

Australian/New Zealand Standard™

**Performance of electrical appliances—  
Air conditioners and heat pumps**

**Part 4.1: Air-cooled air conditioners and  
air-to-air heat pumps—Testing and  
calculating methods for seasonal  
performance factors—Cooling seasonal  
performance factor (ISO 16358-1:2013,  
(MOD))**



#### **AS/NZS 3823.4.1:2014**

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee EL-056, Room Air Conditioners. It was approved on behalf of the Council of Standards Australia on 5 September 2014 and on behalf of the Council of Standards New Zealand on 12 September 2014.  
This Standard was published on 1 October 2014.

---

The following are represented on Committee EL-056:

Airconditioning and Refrigeration Equipment Manufacturers Association of Australia  
Australian Building Codes Board  
Australian Industry Group  
CHOICE  
Consumer Electronics Association of New Zealand  
Consumer Electronics Suppliers Association  
Department of Industry (Australian Government)  
Electrical Compliance Testing Association  
Energy Efficiency and Conservation Authority of New Zealand  
Energy Safe Victoria  
Institute of Refrigeration Heating and Air Conditioning Engineers of New Zealand  
Institution of Professional Engineers New Zealand  
University of New South Wales

---

#### **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 Standards may also be withdrawn.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 102470.*

## Australian/New Zealand Standard™

### **Performance of electrical appliances— Air conditioners and heat pumps**

#### **Part 4.1: Air-cooled air conditioners and air-to-air heat pumps—Testing and calculating methods for seasonal performance factors—Cooling seasonal performance factor (ISO 16358-1:2013, (MOD))**

First published as AS/NZS 3823.4.1:2014.

#### **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.

ISBN 978 1 74342 851 1

## PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-056, Room Air Conditioners.

The objective of this Standard is to provide a method of testing and calculating the seasonal performance factor of equipment using temperature bin distributions modified for Australian and New Zealand conditions.

This Standard is an adoption with national modifications and has been reproduced from ISO 16358-1:2013, *Air-cooled air conditioners and air-to-air heat pumps—Testing and calculating methods for seasonal performance factors*, Part 1: *Cooling seasonal performance factor*, and has been varied as indicated to take account of Australian/New Zealand conditions. The modifications are specified in Appendix ZZ.

As this Standard is reproduced from an International Standard, the following applies:

- (a) In the source text ‘this part of ISO 16358’ should read ‘this Australian/New Zealand Standard’.
- (b) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

| <i>Reference to International Standard</i> |                                                                                                     | <i>Australian/New Zealand Standard</i> |                                                                                                                                    |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| ISO                                        |                                                                                                     | AS/NZS                                 |                                                                                                                                    |
| 5151                                       | Non-ducted air conditioners and heat pumps—Testing and rating for performance                       | 3823                                   | Performance of electrical appliances—Airconditioners and heat pumps                                                                |
|                                            |                                                                                                     | 3823.1.1                               | Part 1.1: Non-ducted airconditioners and heat pumps—Testing and rating for performance (ISO 5151:2010, MOD)                        |
| 13253                                      | Ducted air-conditioners and air-to-air heat pumps—Testing and rating for performance                | 3823.1.2                               | Part 1.2: Ducted airconditioners and air-to-air heat pumps—Testing and rating for performance (ISO 13253:2011, MOD)                |
| 15042                                      | Multiple split-system air-conditioners and air-to-air heat pumps—Testing and rating for performance | 3823.1.4                               | Part 1.4: Multiple split-system airconditioners and air-to-air heat pumps—Testing and rating for performance (ISO 15042:2011, MOD) |

