BS EN 14511-3:2013

BSI Standards Publication

Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling

Part 3: Test methods

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National foreword

This British Standard is the UK implementation of EN 14511-3:2013. It supersedes BS EN 14511-3:2011 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/17, Testing of air conditioning units.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 80735 0

ICS 27.080; 91.140.30

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14511-3

July 2013

ICS 27.080; 91.140.30

Supersedes EN 14511-3:2011

English Version

Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 3: Test methods

Climatiseurs, groupes refroidisseurs de liquide et pompes à chaleur avec compresseur entraîné par moteur électrique pour le chauffage et la réfrigération des locaux - Partie 3: Méthodes d'essai

Luftkonditionierer, Flüssigkeitskühlsätze und Wärmepumpen mit elektrisch angetriebenen Verdichtern für die Raumbeheizung und -kühlung - Teil 3: Prüfverfahren

This European Standard was approved by CEN on 7 June 2013.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 14511-3:2013: E

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Foreword

This document (EN 14511-3:2013) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2014 and conflicting national standards shall be withdrawn at the latest by January 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14511-3:2011.

The main changes with respect to the previous edition are listed below:

a) the addition of requirements related to the electrical consumption and the air flow rate measurement of ducted units;

b) the addition of a table template containing the test results of the ducted units;

c) the addition of two normative annexes related to indoor and outdoor units of multsplit and modular heat recovery multisplit systems and air flow rate measurement;

d) the addition of an Annex ZA relating to the Commission Regulation (EC) n°206/2012.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

Although this document has been prepared in the frame of the commission regulation (EU) No 206/2012 implementing Directive 2009/125/EC with regard to ecodesign requirements for air conditioners and comfort fans, it is also intended to support the essential requirements of the European Directive 2010/30/CE.

EN 14511 comprises the following parts under the general title *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling*:

— *Part 1: Terms, definitions and classification*,

— *Part 2: Test conditions*,

— *Part 3: Test methods*,

— *Part 4: Operating requirements, marking and instructions.*

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

1.1 The scope of EN 14511-1 is applicable.

1.2 This European Standard specifies the test methods for the rating and performance of air conditioners, liquid chilling packages and heat pumps using either air, water or brine as heat transfer media, with electrically driven compressors when used for space heating and cooling.

It also specifies the method of testing and reporting for heat recovery capacities, system reduced capacities and the capacity of individual indoor units of multisplit systems, where applicable.

This European Standard also makes possible to rate multisplit and modular heat recovery multisplit systems by rating separately the indoor and outdoor units.

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.

EN 14511-1:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 1: Terms, definitions and classification*

EN 14511-2:2013, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling — Part 2: Test conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14511-1:2013 apply.

4 Rating capacity test

4.1 Basic principles method of calculation for the determination of capacities

4.1.1 Heating capacity

The heating capacity of air conditioners and of air-to-air or water-to-air heat pumps shall be determined by measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B).

However, the heating capacity of air conditioners and of air-to-air heat pumps having a cooling capacity below or equal to 12 kW shall be determined by measurements in a calorimeter room.

The heating capacity of air-to-water, water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

For steady state operation, the heating capacity shall be determined using the following formula:

$$P_H = q \times \rho \times c_p \times \Delta t \quad (1)$$

where

P_H is the heat capacity, expressed in Watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_p is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures, expressed in Kelvin.

NOTE 1 The mass flow rate can be determined directly instead of the term (q x ρ).

NOTE 2 The enthalpy change ΔH can be directly measured instead of the term (cp x Δt).

For the heating capacity calculation in transient operation, refer to 4.5.3.2.

The heating capacity shall be corrected for the heat from the fan or pump:

a) if the fan or pump at the indoor heat exchanger is an integral part of the unit, the same power (calculated in 4.1.5.2 or 4.1.6.3) which is excluded from the total power input shall be also subtracted from the heating capacity;

b) if the fan or pump at the indoor heat exchanger is not an integral part of the unit, the same power (calculated in 4.1.5.3 or 4.1.6.4) which is included in the effective power input shall be also added to the heating capacity.

4.1.2 Cooling capacity

The cooling capacity of air conditioners and of air-to-air or water-to-air heat pumps shall be determined by measurements in a calorimeter room (see Annex A) or by the air enthalpy method (see Annex B).

However, the cooling capacity of air conditioners and of air-to-air heat pumps having a cooling capacity below or equal to 12 kW shall be determined by measurements in a calorimeter room.

The cooling capacity of air-to-water, water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

The cooling capacity shall be determined using the following formula:

$$P_C = q \times \rho \times c_p \times \Delta t \qquad (2)$$

where

P_C is the cooling capacity, expressed in watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_p is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures, expressed in Kelvin.

NOTE 1 The mass flow rate can be determined directly instead of the term (q x ρ).

NOTE 2 The enthalpy change ΔH can be directly measured instead of the term (c_p x Δt).

The cooling capacity shall be corrected for the heat from the fan or pump:

a) If the fan or pump at the evaporator is an integral part of the unit, the same power (calculated in 4.1.5.2 or 4.1.6.3) which is excluded from the total power input is also added to the cooling capacity.

b) If the fan or pump at the evaporator is not an integral part of the unit, the same power (calculated in 4.1.5.3 or 4.1.6.4) which is included in the effective power input is also subtracted from the cooling capacity.

4.1.3 Heat recovery capacity

The heat recovery capacity of air-to-water and water-to-water heat pumps and liquid chilling packages shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium, and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

The heat recovery capacity shall be determined using the following formula:

$$P_{HR} = q \times \rho \times c_p \times \Delta t \quad (3)$$

where

P_{HR} is the heat recovery capacity, expressed in Watts;

q is the volume flow rate, expressed in cubic metres per second;

ρ is the density, expressed in kilograms per cubic metre;

c_{p} is the specific heat at constant pressure, expressed in joules per kilogram and Kelvin;

Δt is the difference between inlet and outlet temperatures expressed in Kelvin.

NOTE The mass flow rate can be determined directly instead of the term (q x ρ). The enthalpy change ΔH can be directly measured instead of the term (c_{p} x Δt).

The heat recovery capacity shall be corrected for the heat of the pump:

a) if the pump at the heat recovery exchanger is an integral part of the unit, the power calculated according to 4.1.6.3 shall be subtracted from heat recovery capacity

b) if the pump at the heat recovery exchanger is not an integral part of the unit, the power calculated according to 4.1.6.4 shall be added to the heat recovery capacity.

4.1.4 Power input of fans for units without duct connection

In the case of units which are not designed for duct connection, i.e. which do not permit any external pressure differences, and which are equipped with an integral fan, the power absorbed by the fan shall be included in the effective power absorbed by the unit.

4.1.5 Power input of fans for units with duct connection

4.1.5.1 The following corrections of the power input of fans shall be made to both indoor and outdoor fans, where applicable.

4.1.5.2 If a fan is an integral part of the unit, only a fraction of the input of the fan motor shall be included in the effective power absorbed by the unit. The fraction that is to be excluded from the total power absorbed by the unit shall be calculated using the following formula:

$$\frac{q.(\Delta p_e - ESP_{\min})}{\eta} \quad (4)$$

where

η is equal to η_{target} ; as declared by the fan manufacturer according to the ecodesign regulation n°327/2011 for fans driven by motors between 125 W and 500 kW.

η is 0.3 by convention, for fans driven by motors below 125 W.

Δp_e is the measured available external static pressure difference, expressed in Pascal, as defined in 2.52 of EN 14511-1:2013.

ESP_{min} is the minimum external static pressure difference specified in Table 2 or Table 3, as applicable for an indoor unit, or 30 Pa for an outdoor unit.

q is the nominal air flow rate, expressed in cubic meters per second.

4.1.5.3 If no fan is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit, shall be calculated using the following formula:

$$\frac{-q.(\Delta p_i) + ESP_{\min}}{\eta} \quad (5)$$

where

η is 0,3 by convention.

Δp_i is the measured internal static pressure difference, expressed in Pascal, as defined in 2.53 of EN 14511-1:2013.

ESP_{min} is the minimum external static pressure difference given in Table 2 or Table 3, as applicable for an indoor unit, or 30 Pa for an outdoor unit.

q is the nominal air flow rate, expressed in cubic meters per second.

4.1.6 Power input of liquid pumps

4.1.6.1 The following corrections of the power input of liquid pumps shall be made to both indoor and outdoor (and heat recovery) liquid pumps, where applicable.

4.1.6.2 When the liquid pump is integrated into the unit, it shall be connected for operation. When the liquid pump is delivered by the manufacturer apart from the unit, it shall be connected for operation according to the manufacturer's instructions and be then considered as an integral part of the unit.

4.1.6.3 If a liquid pump is an integral part of the unit, only a fraction of the input to the pump motor shall be included in the effective power absorbed by the unit. The fraction which is to be excluded from the total power absorbed by the unit shall be calculated using the following formula:

$$\frac{q \times \Delta p_e}{\eta} \quad (6)$$

where

η is the efficiency of the pump calculated according to Annex H;

Δp_e is the measured available external static pressure difference, expressed in Pascal, as defined in 2.52 of EN 14511-1:2013;

q is the nominal liquid flow rate, expressed in cubic meters per second.

4.1.6.4 If no liquid pump is provided with the unit, the proportional power input which is to be included in the effective power absorbed by the unit, shall be calculated using the following formula:

$$\frac{q \times (-\Delta p_i)}{\eta} \tag{7}$$

where

η is the efficiency of the pump calculated according to Annex H.

Δp_i is the measured internal static pressure difference, expressed in Pascal, as defined in 2.53 of EN 14511-1:2013.

q is the nominal liquid flow rate, expressed in cubic meters per second.

4.1.6.5 In the case of appliances designed especially to operate on a distributing network of pressurised water without water-pump, no correction is to be applied to the power input.

4.1.7 Units for use with remote condenser

The power from the auxiliary liquid pump of the remote condenser shall not be taken into account in the effective power input.

4.2 Test apparatus

4.2.1 Arrangement of the test apparatus

4.2.1.1 General requirements

The test apparatus shall be designed in such a way that all requirements on adjustment of set values, stability criteria and uncertainties of measurement according to this European Standard can be fulfilled.

4.2.1.2 Test room for the air side

The size of the test room shall be selected such that any resistance to air flow at the air inlet and air outlet orifices of the test object is avoided. The air flow through the room shall not be capable of initiating any short circuit between these two orifices, and therefore the velocity of the air flows through the room at these two locations shall not exceed 1,5 m/s when the test object is switched off. The air velocity in the room shall also not be greater than the mean velocity through the unit inlet. Unless otherwise stated by the manufacturer, the air inlet or air outlet orifices shall be not less than 1 m distant from the surfaces of the test room.

Any direct heat radiation by heating units in the test room onto the unit or onto the temperature measuring points shall be avoided.

4.2.1.3 Appliances with duct connection

The connections of a ducted air unit to the test facility shall be sufficiently air tight to ensure that the measured results are not significantly influenced by exchange of air with the surroundings.

4.2.1.4 Appliances with integral pumps

For appliances with integral and adjustable water or brine pumps, the external static pressure shall be set at the same time as the temperature difference.

When the liquid pump has one or several fixed speeds, the speed of the pump shall be set in order to provide the minimum external static pressure.

In case of variable speed liquid pump, the manufacturer shall provide information to set the pump in order to reach a maximal external static pressure of 10 kPa.

4.2.1.5 Liquid chilling package for use with remote condenser

Units for use with remote condenser are tested by using a water-cooled condenser, the characteristics of which shall enable the intended operating conditions to be achieved.

4.2.2 Installation and connection of the test object

4.2.2.1 General

The test object shall be installed and connected for the test as recommended by the manufacturer in the installation and operation manual. The accessories provided by option are not included in the test. If a back-up heater is provided in option or not, it shall be switched off or disconnected to be excluded from the testing.

For single ducts, regardless of the manufacturer’s instructions, the discharge duct shall be as short and straight as possible compatibly with minimum distance between the unit and the wall for correct air inlet but not less than 50 cm. No accessory shall be connected to the discharge end of the duct.

For double duct units, the same requirements apply to both suction and discharge ducts, unless the appliance is designed to be installed directly on the wall. For multisplit systems, the test shall be performed with the system operating at a capacity ratio of 1, or as close as possible.

When performing measures in heating mode, set the highest room temperature on the unit/system control device; when performing measures in cooling mode, set the lowest room temperature on the unit/system control device. If in the instructions, the manufacturer indicates a value for the temperature set on the control device for a given rating condition, then this value shall be used.

For unit with open-type compressor the electric motor shall be supplied or specified by the manufacturer. The compressor shall be operated at the rotational speed specified by the manufacturer.

For inverter type control units, the setting of the frequency shall be done for each rating condition. The manufacturer shall provide in the documentation information about how to obtain the necessary data to set the required frequencies.

If a skilled personnel with knowledge of control software is required for the start of the system, the manufacturer or the nominated agent should be in attendance when the system is being installed and prepared for tests.

4.2.2.2 Installation of unit consisting of several parts

In the case of a unit consisting of several parts, the following installation conditions shall be complied for the test.

a) The refrigerant lines shall be installed in accordance with the manufacturer's instructions. The length of the lines shall be 5 m except if the constraints of the test installation make 5 m not possible, in which case a greater length may be used, with a maximum of 7,5 m.

b) The lines shall be installed so that the difference in elevation does not exceed 2,5 m.

c) The thermal insulation of the lines shall be applied in accordance with the manufacturer's instructions.

d) Unless constrained by the design, at least half of the connecting lines shall be exposed to the outside conditions, with the rest of the lines exposed to the inside conditions.

4.2.2.3 Indoor units of multisplit systems

When testing a multisplit system in a calorimeter room, the air flow rate and the external static pressure shall be adjusted separately for each one of the ducted indoor units.

When testing a multisplit system using the air enthalpy method, the air flow rate and the external static pressure shall be adjusted separately for each indoor unit, ducted or not.

In case of equipment with non ducted indoor units tested using the air enthalpy method, the above requirement on ducted indoor units shall apply.

4.2.2.4 Measuring points

Temperature and pressure measuring points shall be arranged in order to obtain mean significant values.

