

Australian/New Zealand Standard™

**Performance of household electrical  
appliances—Refrigerating appliances**

**Part 1: Energy consumption and  
performance**



## **AS/NZS 4474.1:2007**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-015, Quality and Performance of Household Electrical Appliances. It was approved on behalf of the Council of Standards Australia on 5 July 2007 and on behalf of the Council of Standards New Zealand on 22 June 2007. This Standard was published on 15 August 2007.

---

The following are represented on Committee EL-015:

Australian Consumers' Association  
Australian Electrical and Electronic Manufacturers Association  
Australian Greenhouse Office, Department of the Environment and Heritage  
Australian Industry Group  
Australian Retailers Association  
Business New Zealand  
Consumer Electronics Suppliers Association  
Department of Energy, Utilities and Sustainability (NSW)  
Department of Industrial Relations (Qld)  
Electrical Compliance Testing Association  
Energy Efficiency and Conservation Authority of New Zealand  
Energy Safe Victoria  
Institution of Professional Engineers New Zealand  
National Appliance and Equipment Energy Efficiency Committee  
Testing Interests (Australia)

---

### **Keeping Standards up-to-date**

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at [www.saiglobal.com.au](http://www.saiglobal.com.au) or Standards New Zealand web site at [www.standards.co.nz](http://www.standards.co.nz) and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

---

*This Standard was issued in draft form for comment as DR 07173.*

---

# Australian/New Zealand Standard™

## Performance of household electrical appliances—Refrigerating appliances

### Part 1: Energy consumption and performance

Originated in Australia as AS B116—1956.  
Originated in New Zealand as NZS 6205:1982.  
Previous edition AS/NZS 4474.1:1997.  
Second edition 2007.  
Reissued incorporating Amendment No. 1 (October 2008).  
Reissued incorporating Amendment No. 2 (March 2011).

#### **COPYRIGHT**

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-015, Quality and Performance of Household Electrical Appliances to supersede AS/NZS 4474.1:1997 on publication.

*This Standard incorporates Amendment No. 1 (October 2008) and No. 2 (March 2011). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.*

The AS/NZS 4474 series is comprised of two parts as follows:

### AS/NZS

4474	Performance of household electrical appliances—Refrigerating appliances
4474.1	Part 1: Energy consumption and performance (this Standard)
4474.2	Part 2: Energy labelling and minimum energy performance standard requirements

A2

Amendment 2 (2011) to this Standard includes a number of changed requirements regarding the operation of ice-makers during energy tests and an additional requirement for adaptive defrost systems. It also deals with the testing of products that contain automatic anti-condensation heaters where the power is varied in response to changes in ambient conditions (e.g. humidity and/or temperature). It now requires the declaration of any controls that may alter the operation of the refrigerating appliance under specific operating conditions. Amendment 2 (2011) no longer permits products with circumvention devices to comply with the requirements of this Standard.

Amendment 2 forms part of this Standard on publication. AS/NZS 4474.2 sets out transition provisions for the use of this Standard (excluding Amendment 2) for registration purposes.

The Parts of AS/NZS 4474 are defined as follows:

- (a) Part 1 includes all test conditions, requirements for temperature performance and the method for determination of energy consumption.
- (b) Part 2 includes algorithms for the calculation of the energy efficiency rating, star rating and comparative energy consumption, performance requirements, details of the energy label and requirements for the valid application thereof. It also contains the minimum energy performance standards (MEPS) for refrigerators and freezers. It has been structured to be suitable for reference in regulatory legislation and to be used in conjunction with Part 1.

The objective of this series of Standards is to promote high levels of quality, performance and efficiency in household refrigerating appliances.

The objective of this Standard is to provide test laboratories with test methods and minimum performance requirements so that the performance, including energy consumption, of household refrigerating appliances can be measured, compared and evaluated.

While this Standard is generally aligned with ISO 15502:2005 in some areas it follows the ANSI/AHAM approach. A summary of differences between this edition and ISO 15502 and the ANSI/AHAM standard is included in the Foreword.