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

## CONTENTS

|                                                                                                                      |                                                                                                  |           |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------|
| <b>1</b>                                                                                                             | <b>Scope</b>                                                                                     | <b>1</b>  |
| <b>2</b>                                                                                                             | <b>Normative references</b>                                                                      | <b>1</b>  |
| <b>3</b>                                                                                                             | <b>Terms and definitions</b>                                                                     | <b>1</b>  |
| <b>4</b>                                                                                                             | <b>Symbols</b>                                                                                   | <b>3</b>  |
| <b>5</b>                                                                                                             | <b>Tests</b>                                                                                     | <b>5</b>  |
| 5.1                                                                                                                  | General                                                                                          | 5         |
| 5.2                                                                                                                  | Test conditions                                                                                  | 5         |
| 5.3                                                                                                                  | Test methods                                                                                     | 6         |
| <b>6</b>                                                                                                             | <b>Calculations</b>                                                                              | <b>7</b>  |
| 6.1                                                                                                                  | Cooling seasonal performance factor (CSPF) and total cooling seasonal performance factor (TCSPF) | 7         |
| 6.2                                                                                                                  | Defined cooling load                                                                             | 7         |
| 6.3                                                                                                                  | Outdoor temperature bin distribution for cooling                                                 | 7         |
| 6.4                                                                                                                  | Cooling seasonal characteristics of fixed capacity units                                         | 8         |
| 6.5                                                                                                                  | Cooling seasonal characteristics of two-stage capacity units                                     | 9         |
| 6.6                                                                                                                  | Cooling seasonal characteristics of multi-stage capacity units                                   | 10        |
| 6.7                                                                                                                  | Cooling seasonal characteristics of variable capacity units                                      | 11        |
| <b>7</b>                                                                                                             | <b>Test report</b>                                                                               | <b>13</b> |
| <b>Annex A (informative) Figures</b>                                                                                 |                                                                                                  | <b>15</b> |
| <b>Annex B (informative) Calculation of total cooling seasonal performance factor (TCSPF)</b>                        |                                                                                                  | <b>19</b> |
| <b>Annex C (normative) Testing and calculation method for degradation coefficient of cyclic operation</b>            |                                                                                                  | <b>21</b> |
| <b>Annex D (informative) Calculating method for seasonal performance factor when setting a specific cooling load</b> |                                                                                                  | <b>24</b> |
| <b>Annex E (informative) Calculating method for temperature when defined load line crosses each capacity line</b>    |                                                                                                  | <b>25</b> |

NOTES

## AUSTRALIAN/NEW ZEALAND STANDARD

**Performance of electrical appliances—Air conditioners and heat pumps****Part 4.1:**

**Air-cooled air conditioners and air-to-air heat pumps—Testing and calculating methods for seasonal performance factors—Cooling seasonal performance factor (ISO 16358-1:2013, (MOD))**

**1 Scope**

**1.1** This part of ISO 16358 specifies the testing and calculating methods for seasonal performance factor of equipment covered by ISO 5151, ISO 13253 and ISO 15042.

**1.2** This part of ISO 16358 also specifies the seasonal performance test conditions and the corresponding test procedures for determining the seasonal performance factor of equipment, as specified in [1.1](#), under mandatory test conditions and is intended for use only in marking, comparison, and certification purposes. For the purposes of this part of ISO 16358, the rating conditions are those specified under T1 in the reference standards in [1.1](#). The procedures in this part of ISO 16358 may be used for other temperature conditions.

**1.3** This part of ISO 16358 does not apply to the testing and rating of:

- a) water-source heat pumps or water-cooled air conditioners;
- b) portable units having a condenser exhaust duct;
- c) individual assemblies not constituting a complete refrigeration system; or
- d) equipment using the absorption refrigeration cycle.

**2 Normative references**

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5151, *Non-ducted air conditioners and heat pumps — Testing and rating for performance*

ISO 13253, *Ducted air-conditioners and air-to-air heat pumps — Testing and rating for performance*

ISO 15042, *Multiple split-system air-conditioners and air-to-air heat pumps — Testing and rating for performance*

**3 Terms and definitions**

For the purposes of this document, the terms and definitions given in ISO 5151, ISO 13253, ISO 15042 and the following apply.

**3.1**

**defined cooling load,  $L_c$**

heat defined as cooling demand for a given outdoor temperature

### 3.2 cooling seasonal total load CSTL

total annual amount of heat that is removed from the indoor air when the equipment is operated for cooling in active mode

### 3.3 cooling seasonal energy consumption CSEC

total annual amount of energy consumed by the equipment when it is operated for cooling in active mode

### 3.4 cooling seasonal performance factor CSPF

ratio of the total annual amount of heat that the equipment can remove from the indoor air when operated for cooling in active mode to the total annual amount of energy consumed by the equipment during the same period

### 3.5 part load factor PLF

ratio of the performance when the equipment is cyclically operated to the performance when the equipment is continuously operated, at the same temperature and humidity conditions

### 3.6 degradation coefficient, $C_D$

coefficient that indicates efficiency loss caused by cyclic operation

### 3.7 fixed capacity unit

equipment which does not have possibility to change its capacity

Note 1 to entry: This definition applies to each cooling and heating operation individually.

