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Refrigerated display cabinets —

Part 2: Classification, requirements and test conditions

AMENDMENT 1

Meubles frigorifiques de vente —

Partie 2: Classification, exigences et méthodes d'essai

AMENDEMENT 1

Reference number
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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

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.

Amendment 1 to ISO 23953-2:2005 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 44, *Commercial refrigerated cabinets, catering refrigerating appliances and industrial refrigeration*, in collaboration with Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 7, *Testing and rating of commercial refrigerated display cabinets*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This corrected version of ISO 23953-2:2005/Amd.1:2012 incorporates the following correction on page 3:

Page 14, Figure 3

Replace Figure 3 with the following new Figure 2 a), b), c) and d).

has been corrected to read:

Page 14, Figure 3

Renumber Figure 3 as Figure 2.

Refrigerated display cabinets —

Part 2: Classification, requirements and test conditions

AMENDMENT 1

Page 6, 4.1.4.1

Replace “the maximum working pressure to which they will be subjected when the cabinet is in operation or at rest.” with “the maximum working pressure to which they are subjected when the cabinet is in operation or at rest.”

Page 7, 4.1.6.2

Replace the subclause with the following:

4.1.6.2 Temperature sensor location

The temperature sensor location shall be readily accessible to enable on-site testing for the correct indication of temperature and replacement of the temperature measuring instrument on site in service.

NOTE 1 The temperature sensor of a thermometer is considered to be “readily accessible” if it can be reached directly for examination. It can be necessary to remove access panel(s) to carry out replacement.

NOTE 2 For cabinets with natural convection cooling, the positioning of the temperature sensor in a guide tube is also considered to be “readily accessible” if the sensor can be introduced into and removed from the guide tube without a tool.

Wherever possible, the mounting method shall not supply heat to, or withdraw heat from, the temperature sensor.

The temperature sensor shall be protected against heat radiation from the external ambient.

The temperature sensor's location is defined as part of the temperature test of the refrigerated display cabinet. During the temperature test, air temperatures at the declared sensor location shall be measured and these values noted in the test report.

NOTE 3 For electronic controllers, it is possible to display a calculated temperature.

NOTE 4 For the recording and display of temperatures, one or two temperature sensors can be used. The temperature sensor can be the same as those used for controlling the refrigeration. An alarm can be activated in case of error. This option is not in accordance with the requirements of EN 12830.

NOTE 5 It is the responsibility of the supplier and user to ensure that the location of the temperature sensor complies with national regulation on temperature control of foodstuffs.

Page 8, Figure 2

Delete Figure 2.

Page 9, 4.2.2

Replace the Note with the following:

NOTE Annex B compares laboratory and store condition.

Page 9, Table 1

Replace the table with the following:

Table 1 — M-package temperature classes

Class	Highest temperature, θ_{ah}, of warmest M-package colder than or equal to[a]	Lowest temperature, θ_b, of coldest M-package warmer than or equal to[a]	Lowest temperature, θ_{al}, of all M-package colder than or equal to[a]
	°C		
L1	−15	—	−18
L2	−12	—	−18
L3	−12	—	−15
M1	+5	−1	—
M2	+7	−1	—
H1	+10	+1	—
H2	+10	−1	—
S	Special classification		

[a] See Figure 28.

Page 10, Table 2

In the third row of the table, replace “Annex D” with “Annex C”.

Page 11, 5.2.2

Replace the fourth and final paragraph with the following:

The total display (TDA) area is calculated according to Annex A.

Page 13, Table 3

Replace the table with the following:

Table 3 — Climate classes

Test room climate class	Dry bulb temperature °C	Relative humidity %	Dew point °C	Water vapour mass in dry air g/kg
0	20	50	9,3	7,3
1	16	80	12,6	9,1
8	23,9	55	14,3	10,2
2	22	65	15,2	10,8
3	25	60	16,7	12,0
4	30	55	20,0	14,8
6	27	70	21,1	15,8
5	40	40	23,9	18,8
7	35	75	30,0	27,3

NOTE The water vapour mass in dry air is one of the main points influencing the performance and the energy consumption of the cabinets. Therefore, the order of the climate class in the table is based on the water vapour mass column. See also Annex B to compare lab and store conditions.

Page 13, 5.3.1.3.2

Replace the first paragraph with the following:

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

In the case of typical island cabinets, and island with air discharge in the middle, temperatures shall be taken at both sides [see Figure 3 a), b), c)].

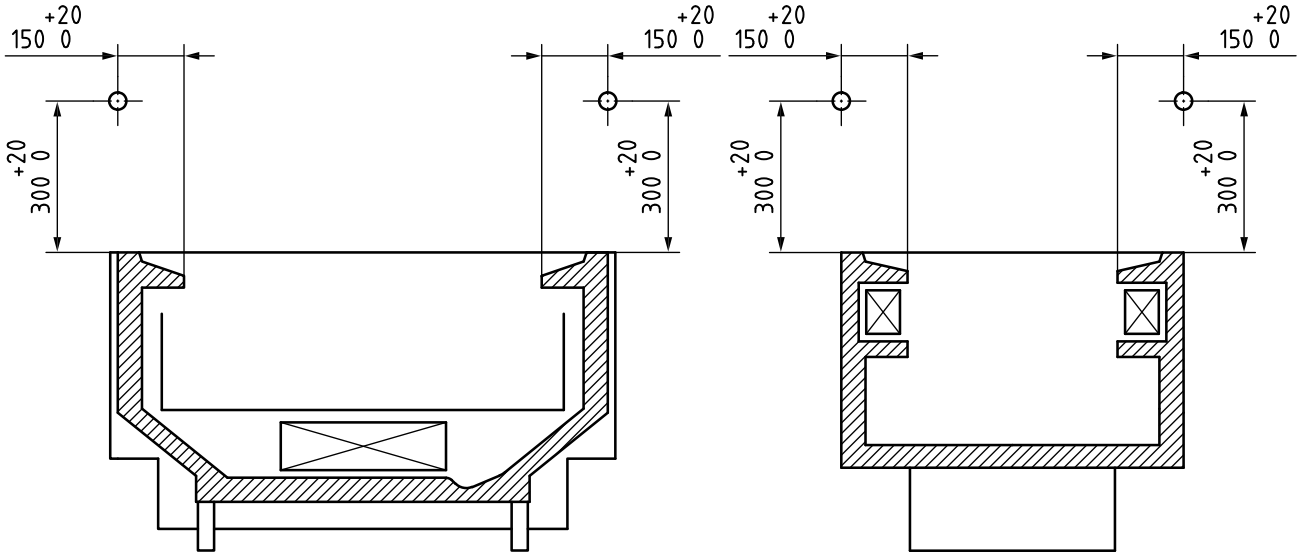
For plug-in cabinets, the warm condenser air flow shall be prevented from influencing the temperature at the measuring point by air deflectors or other suitable means (see 5.3.2.1, Figure 10).

Page 14, Figure 3

Renumber Figure 3 as Figure 2.

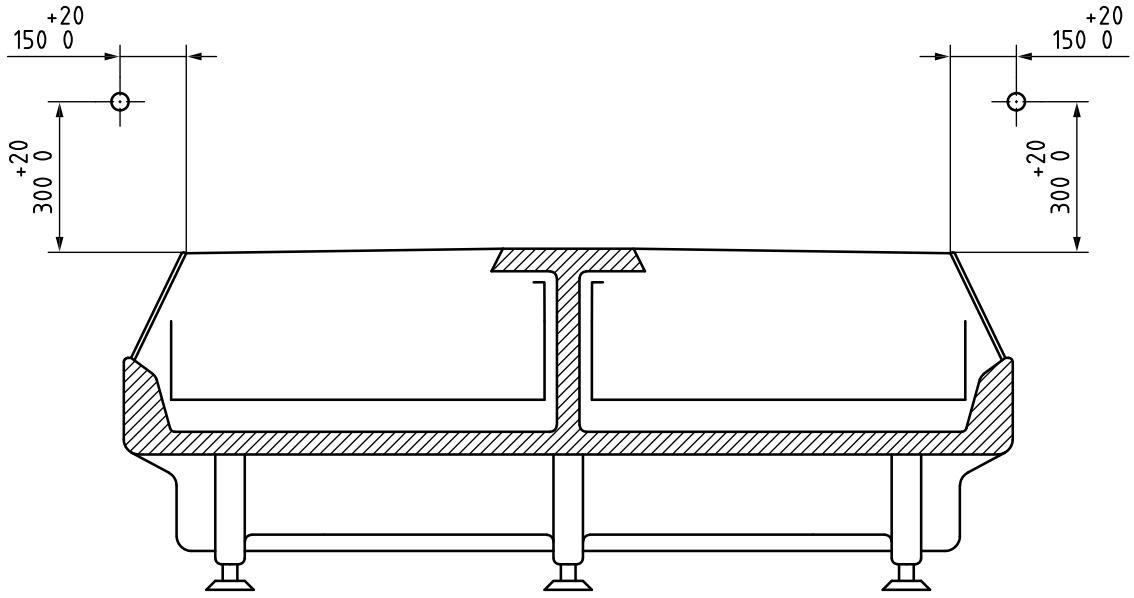
Page 15, Figure 4

Replace Figure 4 with the following new Figure 3 a), b), c) and d):



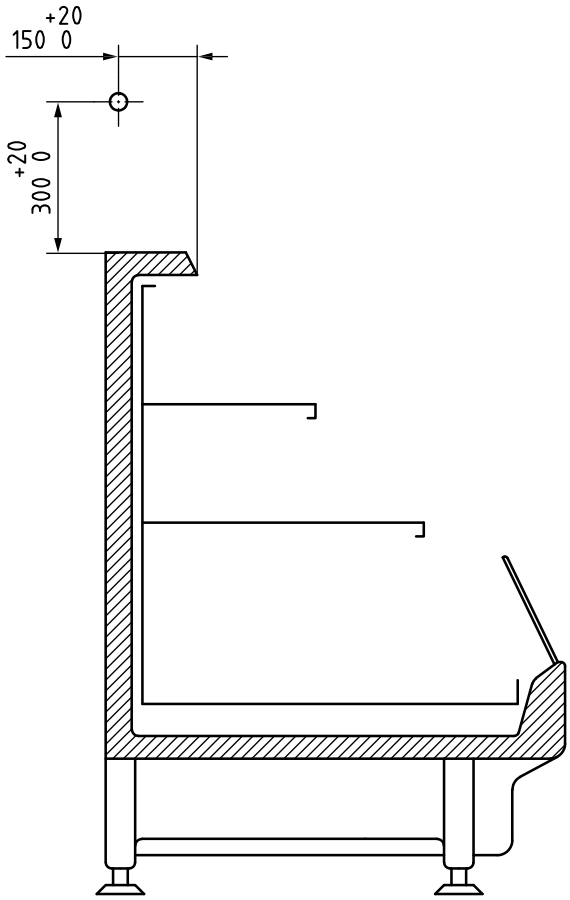
a) Horizontal, open, island site cabinet

b) Horizontal, open, island site cabinet



c) Island with air discharge in the middle

Figure 3 (*continued*)



d) Island with semi-vertical cabinet

Figure 3 — Climate measuring point for two typical examples of horizontal, open, island site cabinets [a), b)] for island with air discharge in the middle [c)] and for semi-vertical cabinet [d)]

Pages 15 and 16, Figures 5 and 6

Renumber Figures 5 and 6 as Figures 4 and 5.

Page 16, Table 4

Replace the last row with the following (thus deleting the dimension and mass of test packages "(37,5 × 100 × 200) 750":

The following package may be used as fillers to complete the cabinet loading:	
25 × 100 × 200	500

Page 18, Figure 7

Renumber Figure 7 as Figure 6.

Page 20, Figure 8

Renumber Figure 8 as Figure 7.

Page 20, 5.3.1.6

Insert the following new subclause after renumbered Figure 8 (M-package):

5.3.1.6 Alternative for filling test packages

Alternative filling test packages having the dimensions shown in Table 4 and density of (480 ± 80) kg/m^3 may be used, except for rows and columns on transverse section containing M-packages.

This test package may be a box made of plastic material, of any density, and of 1 mm nominal thickness. Cellular or foam material shall not be used. The case shall not incorporate any protrusions that would cause the vertical separation of packages in a stack. Opposite faces shall be substantially parallel and moulding draft shall be the minimum practicable. Seams or joints shall not result in protrusions sufficient to cause significant air gaps between adjacent packages.

Colour can be important, if dark enough to be affected by ambient heat radiation; however, a pastel colour, such as light pink, pale blue or pale green, shall have no significant effect in normal surroundings.

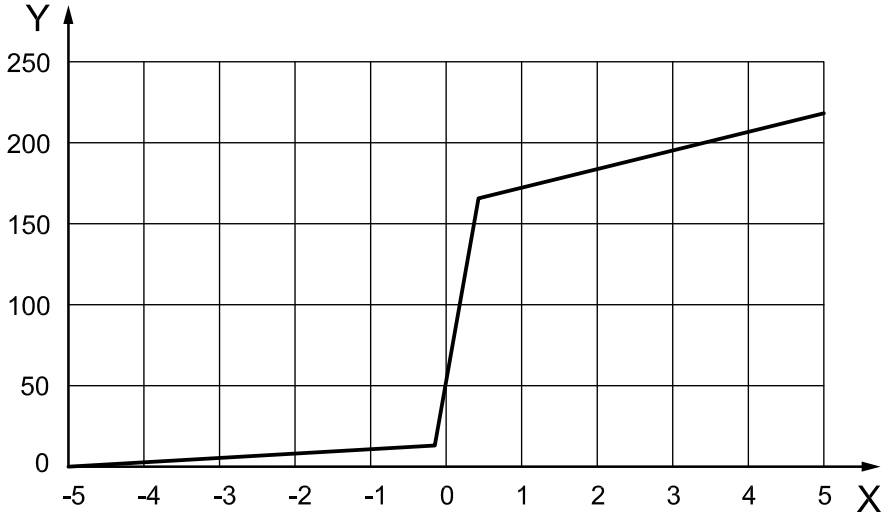
The contents shall be water soaked into a porous material, such as a natural, plastics or cellulose sponge.

Table 7 — Temperature and specific enthalpy of filler packages

Temperature °C	Specific enthalpy kJ/kg
−5	0
−4	3
−3	4
−2	7
−1	10
0	45
+1	172
+2	183
+3	194
+4	206
+5	218

Table 8 — Temperature and increase in specific enthalpy of filler packages

Temperature range °C	Increase in specific enthalpy kJ/kg
−5 to −1	10
−1 to +1	162
+1 to +5	46
−5 to +5	218



Key

X temperature, °C

Y specific enthalpy, kJ/kg

Figure 8 — Thermal characteristics of filler packages

Page 20, 5.3.1.6

Renumber 5.3.1.6 as 5.3.1.7.

