PS: IEC: 62552-2/2018

Adopted

PAKISTAN STANDARD

HOUSEHOLD REFRIGERATING APPLIANCES - CHARACTERISTICS AND TEST METHODS - PART 2: PERFORMANCE REQUIREMENTS

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HOUSEHOLD REFRIGERATING APPLIANCES - CHARACTERISTICS AND TEST METHODS - PART 2: PERFORMANCE REQUIREMENTS

0. FOREWORD

0.1 This Pakistan Standard was adopted by the authority of the Board of Directors for Pakistan Standard and Quality Control Authority after approval by the Technical Committee for "Electrical Appliances & Accessories (TC-3)" had been approved and endorsed by the Electrotechnical National Standards Committee on 31 January 2018.

0.2 This Pakistan Standard was adopted on the basis of PS: IEC: 62552-2/2018 since IEC Standard have been established in 2015, hence it is deemed necessary to adopt the International standard to keep abreast with the latest technology and as par with IEC standard.

0.3 This Pakistan Standard is an adoption of IEC: 62552-2-2018 "Household refrigerating appliances - Characteristics and test methods - Part 2: Performance requirements," and its use hereby acknowledged with thanks.

0.4 This standard is subject to periodical review in order to keep pace with the development in industry. Any suggestions for improvement shall be recorded and placed before the revising committee in due course.

0.5 This standard is intended chiefly to cover the technical provisions relating to this standard and it does not include all the necessary provisions of a Contract.

CONTENTS

HOUSEHOLD REFRIGERATING APPLIANCES – CHARACTERISTICS AND TEST METHODS –

Part 2: Performance requirements

1 Scope

This part of IEC 62552 specifies the essential characteristics of household **refrigerating appliances** cooled by internal natural convection or forced air circulation, and specifies test methods for checking the characteristics.

This part of IEC 62552 describes the methods for the determination of performance requirements. Although there is some commonality in the set-ups for different tests (and so it may be an advantage to apply them all to one sample), these are separate tests to evaluate specific characteristics of the sample being tested. This part of IEC 62552 does not specify a procedure to generalise the results from sample test results to a prediction of the characteristics of the whole population from which that sample was selected.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62552-1:2015, *Household refrigerating appliances – Characteristics and test methods – Part 1: General requirements*

IEC 62552-3:2015, *Household refrigerating appliances – Characteristics and test methods – Part 3: Energy consumption and volume*

3 Terms, definitions and symbols

For the purposes of this document, the terms, definitions and symbols given in IEC 62552-1:2015 apply.

4 Performance requirements and tests covered in this standard

4.1 General

This standard sets out tests to assess the performance of household and similar **refrigerating appliances**. While this standard does not require these tests to be performed, when they are performed, they shall be carried out as specified.

4.2 Storage test

The storage test is used to establish whether the **refrigerating appliance** is capable of maintaining suitable internal **storage temperatures** in a range of ambient conditions defined under the climate classes for which it is **rated**. See Clause 6.

4.3 Cooling capacity test

The **cooling capacity** test is used to measure the load processing capability of **fresh food compartment**s by determining the time to pull down a specified test load from ambient to a specified temperature. See Clause 7.

4.4 Freezing capacity test

The **freezing capacity** test is used to measure the load processing capability of **frozen compartment**s by determining the time to pull down a specified test load from ambient to a specified temperature. This test is required to establish whether a **frozen compartment** also qualifies for a **four-star** performance rating. See Clause 8.

4.5 Automatic ice-making capacity test

The **ice-making capacity** test is used to determine the quantity of new ice cubes that can be produced over a specified period of time. See Clause 9.

4.6 Other tests

Other tests that may not be required to be performed are found in the annexes.

These tests are

a) Pull-down test (Annex A): This test is used to measure the reserve refrigerating capacity of a **refrigerating appliance**.

b) Wine storage test (Annex B): This test is used to check compliance with the requirements of Part 2 at appropriate **ambient temperatures** for the various climate classes.

c) Temperature rise test (Annex C): This test is used to determine the time taken for the temperature to rise in the warmest test package from –18ºC to –9ºC after the power is disconnected. It is applicable to **refrigerating appliances** with one or more **three-star** or **four-star compartments**.

d) Water vapour condensation test (Annex D): This test is used to determine the extent of water condensation on the external surface of the **refrigerating appliance** under specified ambient conditions.

4.7 Test summary

Table 1 provides a summary of the tests to be performed.

Table 1 – Test summary

Clause / Annex and Test	**Ambient**		**Pantry and cellar**	**Fresh food**	**Chill**	**zero star**	**1 and 2 star**	**3 and 4 star**	**Temperature requirements after test has started**
Clause 6 Storage	Various	Packages	No		Yes	No	Yes		To hold initial values
		Initial temp	Mean		Instant	Mean	Max		
Clause 7 **Cooling capacity**	25 °C	Packages	No						For test load final only
		Initial temp	Table 2	+4 °C ± 0,5 K	Table 2	Maximum/ minimum	Average/ minimum		
Clause 8 **Freezing capacity**	25 °C	Packages	M-packages only		Yes	No	Yes		Yes excursion and final
		Initial temp	Table 2		Not measured	Maximum/minimum			
Clause 9 Auto ice-making	25 °C	Packages	No						No
		Initial temp	As for Table 2			Maximum/minimum			
Annex A Pull-down	43 °C	Packages	No						Final only
		Initial temp	43 °C						
Annex C Temp rise	25 °C	Packages	As for the storage test						For –18 °C **compartments** only
		Initial temp	Not specified					–18 °C	
Annex D Condensation	25 °C for SN and N 32 °C for ST and T	Packages	No						To hold initial values
		Initial temp	≤ energy test temperatures as in Table 1 in IEC 62552-3:2015						

NOTE 1 For definitions of symbols, see 3.7 in IEC 62552-1:2015.

NOTE 2 In the event of any discrepancy between data in this Table and the individual test procedures, the test procedures take precedence.

NOTE 3 Wine storage test parameters are specified in Annex B.

Table 2 – Compartment temperatures

°C								
Compartment type								
Fresh food		**Three-star and four-star**	**Two-star**	**One-star**	**Zero-star**	**Chill**	**Cellar**	**Pantry**
T_{1m}, T_{2m}, T_{3m}	T_{ma}	T^{***} [a]	T^{**} [a]	T^{*} [a]	T_{zma}	T_{cci}	T_{cma}	T_{pma}
$0 \leq T_{1m}$, T_{2m}, $T_{3m} \leq +8$	$\leq +4$	≤ -18 [b]	≤ -12 [b]	≤ -6	≤ 0	$-3 \leq T_{cci} \leq +3$	$+2 \leq T_{cma} \leq +14$	$+14 \leq T_{pma} \leq +20$
average	average	maximum	maximum	maximum	average	instantaneous	average	average

[a] The superscripts attached to the symbol T correspond to the **three-star** and **four-star**, **two-star** or **one-star compartment** temperature.

[b] During a **defrost and recovery period**, these **storage temperatures** of **frost-free refrigerating appliances** are permitted to rise by no more than 3 K.

NOTE For definitions of symbols, see 3.7 in IEC 62552-1:2015

5 General test conditions

Unless otherwise noted, test room set-up and instrumentation shall be as specified in Annex A of IEC 62552-1:2015.

Unless otherwise noted, installation and set-up of **shelves**, drawers, bins, flaps and controls etc. shall be as specified in Annex B of IEC 62552-1:2015.

6 Storage test

6.1 Objective

The purpose of this test is to check that the **refrigerating appliance** is capable of maintaining specified internal temperatures at different **ambient temperatures**.

Under the conditions specified in this clause (Clause 6) and at the **ambient temperatures** for the appropriate climate classes as specified in A.3.2.3 of IEC 62552-1:2015, the **refrigerating appliance** shall be capable of maintaining, simultaneously, the required **compartment temperatures** (within the permitted temperature deviations during the **defrost and recovery period**) as given in Table 2.

To meet these test requirements, there shall be, for each **ambient temperature**, at least one control setting at which all **compartments** meet the specified internal temperatures. The control(s) however, may be adjusted for testing at different ambients.

NOTE Because the **frozen compartment** loading is largely the same as that for the **freezing capacity** test, there may be an advantage in doing these tests consecutively.

6.2 Preparation of refrigerating appliance

The test room ambient shall be as specified in A.3.2.3 of IEC 62552-1:2015.

The **refrigerating appliance** shall be installed in the test room in accordance with Annex B of IEC 62552-1:2015.

Refrigerating appliances with anti-condensation heater(s) which are permanently on during **normal use** shall be tested with the heater(s) operating.

Anti-condensation heaters which can be manually controlled by the user shall be switched on and, if adjustable, they shall be set at their maximum heating rate.

Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

The empty **refrigerating appliance** should be set up and operated until it has reached equilibrium at or close to the temperatures specified in Table 2.

Any automatic icemaker shall be configured so that no new ice is made during the test, but shall otherwise remain operational. However, connection to a water supply may be omitted if it can be demonstrated that the absence or presence of a connection to a water supply would make no difference to the results of this test.

6.3 Air temperature sensor location and test and M-package loading

6.3.1 Unfrozen compartments (except chill compartment and wine storage compartment)

For determining the **storage temperatures** of these **compartment**s, air temperature sensors shall be located in accordance with D.2.2 of IEC 62552-1:2015.

NOTE See Annex B, Wine storage appliances and compartments; storage test.

6.3.2 Chill compartments

6.3.2.1 General

All test packages and M-packages shall be as specified in Clause C.2 b) of IEC 62552-1:2015.

For determining the **storage temperature** of any **chill compartment**, the storage load shall be in accordance with 6.3.2.2.

The temperature T_{cci} (see Table 2) shall be measured in M-packages positioned or suspended so that their largest surface is horizontal. They may be positioned directly on the floor of the **compartment**/drawer but shall always be at least 15 mm away from all walls and ceilings and from the other packages of the test load.

In these **compartments**, M-packages shall be placed in diagonally opposite corners.

In the case of a **compartment** with special subdivisions (**shelves**, etc.) which are part of the design, if the dimensions are too small to allow the horizontal positioning of the M-packages, it is permissible to position them vertically.

If the dimensions are too small to accommodate an M-package (for example in door **shelves**), a special support shall be used to position the M-package next to the **shelf** and as close as possible to the door liner.

The temperature of the **chill compartment** is the instantaneous temperature of any M-package in that **compartment**. The temperatures and conditions specified in Table 2 shall apply.

6.3.2.2 Chill compartment storage load

The **compartment** shall be loaded with the number of packages specified in Table 3.