### 3.8 two (2)-stage capacity unit

equipment where the capacity is varied by two steps

Note 1 to entry: This definition applies to each cooling and heating operation individually.

### 3.9 multi-stage capacity unit

equipment where the capacity is varied by three or four steps

Note 1 to entry: This definition applies to each cooling and heating operation individually.

### 3.10 variable capacity unit

equipment where the capacity is varied by five or more steps to represent continuously variable capacity

Note 1 to entry: This definition applies to each cooling and heating operation individually.

### 3.11 cooling full-load operation

operation with the equipment and controls configured for the maximum continuous refrigeration capacity specified by the manufacturer and allowed by the unit controls

Note 1 to entry: Unless otherwise regulated by the automatic controls of the equipment, all indoor units and compressors shall be functioning during the full-load operation.

**3.12****minimum-load operation**

operation of the equipment and controls at minimum continuous refrigeration capacity

Note 1 to entry: All indoor units shall be functioning during the minimum-load operation.

**3.13****standard cooling full capacity**

cooling capacity at T1 at full-load operating conditions

**3.14****standard cooling full power input**

electric power input at T1 at full-load operating conditions

**3.15****standard cooling half capacity**

capacity which is 50 % of cooling full capacity at T1 condition with all indoor units functioning

**3.16****standard cooling half power input**

electric power input when operated at 50 % of cooling full capacity at T1 condition with all indoor units functioning

**3.17****standard cooling minimum capacity**

capacity at T1 condition at the minimum-load operation

**3.18****standard cooling minimum power input**

electric power input at T1 condition at the minimum-load operation

**3.19****total cooling seasonal performance factor****TCSPF**

ratio of the total annual amount of heat that the equipment can remove from the indoor air to the total annual amount of energy consumed by the equipment, including the active, inactive and disconnected modes

**3.20****active mode**

mode corresponding to the hours with a cooling demand of the building and whereby the cooling function of the unit is switched on

**3.21****inactive mode**

mode corresponding to the hours when the unit is not operating to meet cooling demand

Note 1 to entry: This mode may include the operation of a crankcase heater.

**3.22****disconnected mode**

mode corresponding to the hours when the unit is electrically disconnected from the main power supply

Note 1 to entry: Power consumption is zero.

**4 Symbols**

| Symbol      | Description                                                         | Unit |
|-------------|---------------------------------------------------------------------|------|
| $C_{CSE}$   | cooling seasonal energy consumption (CSEC)                          | Wh   |
| $E_{ER}(t)$ | energy efficiency ratio (EER) at continuous outdoor temperature $t$ | W/W  |