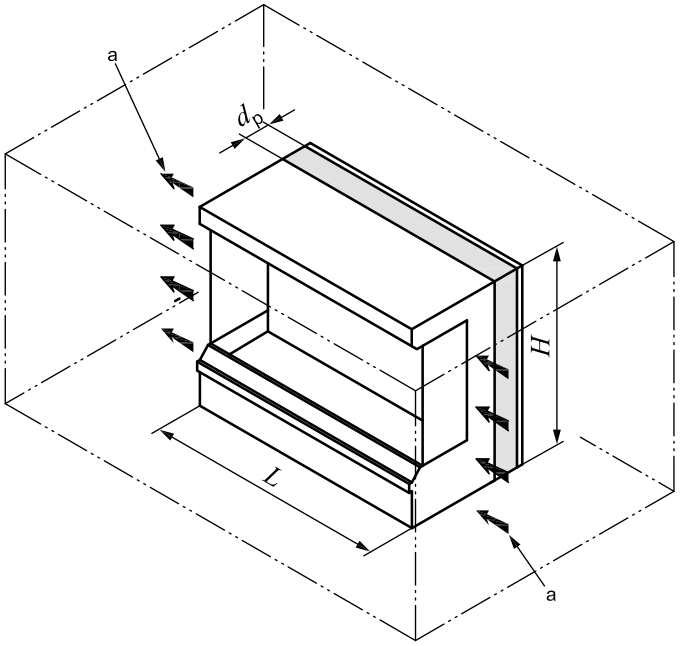
Page 21, 5.3.2.1

Replace the fourth paragraph with the following:

> For cabinets intended to be placed against a wall, and in order to check the running of cabinets with incorporated condensing unit correctly according to 5.3.2 or the water vapour condensation according to 5.3.4, a vertical partition shall be placed either against the rear of the cabinet or at a distance, d_p, from the rear as specified by the manufacturer [see Figure 9 and 7.3 b)].

Add the following two paragraphs and new Figure 10 at the end of the subclause:

> For all vertical and semi-vertical cabinets, when the warm condenser air flow direction is across the testing room air flow direction, from the front to the back of the cabinet, an air deflector positioned as shown in Figure 10 shall be used in such a way to create a duct between the back of the cabinet and the vertical panel. This duct shall be closed in the front end side towards the testing room airflow discharge direction and open in the opposite side. On the top, this duct shall be closed at the same height of the cabinet.
>
> The distance, d_p, between the back of the cabinet and the vertical panel shall be specified by the manufacturer [see 7.3 b)].



Key

d_p depth of the air back duct

H height of the air back duct equals height of the cabinet

L length of the air back duct equals length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

Figure 10 — Size and position of the air back duct

For horizontal plug-in cabinets, a back duct is not required.

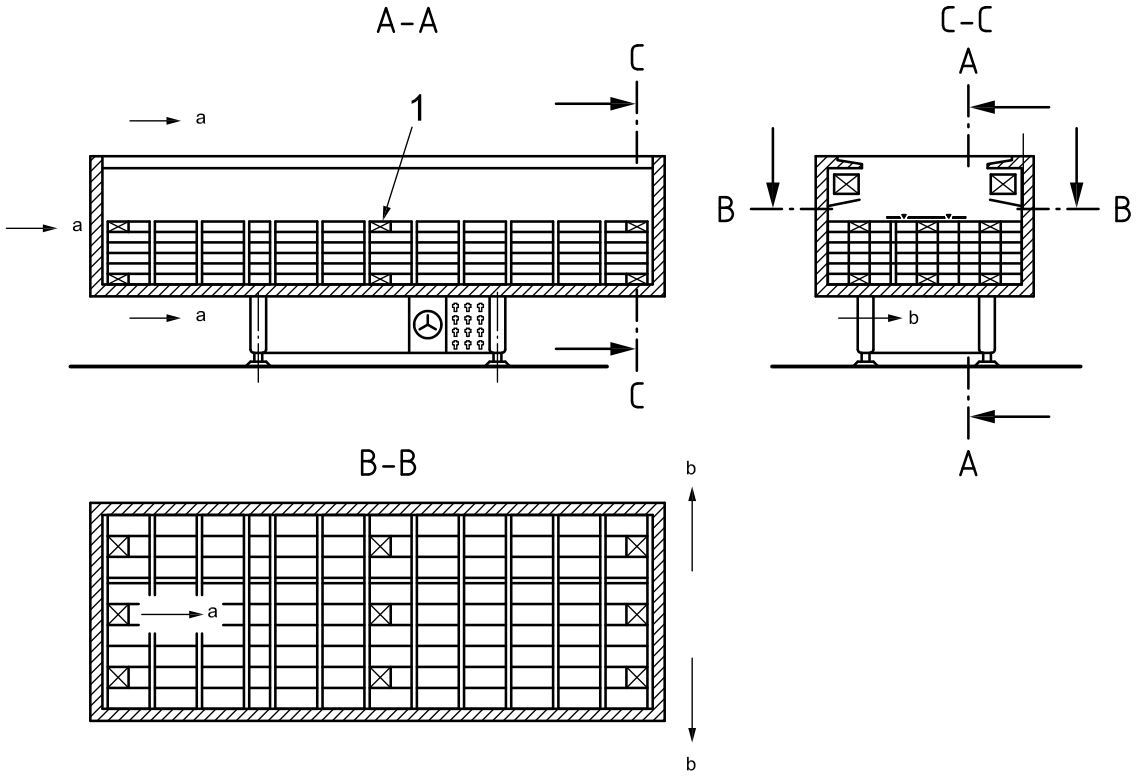
NOTE In general, the power of horizontal cabinets is much lower than that of vertical cases.

The warm condenser air can be removed by the test room airflow.

The air movement of the test room shall be parallel to the longitudinal axis according to 5.3.2.2.

The direction of the warm condenser airflow should be the same as the test room air flow direction and not opposed to it.

If this is not possible because of the cabinet's design, the condenser airflow should be across the test room airflow direction (see Figure 11).



Key

1 M-package

a Air currents parallel to the plane of the opening (in longitudinal direction).

b Air flow direction of condensing unit.

Figure 11 — Condensing air with test room air flow, or across, but not opposed the test room air flow

Page 22, 5.3.2.2

At the end of the first paragraph, replace “shown in Figure 10 shall be 0,2 m/s” with “shown in Figure 12 shall be $0{,}2^{+0}_{-0{,}1}$ m/s ”.

Page 23, 5.3.2.2

Replace the second and third paragraphs with the following:

For closed refrigerated cabinets with lids or doors hinged in such a way that the rotation axis is perpendicular to the longitudinal axis of the cabinet, the direction of air flow shall be such that the air movement is parallel to the plane of the cabinet display opening and the air enters the cabinet when the door(s) or lid(s) is (are) open.

The majority of the doors or lids shall open in order to allow the air entry into the cabinet; if doors or lids can be indifferently hinged left and right, all doors or lids shall open in the same direction.

Test room air movement shall be checked during the test in order to be sure that the test room is running correctly. The method of checking is left to the discretion of the testing authority.

Page 23, Figure 10

Renumber Figure 10 as Figure 12.

Page 24, 5.3.2.3.1

Replace in the first sentence “up to the load limit, as illustrated in Figures 11 to 24” with “up to the load limit, as illustrated in Figures 13 to 26”.

Replace the fourth paragraph with the following (thus deleting the “37,5 mm × 100 mm × 200 mm” size):

To complete the loading, use test packages of the following size as fillers: 25 mm × 100 mm × 200 mm.

In the first sentence of the eleventh paragraph, before the Example, replace “loading height above 500 mm (see Figure 23)” with “loading height above 500 mm (see Figure 25)”.

Add the following two paragraphs and Note at the end of the subclause:

If not otherwise stated in the manufacturer's handbook/instructions or marked inside the cabinet, the packages and the wood shall be loaded on standard Euro pallets (1 200 × 800 × 144) mm or, if not applicable, on a similar tray of the same height. The surface of the pallet should be covered by a sheet of plastic or carton so that the packages can be loaded properly.

If the cabinet is designed for the use of special storage trolleys, these trolleys shall be used for testing. In this case, the M-packages shall be positioned as specified in Figure 25, but inside the trolleys.

NOTE Sensitive foodstuff loading type can be possible only for the top part (shelves) of this type of cabinet.

Page 24, 5.3.2.3.2 a)

Replace “a tolerance of $^{0}_{-15}$ mm (see Figure 11 and Figures 13 to 18)” with “a tolerance of $^{0}_{-25}$ mm (see Figure 13 and Figures 15 to 20)”.

Page 24, 5.3.2.3.2 b)

Replace “(see Figures 19 to 21 and Figure 23)” with “(see Figures 21 to 23 and Figure 25)”.

Page 24, 5.3.2.3.2 c)

Replace the text with the following:

c) For all open cabinets, intended for sensitive foodstuffs not suitable for multiple layer stacking, the loading shall be equal to 100 mm (for an example, see Figures 14 and 24).

NOTE The meaning of “intended for sensitive foodstuffs not suitable for multiple layer stacking” is that the foodstuffs are displayed on tilted shelves, where it is not possible to make a load level over 100 mm. This type of loading can also be used for horizontal shelves. It is intended that manufacturers indicate the load limit in the technical documentation and also specify the type of loading used for testing the cabinet.

Page 25, 5.3.2.3.2 d)

Replace “(see Figure 24)” with “(see Figure 26)”.

Page 25, 5.3.2.3.3

Replace “(see Figures 11 to 24)” with “(see Figures 15 to 26)” at the end of the sentence.

Page 25, 5.3.2.3.3.2

Replace the text with the following:

5.3.2.3.3.2 Cross-section

For refrigerated base deck depths of less than or equal to 550 mm, or any shelf depth, M-packages shall be located in two longitudinal sections, such that the M-package axis is situated 50 mm from the back panel and 50 mm from the front limit of loading (see Figures 13 to 26).

For refrigerated base deck depths of more than 550 mm, a third longitudinal section shall be placed midway across the base deck depth with a tolerance of

— $d / 2 \, {}^{+100}_{-0}$ mm from the air-discharge side for cabinets with forced-air cooling [see Figures 13 to 15, Figure 17 a) and b) and Figures 21 to 25], or

— $d/2 \pm 50$ mm for natural-convection-cooled cabinets equipped with two evaporators or having a symmetrical layout (see Figures 18 to 20), or

— $d / 2 \, {}^{+100}_{-0}$ mm from the evaporator side for other natural-convection-cooled cabinets (see Figure 16).

In the height, for the base deck and each refrigerated shelf, M-packages shall be located in the lower and upper loading layers. Where the distance between the axes of M-packages is more than 400 mm, another M-package layer shall be introduced (see Figures 22, 23 and 25).

For cabinets with a minimum of four superimposed refrigerated shelves, of which two are strictly identical and have

a) the same shape and sizes (length, depth and loading height),

b) the same air flow design (discharge and return), and

c) the same radiation heat transfer conditions, more particularly, the same location and intensity of the lower and upper lighting devices,

M-packages shall be located in the following places:

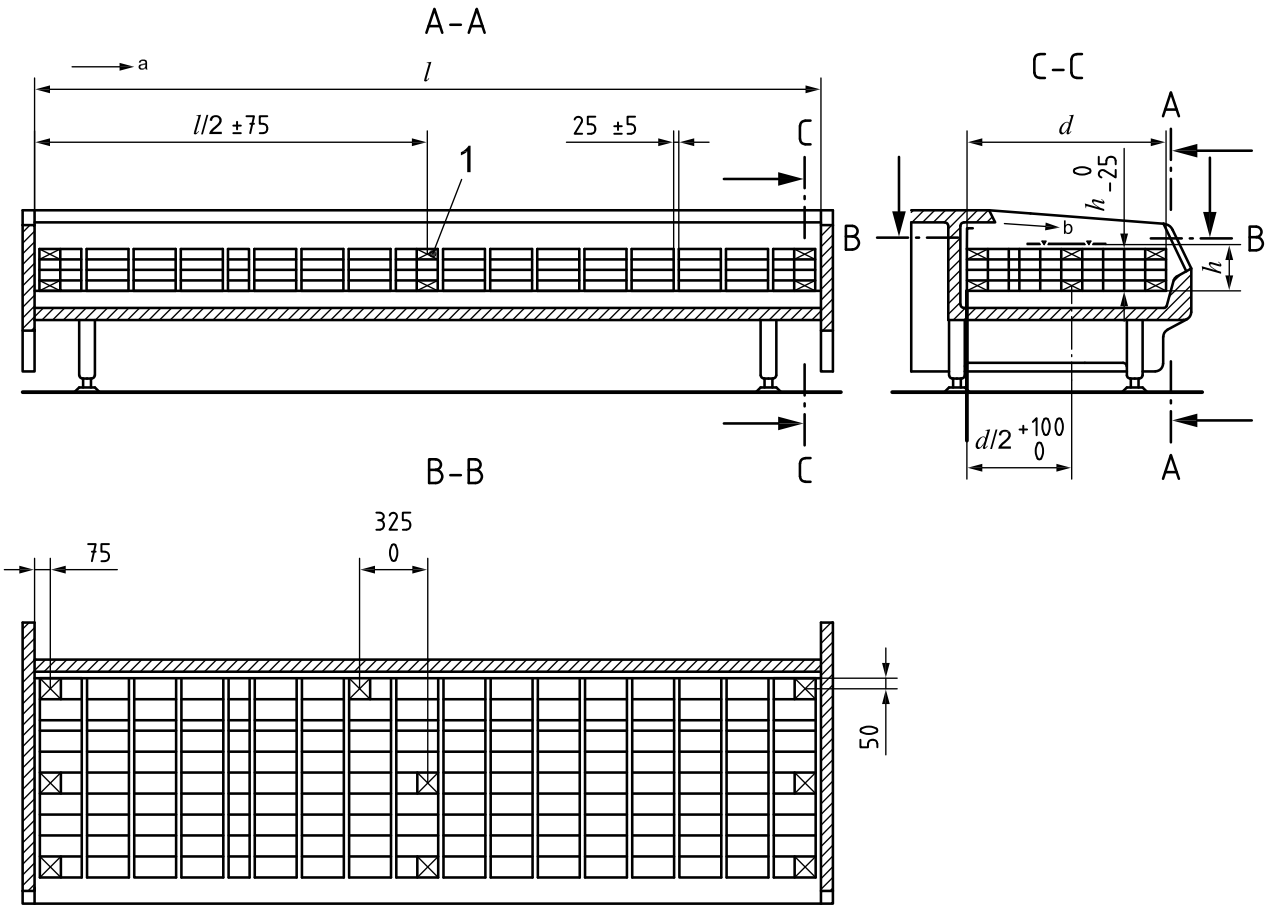
— with two identical refrigerated shelves: on the lower shelf (see Figure 22, where the second and the third shelves from the top are identical);

— with three identical refrigerated shelves: on the central shelf (see Figures 23 and 26, where the second, third and fourth shelves from the top are identical).