There shall always be at least two M-packages and test packages may be replaced by M-packages.

Table 3 – Chill compartment storage load

Volume, V, of chill compartment (l)	**Number of packages**
$V < 10$	2
$10 \leq V < 20$	3
$20 \leq V < 30$	4
$30 \leq V < 40$	5
$40 \leq V < 50$	6
$50 \leq V < 60$	7
$60 \leq V < 70$	8
$70 \leq V < 80$	9

$V \geq 80$	10

6.3.3 Frozen compartments/sections

6.3.3.1 General

Temperatures shall be measured in M-packages, which are distributed throughout the load of test packages as specified in the test package placement (6.3.3.3). They shall be placed as specified in 6.3.3.4.

The temperature of each section, or **compartment**, is the maximum temperature of any M-package in that section or **compartment**. The temperatures and conditions specified in Table 2 shall apply.

6.3.3.2 Packages

All packages (test packages and M-packages) shall be as specified in Annex C of IEC 62552-1:2015.

The packages shall have previously been brought to the approximate **compartment** temperature as set out in Table 2.

Wetting of packages to freeze them together is not permitted but to keep packages aligned in a stack, they may be strapped together with non-metallic strapping.

The use of spacers to maintain free air spaces between stacks of packages is permissible provided that the spacers are of the smallest practicable cross-section and of low thermal mass and conductivity and are placed in such a way that they do not significantly interfere with normal air circulation. A few 15 mm diameter spherical plastic beads threaded on vertical ties strapping stacks of packages together would meet these requirements.

6.3.3.3 Package placement

6.3.3.3.1 General

Packages shall be placed as follows:

a) The **compartment** (Including any door storage) shall be filled with as many packages as possible while still complying with the air passage and clearance requirements in 6.3.3.3.2 and 6.3.3.3.3.

b) Packages on **shelves** shall be placed so that the front of the front row is in line with the front of the **shelf** and they shall be arranged symmetrically about the front-to-back centre line of the **shelf**. Where lack of symmetry in the **compartment** makes this impossible, the stacking shall be as symmetrical as possible.

c) Stacks shall be made directly on each horizontal surface intended for storage (see Figures 1 and 2). The packages shall be stacked vertically (i.e. with each package fully covering the one below with no off-sets in the stacks).

   – Except for door storage, the packages shall be placed with their largest surface horizontal.

   Shelves with ribs, etc. are considered to be horizontal surfaces. If necessary, packers may be used in **shelf** depressions to stabilise stacks.

d) Packages in door storage shall be placed so that the free air spaces between the packages and the inner surface of the door and between the packages and the retainer are equal.

   – For door storage, if there is not enough space to place packages horizontally they shall be placed vertically. If there is sufficient height available packages placed vertically shall be stacked (see Figure 2 e)).

If required, because of the bottom shape of the door storage, minimal packaging may be used to keep the packages central and vertical.

e) When the vertical surface is the inner surface of a door, the stacks shall be loaded as follows:

   – if there is a marked **load limit** line, the packages shall be loaded up to that line (see Figure 1 a);

   – if there is no **load limit** line, but a natural **load limit**, the packages shall be loaded up to that limit (see Figure 1 b)).

   Internal doors, edges of **shelves**, baskets and flaps are considered natural **load limits**.

f) When the intersection of a horizontal loading surface and a vertical surface is radiused, the bottom package of any stack shall be placed in direct contact with the horizontal loading surface (see Figure 1 e)).

g) If a subdivision is provided specifically for non-automatic making and storing of ice and is not removable without the use of tools, the **ice cube trays** shall be filled with water, and the contents frozen and placed in position before the **compartment** is loaded with packages; otherwise, the **ice cube trays** and the subdivisions shall be removed and the whole **compartment** loaded with packages.

h) In a **refrigerating appliance** fitted with an automatic icemaker, any dedicated ice storage bin shall remain in place and be filled with packages.

6.3.3.3.2 Side clearance

Minimum clearances of 15 mm shall be calculated from the nominal dimensions of the test packages and shall be left between adjacent stacks of packages and between package stacks and the **compartment** walls and ducts etc. (see Figure 1). As far as practicable, spaces between packages shall be equal across each horizontal dimension.

Where the storage is in containers, as far as the internal radiuses allow, the packages shall be stacked right up to the internal walls of the containers.

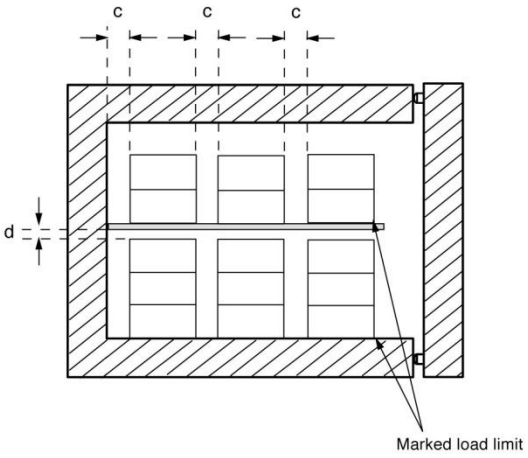
Where packages, when frozen, are slightly larger than the nominal dimensions, the actual air spaces may be less than 15 mm in some cases. Refer to Annex C of IEC 62552-1:2015 for permitted tolerances on package dimensions.

6.3.3.3.3 Top clearance

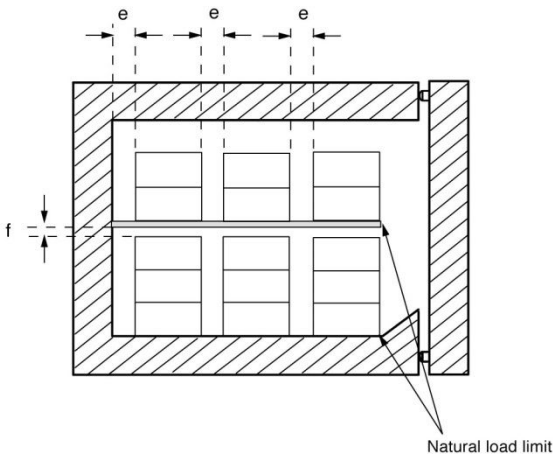
The vertical clearance between the upper face of the highest package and the **load limit**, the **shelf** or the horizontal surface situated immediately above shall be less than 60 mm but not less than 10 mm (i.e. 10 mm ≤ clearance < 60 mm).

Similarly, for a **top-opening type** of **compartment** without a **load limit** line, the vertical clearance between the upper face of the highest package and the inner surface of the lid above shall be less than 60 mm but not less than 10 mm (ie 10 mm ≤ clearance < 60 mm).

The only exception is that for **compartments** with a height of less than 60 mm which have been claimed as **volume**, the vertical clearance between the upper edge of the highest package and the horizontal surface situated immediately above may be less than 10 mm (but the package shall still not touch the ceiling).

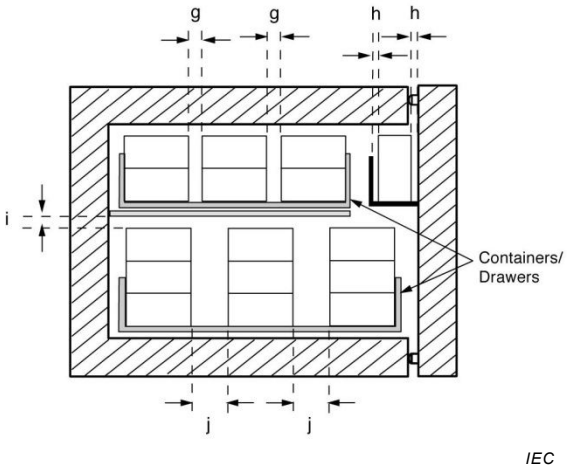


a) Side view – marked load limit

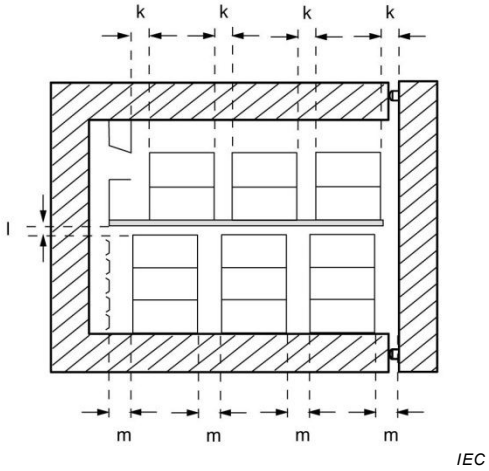


b) Side view – natural load limit

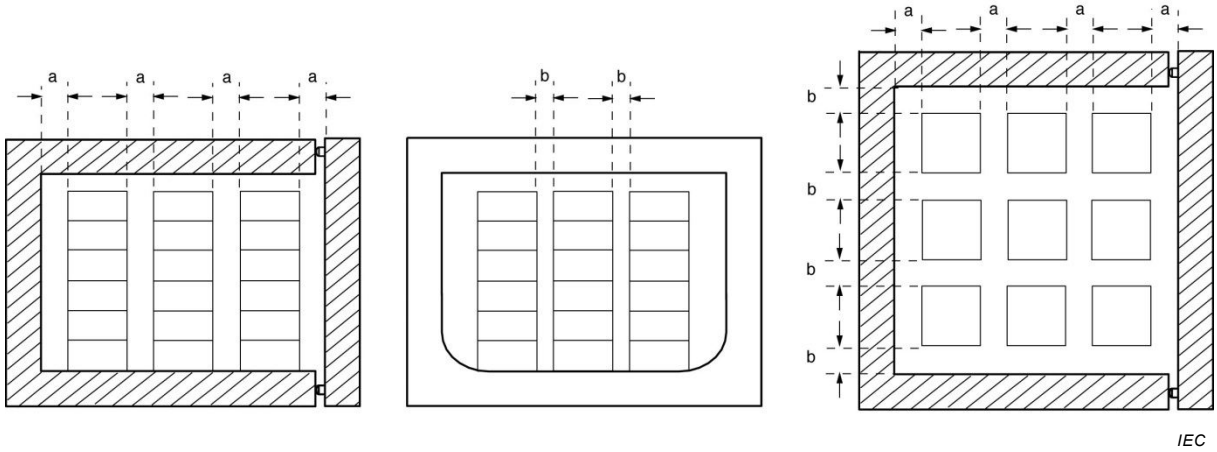
Figure 1 – Location of packages in frozen compartment, showing clearances *(1 of 2)*



c) Side view – with containers



d) Side view – clearance maintained round ducts etc.



