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Ducted air-conditioners and air-to-air heat pumps — Testing and rating for performance

Climatiseurs et pompes à chaleur air/air raccordés — Essais et détermination des caractéristiques

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Contents

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Annexes

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 13253 was prepared by Technical Committee ISO/TC 86, *Refrigeration*, Subcommittee SC 6, *Factory-made air-conditioning and heat pump units*.

Annexes A and B form an integral part of this International Standard. Annexes C, D, E, F, G, H, J and K are for information only.

Ducted air-conditioners and air-to-air heat pumps — Testing and rating for performance

1 Scope

1.1 This International Standard establishes performance testing and rating criteria for factory-made residential, commercial and industrial, electrically driven, mechanical-compression, ducted air-conditioners using air- and water-cooled condensers and ducted air-to-air heat pumps. The requirements of testing and rating contained in this International Standard are based on the use of matched assemblies.

This International Standard is limited to systems which use a single refrigeration circuit and have one evaporator and one condenser.

1.2 This International Standard does not apply to the testing and rating of

a) individual assemblies for separate use,

b) equipment using the absorption refrigeration cycle,

c) non-ducted air-conditioners or non-ducted heat pumps, or

d) water-source heat pumps.

1.3 It does not cover the determination of either seasonal efficiencies or part-load performances which may be required in some countries because they provide a better indication of efficiency under actual operating conditions.

NOTE 1 For the purposes of this International Standard, the term "equipment" will be used to mean "ducted air-conditioner" and/or "ducted heat pumps".

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

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard 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.

ISO 817:—[1], *Refrigerants — Number designation.*

3 Definitions

For the purposes of this International Standard, the following definitions apply. Annex J lists the symbols used to identify the terms contained in this International Standard.

3.1 standard air: Dry air at 20,0 °C, and at a standard barometric pressure of 101,325 kPa, having a mass density of 1,204 kg/m^3.

3.2 heating capacity: Amount of heat that the equipment can add to the conditioned space in a defined interval of time. It is expressed in watts.

3.3 latent cooling capacity: Amount of latent heat that the equipment can remove from the conditioned space in a defined interval of time. It is expressed in watts.

3.4 sensible cooling capacity: Amount of sensible heat that the equipment can remove from the conditioned space in a defined interval of time. It is expressed in watts.

3.5 total cooling capacity: Amount of sensible and latent heat that the equipment can remove from the conditioned space in a defined interval of time. It is expressed in watts.

3.6 energy efficiency ratio (EER): Ratio of the total cooling capacity to the effective power input at any given set of rating conditions. (Where EER is stated without an indication of units, it shall be understood that it is derived from watts/watt.)

3.7 coefficient of performance (COP): Ratio of the heating capacity to the effective power input of the equipment at any given set of rating conditions. (Where COP is stated without an indication of units, it shall be understood that it is derived from watts/watt.)

3.8 ducted air-conditioner: An encased, factory-made assembly or assemblies designed to be used as permanently installed equipment to provide conditioned air to enclosed space(s) through a duct. It includes a prime source of refrigeration for cooling and dehumidification and may optionally include other means for heating, humidifying, ventilating, exhausting and cleaning the air. It normally includes an evaporator, compressor and condenser. Such equipment may be provided in more than one assembly, the separated assemblies of which are designed to be used together.

3.9 ducted heat pump: An encased, factory-made assembly or assemblies designed to be used as permanently installed equipment to take heat from a heat source and deliver it to the conditioned space through a duct when heating is desired. It may be constructed to remove heat from the conditioned space and discharge it to a heat sink if cooling and dehumidification are desired from the same equipment. It normally includes an indoor conditioning coil, a compressor and an outdoor coil. Such equipment may be provided in more than one assembly, the separated assemblies of which are designed to be used together. The equipment may also provide the functions of air cleaning, circulating and humidifying.

3.10 air-to-air heat pump: Heat pump which takes heat from outside air and delivers it to the conditioned space when heating is desired, or takes heat from the conditioned air and delivers it to the outside air when cooling is desired.

3.11 effective power input, P_E: Average electrical power input to the equipment within a defined interval of time, obtained from

— the power input for operation of the compressor and any power input for defrosting, excluding additional electrical heating devices not used for defrosting;

— the power input of all control and safety devices of the equipment; and

— the power input of the conveying devices within the equipment for heat transport media (e.g. fan, pump), or the power allowance for equipment supplied without indoor fans (see 7.1.5).

