

Australian/New Zealand Standard™

**Performance of electrical appliances—
Airconditioners and heat pumps**

**Part 1.3: Water-source heat pumps—
Water-to-air and brine-to-air heat
pumps—Testing and rating of
performance (ISO 13256-1:1998, MOD)**



AS/NZS 3823.1.3:2005

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EL-015, Quality and Performance of Household Electrical Appliances.

This Standard incorporates Amendment No. 1 (September 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.

This Standard is an adoption with national modifications and has been reproduced from ISO 13256-1:1998, *Water-source heat pumps—Testing and rating for performance—Part 1: Water-to-air and brine-to-air heat pumps*, and has been varied as indicated to take account of Australian/New Zealand conditions.

Variations to ISO 13256-1:1998 are indicated at the appropriate places throughout this standard. Strikethrough (~~example~~) identifies ISO text, tables and figures which, for the purposes of this Australia/New Zealand Standard, are deleted. Where text, tables or figures are added, each is set in its proper place and identified by shading (example). Added figures are not themselves shaded, but are identified by a shaded border.*

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The terms 'normative' and 'informative' are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

* Obvious spelling errors have been corrected.

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STANDARDS AUSTRALIA

Australia/New Zealand Standard

Performance of electrical appliances—Airconditioners and heat pumps
Part 1.3: Water-source heat pumps—Water-to-air and brine-to-air heat
pumps—Testing and rating of performance
(ISO 13256-1:1998, MOD)

Any table, figure or text of the international standard that is struck through is not part of this standard. Any Australian/New Zealand table, figure or text that is added is part of this standard and is identified by shading.

1 Scope

1.1 This part of ISO 13256 establishes performance testing and rating criteria for factory-made residential, commercial and industrial, electrically-driven, mechanical-compression type, water-to-air and brine-to-air heat pumps. The requirements for testing and rating contained in this part of ISO 13256 are based on the use of matched assemblies.

1.2 Equipment designed for rating at one application under this part of ISO 13256 may not be suitable at all applications covered in this part of ISO 13256.

1.3 This part of ISO 13256 does not apply to the testing and rating of individual assemblies for separate use, nor to the testing and rating of heat pumps covered in ISO 5151, ISO 13253 or ISO 13256-2.

NOTE — For the purpose of the remaining clauses, the terms “equipment” or “heat pumps” may be used to mean “water-to-air heat pumps” or “brine-to-air heat pumps” and the term “liquid” refers to either “water” or “brine”.

NOTE: Airconditioners with water cooled condensers have been excluded from AS/NZS 3823.1.1 and AS/NZS 3823.1.2 and are covered under the requirements of this Standard.

1.4 This does not cover the determination of seasonal efficiencies which may be required in some countries.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 13256. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 13256 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

References to international standards that are struck through in this clause are replaced by references to Australian or Australian/New Zealand Standards that are listed immediately thereafter and identified by shading. Any Australian or Australian/New Zealand Standard that is identical to the International Standard it replaces is identified as such.

~~ISO 817:—*, Refrigerants—Number designation.~~

AS/NZS 1677.1, Refrigerating systems, Part 1: Refrigerant classification

*To be published. (Revision of ISO 817:1974)

3 Definitions

For the purposes of this part of ISO 13256, the following definitions apply.

3.1

water-to-air heat pump and/or brine-to-air heat pump

heat pump which consists of one or more factory-made assemblies which normally include an indoor conditioning coil with air-moving means, compressor(s), and refrigerant-to-water or refrigerant-to-brine heat exchanger(s), including means to provide both cooling and heating, cooling-only, or heating-only functions

NOTES

1 When such equipment is provided in more than one assembly, the separated assemblies should be designed to be used together.

2 Such equipment may also provide functions of sanitary water heating, air cleaning, dehumidifying, and humidifying.

3.1.1

water-loop heat pump application

water-to-air heat pump using liquid circulating in a common piping loop functioning as a heat source/heat sink

NOTE — The temperature of the liquid loop is usually mechanically controlled within a temperature range of 15 °C to 40 °C.