Side View – no **shelves** Front view – no **shelves** Top view – no **shelves**

e) Loading on horizontal surface only

All horizontal dimensions marked shall be ≥15 mm.

All vertical clearances shall be ≥10 mm and <60 mm.

Figure 1 – Location of packages in frozen compartment, showing clearances *(2 of 2)*

6.3.3.4 Measurement package placement

6.3.3.4.1 Front opening compartments

M-packages shall replace test packages as indicated in Figures 2a), b), c), d), and e).

The general arrangement is to place two M-packages in diagonally opposite corners in the top layer and in the opposite two diagonally opposite corners in the bottom layer.

If a front-opening **compartment** has an opening height of 1 meter or greater, an M-package shall replace a test package at the geometric mid-point of the front stacks.

Where the **compartment** is at the bottom of the cabinet and there is a compressor step, another M-package shall replace the lowest test package that is most nearly directly above the compressor.

Where there are test packages in door storage, an M-package shall replace the topmost test package that is the opposite side of the cabinet from the front M-package on the top **shelf**. Another shall replace the lowest test package in the door storage that is the opposite side from the lowest front M-package. If the door storage space is over 1 m high, the middle front M-package shall be placed in the corresponding position in the door storage rather than in the cabinet itself (position $TMP_{8'}$ rather than TMP_8 in Figure 2 e)).

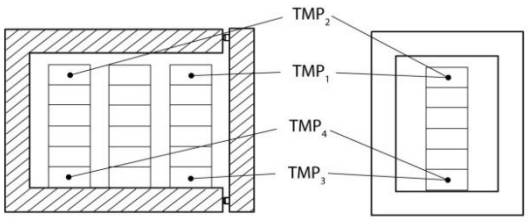
Where it is not possible to place M-packages in the numbers or positions specified, they shall be loaded in numbers and positions as nearly as practicable to the specified location and in positions which will provide an equivalent result.

If a **compartment** is too small to accommodate the specified M-packages with the required clearances, then fewer packages, as appropriate, shall be used.

In all cases where the number or location of M-packages differs from that specified, the details of the adopted alternative shall be recorded for any test reporting.

6.3.3.4.2 Top opening compartments including chest freezers

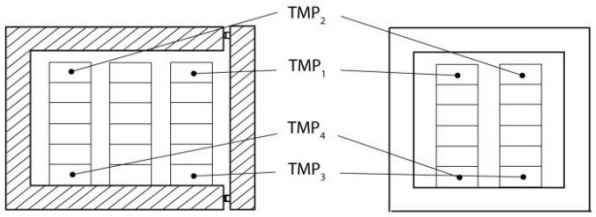
M-packages shall replace test packages in the four corners and centre top, centre bottom and on top of the compressor. If there is no compressor step this package shall be placed in the bottom corner or end position which is likely to be warmest (see Figures 2f) and 2g)).



IEC

Side view Front view

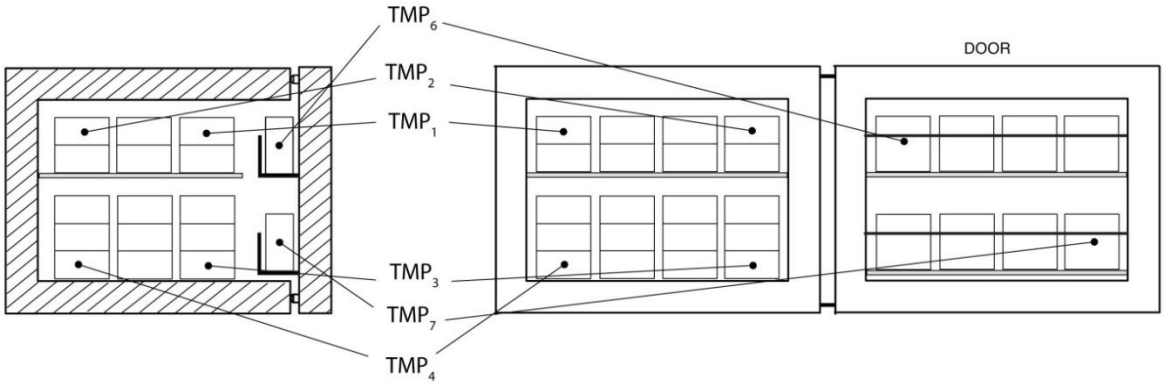
a) width < 245 mm



IEC

Side view Front view

b) 245 mm ≤ width < 360 mm

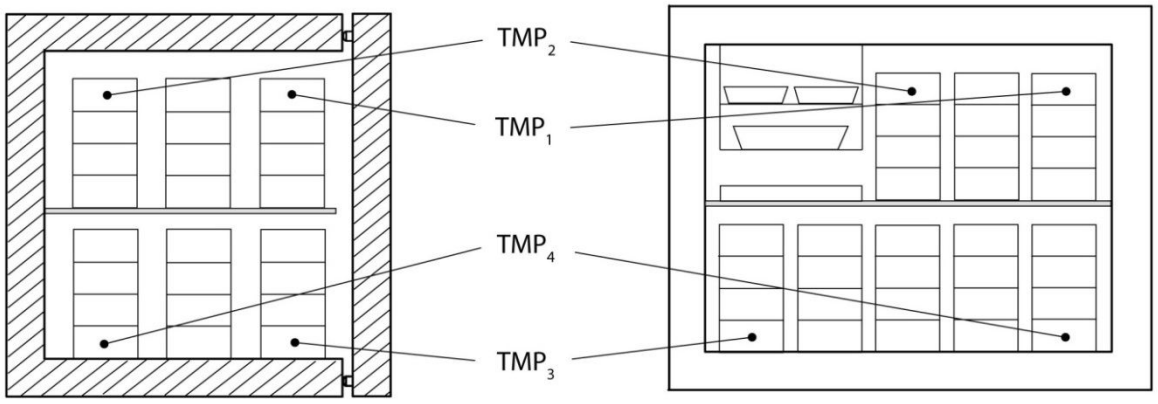


IEC

Side view Front view

c) full width compartment with door storage

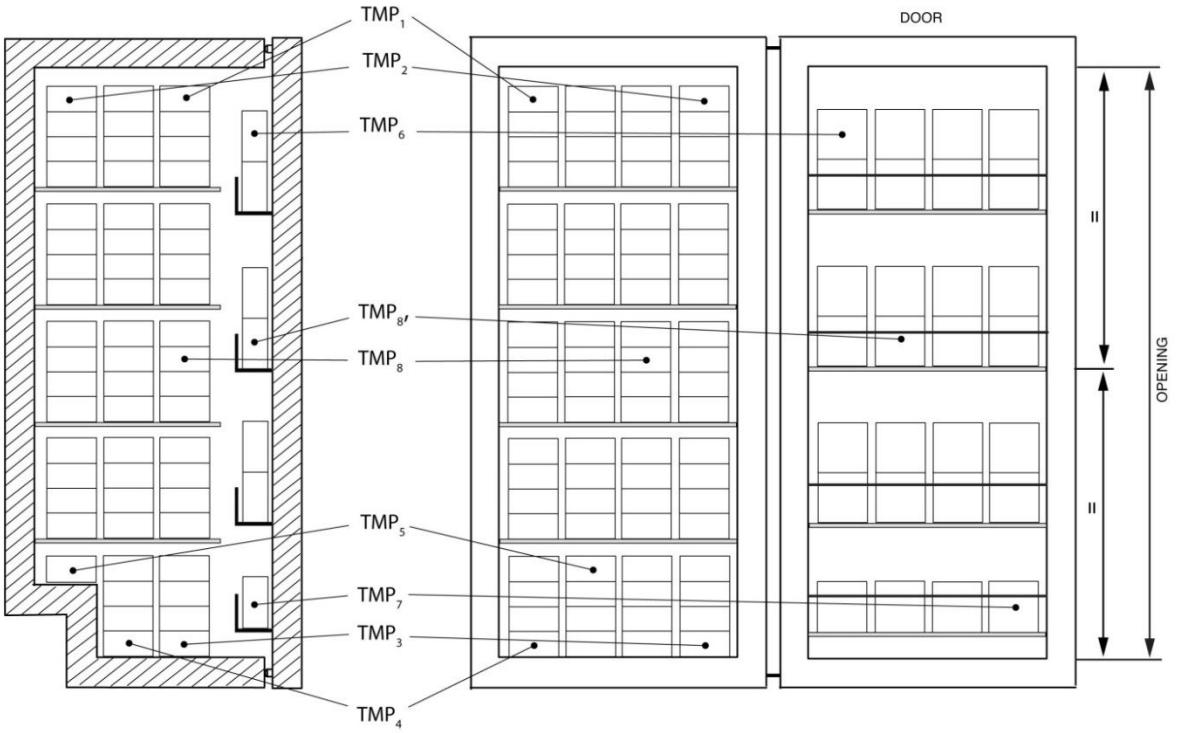
Figure 2 – Location of test packages and M-packages, in frozen compartment *(1 of 3)*



IEC

Side view Front view

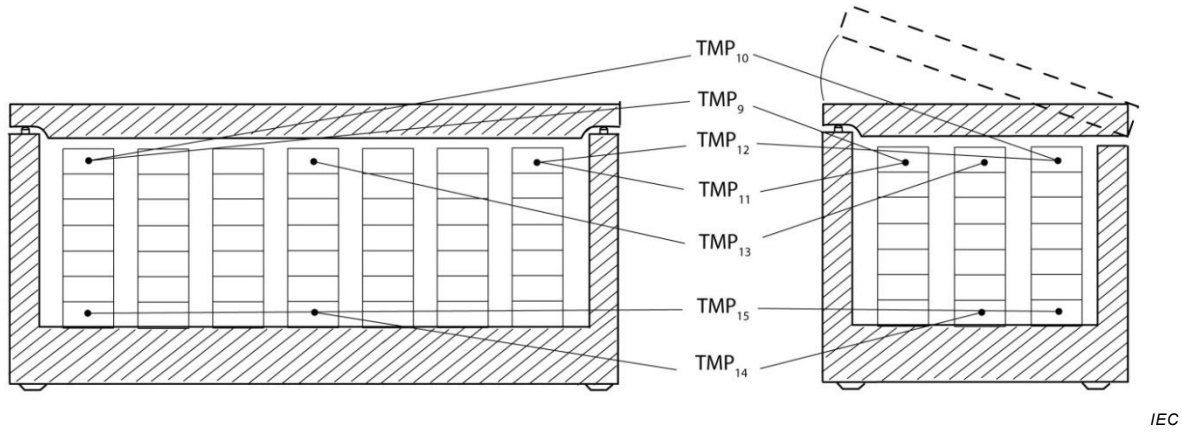
d) Full width compartment with fixed ice cube tray racks, ice bins with mirror M-package positions