This Standard incorporates the following significant changes from the previous editions of this Standard:

- (i) The defined terms have been bolded wherever they are used through this Standard. The defined terms could be grouped under appropriate headings, and users seeing a bolded defined term, should also look within the headings and not just look for the specified term in alphabetical order.

- (ii) Revised group definition—The definitions of a chest type have been amended to include rules about combination configurations that have now appeared on the market. There are also revised rules to cover appliances with frozen food compartments with different defrost types.
- (iii) The definition of the start of the defrost control cycle has been altered to include any sequence of events that occur prior to the initiation of the defrost heating.
- (iv) The text defining thermal equilibrium and the test period for temperature operation performance tests and energy consumption has been refined to make its application clearer and now defines stability requirements for tests which include test packages.
- (v) Reference to testing at 240 V has been deleted as this ceased to be an option with the introduction of MEPS 2005.
- (vi) The definition of adaptive defrost systems has been refined further in this edition. The time between defrosts for an adaptive defrost system is still limited to 24 h for the determination of energy consumption. In the future, experience with adaptive defrost systems may result in appropriate amendments to this approach.
- (vii) New rules have been introduced regarding the placement of sensors in small, wide/short and very tall compartments.
- (viii) Many figures have been added or re-drawn, including those showing sensor placement and locations of test packages. The objectives of this have been to update the illustrations to show newer typical cabinet configurations, correct errors and to accommodate the changes in (vii).
- (ix) Although this Standard is not intended to cover wine storage cabinets, a definition covering them has been introduced to clarify the demarcation between cabinets specifically designed for wine storage and those covered by this Standard.
- (x) With the advent of microprocessors and electronic controls, refrigerating appliances have emerged with various unusual operating patterns. These are patterns that were not displayed by appliances managed by electromechanical controls. The emergence of these patterns has necessitated the tightening of test specifications to detect and deal with those patterns that would consequently provide poor food care. It has also been necessary to deal with patterns that give abnormally low energy consumption in an energy test by modifying or eliminating functions that are otherwise operational in normal use such as anti-sweat heaters. Notice is served that should products appear in the marketplace that meet the letter but not the intent of this Standard, then this Standard will be amended accordingly.
- (xi) Another consequence of electronic controls is that adjustments are often made in steps rather than continuously. The Standard has been amended to preclude interpolation to target temperatures where the nearest achievable temperatures are too far from the target values.
- (xii) With the emergence of electronic controls on appliances and the now universal use of electronic data logging for testing, the opportunity has been taken to include all the defrost and recovery temperature profile in the total of the average temperature for energy determination. Analysis of available data has shown that this will have a minimal effect on reported temperatures for normal well managed appliances.

It is envisaged that the MEPS checking criteria used by government will be changed to make it clear that all the population of a model rather than just the mean of that population must have a lower energy test consumption than MEPS. MEPS values in Part 2 will be adjusted to compensate for that tightening. If the above change in temperature measurement is demonstrated to measurably increase

measured energy consumption, any extra MEPS adjustment deemed necessary will be incorporated simultaneously.

- (xiii) The way of dealing with cabinets containing multiple convenience features has been clarified.
- (xiv) Integration over time is the only method now allowed for determining average temperatures.
- (xv) The automatic ice-making section has been re-written to align it much more closely with the US test procedure. The testing is now done without test packs in the compartment.
- (xvi) Electronically controlled systems are often such that it is not possible to disable defrost heaters without the system detecting that as a fault and responding. To overcome this problem the temperature performance test has been modified to also take into account defrost that can neither be disabled nor avoided during testing. A test procedure and pass criteria for each alternative is now included.
- (xvii) Tests for thermal stability have been modified to reduce testing time when it is clear that performance is adequate. It has also been modified to cope with some of the less regular cycling that is a characteristic of some electronic control systems.
- (xviii) Methods for the determination of energy consumption where there are multiple cooling systems has been modified to also apply to cabinets with multiple independent defrost systems. It is envisaged that, with future revisions of this Standard, the two-part method may be required for selected tests.
- (xix) Intermediate freezer test pack sizes have been added to align with ISO 15502.
- (xx) Appendix Q introduces a 2 part energy test procedure. Based on the US DOE test method, this sets out a procedure for the calculation of average energy consumption from two (or more) components of energy consumption of a frost free refrigerating appliance. It combines the rate of use during normal running with the rate during an automatic defrost cycle. This allows an accurate estimate of the total energy consumption to be calculated for any elapsed time between defrosts.