It is expressed in watts.

3.12 total power input, P_t: Power input to all components of the equipment as delivered. It is expressed in watts.

4 Cooling tests

4.1 Cooling capacity ratings

4.1.1 General conditions

All equipment within the scope of this International Standard shall have the cooling capacities and energy efficiency ratios determined in accordance with the provisions of this International Standard and rated at the cooling conditions specified in table 1.

4.1.2 Temperature conditions

4.1.2.1 Test conditions stated in table 1, columns T1, T2 and T3, shall be considered standard rating conditions.

4.1.2.2 Equipment manufactured for use in a moderate climate similar to that specified in table 1, column T1 only, shall have a nameplate rating determined by tests conducted at these specified conditions and shall be designated type T1 units.

Table 1 — Cooling capacity test conditions

Parameter	Standard test conditions		
	T1	T2	T3
Temperature of air entering indoor side (°C)			
dry-bulb	27	21	29
wet-bulb	19	15	19
Temperature of air entering outdoor side (°C)			
dry-bulb	35	27	46
wet-bulb[1]	24	19	24
Condenser water temperature[2] (°C)			
inlet	30	22	30
outlet	35	27	35
Test frequency	Rated frequency[3]		
Test voltage	Rated voltage[4]		

T1 = Standard cooling capacity rating conditions for **moderate** climates
T2 = Standard cooling capacity rating conditions for **cool** climates
T3 = Standard cooling capacity rating conditions for **hot** climates

1) The wet-bulb temperature condition is not required when testing air-cooled condensers which do not evaporate the condensate.

2) Representative of equipment with cooling towers. For equipment designed for other uses, the manufacturer shall designate the condenser water inlet and outlet temperatures or the water flow rates and the inlet water temperature in the ratings.

3) Equipment with dual-rated frequencies shall be tested at each frequency.

4) The test voltage on dual-rated voltage equipment shall be performed at both voltages or at the lower of the two voltages if only a single rating is published.

4.1.2.3 Equipment manufactured for use in a cool climate similar to that specified in table 1, column T2 only, shall have a nameplate rating determined by tests conducted at these specified conditions and shall be designated type T2 units.

4.1.2.4 Equipment manufactured for use in a hot climate similar to that specified in table 1, column T3 only, shall have a nameplate rating determined by tests conducted at these specified conditions and shall be designated type T3 units.

4.1.2.5 Equipment manufactured for use in more than one of the types of climate defined in table 1, columns T1, T2 and T3, shall have the rating determined by test for each of the specified conditions for which they have been designated and tested.

4.1.3 Airflow conditions

4.1.3.1 Indoor-side air quantity

4.1.3.1.1 All standard ratings shall be determined at an indoor-side air volume flow rate as established below. All air quantities shall be expressed as cubic metres per second of standard air as defined in 3.1 and as recommended by the test methods described in annex E.

4.1.3.1.2 Equipment with indoor fans intended for use with field-installed duct systems shall be rated at the indoor-side air volume flow rate delivered when operating against the minimum external resistance specified by the manufacturer.

4.1.3.1.3 For equipment supplied without indoor fans and which are rated for general use to be applied to a variety of heating equipment, the indoor-side air volume flow rate shall be specified by the manufacturer in the published standard ratings. However, the pressure drop across the indoor coil assembly and the recommended enclosures and attachment means shall not exceed 75 Pa.

4.1.3.1.4 Indoor-side air quantities and pressures referred to herein apply to the air quantity experienced when the equipment is cooling and dehumidifying under the conditions specified in this section. This air quantity, except as noted in 4.3.3 and 4.4.3, shall be employed in all other tests specified herein without regard to the resulting external static pressure.

4.1.3.2 Outdoor-side air quantity

All standard ratings shall be determined at the outdoor-side air quantity specified by the manufacturer when the fan drive is adjustable. When the fan is non-adjustable, they shall be determined at the outdoor-side air volume flow rate inherent in the equipment when operated with all of the resistance elements associated with inlets, louvres, and any ductwork and attachments considered by the manufacturer as normal installation practice. Once established, the outdoor-side air circuit of the equipment shall remain unchanged throughout all tests specified herein.

4.1.4 Test conditions

4.1.4.1 Preconditions

The test room reconditioning apparatus and the equipment under test shall be operated until equilibrium conditions are attained, but for not less than 1 h, before capacity test data are recorded.