| Symbol             | Description                                                                                                           | Unit |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|------|
| $E_{ER}(t_j)$      | energy efficiency ratio (EER) at outdoor temperature $t_j$                                                            | W/W  |
| $E_{ER, ful}(t_b)$ | energy efficiency ratio (EER) when cooling load is equal to cooling full capacity                                     | W/W  |
| $E_{ER, haf}(t_c)$ | energy efficiency ratio (EER) when cooling load is equal to cooling half capacity                                     | W/W  |
| $E_{ER, hf}(t_j)$  | energy efficiency ratio (EER) in variable operation between half and full capacity at outdoor temperature $t_j$       | W/W  |
| $E_{ER, mh}(t_j)$  | energy efficiency ratio (EER) in variable operation between minimum and half capacity at outdoor temperature $t_j$    | W/W  |
| $E_{ER, min}(t_p)$ | energy efficiency ratio (EER) when cooling load is equal to cooling minimum capacity                                  | W/W  |
| $F_{CSP}$          | cooling seasonal performance factor (CSPF)                                                                            | –    |
| $F_{PL}(t_j)$      | part load factor (PLF) at outdoor temperature $t_j$                                                                   | –    |
| $F_{TCSP}$         | total cooling seasonal performance factor (TCSPF)                                                                     | –    |
| $L_{CST}$          | cooling seasonal total load (CSTL)                                                                                    | Wh   |
| $L_c(t_j)$         | defined cooling load at outdoor temperature $t_j$                                                                     | W    |
| $n_j$              | bin hours                                                                                                             | h    |
| k, p, n, m         | number of temperature bins                                                                                            | –    |
| $P(t)$             | cooling power input calculated by equation of $P(t_j)$ at continuous outdoor temperature $t$                          | W    |
| $P(t_j)$           | cooling power input applicable to any capacity at outdoor temperature $t_j$                                           | W    |
| $P_{ful}(t_j)$     | cooling full power input at outdoor temperature $t_j$                                                                 | W    |
| $P_{ful}(35)$      | cooling full power input at T1 temperature condition                                                                  | W    |
| $P_{ful}(29)$      | cooling full power input at outdoor temperature 29 °C                                                                 | W    |
| $P_{haf}(t_j)$     | cooling half power input at outdoor temperature $t_j$                                                                 | W    |
| $P_{haf}(35)$      | cooling half power input at T1 temperature condition                                                                  | W    |
| $P_{haf}(29)$      | cooling half power input at outdoor temperature 29 °C                                                                 | W    |
| $P_{hf}(t_j)$      | cooling power input in variable operation between half and full capacity at outdoor temperature $t_j$                 | W    |
| $P_{mf}(t_j)$      | cooling power input in second stage cyclic operation between minimum and full capacity at outdoor temperature $t_j$   | W    |
| $P_{mh}(t_j)$      | cooling power input in variable operation between minimum and half capacity at outdoor temperature $t_j$              | W    |
| $P_{min}(t_j)$     | cooling minimum power input at outdoor temperature $t_j$                                                              | W    |
| $P_{min}(35)$      | cooling minimum power input at T1 temperature condition                                                               | W    |
| $P_{min}(29)$      | cooling minimum power input at outdoor temperature 29 °C                                                              | W    |
| $t$                | general continuous outdoor temperature                                                                                | °C   |
| $t_j$              | outdoor temperature corresponding to each temperature bin                                                             | °C   |
| $t_b$              | outdoor temperature when cooling load is equal to cooling full capacity                                               | °C   |
| $t_c$              | outdoor temperature when cooling load is equal to cooling half capacity                                               | °C   |
| $t_p$              | outdoor temperature when cooling load is equal to cooling minimum capacity                                            | °C   |
| $X(t_j)$           | ratio of load to capacity at outdoor temperature $t_j$                                                                | –    |
| $X_{hf}(t_j)$      | ratio of excess capacity over load to capacity difference between half and full capacity at outdoor temperature $t_j$ | –    |

| Symbol            | Description                                                                                                              | Unit |
|-------------------|--------------------------------------------------------------------------------------------------------------------------|------|
| $X_{mf}(t_j)$     | ratio of excess capacity over load to capacity difference between minimum and full capacity at outdoor temperature $t_j$ | –    |
| $X_{mh}(t_j)$     | ratio of excess capacity over load to capacity difference between minimum and half capacity at outdoor temperature $t_j$ | –    |
| $\phi(t)$         | cooling capacity calculated by equation of $\phi(t_j)$ at continuous outdoor temperature $t$                             | W    |
| $\phi(t_j)$       | cooling capacity applicable to any capacity at outdoor temperature $t_j$                                                 | W    |
| $\phi_{ful}(t_j)$ | cooling full capacity at outdoor temperature $t_j$                                                                       | W    |
| $\phi_{ful}(35)$  | cooling full capacity at T1 temperature condition                                                                        | W    |
| $\phi_{ful}(29)$  | cooling full capacity at outdoor temperature 29 °C                                                                       | W    |
| $\phi_{haf}(t_j)$ | cooling half capacity at outdoor temperature $t_j$                                                                       | W    |
| $\phi_{haf}(35)$  | cooling half capacity at T1 temperature condition                                                                        | W    |
| $\phi_{haf}(29)$  | cooling half capacity at outdoor temperature 29 °C                                                                       | W    |
| $\phi_{min}(t_j)$ | cooling minimum capacity at outdoor temperature $t_j$                                                                    | W    |
| $\phi_{min}(35)$  | cooling minimum capacity at T1 temperature condition                                                                     | W    |
| $\phi_{min}(29)$  | cooling minimum capacity at outdoor temperature 29 °C                                                                    | W    |

## 5 Tests

### 5.1 General

These tests are additional to those in ISO 5151, ISO 13253 and ISO 15042.