For free air intake temperature measurements, it is required:

— either to have at least one sensor per square meter, with not less than four measuring points and by restricting to 20 the number of sensors equally distributed on the free air surface;

— or to use a sampling device. It shall be completed by four sensors for checking uniformity if the surface area is greater than 1 m².

Air temperature sensors shall be placed at a maximum distance of 0,25 m from the free air surface.

For control cabinet air conditioners, the inlet temperature at the evaporator is measured instead of the temperature inside the control cabinet.

For units consisting of a heat pump and a storage tank as a factory made unit, water inlet and outlet temperature measurements shall be taken at the inlet and outlet of this unit.

For water and brine, the density in formulae (1), (2) and (3) shall be determined in the temperature conditions measured near the volume flow measuring device.

4.3 Uncertainties of measurement

The uncertainties of measurement shall not exceed the values specified in Table 1.

Table 1 — Uncertainties of measurement for indicated values

Measured quantity	Unit	Uncertainty of measurement
Liquid		
- temperature difference	K	± 0,15 K
- temperature inlet/outlet	K	± 0,15 K
- volume flow	m^3/s	± 1 %
- static pressure difference	kPa	± 1 kPa (Δp ≤ 20 kPa) or ± 5 %(Δp > 20 kPa)
Air		
- dry bulb temperature	°C	± 0,2 K
- wet bulb temperature	°C	± 0,4K
- volume flow	m^3/s	± 5 %
- static pressure difference	Pa	± 5 Pa ($\Delta p \leq$ 100 Pa) or ± 5 %(Δp > 100 Pa)
Refrigerant		
- pressure at compressor outlet	kPa	± 1 %
- temperature	°C	± 0,5 K
Concentration		
- Heat transfer medium	%	± 2
Electrical quantities		
- electric power	W	± 1 %
- voltage	V	± 0,5 %
- current	A	± 0,5 %
- electrical energy	kWh	± 1 %
Compressor rotational speed	min^{-1}	± 0,5 %

The heating or cooling capacities measured on the liquid side shall be determined within a maximum uncertainty of 5 % independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.

The steady state heating or cooling capacities determined using the calorimeter method shall be determined with a maximum uncertainty of 5 %, independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids; this maximum uncertainty is extended to 10 % for single duct units due to the air exchange between the two compartments of the calorimeter room.

Heating capacity determined during transient operation (defrost cycles) using the calorimeter method shall be determined with a maximum uncertainty of 10 %, independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.

The heating and cooling capacities measured on the air side using the air enthalpy method shall be determined with a maximum uncertainty of 10 %, independent of the individual uncertainties of measurement including the uncertainties on the properties of fluids.

4.4 Test procedure

4.4.1 General

4.4.1.1 All units

The test conditions are given in EN 14511-2.

If liquid heat transfer media other than water are used, the specific heat capacity and density of such heat transfer media shall be determined and taken into consideration in the evaluation.

Table 4 states permissible deviations of the measured values from the test conditions.

4.4.1.2 Non ducted units

For non-ducted units, the adjustable settings such as louvers and fan speed shall be set for maximum steady-state air flow.

For inverter type control units, if the manufacturer indicates a speed of the fan different from the maximum one to set on the control device for a given rating condition, then this speed shall be used.

4.4.1.3 Units ducted on the indoor heat exchanger

The volume flow and the external static pressure, as specified by the manufacturer for the cooling mode (or heating mode if no cooling mode of the unit), shall be related to standard air and with dry heat exchanger.

The volume flow and the pressure difference shall be related to standard air and with dry heat exchanger.

If the airflow rate is given by the manufacturer with no atmospheric pressure, temperature and humidity conditions, it shall be considered as given for standard air conditions.

The airflow rate given by the manufacturer shall be converted into standard air conditions.

$$q_{\mathrm{vi}} = \frac{q_{\mathrm{vi(measured)}}\,\rho_{\mathrm{(measured)}}}{1{,}204} \qquad (8)$$

The setting of this airflow rate shall be made when the fan only is operating.

The rated air flow rate given by the manufacturer converted into standard air conditions if necessary shall be set and the resulting ESP measured. This ESP shall also be converted into standard air conditions as follows:

$$\Delta p_{\mathrm{e}} = \frac{\Delta p_{\mathrm{e(measured)}}\,\rho^{2}_{\mathrm{(measured)}}}{1{,}204^{2}} \qquad (9)$$

If the ESP is lower than the minimum value given in Table 2 (or Table 3), the air flow rate is decreased to reach this minimum value.

If the ESP is greater than twice the minimum value given in Table 2 (or Table 3), the air low rate is increased to reach twice this minimum value.

If the ESP is greater than the minimum value given in Table 2 (or Table 3) but not greater than twice this minimum value, then keep this ESP.

The apparatus used for setting the ESP shall be maintained in the same position during all the tests.

Table 2 — Pressure requirement for comfort air conditioners

Standard capacity ratings kW	**Minimum external static pressure (ESP_{min})** [a b] Pa
$0 < Q < 8$	25
$8 \leq Q < 12$	37
$12 \leq Q < 20$	50
$20 \leq Q < 30$	62
$30 \leq Q < 45$	75
$45 \leq Q < 82$	100
$82 \leq Q < 117$	125
$117 \leq Q < 147$	150
$Q \geq 147$	175

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

[b] If the manufacturer's installation instructions state that the maximum allowable discharge duct length is less than 1m, then the unit can be considered as a free delivery unit and be tested as a non ducted indoor unit with an ESP of 0 Pa.

Table 3 — Pressure requirement for close control air conditioners

Capacity kW	**Minimum external static Pressure (ESP_{min})** Pa	
	For down-flow discharge into double floor	For up-flow discharge into duct all units
< 30	50	-
≥ 30	75	-
All	-	50

4.4.1.4 Units ducted on the outdoor heat exchanger

The volume flow and the pressure difference shall be related to standard air and with dry heat exchanger.

If the air flow rate is given by the manufacturer with no atmospheric pressure, temperature and humidity conditions, it shall be considered as given for standard air conditions.

The air flow rate given by the manufacturer shall be converted into standard air conditions. The air flow rate setting shall be made when the fan only is operating.

The rated air flow rate given by the manufacturer shall be set and the resulting external static pressure (ESP) measured.

If the ESP is lower than 30 Pa, the air flow rate is decrease to reach this minimum value.

The apparatus used for setting the ESP shall be maintained in the same position during all the tests.

If the manufacturer's installation instructions state that the maximum allowable discharge duct length is less than 1m, then the unit can be considered as a free delivery unit and be tested as a non ducted outdoor unit with an ESP of 0 Pa.

Table 4 — Permissible deviations from set values

Measured quantity	Permissible deviation of the arithmetic mean values from set values	Permissible deviations of each of the individual measured values from set values
Liquid		
- inlet temperature	± 0,2 K	± 0,5 K
- outlet temperature	± 0,3 K	± 0,6 K
- volume flow	± 1 %	± 2,5 %
- static pressure difference	--	± 10 %
Air		
- inlet temperature (dry bulb)[a]	± 0,3 K	± 1 K
- inlet temperature (wet bulb)	± 0,4 K	± 1 K
- volume flow	± 5 %	± 10 %
- static pressure difference	-	± 10 %
Refrigerant		
- liquid temperature	± 1 K	± 2 K
- saturated vapour/bubble point temperature	± 0,5 K	± 1 K
Voltage	± 4 %	± 4 %

[a] For units with outdoor heat exchanger surfaces greater than 5 m², the deviation on the air inlet dry bulb temperature is doubled.

When testing single duct units the arithmetic mean value of the difference between the dry bulb temperature of the indoor compartment and of the air introduced from the outdoor compartment should have a maximum permissible deviation of 0,3 K. This requirement also applies to the wet bulb temperature difference.

4.4.2 Output measurement for water (brine)-to-water (brine) and water (brine)-to-air units

4.4.2.1 Steady state conditions

This condition is considered obtained and maintained when all the measured quantities remain constant without having to alter the set values, for a minimum duration of 30 min, with respect to the tolerances given in Table 4. Periodic fluctuations of measured quantities caused by the operation of regulation and control devices are permissible, on condition the mean value of such fluctuations does not exceed the permissible deviations listed in Table 4.

4.4.2.2 Measurement of heating capacity, cooling capacity and heat recovery capacity

For the output measurement, it is necessary to record all the meaningful data continuously. In the case of recording instruments which operate on a cyclic basis, the sequence shall be adjusted such that a complete recording is effected at least once every 30 s.

The output shall be measured in the steady state condition. The duration of measurement shall be not less than 35 min.

4.4.3 Output measurement for cooling capacity of air-to-water and air-to-air units

4.4.3.1 Steady state conditions

This condition is considered obtained and maintained when all the measured quantities remain constant without having to alter the set values, for a minimum duration of 1 h, with respect to the tolerances given in Table 4. Periodic fluctuations of measured quantities caused by the operation of regulation and control devices are permissible, on condition the mean value of such fluctuations does not exceed the permissible deviations listed in Table 4.

4.4.3.2 Measurement of cooling capacity

For the output measurement it is necessary to record all the meaningful data continuously. In the case of recording instruments which operate on a cyclic basis, the sequence shall be adjusted such that a complete recording is effected at least once every 30 s.

The output shall be measured in the steady state condition. The duration of measurement shall not be less than 35 min.

4.4.4 Output measurement for heating capacity of air-to-air units with the air enthalpy method and of air-to-water units

4.4.4.1 General

The test procedure consists of three periods: a preconditioning period, an equilibrium period, and a data collection period. The duration of the data collection differs depending upon whether the heat pump's operation is steady state or transient.

Annex C gives a flow chart of the procedure and schematically represents most of the different test sequences that are possible when conducting a heating capacity test.

4.4.4.2 Preconditioning period

The test room reconditioning apparatus and the heat pump under test shall be operated until the test tolerances specified in Table 4 are attained for at least 10 min.

A defrost cycle may end a preconditioning period. If a defrost cycle does end a preconditioning period, the heat pump shall operate in the heating mode for at least 10 min after defrost termination prior to beginning the equilibrium period.

It is recommended that the preconditioning period end with an automatic or manually induced defrost cycle when testing at application rating conditions for outdoor air stated in Table 3 and in Tables 18 to 21 of EN 14511-2:2013.

For units having defrost cycles at the standard rating condition, the water flow rate shall be set at the corresponding inlet/outlet water temperatures 20 min after the end of a defrost cycle, manually or automatically induced.

4.4.4.3 Equilibrium period

The equilibrium period immediately follows the preconditioning period or the defrost cycle and a recovery period of 10 min that ends a preconditioning period.

A complete equilibrium period is one hour in duration.

Except as specified in 4.4.4.7, the heat pump shall operate while meeting the test tolerances specified in Table 4.

4.4.4.4 Data collection period

The data collection period immediately follows the equilibrium period.

Data shall be sampled at equal intervals that span every 30 s or less, except during defrost cycles as specified below.

During defrost cycles, plus the first 10 min following defrost termination, data used in evaluating the integrated heating capacity and the integrated power input of the heat pump shall be sampled more frequently, at equal intervals that span every 10 s or less. When using the indoor air enthalpy method, these more frequently sampled data include the change in indoor-side dry bulb temperature. When using the calorimeter method, these more frequently sampled data include all measurements required to determine the indoor-side capacity.

For heat pumps that automatically cycle off the indoor fan during a defrost, the contribution of the net heating delivered and/or the change in indoor-side dry bulb temperature shall be assigned the value of zero when the indoor fan is off, if using the indoor air enthalpy method. If using the calorimeter test method, the integration of capacity shall continue while the indoor fan is off.

The difference between the leaving and entering temperatures of the heat transfer medium at the indoor heat exchanger shall be measured. For each interval of 5 min during the data collection period, an average temperature difference shall be calculated, ΔT_i (τ). The average temperature difference for the first 5 min of the data collection period, ΔT_i (τ = 0), shall be saved for the purpose of calculating the following percent change:

$$\%\Delta T = \left[\frac{\Delta T_i(\tau = 0) - \Delta T_i(\tau)}{\Delta T_i(\tau = 0)}\right] \tag{10}$$

4.4.4.5 Test procedure: When a defrost cycle ends the preconditioning period

If the quantity $\%\Delta T$ exceeds 2,5 % during the first 70 min of the data collection period, the heating capacity test shall be designated a transient test (see 4.4.4.7). Likewise, if the heat pump initiates a defrost cycle during the equilibrium period or during the first 70 min of the data collection period, the heating capacity test shall be designated a transient test.

If the above conditions do not occur and the test tolerances specified in Table 4 are satisfied during both the equilibrium period and the first 70 min of the data collection period, then the heat capacity test shall be designated a steady-state test. Steady-state tests shall be terminated after 70 min of data collection.

4.4.4.6 Test procedure: When a defrost cycle does not end the preconditioning period

4.4.4.6.1 If the heat pump initiates a defrost cycle during the equilibrium period or during the first 70 min of the data collection period, the heating capacity test shall be restarted as specified 4.4.4.6.3.

4.4.4.6.2 If the quantity $\%\Delta T$ exceeds 2,5 % any time during the first 70 min of the data collection period, then the heating capacity test procedure shall be restarted as specified in 4.4.4.6.3. Prior to the restart, defrost cycle shall occur. This defrost cycle may be manually initiated or delayed until the heat pump initiates an automatic defrost.

4.4.4.6.3 If either 4.4.4.6.1 or 4.4.4.6.2 apply, then the restart shall begin 10 min after the defrost cycle terminates with a new equilibrium period of one hour. This second attempt shall follow the requirements of 4.4.4.3 and 4.4.4.4 and the test procedure of 4.4.4.5.

4.4.4.6.4 If the conditions specified in 4.4.4.6.1 or 4.4.4.6.2 do not occur and the test tolerances specified in Table 4 are satisfied during both the equilibrium period and the first 70 min of the data collection period, then the heating capacity test shall be designated a steady-state test. Steady-state tests shall be terminated after 70 min of data collection.

4.4.4.7 Test procedure for transient tests

When, in accordance with 4.4.4.5, a heating capacity test is designated a transient test, the following adjustments shall apply.