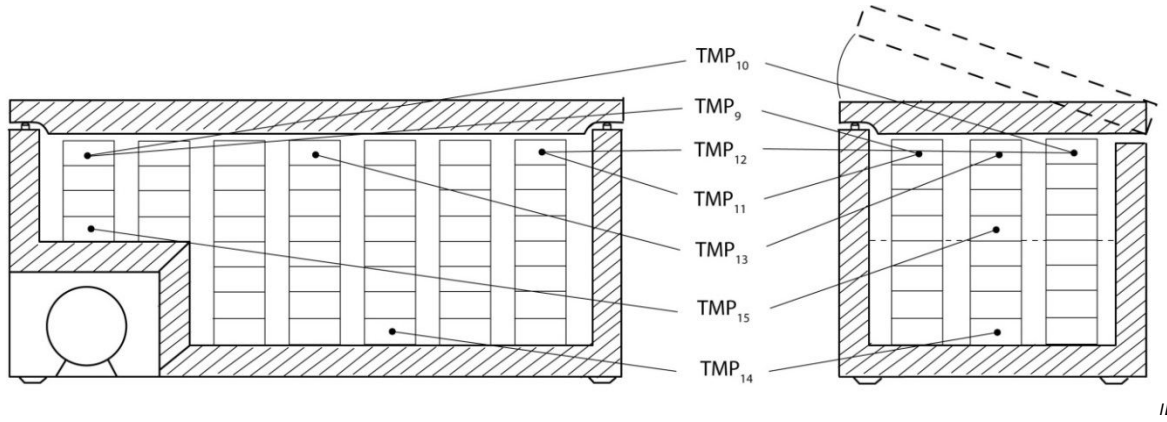
Side view Front view

e) Tall compartment showing mid-height M-package added

Figure 2 – Location of test packages and M-packages, in frozen compartment *(2 of 3)*



f) Chest freezer



g) Chest freezer (stepped liner)

Key to Figure 2

Front opening **compartment**s

TMP_1 = top front left[a] M-package

TMP_2 = top back right[a] M-package

TMP_3 = bottom front right[a] M-package

TMP_4 = bottom back left[a] M-package

TMP_5 = compressor step M-package

TMP_6 = door top right[a] M-package (right when the door is shut)

TMP_7 = door bottom left[a] M-package (left when the door is shut)

TMP_8 = mid height, mid width package when opening height ≥ 1m

$TMP_{8'}$ = alternative location for TMP_8 when a tall **compartment** has door storage.

Chest **freezers** and other top opening **compartments**

TMP_9 = top left front M-package

TMP_{10} = top left back M-package

TMP_{11} = top right front M-package

TMP_{12} = top right back M-package

TMP_{13} = centre top

TMP_{14} = centre bottom

TMP_{15} = above the compressor or bottom corner or end likely to be warmest

[a] If asymmetry is such that it is better to put TMP_1 in the top front right corner (for example as in Figure 2 (d), then all other M-packages shall also be swapped to the opposite side (I.e. all “lefts” become “rights” and all “rights” become “lefts”)

Left and right are from the viewpoint of the front of the cabinet with the door shut.

Figure 2 – Location of test packages and M-packages, in frozen compartment *(3 of 3)*

6.4 Test procedure

6.4.1 Overview

Once all temperatures are in compliance with Table 2, the test period is usually up to about 24 h long. A “pass” requires temperatures to be in compliance with Table 2 (including allowed excursions) throughout the entire test period and average temperatures of each package in a 3 h block at the end (period E) to not be significantly warmer than their average temperature in the 3 h block at the start (period S) (see Figure 3).

If the **refrigerating appliance** has a **defrost control cycle** at least one **defrost and recovery period** has to be included between the periods S and E.

6.4.2 Details

The test shall start after all temperatures are in compliance with Table 2.

Table 4 specifies where periods S and E are located and their lengths.

Table 4 – Requirements for periods S and E

Item	Are there temperature control cycles?	Without defrost control cycles	With more than one defrost control cycles starting within a 24 h test	With only one defrost control cycle starting within a 24 h test
Length of periods S and E	No	Each period shall be at least 3 h long		
	Yes	Each period shall consist of the same integral number of **temperature control cycles** totalling not less than 3 h.		
Location of period S	No	Any convenient time	Period S ends just before a **defrost and recovery period** begins.	
	Yes			
Location of period E	No	Period E ends at least 24 h after period S begins	Period E ends just before the beginning of the last **defrost and recovery period** that begins within 24 h of the start of period S	Period E ends at least 24 h after period S begins and before the beginning of the next **defrost and recovery period**
	Yes	Period E ends with the conclusion of a **temperature control cycle** that is in progress at least 24 h after the beginning of period S	Period E ends with the conclusion of the last **temperature control cycle** completed before the beginning of the last **defrost and recovery period** that begins within 24 h from the start of period S	Period E ends with the conclusion of a **temperature control cycle** that is in progress at least 24 h after period S begins and before the beginning of the next **defrost and recovery period**

EXAMPLE 1 For a refrigerating appliance with a **defrost control cycle** of 10 h, if period S is 3 h long, the 2nd **defrost and recovery period** will start 13 h from the beginning of the test and the 3rd will start 23 h from the beginning of the test. Thus, the test will include two complete **defrost control cycles** and end about 23 h after period S begins.

EXAMPLE 2 For a refrigerating appliance with a **defrost control cycle** of 11 h, if period S is 3 h long, the 2nd **defrost and recovery period** will start 14 h from the beginning of the test and the 3rd would start 25 h from the beginning of the test. Thus, the test will include only one complete **defrost control cycle** and end about 14 h after period S begins.

EXAMPLE 3 For a **refrigerating appliance** with a **defrost control cycle** of 22 h, if period S is 3 h long, the 2nd **defrost and recovery period** would start 25 h from the beginning of the test. Thus, the test will include only one complete **defrost control cycle** and end about 24 h after period S begins.

For **refrigerating appliances** with irregular cycles, the lengths of periods S and E and time between them may be increased.

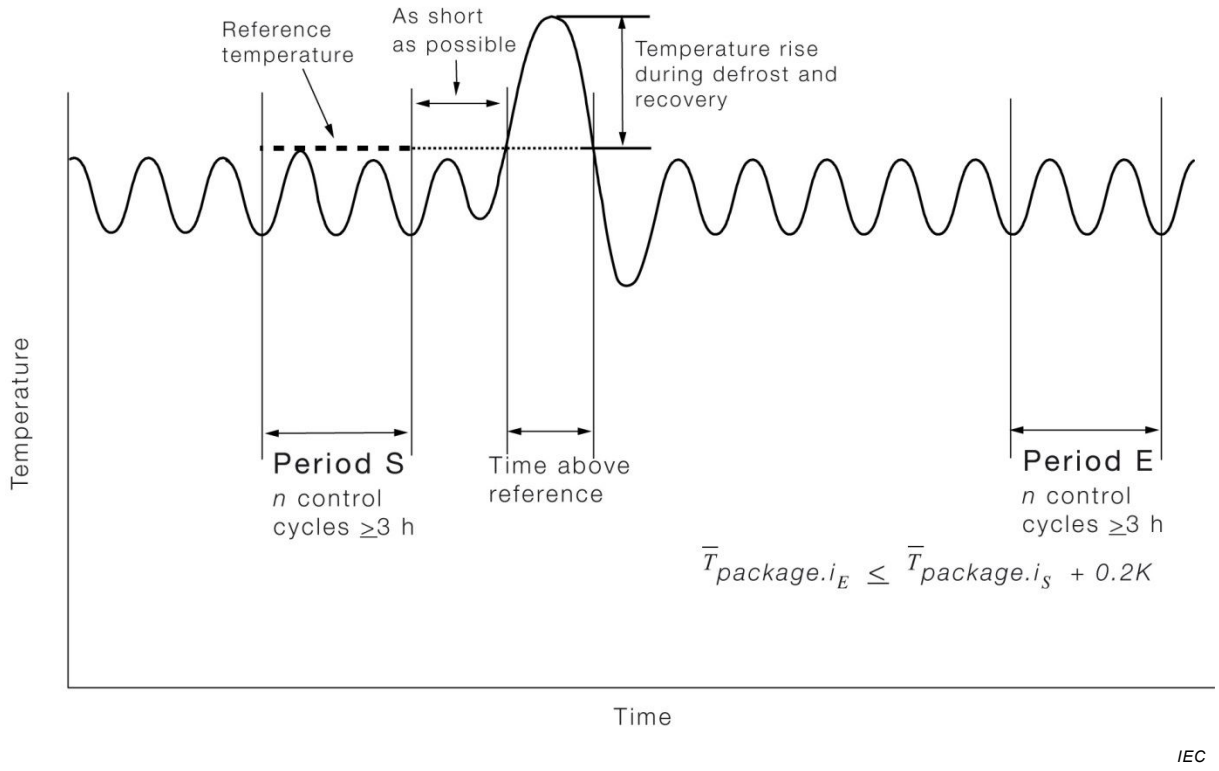


Figure 3 – Storage test sequence

6.4.3 Compliance criteria

Throughout the entire test period all temperatures shall be in compliance with Table 2 (including allowed **defrost and recovery period** excursions)

The average temperature of no package in period E shall be more than 0,2 K higher than its average temperature in period S.

6.5 Storage temperature

The **refrigerating appliance** shall maintain simultaneously, the required **storage temperatures** in the different **compartments** (and the permitted temperature deviations during the **defrost and recovery period**) as given in Table 2.