The accuracy of the instruments used for tests shall conform to the test methods and uncertainties of measurements specified in ISO 5151, ISO 13253 and ISO 15042.

### 5.2 Test conditions

Temperature and humidity conditions as well as default values for calculation shall be as specified in [Table 1](#).

**Table 1 — Temperature and humidity conditions and default values for cooling at T1 moderate climate condition of ISO 5151, ISO 13253 and ISO 15042**

| Test                                                                                                                                                                                                                                                                                                                           | Characteristics                              | Fixed | Two-stage | Multi-stage | Variable | Default value                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------|-----------|-------------|----------|-------------------------------|
| Standard cooling capacity                                                                                                                                                                                                                                                                                                      | Full capacity $\phi_{\text{ful}}(35)$ (W)    | ■     | ■         | ■           | ■        | —                             |
|                                                                                                                                                                                                                                                                                                                                | Full power input $P_{\text{ful}}(35)$ (W)    |       |           |             |          |                               |
| Indoor DB 27°C                                                                                                                                                                                                                                                                                                                 | Half capacity $\phi_{\text{haf}}(35)$ (W)    | —     | —         | ○           | ■        | $\phi_{\text{haf}}(29)/1,077$ |
| WB 19°C                                                                                                                                                                                                                                                                                                                        | Half power input $P_{\text{haf}}(35)$ (W)    |       |           |             |          | $P_{\text{haf}}(29)/0,914$    |
| Outdoor DB 35°C                                                                                                                                                                                                                                                                                                                | Minimum capacity $\phi_{\text{min}}(35)$ (W) | —     | ○         | ○           | ○        | $\phi_{\text{min}}(29)/1,077$ |
| WB 24°C                                                                                                                                                                                                                                                                                                                        | Minimum power input $P_{\text{min}}(35)$ (W) |       |           |             |          | $P_{\text{min}}(29)/0,914$    |
| <div>■ required test.</div> <div>○ optional test.</div> <div>NOTE 1 If the minimum capacity test is measured, min(29) test is conducted first. Min(35) test may be measured or may be calculated by using default value.</div> <div>NOTE 2 Voltage(s) and frequency(ies) are as given in the three referenced standards.</div> |                                              |       |           |             |          |                               |

Table 1 (continued)

| Test                                                                                             | Characteristics                              |                  | Fixed | Two-stage | Multi-stage | Variable | Default value                        |
|--------------------------------------------------------------------------------------------------|----------------------------------------------|------------------|-------|-----------|-------------|----------|--------------------------------------|
| Low temperature cooling capacity                                                                 | Full capacity $\phi_{\text{ful}}(29)$ (W)    |                  | ■     | ■         | ■           | —        | $1,077 \times \phi_{\text{ful}}(35)$ |
|                                                                                                  | Full power input $P_{\text{ful}}(29)$ (W)    |                  |       |           |             |          | $0,914 \times P_{\text{ful}}(35)$    |
| Indoor DB 27°C<br>WB 19°C                                                                        | Half capacity $\phi_{\text{haf}}(29)$ (W)    |                  | —     | —         | ■           | ○        | $1,077 \times \phi_{\text{haf}}(35)$ |
|                                                                                                  | Half power input $P_{\text{haf}}(29)$ (W)    |                  |       |           |             |          | $0,914 \times P_{\text{haf}}(35)$    |
| Outdoor DB 29°C<br>WB 19°C                                                                       | Minimum capacity $\phi_{\text{min}}(29)$ (W) |                  | —     | ■         | ○           | ○        | —                                    |
|                                                                                                  | Minimum power input $P_{\text{min}}(29)$ (W) |                  |       |           |             |          |                                      |
| Low humidity and cyclic cooling<br>Indoor DB 27°C<br>WB 16°C or lower<br>Outdoor DB 29°C<br>WB - | Degradation coefficient $C_D$                | Full capacity    | ○     | —         | —           | —        | 0,25                                 |
|                                                                                                  |                                              | Half capacity    | —     | —         | ○           | —        | 0,25                                 |
|                                                                                                  |                                              | Minimum capacity | —     | ○         | ○           | —        | 0,25                                 |

■ required test.