Page 26, Figure 11

Replace Figure 11 with the following and renumber it as Figure 13:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

h height at load limit

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

b Direction of forced air flow.

Figure 13 — Self-service counter provided with forced air cooling (horizontal, open)

Page 27, Figure 12

Replace the key and title with the following:

Key

1 M-package

d depth of base deck

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

b Direction of forced air flow.

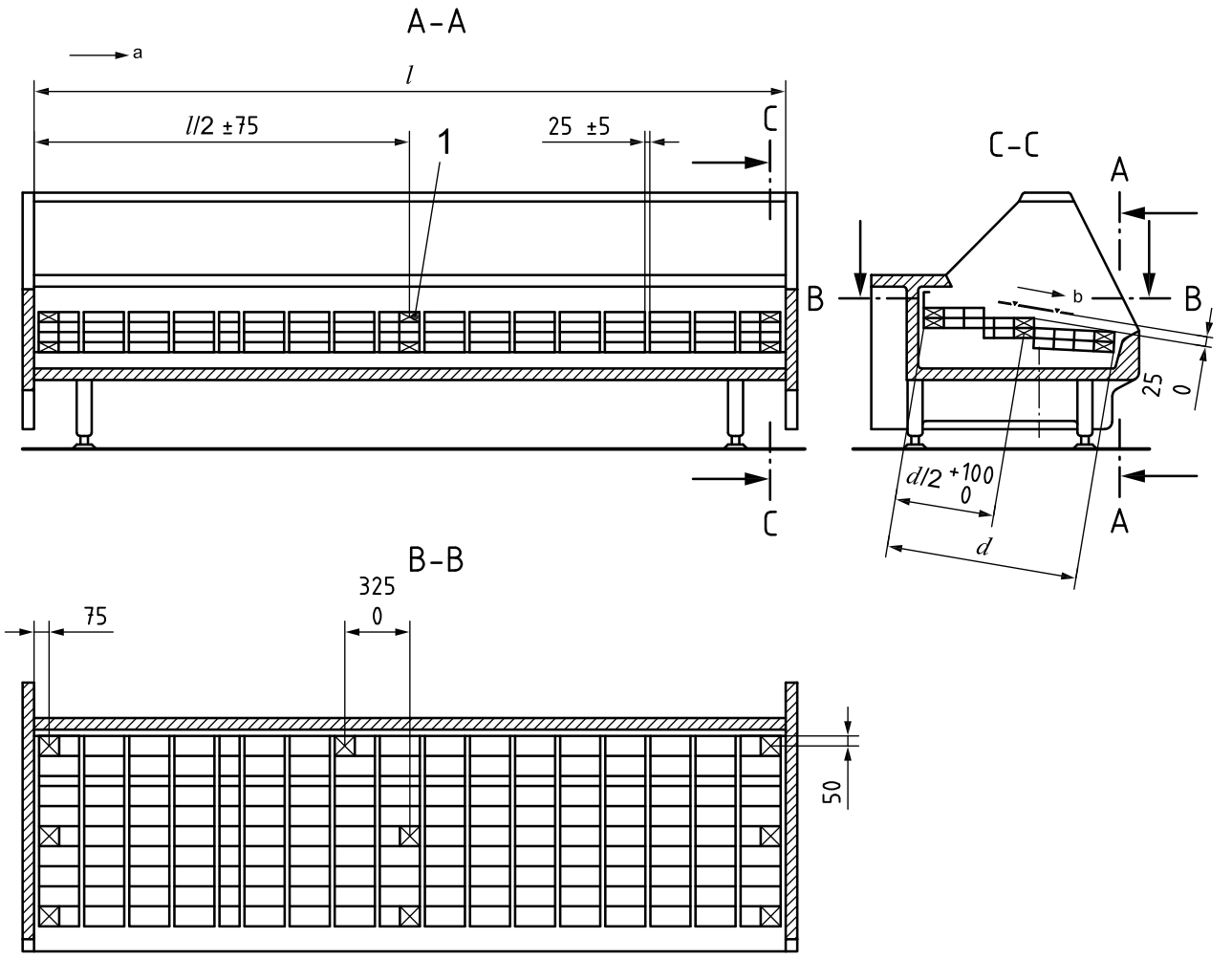
Figure 12 — Self-service counter provided with forced air cooling for sensitive foodstuffs (horizontal, open)

Renumber Figure 12 as Figure 14.

Page 28, Figure 13

Replace Figure 13 with the following and renumber Figure 13 as Figure 15:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

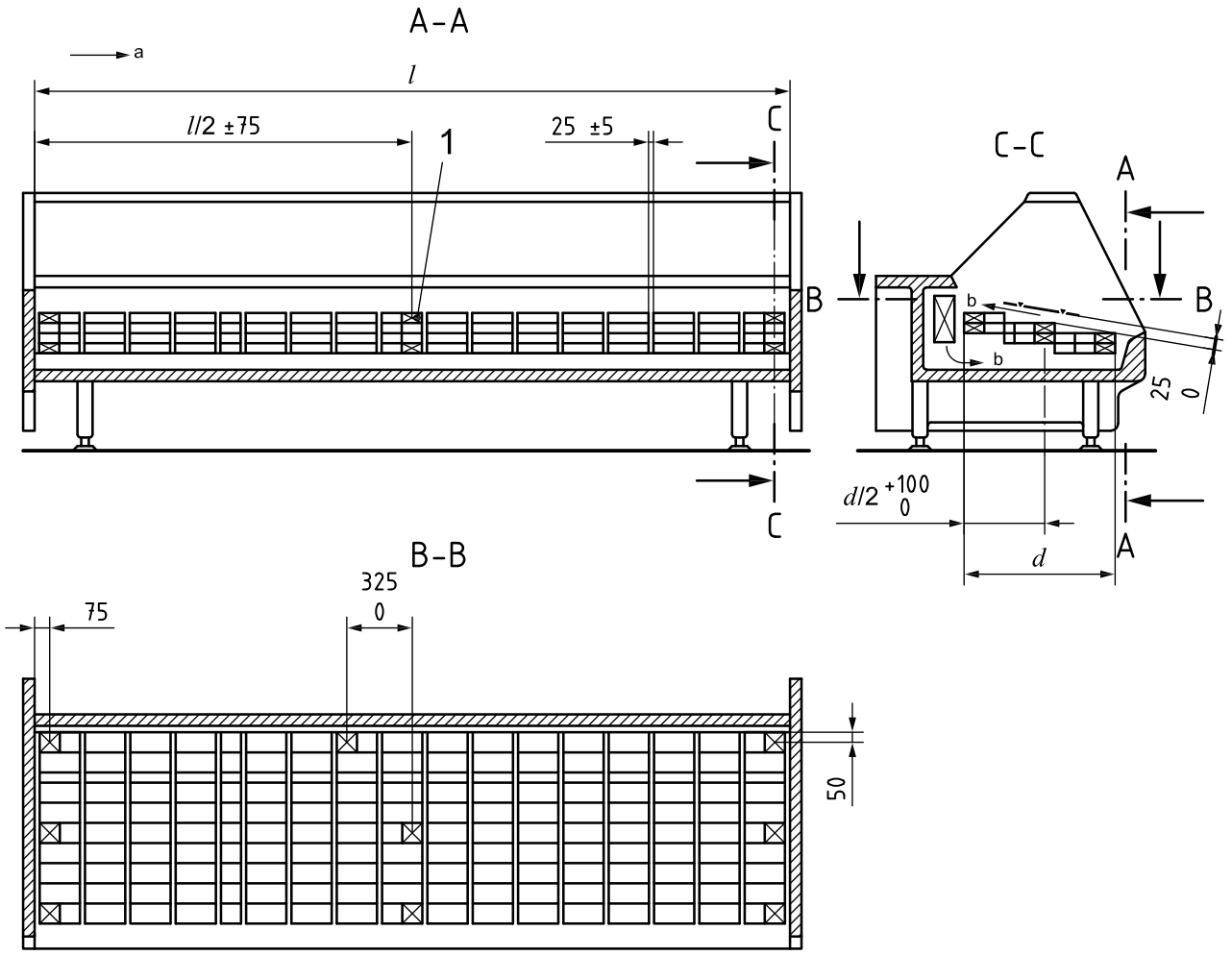
b Direction of forced air flow.

Figure 15 — Serve-over counter provided with forced air cooling (horizontal)

Page 29, Figure 14

Replace Figure 14 with the following and renumber Figure 14 as Figure 16:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

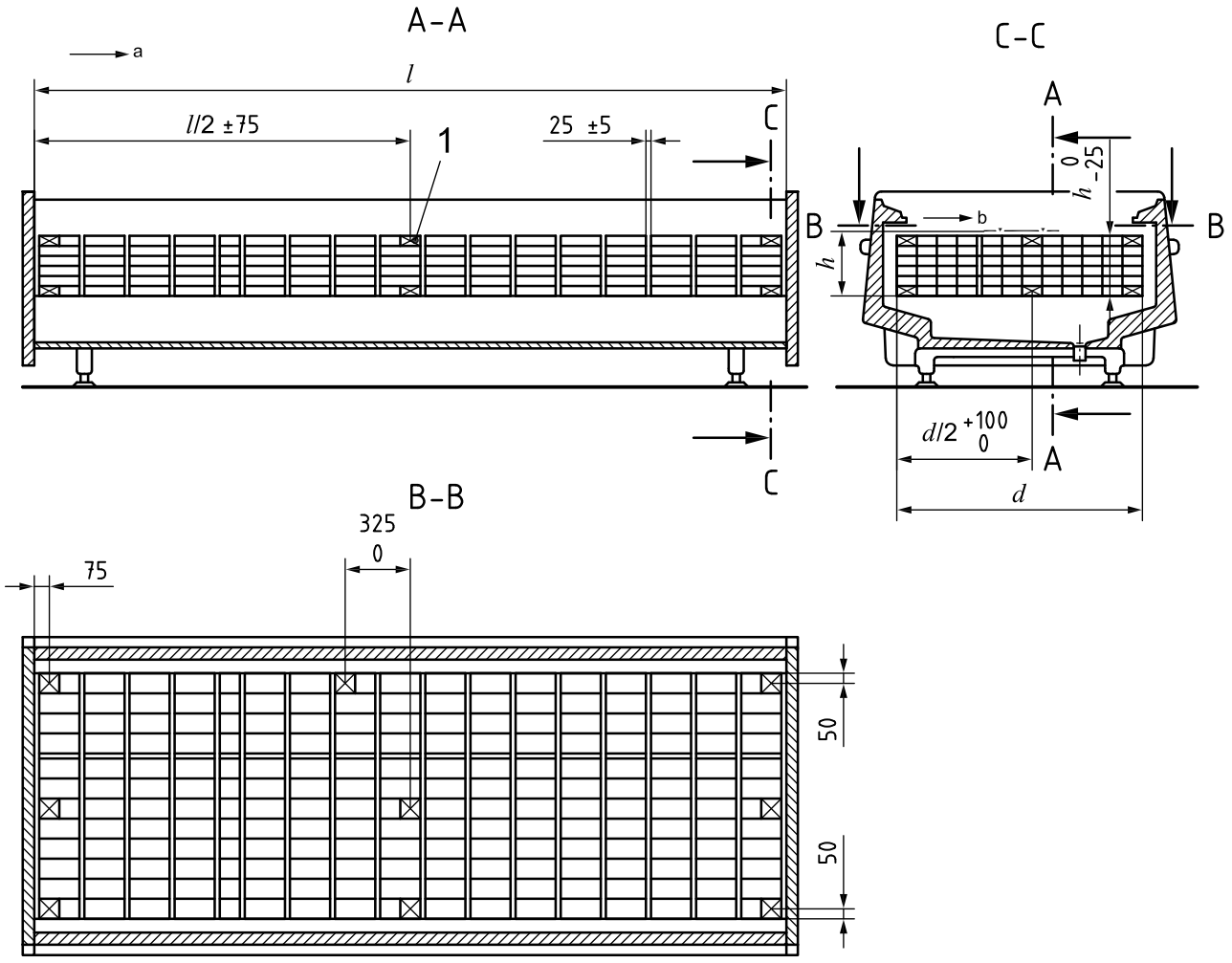
b Direction of forced air flow.

Figure 16 — Serve-over counter provided with natural convection cooling (horizontal)

Page 30, Figure 15

Renumber Figure 15 as Figure 17, and replace it with the following Figures 17 a) and b):

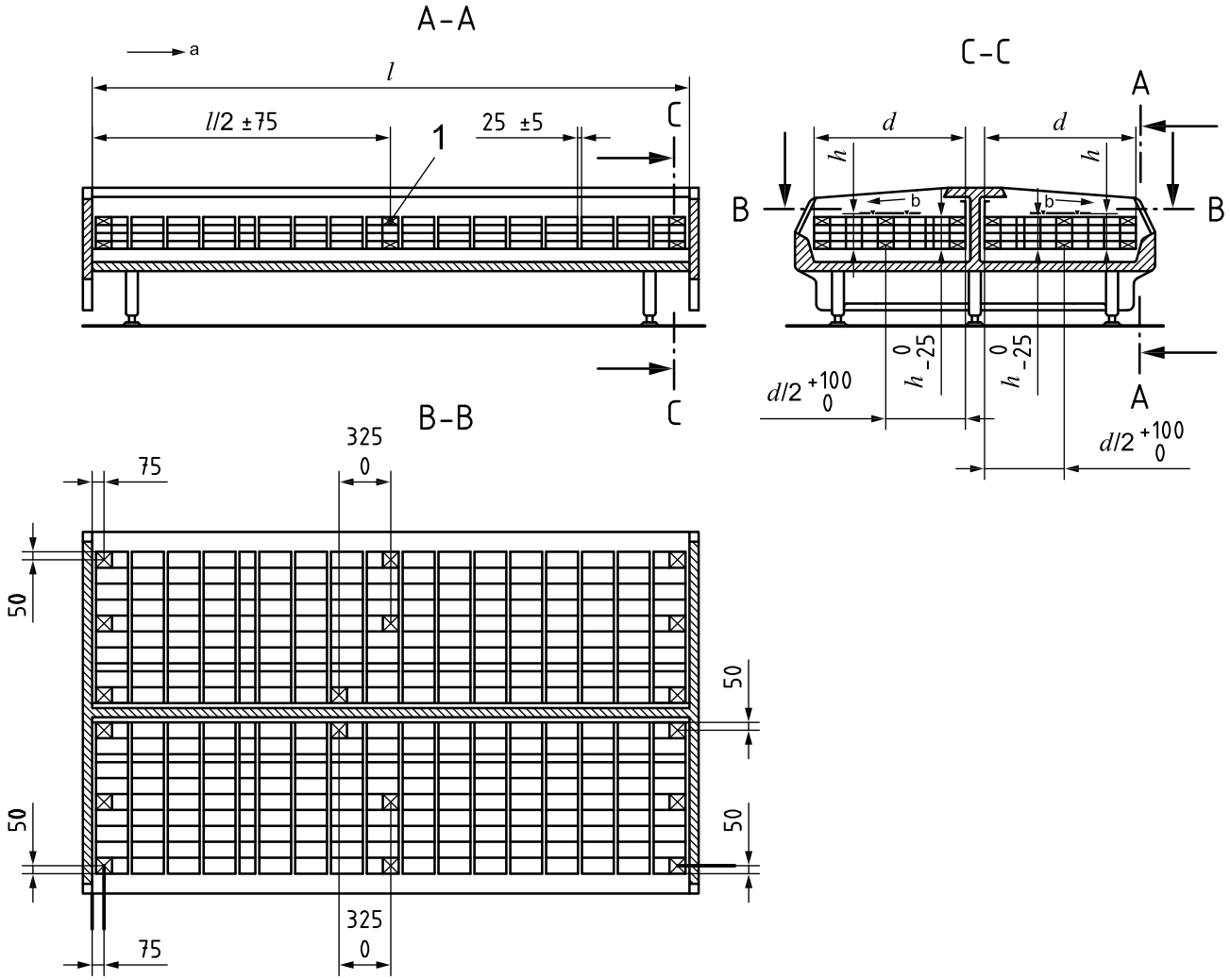
Dimensions in millimetres



a) Open island cabinet provided with forced air cooling (horizontal, open)