4.1.4.2 Duration of test

The data shall be recorded for 30 min at 5-min intervals until seven consecutive sets of readings within the tolerance presented in 6.5 have been attained.

4.2 Maximum cooling test

4.2.1 General conditions

The electrical conditions which shall be used during the maximum cooling test are given in table 2.

4.2.2 Temperature conditions

Tests shall be carried out under the conditions given in column T1, T2 or T3 of table 2, based on the intended use, as determined in 4.1.2. Equipment intended for use under more than one set of operating conditions shall have the most stringent set of the intended operating conditions applied for test purposes. If maximum operating temperature conditions for cooling are specified in the manufacturer's equipment specification sheets, they shall be used in lieu of those in table 2.

Table 2 — Maximum cooling test conditions

Parameter	Standard test conditions		
	T1	T2	T3
Temperature of air entering indoor side (°C)			
dry-bulb	32	27	32
wet-bulb	23	19	23
Temperature of air entering outdoor side (°C)			
dry-bulb	43	35	52
wet-bulb[1]	26	24	31
Condenser water temperature (°C)			
inlet[2]	34	27	34
Test frequency	Rated frequency[3]		
Test voltage	1) 90 % and 110 % of rated voltage with a single nameplate rating 2) 90 % of minimum voltage and 110 % of maximum voltage for units with a dual nameplate voltage		

1) The wet-bulb temperature condition is not required when testing air-cooled condensers which do not evaporate the condensate.

2) For equipment with water-cooled condensers, the water flow rate shall be the same as that used in cooling capacity test (minimum flow rate for equipment with multiple cooling capacity rating). For equipment incorporating a condenser water control valve, it shall be allowed to operate normally.

3) Equipment with dual-rated frequencies shall be tested at each frequency.

4.2.3 Airflow conditions

The maximum cooling test shall be conducted with an indoor-side air volume flow rate as determined under 4.1.3.1.

4.2.4 Test conditions

4.2.4.1 Preconditions

The equipment shall be operated continuously for 1h after the specified air temperatures and the equilibrium condensate level have been established.

4.2.4.2 Duration of test

All power to the equipment shall be cut off for 3 min and then restored for 1 h.

4.2.5 Performance requirements

4.2.5.1 Air conditioners and heat pumps shall meet the following requirements when operating under the conditions specified in table 2.

— during one entire test, the equipment shall operate without any indication of damage;

— the motors of the equipment shall operate continuously for the first hour of the test without tripping of the motor-overload protective devices.

4.2.5.2 The motor-overload protective device may trip only during the first 5 min of operation after the shutdown period of 3 min. During the remainder of that 1-h test period, no motor-overload protective device shall trip.

4.2.5.3 For those models so designed that resumption of operation does not occur after the initial trip within the first 5 min, the equipment may remain out of operation for not longer than 30 min. It shall then operate continuously for 1 h.

4.3 Minimum cooling test

4.3.1 General conditions

The electrical conditions which shall be used during the minimum cooling test are given in table 3.

4.3.2 Temperature conditions

If minimum operating temperature conditions are specified in the manufacturer's equipment specification sheets, they shall be used in lieu of those given in table 3.

Table 3 — Minimum cooling test conditions

Parameter	Standard test conditions	
	T1 and T3	T2
Temperature of air entering indoor side (°C) dry-bulb wet-bulb	 21[1)] 15	 21 15
Temperature of air entering outdoor side (°C) dry-bulb wet-bulb	 21 —	 10 —
Condenser water temperature (°C) inlet	 10	 10
Water flow rate	As specified by the manufacturer	
Test frequency	Rated frequency[2)]	
Test voltage	Rated voltage[3)]	

1) 21 °C or the lowest temperature above 21 °C at which the regulating (control) device will allow the equipment to operate.

2) Equipment with dual-rated frequencies shall be tested at each frequency.

3) Equipment with dual-rated voltages shall be tested at the higher voltage.

4.3.3 Airflow conditions

The controls, fan speeds, dampers and grilles of the equipment shall be set to produce the maximum tendency to frost or ice the evaporator, providing such settings are not contrary to the manufacturer's operating instructions.

4.3.4 Test conditions

4.3.4.1 Preconditions

The equipment shall be started and operated until the operating conditions have stabilized.

4.3.4.2 Duration of test

After the operating conditions have stabilized, the equipment shall be operated for a period of 4 h.

4.3.5 Performance requirements

4.3.5.1 After the end of the starting period of 10 min, no safety element shall cut off during the 4 h of operation under the test conditions specified in table 3.