For this edition of the Standard this method has been provided to give users experience with its application with real test data and appliances. Apart from some of the cases where there are two or more defrost systems in operation, at this stage it is informative only. It is envisaged that in future editions of the Standard this procedure may become mandatory for other energy testing.

Measured values and calculated values determined under this Standard should not be rounded, except where specified for the purposes of rating or inclusion in a test report.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements to this Standard.

The terms 'normative' and 'informative' have been used in this Standard to define the application of the Appendix to which they apply. A 'normative' Appendix is an integral part of a Standard, whereas an 'informative' Appendix is only for information and guidance.

## CONTENTS

	<i>Page</i>
FOREWORD.....	7
SECTION 1 SCOPE AND GENERAL	
1.1 SCOPE .....	10
1.2 REFERENCED DOCUMENTS .....	10
1.3 DEFINITIONS .....	11
SECTION 2 CLASSIFICATION, MEASUREMENT AND TEST REQUIREMENTS	
2.1 SCOPE .....	21
2.2 CONSIDERATION OF CONVENIENCE FEATURES .....	21
2.3 CLASSIFICATION OF APPLIANCES.....	21
2.4 DEFROST CONTROL CYCLE CHARACTERISTICS .....	23
2.5 STORAGE SHELF AREA .....	24
2.6 GROSS AND STORAGE VOLUMES .....	24
2.7 TEST ROOM, INSTRUMENTATION AND MATERIALS .....	24
2.8 PREPARATION OF AN APPLIANCE FOR TESTING .....	24
2.9 DETERMINATION OF COMPARTMENT AIR TEMPERATURES.....	24
2.10 SELECTION AND PLACEMENT OF FREEZER TEST PACKAGES .....	24
2.11 THERMAL EQUILIBRIUM (FOR PULL DOWN TESTS).....	25
2.12 PULL DOWN PERFORMANCE .....	25
2.13 THERMAL STABILITY .....	25
2.14 AUTOMATIC ICE-MAKING PERFORMANCE .....	25
2.15 OPERATING TEMPERATURE PERFORMANCE.....	25
2.16 DETERMINATION OF TESTED ENERGY CONSUMPTION ( $E_t$ ).....	25
2.17 METHOD OF INTERPOLATION WHERE A SINGLE-CONTROL IS ADJUSTED.....	25
2.18 METHOD OF INTERPOLATION WHERE TWO CONTROLS ARE ADJUSTED ..	25
2.19 FITTING A QUADRATIC EQUATION TO EXPERIMENTAL DATA .....	25
2.20 CALCULATION OF $E_t$ —WORKED EXAMPLES .....	25
2.21 DETERMINATION OF APPLIANCE GROUP—WORKED EXAMPLES.....	25
2.22 TWO PART ENERGY CONSUMPTION METHOD.....	26
2.23 NOISE .....	26
2.24 REPORTING OF RESULTS .....	26
SECTION 3 PERFORMANCE REQUIREMENTS	
3.1 GENERAL .....	27
3.2 STORAGE SHELF AREA .....	27
3.3 GROSS AND STORAGE VOLUMES .....	28
3.4 PULL DOWN.....	28
3.5 AUTOMATIC ICE-MAKING.....	28
3.6 OPERATING TEMPERATURE PERFORMANCE.....	29
3.7 ENERGY TEST REQUIREMENTS .....	31
A2        3.8 ADAPTIVE DEFROST.....	37
A2        3.9 DECLARED AUTOMATIC CONTROLS .....	37
SECTION 4 MARKING REQUIREMENTS	
4.1 GENERAL .....	39
4.2 REFRIGERATING APPLIANCE GROUP .....	39
4.3 FOOD STORAGE COMPARTMENT TYPE.....	39
4.4 MODEL IDENTIFICATIONS.....	39
4.5 RATED GROSS AND STORAGE VOLUMES .....	39