Figure 17 (*continued*)

Dimensions in millimetres



b) Island cabinet with air discharge in the middle

Key

1 M-package

d depth of base deck

h height at load limit

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

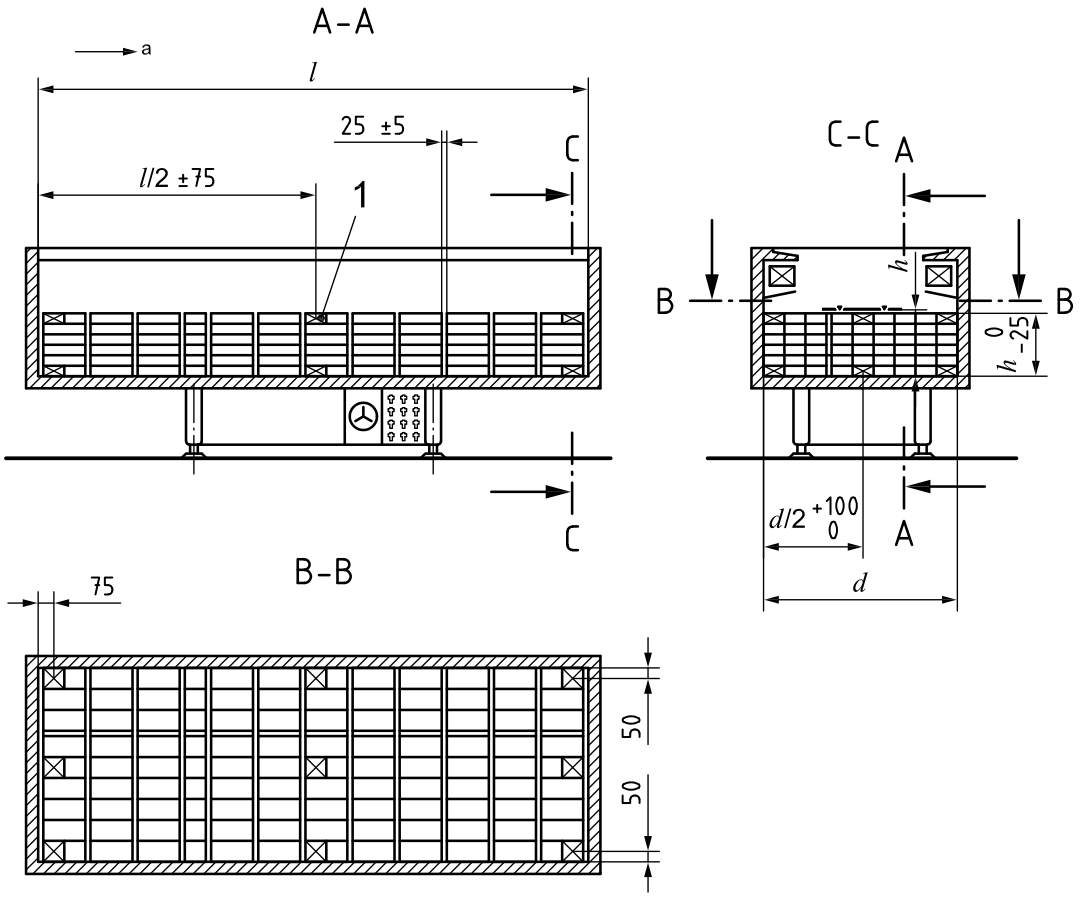
b Direction of forced air flow.

Figure 17 — Open island cabinet provided with forced air cooling (horizontal, open) and island with air discharge in the middle

Page 31, Figure 16

Replace Figure 16 with the following and renumber Figure 16 as Figure 18:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

h height at load limit

l length of the cabinet

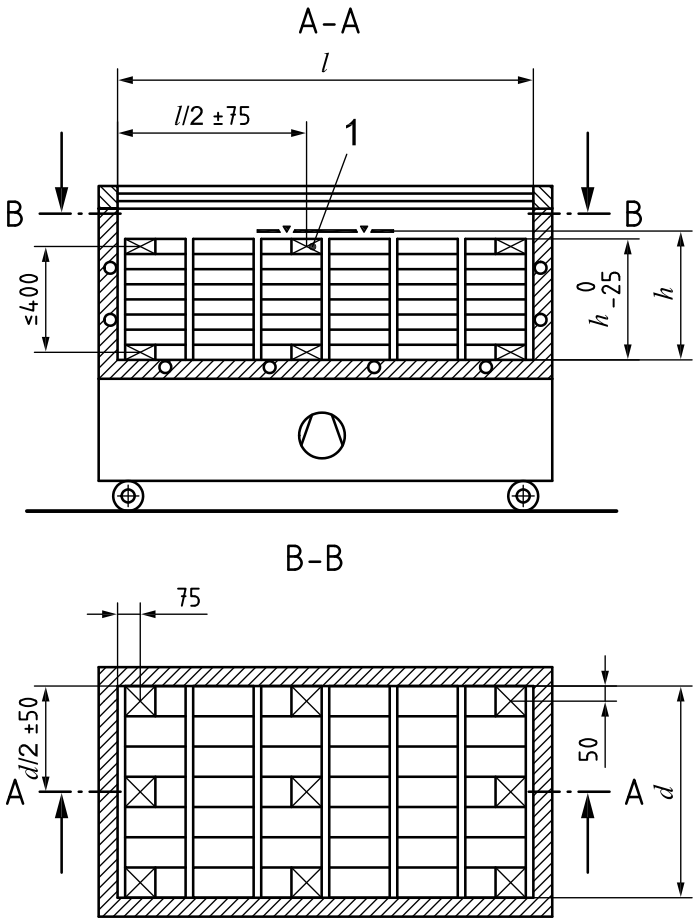
a Air currents parallel to the plane of the opening (in longitudinal direction).

Figure 18 — Open island cabinet provided with natural convection cooling (horizontal, open)

Page 32, Figure 17

Replace Figure 17 with the following and renumber Figure 17 as Figure 19:

Dimensions in millimetres



Key

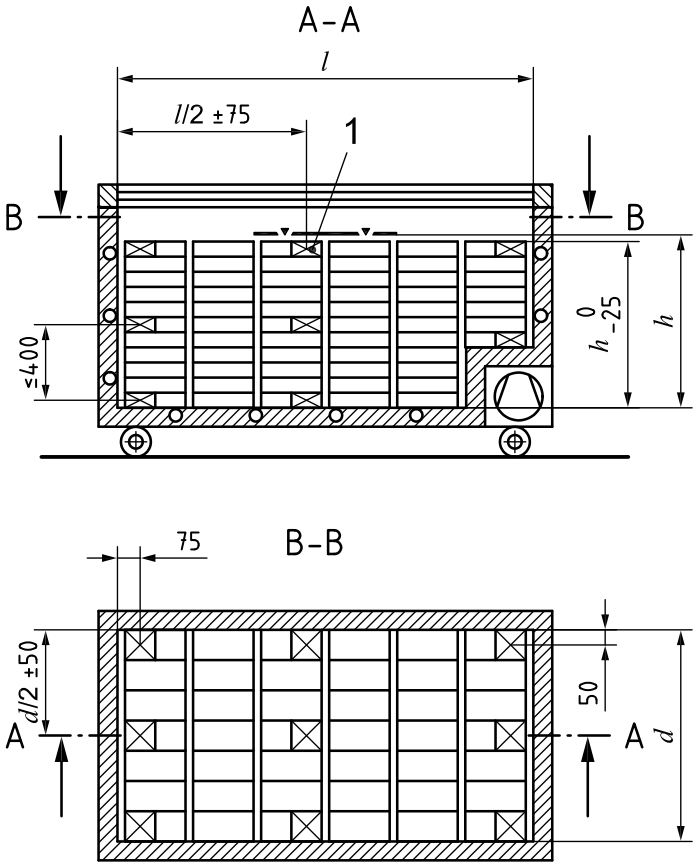
1 M-package
d depth of base deck
h height at load limit
l length of the cabinet

Figure 19 — Glass lid, island cabinet with flat base deck with and without tubes laid at the base (horizontal, closed)

Page 33, Figure 18

Replace Figure 18 with the following and renumber Figure 18 as Figure 20:

Dimensions in millimetres



Key

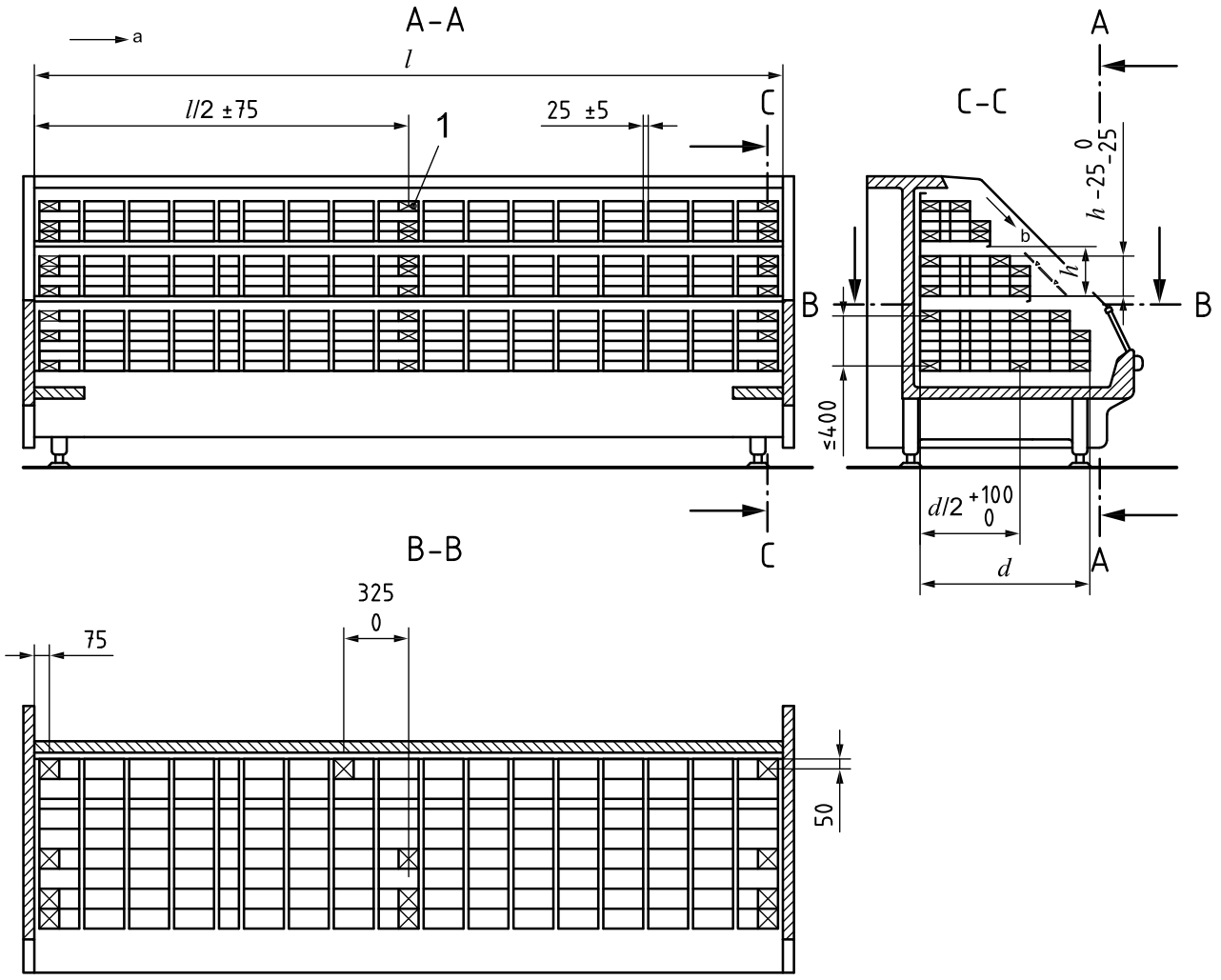
1 M-package
d depth of base deck
h height at load limit
l length of the cabinet

Figure 20 — Glass lid, island cabinet with stepped base deck with and without tubes laid at the base (horizontal, closed)

Page 34, Figure 19

Replace Figure 19 with the following and renumber Figure 19 as Figure 21:

