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## Commercial refrigerated cabinets — Methods of test — Part II : General test conditions

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## FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1992/II (originally ISO/DIS 1993) was drawn up by Technical Committee ISO/TC 86, *Refrigeration*, and circulated to the Member Bodies in September 1971.

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It has been approved by the Member Bodies of the following countries :

Australia	Germany	Spain
Austria	Hungary	Sweden
Belgium	Ireland	Switzerland
Canada	Israel	Turkey
Czechoslovakia	Japan	United Kingdom
Denmark	Netherlands	U.S.S.R.
Egypt, Arab Rep. of	Romania	
France	South Africa, Rep. of	

The Member Body of the following country expressed disapproval of the document on technical grounds :

New Zealand

Other parts in this series under the general title, *Commercial refrigerated cabinets – Methods of test*, are as follows :

- Part I : *Calculation of linear dimensions, areas and volumes.*
- Part III : *Temperature test.*
- Part IV : *Defrosting test.*
- Part V : *Water vapour condensation test.*
- Part VI : *Electrical energy consumption test.*
- Part VII : *Test for odour of material.*

(Parts IV to VII are at present at the stage of draft.)

# Commercial refrigerated cabinets – Methods of test – Part II : General test conditions

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies general conditions for type testing of commercial refrigerated cabinets intended for the sale and/or display of food products.

## 2 REFERENCES

ISO/R 817, *Number designation of organic refrigerants.*

ISO/R 916, *Testing of refrigerating systems.*

## 3 SELECTION AND INSTALLATION OF TEST SPECIMEN

3.1 Each specimen commercial refrigerated cabinet intended to be tested shall, if not a prototype, be selected from stock or routine production and shall be representative as to construction and adjustment.

3.2 The test report shall clearly state whether the cabinet tested is a prototype or a cabinet taken from stock or factory production.

3.3 The cabinet, including all components required for normal operation, shall be assembled, set up and sited as it would be installed in service as nearly as practicable in accordance with the intentions of the manufacturer so far as these are stated or known. All permanently located accessories required for normal use shall be in their respective places.

3.4 Cabinets intended to be placed against a wall shall be positioned with the back at a distance from the wall as recommended or, if no such distance is recommended, at a distance of 100 mm.

3.5 When the condensing unit is remote from the cabinet, the cabinet manufacturer shall state for the specified test conditions of this International Standard :

- a) the international number of the refrigerant (see ISO/R 817);
- b) the actual operating suction pressure taken at the cabinet outlet;

c) the actual operating liquid temperature taken at the cabinet inlet;

d) the heat extraction rate necessary (some measuring methods are described in ISO/R 916).

3.6 During the test, the temperature defined in 3.5 c) above shall not be more than 10 °C above the specified test room temperature. No "flash gas" condition shall occur at the inlet to the cabinet during the type test.

## 4 TESTING EQUIPMENT

### 4.1 Test room

If more than one cabinet is being tested in the same room, appropriate arrangements (such as the use of partitions) shall be used in order to ensure that the conditions surrounding each cabinet are in accordance with the test requirements specified in 4.1.1 to 4.1.7 below.

#### 4.1.1 Power supply

The tolerance on power supply shall be  $\pm 2\%$  for voltage and  $\pm 1\%$  for frequency in relation to the nominal values which are given on the marking plate or otherwise stated.

#### 4.1.2 Air movement

Local air movement shall be provided to some extent. The air movement shall be, however, as far as practicable, parallel to the plane of the display opening and to the longitudinal axis. With the display cabinet(s) switched off, the air velocity at any point along the line shown in figure 1 shall be  $0,2 \pm 0,1$  m/s.

For closed cabinets the direction of air flow shall be such that the air enters the cabinet when the door(s) is (are) open.

#### 4.1.3 Radiant heat

The walls and ceiling and any partitions of rooms intended for the testing of display cabinets shall be painted in light-coloured, semi-gloss paint.

The surface temperatures of walls and ceiling and partitions shall be maintained within  $\pm 2^\circ\text{C}$  of the air temperature measured at the same level.

Fluorescent lighting corresponding to  $600 \pm 100$  lx at a height of 1 m above the floor shall be installed and shall be on continuously during test periods.