To constitute a valid transient heating capacity test, the test tolerances specified in Table 5 shall be achieved during both the equilibrium period and the data collection period. As noted in Table 5, the test tolerances are specified for two sub-intervals. Interval H consists of data collected during each heating interval, with the exception of the first 10 min after defrost termination. Interval D consists of data collected during each defrost cycle plus the first 10 min of the subsequent heating interval.

The test tolerance parameters in Table 5 shall be determined throughout the equilibrium and data collection periods. All data collected during each interval, H or D, shall be used to evaluate compliance with the Table 5 test tolerances. Data from two or more H intervals or two or more D intervals shall not be combined and then used in evaluating Table 5 compliance. Compliance is based on evaluating data from each interval separately.

The data collection period shall be extended until 3 h have elapsed or until the heat pump completes three complete cycles during the period, whichever occurs first. If at an elapsed time of 3 h, the heat pump is conducting a defrost cycle, the cycle shall be completed before terminating the collection of data. A complete cycle consists of a heating period and a defrost period; from defrost termination to defrost termination.

For a multiple refrigerant circuit units, the data collection period is 3 h whatever the state of cycling of the different refrigerant circuits.

Table 5 — Variations allowed in heating capacity tests when using the transient ("T") test procedure

Readings	**Variations of arithmetical mean values from specified test conditions**		**Variation of individual readings from specified test conditions**	
	Interval H [a]	Interval D [b]	Interval H [a]	Interval D [b]
Temperature of air entering indoor-side:				
- dry-bulb	± 0,6 K	± 1,5 K	± 1,0 K	± 2,5 K
- wet-bulb	—	—	—	—
Temperature of air entering outdoor-side:				
- dry-bulb[c]	± 0,6 K	± 1,5 K	± 1,0 K	± 5,0 K
- wet-bulb	± 0,4 K	± 1,0 K	± 0,6 K	—
Inlet water temperature	± 0,2 K	—	± 0,5 K	[d]
Outlet water temperature	± 0,5 K	—	± 1,0 K	[e]

[a] Applies when the heat pump is in the heating mode, except for the first 10 min after termination of a defrost cycle.

[b] Applies during a defrost cycle and during the first 10 min after the termination of a defrost cycle when the heat pump is operating in the heating mode.

[c] For units with outdoor heat exchanger surfaces greater than 5 m², the deviation on the air inlet dry bulb temperature is doubled.

[d] the variation shall not exceed – 5,0 K

[e] The variation shall not exceed + 2,0 K

4.4.5 Output measurement for heating capacity of air-to-air units with the calorimeter room

4.4.5.1 General

The test procedure consists of two periods: an equilibrium period, and a data collection period. The duration of the data collection differs depending upon whether the heat pump's operation is steady state or transient.

4.4.5.2 Equilibrium period

The test room reconditioning apparatus and the heat pump under test shall be operated until the test tolerances specified in Table 4 are attained for at least 1 h, except if a defrost occurs during this period in which case the test tolerances specified in Table 5 apply.

If a defrost occurs during the equilibrium period, then the test procedure described in 4.4.5.5 applies.

4.4.5.3 Data collection period

Data shall be sampled at equal intervals that span every 30 s or less, except during defrost cycles as specified below.

The duration of measurement shall be not less than 70 min.

The difference between the leaving and entering temperatures of the heat transfer medium at the indoor heat exchanger shall be measured. For each interval of 5 min during the data collection period, an average temperature difference shall be calculated, $\Delta Ti\ (\tau)$. The average temperature difference for the first 5 min of the data collection period, $\Delta Ti\ (\tau = 0)$, shall be saved for the purpose of calculating the following percent change:

$$\%\Delta T = \left[\frac{\Delta T_i(\tau = 0) - \Delta T_i(\tau)}{\Delta T_i(\tau = 0)}\right] \times 100 \qquad (11)$$

4.4.5.4 General Test Procedure

If a defrost occurs before the start of the data collection period, or if the quantity $\%\Delta T$ exceeds 2,5 % during the data collection period, the heating capacity test shall be designated a transient test (see 4.4.5.5). Likewise, if the heat pump initiates a defrost cycle during the equilibrium period or during the data collection period, the heating capacity test shall be designated a transient test.

If the above conditions do not occur and the test tolerances specified in Table 4 are satisfied during both the equilibrium period and the data collection period, then the heat capacity test shall be designated a steady-state test. Steady-state tests shall be terminated after at least 70 min of data collection.

4.4.5.5 Test procedure for transient tests

When, in accordance with 4.4.5.4, a heating capacity test is designated a transient test, the following adjustments shall apply.

To constitute a valid transient heating capacity tests, the test tolerances specified in Table 5 shall be achieved during both the equilibrium period and the data collection period. As noted in Table 5, the test tolerances are specified for two sub-intervals. Interval H consists of data collected during each heating interval, with the exception of the first 10 min after defrost termination. Interval D consists of data collected during each defrost cycle plus the first 10 min of the subsequent heating interval.

All data collected during each interval, H or D, shall be used to evaluate compliance with the Table 5. Data from two or more H intervals or two or more D intervals shall not be combined and then used in evaluating Table 5 compliance. Compliance is based on evaluating data from each interval separately.

The data collection period shall be extended until 3 h have elapsed or until the heat pump completes three complete cycles during the period, whichever occurs first. If at an elapsed time of 3 h, the heat pump is conducting a defrost cycle, the cycle shall be completed before terminating the collection of data. A complete cycle consists of a heating period and a defrost period; from defrost termination to defrost termination.

For a multiple refrigerant circuit units, the data collection period is 3 h whatever the state of cycling of the different refrigerant circuits.

During defrost cycles, plus the first 10 min following defrost termination, data used in evaluating the integrated heating capacity and the integrated power input of the heat pump shall be sampled more frequently, at equal intervals that span every 10 s or less. When using the calorimeter room method, these more frequently sampled data include all measurements required to determine the indoor-side capacity.

For heat pumps that automatically turn off the indoor fan during a defrost cycle, the integration of capacity shall continue while the indoor fan is off.

4.5 Test results

4.5.1 Data to be recorded

The data to be recorded for the capacity tests are given in Table 6. The table identifies the general information required but is not intended to limit the data to be obtained.

These data shall be the mean values taken over the data collection period, with the exception of time measurement.

Table 6 — Data to be recorded

Measured quantity of result	Unit	Calorimeter	Air enthalpy method	Water enthalpy method
1) Ambient conditions				
- air temperature, dry bulb	°C		X	X
- atmospheric pressure	kPa	X	X	
2) Electrical quantities				
- voltage	V	X	X	X
- total current	A	X	X	X
- total power input, P_T	W	X	X	X
- effective power input, P_E	W	X	X	X
3) Thermodynamic quantities				
a) Indoor heat exchanger				
Air				
- inlet temperature, dry bulb	°C	X	X	-
- inlet temperature, wet bulb	°C	X	X	-
For duct connection				
- outlet temperature, dry bulb	°C	-	X	-
- outlet temperature, wet bulb	°C	-	X	-
- external/internal static pressure difference	Pa	X	X	-
- volume flow rate, q	m^3/s	--	X	-
rate of condensate	Kg/s	X	X	-

Measured quantity of result	Unit	Calorimeter	Air enthalpy method	Water enthalpy method
Water or brine				
- inlet temperature	°C	X		X
- outlet temperature	°C	X		X
- volume flow	m^3/s	X		X
- liquid pump speed setting, if applicable	-	X		X
- pressure difference	kPa	X		X
b) Outdoor heat exchanger				
Air				
- inlet temperature, dry bulb	°C	X	X	X
- inlet temperature, wet bulb	°C	X	X	X
For duct connection				
- outlet temperature, dry bulb	°C	-	X	-
- outlet temperature, wet bulb	°C	-	X	-
- external/internal static pressure difference	Pa	X	X	-
- volume flow rate, *q*	m^3/s	X	X	X
Water or brine				
- inlet temperature	°C	X	X	X
- outlet temperature	°C	X	X	X
- volume flow	m^3/s	X	X	X
- liquid pump speed setting, if applicable	-	X	X	X
- pressure difference	kPa	X	X	X
c) Heat recovery heat exchanger				
- inlet temperature	°C	-	-	X
- outlet temperature	°C	-	-	X
- volume flow	m^3/s	-	-	X
- pressure difference	kPa	-	-	X
d) Heat transfer medium (other than water)				
- concentration (volume)	%	X	X	X
- density (if needed for calculation)	kg/m^3	X	X	X
- specific heat (if needed for calculation)	J/kg.K	X	X	X
e) Refrigerant [a]				
- discharge pressure	bar abs.	-	-	X
- saturated vapour/bubble point temperature	°C	-	-	X
- liquid temperature	°C	-	-	X
f) Compressor				
- rotational speed of open type	min^{-1}	-	-	X
- power input of motor (only for open compressor type)	W	-	-	X
- compressor frequency for inverter type	Hz	x	x	x

Measured quantity of result	Unit	Calorimeter	Air enthalpy method	Water enthalpy method
g) Calorimeter				
- heat input to calorimeter	W	X	-	-
- heat extracted from calorimeter	W	X	-	-
- ambient temperature around the calorimeter	°C	X	-	-
- temperature of the water entering the humidifier	°C	X	-	-
- condensate temperature	°C	X	-	-
h) Defrost				
- defrost period	s	X	X	x
- operating cycle with defrost	min	X	X	x
4) Data collection period	min	X	X	X
5) Capacities				
- heating capacity (P_H)	W	X	X	X
- total cooling capacity (P_C)	W	X	X	X
- latent cooling capacity (P_L)	W	X	X	X
- sensible cooling capacity (P_S)	W	X	X	X
- heat recovery capacity	W	-	-	X
6) Ratios				
- COP	W/W	X	X	X
- EER	W/W	X	X	X
- SHR[b]	W/W	X	X	-

[a] Only for unit with remote condenser.
[b] Only for air-to-air and water-to-air units.

4.5.2 Cooling capacity and heat recovery capacity calculation

Average cooling and heat recovery capacities shall be determined from the set of cooling and heat recovery capacities recorded over the data collection period, or on the basis of average values of temperature and volume flow recorded over the data collection period.

4.5.3 Heating capacity calculation

4.5.3.1 Steady state capacity test

An average heating capacity shall be determined from the set of heating capacities recorded over the data collection period or on the basis of average values of temperature and volume flow recorded over the data collection period.

4.5.3.2 Transient capacity test

For equipment where one or more complete cycle occur during the data collection period, the following shall apply. The average heating capacity shall be determined using the integrated capacity and the elapsed time corresponding to the total number of complete cycles that occurred over the data collection period.

For equipment where no complete cycle occurs during the data collection period, the following shall apply. The average heating capacity shall be determined by using the integrated capacity and the elapsed time corresponding to the total data collection period.

4.5.4 Effective power input calculation

4.5.4.1 Steady state test

An average electric power input shall be determined from the integrated electrical power over the same data collection period than the one used for the heating/cooling capacity or heat recovery capacity calculation.

4.5.4.2 Transient with defrost cycle

An average electric power input shall be determined on the basis of the integrated electrical power and the time corresponding to the total number of complete cycles during the same data collection period as the one used for the heat capacity calculation.

4.5.4.3 Transient without defrost cycle

An average electric power input shall be determined on the basis of the integrated electrical power and the time corresponding to the same data collection period as the one used for the heat capacity calculation.

5 Electrical consumptions for single duct and double duct units

5.1 Determination of power consumption due to standby mode

The unit (for cooling only and reverse cycle units) is switched in standby mode with the control device, if available. After 10 min, the residual energy consumption is measured and assumed to be the standby mode consumption, P_{SB}.

For heating only units, the measurements are made in the same way, after the following test condition.

Table 7 — Test conditions for power consumption due to standby mode for heating only units

		Outdoor heat exchanger		Indoor heat exchanger	
		Inlet dry bulb temperature °C	Inlet wet bulb temperature °C	Inlet dry bulb temperature °C	Inlet wet bulb temperature °C
Heating mode	All air conditioners and heat pumps except single duct units	12	11	20	15 max
	single duct units	20	12	20	12

5.2 Determination of power consumption in off-mode

Following the standby mode test, the unit shall be switched in off mode, if available, while remaining plugged. After 10 min, the residual energy power is measured and assumed to be the off mode consumption, P_{OFF}.

5.3 Electricity consumption

The electricity consumption in cooling mode, Q_{SD} for single duct units and Q_{DD} for double duct units, shall be declared as the rated power input P_{EER} multiplied by the number of "on mode" hours as specified in the regulation and equal to 1.

It is expressed in kWh/h.

The electricity consumption in heating mode, Q_{SD} for single duct units and Q_{DD} for double duct units, shall be declared as the rated power input P_{COP} multiplied by the number of "on mode" hours as specified in the regulation and equal to 1.

It is expressed in kWh/h.

6 Air flow rate measurement of ducted units

For ducted units, the manufacturer shall declare the rated air flow rate, indoor and/or outdoor as applicable, measured according to Annex J.

7 Heat recovery test for air-cooled multisplit systems

7.1 Test installation

7.1.1 General

The heat recovery capacity of the system is determined by measurements in a three-room calorimeter or by the air enthalpy method using two or three rooms. The three rooms shall consist of one outdoor room and two indoor rooms, one at the heating condition and the other at the cooling condition. The two-room air enthalpy method shall have one room at the outdoor condition and the other at the common indoor side condition given in Table 21 of EN 14511-2:2013.

The calorimeter room and air enthalpy methods are described in Annex A and Annex B respectively. Each calorimeter room should satisfy the requirements of Annex A and the test facilities for the air enthalpy method should satisfy the requirements of Annex B.

7.1.2 Three-room calorimeter method

If measurements are made by the calorimeter method, then the testing of a heat recovery system shall need a three-room calorimeter test facility. The indoor units in the cooling mode shall be assembled in one room and the indoor units in the heating mode in the other. The outdoor unit shall be installed in the third room.

7.1.3 Three-room air-enthalpy method

The indoor units in the cooling mode shall be assembled in one room and the indoor units in the heating mode in another room; the outdoor unit shall be installed in the third room.

7.1.4 Two-room air-enthalpy method

All indoor units, either operating in cooling or heating mode, are assembled in one indoor room. The outdoor unit shall be installed in the other room.

All units operating in the heating mode should be connected to a common plenum; all units operating in the cooling mode should be connected to another common plenum, both in accordance with the requirements established in Annex B.