Dimensions in millimetres



Key

1 M-package
d depth of base deck
h height at load limit
l length of the cabinet

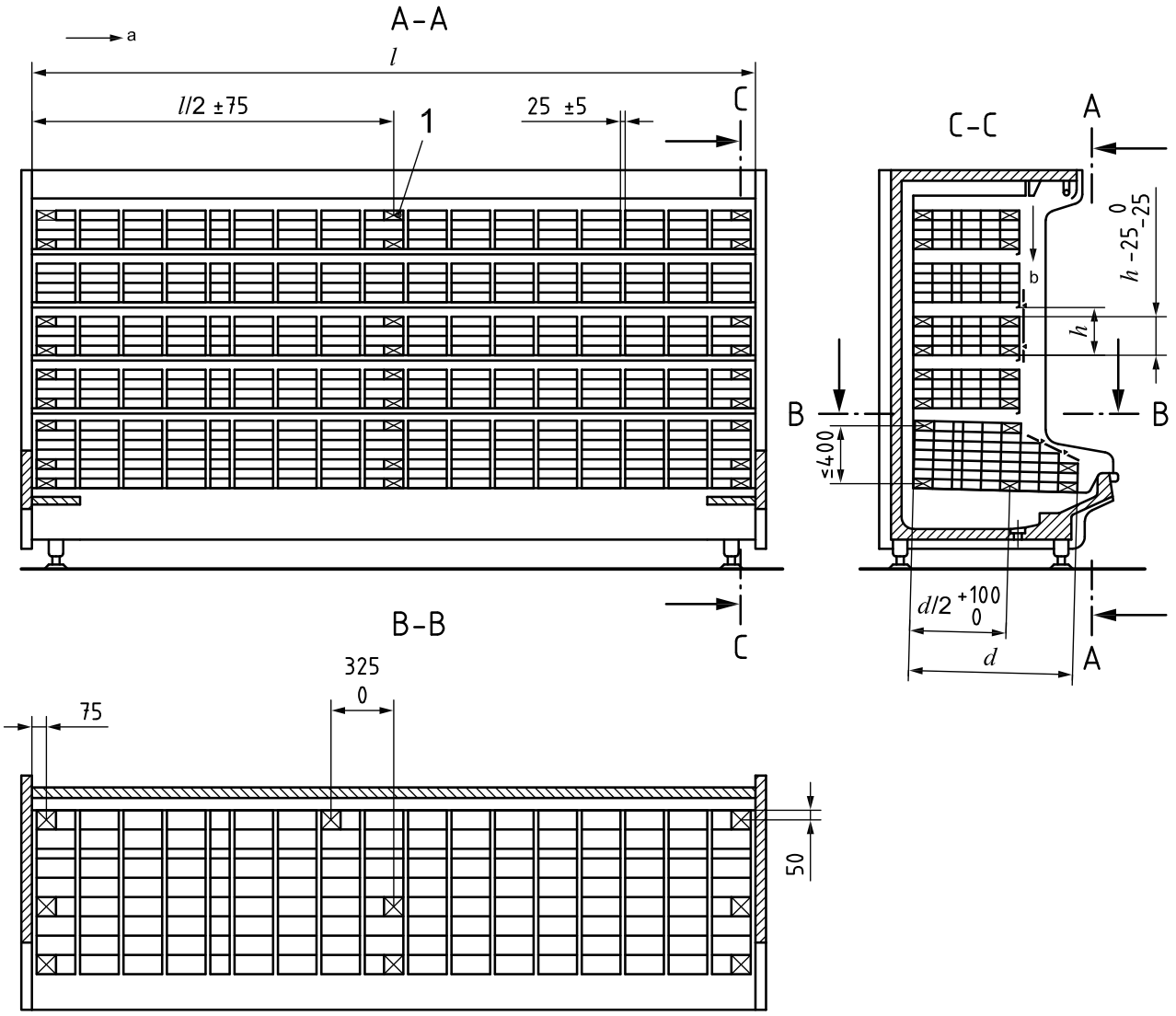
a Air currents parallel to the plane of the opening (in longitudinal direction).
b Direction of forced air flow.

Figure 21 — Semi-vertical cabinet provided with forced air cooling (vertical, open)

Page 35, Figure 20

Replace Figure 20 with the following and renumber Figure 20 as Figure 22:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

h height at load limit

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

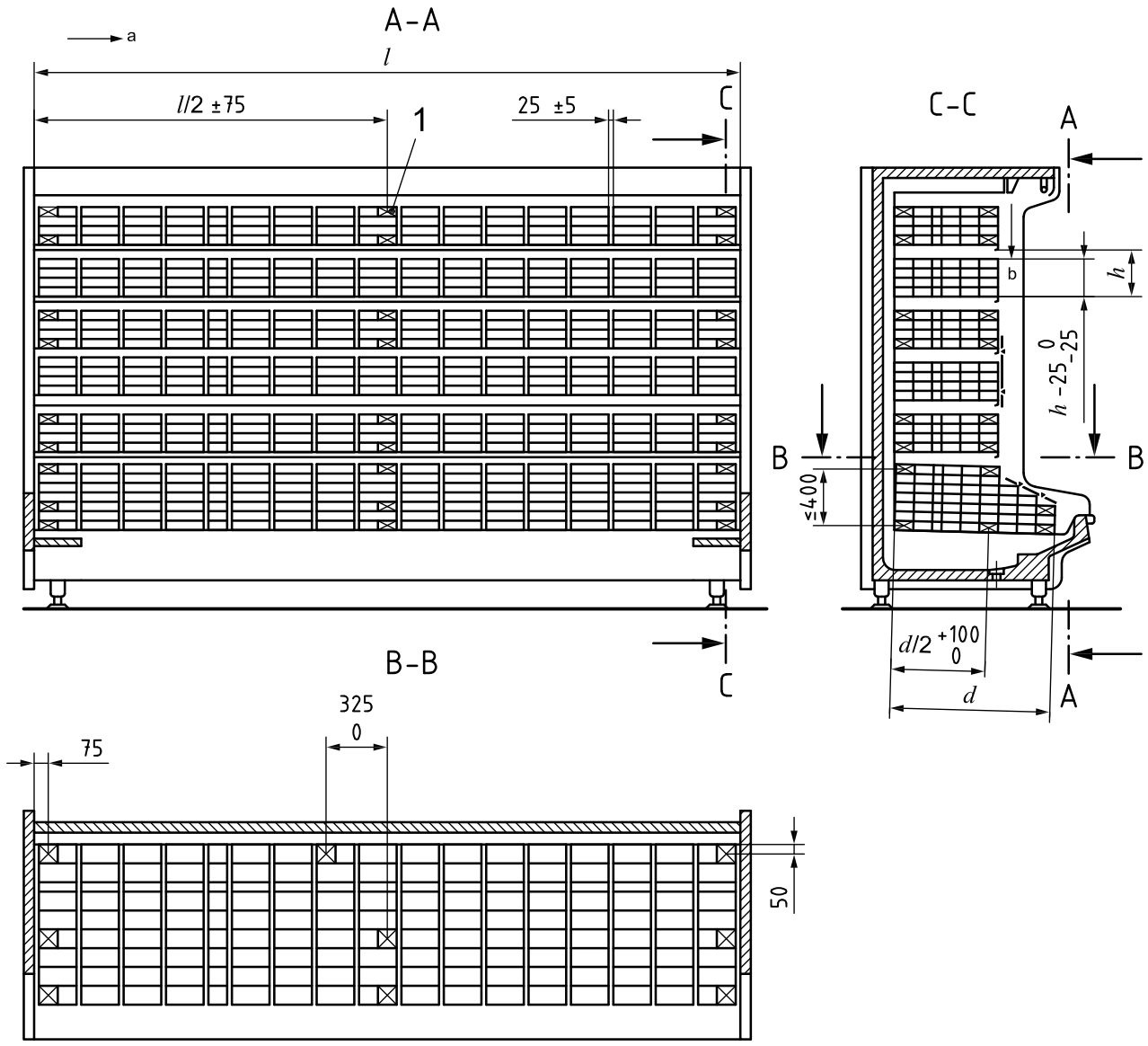
b Direction of forced air flow.

Figure 22 — Multi-deck cabinet provided with forced air cooling (vertical, open)

Page 36, Figure 21

Replace Figure 21 with the following and renumber Figure 21 as Figure 23:

Dimensions in millimetres



Key

1 M-package

d depth of base deck

h height at load limit

l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).

b Direction of forced air flow.

Figure 23 — Multi-deck cabinet provided with forced air cooling (vertical, open)

Page 37, Figure 22

Replace the title of Figure 22 with the following:

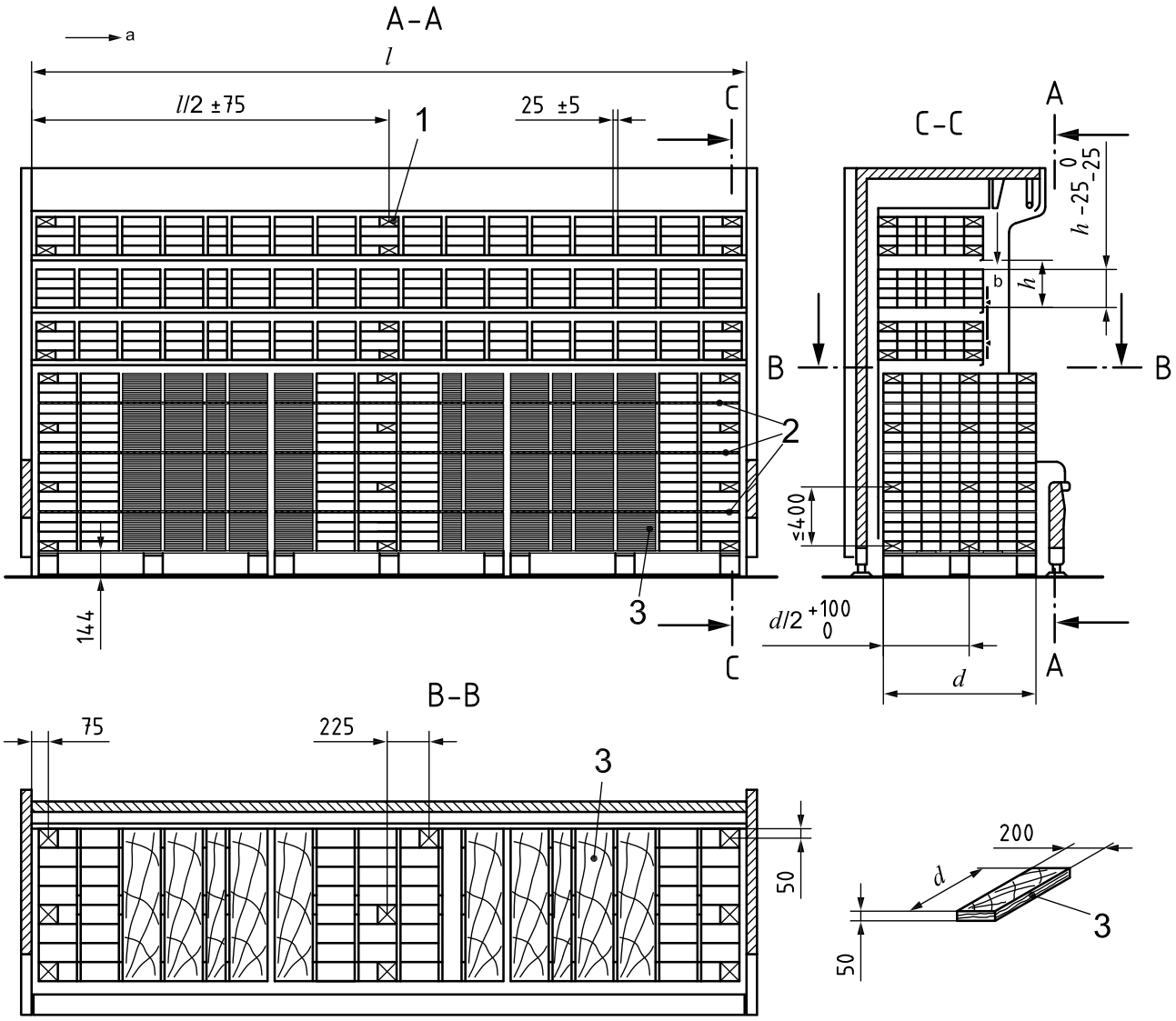
Figure 22 — Multi-deck cabinet provided with forced-air cooling for sensitive foodstuffs (vertical, open)

Renumber Figure 22 as Figure 24.

Page 38, Figure 23

Replace Figure 23 with the following, deleting the term “chilled” from the title and renumbering Figure 23 as Figure 25:

Dimensions in millimetres



Key

1 M-package
2 grids
3 wood loading
d depth of base deck
h height at load limit
l length of the cabinet

a Air currents parallel to the plane of the opening (in longitudinal direction).
b Direction of forced air flow.

Figure 25 — Roll-in cabinet provided with forced air cooling (vertical, open)

Page 39, Figure 24

Renumber Figure 24 as Figure 26.

Page 40, 5.3.2.5

In the first paragraph, replace “The temperatures will vary cyclically” with “The temperatures vary cyclically”.

Add the following two paragraphs at the end of subclause:

For closed refrigerated cabinets, stable conditions shall be determined prior to the door-opening sequence (see 5.3.3.2) and, if the cabinet is fitted with lighting, the lights shall be continuously left switched on.

For open refrigerated cabinets fitted with lighting and night-covers, stable conditions are reached with the cabinet continuously opened with the light continuously switched on.

Page 40, 5.3.2.7

Replace the subclause with the following:

5.3.2.7 Lighting and night-covers

5.3.2.7.1 Lighting

If the test cabinet is fitted with lighting, carry out the tests according to 5.3.3, 5.3.4, 5.3.5 and 5.3.6 as follows:

a) firstly, leave the cabinet lighting switched on continuously for a period of 24 h;

b) secondly, leave the cabinet lighting switched on for a period of 12 h, followed by 12 h with the cabinet lighting switched off.

5.3.2.7.2 Night-covers

If night-covers are supplied for open cabinets, carry out the tests as follows:

a) firstly, with the night-covers removed, leave the cabinet lighting on continuously for a period of 24 h;

b) secondly, with the night-covers removed, leave the cabinet lighting switched on for a period of 12 h; followed by 12 h with the night-covers on and the cabinet lighting switched off.

Page 41, 5.3.3.2

Replace the subclause with the following:

The test for closed refrigerated cabinets shall always be carried out on a complete cabinet, regardless of the number of doors or lids. Each door or lid shall be opened for frozen food applications six times per hour, while for chilled food applications, each shall be opened ten times per hour. Doors that are used for service, cleaning or loading of the cabinet only shall not be opened during this test. Where more than one door or lid pertains to the cabinet under test, the sequence in which the doors and lids are opened shall be staggered, i.e. in the case of two doors for frozen food applications: door 1 at 0 min, door 2 at 5 min, door 1 at 10 min, door 2 at 15 min, etc. For chilled food applications, door 1 at 0 min, door 2 at 3 min, door 1 at 6 min, door 2 at 9 min, etc.

Hinged lids and doors shall be opened beyond an angle of 60°. Sliding glass doors or lids shall be opened beyond 80 % of the maximum area which can be opened.

For frozen food applications, the door or lid shall be opened for a total of 6 s, while for chilled food applications, the door or lid shall be opened for a total of 15 s. During this opening period, the doors or lids shall be kept open beyond the minimum required opening, i.e. for 4 s for frozen food applications and for 13 s for chilled food applications.

Prior to the start of the 12-h period of door opening, each door or lid shall be opened once for 3 min. Where a cabinet is provided with more than one door or lid, each door or lid shall be opened once for 3 min consecutively.