**4.1.4 Temperature gradient**

The temperature gradient shall be measured before the cabinet for test is put into operation. The test room temperature may vary from floor to ceiling but the vertical temperature gradient shall not exceed  $2^\circ\text{C/m}$  and there shall not be a difference of more than  $6^\circ\text{C}$  between the temperature measured at the floor and at the ceiling.

**4.1.5 Climate measuring point**

The point of measurement for ambient temperature and relative humidity shall be approximately midway along the length of the cabinet and in accordance with figures 2 to 5.

The point of measurement for cabinets having an integral condensing unit shall be on the opposite side to the location of the unit.

However, in the case of gondola-type cabinets not fitted with integral units, temperatures shall be taken at both sides (see figure 3a).

Temperatures at the measuring points and at the same height all round the cabinet shall not be lower than the temperature corresponding to the climate class of the test room (see 4.1.6).

**4.1.6 Test room standard climates**

Tests shall be carried out in one of the following climates :

Test room climate class	Dry bulb temperature	Relative humidity
	$^\circ\text{C}$	%
1	16	80
2	22	65
3	25	60
4	30	55
5	40	40

**4.1.7 Tolerance of climate classes**

The test room shall be capable of maintaining values of temperature and humidity within  $\pm 1^\circ\text{C}$  of the temperature and  $\pm 5$  units of the relative humidity percentage figures at the specified measuring points.

**4.2 Test packages**

NOTE – For test packages it is intended to refer to a separate International Standard now in preparation. The following specification should therefore be regarded as temporary, and the enthalpy table and tolerances, in particular, may need revision when an International Standard has been established.

Test packages shall be parallelepipeds of the following dimensions and masses :

Dimensions	Mass
mm	g
50 X 100 X 200	1 000
50 X 100 X 100	500
25 X 50 X 100	125

Tolerance is  $\pm 3\%$  on all linear dimensions and  $\pm 2\%$  on the mass.

The filling substance shall be composed as follows, per 1 000 g :

oxy-ethyl-methyl cellulose	230 g
water	764,2 g <sup>1)</sup>
sodium chloride	5 g
parachlorometacresol	0,8 g

The use of filler materials other than that mentioned is authorised insofar as they have the same thermal characteristics as oxy-ethyl-methyl-cellulose. The values tabulated below (see page 6) are typical.

The substance shall be packed into a plastics wrapper<sup>2)</sup> or other suitable material of such quality that exchanges of moisture with the ambient medium are negligible. After filling, the wrapping sheet shall be sealed by heat.

The surface emissivity shall be equal to  $0,9 \pm 0,05$  at  $25^\circ\text{C}$ .

Some of the packages (50 mm X 100 mm X 100 mm) shall be fitted for temperature measurements. These particular packages shall be equipped with temperature sensors, placed in the geometrical centre of each package and with the connecting leads parallel to the long sides of the packages as shown in figures 6 to 8. Such a package may be constructed from two packages of 25 mm X 100 mm X 100 mm, or four packages of 25 mm X 50 mm X 100 mm, taped together, with thermocouples arranged between the adjacent surfaces provided the sensing element is in good thermal contact with both packages. Packages with temperature sensors are referred to as M-packages.

1) The addition of about 4 % of water is recommended in order to compensate for evaporation during the preparation of the filling material.  
 2) It is advisable to use a sheet of easily sealed high pressure polyethylene, 50  $\mu\text{m}$  thick, covered externally with a sheet of poly terephthalate approximately 12,5  $\mu\text{m}$  thick.

### 4.3 Instruments and measuring equipment

**4.3.1** All measurements shall be carried out with instruments that have been calibrated before each measurement or series of measurements.

**4.3.2** Temperature measurements shall be made to an accuracy of  $\pm 0,5$  °C. Air temperatures shall be measured by sensors, which are protected from radiation by insertion in metal shields with highly reflective surfaces, each having a thermal mass equivalent to 25 g of copper, for example a copper cylinder having a mass of 25 g and a minimum external area. Temperatures shall be registered on recording instruments.