7.2 Test procedure

The heat recovery test shall be carried out with all operating indoor units.

For ducted indoor units, the individual external static pressure of each indoor unit is set by adjusting a damper located in the duct length connecting the discharge area of the unit to the common plenum.

7.3 Test results

Test results are recorded and expressed as specified in 4.5.

The references of the indoor units operating in cooling mode and of the indoor units operating in heating mode shall be specified.

8 Test report

8.1 General information

The test report shall at least contain:

a) date;

b) test institute;

c) test location;

d) test method;

e) test supervisor;

f) test object designation:

   1) type;

   2) serial number;

   3) name of the manufacturer;

g) type of refrigerant;

h) mass of refrigerant;

i) properties of fluids;

j) reference to this European Standard.

8.2 Additional information

Additional information given on the rating plate shall be noted and any other information relevant for the test. Particularly, it shall be stated whether the test is performed on a unit new or not. In the case of a test performed on a unit in use, information relative to the year of installation and heat exchanger tubes cleaning shall be given.

8.3 Rating test results

The rating capacities, power inputs, COP, EER, internal or external static pressure shall be given together with the rating conditions.

Table 8 provides a template for the test results to be reported for single duct and double duct units.

Table 8 — Test results for single duct and double duct units

Description	Symbol	Unit
Standard rating conditions, indoor air dry bulb (wet bulb) temperature in cooling mode	-	°C
Standard rating conditions, outdoor air dry bulb (wet bulb) temperature, in cooling mode	-	°C
Rated capacity for cooling	P_{rated}	kW
Rated power input for cooling	P_{EER}	kW
Rated Energy efficiency ratio	EER_{rated}	-
Electricity consumption in cooling mode - single duct unit - double duct unit	 Q_{SD} Q_{DD}	 kWh/h kWh/h
Standard rating conditions, indoor air dry bulb (wet bulb) temperature, in heating mode	-	°C
Standard rating conditions, outdoor air dry bulb (wet bulb) temperature, in heating mode	-	°C
Rated capacity for heating	P_{rated}	kW
Rated power input for heating	P_{COP}	kW
Rated Coefficient of Performance	COP_{rated}	-
Electricity consumption in heating mode - single duct unit - double duct unit	 Q_{SD} Q_{DD}	 kWh/h kWh/h
Power consumption in off-mode	P_{OFF}	kW
Power consumption in standby mode	P_{SB}	kW

Annex A
(normative)

Calorimeter test method

A.1 General

A.1.1 The calorimeter provides a method for determining capacity simultaneously on both the indoor-side and the outdoor-side. In the cooling mode, the indoor-side capacity determination is made by balancing the cooling and dehumidifying effects with measured heat and water inputs. The outdoor-side capacity provides a confirming test of the cooling and dehumidifying effect by balancing the heat and water rejection on the condenser side with a measured amount of cooling.

A.1.2 The size of the calorimeter shall be sufficient to avoid any restriction to the intake or discharge openings of the equipment. Perforated plates or other suitable grilles shall be provided at the discharge opening from the reconditioning equipment to avoid face velocities exceeding 1,0 m/s. Sufficient space shall be allowed in front of any inlet or discharge grilles of the equipment to avoid interference with the air flow. Minimum distance from the equipment to side walls or ceiling of the compartment(s) shall be 1 m, except for the back of console-type equipment and single duct units, which shall be in normal relation to the wall. Ceiling-mounted equipment shall be installed at a minimum distance of 1,8 m from the floor. Table A.1 gives the suggested dimensions for the calorimeter. To accommodate peculiar sizes of equipment, it may be necessary to alter the suggested dimensions to comply with the space requirements.

Table A.1 — Sizes of calorimeter

Rated cooling capacity of equipment W	**Suggested minimum inside dimensions of each room of calorimeter** m		
	Width	Height	Length
3 000	2,4	2,1	1,8
6 000	2,4	2,1	2,4
9 000	2,7	2,4	3,0
12 000	3,0	2,4	3,7

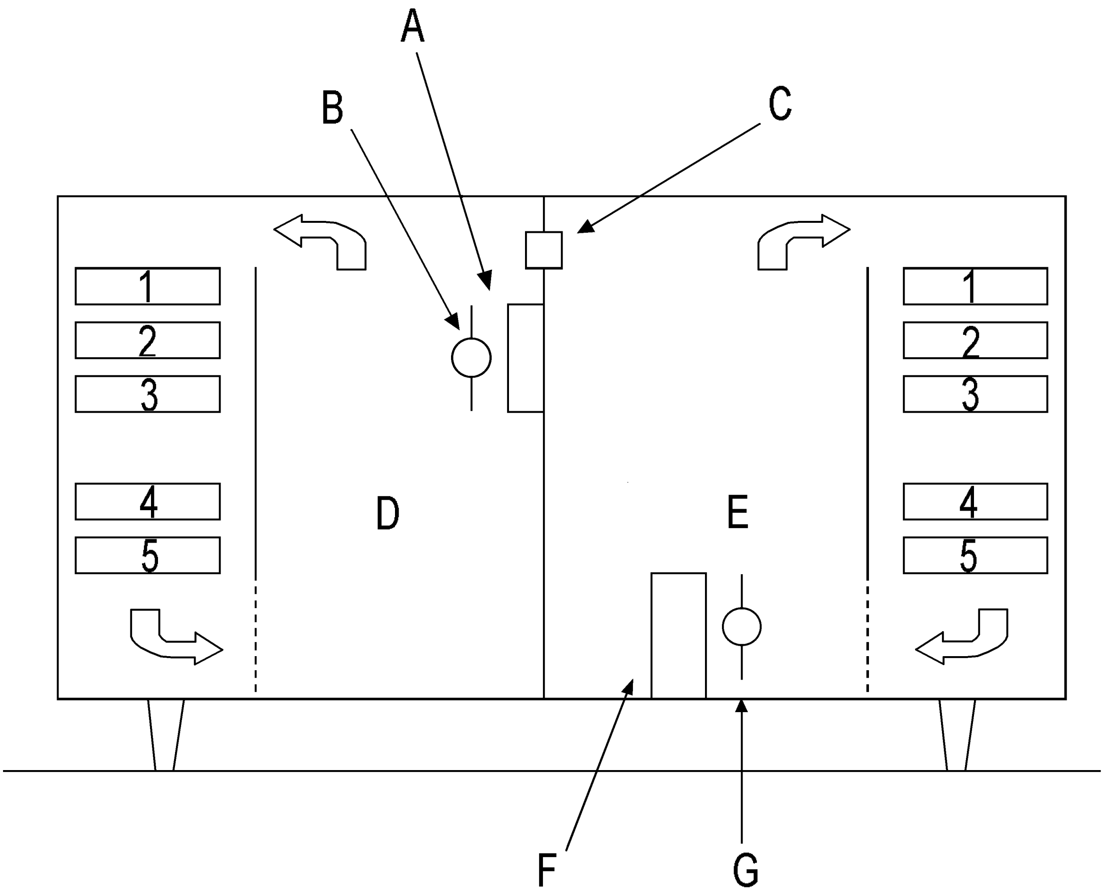
NOTE For larger capacity equipment, the following dimensions could be recommended:

- Width ≥ 4 times the unit width;
- Height ≥ 2,5 times the unit height;
- Length ≥ 1,5 times the unit length.

A.1.3 Each compartment shall be provided with reconditioning equipment to maintain specified air flow and prescribed conditions. Reconditioning apparatus for the indoor-side compartment shall consist of heaters to supply sensible heat and a humidifier to supply moisture. Reconditioning apparatus for the outdoor-side compartment should provide cooling, dehumidification, and humidification. The energy supply shall be controlled and measured.

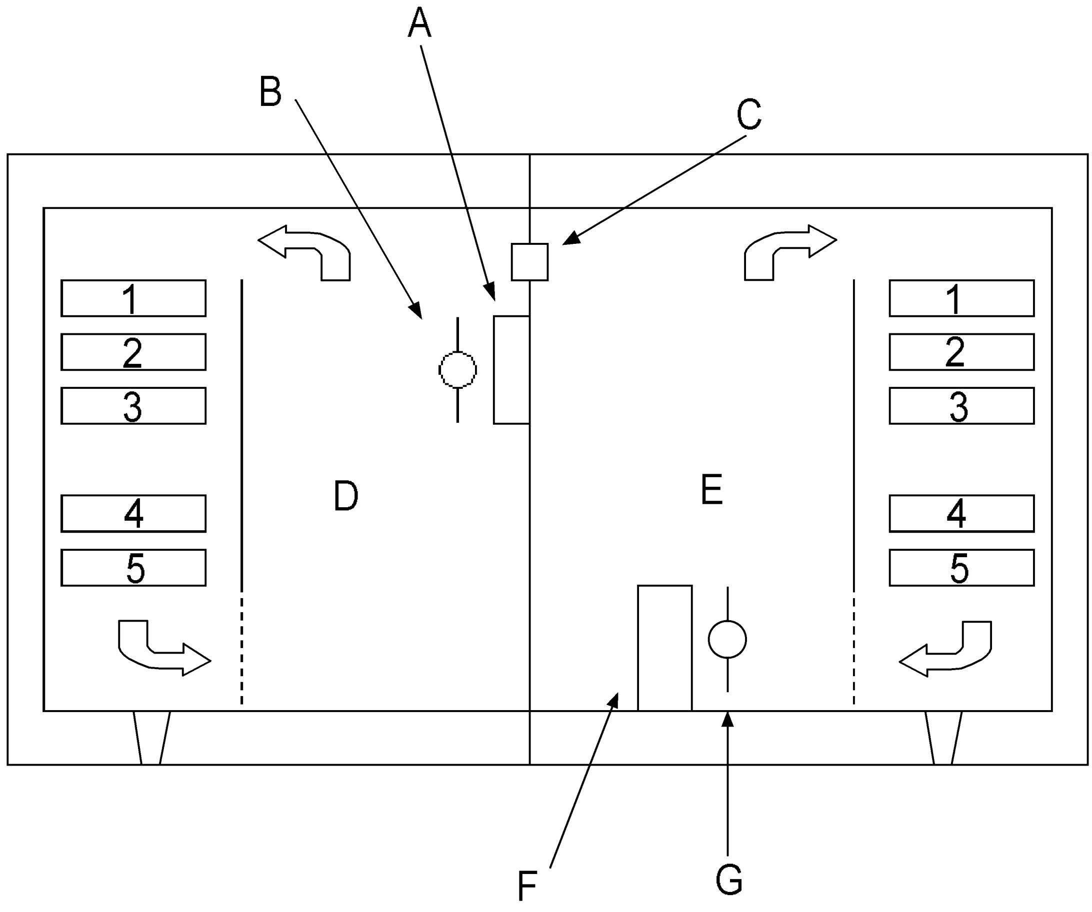
When calorimeters are used for heat pumps, they shall have heating, humidifying and cooling capabilities for both rooms (see Figures A.1 and A.2) or other means, such as rotating the equipment, may be used as long as the rating conditions are maintained.

A.1.4 Reconditioning apparatus for both compartments shall be provided with fans of sufficient capacity to ensure air flows of not less than twice the quantity of air discharged by the equipment under test in the calorimeter. The calorimeter shall be equipped with means of measuring or determining specified wet- and dry-bulb temperatures in both calorimeter compartments.



Key
A indoor unit (wall mounted)
B air sampling tubes
C pressure equalising system
D indoor room side
E outdoor room side
F outdoor unit
G air sampling tubes
1 cooling coil
2 heating coil
3 humidifier
4 fan
5 mixers

Figure A.1 — Typical calibrated ambient room type calorimeter



Key

A indoor unit (wall mounted)
B air sampling tubes
C pressure equalising system
D indoor room side
E outdoor room side
F outdoor unit
G air sampling tubes
1 cooling coil
2 heating coil
3 humidifier
4 fan
5 mixers

Figure A.2 — Typical balanced ambient room type calorimeter

A.1.5 A pressure-equalising device shall be provided in the partition wall between the indoor-side and the outdoor-side compartments to maintain a balanced pressure between these compartments. This device consists of one or more nozzles, a discharge chamber equipped with an exhaust fan and manometers for measuring compartment and air flow pressures.

Since the air flow from one compartment to the other may be in either direction, two such devices mounted in opposite directions, or a reversible device, shall be used. The manometer pressure tubes shall be so located as to be unaffected by air discharged from the equipment or by the exhaust from the pressure-equalising device. The fan or blower, which exhausts air from the discharge chamber, shall permit variation of its air flow by any suitable means, such as variable speed drive or a damper. The exhaust from this fan or blower shall be such that it shall not affect the inlet air to the equipment.

A.1.6 It is recognised that in both the indoor-side and outdoor-side compartments, temperature gradients and air flow patterns result from the interaction of the reconditioning apparatus and test equipment. Therefore, the resultant conditions are peculiar to and dependent upon a given combination of compartment size, arrangement and size of reconditioning apparatus, and the air discharge characteristics of the equipment under test.

The point of measurement of the specified test temperatures, both wet bulb – or dew point - and dry-bulb, temperatures shall be such that the following conditions are fulfilled.

a) The measured temperatures shall be representative of the temperature surrounding each piece of the equipment and shall simulate the conditions encountered in an actual application for both indoor and outdoor sides, as indicated above.

b) At the point of measurement, the temperature of air shall not be affected by air discharged from any piece of the equipment. This makes it mandatory that the temperatures are measured upstream of any recirculation produced by the equipment.

Air sampling tubes shall be positioned on the intake side of the equipment.

A.1.7 Interior surfaces of the calorimeter compartments shall be of non-porous material with all joints sealed against air and moisture leakage. The access door shall be tightly sealed against air and moisture leakage by use of gaskets or other suitable means.

A.2 Transient heating capacity test

If defrost controls on the heat pump provide for stopping the indoor air flow, provision shall be made to stop the test apparatus air flow to the equipment on both the indoor and outdoor-sides during such a defrost period. If it is desirable to maintain operation of the reconditioning apparatus during the defrost period, provision may be made to bypass the conditioned air around the equipment as long as assurance is provided that the conditioned air does not aid in the defrosting. A watt-hour meter shall be used for obtaining the integrated electrical input to the equipment under test.

