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INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
AMENDEMENT 1

Household refrigerating appliances – Characteristics and test methods – Part 3: Energy consumption and volume

Appareils de réfrigération à usage ménager – Caractéristiques et méthodes d'essai – Partie 3: Consommation d'énergie et volume

IEC 62552-3:2015-02/AMD1:2020-11(en-fr)

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FOREWORD

This amendment 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.

The text of this amendment is based on the following documents:

FDIS	Report on voting
59M/128/FDIS	59M/134/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

5.1 General

Replace the NOTE with the following new content:

NOTE Refer to the requirements in Annex B of IEC 62552-1:2015 and IEC 62552-1:2015/AMD1:2020 for **variable temperature compartments**. For energy testing, these are operated on the function (continuous temperature operating range) that uses the most energy.

9 Test report

Replace the existing content with the following new content:

A test report should be prepared that includes all of the relevant information listed in Annex F of IEC 62552-1:2015/AMD:2020 for tests undertaken in accordance with this document.

A.1 General

Replace the fourth paragraph with the following new content:

The **refrigerating appliance** shall have air temperature sensors installed at the positions specified in Annex D of IEC 62552-1:2015 and IEC 62552-1:2015/AMD1:2020. The determination of **compartment** air temperature during energy testing shall be as specified in Annex D of IEC 62552-1:2015 and IEC 62552-1:2015/AMD1:2020.

A.2.6.1 General

Replace the fourth paragraph with the following new content:

Where the ice storage space occupies a complete **compartment**, the temperature sensor placements shall be in accordance with Annex D of IEC 62552-1:2015 and IEC 62552-1:2015/AMD1:2020 (not A.2.6.5 of this document).

A.2.6.5 Position of the temperature sensor in automatic icemakers

Replace the first sentence of the first paragraph with the following:

An automatic icemaker bin shall have a single temperature sensor located in the position specified as follows for all energy tests:

B.4.3 Case SS2 calculation of values

Replace Formula (13) with the following new formula:

$$T_{SS2-i} = \left(T_{av-endX-endY-i}\right) - \left[\frac{\Delta Th_{dfj-i}}{\left(t_{end-Y} - t_{end-X}\right)}\right] \quad (13)$$

Replace the definition of ΔTh_{df-i} with:

ΔTh_{dfj-i} is the accumulated temperature difference over time in each **compartment** i in Kh as determined in accordance with C.3.3 for the **defrost and recovery period** j commencing at the end of period X

Replace Formula (14) with the following new formula:

$$CRt_{SS2} = \frac{Rt_{end-Y} - Rt_{end-X} - \Delta t_{drj}}{\left(t_{end-Y} - t_{end-X}\right)} \quad (14)$$

Replace the definition Δt_{dr} of with:

Δt_{drj} is the additional compressor run time in h as determined in accordance with C.3.3 for the **defrost and recovery period** j commencing at the end of period X

C.3.3 Case DF1 calculation of values

Add the following new content below the NOTE:

During a **load processing efficiency** test, it is possible that one or more defrosts occur for which a correction must be made. This correction is based on splitting the defrost and recovery energy in a fixed part and the energy used by the defrost heater:

Fixed defrost adder: $$\Delta E_{df\text{-}adderj} = \Delta E_{dfj} - E_{df\text{-}heaterj} \qquad (63)$$

where:

$E_{df\text{-}heaterj}$ is the measured defrost heater energy during the **defrost and recovery period** j, expressed in Wh

NOTE This formula is applied to each valid defrost during steady state. A representative value for the fixed defrost adder ($\Delta E_{df\text{-}adder}$) is determined in accordance with Formula (64) and is subsequently used in the evaluation of a load processing test [using Formula (51) or, if multiple defrost systems are present, Formula (65)].

C.4 Number of valid defrost and recovery periods

At the end of the clause, add the following note:

NOTE The defrost heater energy $E_{df\text{-}heaterj}$ and incremental defrost and recovery energy ΔE_{dfj} for new appliances and appliances that have not been operated for some time may be initially low until the defrost heater energy stabilises.

C.5 Calculation of representative defrost energy and temperature

Replace Formula (22) with the following new formula:

$$\Delta E_{df} = F_{df} \frac{\sum_{j=1}^{m} \Delta E_{dfj}}{m} \qquad (22)$$

Add the following text below the line ΔE_{dfj}*:*

F_{df} is a regional scaling factor that can be used to compensate for frost load and usage factor, which impacts the defrost intervals. The default value for F_{df} is 1,0.