Within the test period, the doors or lids shall be opened cyclically for 12 h within 24 h. The 12-h cycle of door or lid opening shall start at the beginning of the test period.

For closed cabinets, only the test of 5.3.2.7.1 b) is required.

Page 41, 5.3.3.2

Insert the following new subclause after 5.3.3.2:

5.3.3.3 Island with air discharge in the middle

5.3.3.3.1 The test for islands with air discharge in the middle shall consider the following design variations:

a) one chest, parts of the air distribution (fans, air ducts) and/or the refrigeration system (evaporator) are used for both sides of the cabinet;

b) one chest, air distribution and refrigeration system are completely separated; the sides of the island are equal and symmetric; all electrical components (fan motors, anti-sweat heaters, defrost heaters), the evaporators and thermostatic expansion valves are the same in each refrigerated volume, and the temperature control system, such as the defrost control system, are symmetrically mounted and independently operative in each specific refrigerated volume.

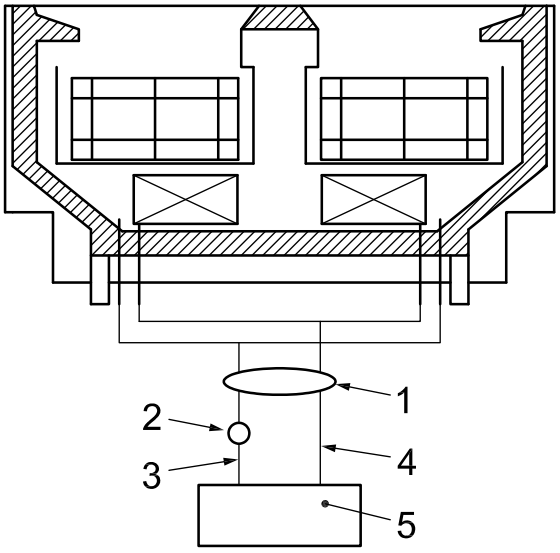
Test procedure:

— For design variation a)

The piping has to be organized in such a way that the whole cabinet is connected to a single refrigeration plant by one main liquid and one main suction line. Even if the island has two evaporators with separate piping, the suction and the liquid lines shall be connected to two main lines inside or outside the cabinet. All temperatures, pressure and mass flow measurements of the refrigerant shall be taken on the main lines. The piping shall be thermally insulated from the cabinet outlet to the locations where the measurements are taken. Both sides of the cabinet shall be loaded with M-packages and the temperature from both sides shall be monitored [see Figure 27 a)].

— For design variation b)

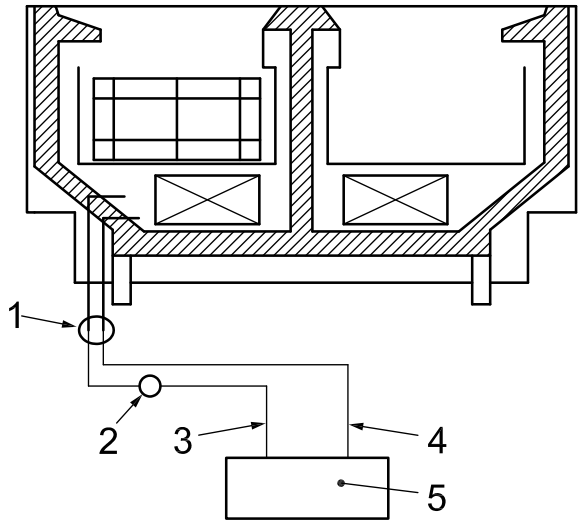
Only one side of the cabinet may be tested, considering it as a single case. Only the tested side(s) shall be loaded with M-packages and connected to the refrigerant plant [see Figure 27 b)].



a) Design variation a)

— For design variation b)

Only one side of the cabinet may be tested considering it like a single case. Only the tested side(s) shall be loaded with M-packages and connected to the refrigerant plant [see Figure 27 b)].



b) Design variation b)

Key

1 temperature and pressure measurements as in a single case (see 5.3.6.2.1 and Figure 31)
2 refrigeration mass flow meter (see 5.3.6.2.1 and Figure 31)
3 liquid supply (see 5.3.6.2.1 and Figure 31)
4 vapour return (see 5.3.6.2.1 and Figure 31)
5 condensing unit

Figure 27 — Island with air discharge in the middle — Design variation a) and design variation b)

5.3.3.3.2 As far as DEC and REC measurement and calculations are concerned (see 5.3.6), the following shall be considered.

— For design variations b), single side test:

the total value of REC_{RC} is double the value calculated for the single side tested;

the total value of DEC is double the value calculated for the single side tested.

— For design variations b), double side tests, follow design variation a).

— For the calculation of TDA, see Figure A.8.

Page 41, 5.3.3.3

Renumber the subclause as 5.3.3.4.

Page 42, 5.3.3.4

Renumber the subclause as 5.3.3.5.

Page 42, 5.3.3.4

Replace “(see Figure 25)” with “(see Figure 28)” in new 5.3.3.5 a) and b).

Page 42, 5.3.3.4

Replace “(see Figure 26)” with “(see Figure 29)” in new 5.3.3.5 c).

Page 42, Figure 25

Renumber Figure 25 as Figure 28.

Replace key items θ_b and θ_{al} of new Figure 28 with the following:

θ_b lowest temperature of coldest M-package [for chilled cabinets only; see 4.2.2 (Table 1)]

θ_{al} lowest temperature of all M-packages [for frozen cabinets only; see 4.2.2 (Table 1)]

Page 43, Figure 26

Renumber Figure 26 as Figure 29.

Page 43, 5.3.3.5

Renumber the subclause as 5.3.3.6.

Replace “(curve c in Figure 26)” with “(curve c in Figure 29)” in new 5.3.3.6.

Page 44, 5.3.4.3

Replace “the code shown in Figure 27” with “the code shown in Figure 30”.

Page 44, Figure 27

Renumber Figure 27 as Figure 30.

Page 45, 5.3.6.1.1

In the fourth paragraph, replace “[see Figures 28 a) and 29 a)]” with “[see Figures 31 a) and 32 a)]”.

Page 46, 5.3.6.1.2

In the first paragraph, replace “in accordance with Figure 28 a)” with “in accordance with Figure 31 a)”.

Page 46, 5.3.6.1.3

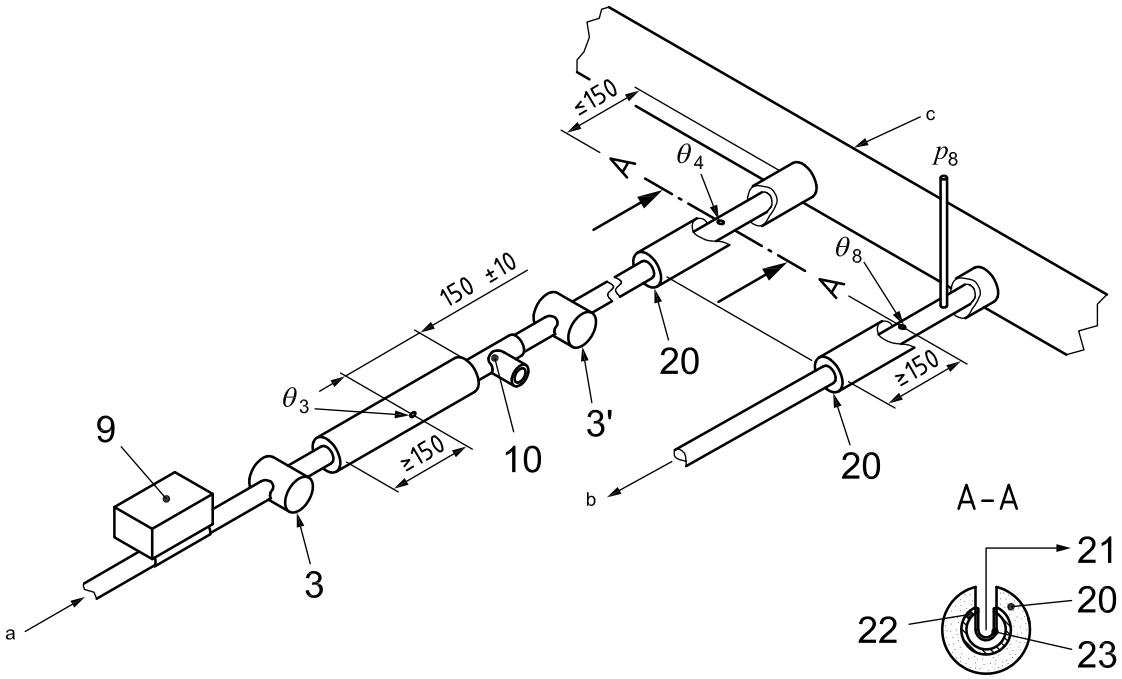
In the first paragraph, replace “in accordance with Figure 29 a)” with “in accordance with Figure 32 a)”.

Page 46, 5.3.6.2.1

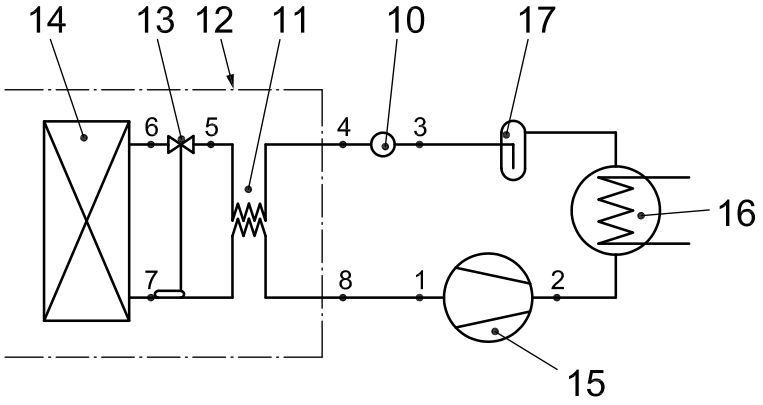
Replace “(see Figure 28)” with “[see Figure 32 a)]”.

Page 47, Figure 28 a) b) c)

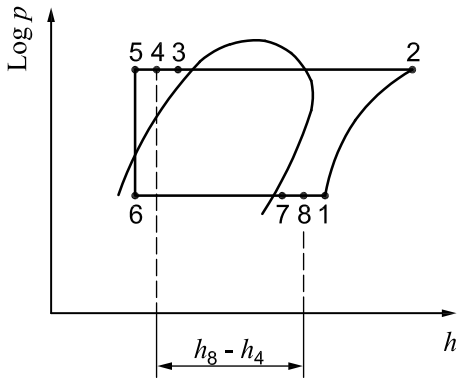
Replace Figure 28 a) b) and c) with the following and renumber as Figure 31 a) b) and c).



a) Connection to remote compression-type refrigerating system



b) Connection to remote compression-type refrigerating system



c) Pressure enthalpy diagram showing points referred to in Figure 31 b)

Figure 31 (*continued*)

Key

1 compressor inlet
2 compressor outlet
3 sight glass location for subcooled liquid state upstream flow meter
3' sight glass, optional for subcooled liquid state downstream flow meter
4 measurement point at the cabinet inlet
5 expansion device inlet
6 expansion device outlet and inlet of the evaporator
7 outlet of the evaporator and superheat measurement of the evaporator
8 measurement point at the outlet of the cabinet
9 inlet valve: open during refrigeration; closed during switch off or defrosting
10 refrigerant mass flow meter
11 fluid vapour heat exchange, if any
12 cabinet
13 expansion device
14 evaporator
15 compressor
16 condenser
17 liquid receiver
20 insulation (to at least 150 mm from temperature sensor
21 to temperature recorder
22 refrigerant circulation pipe
23 copper thermo-pocket for housing the temperature sensor (shall be filled with glycerine or a similar fluid)

[a] Liquid supply.
[b] Vapour return.
[c] Pipe connection to cabinet.

Figure 31 — Cabinets intended for connection to compression-type refrigerating systems

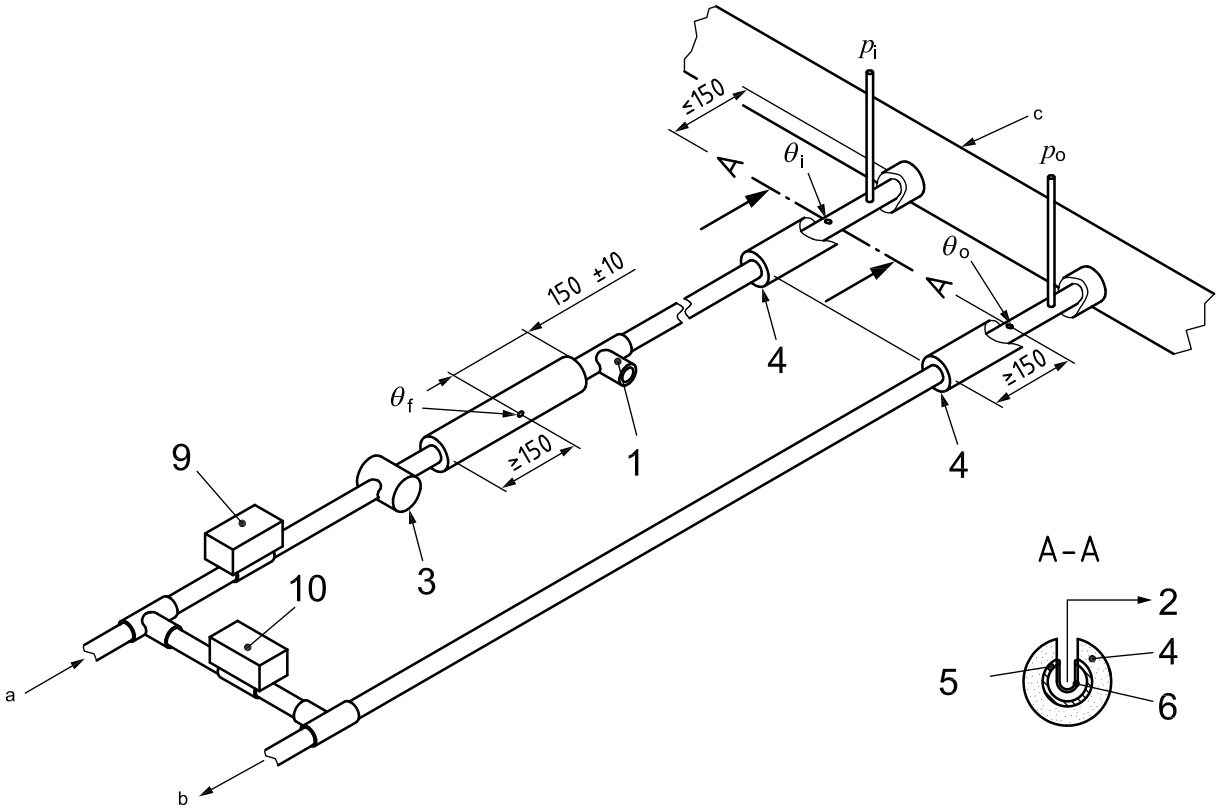
Page 48, 5.3.6.2.2

In the title, replace “(see Figure 29)” with “(see Figure 32)”.

