$
l_6	$35,5_{\ 0}^{+1}$	$1,4_{-0,2}^{\ 0}$
l_7	30 maximum	1,18 maximum
l_8	$19_{-0,5}^{\ 0}$	$0,75_{-0,02}^{\ 0}$
l_9	$63,2_{-0,6}^{\ 0}$	$2,488_{-0,023}^{\ 0}$
R_1	3 ± 0,2	0,12 ± 0,008

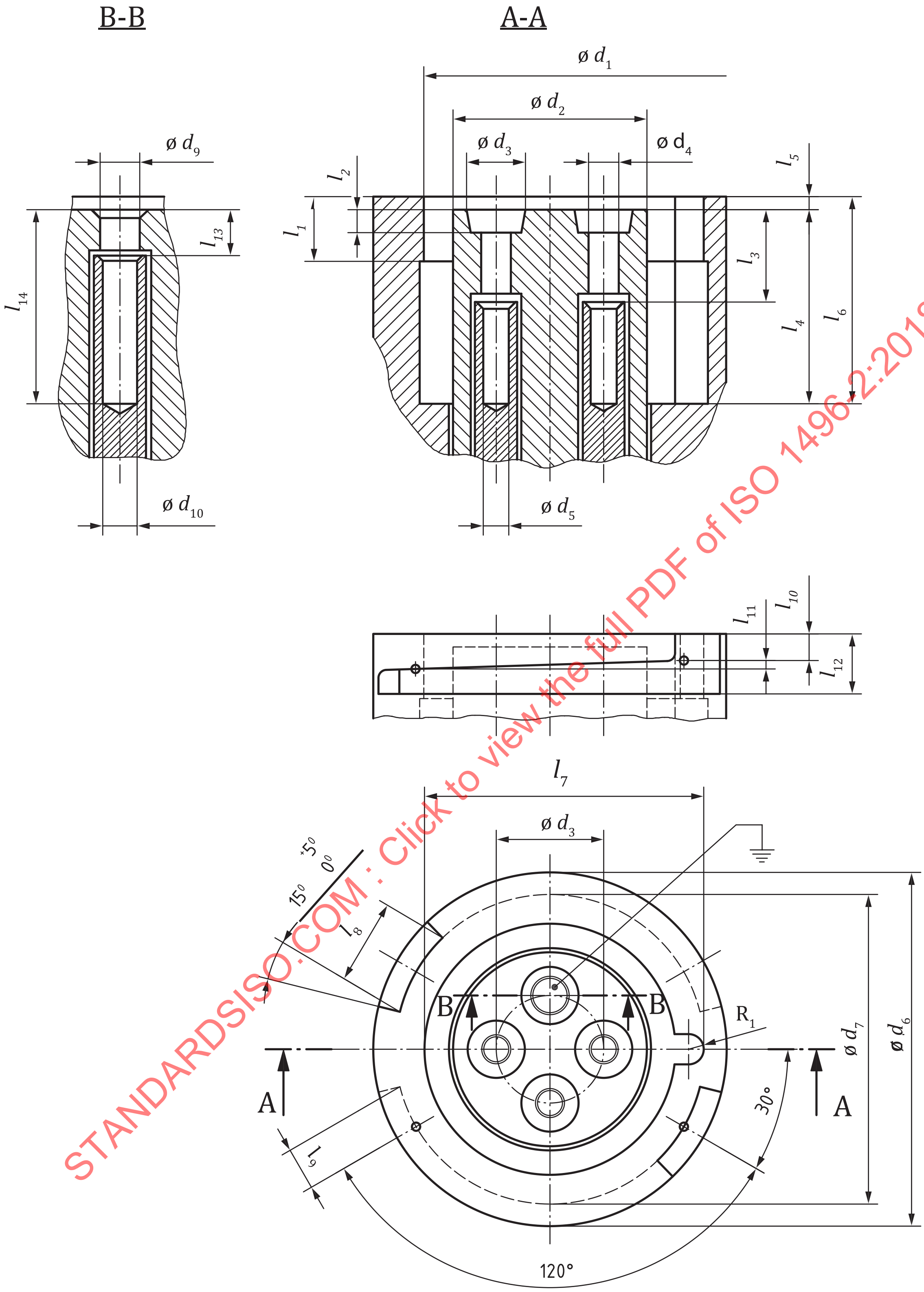


Figure E.2 — Electric socket, four-pin, 380 V/440 V, 50 Hz/60 Hz, 32 A

Table E.2 — Dimensions for Figure E.2

Dimension	Value	
	mm	in
d_1	$58{,}6^{+0{,}6}_{0}$	$2{,}307^{+0{,}023}_{0}$
d_2	$47^{0}_{-1{,}5}$	$1{,}85^{0}_{-0{,}06}$
d_3	$13{,}6^{+1}_{0}$	$0{,}535^{+0{,}004}_{0}$
d_4	$7^{+0{,}6}_{0}$	$0{,}275^{+0{,}023}_{0}$
d_5	6 nominal	0,236 nominal
d_6	$82^{0}_{-0{,}5}$	$3{,}23^{0}_{-0{,}02}$
d_7	$72^{0}_{-0{,}5}$	$2{,}83^{0}_{-0{,}02}$
d_8	25 ± 0,5	0,984 ± 0,02
d_9	$9{,}1^{+0{,}6}_{0}$	$0{,}358^{+0{,}023}_{0}$
d_{10}	8 nominal	0,315 nominal
l_1	15 minimum	0,60 minimum
l_2	$5{,}3^{+3}_{0}$	$0{,}208^{+0{,}012}_{0}$
l_3	$21{,}5^{+1}_{-0{,}5}$	$0{,}846^{+0{,}04}_{-0{,}02}$
l_4	45 minimum	1,77 minimum
l_5	3^{0}_{-1}	$0{,}12^{0}_{-0{,}04}$
l_6	48 minimum	1,89 minimum
l_7	$64{,}6^{+0{,}5}_{0}$	$2{,}54^{+0{,}02}_{0}$
l_8	$20^{+0{,}5}_{0}$	$0{,}787^{+0{,}02}_{0}$
l_9	12 minimum	0,47 minimum
l_{10}	$6{,}2^{0}_{-0{,}2}$	$0{,}244^{0}_{-0{,}008}$
l_{11}	$2^{+0{,}2}_{0}$	$0{,}08^{+0{,}008}_{0}$
l_{12}	14 minimum	0,55 minimum
l_{13}	$9{,}5^{+1}_{-0{,}5}$	$0{,}374^{+0{,}04}_{-0{,}02}$
l_{14}	45 minimum	1,77 minimum
R_1	3,5 ± 0,2	0,137 ± 0,008

