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CONSOLIDATED VERSION

INTERNATIONAL STANDARD

colour inside

Electrical household and similar cooling and freezing appliances – Food preservation

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Electrical household and similar cooling and freezing appliances – Food preservation

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ELECTRICAL HOUSEHOLD AND SIMILAR COOLING AND FREEZING APPLIANCES – FOOD PRESERVATION

FOREWORD

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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 63169 edition 1.1 contains the first edition (2020-06) [documents 59M/123/FDIS and 59M/125/RVD] and its amendment 1 (2024-12) [documents 59M/174/FDIS and 59M/176/RVD].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 63169 has been prepared by subcommittee 59M: Performance of electrical household and similar cooling and freezing appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this document, the following print types are used:

- terms defined in Clause 3 of this document, and in Clause 3 of IEC 62552-1:2015: **Arial bold**.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The **weight loss** test assesses some of the food care aspects of various **compartments**, **sub-compartments** and **convenience features** within a refrigerator. The test can be performed with real or artificial foods. Real foods have seasonal and regional variations, making them difficult for global use for repeatable and reproducible testing.

Research was carried out on materials, which proved that a particular non-woven material was suitable to use to replicate real food. This non-woven material is used to replicate **weight loss** from food in the **weight loss** test. Consequently, this document contains an artificial material weight loss test.

As much as possible, alignment has been made with the performance test standards IEC 62552-1 and IEC 62552-3.

This document contains a link to the SC 59M Supporting Documents that are available on the IEC website. The SC 59M Supporting Documents include the 3D printing files, referred to in Annex B. These files are intended to be used as a complement, and do not form an integral part of the document.

ELECTRICAL HOUSEHOLD AND SIMILAR COOLING AND FREEZING APPLIANCES – FOOD PRESERVATION

1 Scope

~~This document deals with a test to simulate the **weight loss** of leafy produce, given certain conditions of temperature, humidity and air movement in one or more **test zones**. The test can only be applied to spaces larger than 200 mm × 150 mm ×100 mm (L × W × H).~~

~~The aim of the test is to measure the **weight loss rate** by measuring the weight of a **test tray** prior to the test and after a given duration.~~

~~NOTE **Weight loss** is one of the considerations for shelf life of produce. Other considerations such as condensation will be addressed in future amendments.~~

This document deals with two food preservation tests. A **weight loss** test and a **condensation** test.

The **weight loss** test simulates the **weight loss** of leafy produce, given certain conditions of temperature, humidity and air movement in one or more test zones. The aim of the test is to measure the **weight loss rate** by measuring the weight of a **test tray** prior to the test and again after a given duration.

The **condensation** test simulates **condensation** produced by real food on surfaces of the **test zone**, given certain conditions of temperature, humidity and air movement in one or more **test zones**. This test assesses the **condensation** in refrigerator **test zones** by using **test trays** filled with non-woven fabric to generate **condensation**, and then evaluates the **condensation** extent and distribution.

The **weight loss** test and **condensation** test apply to **test zones** that have an average operating temperature greater than 0 °C.

Both the **weight loss** test and **condensation** test are performed in series and not in parallel on the same refrigerator.

Both the **weight loss** test and the **condensation** test can only be applied to **test zones** having all dimensions exceeding 200 mm × 150 mm × 100 mm (L × W × H).

2 Normative references

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

edition of the referenced document (including any amendments) applies.

IEC 62552-1:2015, *Household refrigerating appliances – Characteristics and test methods – Part 1: General requirements*
IEC 62552-1:2015/AMD1:2020

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

3 Terms and definitions

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

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
test zone
space inside the refrigeration appliance subject to the **weight loss** test and the **condensation** test

Note 1 to entry: This space is typically a vegetable drawer or crisper but can also be any other compartment, sub-compartment or convenience feature (see IEC 62552-1:2015, 3.3.1, 3.3.2 and 3.3.3, respectively). The manufacturer shall fully describe any **test zones** to be tested.

Note 2 to entry: Any zone in a refrigerator can be a **test zone**. A **test zone** needs to be separated or at least partially sealed from other zones in the same **compartment** or **sub-compartment**.

Note 3 to entry: These tests cannot be performed in a compartment that is a non-enclosed space.

Note 4 to entry: The height of the **test zone** is the lid. If there is no lid, the height is the next horizontal surface immediately above the **test zone**.

3.2
test tray
tray of specific dimensions containing a predefined number of **test sheets** which is charged with a predefined amount of water

Note 1 to entry: Refer to Annex B for 3D printing files. The **weight loss** test uses one large 18 **test sheet test tray** per **test zone**.

3.3
weight loss
weight of water lost from the **test tray** between two moments in time in [g]

3.4
weight loss rate
weight loss divided by the time difference between the two moments in time expressed in [g/24h]

3.5
test sheet
sheet of the nonwoven fabric specified in Annex A cut to a size of (75 mm × 125 mm) ± 1 mm.

3.6
removable accessory
accessory that is movable, removable, or adjustable by the customer if instructed to do so in the user instructions to enable a different refrigerator function or configuration to be used

Note 1 to entry: Cleaning is not regarded as a different function so instructions to remove parts for cleaning-only, do not meet this requirement.

Note 2 to entry: Tools can be required for removal of such parts if so instructed.

3.7
condensation
droplets of water that appear on the cold surfaces of a **test zone**

3.8
total condensation
sum of all the **condensation** calculated in 6.5.4

3.9
average condensation
total condensation divided by the number of grid rectangles calculated in 6.2

4 Test preparation

4.1 Preparation and handling of test material

Table 1 – Test equipment

Test Tray	~~For 3D printing files (stp and stl files) for the test tray see: https://www.iec.ch/sc59m/supportingdocuments.~~ For 3D printing files (stp and stl files) for both the 18-sheet **test tray** for the **weight loss** test and the 6-sheet **test tray** for the **condensation** test – see normative Annex B. The **weight loss** test uses a single large tray The **condensation** test uses a number of small trays as calculated in 6.2 The **test tray** shall be non-absorbent and watertight. This ~~may~~ can be achieved by coating the **test tray** after the printing process.
Test sheet	**Test sheets** ~~need to~~ shall be cut from a filter material (typically material used for radiator evaporators). The size of a sheet is 75 mm × 125 mm. A material is specified in informative Annex A. For a method of proving equivalence of alternate materials refer to informative Annex D.

If the **test tray** is not directly used after a test series, it should be stored as follows:

a) leave the test sheets inside the test tray;
b) discard the residual water from the test tray;
c) dry the test tray with the test sheets at ambient temperature and low humidity;
d) store the test tray loaded with test sheets in the fresh food compartment of a refrigerator in operation.

After storage, the **test tray** can be recharged with water for new tests. Annex A contains provisions for checking the quality of the non-woven fabric.

4.2 Installation and preparation of refrigerating appliance

The ambient temperature shall be 25 °C (see A.2.6, A.3.1, A.3.2 and A.4.5 of IEC 62552-1:2015).

The ambient humidity shall be in accordance with A.2.3 and A.3.6 of IEC 62552-1:2015.

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

All internal accessories supplied with the refrigerating appliance shall be in their respective positions. See 5.1 in case these accessories interfere with the location of the **test tray**.

Before the test load is added, all **compartments** and **sub-compartments** shall be empty. Their temperatures shall be determined as specified in Annex D of IEC 62552-1:2015. The appliance shall be run until steady-state conditions are observed. Where user-operated baffles or controls are provided for adjustment of temperatures in **test zones,** each shall be adjusted to a setting in accordance with the instructions provided. If no specific instructions are provided, the setting shall be adjusted in accordance with the target temperature listed in Table 1 of IEC 62552-3:2015 within a tolerance of ±1 K.

Other **compartments** and **sub-compartments** shall be operated with temperatures as close as possible to the target temperatures as listed in Table 1 of IEC 62552-3:2015.

If the **test zone** is a **sub-compartment**, it shall be adjusted to a setting that results in a temperature of the **test zone** as close as possible to the specified target temperature in Table 1 of IEC 62552-3:2015. The temperature of the **test zone** shall be measured.

The temperature of a **compartment** or **sub-compartment** temperature shall be the average of temperature sensors placed in the positions as defined in Annex D of IEC 62552-1:2015.

4.3 Measurement sensor uncertainty

For temperature measurement uncertainty, reference is made to A.2.6 of IEC 62552-1:2015.

Because humidity measurement is optional, no uncertainty level is specified.

4.4 Test tray water

The temperature of the water in the **test tray(s)** for the **weight loss** test and **condensation** test shall be within ± 2 K of the temperature of the **test zone** to be evaluated. Each **test tray** shall be preconditioned for 24 h to ensure it is within ± 2 K of the temperature of the **test zone** to be evaluated. Preconditioning can be in the **test zone** or in another refrigerator.

5 Weight loss test

5.1 Procedure

Remove any condensation from the **test zone** prior to placing the **test tray**.

The test material consists of a single large **test tray** with 18 **test sheets.**

The test may be carried out simultaneously on one or more of the **test zones**.

If some of the **test zones** are not being tested at this time, then a **test tray** is placed in each such **test zone** prior to starting the test. Weight measurements need not be taken for these **test trays**.