**4.3.3** Illumination flux per square metre shall be measured to an accuracy of  $\pm 100$  lx.

**4.3.4** Pressure shall be measured to an accuracy of  $\pm 2$  %.

**4.3.5** Relative humidity shall be measured to an accuracy of  $\pm 3$  units of the percentage figure and registered on a recording instrument.

**4.3.6** Energy consumption shall be measured to an accuracy of  $\pm 2$  %.

**4.3.7** Time interval measurement shall be made to an accuracy of  $\pm 1$  % or better and it shall be possible to provide readings of 60 s or less.

**4.3.8** Air velocity shall be measured using a laboratory type instrument and a sufficient number of readings shall be taken to ensure that the average air velocity is within the limits stated in 4.1.2.

### 5 PREPARATION BEFORE TEST

**5.1** Before the test is started, the cabinet shall be switched on and allowed to run for at least 24 h at the specified climate class with no packages in the cabinet.

**5.2** When cabinets with remote condensing units are being tested, the operating conditions shall comply with those stated by the cabinet manufacturer in accordance with clause 3.

**5.3** During the running-in period according to 5.1 and 5.2 above, there shall be no erratic functioning of the refrigerating system, controls or defrosting operations.

**5.4** The cabinet shall be filled up to the load limit by making use primarily of the packages of 200 mm X 100 mm X 500 mm, then of 100 mm X 100 mm X 50 mm and then of 100 mm X 50 mm X 25 mm, previously brought to a temperature approximately equal to the one expected during the test. Packages with temperature sensors shall be placed in the positions specified for each test to be made.

**5.5** Any automatic control shall be set according to the manufacturer's instructions.

**5.6** The normal routine of defrosting shall be followed.

**5.7** If night-covers are supplied for open cabinets, two tests shall be conducted, one without night-covers and one with night-covers.

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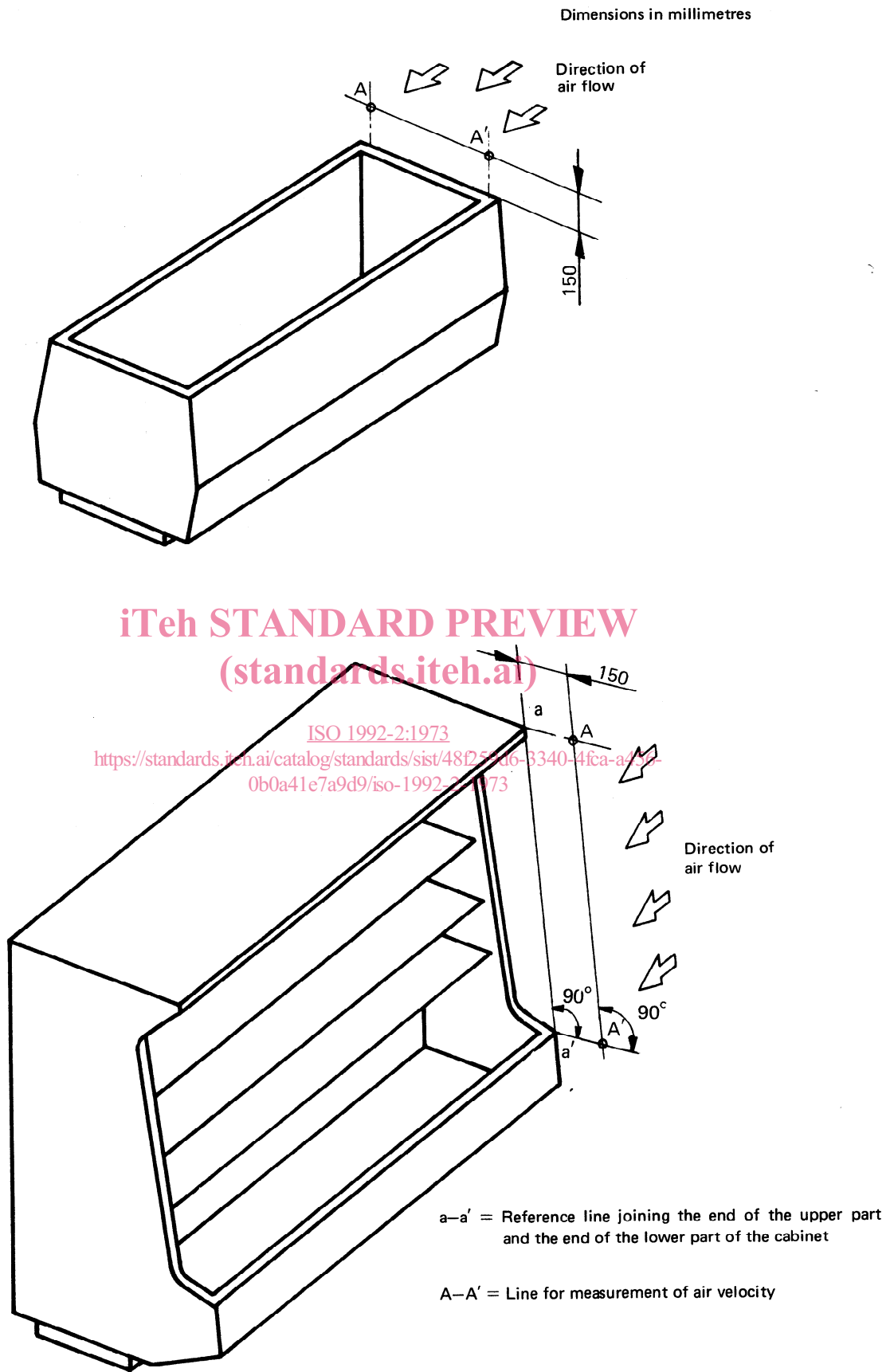