4.6	INTENDED USE MARKINGS .....	39
4.7	MARKING LOCATION .....	39

## APPENDICES

A	DETERMINATION OF VOLUME AND AREAS .....	40
B	TEST ROOM, INSTRUMENTATION AND MATERIALS .....	65
C	PREPARATION OF AN APPLIANCE FOR TESTING AND GENERAL TEST PROCEDURES .....	69
D	DETERMINATION OF COMPARTMENT AVERAGE AIR TEMPERATURES FOR PULL DOWN, OPERATION AND ENERGY CONSUMPTION TESTS .....	75
E	DETERMINATION OF COMPARTMENT TEMPERATURES USING FREEZER TEST PACKAGES .....	90
F	THERMAL EQUILIBRIUM FOR PULL DOWN TESTS .....	98
G	PULL DOWN TEST .....	99
H	THERMAL STABILITY OF COMPARTMENT AVERAGE AIR TEMPERATURES FOR THE DETERMINATION OF OPERATING TEMPERATURE PERFORMANCE, ENERGY CONSUMPTION AND AUTOMATIC ICE-MAKING .....	101
I	AUTOMATIC ICE-MAKER TEST .....	103
J	OPERATING TEMPERATURE PERFORMANCE TEST .....	105
K	DETERMINATION OF ENERGY CONSUMPTION .....	112
L	METHOD OF INTERPOLATION WHEN ONLY ONE CONTROL IS ADJUSTED .....	120
M	METHOD OF INTERPOLATION WHEN TWO CONTROLS ARE ADJUSTED .....	127
N	FITTING A QUADRATIC EQUATION TO THREE POINTS .....	132
O	EXAMPLES OF DETERMINATIONS OF TESTED ENERGY CONSUMPTION ( $E_t$ ) .....	134
P	EXAMPLE DETERMINATIONS OF APPLIANCE GROUP .....	144
Q	TWO PART ENERGY CONSUMPTION METHOD .....	150
R	REFRIGERATING APPLIANCE TEST REPORT FORMAT .....	156
S	APPLIANCES WITH AUTOMATICALLY CONTROLLED ANTI-CONDENSATION HEATERS .....	163

## FOREWORD

In considering the performance of refrigerating appliances available in Australia and New Zealand, it is often necessary to consider the methods of testing used in Europe (i.e. ISO) and in North America.

The scope of this Standard is covered by ISO 15502, Household refrigerating appliances—Characteristics and test methods.

In North America, most energy consumption testing is carried out under US Department of Energy Code of Federal Regulations (10 CFR Part 430, Subpart B, Appendices A1 and B1). This test method references AHAM HRF-1-1979; the revised AHAM HRF-1-2004 includes most of the requirements of the Code of Federal Regulations.

Where possible, this Standard harmonizes with the ISO Standards, however there are many differences, three of the fundamental differences are as follows:

