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Air conditioning unit for data center and communication room

数据中心和通信机房用空气调节机组

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1 Scope

1 The document lays down the types and basic parameters, technical requirements, test methods, inspection rules and the marking, packaging, transport and storage of air conditioning units for data centres and communication rooms.

1 It applies to the air conditioning units, referred to below as computer room air conditioners, that provide a suitable environment for the electronic information equipment placed in data centres and communication rooms and in rooms housing computers, data processors, program-controlled exchanges, servers, network equipment and data storage devices.

3 Terms and definitions

3 The terms and definitions given in JB/T 7249, GB/T 17758 and GB 50174 apply, together

with those below.

3.1 A computer room air conditioner is an air conditioning unit that provides air circulation, filtration, cooling, reheating where fitted and humidity control for the electronic information equipment concentrated in data centres, communication rooms, computer rooms and similar places.

3.2 Free cooling is the process in which a system made up of heat exchangers, fans and distribution equipment brings air, water or another cold source obtained directly from outside the room, at a temperature below that of the air inside the room, into heat exchange with the air inside the room, so as to reduce or wholly replace mechanical refrigeration.

3.3 to 3.5 A compressor refrigeration type computer room air conditioner obtains its cooling capacity from the vapour compression refrigeration cycle alone. A composite refrigeration type unit has at least two modes of operation, compressor refrigeration and free cooling. A chilled-water type unit obtains its cooling capacity from chilled water below room temperature supplied by an external cold source, which a note explains to be equipment such as a water chiller or a cooling tower.

3.6 and 3.7 A dry cooler is a heat exchanger in which the fluid that has exchanged heat with the air inside the room exchanges heat with air obtained directly from outside the room; three notes give its abbreviated name, state that the cooled fluid may serve either as the cooling medium of the condenser of the refrigeration system or to cool the air inside the room, and name it a glycol dry cooler when the fluid inside the tubes is a glycol solution. An economic cooler is a heat exchanger in which the air inside the room exchanges heat with the fluid that has exchanged heat with air obtained directly from outside the room.

3.8 A thermosyphon loop is a device in which, by virtue of the difference in height and in density between condenser and evaporator or by means of a refrigerant pump or other motive equipment, the refrigerant circulates in a closed loop and transfers heat by evaporation and condensation. A note abbreviates it to heat pipe and includes both gravity and pumped heat pipes.

3.9 to 3.12 Standard rating conditions are one operating condition, or a set of them, laid down in the document to establish a comparable basis. Air flow is the volume of air, in the actual air state, that the unit delivers to the room in unit time under the stated test conditions, in cubic metres per hour. Sensible cooling capacity is the sensible heat removed from the room in unit time, and cooling capacity the total heat removed from the room in unit time, both in watts or kilowatts and both under the stated test conditions; a note adds that different conditions give different cooling capacities, the one measured at the nominal cooling condition being called the nominal cooling capacity.

3.13 to 3.15 Sensible heat ratio is the ratio of sensible cooling capacity to cooling capacity under the stated cooling capacity test conditions, reported to two decimal places. Cooling power input is the total power consumed by the unit in operation under those conditions.

Energy efficiency ratio, EER, is the ratio of cooling capacity to cooling power input, in watts per watt or kilowatts per kilowatt and reported to two decimal places, or to three when it is used as an intermediate value; notes add that the value calculated with the sensible cooling capacity is the sensible energy efficiency ratio EERS, and that the values at part load are called the part load energy efficiency ratio PEER and the part load sensible energy efficiency ratio PEERS.

3.16 and 3.17 Energy efficiency coefficient, EEC, is the ratio, for a chilled-water type unit under the stated cooling capacity test conditions, of the cooling capacity to the sum of the total power consumed and the electrical power equivalent of the water resistance, reported to two decimal places; the value calculated with the sensible cooling capacity is the sensible energy efficiency coefficient EECS. Cold-air ratio is the ratio of cooling capacity to air flow under the stated test conditions, in watts per cubic metre per hour and reported to one decimal place.