FIGURE 1 – Air movement

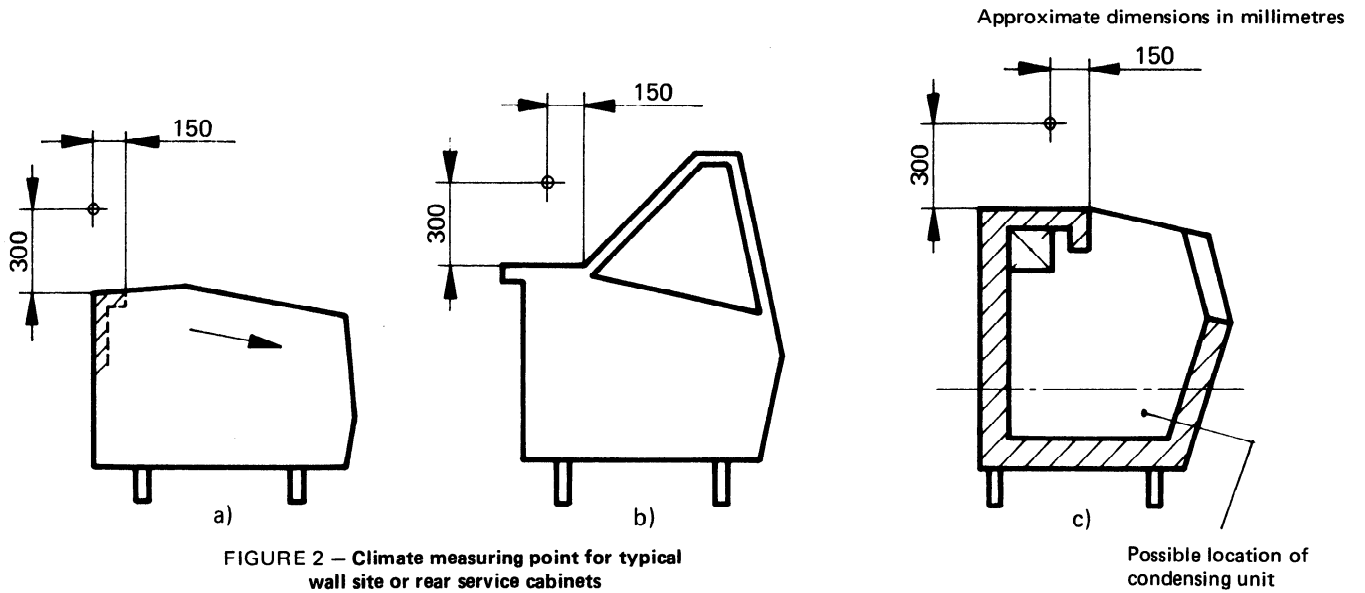
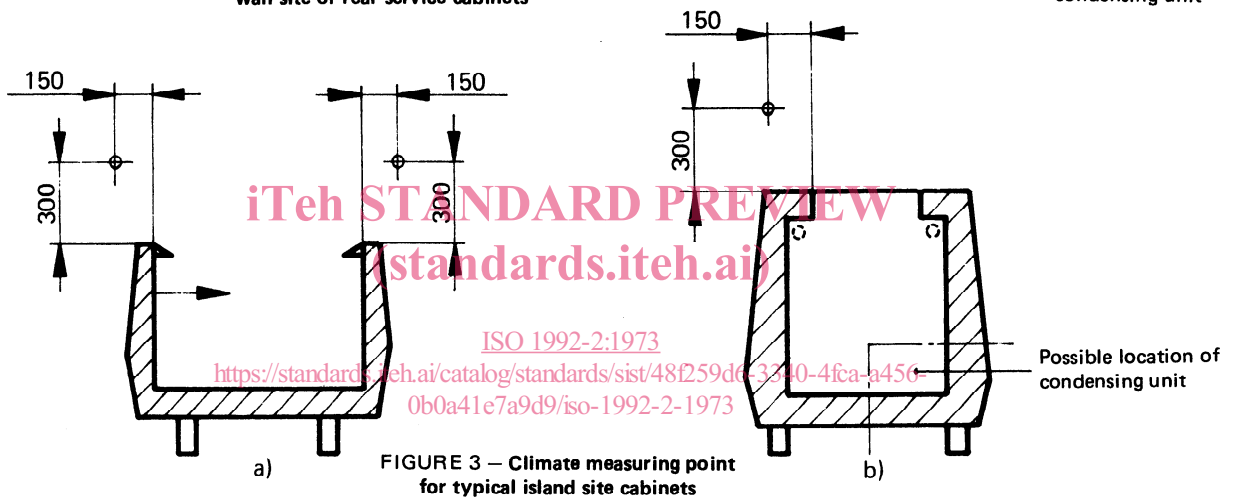