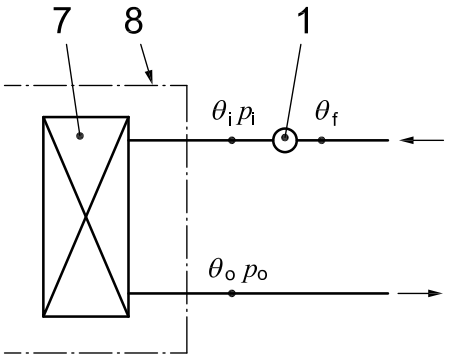
Pages 48 to 49, Figure 29 a)and b)

Replace Figure 29 a) and b) with the following and renumber Figure 29 a) and b) as Figure 32 a) and b):

Dimensions in millimetres



a) Connection to remote indirect-type refrigerating system



b) Reference point locations

Key

1 flow meter
2 to temperature recorder
3 sight glass
4 insulation (to at least 150 mm from temperature sensor)
5 refrigerant circulation pipe
6 copper thermo-pocket for housing the temperature sensor (shall be filled with glycerine or a similar fluid)
7 heat exchanger
8 cabinet
9 inlet valve: open during refrigeration, closed during switch off or defrosting
10 outlet valve: closed during refrigeration, open during switch off or defrosting

a Liquid supply.
b Liquid return.
c Pipe connection to cabinet.

Figure 32 — Cabinets intended for connection to indirect-type refrigerating systems

Page 49, 5.3.6.3.1

In a) replace “(see Figures 30 to 32)” with “(see Figures 33 to 35)”.

Page 50, 5.3.6.3.2

In the title, replace “(see Figures 30 to 33)” with “(see Figures 33 to 35)”.

Add the following at the end of the subclause:

The $\Phi_{24-\text{deft}}$ value shall be used in the REC calculation formula (see 5.3.6.3.3).

Pages 51 to 52, Figure 30

Renumber Figure 30 as Figure 33.

Page 53, Figure 31

Renumber Figure 31 as Figure 34.

Page 54, Figure 32

Renumber Figure 32 as Figure 35.

Pages 51 to 54, Figures 30 to 32

Replace key item I of new Figures 33, 34 and 35 with the following:

I total heat extraction (Q_{tot} = area under graph)

Page 55, 6.2.2

Replace the text with the following:

According to 5.2.2.

See Table 9.

Renumber Table 7 as Table 9.

Page 55, 6.2.3

Replace the text with the following:

See Annex C.

Page 55, 6.3.1

Replace the text with the following:

According to 5.3.1.

See Table 10.

Pages 55 to 58, Tables 8 to 13

Update the following references in Tables 8 to 13 to reflect the renumbering of subclauses throughout the text.

Replace Table 8 with the following and renumber Table 8 as Table 10:

Table 10 — Conditions for tests inside test room

Subclause no.	Description
5.3.1.1	Statement that the test room, test packages, filling material (wood loading), M-packages and the instrumentation used are in accordance with 5.3.1, specifying if the alternative for filling test packages described in 5.3.1.6 are used
5.3.1.3	Test room climate class for which the cabinet is intended and in which the test has been made

Page 56, 6.3.2

Replace the text with the following:

See Table 11.

Page 56, Table 9

Replace Table 9 with the following and renumber Table 9 as Table 11.

Table 11 — Cabinet preparation for tests inside test room

Subclause no.	Description	Symbol	Unit
5.3.2.1	The cabinet location within the test room using the Figure 9 presentation	X, B, Y, A	mm
5.3.2.1	For cabinets intended to be placed against a wall, the location of the vertical partition at the rear of the cabinet	d_p	mm
5.3.2.3	Number of the figure according to which the cabinet was loaded		
5.3.2.4	The method of temperature control, defrost process, defrost termination, setting parameters and sensor locations		
5.3.2.7	Whether the test was made with or without night-covers and/or light		
5.3.2.6	Whether the test was made using alternative filling test packages as specified in 5.3.1.6		
5.3.2.9	When the condensing unit is remote from the cabinet for compression-type refrigerating systems the international number of the refrigerant (see ISO 817)		
5.3.2.9	When the condensing unit is remote from the cabinet for indirect-type refrigerating systems:		
	chemical composition of the secondary refrigerant		
	concentration of the secondary refrigerant		
	The physical properties of the secondary refrigerant:		
	specific heat at the cabinet inlet/outlet	c_i/c_o	kJ/kg/°C
	density	ρ	kg/m^3

Page 56, 6.3.3

Replace the text with the following:

According to 5.3.3.

See Table 12.

Page 56, Table 10

Replace Table 10 with the following and renumber Table 10 as Table 12.

Table 12 — Temperature test for tests inside test room

Subclause no.	Description	Symbol	Unit
5.3.3.1	For cabinets fitted with night-covers and/or lights, if the results are for the "first" or the "second" test of 5.3.2.7.1 and 5.3.2.7.2 or for both tests (two sets of results shall be provided for the latter case)		
5.3.3.2	The time/temperature curves of the warmest and the coldest M-packages and the extreme values θ_{ah}, θ_b and if necessary θ_{al} and the resulting cabinet classification (see 4.2.2 Table 1, 5.3.3.5 and Figure 28)	θ_{ah} θ_b θ_{al}	°C
5.3.3.6	The average mean temperatures of all M-packages (see also 5.3.3.5 and Figure 29)		°C
5.3.3.5	For temperature display systems, the sensor location and the maximum values displayed		
	under stable operating conditions		°C
	at the warmest moment, during or just after the defrost period		°C
	Conditions where the display of temperature may be interrupted (e.g. during defrosting)		
5.3.3.4	The results from defrost check according to 5.3.3.3		

Page 57, 6.3.4

Replace the text with the following:

According to 5.3.4.

See Table 13.

Page 57, Table 11

Replace Table 11 with the following and renumber Table 11 as Table 13.

Table 13 — Water vapour condensation test

Subclause no.	Description	Symbol	Unit
5.3.4.1	For cabinets fitted with night-covers and/or lights, state whether the results are for the “first” or the “second” test of 5.3.2.7.1 and 5.3.2.7.2 or for both tests. Two sets of results shall be provided in the latter case		
5.3.4.1	Whether any manual switch provided for anti-condensation heaters was switched off		
5.3.4.2	The duration of the period of observation		h
	Coded sketches as defined in 5.3.4.3		

Page 57, 6.3.5

Replace the text with the following:

According to 5.3.5.

See Table 14.

Page 57, Table 12

Replace Table 12 with the following and renumber Table 12 as Table 14.

Table 14 — Electrical energy consumption test

Subclause no.	Description	Symbol	Unit
5.3.5.1	For cabinets fitted with night-covers and/or lights, state whether the results are for the “first” or the “second” test of 5.3.2.7.1 and 5.3.2.7.2 or for both tests. Two sets of results shall be provided in the latter case		
5.3.5.2	For cabinets fitted with integral condensing unit:		
	direct electrical energy consumption (= total electrical energy consumption)	DEC (TEC)	kWh/24 h
	compressor switching on/off frequency		
	relative running time		
5.3.5.3	For cabinets with remote condensing unit:		
	direct electrical energy consumption	DEC	kWh/24 h

Page 58, 6.3.6

Replace the text with the following:

According to 5.3.6.

See Table 15.

Page 58, Table 13

Replace Table 13 with the following and renumber Table 13 as Table 15.

Table 15 — Heat extraction rate measurement when the condensing unit is remote from the cabinet

Subclause no.	Description	Symbol	Unit
5.3.6.1.1	For cabinets fitted with night-covers and/or lights, state whether the results are for the "first" or the "second" test of 5.3.2.7.1 and 5.3.2.7.2 or for both tests. Two sets of results shall be provided in the latter case		
5.3.6.1.2 See Figures 31, 33 and 34	For compression-type refrigerating systems:		
	curves and mean values of the suction pressure, in service, and the refrigerant temperature at the cabinet outlet	p_8 θ_8	Pa °C
	mean value of the saturated evaporator temperature during the running time and during the last 10 % of all running periods	θ_{mrun} θ_{min}	°C °C
	arithmetic mean suction superheat at the cabinet outlet		°C
	arithmetic mean suction superheat at the evaporator outlet		°C
	curve and mean value of the liquid temperature at the cabinet inlet	θ_4	°C
	curve and mean value of the mass flow rate of refrigerant	q_m	kg/s
5.3.6.1.3 See Figures 29 and 32	For indirect refrigerating systems:		
	curve and mean value of the secondary refrigerant temperature at the cabinet inlet	θ_i	°C
	curve and mean value of the secondary refrigerant temperature at the cabinet outlet	θ_o	°C
	mean value of the median temperature of the secondary refrigerant during the running time	θ_{mrun}	°C
	mean value of the median temperature of the secondary refrigerant during the last 10 % of all running periods	θ_{min}	°C
	curve and mean value of the mass flow rate	q_m	kg/s
	pressure drop between the inlet and outlet of the cabinet excluding valves not fitted by the manufacturer as part of the cabinet	$p_{irun} - p_{orun}$	Pa
5.3.6.3	Heat extraction rates necessary for the cabinet which result from the foregoing measurements:		
		Φ_{run}	kW
		Φ_{run75}	kW
		Φ_{24}	kW
		$\Phi_{24\text{-deft}}$	kW
	refrigeration electrical energy consumption	REC	kWh/24 h
	total energy consumption	TEC	kWh/24 h
	for cabinets where cycling of the system is necessary for operational reasons, the percentage running time	t_{rr}	%

Page 59, 7.1

In the first paragraph, replace “[see Figure 33 b)], on the inside face, as shown in Figure 35” with “[see Figure 36 b)], on the inside face, as shown in Figure 38”.

In the second paragraph, replace “[see Figure 33 a)]” with “[see Figure 36 a)]”; replace “[see Figure 33 b)]” with “[see Figure 36 b)]”; replace “(see Figure 34)” with (see Figure 37)”.

Replace the third paragraph with the following:

> Where a load limit line cannot be marked on the inside face because of cabinet design, an outline sketch showing the load limit shall be fixed in a visible position and in the manufacturer's instruction handbook.

Page 59, Figures 33 and 34

Renumber Figures 33 and 34 as Figures 36 and 37.

Page 60, Figure 35

Renumber Figure 35 as Figure 38.

Page 60, 7.3 b)

Replace with the following:

b) Overall external dimensions in service including: distance, d_p, between the back of the cabinet and the vertical test panel, if applicable (see 5.3.2.1).

Page 60, 7.3 c) 6)

Replace with the following:

6) for cabinets fitted with night-covers and/or lights, if the results are for the “first” or the “second” test of 5.3.2.7.1 and 5.3.2.7.2 or for both tests, in the latter case with two sets of information being provided for

   i) the electrical energy consumption (DEC), in kilowatt hours per 24 h, measured in accordance with the test described in 5.3.5, and

   ii) if the condensing unit is not fitted in the refrigerated cabinet, the information referred to heat extraction rate according to 5.3.6.

   NOTE For temperature and climate classes, see 4.2.2 and 5.3.1.3.1.

Page 63, A.2.2

Rename the Note as Note 1.

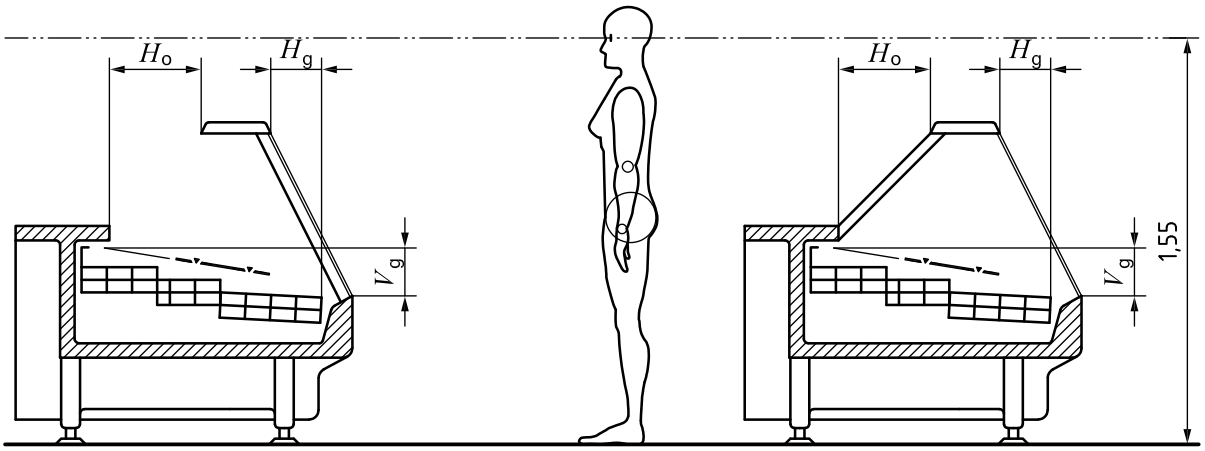
Add the following before Figure A.1:

> NOTE 2 For cabinets with glazing on two or more sides of the cabinet, the TDA shall be calculated for the total glazed area [see Figures A.2 (island), A.8 and A.9].