The **weight loss** test load is a single, large, 18-**test-sheet, test tray**. The **test tray** can be filled with dry or wet **test sheets**. If dry **test sheets** are used, then the **test tray** should be charged with 600 g ± 50 g of distilled water. Less water may be used if the **test sheets** are already wet.

Before starting the test, the quality of the **test tray** can be inspected as detailed in Clause A.3.

The **test tray** shall be placed in the centre of the base area of the **test zone** to be evaluated. If it is not possible to place the **test tray** in the centre (due to the height or shape of the space) then the **test tray** shall be placed in the centre of the next biggest area or the next possible place where the **test sheets** do not touch the upper surface of the space. The **test sheets** in the **test tray** shall face perpendicular to the refrigerator door if possible.

The **test tray** shall not touch the walls of the **test zone**.

Examples of the **test tray** placement are shown in Figure 1.

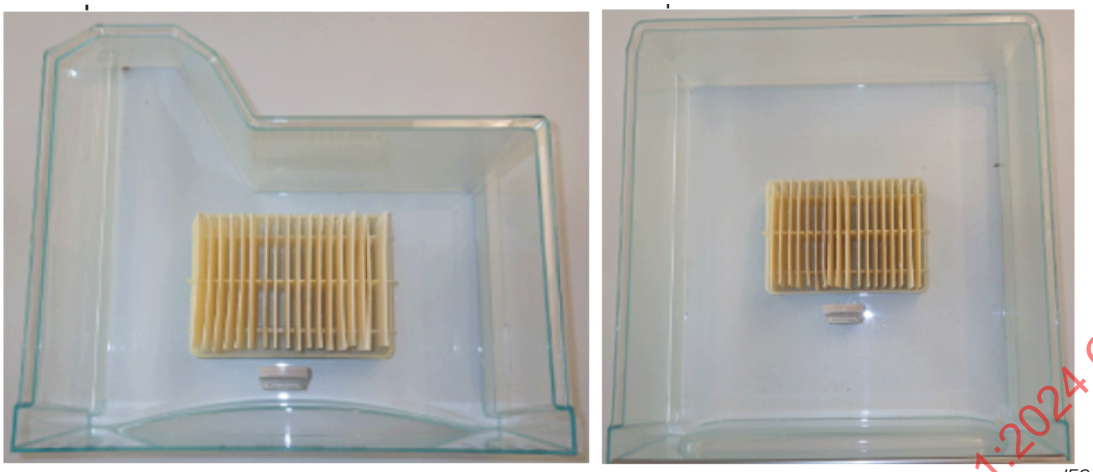


Figure 1 – Examples of test tray placement

~~If a **test tray** cannot be placed due to the presence of an accessory, the accessory shall be placed in accordance with the instructions and the **test tray** placed next to it.~~

~~If no specific instructions are provided:~~

~~a) in the case of a removable accessory at the required position, the accessory shall be removed;~~

~~b) in the case of a non-removable accessory but where it can be shifted with respect to the required position, the accessory shall be moved in the width direction to the right or in the depth direction to the back.~~

If the **test tray** cannot be placed due to the presence of a **removeable accessory**, the accessory can be moved/removed/adjusted in accordance with the manufacturer's **user instructions**.

If the **test tray** still cannot be placed, then a valid **weight loss** test cannot be performed.

During the test, the water shall not freeze.

The temperature of the water in the **test tray** shall be within ±2 K of the temperature of the **test zone** to be evaluated. The **test tray** shall be preconditioned for 24 h to ensure it is within ±2 K of the temperature of the **test zone** to be evaluated. Preconditioning can be in the **test zone** or in another refrigerator.

A temperature sensing element shall be placed 1 cm in front of the **test tray** and shall not be in contact with the **test tray**. If wired sensors are used, the wires shall be mounted such so they do not cross sealing surfaces of the **test zone**.

The maximum duration of door openings for loading and unloading of **test tray**s shall be 1 min.

The **test tray** is then loaded into the **test zone** for another 24 h conditioning. After the conditioning, the weight of the **test tray** shall be measured (M_1 [g]) and the time (t_1 [h]) taken. The weight shall be determined with a resolution of 0,1 g and the time with a resolution of 1 min.

At least 24 hours after time t_1, the weight of the **test tray** shall again be measured (M_2 [g]) and the time recorded (t_2 [h]). The time taken to measure M_2 shall be less than 2 min.

The difference between M_1 and M_2 shall not be greater than 200 g.

Immediately after a test, another test may be conducted using the same **test zone** for the 24 h conditioning.

5.2 Weight loss calculation.

The **weight loss rate** is calculated as follows:

$$W = [(M_1 - M_2)/(t_2 - t_1)] \times 24 \text{ [g/24h]}$$

The **weight loss** test is concluded after the measurement of M_2 and the **weight loss rate** calculation.

For a suggested test report format, refer to Annex C. For guidance on expected uncertainty, refer to Annex E.

6 Condensation test

6.1 General

The **condensation** test consists of evaluating the **condensation** in a **test zone.** This is done by dividing all 6 **test zone** surfaces into rectangles. Multiple small **test trays** are loaded with water and non-woven fabric. The compartment/refrigerator door is closed. After 72 h, evaluation is made by assessing the **condensation** in each rectangle and summing them accordingly. Clarification of some **test zone** surfaces is contained in informative Annex H.

6.2 Preparation of test zone

Remove any **condensation** from the **test zone** prior to placing the **test tray** by wiping with a tissue or paper towel.

The test material consists of a number of small **test trays** with 6 sheets of non-woven fabric material as specified in Table A.1.

The number of small **test trays** is the volume of the **test zone** (in litres)/3 rounded to the nearest integer value.

For example, a 25,3 l crisper should load 25,3/3 = 8,43 to be rounded to 8 small **test trays,** and a 25,6 l crisper should load 25,6/3 = 8,53 to be rounded to 9 small **test trays**.

Each surface of the **test zone** is divided into a grid of rectangles according to the following method.

- determine each length or height of the **test zone** in mm and divide by 50;
- round the length or height up to the next whole number and this gives the number of rectangles for that dimension.

See informative Annex G for examples. This means that there will likely be a different number of rectangles horizontally and vertically. The maximum dimension of a rectangle will be 50 mm.

Part rectangles (for example a sloping side) are counted as a complete rectangle.

NOTE For practical purposes, examples of usable rectangles could be a grid marked on the **test zone** before testing, or a transparency held against the surface during evaluation.

For the **condensation** test multiple **test zones** may be tested simultaneously. Any **test zones** in the refrigerator that are not being tested do not need to have **test trays** loaded.

6.3 Test tray placement

To allow a trial **test tray** placement, the **test trays** are left empty and loaded into the **test zone**.

The **test trays** are clipped together using the clips of normative Annex B. If all the **test trays** can be placed on the base of the **test zone** then they are centralised both left to right and front to back.

If the shape of the **test zone** prohibits centralising the **test trays** as above, the **test trays** are biased to the front and/or left to try and place them on the base.

If necessary, the **test trays** can be disconnected from the clips to allow some **test trays** to move forward or backward relative to one another (or left or right) but the **test trays** spacing shall be at least 5 mm side to side. These 5 mm do not include any spacers which are formed as part of the **test tray**.

The **test trays** can be at angles to each other (preferably a right angle).

If necessary, an upper layer of **test trays** can be stacked on top of the lower layer. As many **test trays** as possible shall be in the lower layer before any additional **test trays** are stacked.

At all times there shall be at least 10 mm vertical clearance between the top of any **test sheet** and the underside of the **test zone** lid.

If, because of the size and/or shape of the **test zone**, the required number of **test trays** cannot be loaded, then the **test trays** spacing can be reduced. For the test to remain valid, the following minimums shall be observed. There shall be at least

- 1 mm spacing between **test trays**;
- 3 mm spacing between the **test trays** and **test zone** walls.

Any upper layer **test trays** should be centralised over the lower layer biasing to the front and left if necessary.

If the base of the **test zone** is angled, then the **test trays** can sit on the angled base if the inclination is less than 15 mm high for each 100 mm length of the base. Inclinations greater than this shall have the **test trays** supported horizontally by a packer. In all cases, the 10 mm vertical clearance of any **test sheet** and the **test zone** lid shall be observed.

A record (photos or drawings, etc.) of the **test trays** layout should be in the test report described in informative Annex C.

Before starting the test, the quality of the non-woven materials can be inspected as detailed in informative Annex A.

If **test trays** cannot be placed due to the presence of an accessory, the accessory can be moved/removed/adjusted in accordance with the manufacturer's **test zone** description. If no specific instructions are provided, in the case of a:

- **removeable accessory** at the required position, the accessory shall be moved, removed or adjusted if possible;
- non-removable accessory, **test trays** may be stacked in 2 layers.

If **test trays** still cannot be placed, then a valid **condensation** test cannot be performed.

Test trays can be filled with dry or wet **test sheets**. If dry **test sheets** are used then the **test tray** should be charged with 200 g ± 50 g of distilled water. Less water can be used if wet **test sheets** are used.

NOTE Historical weight data of the **test tray** and **test sheets** can expedite the addition of an appropriate quantity of water.