6.6 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) the **ambient temperature**;

b) the setting(s) of any **user-adjustable temperature control** device(s) and any other user-adjustable control(s), damper(s) etc.;

c) the value of the fresh food **storage temperature** T_{ma}, and the values of T_{1m}, T_{2m} and T_{3m};

d) for **frozen compartments** the values of the maximum temperature(s) of the warmest M-package (see k)) during period S (reference temperature), the duration of the temperature rise above the reference temperature during the **defrost and recovery period** and the maximum temperature rise above the reference temperature during the **defrost and recovery period**;

e) the average temperature and the maximum temperature for each M-package in period E and period S;

f) the value of the **zero-star storage temperature** T_{zma}, and the values of T_{z1m}, T_{z2m} and T_{z3m};

g) the value of the maximum and minimum recorded **chill compartment** T_{cci} and the values of T_{ccim} for each of the M-packages;

h) the value of the **cellar compartment** T_{cma} and the values of T_{c1m}, T_{c2m}, T_{c3m}, as appropriate;

i) the value of the **pantry compartment** T_{pma} and the values of T_{p1m}, T_{p2m}, T_{p3m}, as appropriate;

j) a diagram of the **storage plan** showing locations of test packages and M-packages in all **compartments** as applicable;

k) a diagram or tabulation of the location of the M-package with the highest maximum temperature in each of these **compartments** and in any **two-star section**, and the location of the M-packages with the highest maximum temperature during any temperature deviation as a result of the **defrost control cycle**;

l) the rating of the **compartment** (or parts of **compartments**) by type.

7 Cooling capacity test

7.1 Objective

The purpose of this test is to measure the cooling capability of **fresh food compartments** by determining the time for a load of 4,5 kg per 100 l of **volume** to be cooled from +25 °C to +10 °C.

7.2 Set-up procedure

7.2.1 Ambient temperature

The **ambient temperature** shall be 25 °C (see A.3.2.3 of IEC 62552-1:2015).

7.2.2 Installation

The **refrigerating appliance** shall be installed in accordance with Annex B of IEC 62552-1:2015.

Refrigerating appliances with anti-condensation heater(s) which are permanently on during **normal use** shall be tested with the heater(s) operating.

Anti-condensation heaters which can be manually controlled by the user shall be switched on and, if adjustable, they shall be set at their maximum heating rate.

Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

All internal accessories supplied with the **refrigerating appliance** shall be in their respective positions.

Before the test load is added, all **compartments** shall be empty. Their temperatures shall be determined as specified in Annex D of IEC 62552-1:2015.

After **stable operating conditions** have been attained, for all **compartments** except for the **fresh food compartment** (see 7.3), the temperatures shall be in accordance with Table 2 with the following exceptions:

- The average starting temperature of any **compartment**(**s**) with no lower temperature limit(s) specified in Table 2 shall be no more than 2 K below the **target temperature**.

- In the case of a **refrigerating appliance** where the **compartment** temperatures cannot be adjusted independently, if such a setting is not possible, the non-complying **compartments** below the bottom limit shall be set to be as warm as possible.
- For the **frozen compartments**, the **target temperatures** shall be reached by the average **compartment** temperatures (T_{fma}) instead of the warmest temperatures of the M-packages.

7.2.3 Adjustment of compartments

Where the **volumes** of a **cellar** or **chill compartment** and the **fresh food compartment** can be adjusted by the user in relation to each other, the **fresh food compartment** shall be adjusted to its greatest possible **volume**. This **volume** is used as a basis for the test.

7.2.4 Arrangement of shelves

If adjustable, a **shelf** shall be positioned at each of three levels so that the centres of M-packages placed directly on the **shelves** (or bottom of the baskets etc.) have the smallest possible vertical distance to the temperature measurement points TMP_1, TMP_2 and TMP_3 as specified in Annex D of IEC 62552-1:2015.

Packages shall not be placed in **vegetable drawers**, **crispers** or similar containers. However, when drawers and/or bins wholly or predominantly occupy the space within a **fresh food compartment** the bottoms of the drawers or bins shall be regarded as **shelves**. Packages shall be placed within these drawers or bins in positions specified below.

NOTE For **compartments** without **vegetable drawers**, **crispers** or similar containers, the bottom of the inner container or any divider(s) separating **compartments** is considered to be the lowest **shelf**.

If no appropriate position can be found for 3 levels in **refrigerating appliances** with little height (e.g. box **evaporators** as shown in a) of Figure D.3 of IEC 62552-1:2015) only levels TMP_1 and TMP_2 shall be used for testing.

Shelves with adjustable positions which are not used for the loading shall be distributed uniformly in the **refrigerating appliance** with care taken that the positions selected have as little influence as possible on the **cooling time** of the packages.

A minimum vertical distance of 15 mm shall be maintained between the packages and any **shelf** (or basket) located above them.

7.3 Test procedure

7.3.1 General

The **fresh food compartment** shall have a mean temperature of T_{ma} = + 4 °C ± 0,5 K at **stable operating conditions**. If the mean temperature cannot be adjusted within these limits, the result shall be determined from two measurements by interpolation, whereby the temperature during one test shall be colder and the temperature during the other test shall be warmer than the **target temperature**. The difference between the two test temperatures shall not be greater than 4 K.

Except as in the paragraph below changes of the settings of the control devices are not permitted once stable temperatures complying with Table 2 have been reached at the beginning of the test.

If the **refrigerating appliance** is provided with a “quick cooling” (fast cooling) function this should be activated, according to the instructions, at the moment of inserting the load.

NOTE To qualify as a “quick cooling” function, the operation of the function will automatically terminate at a later time. Manually setting the thermostat colder and then manually setting it warmer at a later time, does not qualify as a ”quick cooling” function.

Test packages and M-packages, as specified in Annex C of IEC 62552-1:2015, shall be used for loading.

Before insertion, the test packages and M-packages shall be stabilised at a temperature of +25 °C ± 0,5 K.

For models with **defrost control cycles**, the **packages** should be added when stability has been regained and temperature criteria met after a **defrost and recovery period**. The test should not overlap a **defrost and recovery period**.

The packages shall be placed quickly into the **compartment**. Where required by the loading, the measuring devices for measuring points TMP_1, TMP_2 and TMP_3 may be removed or moved aside.

The temperatures of the M-packages shall be recorded until the arithmetic mean of the instantaneous temperatures of all M-packages has reached +10 °C. The time required to reach this temperature shall be recorded.

7.3.2 Positioning of the load in the fresh food compartment

The loading shall be 4,5 kg / 100 l **volume** of the **fresh food compartment**. The calculated load shall be rounded to the nearest 0,5 kg.

When possible, the same number of packages shall be allocated to each **shelf**. Where the number of packages to be distributed is not an exact multiple of the number of **shelves**, any extra packages shall be allocated one per **shelf** starting from the bottom (i.e. the difference between the final loadings on different **shelves** shall not be greater than one package).

The packages shall be placed horizontally in the **refrigerating appliance** (i.e. with their greatest area in direct contact with the appropriate **shelf** (or **compartment** floor or bin or basket bottom).

As far as practicable, spaces between packages shall be equal across each horizontal dimension. A minimum side-to-side and front-to-back clearance of 15 mm shall be maintained between packages and between packages and walls or solid-wall containers. Dedicated ventilation openings in the **shelves** shall not be covered. The packages shall not extend beyond the edges of the **shelves**.

The first layer of packages shall be distributed evenly across the width and depth of each **shelf** and arranged symmetrically about the front-to-back centreline (see Figure 4). Where lack of symmetry makes this impossible, the loading shall be as symmetrical as possible.

If the loading at any level is physically prevented from being arranged as specified (as, for example, if a layer were required at a level where storage provided by two equal width bins would prevent the placement of a central row, or where there is less than 360 mm **shelf** depth in front of a compressor step) then alternative positions shall be selected which most nearly match those specified. The alternative positions selected shall be recorded.

Package shall be arranged in, at most, a 3 × 3 configuration, i.e. no more than nine packages shall be placed in any one layer.

If the maximum allowed allocation of packages for the first layer on any **shelf** has been made, and further packages are still required to be placed on that **shelf**, a second layer shall follow the same stacking sequence as for the first layer. Packages in any subsequent layers shall be stacked vertically (i.e. with each package fully covering the one below with no off-sets in the stacks).

NOTE The text in this subclause describes how the package positions are selected, not necessarily the sequence in which they are loaded for a test.

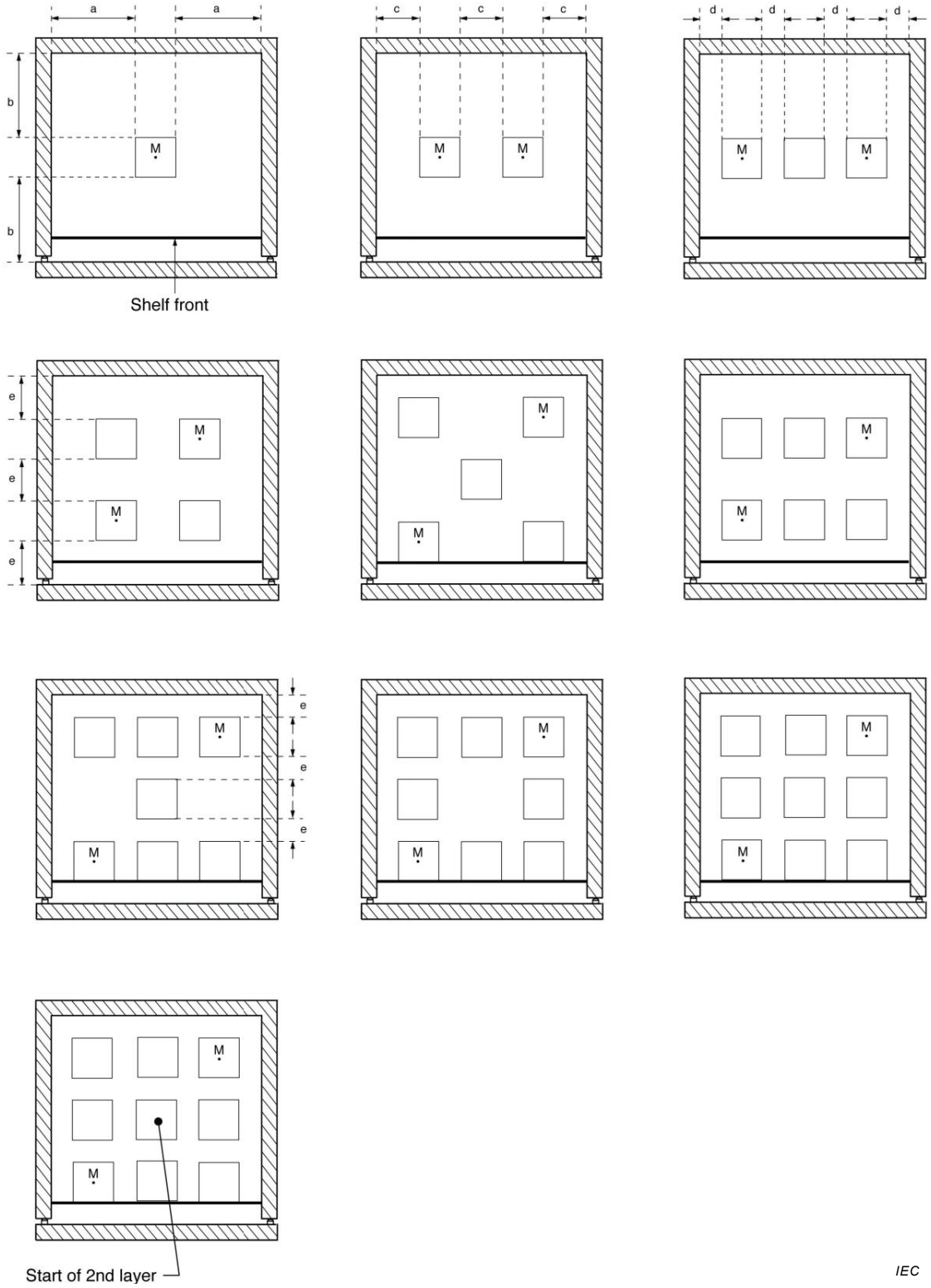
7.3.3 M-packages

Unless the total loading is less than 3 kg, six M-packages shall be used for all types of **refrigerating appliances**. If the total loading is 3 kg or less, M-packages alone shall be used. A maximum of two M-packages shall be placed in the bottom layer of each of the three levels.