A.3 Calibrated room-type calorimeter

A.3.1 The calibrated room-type calorimeter is shown in Figure A.1. Each calorimeter, including the separating partition, shall be insulated to prevent heat leakage (including radiation) in excess of 5 % of the equipment's capacity. An air space permitting free circulation shall be provided under the calorimeter floor.

A.3.2 Heat leakage may be determined in either the indoor-side or outdoor-side compartment by the following method: all openings shall be closed. Either compartment may be heated by electric heaters to a temperature of at least 11 K above the surrounding ambient temperature. The ambient temperature shall be maintained constant within ± 1 K outside all six enveloping surfaces of the compartment, including the separating partition. If the construction of the partition is identical with that of the other walls, the heat leakage through the partition may be determined on a proportional area basis.

A.3.3 For calibrating the heat leakage through the separating partition alone, the following procedure may be used: a test is carried out as described above. Then the temperature of the adjoining area on the other side of the separating partition is raised to equal the temperature in the heated compartment, thus eliminating heat leakage through the partition, while the 11 K differential is maintained between the heated compartment and the ambient surrounding the other five enveloping surfaces.

The difference in heat input between the first test and second test shall permit the determination of the leakage through the partition alone.

A.3.4 For the outdoor-side compartment equipped with means for cooling, an alternative means of calibration may be to cool the compartment to a temperature at least 11 K below the ambient temperature (on six sides) and carry out a similar analysis.

A.3.5 As an alternative to the two-room simultaneous method of determining capacities, the performance of the indoor room-side compartment may be verified at least every six months using an industry standard cooling capacity calibrating device. A calibrating device may also be another piece of equipment whose performance has been measured by the simultaneous indoor and outdoor measurement method at an accredited national test laboratory as part of an industry-wide cooling capacity verification program.

A.4 Balanced ambient room-type calorimeter

A.4.1 The balanced ambient room-type calorimeter is shown in Figure A.2 and is based on the principle of maintaining the dry-bulb temperatures surrounding the particular compartment equal to the dry-bulb temperatures maintained within that compartment. If the ambient wet-bulb temperature is also maintained equal to that within the compartment, the vapour-proofing provisions of A.1.6 are not required.

A.4.2 The floor, ceiling, and walls of the calorimeter compartments shall be spaced a sufficient distance away from the floor, ceiling, and walls of the controlled areas in which the compartments are located in order to provide a uniform air temperature in the intervening space. It is recommended that this distance be at least 0,3 m. Means shall be provided to circulate the air within the surrounding space to prevent stratification.

A.4.3 Heat leakage through the separating partition shall be introduced into the heat balance calculation and may be calibrated in accordance with A.3.3, or may be calculated.

A.4.4 It is recommended that the floor, ceiling, and walls of the calorimeter compartments be insulated so as to limit heat leakage (including radiation) to no more than 10 % of the test equipment's capacity, with an 11 K temperature difference, or 300 W for the same temperature difference, whichever is greater, as tested using the procedure given in A.3.2.

A.5 Calorimeter and auxiliary equipment for water-cooled condenser tests

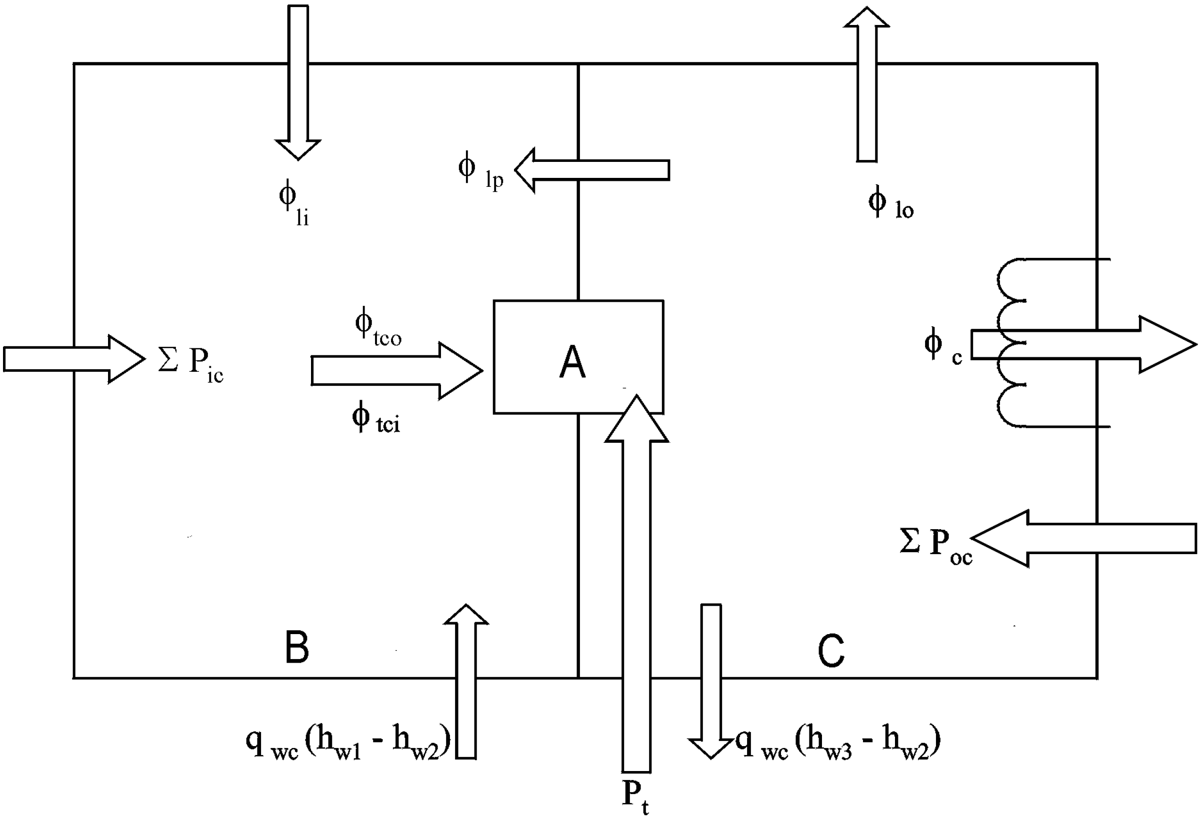
A.5.1 The indoor-side compartment of a room calorimeter of either the calibrated or the balanced ambient type shall be used.

A.5.2 Measurements shall be made for determining flow and temperature rise of condenser cooling water. Water lines shall be insulated between the condenser and points of temperature measurement.

A.6 Calculations-cooling capacities

A.6.1 General

The energy flow quantities used to calculate the total cooling capacity based on indoor and outdoor-side measurements are shown below in Figure A.3.



Key

A equipment under test

B indoor chamber

C outdoor chamber

All symbols with their units are defined in Annex E.

Figure A.3 — Calorimeter energy flows during cooling capacity tests

A.6.2 The total cooling capacity on the indoor-side, as tested in either the calibrated or balanced-ambient, room-type calorimeter (see Figures A.1 and A.2), is calculated as follows:

$$\phi_{tci} = \sum P_{ic} + q_{wc}\left(h_{w1} - h_{w2}\right) + \phi_{lp} + \phi_{li} \quad \text{(A.1)}$$

NOTE 1 If no water is introduced during the test, h_{w1} is taken at the temperature of the water in the humidifier tank of the conditioning apparatus.

When it is not practical to measure the temperature of the water leaving the indoor-side compartment to the outdoor-side compartment, the temperature of the condensate may be assumed to be at the measured or estimated wet-bulb temperature of the air leaving the test equipment.

The water vapour (q_{wc}) condensed by the equipment under test may be determined by the amount of water evaporated into the indoor-side compartment by the reconditioning equipment to maintain the required humidity.

The heat leakage $\phi_{\lambda p}$ into the indoor-side compartment through the separating partition between the indoor-side and outdoor-side compartments may be determined from the calibrating test or, in the case of the balanced-ambient room-type compartment, may be based on calculations.

The total cooling capacity on the outdoor-side, as tested in either the calibrated or balanced-ambient, room-type calorimeter (see Figures A.1 and A.2), is calculated as follows:

$$\phi_{tco} = \phi_{c-} \sum P_{oc} - P_t + q_{wc}\left(h_{w3} - h_{w2}\right) + \phi_{lp} + \phi_{lo} \tag{A.2}$$

NOTE 2 The h_{w3} enthalpy is taken at the temperature at which the condensate leaves the outdoor-side compartment.

The heat leakage rate (ϕ_{lp}) into the indoor-side compartment through the separating partition between the indoor-side and outdoor-side compartments may be determined from the calibrating test or, in the case of the balanced-ambient room-type compartment, may be based on calculations.

NOTE 3 This quantity can be numerically equal to that used in Formula (A.1) if, and only if, the area of the separating partition exposed to the outdoor-side is equal to the area exposed to the indoor-side compartment.

A.6.3 The total cooling capacity of liquid (water)-cooled equipment deducted from the condenser side is calculated as follows:

$$\phi_{tco} = \phi_{co} - \sum P_E \tag{A.3}$$

A.6.4 The latent cooling capacity (room dehumidifying capacity) is calculated as follows:

$$\phi_d = K_1 q_{wc} \tag{A.4}$$

A.6.5 The sensible cooling capacity is calculated as follows:

$$\phi_s = \phi_{tci} - \phi_d \tag{A.5}$$

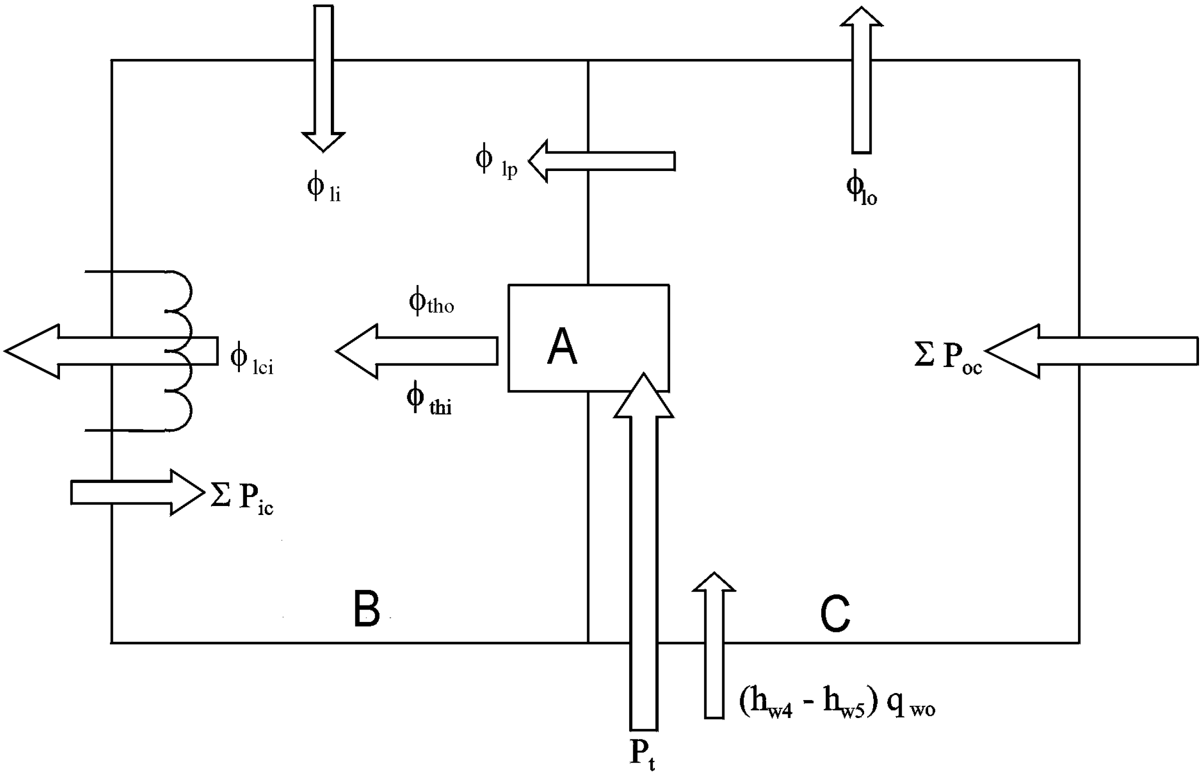
A.6.6 Sensible heat ratio is calculated as follows:

$$SHR = \frac{\phi_s}{\phi_{tci}} \tag{A.6}$$

A.7 Calculation-heating capacities

A.7.1 General

The energy flow quantities used to calculate the total heating capacity based on indoor and outdoor-side measurements are shown below in Figure A.4.



Key

A equipment under test

B indoor chamber

C outdoor chamber

All symbols with their units are defined in Annex E.

Figure A.4 — Calorimeter energy flows during heating capacity tests

A.7.2 Determination of the heating capacity by measurement in the indoor-side room

The determination of the heating capacity by measurement in the indoor-side room of the calorimeter is calculated as follows:

$$\phi_{thi} = \phi_{lci} - \phi_{lp} - \phi_{li} - \sum P_{ic} \quad \text{(A.7)}$$

A.7.3 Determination of the heating capacity by measurement of the heat absorbing side

The determination of the heating capacity by measurement of the heat absorbing is calculated for equipment where the evaporator takes the heat from an air-flow as follows:

$$\phi_{tho} = \sum P_{oc} + P_t + q_{wo}(h_{w4} - h_{w5}) - \phi_{lp} - \phi_{lo} \quad \text{(A.8)}$$

A.7.4 Total heating capacity of liquid (water)-to-air unit deducted from the evaporator side

The total heating capacity of liquid (water)-to-air unit deducted from the evaporator side is calculated as follows:

$$\phi_{tho} = \phi_{eo} + \sum P_E \quad \text{(A.9)}$$

where

ϕ_{eo} is the heat supplied to the evaporator coil of the equipment.

Annex B
(normative)

Indoor air enthalpy test method

B.1 General

In the air-enthalpy method, capacities are determined from measurements of entering and leaving wet-bulb – or dew point - and dry-bulb temperatures and the associated air flow rate.

B.2 Determination of the air flow rate

The indoor air flow rate measurement shall be made in accordance with Annex J.