If the **test sheets** cannot face perpendicular to the refrigerator front door, the **test trays** shall be placed with **test sheets** facing parallel to the door.

See informative Annex F for examples of alternative **test tray** layouts.

6.4 Test procedure

1) Prepare the **test zone** as specified in 6.2.
2) Load and place the **test trays** as specified in 6.3.
3) Close the **test zone** and/or refrigerator door.
4) Record the start time.
5) Leave the refrigerator door closed during the test.
6) During the test, the water shall not freeze.
7) After 72 h, begin the **condensation** evaluation.

6.5 Condensation evaluation

6.5.1 General

Condensation evaluation is made by visual assessment of the **condensation** on each surface of the **test zone**. The degree of **condensation** depends on:

- the position of **condensation** on the surface of **test zone**;
- the severity of **condensation**.

NOTE Guidance on how to carry out the evaluation is given in informative Annex H.

6.5.2 Position and severity of condensation

6.5.2.1 Position of condensation on the surface of test zone

Each rectangle as specified in 6.2 is used when assessing **condensation** on each **test zone** surface.

6.5.2.2 Severity of condensation

Each rectangle is assessed for severity with only the maximum severity being recorded for the final calculation. Then assess the number of rectangles for each level of **condensation**. Any **condensation** in a rectangle means that rectangle is counted in the final calculation, regardless of the area of **condensation** within the rectangle.

Each rectangle is allocated a **condensation** severity score (CSS) as specified in Table 2.

Table 2 – Condensation severity score

Condensation type	CSS
Mist/No **condensation**	0
Drops with any dimension < 10 mm	1
Running water	1
Pooling with any dimension > 10 mm	3
NOTE Pooling is only on the **test zone** base and is the result of running water	

6.5.2.3 Condensation

The **condensation** on each rectangle is assessed according to 6.5.2.2. **Condensation** (C) on each surface is the sum of all of the rectangles on that surface with any **condensation**, multiplied by each rectangle's **condensation** severity score. Each surface of the **test zone** is calculated separately and then added for the total.

6.5.3 Total condensation (TC)

$$TC = C_{Front} + C_{Back} + C_{Top} + C_{Bottom} + C_{LH\ Side} + C_{RH\ Side}$$

6.5.4 Average condensation (C_{Avg})

$$C_{Avg} = TC/(\text{Total number of rectangles on all surfaces})$$

Annex A
(informative)

Non-woven material specifications

A.1 General

The products cited in this annex are examples of suitable products available commercially[1].

A.2 Non-woven fabric specification 1

Specification for Brune 02 (3614) Humidifier Filter Pads

Product	Humidifier filter pad with holes and additive
Raw materials	Wetlaid cellulose 330 g/m^2. Additive added during manufacture is Wax shell.
Final dimensions	(370 mm × 440 mm) ± 5 mm
Wax	440 mm long. Saturated down from one long edge
Punched holes	13 mm from long edge where wax/crush line has been input and 90 mm from each edge forming a gap of 260 mm between the centre of each hole

- Supplier of already cut sheets

  Lerch Raumklima GmbH

  Faistenbergerstrasse 6

  81545 München

  Germany

  Tel: +49 (0)89 64 74 95

  Fax: +49 (0)89 642 18 68

  E-Mail: info@lerch24.de

  Internet: www.lerch-raumklima.de
- Supplier of non-woven material

  www.brune-humidifier.com/shop/filters/filters-for-radiator-evaporators.html

A.3 Visual inspection of test trays

Figure A.1 gives guidance in deciding whether the **test sheets** are fit for use or reuse in testing. Care should be taken to avoid contact between **test sheets**.

[1] This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these brands or suppliers. Equivalent products may be used if they can be shown to lead to the same results.

Figure A.1 – Non-woven fabric of various ages

A.4 Non-woven fabric, material specification 2

Tests have been carried out at the DITF (Deutsche Institute für Textil- und Faserforschung) and details are found in report No E-0053-TT-18. A summary of the material specification is given in Table A.1.

Table A.1 – Non-woven fabric material specification 2

Material composition	**100 % cotton 330 g/m^2 wetlaid cellulose**	
Test method	Property	Value
DIN 53924:1997	Rising height after 15 s (mm)	35 – 42
DIN 53923:1978	Water absorption (%)	570 – 594
ISO 9073-3:1989	Tensile strength (N/5 cm)	94 (length) 86 (cross)
ISO 9073-3:1989	Elongation (%)	3,8 (length) 4,6 (cross)
ISO 9237:1995	Permeability (l/s m^2) at pressure 200 Pa/5 cm^2	224 – 227

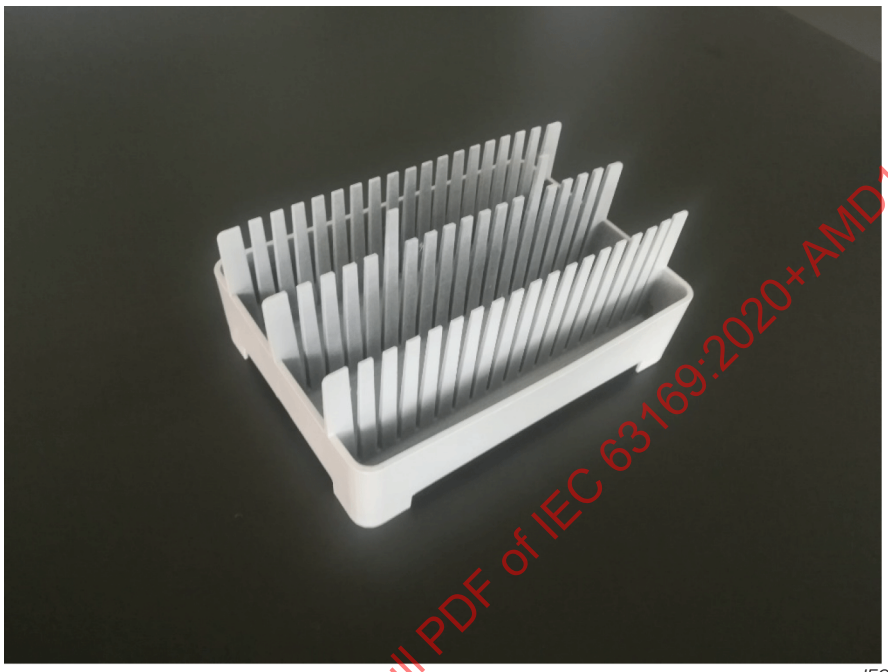
The test may be carried out

- using the material in the delivery state;
- using the material in the delivery state but after rinsing and drying;
- by placing the fibres in the cross or length direction.

Annex B
(normative)

Weight loss and condensation test trays

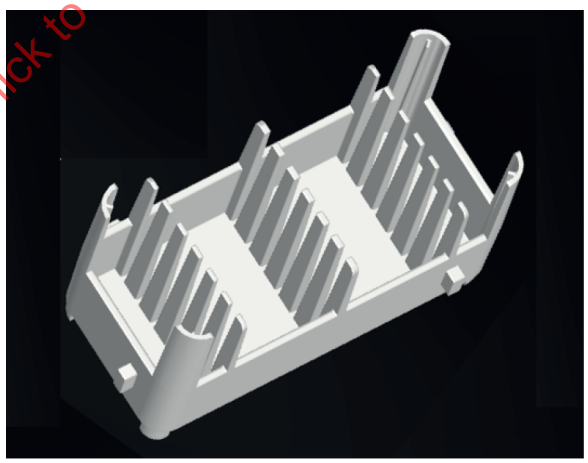
This annex shows the **weight loss** and condensation **test trays.** The 18-sheet weight loss **test tray** is shown in Figure B.1. The 6-sheet weight loss **test tray** is shown in Figure B.2.



IEC

Nominal dimensions (mm): 196(L) × 141(W) × 90(H)

Figure B.1 – 18-sheet weight loss test tray



IEC

Nominal dimensions (mm): 151(L) × 75(W) × 81(H)

Figure B.2 – 6-sheet condensation test tray

3D printing files (stp and stl files) for an 18-sheet **test tray** ~~are available from the online dashboard of IEC SC 59M~~ and the 6-sheet **test tray** can be accessed via SC 59M supporting documents at the following link: www.iec.ch/sc59m/supportingdocuments

The test tray clip in Figure B.3 may be used for securing and spacing adjacent **test trays** apart for the **condensation** test.

IEC

Figure B.3 – Test tray clip

Annex C
(informative)

Outline of test report for weight loss test

Test report number

Date

Laboratory details (name & location)

Refrigerator Description.

Brand

Model Number

Test zone descriptions and conditions.

(All **test zones** to be tested are to be described in detail).

To include:

- voltage and frequency;
- physical description of test zone including sketches/photos etc.;
- position in refrigerator;
- definition of each test zone as per IEC 62552-1;
- identify which test zones are tested in this report;
- features of tested test zone;
- setting of test zone if tested;
- test tray placement in accordance with 5.1;
- settings of untested test zones;
- test tray position in untested zones;
- volume of each test zone;
- average temperature and humidity of test room.