3.18 to 3.20 Annual energy efficiency ratio, AEER, is the ratio of the total heat removed from the room over a year of cooling operation to the total electricity consumed, in watt hours per watt hour and reported to two decimal places, the value calculated with the sensible energy efficiency ratio being the sensible annual energy efficiency ratio AEERS. Part load ratio is the ratio of the measured nominal cooling capacity to the declared value when the capacity control device, where fitted, is set at the position corresponding to part load, expressed as a percentage, full load being the state that gives the declared nominal cooling capacity and corresponding to a ratio of 100%. Part load annual energy efficiency ratio, PAEER, is the corresponding annual ratio at a particular part load ratio, which is normally agreed with the customer.

4 Types and basic parameters

4.1 Units are classified by construction as integral or split; by position relative to the servers as room level, in-row or rack level, the last two being abbreviated to in-row air conditioner and rack air conditioner; by the direction of supply air as upflow, horizontal flow or downflow; by return air temperature as the standard return air temperature type or the low return air temperature type; by capacity control as fixed capacity or variable capacity; and by product kind as compressor refrigeration type, subdivided into air-cooled, water-cooled and evaporatively cooled, composite refrigeration type, subdivided into heat pipe composite, glycol economic cooler composite and indirect evaporative cooling composite, and chilled-water type, subdivided into coil type and water-cooled heat pipe type. Together with the water-delivering products, these types make up the product standard system for the cooling equipment used in data centres and communication rooms, the standards followed by the typical products being given in Annex A.

4.2 The model designation may be settled by the manufacturer, but is to convey the cooling capability of the unit at the nominal condition; a note allows that capability to be an

approximation of the nominal cooling capacity.

4.3.1 The unit is to work normally under the conditions of Table 1. The indoor dry-bulb temperature range is 5 °C to 45 °C and the indoor relative humidity range 8% to 80%, both common to all three product kinds. The outdoor dry-bulb temperature range is -15 °C to 45 °C for the compressor refrigeration type and -35 °C to 45 °C for the composite refrigeration type, and is not applicable to the chilled-water type. The entering water temperature range is 7 °C to 34 °C for the compressor refrigeration type, 4 °C to 34 °C for the composite refrigeration type and 5 °C to 35 °C for the chilled-water type. The altitude is not to exceed 1000 m. Where the unit is used beyond these conditions, the manufacturer is to declare the fact and agree with the user on additional measures or on derating.

4.3.2 The test conditions of indirect evaporative cooling units follow JB/T 14641 and JB/T 14643. For other kinds, the standard conditions for the general performance tests are set in Tables 2, 3, 4 and 5 and those for the annual energy efficiency tests in Tables 6 and 7. Tables 2 to 7 set out, for each condition type such as nominal cooling, maximum load cooling, low temperature cooling, condensation, humidification capacity and reheating capacity, and for each unit mode and return air temperature type, the dry-bulb and wet-bulb temperatures on the using side and the dry-bulb, entering water, leaving water or glycol temperatures on the heat source side. In the extracted text the headings and the values of these six tables are destacked and cannot be matched to one another with confidence, so the individual temperatures are not reproduced here; footnotes to them state that the make-up water temperature on the heat source side of an evaporatively cooled unit is 15 °C to 30 °C during the test, that the water or liquid flow is held the same as at the nominal cooling condition, that a temperature recommended by the manufacturer is used where it is more severe than the one tabulated, and that the humidification condition applies when a wetted-film humidifier is used.

4.3.2 The external static pressure for both the general performance test and the annual energy efficiency test is 75 Pa for an upflow room level unit, 0 Pa for a horizontal flow room level unit and 20 Pa for a downflow room level unit; 0 Pa for an in-row unit; and 10 Pa for a rack level unit. A note allows a unit whose declared nominal cooling capacity was designed for conditions other than the nominal cooling condition of the document to be tested at the nominal condition declared by the manufacturer, using the test methods of the document.

5 Technical requirements

5.1 The general requirements are that the unit be made to drawings and technical documents approved by the prescribed procedure; that ferrous parts be given an anti-rust treatment; that electroplated surfaces be smooth and even in colour and free of peeling, exposed base metal, pinholes, obvious mottling and scratches, and that after the salt spray test of 6.23.1 no single rust spot or rust mark on the plated layer exceed 1 square millimetre in area, that there be not more than two rust spots or marks per 100 square centimetres of