FIGURE 2 – Climate measuring point for typical wall site or rear service cabinets



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FIGURE 3 – Climate measuring point for typical island site cabinets

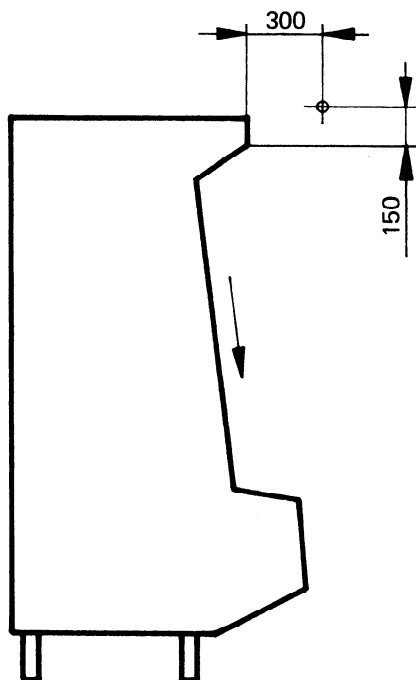


FIGURE 4 – Climate measuring point for typical vertical cabinet

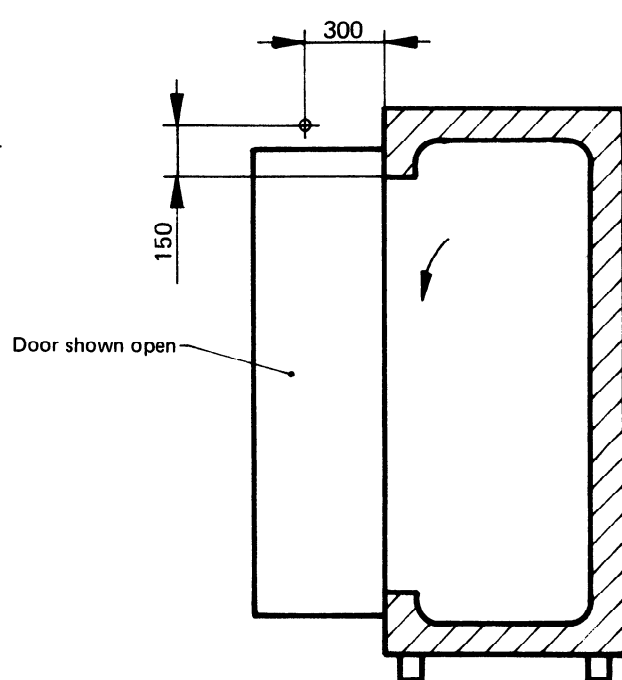
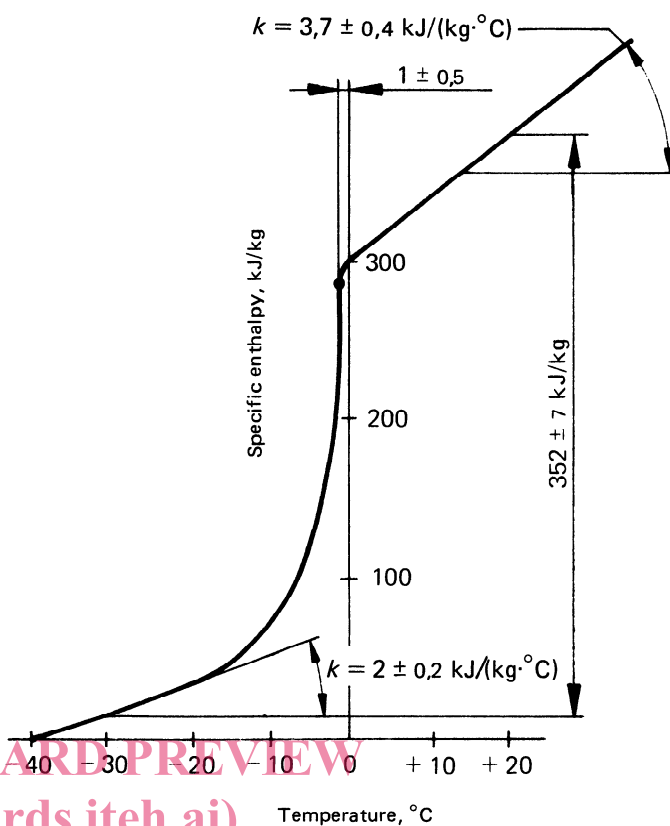


FIGURE 5 – Climate measuring point for typical vertical closed cabinet

Temperature	Specific enthalpy
°C	kJ/kg
-40	0
-30	19
-25	28
-20	39
-18	43
-16	49
-14	55
-12	63
-10	73
-9	79
-8	85
-7	93