3.1.2

ground-water heat pump application

water-to-air heat pump using water pumped from a well, lake or stream functioning as a heat source/heat sink

NOTE — The temperature of the water is related to the climatic conditions and may vary from 5 °C to 25 °C for deep wells.

3.1.3

ground-loop heat pump application

brine-to-air heat pump using a brine solution circulating through a subsurface piping loop functioning as a heat source/heat sink

NOTES

1 The heat exchange loop may be placed in horizontal trenches or vertical bores, or be submerged in a body of surface water.

2 The temperature of the brine is related to the climatic conditions and may vary from -5 °C to 40 °C.

3.2

total cooling capacity

amount of sensible and latent heat that the equipment can remove from the conditioned space in a defined interval of time, in watts, as determined by the specified test methods

3.3

net total cooling capacity

total cooling capacity with fan power adjustment

(See 4.1.3.)

3.4

heating capacity

amount of heat that the equipment can add to the conditioned space in a defined interval of time, expressed in watts, as determined by the specified test methods, but excluding all manually switchable electric heating devices.

~~amount of heat that the equipment can add to the conditioned space in a defined interval of time, in watts, as determined by the specified test methods~~

3.5**net heating capacity**

heating capacity with fan power adjustment

(See 4.1.3.)

3.6**rated voltage**

voltage shown on the nameplate of the equipment, in volts

3.7**rated frequency**

frequency shown on the nameplate of the equipment, in hertz

3.8**energy efficiency ratio (EER)**

ratio of the net total cooling capacity to the effective power input at any given set of rating conditions, in watts per watt

3.9**coefficient of performance (COP)**

ratio of the net heating capacity to the effective power input of the equipment at any given set of rating conditions, in watts per watt

3.10**standard air**

dry air at 20,0 °C and 101,324 kPa having a mass density of 1,204 kg/m³

3.11**effective power input**

average electrical power input to the equipment (expressed in watts) within a defined interval of time, in watts; i.e. the sum of:

- the power input for operation of the compressor excluding additional electrical heating devices,
- the power input for operation of the compressor and any power input for defrosting, excluding all manually switchable electric heating devices, ~~the power input of all control and safety devices of the equipment,~~ and
- the proportional power input of the conveying devices for the transport of the heat transfer media through the heat pump only (e.g., fans, pumps, whether internal or external, whether provided with the equipment or not) (See 4.1.3 and 4.1.4.)

3.12**latent cooling capacity**

amount of latent heat that the equipment can remove from the conditioned space in a defined interval of time, in watts

3.13**sensible cooling capacity**

amount of sensible heat that the equipment can remove from the conditioned space in a defined interval of time, in watts

3.14**Shall**

indicates that a statement is mandatory

3.15**Should**

indicates a recommendation

4 Rating and test conditions

4.1 Rating conditions for the determination of capacity

4.1.1 Standard ratings

Standard ratings shall be established at the standard rating conditions specified in 4.2, using the test procedures described in clause 6. Standard ratings relating to cooling and heating capacities shall be net values, including the effects of circulating- fan heat, but not including supplementary heat. Standard efficiency ratings shall be based on the effective power input as defined in 3.11. The electrical input values used for rating purposes shall be measured during the cooling capacity test.

4.1.2 Power input of fans for heat pumps without duct connection

In the case of heat pumps which are not designed for duct connection and which are equipped with an integral fan, all power consumed by the fans shall be included in the effective power input to the heat pump.

4.1.3 Power input of fans for heat pumps with duct connection

A1 4.1.3.1 If no fan is provided with the heat pump, a fan power adjustment is to be included in the effective power input to the heat pump, using the following formula:

$$\phi_{fa} = \frac{q \times \Delta p}{\eta}$$

where

ϕ_{fa} is the fan power adjustment, in watts;

η = 0,3 by convention;

Δp is the measured static pressure difference across the indoor refrigerant to air heat-exchanger, in pascals;

q is the nominal airflow rate, in cubic metres per second.

This value shall also be added to the measured heating capacity and subtracted from the measured cooling capacity.