Add the following paragraph above Formula (23):

To correct a **load processing efficiency** test where one or more defrosts occurs, a representative value for the fixed defrost adder is defined:

$$\Delta E_{df-adder} = \frac{\sum_{j=1}^{m} \Delta E_{df-adderj}}{m} \qquad (64)$$

D.2 Elapsed time defrost controllers

Replace NOTE 2 with the following new note:

NOTE 2 The same timers could be used as compressor run time controllers or as elapsed time controllers, depending on how they are configured in the **refrigerating appliance**.

D.3 Compressor run time defrost controllers

Replace the entire clause with the following:

D.3 Compressor run time defrost controllers

For these controllers, the **defrost interval** is defined by the compressor run time (or on time in hours) (or, in some cases, the compressor run time plus the maximum time allocated for defrost heater operation). These controllers are only applicable to single-speed compressors. The **defrost interval** is therefore approximately inversely proportional to the total heat load on the refrigeration system (**ambient temperature** and user loads plus any internal heat loads). The most common defrost run time controllers range from 6 h to 12 h of compressor run time. Typically, this would result in **defrost intervals** of the order of 12 h to 30 h (elapsed time) at elevated **ambient temperatures** and somewhat longer **defrost intervals** at lower **ambient temperatures**.

NOTE 1 The same timers could be used as compressor run time controllers or as elapsed time controllers, depending on how they are configured in the **refrigerating appliance**.

If the run time controller is not accessible (or where it is not clear whether the controller is a run time controller) or where the laboratory is not able to directly measure the controller operation and does not know its run time, the value for the proxy run time shall be measured by testing as set out below. Any routine energy tests or other tests may be used for this purpose.

Each measurement shall be undertaken over a whole **defrost control cycle** and tests shall be undertaken in at least two different **ambient temperatures** in order to verify that it is a run time controller and to estimate the value of t_{prt}. The period selected shall comply with the following requirements:

- the first defrost shall qualify as a valid defrost as specified in Clause C.3;
- the test period shall include at least part of the subsequent **defrost and recovery period** that is initiated automatically without any intervention (defrost heater on).

The estimated proxy run time of the compressor run time defrost controller for a given set of test data that complies with these requirements is given by:

$$t_{prtj} = t_{crtj} + t_{dhj} \qquad (25)$$

where

t_{prtj} is the estimated proxy run time of the compressor run time defrost controller for the test period starting with **defrost and recovery period** j in h;

t_{crtj} is the measured compressor run time in h from the initiation of defrost heater operation for **defrost and recovery period** j to the initiation of defrost heater operation for the subsequent **defrost and recovery period** j + 1;

t_{dhj} is the time from the start of the defrost heater on until the compressor restarts, in h, during **defrost and recovery period** j where the timer advances during the heater operation; otherwise, a value of zero if the timer does not advance during the heater operation.

NOTE 2 A common configuration is that the defrost heater is allocated a fixed maximum time of operation in the timer defrost controller (say 20 min). The actual heater on time will vary depending on the frost load for the specific defrost. The time between the heater off and the compressor on can vary, but the total time from heater on to compressor on is typically constant in this configuration. Where the laboratory has any doubt about the appliance configuration, it is assumed that the defrost timer does not advance when the defrost heater is on, so that only compressor on time is counted and the value of t_{dhj} is set to zero in Formula (25).

Additional routine tests undertaken at other **ambient temperatures** and/or **temperature control settings,** including user related loads, such as door openings and small **processing**

loads, should be reviewed to assess defrosting behaviour. The observed **defrost interval** should be consistent with the measured proxy run time, otherwise it shall be classified as a **variable defrost** controller.

NOTE 3 These tests can be used to detect whether the run time controller is overridden by some other control mechanism during **normal use** conditions.

To qualify as a compressor run time defrost controller, the coefficient of variation (standard deviation divided by the mean) of the measured values for either compressor proxy run time t_{prtj} or compressor run time alone t_{crtj} shall be less than 5 % for the **defrost intervals** examined. Where the product does not comply with this requirement, it shall be classified as a **variable defrost** controller. The value of t_{prt} used in subsequent calculations shall be the average of all measured values of t_{prtj}.