For a loading of more than 3 packages the M-packages shall be arranged diagonally at the outer positions of loading as in Figure 4.

The M-packages shall be used in the bottom layers only of relevant levels. Any further layer required shall be made up of test packages only.

Diagonally opposite positions for M-packages shall be chosen alternately for **shelves** positioned directly one above the other.



All dimensions marked shall be ≥ 15 mm.

Figure 4 – Filling of a shelf with test packages and M-packages for cooling capacity test

7.4 Data to be recorded

The following data shall be recorded:

a) load mass in kg;

b) **volume** of the **fresh food compartment** used for testing;

c) **cooling time** in hours (to one decimal place);

d) any **shelf**, drawer or bin positions which differ from those specified;

e) any package positions which differ from those specified;

f) settings of any “quick cooling” functions used.

8 Freezing capacity test

8.1 Objective

The purpose of this test is to measure the **freezing capacity** of **freezer compartment**(**s**). If the capacity is great enough the **compartment(s)** may also be **rated** as a **four-star compartment(s).**

8.2 Method overview

Apart from space for the **light load,** ballast packages are loaded into the **frozen compartment**(**s**) as for the storage test (Clause 6). The **refrigerating appliance** is operated till temperatures are stable and in compliance with Table 2. Then a load of packages at +25 °C is added. This is the so-called **light load** representing a food load to be processed. It is 3,5 kg/100 l of **volume** for **compartments** operating at –18 °C. The time to freeze this load to –18 °C is measured. When this can be achieved in no more than 24 h and other maximum temperature-excursion conditions are met, a **four-star compartment** rating may be claimed.

NOTE Because the **frozen compartment** loading is largely the same as for the storage test, there may be an advantage in doing these tests consecutively.

8.3 Set-up procedure

8.3.1 Ambient temperature

The **ambient temperature** shall be 25 °C (see A.3.2.3 of IEC 62552-1:2015).

8.3.2 Preparation of the refrigerating appliance

8.3.2.1 General

The **refrigerating appliance** shall be installed according to Annex B of IEC 62552-1:2015.

If the configuration of the **refrigerating appliance** can be changed by the user the configuration with the greatest **volume** at the lowest temperatures shall be used for this test.

Refrigerating appliances with anti-condensation heater(s) which are permanently on during **normal use** shall be tested with the heater(s) operating.

Anti-condensation heaters which can be manually controlled by the user shall be switched on and, if adjustable, they shall be set at their maximum heating rate.

Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

The empty **refrigerating appliance** should be set up and operated until it has reached equilibrium at, or close to, the temperatures specified in Table 2.

8.3.2.2 Measurement of temperature of chill compartment and all compartments operating above 0 °C

During the test, the **chill compartment** temperature is not measured, but it shall be loaded with test packages as for the **storage temperature** measurement (see 6.3.2). For determining the **storage temperature** of the **compartments** normally operating above 0 °C, measurement points shall be as per Annex D of IEC 62552-1:2015 but with M-packages used instead of cylinders.

8.3.3 Loading of refrigerating appliance

8.3.3.1 Frozen compartment(s) – ballast load

8.3.3.1.1 General

Apart from space for the **light load** in the appropriate –18 °C **compartment**(**s**), ballast packages are brought to the approximate **compartment** temperatures and loaded into the **frozen compartment**(**s**) as for the storage test (Clause 6).

In the –18 °C **compartment**(**s**), up to 3 packages of the **ballast load** may be left out to make room for each package of **light load** that is to be accommodated.

If the instructions indicate that there is a separate section for freezing food, this section shall be used for the **light load**.

8.3.3.1.2 M-package placement in the ballast load to accommodate the light load

The M-packages in the **ballast load** shall be located as for the storage test apart from any locations that are disrupted by the need to leave space for the **light load**. In that case, the M-packages shall be placed in the nearest equivalent position to that specified for the storage test and the new positions recorded. If there are stacks of **ballast load** packages beside the **light load** an M-package shall also replace the top test package in at least one of those stacks on each side of the **light load**. If there is **ballast load** above the **light load** an M-package shall replace a test package in the centre of the layer immediately above the **light load**. If there is **ballast load** below the **light load** an M-package may replace a test package in the centre of the layer immediately below the **light load**.

8.3.3.2 Refrigerating appliances with separate three-star compartment

If a **refrigerating appliance** has a separate **three-star compartment** with its own external access door or lid, and the instructions recommend that, before freezing, frozen food already in storage be placed in that **compartment** while leaving space in the **freezer compartment** to receive the load for freezing (i.e. the **three-star compartment** is to be regarded as an extension of the **freezer compartment**), a **freezing time** claim based upon this method of use is permissible, provided that:

a) when tested according to this method of use, the claimed **freezing time** is confirmed and the temperature requirements for the other **compartments** (see 8.5 a) to g)), if applicable, are fulfilled during the **freezing capacity test**, and

b) the **light load** used in the **freezer compartment** is at least equivalent to 3,5 kg/100 l of the combined **volumes** of the **freezer compartment** and **three-star compartment**.

To meet the requirement that no more than 3 packages of **ballast load** shall be left out to make room for each **light load** package, it is likely that some **ballast load** will still be required to be retained in the **freezer compartment**.

8.4 Test procedure

8.4.1 Starting conditions

After all relevant control devices have been adjusted as required, the loaded **refrigerating appliance** is left to run until **stable operating conditions** are reached.

After **stable operating conditions** have been attained, internal temperature(s) shall be in accordance with Table 2 except that the starting temperature of any **compartment**(**s**) with no lower temperature limit(s) specified in that table shall be no more than 2 K below the **target temperature**.

In the case of a **refrigerating appliance** where the **compartment** temperatures cannot be adjusted independently, if such a setting is not possible, the non-complying **compartment**s below the bottom limit shall be set to be as warm as possible.

The temperature indication succession from left to right in Table 2 also indicates the order of precedence in the case of several temperature possibilities.

In some circumstances it might be unnecessary to carry out the stabilisation specified here before the stabilisation specified in 8.4.2.

8.4.2 Setting of control devices

If the **refrigerating appliance** is provided with means for a pre-freezing (fast-freezing or quick-freezing) operation, after **stable operating conditions** in accordance with 8.4.1 have been attained, the **refrigerating appliance** shall be set in operation in the pre-freezing condition according to the instructions. The procedure specified in 8.4.3 shall then be carried out.

If there are no special instructions for pre-freezing, the procedure according to 8.4.3 shall be carried out after the **refrigerating appliance** has reached **stable operating conditions** in accordance with the temperature requirements of 8.4.1.

8.4.3 Freezing of the light load

After the conditions specified in 8.4.2 have been attained, the **light load** shall be introduced. For models with **defrost control cycle**s, the **light load** should be added when stability has been regained and temperature criteria met after a **defrost and recovery period**. This test should not overlap a **defrost and recovery period**. When stability has been achieved prior to the introduction of the **light load,** apart from as in 8.4.2, changes of setting of manually adjustable controls are no longer permitted.

The **light load** shall be 3,5 kg/100 l of the total **volume** of all **compartments** (excluding any **two star sections**) being evaluated for **four-star** ratings. The calculated load shall be rounded to the nearest 0,5 kg except that in no case shall it be less than 2,0 kg.

The **light load** is made from packages which have previously been brought to a temperature of +25 °C ± 1 K.

The **light load** packages shall be placed flat and positioned taking into account the instructions and the requirements of the loading **storage plan** (see Clause 6). If no instructions are given, the packages shall be placed such that they are likely to be frozen as rapidly as possible.

Light load packages shall be separated by at least 15 mm from **ballast load packages.** The use of spacers between adjacent stacks of packages is permitted, but other spacing methods are not (see 6.3.3.2).

M-packages shall be uniformly distributed throughout the **light load** with at least one as close as practicable to its geometric centre. There shall be one M-package per 3 kg of **light load**, with a minimum of 2 M-packages.

8.4.4 Intermediate test data to be recorded

The temperatures of the M-packages in the **ballast load** and in the **light load** shall be recorded, together with those of the M-packages in the other **compartment**(**s**), if any. This shall be done until the arithmetic mean of the instantaneous temperatures of all the M-packages in the **light load** reaches ≤ –18 °C. The time necessary for reaching this temperature shall be noted.

8.5 Criteria to achieve a four-star compartment rating

A **compartment** achieves a **four-star** rating if the arithmetic mean of the instantaneous temperatures of all the M-packages in the **light load** reaches ≤ –18 °C in no more than 24 h and:

a) unless a **defrost and recovery period** overlaps the test, the maximum temperature of any M-packages of the **ballast load** remains ≤ –15 °C and at the end of the test the maximum temperature of the warmest M-package of the **ballast load** is ≤ –18 °C;

b) if a **defrost and recovery period** does overlap the test, the maximum temperature of any M-packages of the **ballast load** remains ≤ –12 °C during the **defrost and recovery period** and at the end of the test the maximum temperature of the warmest M-package of the **ballast load** is ≤ –18 °C;

c) the maximum temperature of the warmest M-package in any separate **three-star compartment** not used for ballast in accordance with 8.3.3.2 remains ≤ –18 °C (plus the allowed excursions during any **defrost and recovery period** as specified in Table 2);

d) the maximum temperature of the warmest M-package in any **two-star section** or **compartment** remains ≤ –12 °C (plus the allowed excursions during a **defrost and recovery period** as specified in Table 2);

e) the maximum temperature of the warmest M-package in any **one-star compartment** remains ≤ –6 °C;

f) the instantaneous **compartment** average temperature T_a of the **fresh food compartment** during the test does not exceed +7 °C, with T_1, T_2, T_3 each remaining between –1 °C and +10 °C;

g) the instantaneous temperatures T_{c1}, T_{c2}, T_{c3} as appropriate of the **cellar compartment** do not drop below 0 °C.