B.3 Calculations-cooling capacities

Total, sensible and latent indoor cooling capacities based on the indoor-side test data are calculated by the following formulas:

$$\phi_{tci} = \frac{q_{vi}(h_{a1} - h_{a2})}{v'_n(1+W_n)} 1000 \quad \text{(B.1)}$$

$$\phi_s = \frac{q_{vi}(c_{pa1}t_{a1} - c_{pa2}t_{a2})}{v'_n(1+W_n)} \quad \text{(B.2)}$$

$$\phi_d = \frac{K_1 q_{vi}(W_{i1} - W_{i2})}{v'_n(1+W_n)} 1000 \quad \text{(B.3)}$$

$$\phi_d = \phi_{tci} - \phi_s \quad \text{(B.4)}$$

$$\phi_d = K_1 q_{wc} \quad \text{(B.5)}$$

NOTE All symbols and their units are defined in Annex E.

B.4 Calculations-heating capacities

B.4.1 Total heating capacity based on indoor-side data is calculated by the following formula:

$$\varphi_{\text{thi}} = \frac{q_{\text{vi}}\left(h_{\text{a2}} - h_{\text{a1}}\right)}{v'_{\text{n}}\left(1+W_{\text{n}}\right)} \times 1000 \quad \text{(B.6)}$$

NOTE 1 Formulas B.1, B.2, B.3 and B.6 do not provide allowance for heat leakage in the duct section.

NOTE 2 All symbols and their units are defined in Annex E.

Annex C
(informative)

Heating capacity tests - Flow chart and examples of different test sequences

C.1 Figure C.1 illustrates with a flow chart the test procedure described in 4.4.4.

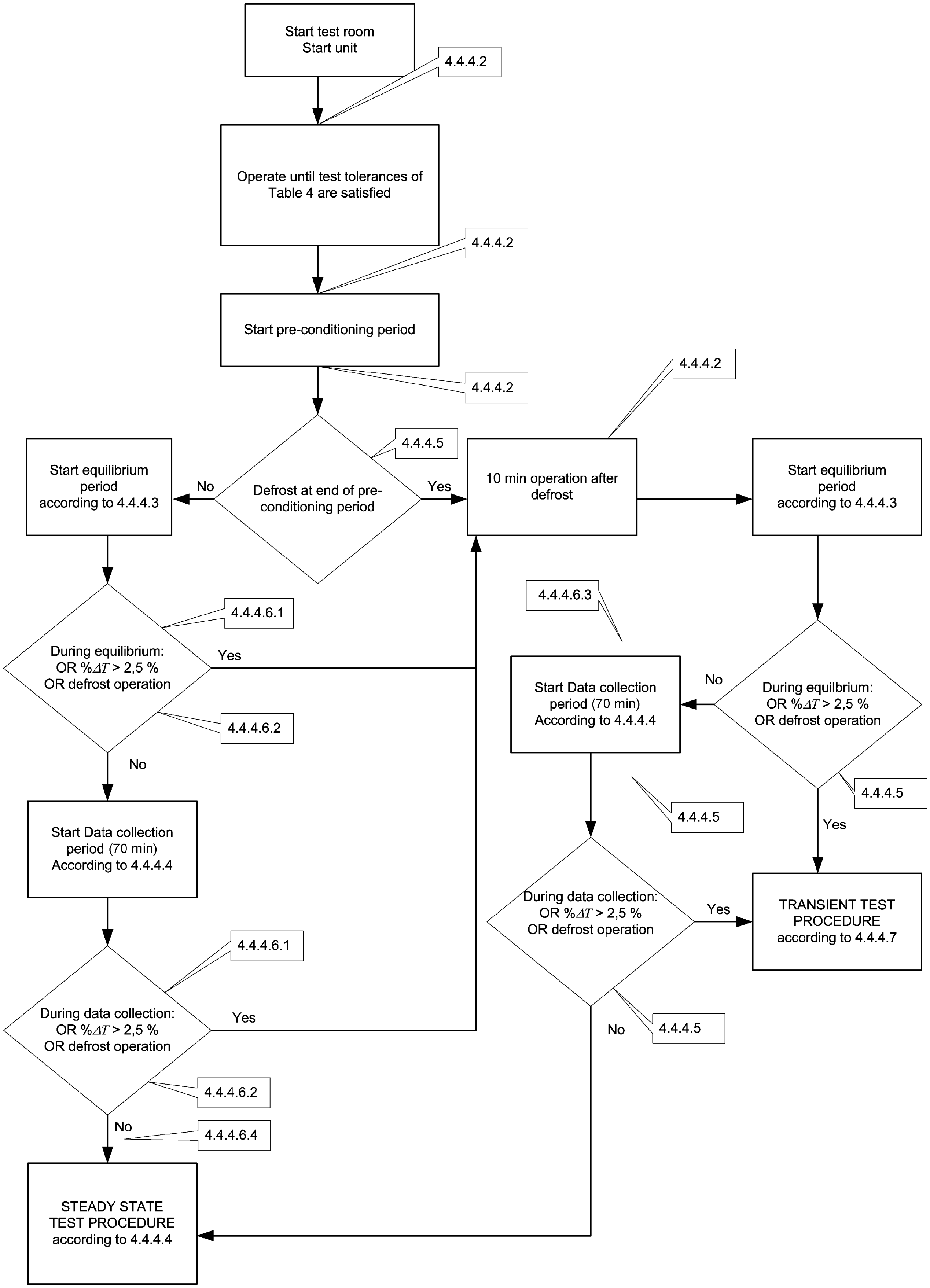


Figure C.1 — Flow chart

C.2 The Figures C.2 to C.7 given below show several of the cases that could occur while conducting a heating capacity test as specified in 4.4.4. All examples show cases where a defrost cycle ends the preconditioning period.

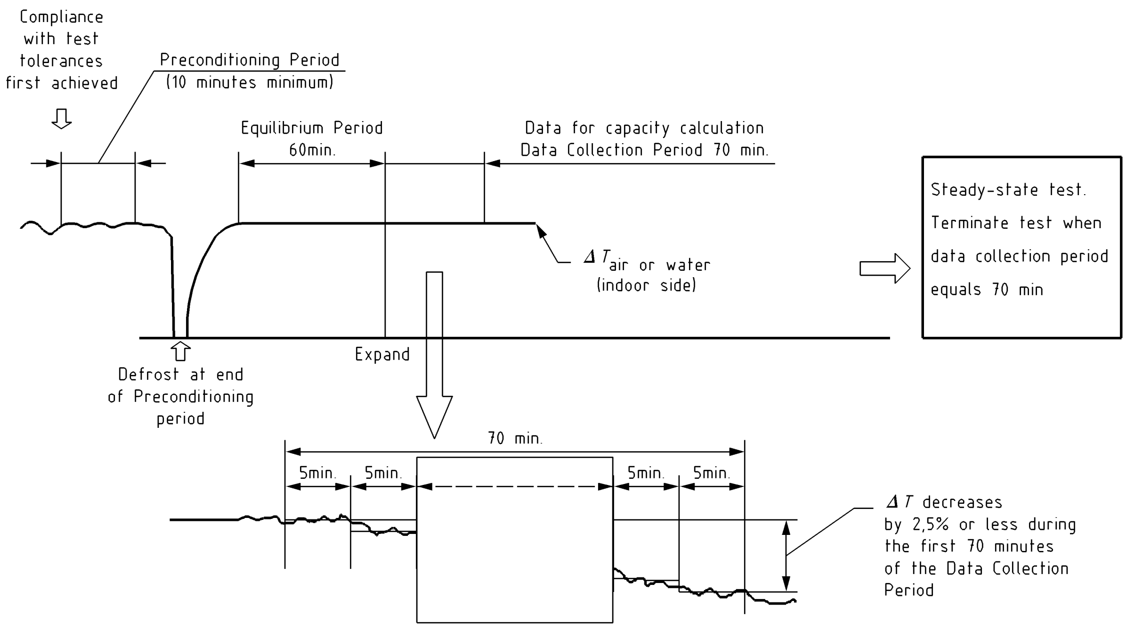


Figure C.2 — Steady state heating capacity test

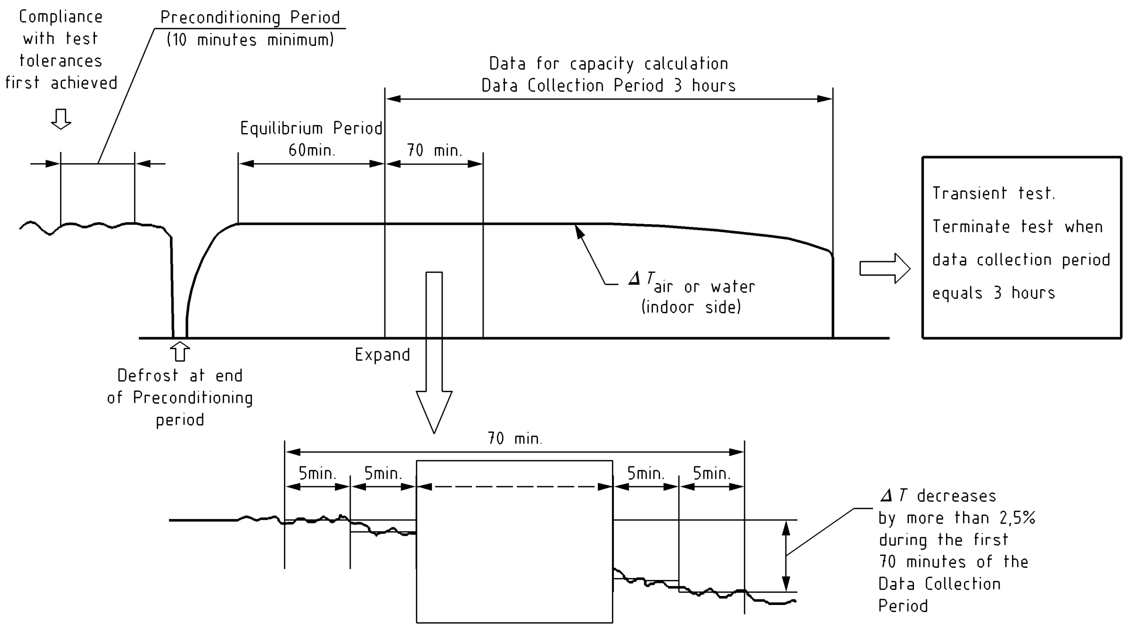


Figure C.3 — Transient heating capacity test with no defrost cycle

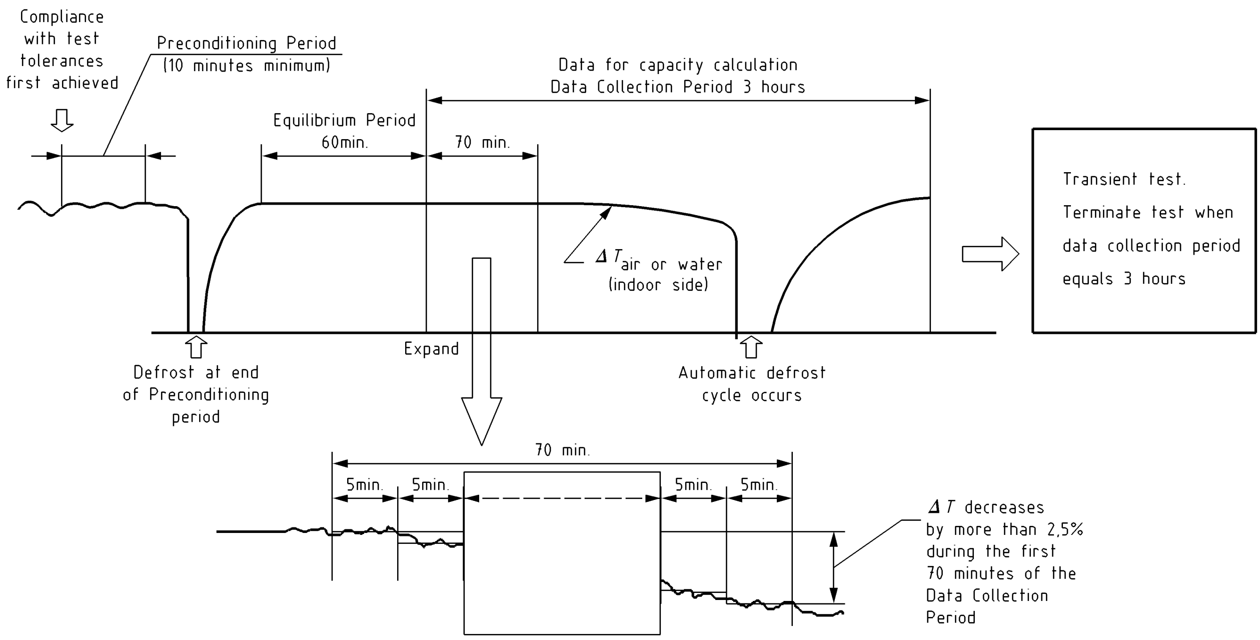


Figure C.4 — Transient heating capacity test with one defrost cycle during the data collection period

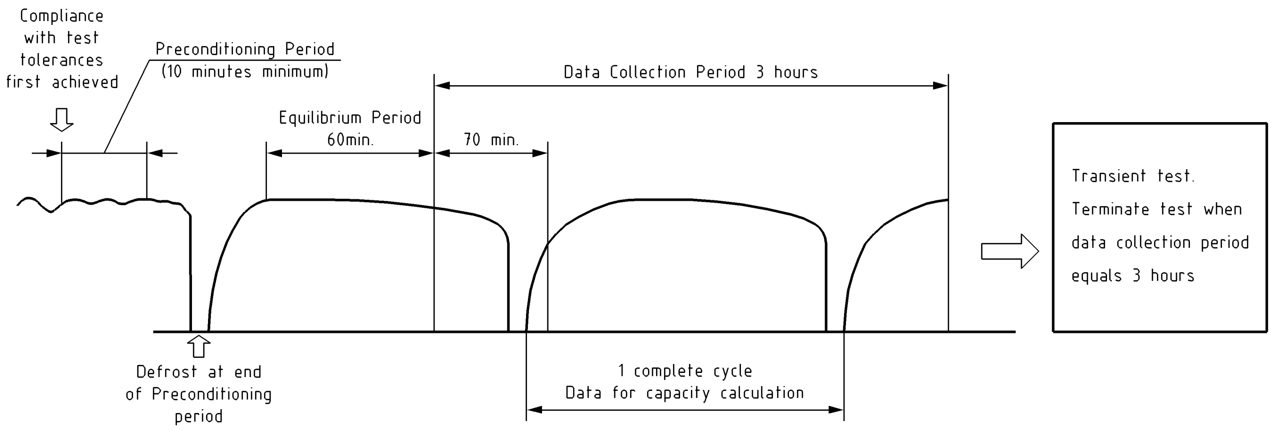


Figure C.5 — Transient heating capacity test with one complete cycle during the data collection period