Once confirmed, the proxy run time can be used to calculate the actual **defrost interval** (in elapsed time) for any **temperature control setting**, **ambient temperature** and load processing condition, as a function of the compressor run time. For all **refrigerating appliances** with compressor run time defrost controllers, the percentage run time shall be reported for **steady state** conditions in Annex B and the extra compressor run time (in h) shall be calculated for **defrost and recovery periods** (Annex C, Formula (21)). The **defrost interval** for each test condition and **temperature control setting** is given by:

$$t_{df} = \frac{t_{prt} - \Delta t_{dr} - t_{dh}}{CRt_{SS}} = \frac{t_{crt} - \Delta t_{dr}}{CRt_{SS}} \qquad (26)$$

where

t_{df} is the estimated **defrost interval** (elapsed time) for each **temperature control setting** and **ambient temperature** under test, in h, including the impact of **defrost and recovery**;

t_{prt} is the representative measured proxy run time of the compressor run time defrost controller (in h) in accordance with Formula (25);

CRt_{SS} is the compressor run time (as a percentage) during the **steady state** operation for each **temperature control setting** and **ambient temperature** under test as determined in B.3.3 or B.4.3;

Δt_{dr} is the representative incremental compressor run time (in h) for **defrost and recovery** in accordance with Annex C (Clause C.5) in accordance with Formula (21);

t_{dh} is the representative time from the start of the defrost heater on until the compressor restarts (in h) during a **defrost and recovery period** where the timer advances during the heater operation, otherwise a value of zero;

t_{crt} is the representative compressor run time (in h) from the initiation of one defrost heater operation until the initiation of the next defrost heater operation (this can be determined by rearranging Formula (25)).

The exclusion of the heater on time t_{dhj} and t_{dh} is the default assumption for calculations in Formula (25) and Formula (26). If the defrost timer does not advance during the defrost heater operation or if the laboratory is unsure, then the value of t_{dhj} and t_{dh} is set to be zero for both equations. Heater on time t_{dhj} and t_{dh} shall be consistently applied in Formula (25) and Formula (26).

D.4.1 Variable defrost controllers

Replace the first paragraph with the following:

For this type of controller, the **defrost interval** is varied in proportion to the frost load on the **evaporator**. Most systems do not measure the frost load on the **evaporator** directly (but this is possible), so these types of systems are usually controlled by software which uses a number of parameters to indirectly estimate the frost load and adjust the **defrost interval** progressively.

D.4.2 Variable defrost controllers – declared defrost intervals

Replace the first bullet point of the third paragraph with the following:

$\Delta t_{d\text{-}min}$ shall not exceed 12 h at an **ambient temperature** of 32 °C (elapsed time).

E.3.2 Requirements

Replace the second paragraph by the following new paragraph:

For linear interpolation to be valid, the temperature difference between test runs in the compartment used for energy interpolation shall not exceed 4 K.

E.3.3 Calculations

Replace item 1 with the following content:

1) Check that ABS(T_{i1} – T_{i2}) is 4 K or less and that one test point is below **target temperature** and one test point is above **target temperature**. Where this condition is not met, linear interpolation is not permitted on this compartment.

G.5.3 Quantification of additional energy used to process the load

Replace Formula (51) and the text below it with the following new content:

$$\Delta E_{additional-test} = \left(E_{end} - E_{start}\right) - P_{after} \times \left(t_{end} - t_{start}\right) - z \times \Delta E_{df-adder} - \sum_{j=1}^{z} E_{df-heater\ j} \quad (51)$$

where

$\Delta E_{additional\text{-}test}$	is the additional energy consumed by the **refrigerating appliance** during the test to fully process the loaded added as specified in Clause G.3;
E_{start}	is the accumulated energy reading at the start of **load processing efficiency** test as defined in G.4.1, in Wh;
E_{end}	is the accumulated energy reading at the end of **load processing efficiency** test as defined in G.4.4, in Wh;
P_{after}	is the **steady state** power consumption that occurs after the load has been fully processed during the valid energy test period (Clause B.3 or Clause B.4) as defined in G.4.4, in W;
t_{start}	is the test time at the start of **load processing efficiency** test as defined in G.4.1, in h;
t_{end}	is the test time at the end of **load processing efficiency** test as defined in G.4.4, in h;
Δ *Edf-adder*	is the average defrost adder calculated in Annex C for all valid defrosts for the relevant ambient temperature;
z	the number of defrosts that occur during **the load processing efficiency test**;

$\sum_{j=1}^{z} E_{df-heater\ j}$ is the sum of the defrost heater energy for the z defrosts that occur during the **load processing efficiency** test.

If there are multiple defrost systems active, the adder has to be defined for each defrost system i in accordance with Formula (65). The additional energy to process the added load then becomes:

$$\Delta E_{additional-test} = \left(E_{end} - E_{start}\right) - P_{after} \times \left(t_{end} - t_{start}\right) - \sum_{i=1}^{n}\left(z_i \times \Delta E_{df-adder\ i}\right) - \sum_{i=1}^{n}\sum_{j}^{z} E_{df-heater\ ij} \quad (65)$$

where:

n is the number of defrost systems in the appliance;

z_i is the number of defrosts occurring during the load processing efficiency tests for defrost system i.