8.6 Data to be recorded

a) the mass, in kilograms, of the **ballast load**;

b) the mass, in kilograms, of the **light load**;

c) the **freezing time**, in hours, of the **light load**;

d) the **volume** of the relevant **compartments**;

e) the warmest temperature measured in the M-packages in the **ballast load** stored during the light-load **freezing capacity test**, together with the warmest temperature measured in the M-packages in any **three-star compartment**, **two-star section** or **compartment** and in any **one-star compartment** and the duration of the temperature deviation above –18 °C (or –12 °C as appropriate) and the duration of any **defrost control cycle** (see Table 2);

f) the highest and lowest values of T_1, T_2, T_3, and T_{c1}, T_{c2}, T_{c3}, if applicable;

g) the settings of all **temperature control** devices, including timer(s), if any;

h) a diagram of the **storage plan** for the **refrigerating appliance** showing the location of the M-packages and the location of the warmest M-package(s)for both the **ballast load** and the **light load**;

i) if the **refrigerating appliance** is fitted with a device intended to set the refrigeration of the **freezer compartment** into continuous operation when freezing and then to revert to thermostatic operation automatically, the time which elapsed before it reverted to normal thermostatically controlled operation;

j) whether, with the **light load** being at least 3,5 kg of packages per 100 litres of its **volume** and in no case less than 2,0 kg, the freezing time is achieved in no more than 24 h;

k) the specific **freezing capacity** (x) in [kg / 12 h] = $\left(\frac{M_l \times 12\ h}{\Delta t_f} \right)$

where

M_l is the **light load** (kg)

Δt_f is the freezing time (h).

9 Automatic ice-making capacity test

9.1 Objective

The purpose of this test is to determine the **ice-making capacity** of automatic icemakers in **refrigerating appliance**.

9.2 Procedure

9.2.1 Ambient and water temperatures

The **ambient temperature** and water supply temperature shall be 25 °C (see A.3.2.3 of IEC 62552-1:2015).

If the **refrigerating appliance** is connected to a water supply, the water temperature shall be measured at the point of connection to the **refrigerating appliance**.

9.2.2 Preparation of refrigerating appliance

The **refrigerating appliance** shall be installed in accordance with Annex B of IEC 62552-1:2015.

All **compartment** shall be empty. Their average air temperatures shall be determined as specified in Annex D of IEC 62552-1:2015.

Refrigerating appliances with anti-condensation heater(s) which are permanently on during **normal use** shall be tested with the heater(s) operating.

Anti-condensation heaters which can be manually controlled by the user shall be switched on and, if adjustable, they shall be set at their maximum heating rate.

Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

All internal accessories supplied with the **refrigerating appliance** shall be in their respective positions except that any manually filled **ice cube trays** shall be removed.

After **stable operating conditions** have been attained, internal temperature(s) shall be in accordance with Table 2 except that the average starting temperature of any **compartment**(s) with no lower temperature limit(s) specified in that table shall be no more than 2 K below the **target temperature**.

In the case of a **refrigerating appliance** where the **compartment** temperatures cannot be adjusted independently, if such a setting is not possible, the non-complying **compartments** below the bottom limit shall be set to be as warm as possible.

The **cellar compartment** shall be as small as possible (if the size is adjustable), with **temperature control** devices (flaps, etc.) set in accordance with the instructions or, in the absence of any instructions, set to achieve the temperatures in Table 2.

Where the **refrigerating appliance** has a **defrost control cycle**, it shall remain in operation for this test but the **ice-making capacity** test should not overlap a **defrost and recovery period**.

9.2.3 Test procedures

9.2.3.1 Direct water connection type

Automatic icemakers of the direct water connection type shall be connected in accordance with the instructions to a water supply having a temperature of 25 °C ± 1 K. Prior to initiation of the **ice-making capacity** test, the automatic icemaker shall have been operating for a sufficient time to ensure proper operation. There shall be no evidence of free water having entered the storage bin.

For cycling icemakers, the test shall begin at the completion of the water-fill portion of a cycle. For continuous (non-cycling) ice-making devices, the test may be started at any time after **steady state** ice-making conditions have been established. The ice storage bin shall be emptied and repositioned at the time the test is started.

The test shall continue uninterrupted for a minimum of 12 h for continuous icemakers and for 12 h plus the additional time required to complete a whole number of cycles for cycling icemakers. If the storage bin is emptied during the test to ensure uninterrupted operation, the ice shall be weighted and this amount added to the weight of the ice in the storage bin at the termination of the test.

At completion of the test, the ice in the storage bin shall be weighed. If there is evidence of free water having entered the storage bin, the test shall be repeated at least once. If this condition continues, the test shall be stopped and the condition reported.

The time duration of the test shall be recorded for use in calculating the **ice-making capacity** in kilograms per twenty-four hours.

9.2.3.2 Tank-type

To ensure proper operation, prior to initiation of the **ice-making capacity** test, the automatic icemaker shall have 300 g of water with an initial temperature of 25 °C ± 1 K in the tank and shall operate for a minimum of 12 h until the minimum water level is reached and no more ice is being made. There shall be no evidence of free water having entered the ice storage bin.

The door which gives access to the ice storage bin shall be opened and the ice in the ice storage bin shall be removed. The door shall be kept open for one minute.

The tank shall be filled with the maximum quantity of water (at 25 °C ± 1 K) that is specified in the instructions. The tank shall be reinstalled. The time between tank removal and reinstallation shall be less than one minute. The door of the **compartment** which gives access to the tank shall be kept open for 1 min.

The test start shall be at the time of first water filling of the **ice mould** after the tank has been re-installed.

The test shall continue uninterrupted for a minimum of 12 h for continuous ice-making and for 12 h plus the additional time required to complete a whole number of cycles for cycling icemakers. At the completion of the test, the ice in the ice storage bin shall be weighed.

The cycles may be detected by monitoring temperature on the bottom of the **ice mould**.

The duration of the test shall be recorded for use in calculating the **ice-making capacity** in kilograms per twenty-four hours.

9.3 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) type, model number and serial number of the icemaker;

b) average **compartment** temperature for each **compartment** at the beginning of the test;

c) the **ice-making capacity** in kg/24 h;

d) **temperature control settings**.

Annex A
(normative)

Pull-down test

A.1 General

The purpose of this test is to measure the reserve capacity of a **refrigerating appliance** – particularly for high **ambient temperature** environments. This test is not applicable to stand-alone **wine storage appliance** or **wine storage compartments** within the **refrigerating appliance.**

A.2 Method overview

The pull down part of the test begins when the whole **refrigerating appliance**, including the inside, is in thermal equilibrium with the test room at 43 °C. The **refrigerating appliance** is then switched on and run to determine the time taken to meet pull-down temperature(s) as specified in Table A.1.

A.3 Set-up procedure

A.3.1 Test room ambient temperature

The temperature of the test room shall be set at 43 °C throughout the temperature stabilization period and for the duration of the test. It shall be maintained at 42,5 °C or warmer except, when verifying a supplier's claimed performance when it shall be maintained at 43,0 °C ± 0,5 K.

A.3.2 Installation

The **refrigerating appliance** shall be installed according to Annex B of IEC 62552-1:2015.

A.3.3 Disconnection of devices

Compressor overload devices shall not be disconnected or bridged. Any other device which might prevent continuous operation of the refrigerating system during a pull down test and which can be controlled by the user shall be disabled or set so that continuous operation of the cooling system occurs for the duration of test. **Temperature controls** shall be set (or bridged) and, where possible and necessary, **automatic defrost** systems disabled to ensure continuous operation for this test. Where the defrost system cannot be disabled without adversely affecting the performance, the controls shall be set to the manufacturer's default or recommended position.

A.3.4 User-adjustable features

User-adjustable baffles and **temperature controls** shall be set as required to obtain an optimum result.

This includes those on multi-function **compartments**, if any, where such adjustment does not take the temperature performance of those **compartments** outside the specified range for their coldest claimed functions.

This excludes baffles and controls on **convenience features**. These shall be set on the coldest setting.

A.3.5 Internal components

Any thermal storage devices (e.g. ice-bricks or similar) that are removable without the use of a tool shall be removed for all tests, irrespective of instructions.

All other internal components shall be positioned (or removed) as specified in B.2.5.1 of IEC 62552-1:2015.

Any remaining **ice cube trays** shall be empty for the duration of the test.

A.3.6 Determination of compartment temperature

Air temperature sensors shall be located in all **compartments** as specified in Annex D of IEC 62552-1:2015, except for **zero star compartments**, where no temperature measurements are required.

A.4 Test procedure

A.4.1 General

The test procedure shall be as follows:

A.4.2 Heat soak

With the test room ambient at 43 °C, and the **refrigerating appliance** switched off, open all doors, drawers and lids on the **refrigerating appliance** and let it stand to allow the whole **refrigerating appliance** to reach the **ambient temperature**.

NOTE Experience suggests that at least six hours with the **refrigerating appliance's** door(s) open in the test room is usually required to meet the equilibrium requirements below.

Close the doors but do not switch the **refrigerating appliance** on. The **refrigerating appliance** has reached the required starting condition for a pull down test when, over a period of 30 min. either of the following applies:

a) The average **compartment** temperature in each **compartment** does not vary by more than 0,3 °C.

or

b)

i) For a test to determine the performance of a **refrigerating appliance** the average **compartment** temperature in each **compartment** does not fall below 43 °C.

ii) For a test to verify claimed performance, the average temperature of each **compartment** does not rise above 43 °C.

A.4.3 Pull down

Start the **refrigerating appliance** and operate it until the average air temperature in all **compartments** is simultaneously at or below their applicable pull down temperatures in Table A.1.

NOTE As the **compartment** temperature is continuously falling during a pull down test, the instantaneous **compartment** temperature at any time is the arithmetic mean of the air temperatures of all measurement points within the **compartment** or **sub-compartment** at that time.

A.5 Test end-point

The test can be terminated when the average air temperature in all **compartment** is simultaneously at or below their applicable pull-down temperatures.