○ optional test.

NOTE 1 If the minimum capacity test is measured, min(29) test is conducted first. Min(35) test may be measured or may be calculated by using default value.

NOTE 2 Voltage(s) and frequency(ies) are as given in the three referenced standards.

## 5.3 Test methods

### 5.3.1 Standard cooling capacity tests

The standard cooling capacity tests shall be conducted in accordance with Annex A of ISO 5151 and Annex B of ISO 13253 and ISO 15042. The cooling capacity and effective power input shall be measured during the standard cooling capacity tests.

The half capacity test shall be conducted at 50 % of full load operation. The test tolerance shall be  $\pm 5$  % of full load capacity for continuously variable equipment. For multi-stage equipment, if 50 % capacity is not achievable, then the tests shall be conducted at the next step above 50 %.

The minimum capacity test shall be conducted at the lowest capacity control setting which allows steady-state operation of the equipment at the given test conditions.

If the minimum capacity tests are conducted, but if the required uncertainty of measurement specified in ISO 5151, ISO 13253 and ISO 15042 cannot be achieved, the alternative method of calculation shall be used. (Refer to 6.6.4 and 6.7.4.)

The manufacturer shall provide information on how to set the capacity if requested by the testing laboratories.

### 5.3.2 Low temperature cooling capacity tests

The low temperature cooling capacity test shall be conducted in accordance with Annex A of ISO 5151 and Annex B of ISO 13253 and ISO 15042. If the test is not conducted, default values as given in Table 1 shall be used.

The half capacity test shall be conducted at 50 % of full load operation. The test tolerance shall be  $\pm 5$  % of full load capacity for continuously variable equipment. For multi-stage equipment, if 50 % capacity is not achievable, then the tests shall be conducted at the next step above 50 %.

The minimum capacity test shall be conducted at the lowest capacity control setting which allows steady-state operation of the equipment at the given test conditions.

If the minimum capacity tests are conducted, but if the required uncertainty of measurement specified in ISO 5151, ISO 13253 and ISO 15042 cannot be achieved, the alternative method of calculation shall be used. (Refer to [6.6.4](#) and [6.7.4](#).)

The manufacturer shall provide information on how to set the capacity if requested by the testing laboratories.

### 5.3.3 Low humidity cooling test and cyclic cooling test

The low humidity cooling test and cyclic cooling test shall be conducted in accordance with [Annex C](#). If the test is not conducted, default values as given in [Table 1](#) shall be used.

## 6 Calculations

### 6.1 Cooling seasonal performance factor (CSPF) and total cooling seasonal performance factor (TCSPF)

The cooling seasonal performance factor (CSPF),  $F_{CSP}$ , of the equipment shall be calculated by Formula (1).

$$F_{CSP} = \frac{L_{CST}}{C_{CSE}} \quad (1)$$

In case of calculating the total cooling seasonal performance factor (TCSPF), refer to [Annex B](#).

### 6.2 Defined cooling load

The defined cooling load shall be represented by a value and the assumption that it is linearly changing depending on the change in outdoor temperature.

Defined cooling load which shall be used is shown in [Table 2](#).

**Table 2 — Defined cooling load**

| Parameter        | Load zero (0) | Load 100 %            |
|------------------|---------------|-----------------------|
| Cooling load (W) | 0             | $\phi_{ful}(t_{100})$ |
| Temperature (°C) | $t_0$         | $t_{100}$             |

where  $t_{100}$  is the outdoor temperature at 100 % load and  $t_0$  is the outdoor temperature at 0 % load.

Reference values of defined cooling load to be used shall be as follows:

$$t_0 = 20 \text{ °C and } t_{100} = 35 \text{ °C}$$

In case of setting other cooling load, refer to the setting method as described in [Annex D](#).

Defined cooling load  $L_c(t_j)$  at outdoor temperature  $t_j$ , which is necessary to calculate the cooling seasonal energy consumption, shall be determined by Formula (2).

$$L_c(t_j) = \phi_{ful}(t_{100}) \times \frac{t_j - t_0}{t_{100} - t_0} \quad (2)$$

where  $\phi_{ful}(t_{100})$  is the cooling capacity at  $t_{100}$  at full-load operating conditions.