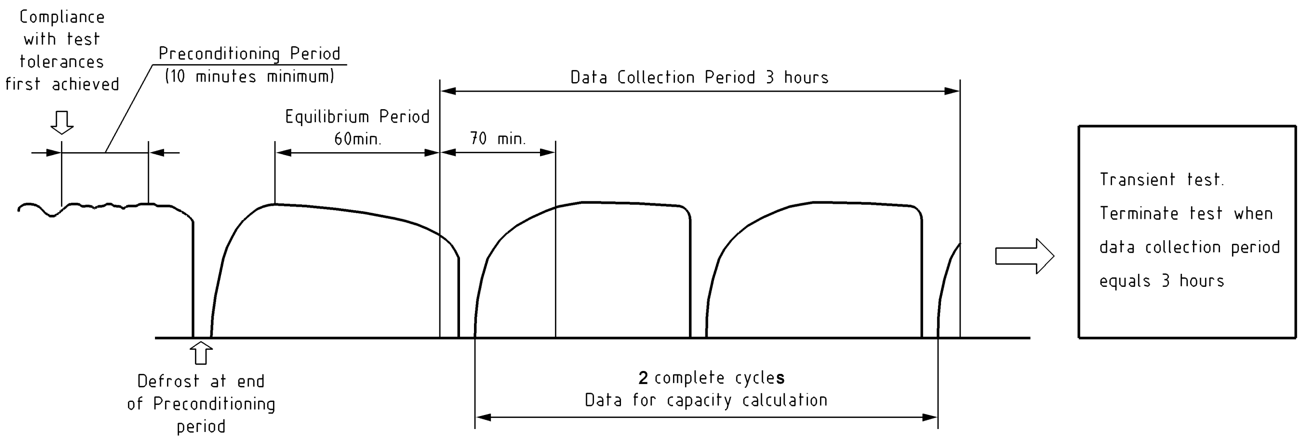


Figure C.6 — Transient heating capacity tests with two complete cycles during the data collection period

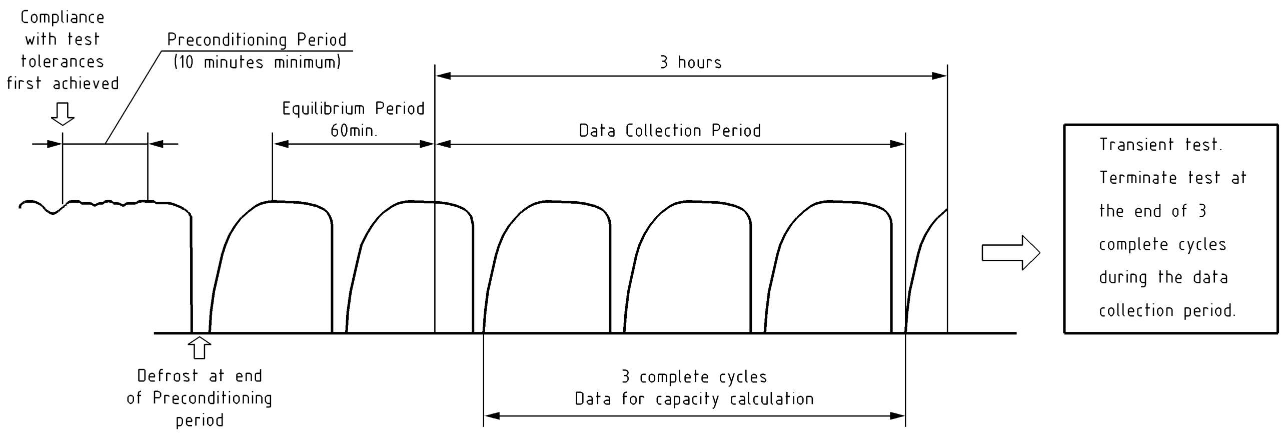


Figure C.7 — Transient heating capacity test with three complete cycles during the data collection period

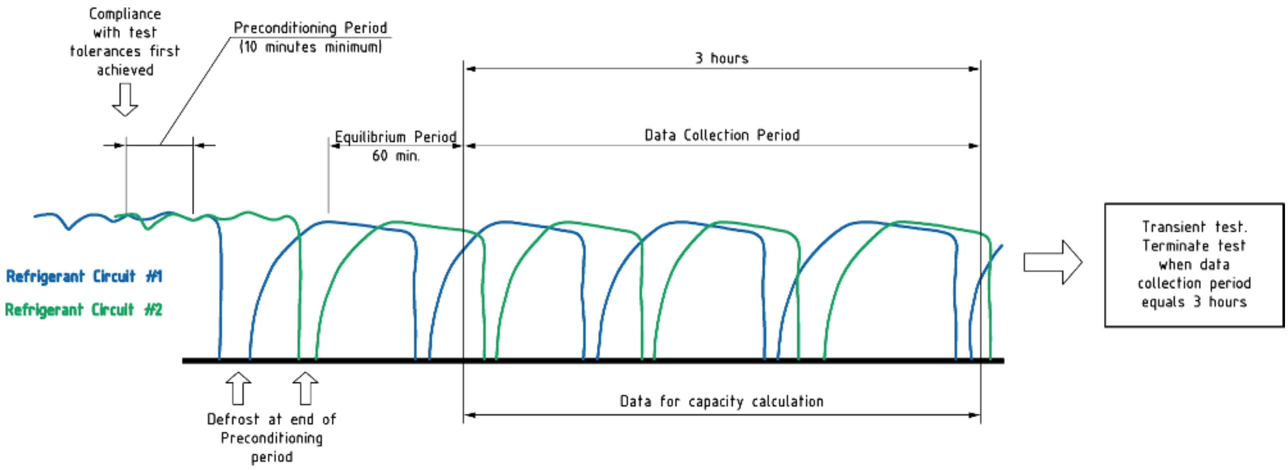


Figure C.8 – Transient heating capacity test for multi-refrigerant circuit units

Annex D
(informative)

Conformance criteria

D.1 Liquid chilling packages

For water-to-water or brine-to-water units for which a heat balance on the cooling and/or heating capacity may be calculated, this balance should not exceed 5 %.

This heat balance may be calculated as the difference between the direct measured cooling (heating) capacity and the indirect cooling (heating) capacity related to the direct capacity.

The indirect cooling capacity is determined as the heat rejection capacity minus the compressor power input.

The indirect heating capacity is the sum of the cooling capacity and the compressor power input.

For water cooled liquid chilling packages including a heat recovery heat exchanger, the heat balancing between the direct measured cooling capacity and the indirect cooling capacity calculation should not exceed 5 %.

The indirect cooling capacity is calculated as the sum of the heat rejection capacity and the heat recovery capacity minus the compressor power input.

D.2 Calorimeter room method

When using the calorimeter room method, the capacity determined using the outdoor-side data should agree within 5 % of the value obtained using the indoor-side data.

In the case of non-ducted air conditioners with water-cooled condensers, the heat flow rejected via the cooling water is measured instead of the measurement in the outdoor-side compartment.

D.3 Heat recovery of multisplit systems

For the results to be valid, the sum of the cooling capacity of the indoor units (see A.6.2) and the power input to the compressor and any fans should differ by not more than 5 % from the sum of the heating capacity of the indoor units (see A.7.2) and the heat from the outdoor unit. The heat from the outdoor unit may be negative if the unit is absorbing heat, or positive if the unit is rejecting heat.

Annex E
(informative)

Symbols used in annexes

Symbol	Description	Unit
c_{pa1}	Specific heat of moist air entering indoor-side	J/kg.K
c_{pa2}	Specific heat of moist air leaving indoor-side	J/kg.K
h_{a1}	Specific enthalpy of wet air entering indoor-side compartment	kJ/kg of dry air
h_{a2}	Specific enthalpy of air leaving indoor-side compartment	kJ/kg of dry air
h_{w1}	Specific enthalpy of water or steam supplied to indoor-side compartment	kJ/kg
h_{w2}	Specific enthalpy of condenser moisture leaving indoor-side compartment	kJ/kg
h_{w3}	Specific enthalpy of condensate removed by the air-treating coil in the outdoor-side compartment	kJ/kg
h_{w4}	Specific enthalpy of the water supplied to the outdoor-side compartment	kJ/kg
h_{w5}	Specific enthalpy of the condensed water or the frost generated by the equipment	kJ/kg
K_1	Latent heat of vaporisation of water (constant = 2 460)	kJ/kg
ϕ_{c}	Heat removed by cooling coil in the outdoor-side compartment	W
ϕ_{co}	Heat removed by the condenser coil of the equipment	W
ϕ_{d}	Latent cooling capacity (dehumidifying)	W
ϕ_{eo}	Heat supplied to the evaporator coil of the equipment	W
ϕ_{lci}	Heat removed from indoor-side compartment	W
ϕ_{li}	Heat leakage flow into the indoor-side compartment through all the enveloping surfaces of the indoor-side compartment, except the separating partition to the outdoor-side compartment	W
ϕ_{lo}	Heat leakage flow out of the outdoor-side compartment through all the enveloping surfaces of the outdoor-side compartment, except the separating partition to the indoor-side compartment	W
ϕ_{lp}	Heat leakage flow through the separating partition into the indoor-side compartment from the outdoor-side compartment	W
ϕ_{s}	Sensible cooling capacity	W
ϕ_{tci}	Total cooling capacity, indoor-side data	W
ϕ_{tco}	Total cooling capacity, outdoor-side data	W
ϕ_{thi}	Total heating capacity, indoor-side data	W
ϕ_{tho}	Total heating capacity, outdoor-side data	W
P_{t}	Total power input to equipment	W
ΣP_{E}	Effective power input to the equipment	W

Symbol	Description	Unit
ΣP_{ic}	Sum of all power inputs to the indoor-side compartment	W
ΣP_{oc}	Sum of all power inputs to any apparatus in the outdoor-side compartment (e.g. reheaters, fans, etc.)	W
q_{vi}	Indoor air flow rate	m^3/s
q_{wo}	Mass flow rate of water supplied to the outdoor-side calorimeter compartment	g/s
SHR	Sensible heat ratio	—
t_{a1}	Temperature of air entering indoor-side compartment	°C
t_{a2}	Temperature of air leaving indoor-side compartment	°C
v'_n	Specific volume of air at air-flow measuring device	m^3/kg of air-water vapour mixture
q_{wc}	Rate at which water vapour is condensed by the equipment	g/s
W_{i1}	Specific humidity of air entering indoor-side compartment	kg/kg of dry air
W_{i2}	Specific humidity of air leaving indoor-side compartment	kg/kg of dry air
W_n	Specific humidity at the nozzle inlet	kg water vapour/kg of dry air

Annex F
(informative)

Test at system reduced capacity

F.1 Test at system reduced capacity for multisplit system and modular heat recovery multisplit system

System reduced capacities and energy efficiency ratios or coefficients of performance are determined in accordance with the provisions specified in EN 14511-2 and this part, with a system capacity ratio of (0,5 ± 5) %, by the disconnection of indoor units, if the arrangement of indoor units allows; if not, an alternative ratio should be selected.

Other system reduced capacities and energy efficiency ratios or coefficients of performance may be determined, if required, at system capacity ratios different from 0,5.

F.2 Selection of units

The modular multisplit system is selected so that one or a combination of indoor units can be used to give a system reduced capacity required.

F.3 Temperature conditions

Temperature conditions are the standard rating conditions specified in Table 19 of EN 14511-2:2013 for the heating test and in Table 20 of EN 14511-2:2013 for the cooling test.

F.4 Test results

Test results are recorded and expressed as specified in 4.5.

Annex G
(informative)

Individual unit tests

G.1 General

G.1.1 Methods

The described methods provide means to determine the capacity of an individual indoor unit, either operating on its own with the other indoor units disconnected, or with all indoor units operating.

All tests are made in accordance with the requirements of EN 14511-2 and of this part.

G.1.2 Calorimeter method

If measurements are made by the calorimeter method, then the testing of an individual unit, with all others operating, needs at least a three-room calorimeter test facility. If only one unit is operating, a two-room calorimeter is suffice. Each calorimeter should satisfy requirements described in Annex A.

For the result to be valid, the total capacity calculated from the two indoor rooms should differ by not more than 5 % from the capacity calculated from the outdoor unit.

G.1.3 Air-enthalpy method

If measurements are made by the air-enthalpy method, then the testing should be done with one or more indoor rooms and one or more air measuring devices connected to the indoor units. The outdoor unit should be situated at least in an environmental test room.

The test facility should satisfy the requirements described in Annex B, except that the individual indoor unit to be tested should have its own plenum and air flow measuring device.

G.2 Temperatures conditions

Temperature conditions are as specified in Tables 19 and 20 of EN 14511-2:2013.

G.3 Other test conditions

Other test conditions, such as environmental conditions or installation, are as specified in EN 14511-2 and this European Standard.

G.4 Test results

Test results should be recorded and expressed as specified in 4.5.

G.5 Published results

Results should state if the units not being tested are disconnected or running during the test.

Annex H
(normative)

Determination of the liquid pump efficiency

H.1 General

The method for calculating the efficiency of the liquid pump, whether the pump is an integral part of the unit or not, is based on the relationship between the efficiency of the pump and its hydraulic power.

If the liquid pump is an integral part of the unit but that a static pressure difference is measured, the total power input of the pump is the sum of its electric power and the complementary required power calculated from Formula (H.2).

