

Australian/New Zealand Standard™

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

**Part 4.3: Air-cooled air conditioners and
air-to-air heat pumps—Testing and
calculating methods for seasonal
performance factors—Annual
performance factor**



AS/NZS 3823.4.3:2014

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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
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PREFACE

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

The objective of this Standard is to provide a method of testing and calculating the annual performance factor of equipment using temperature bin distributions.

This Standard is identical with and has been reproduced from ISO 16358-3:2013, *Air-cooled air conditioners and air-to-air heat pumps—Testing and calculating methods for seasonal performance factors*, Part 3: *Annual performance factor*.

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 ISO 16358, Parts 1 to 3 have been adopted as the AS/NZS 3823.4, Parts 4.1 to 4.3.

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

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AUSTRALIAN/NEW ZEALAND STANDARD

Performance of electrical appliances—Air conditioners and heat pumps

Part 4.3:

Air-cooled air conditioners and air-to-air heat pumps—Testing and calculating methods for seasonal performance factors—Annual performance factor**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.

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*

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

ISO 16358-2, *Air-cooled air conditioners and air-to-air heat pumps — Testing and calculating methods for seasonal performance factors — Part 2: Heating seasonal performance factor*

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
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

3.2
cooling seasonal energy consumption
CSEC

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

3.3
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

3.4
heating seasonal total load
HSTL

total annual amount of heat, including make-up heat, which is added to the indoor air when the equipment is operated for heating in active mode

3.5
heating seasonal energy consumption
HSEC

total annual amount of energy consumed by the equipment, including make-up heat, when it is operated for heating in active mode

3.6
annual performance factor
APF

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

3.7
total annual performance factor
TAPF

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

3.8
active mode

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

3.9
inactive mode

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

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

3.10
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
C_{HSE}	heating seasonal energy consumption (HSEC)	Wh
F_{AP}	annual performance factor (APF)	—
F_{CSP}	cooling seasonal performance factor (CSPF)	—
F_{TAP}	total annual performance factor (TAPF)	—
L_{CST}	cooling seasonal total load (CSTL)	Wh
L_{HST}	heating seasonal total load (HSTL)	Wh

5 Calculation of annual performance factor (APF) and total annual performance factor (TAPF)

Annual performance factor (APF), F_{AP} , shall be calculated by Formula (1).

$$F_{AP} = \frac{L_{CST} + L_{HST}}{C_{CSE} + C_{HSE}} \quad (1)$$

Calculation of L_{CST} and C_{CSE} is according to ISO 16358-1, and calculation of L_{HST} and C_{HSE} is according to ISO 16358-2.

For the cooling-only equipment, the annual performance factor (APF) shall be equal to the cooling seasonal performance factor (CSPF).

In case of calculating the total annual performance factor (TAPF), refer to [Annex A](#).

6 Test report

The test report for this part of ISO 16358 shall include the calculation of APF (and TAPF if applicable) and test reports from ISO 16358-1 for cooling and ISO 16358-2 for heating.

Annex A (informative)

Calculation of total annual performance factor (TAPF)

A.1 General

This annex applies only to the reverse cycle units.

A.2 Measurement of the electric power consumption during the inactive mode

The unit shall be electrically connected to the main power source after shut-down for 6 h. Indoor and outdoor temperature of 20 °C condition shall be reached. The power consumption shall be measured for one hour after the temperature conditions are stabilized. The same test is repeated with the temperature condition of 5 °C, 10 °C and then 15 °C with the stabilization period of 2 h between each test. As a reference case, each power consumption value shall be weighted by weighting factors in [Table A.1](#) and then integrated to obtain a weighted average inactive power consumption, P_{ia} . The calculation of inactive power may also be undertaken for other climate conditions and operating schedules.

NOTE If the results of the tests at 20 °C and 5 °C are within 5 % or 1 W, then the tests at 15 °C and 10 °C are not mandatory. The average value of these results is used for the four considered temperature conditions.

Table A.1 — Default weighting factors for determination of reference inactive energy consumption

Temperature condition	5 °C	10 °C	15 °C	20 °C
Weighting factor	0,05	0,13	0,27	0,55

Inactive energy consumption (IAEC) shall be calculated by Formula (A.1).

$$C_{IAE} = H_{ia} \times P_{ia} \quad (A.1)$$

where

C_{IAE} is the inactive energy consumption;

H_{ia} is the number of hours of inactive mode as given in [Table A.2](#);

P_{ia} is the weighted average power consumption.

A.3 Calculation of total annual performance factor (TAPF)

Total annual performance factor (TAPF), F_{TAP} , shall be calculated by Formula (A.2).

$$F_{TAP} = (L_{CST} + L_{HST}) / (C_{CSE} + C_{HSE} + C_{IAE}) \quad (A.2)$$

Calculation of L_{CST} and C_{CSE} is according to ISO 16358-1, and calculation of L_{HST} and C_{HSE} is according to ISO 16358-2.

Inactive energy consumption (IAEC), C_{IAE} , shall be calculated by Formula (A.1).

The default mode hours for the calculation of reference total annual performance factor are shown in [Table A.2](#). The calculation of total annual performance factor may also be undertaken for other distributions of mode hours.

Table A.2 — Default hours by mode for the calculation of reference total annual performance factor

	Active mode h	Inactive mode, H_{ia} h	Disconnected mode h
Cooling season	1 817	—	—
Heating season	2 866	—	—
Annual total hours	4 683	4 077	0

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