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Food preservation**

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Test preparation	9
4.1 Preparation and handling of test material.....	9
4.2 Installation and preparation of refrigerating appliance	9
4.3 Measurement sensor uncertainty	10
4.4 Test tray water.....	10
5 Weight loss test.....	10
5.1 Procedure	10
5.2 Weight loss calculation.	12
6 Condensation test.....	12
6.1 General.....	12
6.2 Preparation of test zone.....	12
6.3 Test tray placement	13
6.4 Test procedure.....	14
6.5 Condensation evaluation.....	14
6.5.1 General.....	14
6.5.2 Position and severity of condensation.....	14
6.5.3 Total condensation (TC)	15
6.5.4 Average condensation (C_{Avg})	15
Annex A (informative) Non-woven material specifications	16
A.1 General.....	16
A.2 Non-woven fabric specification 1.....	16
A.3 Visual inspection of test trays	16
A.4 Non-woven fabric, material specification 2	17
Annex B (normative) Weight loss and condensation test trays	19
Annex C (informative)	21
Annex D (informative) Equivalence of non-woven material.....	25
Annex E (informative) Expected uncertainty of weight loss.....	26
Annex F (informative) Condensation test tray placement guidelines	27
Annex G (informative) Condensation rectangle dimension examples.....	29
Annex H (informative) Condensation evaluation guidance.....	30
Bibliography.....	31
Figure 1 – Examples of test tray placement	11
Figure A.1 – Non-woven fabric of various ages	17
Figure B.1 – 18-sheet weight loss test tray	19
Figure B.2 – 6-sheet condensation test tray.....	19
Figure B.3 – Test tray clip.....	20
Figure D.1 – Example of an acceptable equivalence	25
Figure E.1 – Individual laboratory test results	26

Figure F.1 – Sheet layout.....	27
Figure F.2 – Alternate sheet layout.....	28
Figure G.1 – Examples of condensation rectangle dimensions.....	29
Table 1 – Test equipment.....	9
Table 2 – Condensation severity score.....	15
Table A.1 – Non-woven fabric material specification 2.....	17
Table C.1 – Test results.....	24
Table C.1 – Test settings.....	24
Table C.2 – Test results – Weight loss – Weight loss rate W^a	24
Table C.3 – Test results – Condensation – TC and C_{AVG}	24

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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].

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.

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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.

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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.

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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	<p>For 3D printing files (stp and stl files) for the test tray see: https://www.iec.ch/sc59m/supportingdocuments.</p> <p>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</p> <p>The test tray shall be non-absorbent and watertight. This may can be achieved by coating the test tray after the printing process.</p>
Test sheet	<p>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.</p> <p>A material is specified in informative Annex A. For a method of proving equivalence of alternate materials refer to informative Annex D.</p>

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 $600 \text{ g} \pm 50 \text{ g}$ 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.

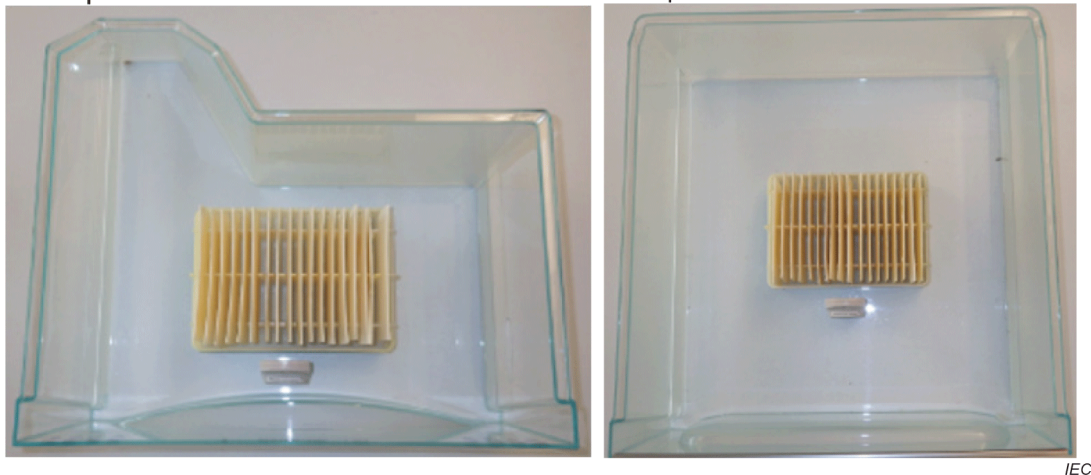


Figure 1 – Examples of test tray placement

~~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**.

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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 trays** 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.