DRAFT INTERNATIONAL STANDARD ISO/DIS 15042

ISO/TC **86**/SC **6** Secretariat: **ANSI**

Voting begins on: **2005-07-11** Voting terminates on: **2005-12-12**

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Multiple split-system air-conditioners and air-to-air heat pumps — Testing and rating for performance

Systèmes de climatisation à division multiple et pompes à chaleur air/air — Essais et détermination des caractéristiques de performance

ICS 23.120; 27.080

In accordance with the provisions of Council Resolution 15/1993 this document is circulated in the English language only.

Conformément aux dispositions de la Résolution du Conseil 15/1993, ce document est distribué en version anglaise seulement.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

Pour accélérer la distribution, le présent document est distribué tel qu'il est parvenu du secrétariat du comité. Le travail de rédaction et de composition de texte sera effectué au Secrétariat central de l'ISO au stade de publication.

Contents **Page**

Tables

Annexes

1. SCOPE

1.1 This International Standard establishes performance testing and rating criteria for factory-made residential, commercial and industrial, electrically-driven, mechanical-compression, air-conditioners and heat pumps, described as basic multi-split systems, modular multi-split systems and modular heat recovery multi-split systems (see definitions in 3.15, 3.16, 3.17 and 3.18). These multi-split systems included air-to-air and water-to-air systems with non-ducted and/or including ducted indoor units with integral fans.

1.2 This International Standard is limited to single and multiple circuit split-systems which utilize one or more compressors with no more than two steps of control of the outdoor unit, and to split-systems with a single refrigeration circuit which utilize one or more variable-speed compressors or alternative compressor combinations for varying the capacity of the system by three or more steps and which are designed to operate with a combination of one or more outdoor units and two or more indoor units designed for individual operation, and such modular systems that are capable of transferring recovered heat from one or more indoor units to other units in the same system. The requirements of testing and rating contained in this standard are based on the use of matched assemblies.

1.3 This standard does not apply to the testing and rating of individual assemblies for separate use..

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

NOTE: For the purpose of the remaining clauses, the terms equipment and systems will be used to mean multi-split air-conditioners and/or multi-split heat pumps that are described in 1.1.

2. NORMATIVE REFERENCES

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard.

ISO 817, *Refrigerants Number designation*

ISO 3966, *Measurement of fluid flow in closed conduits – Velocity area method using pitot static tubes*

ISO 5221, *Air distribution and air diffusion Rules for methods of measuring air flow rate in an air handling duct*

ISO 5167, *Measurement of fluid flow by means of pressure differential devices*

Part 1: Orifice plates, nozzles and Venturi tubes inserted in circular cross-section conduits running full

3. DEFINITIONS

For the purposes of this International Standard, the following definitions apply (see Annex L for the symbols used to identify the terms contained in this International Standard):

3.1 Air, standard: dry air at 20,0EC and 101,325 kPa, having a mass density of 1,204 kg/m^3.

3.2 Capacity, full-: the capacity of the system when all indoor units and outdoor units are operated in the same mode. **3.3 Capacity, latent cooling**: the amount of latent heat the equipment can remove from the conditioned space in a defined interval of time, in watts.

3.4 Capacity, part-load: the capacity of the system when the capacity ratio is less than one.

3.5 Capacity ratio: ratio of the total stated cooling capacity of all operating indoor units to the stated cooling capacity of the outdoor unit at the rating conditions.

3.6 Capacity, heating: the amount of heat the equipment can add to the conditioned space in a defined interval of time, in watts.

3.7 Capacity, sensible cooling: the amount of sensible heat the equipment can remove from the conditioned space in a defined interval of time, in watts.

3.8 Capacity, total cooling: the amount of sensible and latent heat the equipment can remove from the conditioned space in a defined interval of time, in watts.

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

3.10 Coefficient of performance (COP): the ratio of the heating capacity to the effective power input to the device at any given set of rating conditions. (Where COP is stated without an indication of units, it shall be understood that it is derived from W/W.)

3.11 Heat recovery efficiency (HRE): the ratio of the total capacity of the system (heating and cooling capacity) to the effective power when operating in the heat recovery mode. (Where HRE is stated without an indication of units, it shall be understood that it is derived from W/W.)

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

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

3.14 Basic multi-split system: a split system air-conditioner or heat pump incorporating a single refrigerant circuit with one or more compressors, multiple evaporators (indoor units) designed for individual operation, and one outdoor unit. The system shall have no more than two steps of control and be capable of operating either as an air-conditioner or as a heat pump. Alternatively, a system having a variable speed compressor and a fixed combination of units specified by the manufacturer shall also be considered a basic multi-split system.

3.15 Multiple circuit multi-split system: a split system air-conditioner or heat pump incorporating multiple refrigerant circuits, two or more single speed compressors, multiple evaporators (indoor units) and an integrated heat exchanger in a single outdoor unit. The system shall be capable of operating either as an air conditioner or a heat pump. Alternatively, a system having a variable, fixed speed combination compressor and a number of indoor units as specified by the manufacturer shall also be considered a basic multi-split system

3.17 Modular multi-split system: a split system air-conditioner or heat pump incorporating a single refrigerant circuit, at least one variable speed compressor or an alternative compressor combination for varying the capacity of the system by three or more steps, multiple indoor units, each of which can be individually controlled, and one or more outdoor units. The system shall be capable of operating either as an air conditioner or a heat pump.