Test conditions

- Average compartment temperature.
- **Test zone** temperature and humidity (if measured).

Test results

As detailed in Table C.1.

~~Table C.1 – Test results~~

~~Compartment type~~[b]	~~Compartment identification~~	~~Refrigerator/Freezer~~		~~Compartment~~		t_1[a]	M_1[a]	t_2[a]	M_2[a]	W[a]
		~~Setting~~	~~Temperature~~	~~Test zone setting~~	~~Temperature~~	~~[h]~~	~~[g]~~	~~[h]~~	~~[g]~~	~~[g/24h]~~

~~[a] t_1, M_1, t_2, M_2 and W are in accordance with 5.1 and 5.2~~

~~[b] Compartment types are as specified IEC 62552-1:2015~~

Test report

Are both **weight loss** test and **condensation** tests covered in this report? **YES/NO**

Test report number

Date

Laboratory details (name & location)

Refrigerator description

Brand

Model number

Test zone descriptions and conditions

(All **test zones** to be tested are to be described in detail).

To include:

- voltage and frequency,
- physical description of **test zone** including sketches/photos etc.,
- position in refrigerator,
- definition of each **test zone** as per IEC 62552-1,
- identification of which **test zones** are tested in this report,
- features of tested **test zone**,
- setting of **test zone** if tested,
- **test tray** placement according to 5.1,
- settings of untested **test zones**,
- **test tray** position in untested zones,
- volume of each **test zone,**
- average temperature and humidity of test room.

Test conditions

- average compartment temperature,
- **test zone** temperature and humidity (if measured).

Test results

As detailed in Table C.1, Table C.2 and Table C.3

Table C.1 – Test settings

Refrigerator model			Compartment		
Compartment type [a]	Compartment ID	Temperature control setting	Compartment temperature	Test zone setting	Test zone temperature

[a] Compartment types are as specified IEC 62552-1:2015 and IEC 62552-1:2015/AMD1:2020.

Table C.2 – Test results – Weight loss – Weight loss rate W[a]

t_1[a] [h]	M_1[a] (g)	t_2[a] (h)	M_2[a] (g)	W[a] (g/24 h)	

[a] t_1, M_1, t_2, M_2 and W are in accordance with 5.1 and 5.2

Table C.3 – Test results – Condensation – TC and C_{AVG}

Surface	Top	Bottom	Left	Right	Front	Back	Total
Number of rectangles							
Condensation score							

Total condensation (TC) =

Average condensation (C_{AVG}) =

Annex D
(informative)

Equivalence of non-woven material

If the specified non-woven material is difficult to obtain at any time, an equivalent material may be used. Equivalence needs to be proven and documented.

Equivalence is proven by testing both the original and replacement non-woven materials under similar conditions, thus getting a calibration curve (see Figure D.1).

The ideal case for an alternative material is a 1 to 1 correlation to the specified material, that gives a straight-line equivalence over a wide **weight loss rate** range (see Figure D.1). As a consequence, the alternative material is considered to behave in a more or less identical way to the specified material at both low **weight loss rate** and high **weight loss rate**.

Guidance:

- At least 3 evaporation conditions need to be tested.
- More evaporation conditions will need to be tested if the equivalence is not linear.
- The evaporation conditions need to span the conditions of the test zones to be tested. No extrapolation is allowed.
- The results, including uncertainty, need to be documented and accompany the test report.
- Figure D.1 shows the result of an acceptable equivalence to Brune 02 (3614) filter pad material.
- The final results of the weight loss rates need to be calculated back to the Brune non-woven weight loss rates by means of the calibration curve.

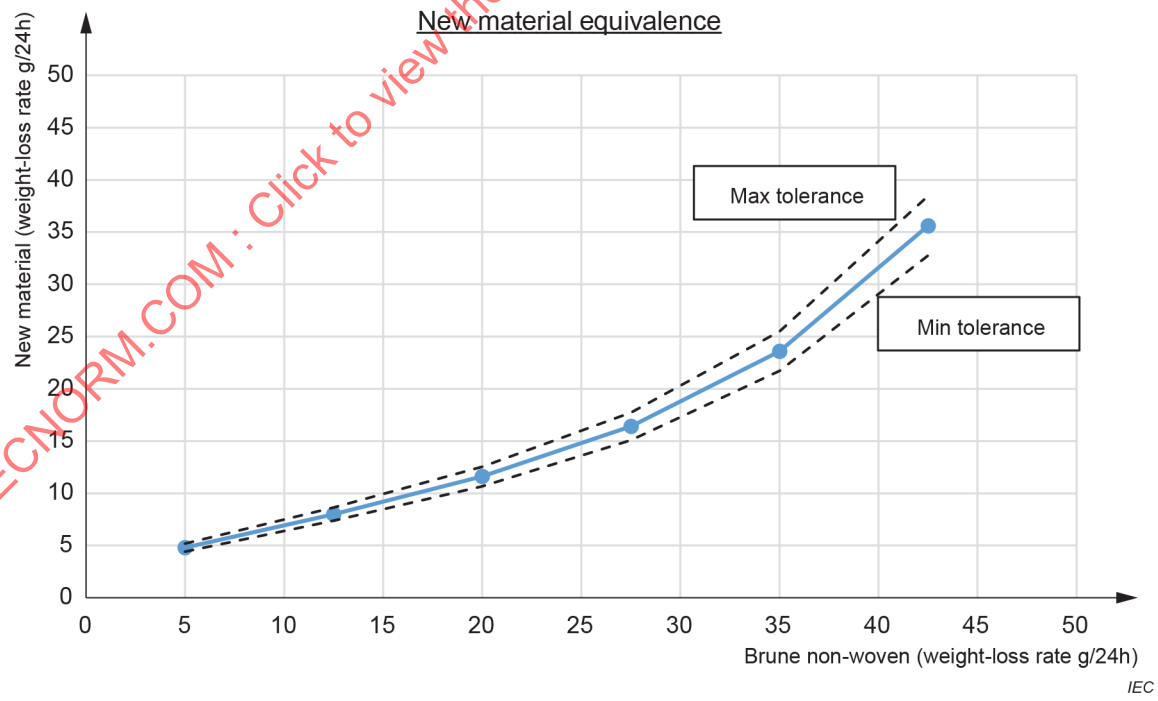


Figure D.1 – Example of an acceptable equivalence

Annex E
(informative)

Expected uncertainty of weight loss

During the development of the **weight loss** testing protocol, measurements have been undertaken by various companies and institutions in order to understand the practicality, repeatability and reproducibility of the test procedure. To estimate reproducibility, the testing also included interlaboratory testing trials. From the test data available, the interlaboratory data selected is from the CoolFresh project executed in Germany during 2018-2020. This represents the most extensive ring testing performed following the final procedure laid down in this document. The data has been accumulated in a single chart as shown Figure E.1. The ring test included seven laboratories and in total three different **test zones** were investigated, having a low, medium and high sealing quality, respectively. Each test was repeated five times. The individual laboratory test results are shown in Figure E.1 where each test result is compared with the average result from all test laboratories for the respective bin. In Figure E.1, circles are drawn that represent twice the standard deviation for each type of **test zone**.