H.2 Hydraulic power of the liquid pump

H.2.1 The liquid pump is an integral part of the unit

When the liquid pump is an integral part of the unit, the hydraulic power of the pump is defined as:

$$P_{hydrau} = q \times \Delta p_e \text{ (W)} \tag{H.1}$$

where

q is the water volume flow rate, expressed in m^3/s;

Δp_e is the measured available external static pressure difference, expressed in Pascal.

H.2.2 The liquid pump is not an integral part of the unit

When the liquid pump is not an integral part of the unit, the hydraulic power of the pump is defined as:

$$P_{hydrau} = q \times (-\Delta pi) \text{ (W)} \tag{H.2}$$

where

q is the water volume flow rate, expressed in m^3/s;

Δpi is the measured internal static pressure difference, expressed in Pascal.

H.3 Efficiency of the liquid pump

The efficiency of the circulating pump required to deliver the hydraulic power is determined by using the following formula:

a) When the measured hydraulic power of the liquid pump is lower than 500 W, then the efficiency of the pump is determined from the following formula:

$$\eta = 0{,}0721 P_{hydrau}^{0.3183} \tag{H.3}$$

b) When the measured hydraulic power of the liquid pump is greater than 500 W, then the efficiency of the pump is determined from the following formula:

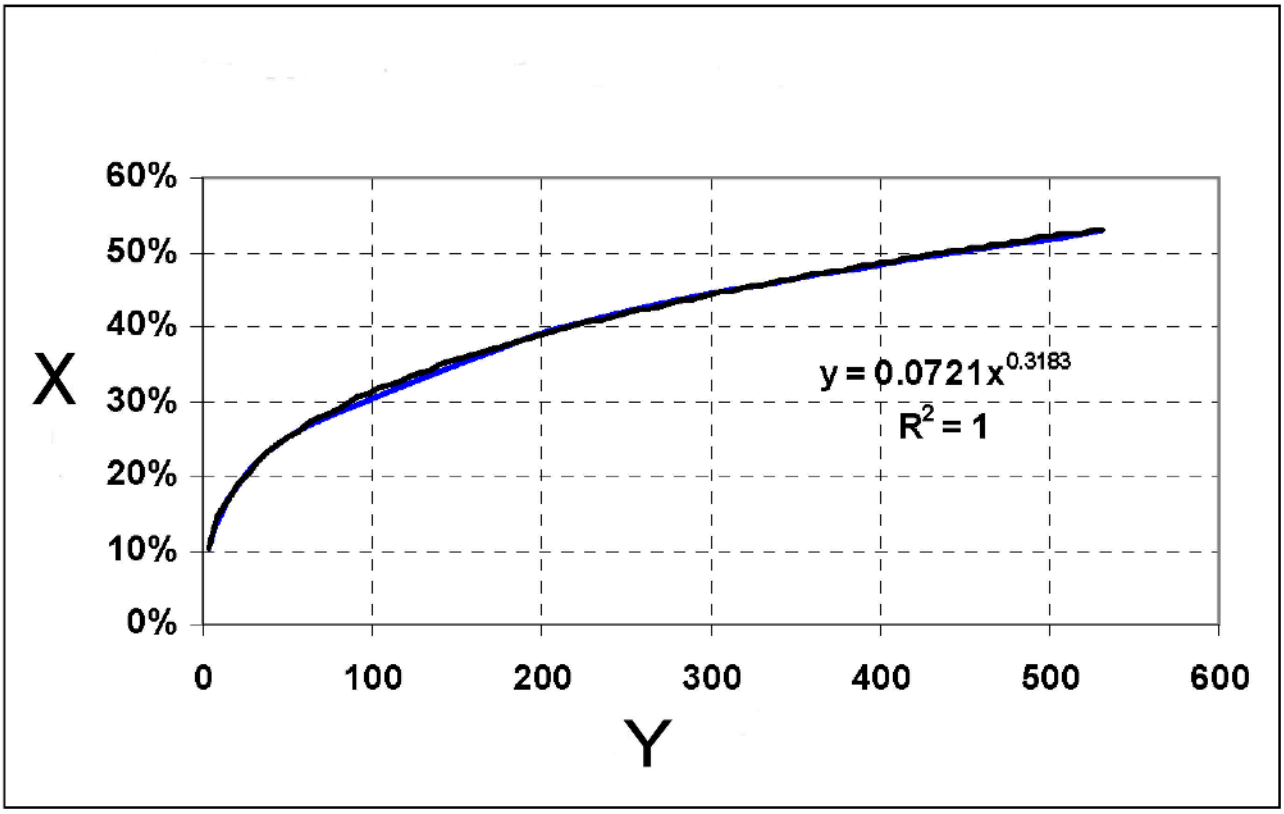
$$\eta = 0{,}092 Ln(P_{hydrau}) - 0{,}0403 \tag{H.4}$$

where

η is the efficiency of the liquid pump:

P_{hydrau} is the measured hydraulic power of the pump, expressed in W.

For information, the graphs of the efficiency of the pump versus its hydraulic power are given below.

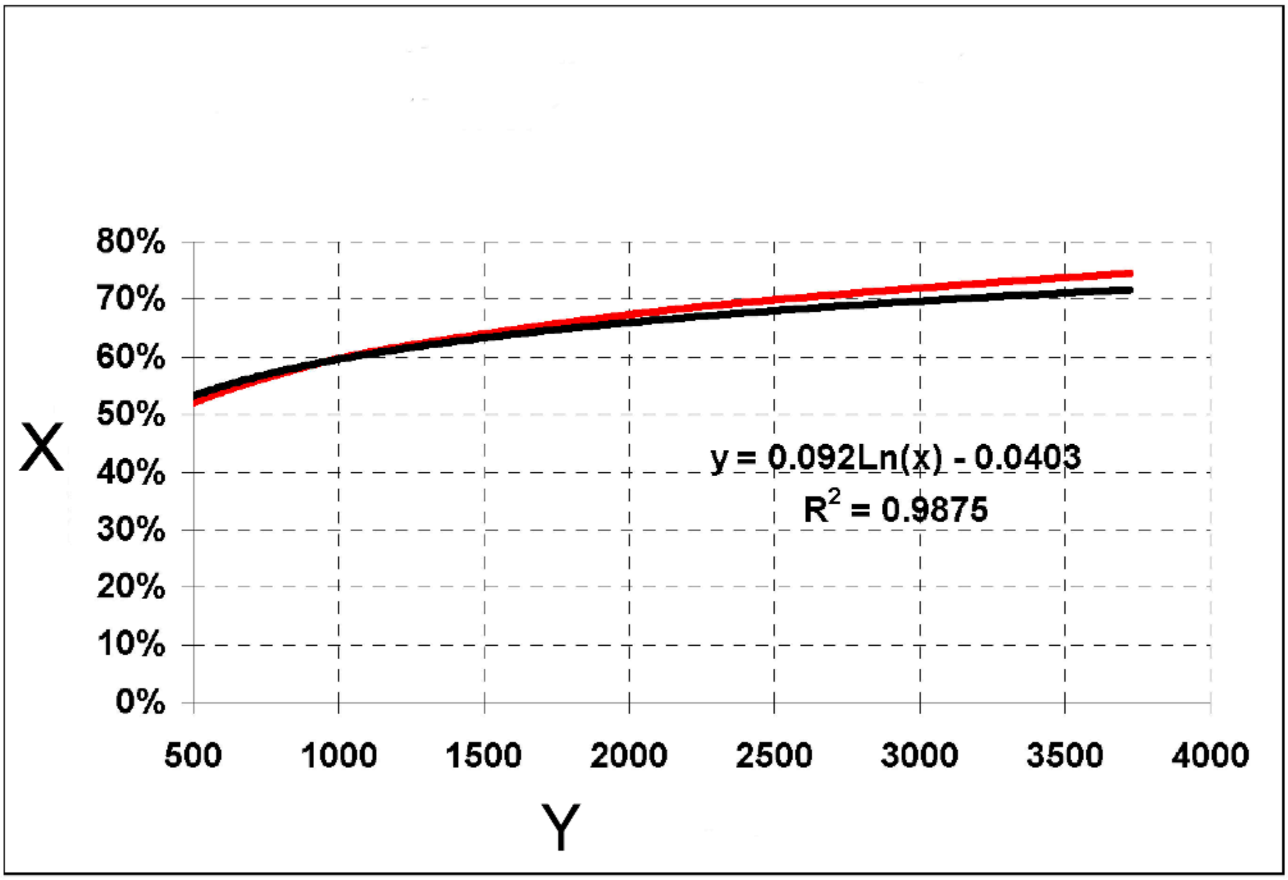


Key

X – efficiency

Y – phydrau (W)

Figure H.1a – Efficiency of circulating pumps (source: COSTIC)



Key

X – efficiency

Y – phydrau (W)

Figure H.1b – Efficiency of circulating pumps (extrapolation of COSTIC curve above 1kW)

Figure H.1 — Efficiency of the pump versus its hydraulic power graphs

Annex I
(informative)

Rating of indoor and outdoor units of multisplit and modular heat recovery multisplit system

I.1 General

This annex provides a possibility of rating multisplit and modular heat recovery multisplit systems by rating separately the indoor and outdoor units.

I.2 Definitions

In addition to the definitions given in EN 14511-1:2013, the following apply:

I.2.1
Outdoor cooling capacity
$P_{C,outdoor}$
total cooling capacity of the outdoor unit measured as the total indoor cooling capacity unit

I.2.2
Outdoor heating capacity
$P_{H,outdoor}$
heating capacity of the outdoor unit measured as the indoor heating capacity unit

I.2.3
Outdoor power input
$P_{E,outdoor}$
effective power input measured on the outdoor unit

I.2.4
Indoor power input
$P_{E,indoor}$
effective power input measured on the indoor unit

I.2.5
Outdoor energy efficiency ratio
$EER_{outdoor}$
ratio of the outdoor cooling capacity to the outdoor power input

I.2.6
Outdoor energy efficiency ratio
$COP_{outdoor}$
ratio of the outdoor heating capacity to the outdoor power input

I.3 Rating of indoor units

I.3.1 General

Non ducted indoor units shall be rated on the basis of the measurement of the power input, $P_{E,indoor}$

Ducted indoor units shall be rated on the basis of the measurement of the air flow rate and on the power input $P_{E,\text{indoor}}$

I.3.2 Air flow rate measurement

Ducted units shall have their flow rate measured according to Annex J.

I.3.3 Measurement of the power input of indoor units

The indoor unit shall be connected and shall run for a minimum of 30 min before measuring the total power input to the unit.

For ducted units, the measured power input shall be corrected from the fan power input due to external static pressure as specified in 4.1.5.

I.4 Rating of outdoor units

I.4.1 General

For rating an outdoor unit, it shall be connected to a minimum of two indoor units, for which a capacity ratio of (1 ± 5) % is obtained.

In case of ducted indoor units, the correction on the fan power due to the ESP of these units shall not be taken into account in the calculation of the effective power input, the cooling and/or heating capacities of the outdoor unit.

I.4.2 Test conditions

The test conditions shall be those as described in EN 14511-2 and as applicable to the multisplit or modular heat recovery multisplit system under test.

I.4.3 Test procedure

The cooling and/or heating capacity test(s) shall be performed according to the test procedure described in this standard.

The rated performance of outdoor units shall include the following as applicable:

- outdoor cooling / heating capacity : $P_{C,\text{outdoor}}$, $P_{\text{H,outdoor}}$
- outdoor power input in cooling/heating mode : $P_{\text{E, outdoor}}$
- outdoor energy efficiency ratio : EER_{outdoor}
- outdoor energy efficiency ratio : COP_{outdoor}

Annex J
(normative)

Air flow rate measurement

J.1 General

This annex provides information and describes the test procedure for rating the indoor and/or outdoor air flow rate of a ducted or non ducted air conditioner or heat pump.

J.2 Test installation

Packaged units and single split units shall have a duct section attached to the outlet area of the indoor section for connection to the air flow measuring device.

Multisplit systems shall have short plenums attached to each indoor unit. Each plenum shall discharge into a common duct section, the duct section in turn discharging into an air measuring device. Each plenum shall have an adjustable restrictor located in the plane where the plenums enter the common duct section for the purpose of adjusting the static pressures in each plenum to the manufacturer's specifications.

The length of the duct section for package and single split systems and the length of the individual plenums for multisplit systems is a minimum of $2{,}5 \times \sqrt{\left(4 \times \left(A \times B\right) \div \pi\right)}$ where A = width and B = height of duct or outlet. Static pressure readings are taken at a distance of $2 \times \sqrt{\left(A \times B\right)}$ from the outlet.

J.3 Test conditions

The air flow rate shall be related to standard air and measured with dry heat exchanger, when the fan only is operating.

For ducted units, the external static pressure ESP shall be set in accordance with 4.4.1.3 for units ducted on in the indoor heat exchanger and with 4.4.1.4 for units ducted on the outdoor heat exchanger.

For non ducted units, the ESP shall be set equal to zero (0).

J.4 Air flow measurement

Air flow measurements shall be made so that the requirement on the uncertainty of measurement given in Table 1 is fulfilled.

EN ISO 5167-1 and ISO 5801 may be used.

Annex ZA
(informative)

Relationship between this European Standard and the requirements of Commission regulation (EC) No 206/2012

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to requirements of *Commission Regulation (EC) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners*

Once this standard is cited in the Official Journal of the European Union under that Commission Regulation, compliance with the clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding requirements of that and associated EFTA regulations

Table ZA.1 — Correspondence between this European Standard and Commission Regulation (EC) No 206/2012

Clauses and subclauses of this EN	Requirements of Commission Regulation (EC) No 206/2012	Qualifying remarks/Notes
4 Annex A	Minimum energy efficiency for double duct and single duct air conditioners, EER_{rated}, COP_{rated}	
5.1 5.2	Maximum power consumption in off-mode and standby mode for single duct and double duct air conditioners, P_{off} and P_{SB}	
4 5.1 5.2 5.3 Annex A	Product information requirements for single duct and double duct air conditioners	
6 Annex J	Product information requirements for air conditioners except single duct and double duct air conditioners	

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] EN 14825, *Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors, for space heating and cooling — Testing and rating at part load conditions and calculation of seasonal performance*

[2] EN ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements (ISO 5167-1)*

[3] ISO 5801, *Industrial fans — Performance testing using standardized airways*

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