### 6.3 Outdoor temperature bin distribution for cooling

[Table 3](#) shows the reference outdoor temperature bin distribution.

Cooling seasonal performance factor (CSPF) shall be calculated at the reference climate conditions in [Table 3](#).

The calculation of cooling seasonal performance factor may also be done for other climate conditions.

**Table 3 — Reference outdoor temperature bin distribution**

| Bin number j                    | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10       | 11       | 12       | 13       | 14       | 15       | Total |
|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|----------|----------|----------|----------|----------|-------|
| Outdoor temperature $t_j$ °C    | 21    | 22    | 23    | 24    | 25    | 26    | 27    | 28    | 29    | 30       | 31       | 32       | 33       | 34       | 35       | —     |
| Fractional bin hours            | 0,055 | 0,076 | 0,091 | 0,108 | 0,116 | 0,118 | 0,116 | 0,100 | 0,083 | 0,066    | 0,041    | 0,019    | 0,006    | 0,003    | 0,002    |       |
| Bin hours $n_j$                 | $n_1$ | $n_2$ | $n_3$ | $n_4$ | $n_5$ | $n_6$ | $n_7$ | $n_8$ | $n_9$ | $n_{10}$ | $n_{11}$ | $n_{12}$ | $n_{13}$ | $n_{14}$ | $n_{15}$ | —     |
| Reference bin hours ( $n_j$ ) h | 100   | 139   | 165   | 196   | 210   | 215   | 210   | 181   | 150   | 120      | 75       | 35       | 11       | 6        | 4        | 1 817 |

Bin hours of each outdoor temperature may be calculated by multiplying the fractional bin hours by the total annual cooling hours if the fractional bin hours are applicable.

In case of setting other outdoor temperature bin distribution, refer to the setting method as described in [Annex D](#).

## 6.4 Cooling seasonal characteristics of fixed capacity units

Operational performance at each test, which is used for calculation of seasonal performance factor, shall be in accordance with [Table 1](#).

### 6.4.1 Capacity characteristics against outdoor temperature

Capacity  $\phi_{\text{ful}}(t_j)$  (W) of the equipment when it is operated for cooling at outdoor temperature  $t_j$  linearly changes depending on outdoor temperatures as shown in [Figure A.1](#) in [Annex A](#), and it is determined by Formula (3) from two characteristics, one at 35 °C and the other at 29 °C.

$$\phi_{\text{ful}}(t_j) = \phi_{\text{ful}}(35) + \frac{\phi_{\text{ful}}(29) - \phi_{\text{ful}}(35)}{35 - 29} \times (35 - t_j) \quad (3)$$

### 6.4.2 Power input characteristics against outdoor temperature

Power input  $P_{\text{ful}}(t_j)$  (W) of the equipment when it is operated for cooling at outdoor temperature  $t_j$  linearly changes depending on outdoor temperatures as shown in [Figure A.1](#) in [Annex A](#), and it is determined by Formula (4) from two characteristics, one at 35 °C and the other at 29 °C.

$$P_{\text{ful}}(t_j) = P_{\text{ful}}(35) + \frac{P_{\text{ful}}(29) - P_{\text{ful}}(35)}{35 - 29} \times (35 - t_j) \quad (4)$$

### 6.4.3 Calculation of cooling seasonal total load (CSTL)

Cooling seasonal total load (CSTL),  $L_{\text{CST}}$ , shall be determined using Formula (5) from the total sum of cooling load at each outdoor temperature  $t_j$  multiplied by bin hours  $n_j$ .

$$L_{\text{CST}} = \sum_{j=1}^m L_c(t_j) \times n_j + \sum_{j=m+1}^n \phi_{\text{ful}}(t_j) \times n_j \quad (5)$$

a) In the range of  $L_c(t_j) \leq \phi_{\text{ful}}(t_j)$  ( $j = 1$  to  $m$ ):

$L_c(t_j)$  shall be calculated by Formula (2).

b) In the range of  $L_c(t_j) > \phi_{\text{ful}}(t_j)$  ( $j = m+1$  to  $n$ ):

$\phi_{\text{ful}}(t_j)$  shall be calculated by Formula (3).