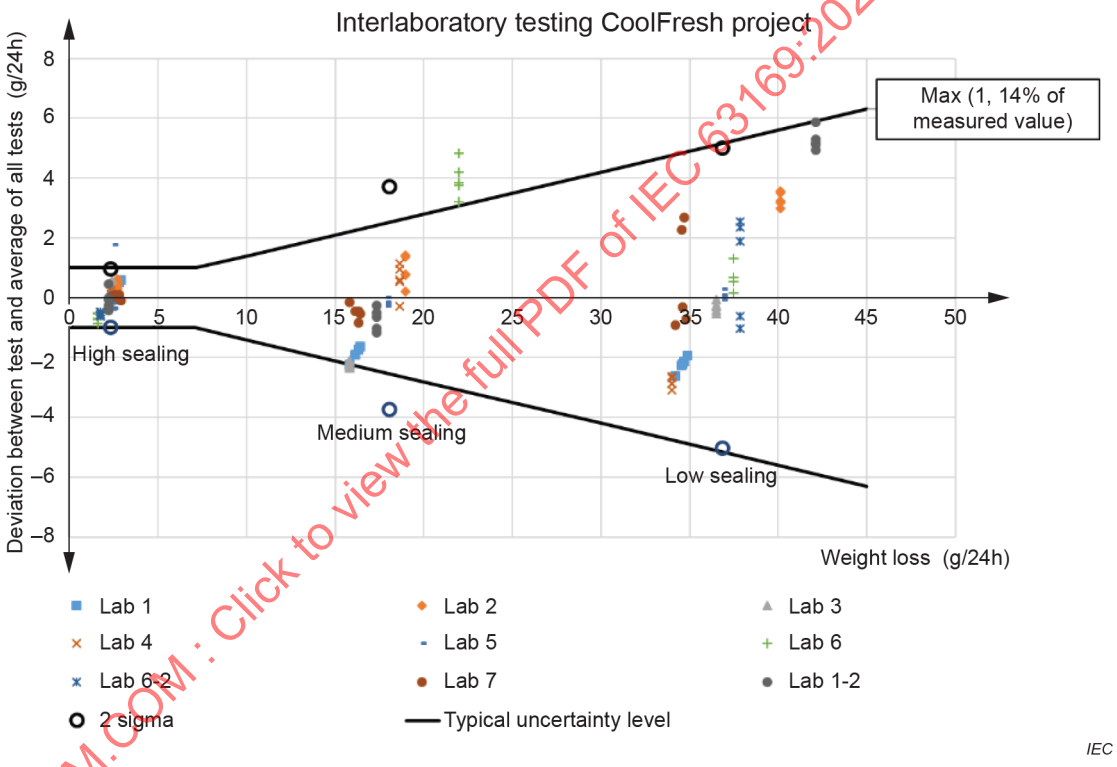


Figure E.1 – Individual laboratory test results

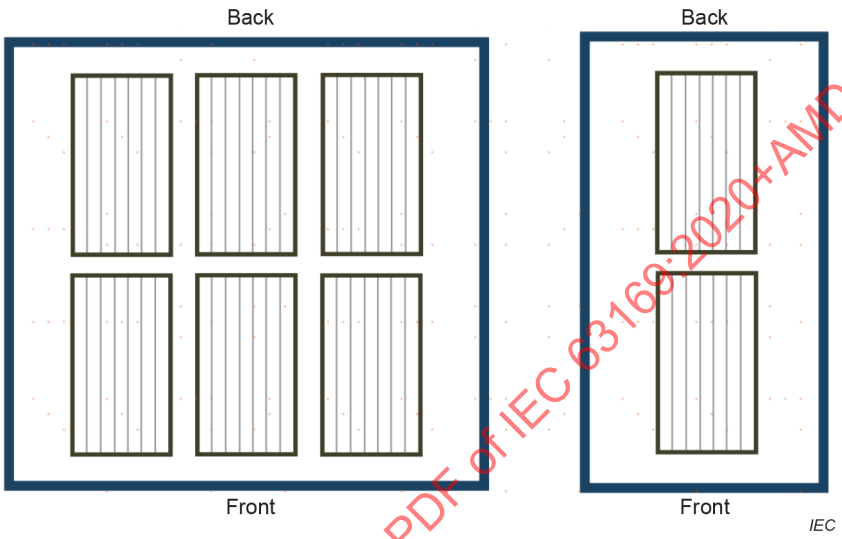
From this data field, it is possible to estimate a typical uncertainty level (top-down approach) taking into consideration that there are some outliers in the data. It is believed that this typical uncertainty (based on 2 times the standard deviation) of the **weight loss** test procedure is approximately 14 % of the measured value with a minimum of 1 g/d.

Annex F
(informative)

Condensation test tray placement guidelines

This annex contains general guidance on the condensation **test tray** placement. It shows examples of alternative **test tray** layouts.

In Figure F.1 the **sheet** layout is shown. The preferred position is with all **test sheets** facing perpendicularly to the refrigerator door.

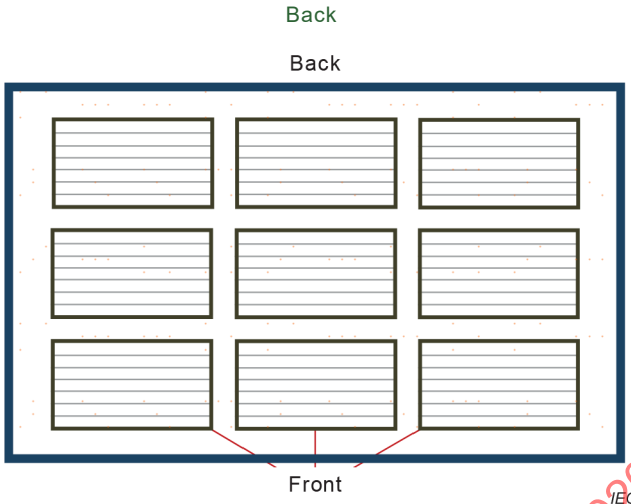


a) Sheet layout drawing

b) Sheet layout pictures

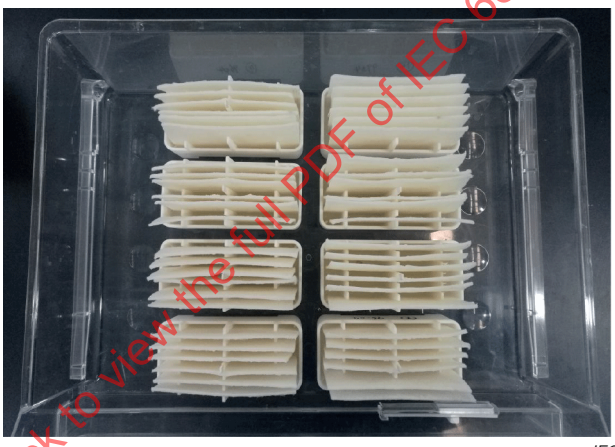
Figure F.1 – Sheet layout

Alternate **sheet** layout facing parallel to the door, if the **sheets** cannot face perpendicularly to the refrigerator door, is shown in Figure F.2.



Front

a) Alternate sheet layout drawing



b) Alternate sheet layout picture

Figure F.2 – Alternate sheet layout

Annex G
(informative)

Condensation rectangle dimension examples

This annex contains examples of the condensation rectangle dimensions and of the calculations of the number of rectangles from the condensation rectangle dimensions. Examples of condensation rectangle dimensions are shown in Figure G.1.

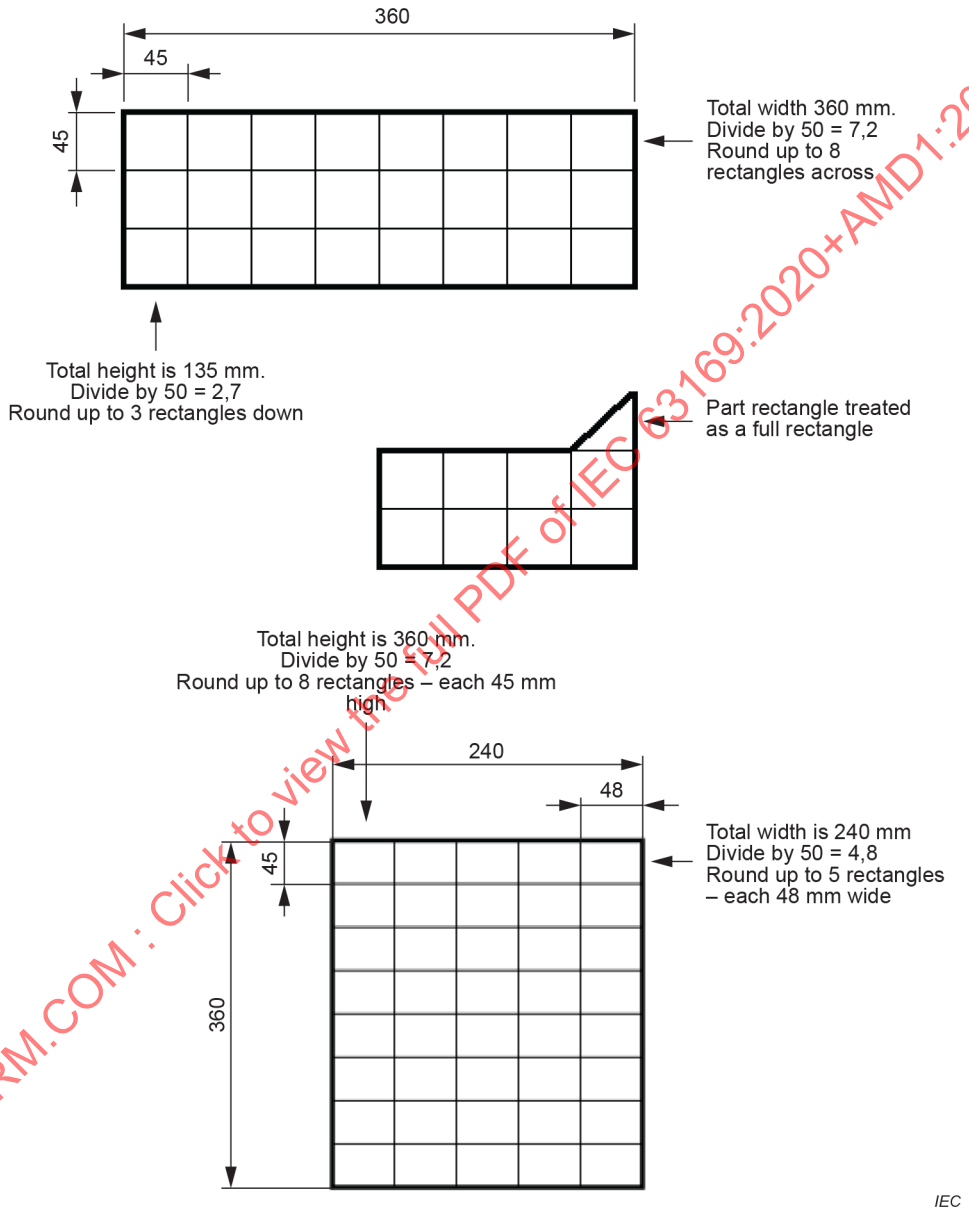


Figure G.1 – Examples of condensation rectangle dimensions

Annex H
(informative)

Condensation evaluation guidance

This annex contains general guidance based on experience to improve the repeatability of the **condensation** evaluation assessment.