A1 4.1.3.2 If a fan is an integral part of a heat pump, only the portion of the fan power required to overcome the internal resistance shall be included in the effective power input to the heat pump. The fraction which is to be excluded from the total power consumed by the fan shall be calculated using the following formula:

$$\phi_{fa} = \frac{q \times \Delta p}{\eta}$$

where

ϕ_{fa} is the fan power adjustment, in watts;

η = 0,3 by convention;

- A1 Δp is the measured external static pressure difference, in pascals;
- q is the nominal airflow rate, in cubic metres per second.
- This value shall also be subtracted from the measured heating capacity and added to the measured cooling capacity.

4.1.4 Power input of liquid pumps

- A1 **4.1.4.1** If no liquid pump is provided with a heat pump, a pump power adjustment is to be included in the effective power consumed by the heat pump, using the following formula:

$$\phi_{pa} = \frac{q \times \Delta p}{\eta}$$

where

ϕ_{pa} is the pump power adjustment, in watts;

η = 0,3 by convention;

Δp is the measured liquid static pressure difference across the refrigerant to liquid heat exchanger, in kilopascals;

q is the nominal liquid flow rate, in litres per second.

- A1 **4.1.4.2** If a liquid pump is an integral part of the heat pump, only the portion of the pump power required to overcome the internal resistance shall be included in the effective power input to the heat pump. The fraction which is to be excluded from the total power consumed by the pump shall be calculated using the following formula:

$$\phi_{pa} = \frac{q \times \Delta p}{\eta}$$

where

ϕ_{pa} is the pump power adjustment, in watts;

η = 0,3 by convention;

Δp is the measured external static pressure difference of the liquid circuit, in kilopascals;

q is the nominal liquid flow rate, in litres per second.

4.1.5 Airflow rates

4.1.5.1 All standard ratings shall be determined at airflow rates as described below. All airflow rates shall be expressed as litres per second of standard air as defined in 3.10.

4.1.5.2 Indoor-side air quantities and external or internal static pressures referred to in this Standard apply when the equipment is cooling and dehumidifying. For equipment supplied with an indoor fan, the cooling capacity test shall be conducted at the air flow specified by the manufacturer while achieving an external static pressure equal to or greater than the following:

Standard capacity ratings	Minimum external static pressure
(kW)	(Pa)
<8	25
8 to <12	37
12 to <20	50
20 to <30	62
30 to <45	75
45 to <82	100
82 to <117	125
117 to <147	150
Above 147	175

NOTE: For equipment tested without an air filter installed, the minimum external static pressure shall be increased by 10 Pa.

For equipment supplied without an indoor fan, the cooling capacity test shall be conducted at the air flow specified by the manufacturer or at a maximum pressure drop of 75 Pa across the indoor coil assembly, recommended enclosures and attachment means, whichever results in lower airflow.

~~**4.1.5.2** Ducted heat pumps which have integral fans shall be tested at the airflow rates specified by the manufacturer, or those obtained at zero external static pressure difference, whichever provides the lower airflow rate.~~

4.1.5.3 Ducted heat pumps which do not have integral fans, but which are tested in combination with a device employing a fan, shall be tested as described in 4.1.5.2. Ducted heat pumps which do not have integral fans but which are rated for general use with a variety of air moving devices, shall be tested at the airflow rates specified by the manufacturer in the published ratings. However, the pressure drop across the indoor coil assembly and the recommended enclosures and attachment means shall not exceed 75 Pa.

4.1.5.4 Airflow tests for non ducted equipment

Airflow tests shall be conducted with 0 Pa static maintained at the air discharge of the equipment and may be measured without the refrigeration system in operation. All air quantities shall be measured in accordance with Annex F and expressed in cubic metres per second (m³/s) of standard air as defined in Clause 3.10.

~~**4.1.5.4** Non-ducted heat pumps shall be tested at the airflow rates obtained at zero external static pressure difference.~~

4.1.5.4.1 Test conditions

The following test conditions shall apply:

- (a) Filters and grilles shall be in position.
- (b) Where the airconditioner is equipped to operate at two or more fan speeds, the test shall be conducted at the highest fan speed. Additional tests may be conducted at other fan speeds.