- (a) The ISO Standard provides for a choice of climate classes, each of which is considered to be too narrow for Australia and New Zealand, where, because of factors such as wide diurnal temperature ranges, the methods of house construction, and a diversity of climates, the ability to operate over a wide temperature range, i.e. 10°C to 43°C, is considered essential. Under AS/NZS 4474.1, the energy consumption test is performed at an ambient temperature of 32°C which is classified as tropical by ISO. (See (c) below and the table following for a brief summary of the ISO test and the differences between it and this Standard).
- (b) The ISO ‘star’ (snowflake) marking scheme, the purpose of which is to indicate the freezing capability of the freezer compartment(s), is not used in Australia or New Zealand. It should be noted the ISO ‘star’ scheme is unrelated to the energy labelling scheme in Australasia which uses ‘star’ as a measure of the relative energy efficiency of the appliance. It is also unrelated to the ENERGY STAR scheme originating from the US EPA. Under that scheme ENERGY STAR labels are awarded to the most efficient segment of a product range.
- (c) The ISO test method attempts to combine the operation temperature test with the energy consumption test – in this case any frozen food compartments are fully loaded with freezer test packages which must be in contact with the freezer walls. In AS/NZS 4474.1 the energy test is performed separately with unloaded frozen food compartments. This has been found to provide more consistent results. In the AS/NZS 4474.1 operation temperature test, freezer test packages are spaced away from the freezer walls to allow air circulation in frost-free systems.

Because of the many significant differences between test conditions in this Standard and those of ISO or North America, direct comparison of results obtained under any two of the test regimes are generally not possible. Some of the main differences are set out in the following table and accompanying notes, however it should be noted that this is not a complete comparison.

Variable	AS/NZS 4474.1	ANSI/AHAM <sup>1</sup>	ISO <sup>2</sup>
Energy consumption ambient temperature	32 ±0.5°C	32.3 ±0.6°C	25 ±0.5°C <sup>3</sup>
Energy consumption fresh food temperature	3°C	3.3/7.22°C <sup>4</sup>	5°C
Energy consumption freezer temperature <sup>5</sup>	-15°C	-15/-17.8°C <sup>6</sup>	-18°C
Freezer for energy consumption	unloaded	unloaded <sup>7</sup>	loaded
Operation test ambient temperatures <sup>8</sup>	10/32/43°C	21.1/32.2/43.3°C <sup>9</sup>	16/32°C <sup>10</sup>
Operation test fresh food temperatures <sup>11</sup>	0.5°C to 6°C	1.1°C to 5°C	0°C to 4°C <sup>12</sup>
Operation test freezer temperatures <sup>13</sup>	≤-15°C	≤-15/-17.8°C <sup>6</sup>	≤-18°C <sup>14</sup>
Pull down test	Y	Y	N
Freezing capacity test	N	N	Y
Ice-making capacity	Y	Y	Y
Temperature rise time	N	N	Y
Other performance tests	N	Y <sup>15</sup>	Y <sup>16</sup>
Gross volume <sup>17</sup>	compartment (including sub-compartment)	Not specified	total only (Not specified at sub-compartment level)
Storage volume <sup>18</sup>	all levels	all levels	all levels
Volume used for MEPS and energy labelling	gross	storage	storage
Freezer adjustment factor (adjusted volume)	1.6	1.63	2.15
Separate freezer energy adjustment	N	0.7/0.85 <sup>19</sup>	N
Energy sources and refrigeration systems covered	mains powered electric vapour compression <sup>20</sup>	all electric a.c. single phase systems <sup>21</sup>	any
Humidity	not specified	not specified <sup>22</sup>	45% to 75%
Anti-sweat heaters during energy consumption tests	on	average on and off	only when needed