– Removal of bins/lids. Sometimes it is necessary to remove the crisper bin to assist evaluation.

– It is important to evaluate pooling, large drops and running water as much as possible prior to moving or removing the bin.

– Carry out the evaluation as far as possible before any sudden or tilting movement.

– If multiple assessors are used it is important that all assessors carry out the evaluation independently and as far as possible before any components are moved.

– Textured/coloured **test zones**. The use of a light source or torch can aid assessment with textured/coloured **test zones**.

– Carry out the assessment immediately, as there can be a rapid change in **condensation** when a door is opened.

– Take images of **condensation** but do not grade **condensation** from an image. If scoring a particular plane is difficult, get a second opinion or divide plane into smaller areas (then average to obtain 2 scores).

– Light mist or fog can occur on all planes when opening the refrigerator door. For this reason, a light mist will be scored no differently to zero **condensation**.

NOTE A waiting period of approximately 2 min to let fog clear can assist evaluation.

– Analyse the base of the bin first as it is the most sensitive to pooling.

– For visual evaluation a two-step method should be used to distinguish small drops from fog/light mist:

- Step 1. Do not remove bins/lids. Distinguish small drops, big drops and pooling water.
- Step 2. Remove the bin/lid, and then examine it to distinguish small drops and fog/light mist under the room strong light.

Bibliography

IEC 62552-2:2015, *Household refrigerating appliances – Characteristics and test methods – Part 2: Performance requirements*

ISO 9073-3:1989, *Textiles – Test methods nonwovens – Part 3: Determination tensile strength elongation*.

ISO 9237:1995, *Textiles – Determination of the permeability of fabrics to air*

DIN 53923:1978, *Testing of textiles; Determination of water absorption of textile fabrics*

DIN 53924:1997, *Testing of textiles – Velocity of soaking water of textile fabrics (method by determining the rising height)*

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL HOUSEHOLD AND SIMILAR COOLING AND FREEZING APPLIANCES – FOOD PRESERVATION

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 63169 edition 1.1 contains the first edition (2020-06) [documents 59M/123/FDIS and 59M/125/RVD] and its amendment 1 (2024-12) [documents 59M/174/FDIS and 59M/176/RVD].

This Final version does not show where the technical content is modified by amendment 1. A separate Redline version with all changes highlighted is available in this publication.

International Standard IEC 63169 has been prepared by subcommittee 59M: Performance of electrical household and similar cooling and freezing appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this document, the following print types are used:

- terms defined in Clause 3 of this document, and in Clause 3 of IEC 62552-1:2015: **Arial bold**.

The committee has decided that the contents of this document and its amendment will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

NOTE The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The **weight loss** test assesses some of the food care aspects of various **compartments**, **sub-compartments** and **convenience features** within a refrigerator. The test can be performed with real or artificial foods. Real foods have seasonal and regional variations, making them difficult for global use for repeatable and reproducible testing.

Research was carried out on materials, which proved that a particular non-woven material was suitable to use to replicate real food. This non-woven material is used to replicate **weight loss** from food in the **weight loss** test. Consequently, this document contains an artificial material weight loss test.

As much as possible, alignment has been made with the performance test standards IEC 62552-1 and IEC 62552-3.

This document contains a link to the SC 59M Supporting Documents that are available on the IEC website. The SC 59M Supporting Documents include the 3D printing files, referred to in Annex B. These files are intended to be used as a complement, and do not form an integral part of the document.

ELECTRICAL HOUSEHOLD AND SIMILAR COOLING AND FREEZING APPLIANCES – FOOD PRESERVATION

1 Scope

This document deals with two food preservation tests. A **weight loss** test and a **condensation** test.

The **weight loss** test simulates the **weight loss** of leafy produce, given certain conditions of temperature, humidity and air movement in one or more test zones. The aim of the test is to measure the **weight loss rate** by measuring the weight of a **test tray** prior to the test and again after a given duration.

The **condensation** test simulates **condensation** produced by real food on surfaces of the **test zone**, given certain conditions of temperature, humidity and air movement in one or more **test zones**. This test assesses the **condensation** in refrigerator **test zones** by using **test trays** filled with non-woven fabric to generate **condensation**, and then evaluates the **condensation** extent and distribution.

The **weight loss** test and **condensation** test apply to **test zones** that have an average operating temperature greater than 0 °C.

Both the **weight loss** test and **condensation** test are performed in series and not in parallel on the same refrigerator.

Both the **weight loss** test and the **condensation** test can only be applied to **test zones** having all dimensions exceeding 200 mm × 150 mm × 100 mm (L × W × H).

2 Normative references

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

edition of the referenced document (including any amendments) applies.

IEC 62552-1:2015, *Household refrigerating appliances – Characteristics and test methods – Part 1: General requirements*
IEC 62552-1:2015/AMD1:2020

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

3 Terms and definitions

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

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

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

- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
test zone
space inside the refrigeration appliance subject to the **weight loss** test and the **condensation** test

Note 1 to entry: This space is typically a vegetable drawer or crisper but can also be any other compartment, sub-compartment or convenience feature (see IEC 62552-1:2015, 3.3.1, 3.3.2 and 3.3.3, respectively). The manufacturer shall fully describe any **test zones** to be tested.

Note 2 to entry: Any zone in a refrigerator can be a **test zone**. A **test zone** needs to be separated or at least partially sealed from other zones in the same **compartment** or **sub-compartment**.

Note 3 to entry: These tests cannot be performed in a compartment that is a non-enclosed space.

Note 4 to entry: The height of the **test zone** is the lid. If there is no lid, the height is the next horizontal surface immediately above the **test zone**.

3.2
test tray
tray of specific dimensions containing a predefined number of **test sheets** which is charged with a predefined amount of water

Note 1 to entry: Refer to Annex B for 3D printing files. The **weight loss** test uses one large 18 **test sheet test tray** per **test zone**.

3.3
weight loss
weight of water lost from the **test tray** between two moments in time in [g]

3.4
weight loss rate
weight loss divided by the time difference between the two moments in time expressed in [g/24h]

3.5
test sheet
sheet of the nonwoven fabric specified in Annex A cut to a size of (75 mm × 125 mm) ± 1 mm.

3.6
removable accessory
accessory that is movable, removable, or adjustable by the customer if instructed to do so in the user instructions to enable a different refrigerator function or configuration to be used

Note 1 to entry: Cleaning is not regarded as a different function so instructions to remove parts for cleaning-only, do not meet this requirement.

Note 2 to entry: Tools can be required for removal of such parts if so instructed.

3.7
condensation
droplets of water that appear on the cold surfaces of a **test zone**

3.8
total condensation
sum of all the **condensation** calculated in 6.5.4

3.9
average condensation
total condensation divided by the number of grid rectangles calculated in 6.2

4 Test preparation

4.1 Preparation and handling of test material

Table 1 – Test equipment

Test Tray	For 3D printing files (stp and stl files) for both the 18-sheet **test tray** for the **weight loss** test and the 6-sheet **test tray** for the **condensation** test – see normative Annex B. The **weight loss** test uses a single large tray The **condensation** test uses a number of small trays as calculated in 6.2 The **test tray** shall be non-absorbent and watertight. This can be achieved by coating the **test tray** after the printing process.
Test sheet	**Test sheets** shall be cut from a filter material (typically material used for radiator evaporators). The size of a sheet is 75 mm × 125 mm. A material is specified in informative Annex A. For a method of proving equivalence of alternate materials refer to informative Annex D.

If the **test tray** is not directly used after a test series, it should be stored as follows:

a) leave the test sheets inside the test tray;

b) discard the residual water from the test tray;

c) dry the test tray with the test sheets at ambient temperature and low humidity;

d) store the test tray loaded with test sheets in the fresh food compartment of a refrigerator in operation.

After storage, the **test tray** can be recharged with water for new tests. Annex A contains provisions for checking the quality of the non-woven fabric.

4.2 Installation and preparation of refrigerating appliance

The ambient temperature shall be 25 °C (see A.2.6, A.3.1, A.3.2 and A.4.5 of IEC 62552-1:2015).

The ambient humidity shall be in accordance with A.2.3 and A.3.6 of IEC 62552-1:2015.

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

All internal accessories supplied with the refrigerating appliance shall be in their respective positions. See 5.1 in case these accessories interfere with the location of the **test tray**.

Before the test load is added, all **compartments** and **sub-compartments** shall be empty. Their temperatures shall be determined as specified in Annex D of IEC 62552-1:2015. The appliance shall be run until steady-state conditions are observed. Where user-operated baffles or controls are provided for adjustment of temperatures in **test zones,** each shall be adjusted to a setting in accordance with the instructions provided. If no specific instructions are provided, the setting shall be adjusted in accordance with the target temperature listed in Table 1 of IEC 62552-3:2015 within a tolerance of ±1 K.