3.18 Modular heat recovery multi-split system: a split system air-conditioner or heat pump incorporating a single refrigerant circuit, at least one variable-speed compressor or an alternate compressor combination for varying the capacity of the system by three or more steps, multiple evaporators (indoor units, each capable of being individually controlled), and one or more condensers (outdoor units). This system is capable of operating as a heat pump where recovered heat from the indoor units operating in the cooling mode can be transferred to one or more other indoor units operating in the heating mode. NOTE: This may be achieved by a gas/liquid separator or a third line in the refrigeration circuit.

3.19 Effective power input (P_E) Average electrical power input to the equipment expressed in watts and obtained from:

- the power input for operation of the compressor;
- the power input to electric heating devices used only for defrosting;
- the power input to all control and safety devices of the equipment; and
- the power input for operation of all fans and, if applicable, any water-cooled condenser pump(s).

3.20 Total power input (P_t): the measured electrical input to the equipment during the test, expressed in watts.

4. Air Flow.

4.1 General

The volume flow and the pressure difference shall be related to standard air and with dry evaporator

4.2 Indoor Air Flow Setting.

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, and at an ambient dry-bulb temperature from 20 to 30 C and wet-bulb 13 to 17C with a relative humidity from 30% to 70%. The rated airflow rate given by the manufacturer shall be set and the resulting external static pressure (ESP) measured. This ESP shall be greater than the minimum value given in Table 1 but not greater than 80% of the maximum external static pressure specified by the manufacturer. If the fan of the unit has an adjustable speed, it shall be adjusted to the lowest speed that provide the minimum ESP or greater.

If the maximum ESP of the unit is lower than the minimum ESP given in Table 1, then the air flow rate is lowered to achieve an ESP equal to 80% of the maximum ESP of the manufacturer. In case this ESP is lower than 25 Pa, the unit can be considered as a free delivery unit

For units with free delivery the tests shall be conducted at standard rating conditions (see Table 1) with O Pa static pressure maintained at the air-discharge of the equipment and with the refrigeration means in operation and after condensate equilibrium has been obtained. All air quantities shall be expressed as m^3/s of standard air as defined in 3.1.

Table 1 — Pressure requirement for comfort air conditioners

Standard capacity ratings kW	Minimum external static pressure [a] [b] Pa
0 < Q < 8	25
8 ≤ Q < 12	37
12 ≤ Q < 20	50
20 ≤ Q < 30	62
30 ≤ Q < 45	75
45 ≤ Q < 82	100
82 ≤ Q < 117	125
117 ≤ Q < 147	150
Q > 147	175

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

[b]

4.3 Outdoor Air Flow

If the outdoor airflow is adjustable, all tests shall be conducted at the outdoor-side air quantity or fan control setting that is specified by the manufacturer. Where the fan is non-adjustable, all tests shall be conducted at the outdoor-side air volume flow rate inherent in the equipment when operated with the following in place: all of the resistance elements associated with inlets, louvers, and any ductwork and attachments considered by the manufacturer as normal installation practice. Once established, the outdoor-side air circuit of the equipment shall remain unchanged throughout all tests prescribed herein, except to adjust for any change caused by the attachment of the air-flow measuring device when using the outdoor air-enthalpy test method (see L.2.1).

4.4 Test Method.

4.4.1 The air flow settings of the units shall be in accordance with Annex A,.

4.5 Unit without indoor fan.

If no fan is supplied with the unit i.e. coil only units, the requirements in Annex A and the supplemental requirements given in Annex P also apply.

