

3.2 cooling capacity

amount of heat that the equipment can remove from the water used to condition the indoor space in a defined interval of time, in watts, as determined by the specified test methods

3.3 net cooling capacity

cooling capacity with indoor-side pump power adjustment
(See 4.1.2.)

3.4 heating capacity

amount of heat that the equipment can add to the water used to condition the indoor space in a defined interval of time, in watts, as determined by the specified test methods

3.5 net heating capacity

heating capacity with indoor-side pump power adjustment
(See 4.1.2.)

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 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 effective power input

average electrical power input to the equipment 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 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., indoor-side and outdoor-side pumps, whether internal or external, whether provided with the equipment or not)
(See 4.1.2 and 4.1.3.)

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 the circulating-pump heat, but not including supplementary heat. Standard efficiency ratings shall be based on the effective power input as defined in 3.10.

4.1.2 Power input to indoor-side liquid pumps

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

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

where

- ϕ_{pai} is the pump power adjustment, indoor, in watts;
 $\eta = 0.3 \times 10^3$ by convention;
 Δp is the measured indoor-side internal static pressure difference, in pascals;
 q is the nominal indoor-side liquid flow rate, in litres per second.

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

4.1.2.2 If an indoor-side 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:

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

where

- ϕ_{pai} is the pump power adjustment, indoor, in watts;
 $\eta = 0.3 \times 10^3$ by convention;
 Δp is the measured indoor-side external static pressure difference, in pascals;
 q is the nominal indoor-side liquid flow rate, in litres per second.

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

4.1.3 Power input to outdoor-side liquid pumps

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

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

where

- ϕ_{pao} is the pump power adjustment, outdoor, in watts;
 $\eta = 0.3 \times 10^3$ by convention;
 Δp is the measured outdoor-side internal static pressure difference, in pascals;
 q is the nominal outdoor-side liquid flow rate, in litres per second.

4.1.3.2 If an outdoor-side 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:

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

where

- ϕ_{pao} is the pump power adjustment, outdoor, in watts;
- $\eta = 0.3 \times 10^3$ by convention;
- Δp is the measured outdoor-side external static pressure difference, in pascals;
- q is the nominal outdoor-side liquid flow rate, in litres per second.

4.1.4 Liquid flow rates

4.1.4.1 All standard ratings shall be determined at the liquid flow rates described below, expressed as litres per second.

4.1.4.2 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 rates.

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

4.1.4.4 The manufacturer shall specify a single liquid flow rate for the indoor-side and a single liquid flow rate for the outdoor-side 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.

4.1.5 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).

4.1.6 Requirements for heat pumps with capacity control

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

4.1.6.2 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.

4.1.7 Test liquids

4.1.7.1 The test liquid for the indoor-side of all heat pumps shall be water.

4.1.7.2 The test liquid for the outdoor-side of water-loop heat pumps and ground-water heat pumps shall be water.

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

4.1.7.4 The test liquids shall be sufficiently free of gas to ensure that the measured results are 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 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 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
Liquid entering indoor side	12°C	12°C	12°C
Air surrounding unit, dry bulb	15°C to 30°C	15°C to 30°C	15°C to 30°C
Standard rating test			
Liquid entering heat exchanger	30°C	15°C	25°C
Part-load rating test			
Liquid entering heat exchanger	30°C	15°C	20°C
Frequency ^a	Rated	Rated	Rated
Voltage ^b	Rated	Rated	Rated

^aEquipment with dual-rated frequencies shall be tested at each frequency.

^bEquipment with dual-rated voltages shall be performed 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
Liquid entering indoor side	40°C	40°C	40°C
Air surrounding unit, dry bulb	15°C to 30°C	15°C to 30°C	15°C to 30°C
<u>Standard rating test</u>			
Liquid entering outdoor-side heat exchanger	20°C	10°C	0°C
<u>Part-load rating test</u>			
Liquid entering outdoor-side heat exchanger	20°C	10°C	5°C
Frequency ^a	Rated	Rated	Rated
Voltage ^b	Rated	Rated	Rated
^a Equipment with dual-rated frequencies shall be tested at each frequency.			
^b Equipment with dual-rated voltages shall be performed 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-water and brine-to-water 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 requirement tests shall be conducted at maximum capacity.

5.2 Maximum operating conditions test

5.2.1 Test conditions

The maximum operating conditions test 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.

5.2.2 Test procedures

5.2.2.1 The equipment shall be operated continuously for one hour after the specified temperatures have been established at each specified voltage level.