Page 63, Figure A.1

Replace the figure with the following:

Dimensions in metres



	L_{oh} = 2,500	H_o = 0,350
T_{gh} = 90 %	L_{gh} = 2,400	H_g = 0,194
	L_{ov} = 2,500	V_o = 0
T_{gv} = 90 %	L_{gv} = 2,400	V_g = 0,185

TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	1,694

	L_{oh} = 2,400	H_o = 0,350
T_{gh} = 90 %	L_{gh} = 2,500	H_g = 0,194
	L_{ov} = 2,500	V_o = 0
T_{gv} = 90 %	L_{gv} = 2,500	V_g = 0,185

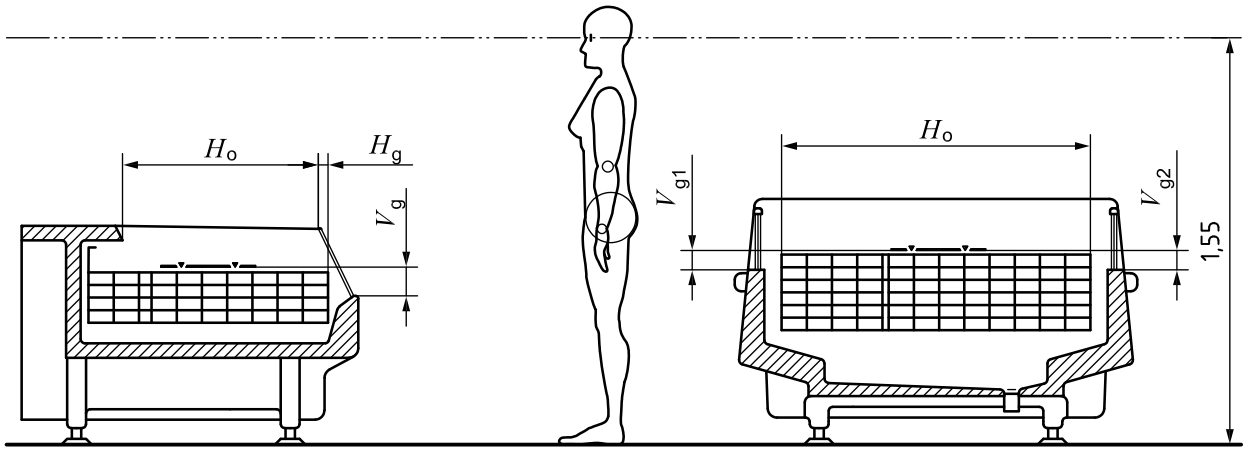
TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	1,693

Figure A.1 — Horizontal, serve-over counters

Page 64, Figure A.2

Replace the figure with the following:

Dimensions in metres



	L_{oh} = 2,500	H_o = 0,770
T_{gh} = 90 %	L_{gh} = 2,500	H_g = 0,012
	L_{ov} = 2,500	V_o = 0
T_{gv} = 90 %	L_{gv} = 2,500	V_g = 0,090

	L_{oh} = 2,500	H_o = 1,176
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} =2,500	V_o = 0
T_{gv1} = 81 %	L_{gv1} = 2,400	V_{g1} = 0,058
T_{gv2} = 81 %	L_{gv2} = 2,400	V_{g2} = 0,058

TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	2,155

TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_{g1} \times T_{gv1} \times L_{gv1})) + (V_{g2} \times T_{gv2} \times L_{gv2})$	3,166

Figure A.2 — Horizontal, open, wall-site and island cabinets

Page 64, Figure A.3

Delete “chilled,” from the figure title.

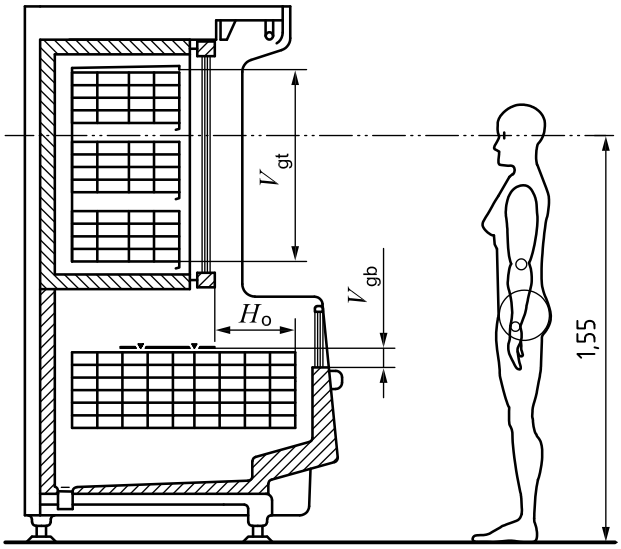
Page 65, Figure A.4

Delete “chilled,” from the figure title.

Page 65, Figure A.5

Replace Figure A.5 with the following (while deleting the term “frozen,” from the title):

Dimensions in metres



	L_{oh} = 2,500	H_o = 0,306
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 0
T_{gvt} = 73 %	L_{gv} = 2,250	V_{gvt} = 0,731
T_{gvb} = 73 %	L_{gv} = 2,400	V_{gvb} = 0,058

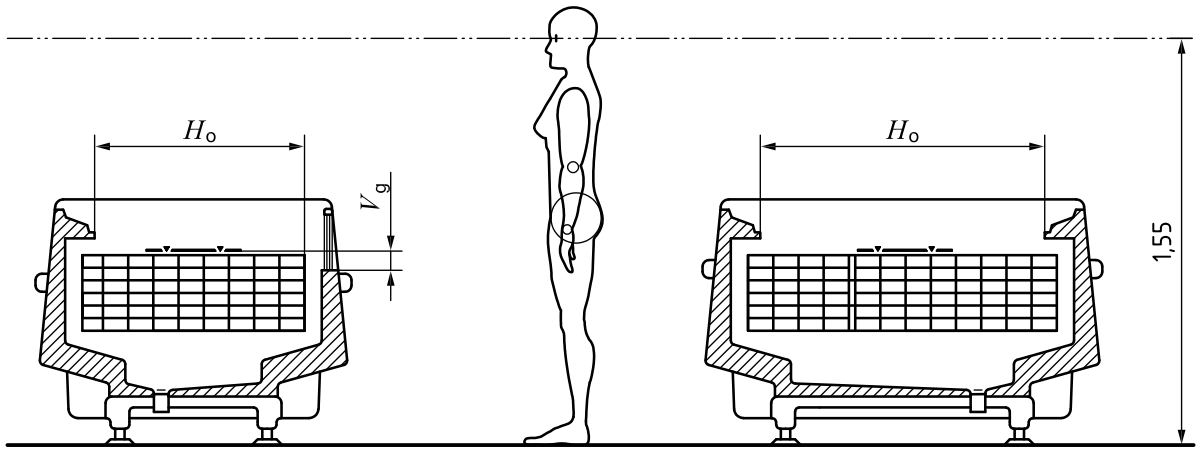
TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	2,067

Figure A.5 — Combined, glass door top, open bottom, cabinet

Page 66, Figure A.6

Replace Figure A.6 with the following (while deleting the term “frozen,” from the title):

Dimensions in metres



	L_{oh} = 2,500	H_o = 0,800
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 0
T_{gv} = 73 %	L_{gv} = 2,400	V_g = 0,058

TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	2,102

	L_{oh} = 2,500	H_o = 1,084
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 0
T_{gv} = 100 %	L_{gv} = 2,500	V_g = 0

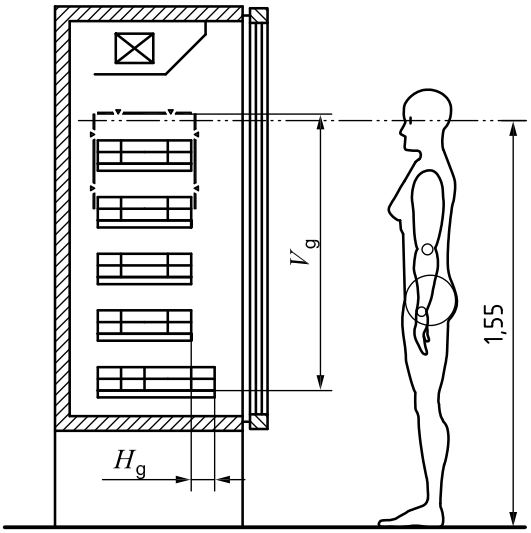
TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	2,710

Figure A.6 — Horizontal, open, island cabinets

Page 66, Figure A.7

Replace Figure A.7 with the following (while deleting the term “frozen,” from the title):

Dimensions in metres



	L_{oh} = 2,500	H_o = 0
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 0
T_{gv} = 64 %	L_{gv} = 2,250	V_g = 1,053

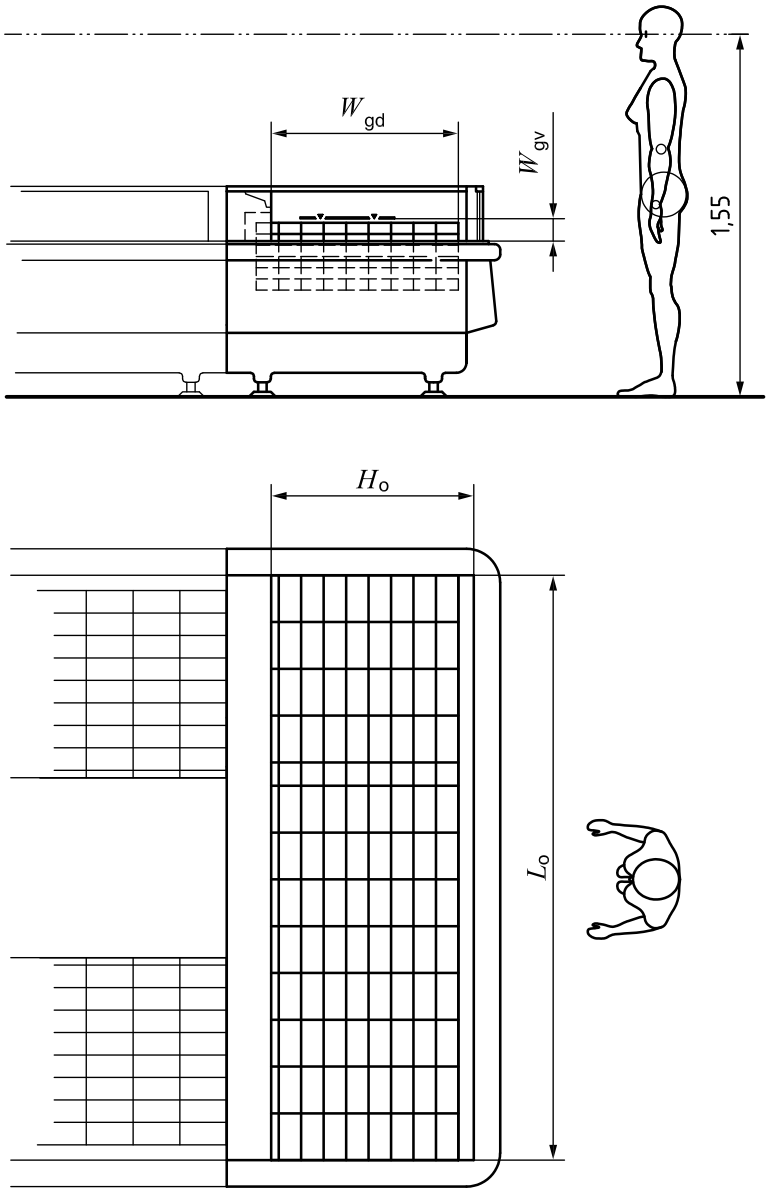
TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv})$	1,516

Figure A.7 — Vertical, glass door, cabinet

Page 67, Figure A.8

Replace Figure A.8 with the following, thus replacing the TDA calculation (while deleting the term “frozen,” from the title):

Dimensions in metres



	L_{oh} = 2,500	H_o = 0,800
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 0
T_{gv} = 73 %	L_{gv} = 2,400	V_g = 0,058
T_{gw} = 73 %	W_{gv} = 0,058	W_{gd} = 0,800

TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv}) + (2 \times T_{gw} \times V_{gw} \times W_{gd})$	2,169

Figure A.8 — Horizontal, open, island end cabinet

Page 68, Figure A.9

Replace the TDA calculation of Figure A.9 with the following:

	L_{oh} = 2,500	H_o = 0,291
T_{gh} = 100 %	L_{gh} = 2,500	H_g = 0
	L_{ov} = 2,500	V_o = 1,367
T_{gv} = 100 %	L_{gv} = 2,500	V_g = 0
T_{gw} = 81 %	W_{gv} = 1,022	W_{gd} = 0,415

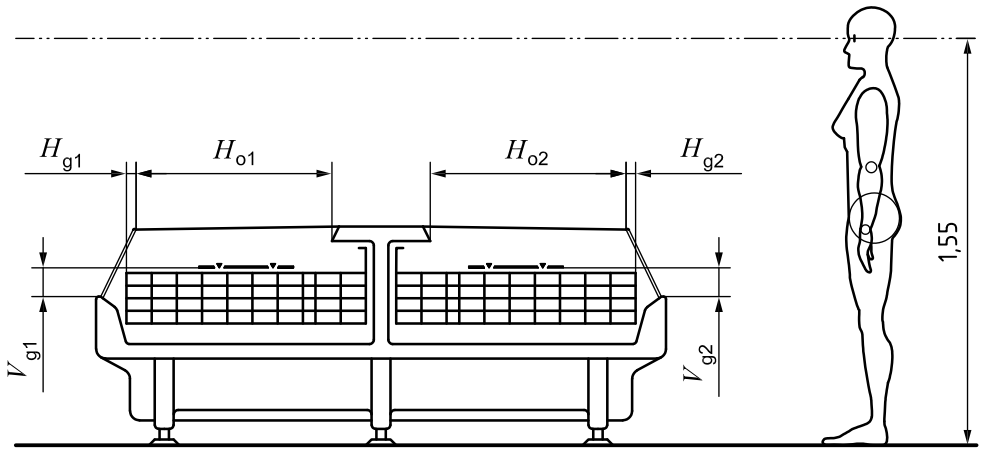
TDA = $(H_o \times L_{oh}) + (H_g \times T_{gh} \times L_{gh}) + (V_o \times L_{ov}) + (V_g \times T_{gv} \times L_{gv}) + (2 \times T_{gw} \times V_{gw} \times W_{gd})$	4,832

Figure A.9 — Vertical, chilled, multi-deck end cabinet

Page 68, Annex A

Add the following new Figure A.10:

Dimensions in metres



	L_{oh1} = 2,500	H_{o1} = 0,770
	L_{oh2} = 2,500	H_{o2} = 0,770
T_{gh1} = 73 %	L_{gh1} = 2,400	H_{g1} = 0,012
T_{gh2} = 73 %	L_{gh2} = 2,400	H_{g2} = 0,012
T_{gv1} = 73 %	L_{gv1} = 2,400	V_{g1} = 0,090
T_{gv2} = 73 %	L_{gv2} = 2,400	V_{g2} = 0,090

TDA = $(H_{o1} \times L_{oh1}) + (H_{o2} \times L_{oh2}) + (H_{g1} \times T_{gh1} \times L_{gh1}) + (H_{g2} \times T_{gh2} \times L_{gh2}) + (V_{g1} \times T_{gv1} \times L_{gv1}) + (V_{g2} \times T_{gv2} \times L_{gv2})$	4,207

Figure A.10 — Island with air discharge in the middle

Pages 69 to 75, Annex B

Delete the annex (as it is not applicable).

Page 76, Annex C

Renumber Annex C as Annex B.

In the third row, beginning with “The performance evaluation is taken on:”, replace “the most exposed to the infra red radiation, will be the first taken by the consumers” with “the most exposed to the infra red radiation are the first taken by the consumers”.

Page 77, D.1.3

Renumber Annex D as Annex C.

Replace “the manufacturer's instructions that will give the required temperature” with “the manufacturer's instructions, which give the required temperature”.

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