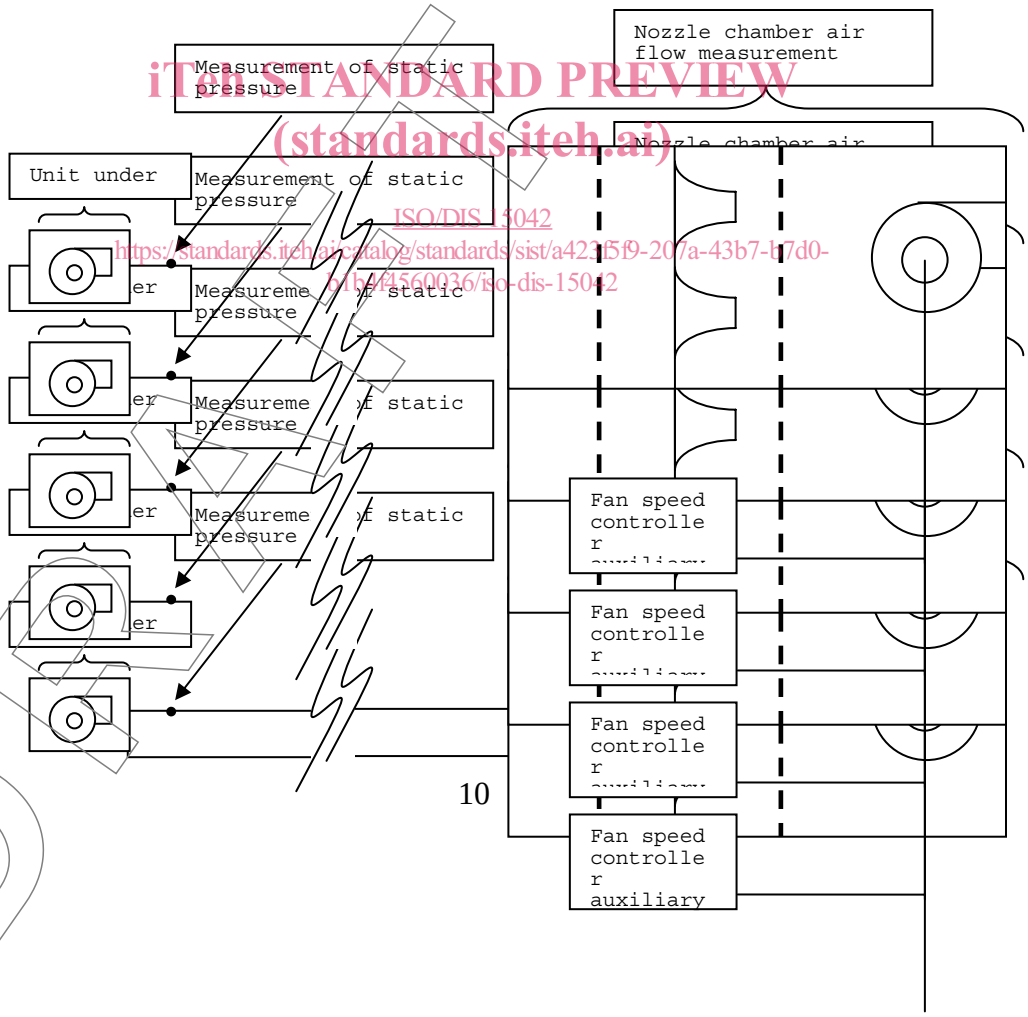

Figure 1 Arrangement of Auxiliary Fan Set Up.

. 5 COOLING TESTS

-5.1 Cooling capacity ratings

-5.1.1 General conditions.

5.1.1.1 All equipment within the scope of this standard shall have the cooling capacities and energy efficiency ratios determined in accordance with the provisions of this international standard and rated at the cooling conditions specified in Table 1. All tests shall be carried out in accordance with the requirements of Annex B and the test methods specified in Clause 7. The electrical input values used for rating purposes shall be measured during the cooling capacity test.

5.1.1.2 The tests shall be conducted with all indoor units and compressors functioning during this test (see A.2.2). Modular multi-split systems and modular heat recovery systems shall, for the purpose of this test, have the capacity ratio of indoor units to outdoor units equal to one, + - 5 %.

5.1.1.3 Tests for modular and modular heat recovery systems may be conducted at part-load cooling capacities. If conducted, part-load cooling capacities shall be determined in accordance with the requirements of Annex H

5.1.1.4 Tests may be conducted to determine the cooling capacities of individual indoor units, either operating with all other indoor units functioning or without any other indoor units functioning. If tests of the cooling capacities of individual indoor units are conducted, the capacities shall be determined in accordance with the requirements of Annex H.

5.1.1.5 The manufacturer shall state, for inverter-controlled compressors, the specific frequency that is needed to give full load capacity and the equipment shall be maintained at that frequency. If the manufacturer does not define the setting, the thermostat or controller shall be set to its minimum allowable temperature setting.

NOTE: If the equipment cannot be maintained at steady state conditions by its normal controls, then the manufacturer shall modify or over-ride such controls so that steady state conditions are achieved.

NOTE: To set up equipment for test which incorporates inverter-controlled compressors, skilled personnel with a knowledge of the control software will be required. The manufacturer or his nominated agent should be in attendance when the equipment is being installed and prepared for test.

5.1.2 Temperature conditions

5.1.2.1 The temperature conditions stated in Table 1, Columns T1, T2 and T3, shall be considered standard rating conditions for the determination of cooling capacity.

5.1.2.2 Equipment manufactured for use in a **moderate** climate similar to that specified in Table 1, Column T1 only, shall have a rating determined by tests conducted at these specified Table 1 conditions and shall be designated type T1 equipment.

5.1.2.3 Equipment manufactured for use in a **cool** climate similar to that specified in Table 1, Column T2 only, shall have a rating determined by tests conducted at these specified Table 1 conditions and shall be designated type T2 equipment.

5.1.2.4 Equipment manufactured for use in a **hot** climate similar to that specified in Table 1, Column T3 only, shall have a rating determined by tests conducted at these specified Table 1 conditions and shall be designated type T3 equipment.

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