4.3.5.2 At the end of 4 h, any accumulation of ice or frost on the evaporator shall not reduce the airflow by more than 25 % of that determined at the start of operation.

4.4 Enclosure sweat and condensate disposal test

4.4.1 General conditions

The electrical conditions which shall be used during the enclosure sweat and condensate disposal test are given in table 4.

4.4.2 Temperature conditions

The temperature conditions which shall be used during this test are given in table 4.

4.4.3 Airflow conditions

The controls, fans, dampers and grilles of the equipment shall be set to produce the maximum tendency to sweat, provided such settings are not contrary to the manufacturer's operating instructions.

4.4.4 Test conditions

4.4.4.1 Preconditions

After establishment of the specified temperature conditions, the equipment shall be started with its condensate collection pan filled to the overflowing point, and the equipment shall be run until the condensate flow has become uniform.

4.4.4.2 Duration of test

The equipment shall be operated for a period of 4 h.

Table 4 — Enclosure sweat and condensate disposal test conditions

Parameter	Standard test conditions
Temperature of air entering indoor side (°C) dry-bulb wet-bulb	 27 24
Temperature of air entering outdoor side (°C) dry-bulb wet-bulb[1)]	 27 24
Condenser water temperature (°C) outlet	 27
Test frequency	Rated frequency[2)]
Test voltage	Rated voltage[3)]

1) The wet-bulb temperature condition is not required when testing air-cooled condensers which do not evaporate the condensate.

2) Equipment with dual-rated frequencies shall be tested at each frequency.

3) Equipment with dual-rated voltages shall be tested at the higher voltage.

4.4.5 Performance requirements

4.4.5.1 When operating under the test conditions specified in table 4, no condensed water shall drip, run or blow from the equipment.

4.4.5.2 Equipment which rejects condensate to the condenser air shall dispose of all condensate and there shall be no dripping or blowing-off of water from the equipment such that the building or surroundings become wet.

5 Heating tests

5.1 Heating capacity ratings

5.1.1 General conditions

All equipment within the scope of this International Standard shall have the heating capacities and coefficients of performance determined in accordance with the provisions of this International Standard and rated at the conditions specified in table 5. The electrical input values used for rating purposes shall be measured during the heating capacity test.

5.1.2 Temperature conditions

5.1.2.1 Test conditions stated in table 5 shall be considered standard rating conditions for the determination of heating capacity.

5.1.2.2 If a manufacturer specifies that the equipment is not suitable for operation under the extra-low temperature test conditions, tests shall be made only at the high and low temperatures specified in table 5.

5.1.3 Airflow conditions

5.1.3.1 Heating-only equipment shall use the airflow quantity specified by the manufacturer.

5.1.3.2 For equipment which provides both heating and cooling, the test shall be conducted at the same airflow rate as for the cooling capacity rating test.

5.1.4 Test conditions

5.1.4.1 Preconditions

5.1.4.1.1 The test room reconditioning apparatus and the equipment under test shall be operated until equilibrium conditions are attained, but for not less than 1 h, before test data are recorded.

Table 5 — Heating capacity test conditions

Parameter	Standard test conditions
Temperature of air entering indoor side (°C)	
dry-bulb	20
wet-bulb (maximum)	15
Temperature of air entering outdoor side (high[1]) (°C)	
dry-bulb	7
wet-bulb	6
Temperature of air entering outdoor side (low[1]) (°C)	
dry-bulb	2
wet-bulb	1
Temperature of air entering outdoor side (extra-low[1][2]) (°C)	
dry-bulb	− 7
wet-bulb	− 8
Test frequency	Rated frequency[3]
Test voltage	Rated voltage[4]

1) If defrosting occurs during the high, low, or extra-low heating capacity tests, testing under these conditions shall be accomplished using the indoor air-enthalpy method (see annex B).

2) Test is to be conducted only if the manufacturer specifies that the equipment is suitable for operation under these conditions.

3) Equipment with dual-rated frequencies shall be tested at each frequency.

4) The test voltage on dual-rated voltage equipment shall be performed at both voltages or at the lower of the two voltages if only a single rating is published.

5.1.4.1.2 Under some conditions of heating, a small amount of frost may accumulate on the outdoor coil and a distinction needs to be made between non-frosting and frosting operations for the test as a whole. For the purposes of this International Standard, the test is to be considered non-frosting provided the effect is such that the indoor and outdoor leaving air temperatures remain within the operating tolerances for non-frosting operation specified in table 10. When the leaving air temperature tolerances exceed the permitted range because of frost, the procedure for the heating capacity test in the defrost region shall be used.