4.1.5.5 The manufacturer shall specify a single airflow rate for all tests required in this part of ISO 13256 unless automatic adjustment of airflow rate is provided by the equipment. A separate control signal output for each step of airflow rate shall be considered as an automatic adjustment.

4.1.6 Liquid flow rates

4.1.6.1 All standard ratings shall be determined at a liquid flow rate described below, expressed as litres per second.

4.1.6.2 Heat pumps with integral liquid pumps shall be tested at the liquid flow rates specified by the manufacturer or those obtained at zero external static pressure difference, whichever provides the lower liquid flow rate.

4.1.6.3 Heat pumps without integral liquid pumps shall be tested at the flow rates specified by the manufacturer.

4.1.6.4 The manufacturer shall specify a single liquid flow rate for all of the tests required in this part of ISO 13256 unless automatic adjustment of the liquid flow rate is provided by the equipment. A separate control signal output for each step of liquid flow rate will be considered as an automatic adjustment.

4.1.7 Requirements for separated assemblies

In the case of heat pumps consisting of separate matched assemblies, the following installation procedures shall be followed.

- a) Each refrigerant line shall be installed in accordance with the manufacturer's instructions with the maximum stated length or 7,5 m, whichever is shorter. If the interconnecting tubing is furnished as an integral part of the equipment and not recommended for cutting the length, the equipment shall be tested with the complete length of tubing furnished.
- b) The lines shall be installed without any significant difference in elevation (not more than 2 m).

4.1.8 Requirements for heat pumps with capacity control

4.1.8.1 Part-load conditions shall be used for rating tests at levels or steps less than that of maximum capacity.

4.1.8.2 Heat pumps with fixed steps of capacity control shall be rated at each step of capacity. Heat pumps with variable capacity control shall be rated at no less than two capacity levels, the minimum and the maximum capacities.

4.1.9 Test liquids

4.1.9.1 The test liquid for water-loop heat pumps and ground water heat pumps shall be water.

4.1.9.2 The test liquid for ground-loop heat pumps shall be a 15% solution by mass of sodium chloride in water.

4.1.9.3 The test liquid shall be sufficiently free of gas to ensure that the measured result is not influenced by the presence of gas.

4.2 Standard rating and part-load rating test conditions

4.2.1 The test conditions for the determination of standard and part-load cooling ratings are specified in table 1.

4.2.2 The test conditions for determination of standard and part-load heating ratings are specified in table 2.

4.2.3 Heat pumps intended for a specific application shall be rated at the conditions specified for that application,

for example, water-loop, ground-water, or ground-loop, and shall be identified as such (i.e. water-loop heat pump, ground-water heat pump, or ground-loop heat pump). Heat pumps intended for two or three applications shall be rated at the conditions specified for each of these applications and shall be so identified (see 7.3).

4.2.4 The test room reconditioning apparatus and the equipment under test shall be operated until equilibrium conditions are attained, and equilibrium shall be maintained for not less than one hour before capacity test data may be recorded.

The data shall be recorded at equal intervals that span 5 min or less. The recording of the data shall continue for at least a 30 min period during which the tolerances specified in Clause 6.4 shall be met.

~~**4.2.4** For each test, the equipment shall be operated continuously until equilibrium conditions are attained, but for not less than one hour before capacity test data are recorded. The data shall then be recorded for 30 min at 5 min intervals until seven consecutive sets of readings have been attained within the tolerances specified in 6.4. The averages of these data shall be used for the calculation of the test results.~~