-6	102
-5	114
-4	129
-3	152
-2	194
-1	285
0	297
+10	334
+20	371



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The enthalpy value 285 kJ/kg shall correspond to the temperature  $-1 \pm 0,5$  °C.

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Temperature range

Temperature range	Increase in specific enthalpy
°C	kJ/kg
-30 to -20	$20 \pm 2$
+10 to +20	$37 \pm 4$
-30 to +20	$352 \pm 7$

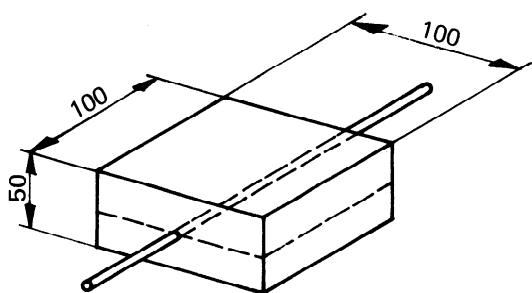


FIGURE 6

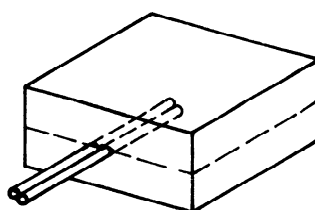


FIGURE 7

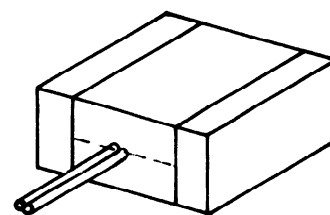


FIGURE 8

Dimensions in millimetres