5.1.4.1.3 During the test in the defrost region, any apparatus disturbing normal outdoor airflow on the equipment shall not be connected. The indoor airflow is to be allowed to continue with no changes in the airflow settings for the test equipment or for the associated test apparatus, except that if the defrost controls provide for stopping the indoor fan, provision shall be made to shut off flow of air through the indoor coil from the test apparatus while the indoor fan is stopped. An integrating watt-hour meter shall be used for obtaining electrical input to the equipment.

5.1.4.1.4 The test room reconditioning apparatus and the equipment under test shall be operated until equilibrium conditions are attained, but for not less than 1 h, except that normal variations due to operation of equipment defrost controls may occur. Under defrost conditions the normal functioning of the test room reconditioning apparatus may be disturbed. Because of this, the maximum allowable deviation of air temperature readings shall be three times those specified in table 10.

5.1.4.2 Duration

Data shall be recorded for 30 min at 5-min intervals until seven consecutive sets of readings within the tolerances specified in 6.5 have been attained. The equipment shall be operated for a test period of 3 h. If the equipment is in defrost at the end of this test period, the cycle shall be completed. Data shall be recorded at normal 5-min intervals, except that during the defrost cycle data shall be recorded at least every 10 s to establish accurately the start and completion of the defrost cycle, the time-temperature pattern of the indoor air stream (if the indoor fan is running), and the electrical input to the equipment.

5.2 Maximum heating test

5.2.1 General conditions

The electrical conditions given in table 6 shall be used during the maximum heating test. The test voltages shall be maintained at the specified percentages under running conditions.

5.2.2 Temperature conditions

The temperature conditions given in table 6 shall be used during these tests unless the manufacturer specifies other conditions in the manufacturer's equipment specification sheets.

5.2.3 Airflow conditions

The controls of the equipment shall be set for maximum heating and all ventilating air dampers and exhaust air dampers shall be closed.

Table 6 — Maximum heating test conditions

Parameter	Standard test conditions
Temperature of air entering indoor side (°C) dry-bulb	27
Temperature of air entering outdoor side (°C) dry-bulb wet-bulb	24 18
Test frequency	Rated frequency[1)]
Test voltage	a) 90 % and 110 % of rated voltage with a single nameplate rating b) 90 % of minimum voltage and 110 % of maximum voltage for equipment with a dual nameplate voltage

1) Equipment with dual-rated frequencies shall be tested at each frequency.

5.2.4 Test conditions

5.2.4.1 Preconditions

The equipment shall be operated continuously for 1 h after the specified air temperatures and the equilibrium condensate level have been established.

5.2.4.2 Duration

All power to the equipment shall then be cut off for 3 min and then restored for 1 h.

5.2.5 Performance requirements

5.2.5.1 Heat pumps shall meet the following requirements when operating under the conditions specified in table 6:

— during one entire test, the heat pump shall operate without indication of damage;

— the heat pump motors shall operate continuously for the first hour of the test without tripping of the motor-overload protective devices.

5.2.5.2 The motor-overload protective device may trip only during the first 5 min following the 3-min cutoff of power. During the remainder of that 1-h test period, no motor-overload protective device shall trip.

5.2.5.3 For those models so designed that resumption of operation does not occur after the initial trip within the first 5 min, the equipment may remain out of operation for not longer than 30 min. It shall then operate continuously for 1 h.

5.3 Minimum heating test

5.3.1 General conditions

The electrical conditions given in table 7 shall be used for this test.

5.3.2 Temperature conditions

The temperature conditions for this test shall be as given in table 7, unless the manufacturer specifies other conditions in the manufacturer's equipment specification sheets.

5.3.3 Airflow conditions

The equipment controls shall be set for maximum heating, and all ventilating air dampers and exhaust air dampers shall be closed.

5.3.4 Test conditions

5.3.4.1 Preconditions

The equipment shall be operated for a sufficient period of time to reach stable operating conditions.

5.3.4.2 Duration

After the equipment has reached stable operating conditions, these conditions shall be maintained for 1 h.

5.3.5 Performance requirements

The heat pump shall operate throughout the test without a cutoff by any safety control.

