

TECHNICAL REPORT



Adjusted volume calculation for refrigerating appliances

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 97.040.30

ISBN 978-2-8322-4330-5

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Determination of adjusted volume.....	7
4.1 General.....	7
4.2 Determination of volume adjustment factor for each compartment type	7
4.3 Adjusted volume calculation.....	8
Annex A (informative) Average ambient temperature used to calculate the volume adjustment factor	9
Annex B (informative) Calculation of volume of sections or sub-compartments	11
B.1 Calculation volume.....	11
B.2 Calculation of the volume of the section or sub-compartment in the compartment whose target temperatures are different from each other	11
Annex C (informative) Normalized volume.....	14
C.1 Background.....	14
C.2 Normalized volume	14
C.3 Worked example	15
Bibliography.....	16
Figure A.1 – Power consumed by a typical refrigerating appliance as a function of ambient temperature	9
Figure B.1 – Part with partition in the freezer is a two-star compartment	11
Figure B.2 – Part without partition in the freezer is a two-star compartment	11
Figure B.3 – Freezer door shelves are a two-star section or compartment	12
Figure B.4 – Drawer-type compartment in the freezer is a two-star section or compartment.....	12
Figure B.5 – Space between a door shelf and drawer-type two-star section or compartment.....	13
Table 1 – Volume adjustment factor by compartment type.....	8
Table A.1 – Suggested weighting of IEC energy values for different ambient temperatures	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ADJUSTED VOLUME CALCULATION FOR REFRIGERATING APPLIANCES**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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a Technical Report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC TR 63061, which is a Technical Report, 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 Technical Report is based on the following documents:

Enquiry draft	Report on voting
59M/71/DTR	59M/79/RVC

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

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

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

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

A bilingual version of this publication may be issued at a later date.

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

A recent international review of energy efficiency standards and energy labelling programs around the world found that refrigerators and freezers were covered by programs in some 75 countries, which included some 185 separate program measures. The report¹ found that household refrigerators and freezers were the most frequently covered products around the world in terms of programs to improve energy efficiency.

Despite being the most commonly covered products in energy efficiency programs, there are a range of different approaches used in different countries to define energy efficiency for refrigerators and freezers.

Besides specifying methods of energy measurement, IEC 62552-3 defines a clear and accurate method for the measurement and determination of compartment volume of household refrigerators and freezers. It is hoped that this international test method will be adopted by all countries in their local energy efficiency programs. However, a uniform approach to volume measurement is not always sufficient for energy efficiency policies, as this fails to take into account the impact of compartments that operate at different temperatures.

One of the most common approaches used to define the energy efficiency of refrigerators and freezers is the concept of adjusted volume. This approach was developed in the 1980s and essentially weights the volume of each compartment in proportion to the temperature difference between the compartment temperature and the ambient temperature outside of the appliance. This provides a method that takes into account, at least to some extent, the effect of variations in the relative size of different temperature compartments between different models. While there is a range of other possible approaches that can be used, adjusted volume is one method that is widely used around the world.

While the concept of adjusted volume is widely used and well accepted, it appears that there are some variations and differences in how this parameter is calculated and applied in different countries. This creates anomalies in how energy efficiency parameters are calculated between countries. While the exact approach used to define adjusted volume is ultimately a matter for individual countries, it is hoped that this document will provide a clear explanation of the approach and will provide a sound basis for how this can be applied in different conditions, as dictated by local policies. The purpose of this document is therefore to encourage alignment in national approaches to the definition and application of adjusted volume.

IEC 62552-3 defines two ambient temperatures for energy consumption measurement. Many countries, especially those with more temperate climates, will want to use this additional data to more accurately reflect the likely energy consumption of refrigeration appliances during normal use. This document assumes that the adjusted volume is calculated using the ambient air temperature expected during normal use of the refrigerating appliance. It is hoped that this will further encourage alignment of approaches across countries.

Ultimately, it is hoped that this document will foster dialogue and cooperation between countries and encourage the use of more uniform approaches to the calculation and application of adjusted volume, where this is used in energy efficiency policies and programs. This will further encourage trade, development of more uniform efficiency benchmarks and overall improvements in energy efficiency globally.

¹ Energy Standards and Labelling Programs Throughout The World In 2013, see <http://www.iea-4e.org/publications> or <http://www.iea-4e.org/document/343/energy-standards-labelling-programs-throughout-the-world-in-2013>

ADJUSTED VOLUME CALCULATION FOR REFRIGERATING APPLIANCES

1 Scope

This document, which is a technical report, sets out a uniform calculation method for the parameter of adjusted volume that is commonly employed in the calculation of energy efficiency household refrigerators, freezers and refrigerator-freezers.

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