Other **compartments** and **sub-compartments** shall be operated with temperatures as close as possible to the target temperatures as listed in Table 1 of IEC 62552-3:2015.

If the **test zone** is a **sub-compartment**, it shall be adjusted to a setting that results in a temperature of the **test zone** as close as possible to the specified target temperature in Table 1 of IEC 62552-3:2015. The temperature of the **test zone** shall be measured.

The temperature of a **compartment** or **sub-compartment** temperature shall be the average of temperature sensors placed in the positions as defined in Annex D of IEC 62552-1:2015.

4.3 Measurement sensor uncertainty

For temperature measurement uncertainty, reference is made to A.2.6 of IEC 62552-1:2015.

Because humidity measurement is optional, no uncertainty level is specified.

4.4 Test tray water

The temperature of the water in the **test tray(s)** for the **weight loss** test and **condensation** test shall be within ± 2 K of the temperature of the **test zone** to be evaluated. Each **test tray** shall be preconditioned for 24 h to ensure it is within ± 2 K of the temperature of the **test zone** to be evaluated. Preconditioning can be in the **test zone** or in another refrigerator.

5 Weight loss test

5.1 Procedure

Remove any condensation from the **test zone** prior to placing the **test tray**.

The test material consists of a single large **test tray** with 18 **test sheets.**

The test may be carried out simultaneously on one or more of the **test zones**.

If some of the **test zones** are not being tested at this time, then a **test tray** is placed in each such **test zone** prior to starting the test. Weight measurements need not be taken for these **test trays**.

The **weight loss** test load is a single, large, 18-**test-sheet, test tray**. The **test tray** can be filled with dry or wet **test sheets**. If dry **test sheets** are used, then the **test tray** should be charged with 600 g ± 50 g of distilled water. Less water may be used if the **test sheets** are already wet.

Before starting the test, the quality of the **test tray** can be inspected as detailed in Clause A.3.

The **test tray** shall be placed in the centre of the base area of the **test zone** to be evaluated. If it is not possible to place the **test tray** in the centre (due to the height or shape of the space) then the **test tray** shall be placed in the centre of the next biggest area or the next possible place where the **test sheets** do not touch the upper surface of the space. The **test sheets** in the **test tray** shall face perpendicular to the refrigerator door if possible.

The **test tray** shall not touch the walls of the **test zone**.

Examples of the **test tray** placement are shown in Figure 1.

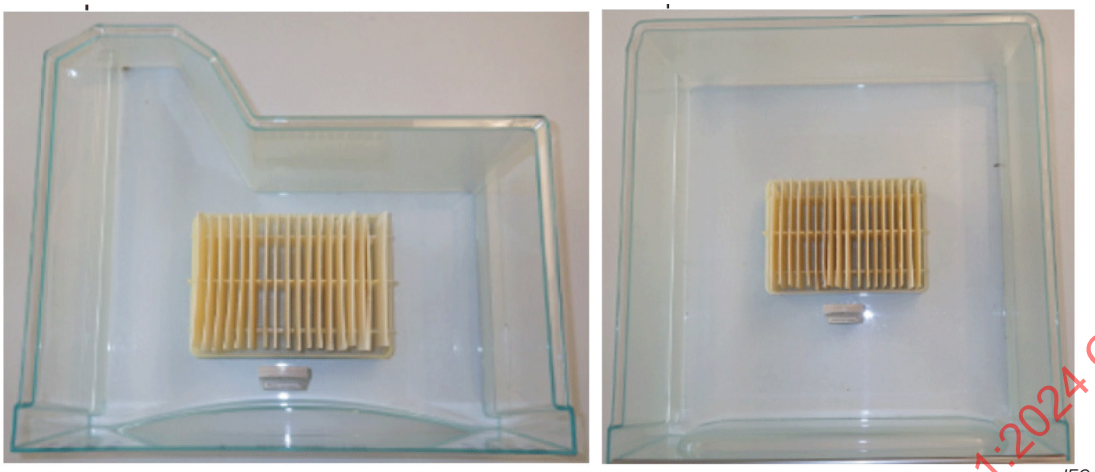


Figure 1 – Examples of test tray placement

If the **test tray** cannot be placed due to the presence of a **removeable accessory**, the accessory can be moved/removed/adjusted in accordance with the manufacturer's **user instructions**.

If the **test tray** still cannot be placed, then a valid **weight loss** test cannot be performed.

During the test, the water shall not freeze.

The temperature of the water in the **test tray** shall be within ±2 K of the temperature of the **test zone** to be evaluated. The **test tray** shall be preconditioned for 24 h to ensure it is within ±2 K of the temperature of the **test zone** to be evaluated. Preconditioning can be in the **test zone** or in another refrigerator.

A temperature sensing element shall be placed 1 cm in front of the **test tray** and shall not be in contact with the **test tray**. If wired sensors are used, the wires shall be mounted such so they do not cross sealing surfaces of the **test zone**.

The maximum duration of door openings for loading and unloading of **test tray**s shall be 1 min.

The **test tray** is then loaded into the **test zone** for another 24 h conditioning. After the conditioning, the weight of the **test tray** shall be measured (M_1 [g]) and the time (t_1 [h]) taken. The weight shall be determined with a resolution of 0,1 g and the time with a resolution of 1 min.

At least 24 hours after time t_1, the weight of the **test tray** shall again be measured (M_2 [g]) and the time recorded (t_2 [h]). The time taken to measure M_2 shall be less than 2 min.

The difference between M_1 and M_2 shall not be greater than 200 g.

Immediately after a test, another test may be conducted using the same **test zone** for the 24 h conditioning.

5.2 Weight loss calculation.

The **weight loss rate** is calculated as follows:

$$W = [(M_1 - M_2)/(t_2 - t_1)] \times 24 \text{ [g/24h]}$$

The **weight loss** test is concluded after the measurement of M_2 and the **weight loss rate** calculation.

For a suggested test report format, refer to Annex C. For guidance on expected uncertainty, refer to Annex E.

6 Condensation test

6.1 General

The **condensation** test consists of evaluating the **condensation** in a **test zone.** This is done by dividing all 6 **test zone** surfaces into rectangles. Multiple small **test trays** are loaded with water and non-woven fabric. The compartment/refrigerator door is closed. After 72 h, evaluation is made by assessing the **condensation** in each rectangle and summing them accordingly. Clarification of some **test zone** surfaces is contained in informative Annex H.

6.2 Preparation of test zone

Remove any **condensation** from the **test zone** prior to placing the **test tray** by wiping with a tissue or paper towel.

The test material consists of a number of small **test trays** with 6 sheets of non-woven fabric material as specified in Table A.1.

The number of small **test trays** is the volume of the **test zone** (in litres)/3 rounded to the nearest integer value.

For example, a 25,3 l crisper should load 25,3/3 = 8,43 to be rounded to 8 small **test trays,** and a 25,6 l crisper should load 25,6/3 = 8,53 to be rounded to 9 small **test trays**.

Each surface of the **test zone** is divided into a grid of rectangles according to the following method.

- determine each length or height of the **test zone** in mm and divide by 50;
- round the length or height up to the next whole number and this gives the number of rectangles for that dimension.

See informative Annex G for examples. This means that there will likely be a different number of rectangles horizontally and vertically. The maximum dimension of a rectangle will be 50 mm.

Part rectangles (for example a sloping side) are counted as a complete rectangle.

NOTE For practical purposes, examples of usable rectangles could be a grid marked on the **test zone** before testing, or a transparency held against the surface during evaluation.

For the **condensation** test multiple **test zones** may be tested simultaneously. Any **test zones** in the refrigerator that are not being tested do not need to have **test trays** loaded.

6.3 Test tray placement

To allow a trial **test tray** placement, the **test trays** are left empty and loaded into the **test zone**.

The **test trays** are clipped together using the clips of normative Annex B. If all the **test trays** can be placed on the base of the **test zone** then they are centralised both left to right and front to back.

If the shape of the **test zone** prohibits centralising the **test trays** as above, the **test trays** are biased to the front and/or left to try and place them on the base.

If necessary, the **test trays** can be disconnected from the clips to allow some **test trays** to move forward or backward relative to one another (or left or right) but the **test trays** spacing shall be at least 5 mm side to side. These 5 mm do not include any spacers which are formed as part of the **test tray**.

The **test trays** can be at angles to each other (preferably a right angle).

If necessary, an upper layer of **test trays** can be stacked on top of the lower layer. As many **test trays** as possible shall be in the lower layer before any additional **test trays** are stacked.

At all times there shall be at least 10 mm vertical clearance between the top of any **test sheet** and the underside of the **test zone** lid.

If, because of the size and/or shape of the **test zone**, the required number of **test trays** cannot be loaded, then the **test trays** spacing can be reduced. For the test to remain valid, the following minimums shall be observed. There shall be at least

- 1 mm spacing between **test trays**;
- 3 mm spacing between the **test trays** and **test zone** walls.

Any upper layer **test trays** should be centralised over the lower layer biasing to the front and left if necessary.

If the base of the **test zone** is angled, then the **test trays** can sit on the angled base if the inclination is less than 15 mm high for each 100 mm length of the base. Inclinations greater than this shall have the **test trays** supported horizontally by a packer. In all cases, the 10 mm vertical clearance of any **test sheet** and the **test zone** lid shall be observed.