Table 1 — Test conditions for the determination of cooling capacity

	Water-loop heat pumps	Ground-water heat pumps	Ground-loop heat pumps
Air entering indoor side			
— dry bulb, °C	27	27	27
— wet bulb, °C	19	19	19
Air surrounding unit			
— dry bulb °C	27	27	27
<u>Standard rating test</u>			
Liquid entering heat exchanger, °C	30	15	25
<u>Part-load rating test</u>			
Liquid entering heat exchanger, °C	30	15	20
Frequency*	Rated	Rated	Rated
Voltage**	Rated	Rated	Rated
* Equipment with dual-rated frequencies shall be tested at each frequency.			
** Where the rated voltage of the equipment lies wholly or partly between 208 V and 253 V, the test voltage shall be 230 V. If the equipment is rated for 240 V only, the test voltage shall be 240 V. Where the rated voltage of the equipment lies wholly or partly between 360 V and 440 V, the test voltage shall be 400 V. If the equipment is rated for 415 V only, the test voltage shall be 415 V. For other rated voltage ranges, the test voltage shall be the mean value of the range.			
~~** Equipment with dual-rated voltages shall be tested at both voltages or at the lower of the two voltages if only a single rating is published.~~			

Table 2 — Test conditions for the determination of heating capacity

	Water-loop heat pumps	Ground-water heat pumps	Ground-loop heat pumps
Air entering indoor side			
— dry bulb, °C	20	20	20
— wet bulb, °C	15	15	15
Air surrounding unit			
— dry bulb °C	20	20	20
<u>Standard rating test</u>			
Liquid entering heat exchanger, °C	20	10	0
<u>Part-load rating test</u>			
Liquid entering heat exchanger, °C	20	10	5
Frequency*	Rated	Rated	Rated
Voltage**	Rated	Rated	Rated
* Equipment with dual-rated frequencies shall be tested at each frequency. ** Where the rated voltage of the equipment lies wholly or partly between 208 V and 253 V, the test voltage shall be 230 V. If the equipment is rated for 240 V only, the test voltage shall be 240 V. Where the rated voltage of the equipment lies wholly or partly between 360 V and 440 V, the test voltage shall be 400 V. If the equipment is rated for 415 V only, the test voltage shall be 415 V. For other rated voltage ranges, the test voltage shall be the mean value of the range. ~~** Equipment with dual rated voltages shall be tested at both voltages or at the lower of the two voltages if only a single rating is published.~~			

5 Performance requirements

5.1 General

5.1.1 To comply with this part of ISO 13256, water-to-air and brine-to-air heat pumps shall be designed and produced such that any production unit will meet the applicable requirements of this part of ISO 13256.

5.1.2 For heat pumps with capacity control, the performance requirements tests shall be conducted at maximum capacity.

5.2 Maximum operating conditions test

5.2.1 Test conditions

The maximum operating conditions tests shall be conducted for cooling and heating at the test conditions established for the specific applications (see 4.2.3) specified in tables 3 and 4. Heat pumps intended for use in two or more applications shall be tested at the most stringent set of conditions specified in tables 3 and 4. The determination of cooling or heating capacity is not required for this performance test. The test voltages in Table 3 and 4 shall be maintained at the specified percentages under running conditions.

5.2.1.1 The maximum cooling test shall be conducted with an indoor side air flow setting as determined in Clause 4.1.5.

Table 3 — Maximum cooling test conditions

	Water-loop heat pumps	Ground-water heat pumps	Ground-loop heat pumps
Air entering indoor side			
— dry bulb, °C	32	32	32
— wet bulb, °C	23	23	23
Air surrounding unit			
— dry bulb °C	32	32	32
Liquid entering heat exchanger*, °C	40	25	40
Frequency**	Rated	Rated	Rated
Voltage	1. 90% and 110% of rated voltage for equipment with a single nameplate rating. 2. 90% of the lower rated voltage and 110% of the higher rated voltage except that where the higher rated voltage is 240 V the maximum required test voltage shall be 253 V.	1. 90% and 110% of rated voltage for equipment with a single nameplate rating. 2. 90% of the lower rated voltage and 110% of the higher rated voltage except that where the higher rated voltage is 240 V the maximum required test voltage shall be 253 V.	1. 90% and 110% of rated voltage for equipment with a single nameplate rating. 2. 90% of the lower rated voltage and 110% of the higher rated voltage except that where the higher rated voltage is 240 V the maximum required test voltage shall be 253 V.
	~~2. 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage~~	~~2. 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage~~	~~2. 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage~~
* Air and liquid flow rates shall be as established in 4.1.5 and 4.1.6. ** Equipment with dual-rated frequencies shall be tested at each frequency.			