G.5.5 Load processing multiplier

In the first sentence of the second paragraph, change processing load *to* **processing load** *(bold type).*

H.2.2 Determination of volume

Replace the content of the subclause with the following new content:

H.2.2 Determination of volume

The **volume** shall take into account the exact shapes of the walls, including all depressions or projections. For through-the-door ice and water dispensers, the ice chute shall be included in the **volume** up to the dispensing function.

The items below shall be considered as being in place and their **volumes** deducted:

a) the **volume** of control housings, including integral parts of it;

b) the **volume** of the **evaporator** space (which includes any space made inaccessible by the **evaporator**) (see H.2.3);

c) the **volume** of air ducts required for proper cooling and operation of the unit;

d) space occupied by **shelves** moulded into the inner door panel;

e) the **volume** of any insulating partition between **compartments** and/or **sub-compartments**. An average thickness of greater than 5 mm is considered to be an insulating partition.

For clarification, the through-the-door ice and water dispensers and the insulating hump are not included in the **volume**. No part of the dispenser unit shall be included as **volume**.

NOTE When the **volume** is determined, internal fittings are considered as not being in place, such as

- **shelves**,
- removable partitions,
- containers,
- convenience features (not classified as **sub-compartments**),
- interior light housings and lights.

H.2.3 Volume of evaporator space

Replace item c) with:

c) In the case of **refrigerant**-filled shelving, the **volume** above the uppermost shelf and below the lowermost shelf, if the distance between the shelf and the nearest horizontal plane of the cabinet inner wall is less than or equal to 50 mm. All refrigerated shelves are considered as not present.

Add item d).

d) In the case where a fan is installed in an **unfrozen compartment** with a refrigerated wall evaporator or a plate style evaporator, the **volume** of the fan and the fan scroll.

Add the new Clause H.4:

H.4 Calculation of the volume of the section or sub-compartment in the compartment whose target temperatures are different from each other

Figures H.6 to H.10 show typical examples of volume calculation for a **two-star section** or **compartment** inside the **freezer compartment** (**three-star** or **four-star**) and should be considered as generic examples. The examples shown in Figures H.6 to H.10 may be combined to adapt the calculation to be representative of the section or **compartment** in the **refrigerating appliance** under consideration.

Figures H.6, H.7 and H.9 can also be applied to a **chill sub-compartment** inside a **fresh food compartment**.

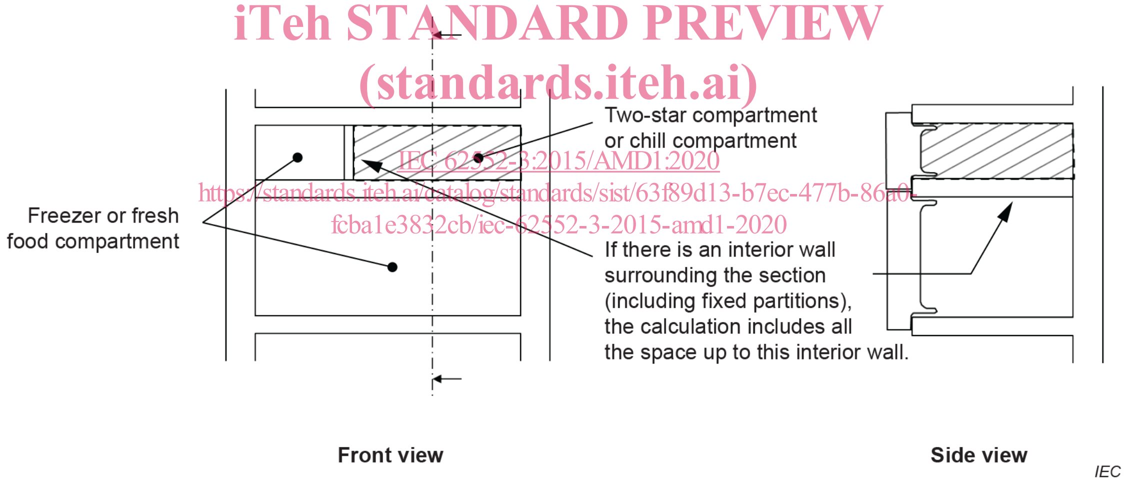

Figure H.6 – Part with partition in the freezer is a two-star compartment (or a chill compartment next to a fresh food compartment)