## FOOTNOTES:

- 1 The current AHAM refrigerator Standard is AHAM HRF-1—2004 . However, most energy consumption data in the U.S.A. is determined under the U.S. Department of Energy Code of Federal Regulations (C.F.R. Part 430 Subpart B Appendices A1 and B1) which draws in parts on the AHAM Standard but also modifies some parts. DOE regulations have precedence regarding all mandatory U.S. Government requirements for energy labelling and MEPS. Note that DOE regulations cite AHAM HRF-1-1979 and not the current version.
- 2 The ISO Standard for refrigerator performance and energy consumption is ISO 15502:2005: Household refrigerating appliances—Characteristics and test methods.
- 3 Ambient test temperature for energy consumption under ISO is 25°C for all climate classes except Tropical, which is 32°C.
- 4 AHAM and DOE regulations only specify a fresh food compartment temperature of 3.3°C for ‘all refrigerators’ (i.e. fresh food compartments with either no freezer or a small ice-making sub-compartment of less than 14.2 L). For tests on refrigerator/freezers, the fresh food temperature has only to be below 7.22°C.
- 5 Freezer compartments in this Table refer to compartments intended for the long term storage of frozen food. There are numerous other frozen and unfrozen compartment types not covered by this Table. AS/NZS 4474.1 freezer compartment temperature is determined from the average of the warmest 4 of the 5 air temperature sensors. ISO report compartment temperatures as the warmest test package position at the warmest part of the cycle for all tests (AS/NZS 4474.1 also uses this method for loaded operation tests). ANSI/DOE compartment temperatures are the average of all temperature points taken at ≤4 min intervals over the test period (excluding defrost cycles).
- 6 A freezer temperature of -15°C applies to refrigerator-freezers while -17.8°C applies to separate freezers.

- 7 Note that HRF-1-1979 specifies that for energy consumption tests all freezer compartments shall be loaded. However, the DOE CFR 430 test procedures specify that freezer packs are not to be used in the determination of energy consumption for automatic defrost (frost-free) refrigerator-freezers (the most common appliance type in the U.S.A.) and 'all refrigerators' with ice makers. In these cases, freezer compartment temperatures are measured with thermocouples inside metallic cylinders of  $29 \pm 6$  mm (the metal is not specified, but if it were copper, this would equate to a thermal mass of between 8 g and 28 g water equivalent). All other appliance types under AHAM (including all separate freezers) are tested with the freezer compartment loaded. The freezer test packs used under AHAM are  $130 \times 100 \times 40$  mm and contain sawdust or spinach. Under the AHAM Standard the freezer compartment is only loaded to 75% of its capacity. AHAM test packs are different from the test packs specified in ISO which are  $200 \times 100 \times 50$  mm and contain oxyethylmethylcellulose. AS/NZS 4474.1 specifies test packs which are identical to ISO  $-1^\circ\text{C}$  packs. Under ISO and AS/NZS the freezer compartments are fully loaded (except for specified air gaps). AS/NZS specifies 15 mm air gaps between test packs and the freezer walls, while ISO specifies that they should be in contact.
- 8 Temperature operation tests are conducted with freezer test packs for all three standards.
- 9 The 'simulated load test' under AHAM has only recommended levels of performance and is not a mandatory requirement for refrigerators in the U.S.A. under DOE regulations for labelling or MEPS.
- 10 This is the temperature range for ISO Temperate, which is the most common climate rating in Europe. Other ISO climate ratings include Extended Temperate ( $10^\circ\text{C}/32^\circ\text{C}$ ), Sub-tropical ( $16^\circ\text{C}/38^\circ\text{C}$ ) and Tropical ( $16^\circ\text{C}/43^\circ\text{C}$ ).
- 11 Fresh food temperatures in all Standards are averages. AS/NZS 4474.1 specifies that thermocouples be placed inside copper or brass cylinders with a thermal mass of between 2.3 g and 20 g water equivalent, while ISO usually specifies cylinders which have 2.3 g water equivalent. AHAM allows thermocouples to be weighted or unweighted, but where weighted, the thermal mass must not be greater than 20 g of water equivalent.
- 12 ISO average fresh food compartment temperatures are to remain at less than  $5^\circ\text{C}$ , but this may rise to  $7^\circ\text{C}$  during defrosting in a frost-free appliance. In addition to this requirement, the temperature at each of the measuring points in the fresh food compartment (generally three points) must remain within the range  $0^\circ\text{C}$  to  $10^\circ\text{C}$  throughout the test (so a theoretical minimum average compartment temperature is  $0^\circ\text{C}$ , but in practice the actual minimum achievable would be higher).
- 13 Allowable freezer pack temperature ranges for an operation test are generally less than or equal to the target temperature for energy consumption.
- 14 Test pack temperatures are allowed to rise to  $-15^\circ\text{C}$  during automatic frost-free defrosting cycles.
- 15 Other AHAM tests for performance are related to durability and include handling and storage test (for packaging), external surface condensation test, internal moisture accumulation test, environmental cracking resistance test and bottom breaker strip impact test. AHAM does not recommend minimum levels of performance for these tests.
- 16 Other ISO performance tests include door air tightness, door opening force, durability of hinges and doors and mechanical strength of shelves. ISO does specify minimum requirements for each of these performance tests.
- 17 Gross volumes for AS/NZS differ from ISO in a number of minor areas. However, the most significant difference is that the volume of air ducts (in a frost-free system) within the liner shape is counted as part of the gross volume in AS/NZS but this is not allowed under ISO.
- 18 The only volume specified in AHAM ('refrigerated volume') is essentially a storage volume equivalent under ISO and AS/NZS. However there are minor differences in the determination of storage volume under all of these Standards.
- 19 The U.S. DOE Code of Federal Regulations specifies that the measured energy consumption is adjusted by a factor of 0.7 for chest freezers and 0.85 for vertical freezers 'to adjust for average household usage'.
- 20 This is within the scope of AS/NZS 4474.2 which covers government requirements for energy labelling and MEPS. The scope of AS/NZS 4474.1 includes all electric powered units.
- 21 This is within the scope of the U.S. DOE Code of Federal Regulations for the purposes of energy labelling and MEPS. The AHAM Standard includes all electric units (but specifically excludes gas powered types).
- 22 Humidity is specified for some of the other performance tests such as external condensation and internal moisture accumulation (at  $75 \pm 2\%$ ), but not for operation or energy consumption tests.

## STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

**Australian/New Zealand Standard****Performance of household electrical appliances—Refrigerating appliances****Part 1: Energy consumption and performance**

## SECTION 1 SCOPE AND GENERAL

**1.1 SCOPE**

This Standard specifies the method for determining the performance characteristics of electric **refrigerating appliances** suitable for connection to mains power, whatever the cooling technology. It does not specify safety requirements, which appear in AS/NZS 3350.2.24 and AS/NZS 60335.2.24. Appliances covered by this Standard include **refrigerators, refrigerator/freezers and freezers**.

Appliances such as multi-fuel **refrigerating appliances** which do not have a mains power option, are not included in the scope of this Standard. This Standard does not apply to separate stand-alone ice-makers.

**Refrigerating appliances** that are not specifically designed for wine storage but that may be nevertheless used for this purpose are covered by this Standard. **Refrigerating appliances** that have a **wine storage compartment** combined with any other compartment type defined in this Standard (see Clause 1.3.12) are included within the scope. Separate **wine storage cabinets** (as defined – see Clause 1.3.18) are not within the scope of this Standard but may be tested using the methods herein as a cellar or special (unfrozen) compartment depending on the claimed temperature range but excluding any pull down requirement.

NOTE: Throughout this Standard, the term ‘**refrigerating appliance**’ is used to denote all appliances covered by this Standard. Refer to Clause 1.3.16.

**1.2 REFERENCED DOCUMENTS**

The following documents are referred to in this Standard:

AS/NZS	
3350	Safety of household and similar electrical appliances
3350.2.24	Part 2.24: Particular requirements for refrigerating appliances and ice-cream appliances and ice-makers
4474	Performance of household electrical appliances—Refrigerating appliances
4474.2	Part 2: Energy labelling and minimum energy performance standard requirements
60335	Household and similar electrical appliances—Safety
60335.1	Part 1: General requirements
60335.2.24	Part 2.24: Particular requirements for refrigerating appliances, ice-cream appliances and ice-makers
IEC	
60704	Household and similar electrical appliances—Test code for the determination of airborne acoustical noise
60704-1	Part 1: General requirements