Pull-down temperatures shall be as specified in Table A.1.

Table A.1 – Pull-down temperatures for compartments

Compartment type	Average air temperature, °C
Pantry	20
Cellar	15
Fresh food	8
Chill	6
Zero star	No requirement
1 star	–1
2 star	–7
3 and 4 star	–12

A.6 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) The period from the start of the test until all **compartments** are simultaneously at or below the **target temperatures** in Table A.1.

b) The average air temperature reached in each **compartment**.

c) Where applicable, any alternative positions for air temperature sensors (all in accordance with Annex D of IEC 62552-1:2015).

d) The function selected for each multi-use **compartment**.

e) The position of each user-adjustable baffle which may affect operating temperatures in any space in the refrigerating appliance (including space in **convenience features** as well as in **compartments**).

f) Settings of all user-adjustable **temperature controls**.

g) Settings of all other user-adjustable switches and controls.

h) Any disconnection, bridging or modification in any way of any devices for the test.

Annex B
(normative)

Wine storage appliances and compartments; storage test

B.1 Objective

The purpose of this test is to check compliance with the requirements of this standard at each of the **ambient temperature**s (see A.3.2.3 in IEC 62552-1:2015) for the appropriate climate class).

B.2 Storage temperature requirements

Under the conditions specified in this clause and for each claimed climate class, the **wine storage appliance** shall be capable of maintaining, simultaneously, the required **storage temperatures** in all **compartments** (and the permitted temperature deviations during the **defrost and recovery period** where applicable) as defined below.

Storage temperature requirements:

Allowed operating range for a **wine storage compartment**.

T_{wim} :+5 °C ≤ T_{wim} ≤ +20 °C

Temperature for a **wine storage compartment** shall be able to operate down to:

T_{wma} ≤ +12 °C

If a **wine storage appliance** or **compartment** cannot achieve ≤+12 °C in this test, it will be classified and tested as a **pantry compartment**. It cannot claim to be a **wine storage compartment** according to this standard.

If there are two or more **wine storage compartments** in one **refrigerating appliance**, the temperature setting range can be subdivided with only part of the temperature range in each **wine storage compartment**. (For example, a **wine storage appliance** with two **compartments**, one **rated** from +6 °C to +14 °C and the other from +10 °C to +18 °C would comply with this requirement).

During a **defrost and recovery period** the temperatures T_{wma} of any **wine storage compartment** is not permitted to rise by more than 1,5 K above the average of that **compartment**.

NOTE 1 This is a smaller excursion than allowed in footnote b to Table 2.

NOTE 2 An example of a **defrost control cycle** for a **frost-free refrigerator-freezer** is given in Figure 1 of IEC 62552-1:2015.

B.3 Measurement of compartment temperature

For determining the **storage temperature** of these **compartments**, M-package**s** shall be located in accordance with Clause G.6 of IEC 62552-1:2015.

B.4 Preparation of refrigerating appliance

The **wine storage appliance** shall be installed in the test room in accordance with Annex B of IEC 62552-1:2015. If the **wine storage appliance** has **user-adjustable temperature control** devices, they shall be set at the positions recommended in the instructions for **normal use** at the appropriate **ambient temperature**. When the devices are not user-adjustable, the measurement shall be carried out on the **refrigerating appliance** as delivered. Readjustment of user-adjustable **temperature controls** is allowed.

If the **wine storage appliance** includes more than one **wine storage compartment** and the **volumes** of those **compartments** can be changed in relation to one another by the user, the **compartments** shall be adjusted so that the **compartment** with the temperature furthest from the test-room ambient has the largest **volume**.

If a **wine storage compartment volume** is adjustable in relation to another colder **compartment** type as specified in Table 2 the **wine storage compartment** shall be adjusted to its minimum **volume**.

Where a **wine storage compartment** has setting options for both uniform temperature and multiple temperature zones, the uniform temperature setting shall be selected for testing.

Wine storage appliances and **compartments** with anti-condensation heater(s) which are permanently on during **normal use** shall be tested with the heater(s) operating.

Anti-condensation heaters which can be manually controlled by the user shall be switched on and, if adjustable, they shall be set at their maximum heating rate.

Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

B.5 Measurements

B.5.1 General

For the appropriate **ambient temperature**, **temperature control** device(s) and other controls, if any, shall be adjusted, as necessary, to a position which is likely to give **storage temperatures** which comply with requirements in this clause, after **stable operating conditions** have been attained.

B.5.2 Conditions for demonstration of compliance

The following conditions shall all be met to demonstrate compliance;

– except during any freezing or **cooling capacity** test, the average of all temperature amplitudes at each measurement point in each **wine storage compartment** T_{wi} during the whole test period shall stay within ±0,5 K (see Clause G.7 of IEC 62552-1:2015)

– during any freezing or **cooling capacity** test the average of all temperature amplitudes at each measurement point in each **wine storage compartment** T_{wi} during the whole test period shall stay within ±1,5 K (see Clause G.7 of IEC 62552-1:2015)

– the integrated time averages of the temperatures T_{wim} shall stay between +5 °C and +20 °C. The arithmetic average T_{wma} of T_{w1m}, T_{w2m}, T_{w3m} shall be equal to or below +12 °C (G.3.1 of IEC 62552-1:2015)

B.6 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) the **ambient temperature(s)**;

b) for each ambient, the setting(s) of **temperature control** device(s) and other controls, if any (if user-adjustable);

c) for each ambient the value of the wine **storage temperature** T_{wma}, and the values of T_{w1m}, T_{w2m} and T_{w3m};

d) for each ambient the average of all temperature amplitudes at each measurement point

e) for each ambient the time averaged **compartment** humidity

f) the number of standard bottles that can be accommodated (see G.5.2 in IEC 62552-1:2015).

Annex C
(normative)

Temperature rise test

C.1 Objective

The purpose of this test is to check the time for the temperature rise of packages in a **refrigerating appliance** with one or more **three-star** or **four-star compartments**.

C.2 Procedure

C.2.1 Ambient temperature

The **ambient temperature** shall be 25 °C (see A.3.2.3 of IEC 62552-1:2015).

C.2.2 Preparation of refrigerating appliance

The **refrigerating appliance** shall be installed according to Annex B of IEC 62552-1:2015.

It shall be prepared, stabilized and loaded with test packages and M-packages (as for the storage test (see Clause 6).

C.2.3 Operation of the refrigerating appliance

The controls shall be set and the **refrigerating appliance** operated till all **frozen compartments** are at or colder than the temperatures specified in Table 2.

C.3 Test period and measurements

The power supply to the **refrigerating appliance** shall be switched off once **stable operating conditions** have been achieved. For automatic-defrosting **refrigerating appliances**, this shall be during the stable part of the **defrost control cycle**.

The times shall be noted when the first M-package in any **three-star** or **four-star compartment** reaches –18 °C and when the first M-package in any of these **compartments** first reaches –9 °C.

NOTE The first M-package to reach -18°C may not be the first to reach –9 °C.

C.4 Temperature rise time

This is the difference between the two times noted in Clause C.3.

C.5 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) the **ambient temperature**;
b) the time for the temperature rise from –18 °C to –9 °C.

Annex D
(normative)

Water vapour condensation test

D.1 Objective

The purpose of this test is to determine the extent of condensation of water on the external surface of the **refrigerating appliance** under specified ambient conditions.

D.2 Procedure

D.2.1 Ambient temperature

The **ambient temperature** shall be

+25 °C for class SN and N **refrigerating appliances**

+32 °C for class ST and T **refrigerating appliances**

D.2.2 Relative humidity

The humidity shall be such that the time averaged value of the dew point is

+19 °C ± 0,5 K for class SN and N **refrigerating appliances**

+27 °C ± 0,5 K for class ST and T **refrigerating appliances**

Two times the standard deviation of the recorded dew point values during the test shall be less than zero point five degrees kelvin.

For relevant conversions between dew point, relative humidity and wet bulb temperatures, see Table D.1

Table D.1 – Humidity conversions

Ambient	Dew point	Relative humidity	Wet bulb at 1013,25 mb
32 °C	27 °C	75 %	28,3 °C
25 °C	19 °C	69,3 %	21,3 °C

D.2.3 Preparation of refrigerating appliance

The **refrigerating appliance** shall be installed in accordance with Annex B of IEC 62552-1:2015.

Compartment average air temperatures shall be determined as specified in Annex D of IEC 62552-1:2015 and throughout the test average **compartment** air temperatures shall be at or below the **target temperatures** for an energy test in Table 1 in IEC 62552-3:2015.

D.2.4 Operation of the refrigerating appliance

If anti-condensation heaters are provided which can be switched on and off by the user, these shall be switched off. If, however, running water appears on the external surface of the **refrigerating appliance**, the test shall be repeated with the anti-condensation heaters switched on and, if adjustable, set at maximum heating. Anti-condensation heaters which are automatically controlled shall be allowed to operate normally.

Anti-condensation heater control settings or adjustment for **refrigerating appliances** with any anti-condensation heaters which are partly automatically controlled shall be set as requested by the person or authority requesting the test.

D.2.5 Test period

After **stable operating conditions** have been attained, all external surfaces of the **refrigerating appliance** shall be carefully wiped dry with a clean cloth and the test continued for a period of 24 h. The observation period shall be selected during the period when condensation is most likely to occur.

D.3 Observations

During the test period, external surface areas exhibiting fog, droplets or running water shall be outlined and coded by the letters “A”, “B” and “C”, respectively. See Figure D.1.

D.4 Data to be recorded

The following data shall be recorded for each test (as applicable):

a) a coded sketch may be made showing the running water area appearing during the test on all external surfaces. Code C as shown in Figure D.1 may be used to indicate this. Codes A and B may also be included;

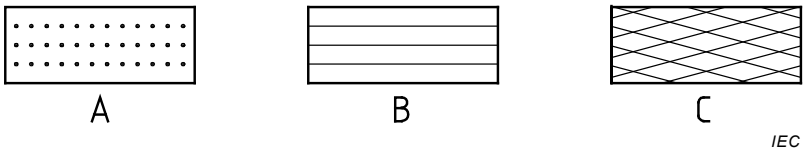
b) the selected test period;

c) the duration of the period of observation;

d) whether any manual switch provided for anti-condensation heaters was switched on or off or adjusted in accordance with D.2.4;

e) whether any semi-automatic anti-condensation heaters control was present, how it was set and how it functioned;

f) whether any automatic anti-condensation heaters control was present and how it functioned.



Key

A fog

B droplets

C running water

Figure D.1 – Condensation codes