5.2.2.2 The 110 % voltage test shall be conducted prior to the 90 % voltage test.

5.2.2.3 All power to the equipment shall be cut off for 3 min at the conclusion of the one hour test at 90 % voltage level and then restored for one hour.

5.2.3 Test requirements

Heat pumps shall meet the following requirements when operating at the conditions specified in Tables 3 and 4.

- During the entire test, the equipment shall operate without any indication of damage.
- During the test period specified in 5.2.2.1, the equipment shall operate continuously without tripping any motor overload or other protective devices.
- During the test period specified in 5.2.2.3, 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 the test period, no motor overload protective device shall trip. For those models so designed that resumption of operation does not occur within the first 5 min after initial trip, the equipment may remain out of operation for not longer than 30 min. It shall then operate continuously for the remainder of the test period.

Table 3—Maximum cooling test conditions

	Water-loop heat pumps	Ground-water heat pumps	Ground-loop heat pumps
Liquid ^a entering indoor-side	30°C	30°C	30°C
Air surrounding unit, dry bulb	15°C to 30°C	15°C to 30°C	15°C to 30°C
Liquid ^a entering outdoor-side heat exchanger	40°C	25°C	40°C
Frequency ^b	Rated	Rated	Rated
Voltage	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.
^a Liquid flow rates shall be established in 4.1.4.			
^b Equipment with dual-rated frequencies shall be tested at each frequency.			

Table 4—Maximum heating test conditions

	Water-loop heat pumps	Ground-water heat pumps	Ground-loop heat pumps
Liquid ^a entering indoor-side	50°C	50°C	50°C
Air surrounding unit, dry bulb	15°C to 30°C	15°C to 30°C	15°C to 30°C
Liquid ^a entering outdoor-side heat exchanger	30°C	25°C	25°C
Frequency ^b	Rated	Rated	Rated
Voltage	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.	1) 90% and 110% of rated voltage for equipment with a single nameplate rating. 2) 90% of minimum voltage and 110% of maximum voltage for equipment with dual nameplate voltage ratings.

^aLiquid flow rates shall be established in 4.1.4.
^bEquipment with dual-rated frequencies shall be tested at each frequency.

5.3 Minimum operating conditions test

5.3.1 Test conditions

Heat pumps shall be tested at the minimum operating test conditions for cooling and heating at the test conditions established for the specific application (see 4.2.3) specified in Tables 5 and 6. Heat pumps intended for use in two or more applications shall be tested at the most stringent set of conditions specified in Tables 5 and 6.

5.3.2 Test procedures

For the minimum operating cooling test, the heat pump shall be operated continuously for a period of not less than 30 min after the specified temperature conditions have been established. For the minimum operation heating test, the heat pump shall soak for 10 min with liquid at the specified temperature circulating through the coil. The equipment shall then be started and operated continuously for 30 min.

5.3.3 Test requirements

No protective device shall trip during these tests and no damage shall occur to the equipment.

5.4 Enclosure sweat test

5.4.1 Test conditions

The enclosure sweat test shall be conducted in the cooling mode at the test conditions established for the specific applications specified in Table 7. Heat pumps intended for two or

more applications shall be tested at the most stringent set of conditions.

5.4.2 Test procedures

After establishment of the specified temperature conditions, the heat pump shall be operated continuously for a period of four hours.

5.4.3 Test requirements

No condensed water shall drip or run off the equipment's casing during the test.

6. Test methods

6.1 General

The standard capacity ratings shall be determined by the test methods and procedures established in this clause and Annex A. The total cooling and heating capacities shall be the average of the results obtained for the indoor and outdoor sides using the liquid enthalpy test method in Annex B. The results obtained by these two methods must agree within 5 % in order for a particular test to be valid. Measurements should be made in accordance with the provisions of Annex C.

6.2 Uncertainties of measurement

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

Table 5—Minimum cooling test conditions

	Water-loop heat pumps	Ground-water heat pumps	Gound-loop heat pumps
Liquid ^a entering indoor-side	12°C	12°C	12°C
Air surrounding unit, dry bulb	15°C to 30°C	15°C to 30°C	15°C to 30°C
Liquid ^a entering outdoor-side heat exchanger	20°C	10°C	10°C
Frequency ^b	Rated	Rated	Rated
Voltage ^c	Rated	Rated	Rated

^aLiquid flow rates shall be as established in 4.1.4.
^bEquipment with dual-rated frequencies shall be tested at each frequency.
^cEquipment with dual-rated voltages shall be performed at the low of the two voltages.