A record (photos or drawings, etc.) of the **test trays** layout should be in the test report described in informative Annex C.

Before starting the test, the quality of the non-woven materials can be inspected as detailed in informative Annex A.

If **test trays** cannot be placed due to the presence of an accessory, the accessory can be moved/removed/adjusted in accordance with the manufacturer's **test zone** description. If no specific instructions are provided, in the case of a:

- **removeable accessory** at the required position, the accessory shall be moved, removed or adjusted if possible;
- non-removable accessory, **test trays** may be stacked in 2 layers.

If **test trays** still cannot be placed, then a valid **condensation** test cannot be performed.

Test trays can be filled with dry or wet **test sheets**. If dry **test sheets** are used then the **test tray** should be charged with 200 g ± 50 g of distilled water. Less water can be used if wet **test sheets** are used.

NOTE Historical weight data of the **test tray** and **test sheets** can expedite the addition of an appropriate quantity of water.

If the **test sheets** cannot face perpendicular to the refrigerator front door, the **test trays** shall be placed with **test sheets** facing parallel to the door.

See informative Annex F for examples of alternative **test tray** layouts.

6.4 Test procedure

1) Prepare the **test zone** as specified in 6.2.
2) Load and place the **test trays** as specified in 6.3.
3) Close the **test zone** and/or refrigerator door.
4) Record the start time.
5) Leave the refrigerator door closed during the test.
6) During the test, the water shall not freeze.
7) After 72 h, begin the **condensation** evaluation.

6.5 Condensation evaluation

6.5.1 General

Condensation evaluation is made by visual assessment of the **condensation** on each surface of the **test zone**. The degree of **condensation** depends on:

- the position of **condensation** on the surface of **test zone**;
- the severity of **condensation**.

NOTE Guidance on how to carry out the evaluation is given in informative Annex H.

6.5.2 Position and severity of condensation

6.5.2.1 Position of condensation on the surface of test zone

Each rectangle as specified in 6.2 is used when assessing **condensation** on each **test zone** surface.

6.5.2.2 Severity of condensation

Each rectangle is assessed for severity with only the maximum severity being recorded for the final calculation. Then assess the number of rectangles for each level of **condensation**. Any **condensation** in a rectangle means that rectangle is counted in the final calculation, regardless of the area of **condensation** within the rectangle.

Each rectangle is allocated a **condensation** severity score (CSS) as specified in Table 2.

Table 2 – Condensation severity score

Condensation type	CSS
Mist/No **condensation**	0
Drops with any dimension < 10 mm	1
Running water	1
Pooling with any dimension > 10 mm	3
NOTE Pooling is only on the **test zone** base and is the result of running water	

6.5.2.3 Condensation

The **condensation** on each rectangle is assessed according to 6.5.2.2. **Condensation** (C) on each surface is the sum of all of the rectangles on that surface with any **condensation**, multiplied by each rectangle's **condensation** severity score. Each surface of the **test zone** is calculated separately and then added for the total.

6.5.3 Total condensation (TC)

$$TC = C_{Front} + C_{Back} + C_{Top} + C_{Bottom} + C_{LH\ Side} + C_{RH\ Side}$$

6.5.4 Average condensation (C_{Avg})

$$C_{Avg} = TC/(\text{Total number of rectangles on all surfaces})$$

Annex A
(informative)

Non-woven material specifications

A.1 General

The products cited in this annex are examples of suitable products available commercially[1].

A.2 Non-woven fabric specification 1

Specification for Brune 02 (3614) Humidifier Filter Pads

Product	Humidifier filter pad with holes and additive
Raw materials	Wetlaid cellulose 330 g/m^2. Additive added during manufacture is Wax shell.
Final dimensions	(370 mm × 440 mm) ± 5 mm
Wax	440 mm long. Saturated down from one long edge
Punched holes	13 mm from long edge where wax/crush line has been input and 90 mm from each edge forming a gap of 260 mm between the centre of each hole

- Supplier of already cut sheets

  Lerch Raumklima GmbH

  Faistenbergerstrasse 6

  81545 München

  Germany

  Tel: +49 (0)89 64 74 95

  Fax: +49 (0)89 642 18 68

  E-Mail: info@lerch24.de

  Internet: www.lerch-raumklima.de
- Supplier of non-woven material

  www.brune-humidifier.com/shop/filters/filters-for-radiator-evaporators.html

A.3 Visual inspection of test trays

Figure A.1 gives guidance in deciding whether the **test sheets** are fit for use or reuse in testing. Care should be taken to avoid contact between **test sheets**.

[1] This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of these brands or suppliers. Equivalent products may be used if they can be shown to lead to the same results.

Figure A.1 – Non-woven fabric of various ages

A.4 Non-woven fabric, material specification 2

Tests have been carried out at the DITF (Deutsche Institute für Textil- und Faserforschung) and details are found in report No E-0053-TT-18. A summary of the material specification is given in Table A.1.

Table A.1 – Non-woven fabric material specification 2

Material composition	**100 % cotton 330 g/m^2 wetlaid cellulose**	
Test method	Property	Value
DIN 53924:1997	Rising height after 15 s (mm)	35 – 42
DIN 53923:1978	Water absorption (%)	570 – 594
ISO 9073-3:1989	Tensile strength (N/5 cm)	94 (length) 86 (cross)
ISO 9073-3:1989	Elongation (%)	3,8 (length) 4,6 (cross)
ISO 9237:1995	Permeability (l/s m^2) at pressure 200 Pa/5 cm^2	224 – 227

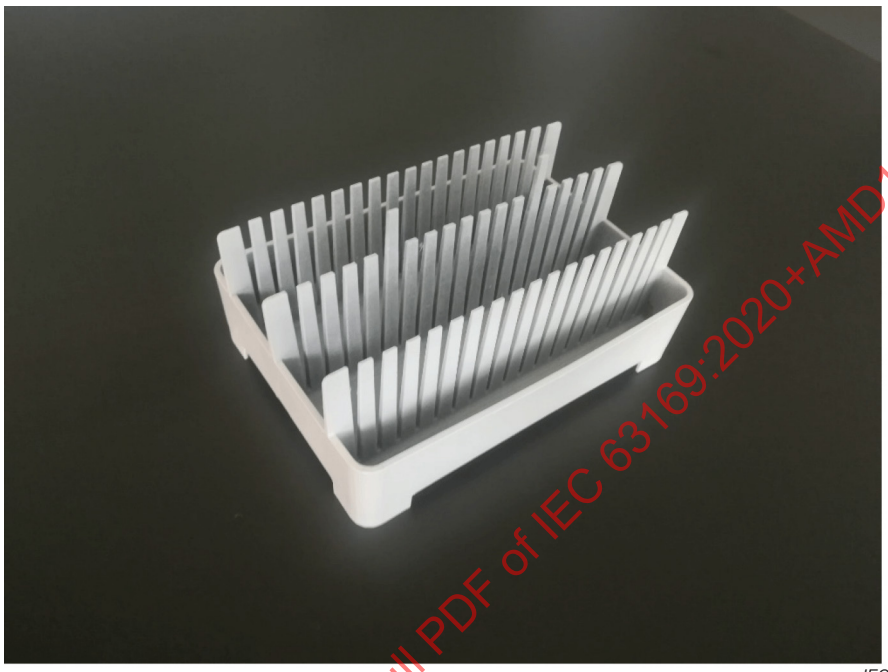
The test may be carried out

- using the material in the delivery state;
- using the material in the delivery state but after rinsing and drying;
- by placing the fibres in the cross or length direction.

Annex B
(normative)

Weight loss and condensation test trays

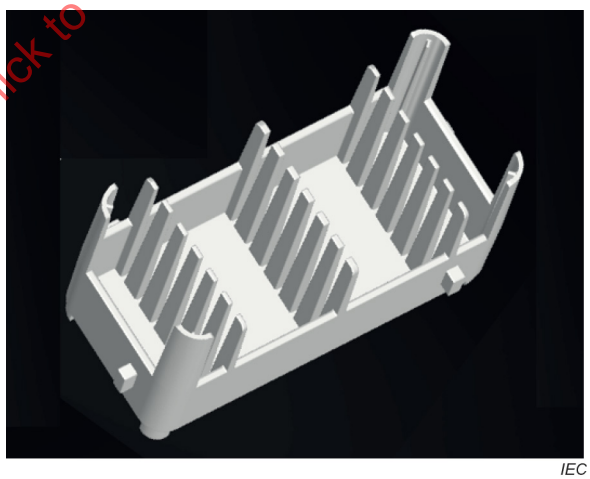
This annex shows the **weight loss** and condensation **test trays.** The 18-sheet weight loss **test tray** is shown in Figure B.1. The 6-sheet weight loss **test tray** is shown in Figure B.2.



IEC

Nominal dimensions (mm): 196(L) × 141(W) × 90(H)

Figure B.1 – 18-sheet weight loss test tray



IEC

Nominal dimensions (mm): 151(L) × 75(W) × 81(H)

Figure B.2 – 6-sheet condensation test tray