Table 7 — Minimum heating test conditions

Parameter	Standard test conditions
Temperature of air entering indoor side (°C) dry-bulb	 20
Temperature of air entering outdoor side[1)] (°C) dry-bulb wet-bulb	 − 5 − 6
Test frequency[2)]	Rated frequency
Test voltage[3)]	Rated voltage

1) If the equipment can be operated under the "extra-low" temperature condition, − 7 °C dry-bulb and − 8 °C wet-bulb temperatures shall be used.

2) Equipment with dual-rated frequencies shall be tested at each frequency.

3) Equipment with dual-rated voltages shall be tested at the higher voltage.

5.4 Automatic defrost test

5.4.1 General conditions

The electrical conditions given in table 5 shall be used during the automatic defrost test for heat pumps.

5.4.2 Temperature conditions

The outdoor air temperature conditions given in table 5 for low outdoor-side entering air temperatures shall be used during the automatic defrost test for heat pumps.

5.4.3 Airflow conditions

Unless prohibited by the manufacturer, the indoor-side fan is to be adjusted to the highest speed and the outdoor-side fan to the lowest speed, if separately adjustable.

5.4.4 Test conditions

5.4.4.1 Preconditions

The equipment shall be operated until the temperatures specified in table 5 have been stabilized.

5.4.4.2 Duration

The equipment shall remain in operation for two complete defrosting periods or for 3 h, whichever is the longer.

5.4.5 Performance requirements

During and directly after the defrosting periods, the air temperature to the outdoor side shall not rise by more than 5 °C. During the defrosting period, the temperature of the air from the indoor coil of the equipment shall not be lower than 18 °C for longer than 1 min. This may be accomplished, if necessary, by using additional heating, provided and mounted in the equipment, or specified by the manufacturer.

6 Test methods and uncertainties of measurements

6.1 Test methods

The following test methods are specified in this International Standard and are described in the annexes:

a) air-enthalpy method, indoor-side (see annex B);

b) compressor calibration method (see annex C);

c) refrigerant enthalpy method (see annex D);

d) airflow measurement method (see annex E);

e) cooling condensate measurement method (see annex F);

f) air-enthalpy method, outdoor-side (see annex G).

6.2 Applicability of test methods

6.2.1 Equipment shall be rated for capacity by the indoor air-enthalpy test method (see annex B).

6.2.2 Additional capacity tests, for example those identified in 6.1 b) to f), may be used for confirmation purposes.

6.3 Uncertainties of measurement

The uncertainties of measurement shall not exceed the values specified in table 8.

6.4 Variations in individual readings

The maximum allowable variations of individual readings from stated conditions in the performance tests shall be as shown in table 9. The maximum permissible variation of any observation during the capacity test shall be as shown in table 10.

6.5 Test tolerances

6.5.1 The maximum permissible variation of any observation represents the greatest permissible difference between maximum and minimum instrument observations during the test. When expressed as a percentage, the maximum allowable variation is the specified percentage of the arithmetical mean of the observations.

6.5.2 The maximum permissible variations of the mean of the test observations from the standard or desired test conditions are shown in table 10.

Table 8 — Uncertainties of measurement of indicated values

Measured quantity	Uncertainty of measurement[1)]
Water temperature temperature difference volume flow static pressure difference	 ± 0,1 °C ± 0,1 °C ± 5 % ± 5 Pa
Air dry-bulb temperature wet-bulb temperature volume flow static pressure difference	 ± 0,2 °C ± 0,2 °C ± 5 % ± 5 Pa for pressure ⩽ 100 Pa ± 5 % for pressure > 100 Pa
Electrical inputs	± 0,5 %
Time	± 0,2 %
Mass	± 1,0 %
Speed	± 1,0 %
NOTE — Uncertainty of measurement comprises, in general, many components. Some of these components may be estimated on the basis of the statistical distribution of the results of series of measurements and can be characterized by experimental standard deviations. Estimates of other components can be based on experience or other information.	
1) Uncertainty of measurement is an estimate characterizing the range of values within which the true value of a measurand lies (measurand is a quantity subject to measurement).	

Table 9 — Variations allowed in performance test readings

Quantity measured	Maximum allowable variations in individual readings from stated performance test conditions
For minimum operating conditions test air temperatures water temperatures	 + 1 °C + 0,6 °C
For maximum operating conditions test air temperatures water temperatures	 − 1 °C − 0,6 °C
For other tests air temperatures water temperatures	 ±1 °C ± 0,6 °C