(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

ANSI/ASHRAE Standard 127 was first published in 1988 and revised in 2001. This revision of the standard makes some significant changes to the 2001 edition. The major revisions and the rationale for them are summarized in the following paragraphs.

Definitions

The definition of coefficient of performance (COP) *has been rewritten to clarify that it is based upon net cooling capacity. Although this rating factor was always based upon net capacity, it is now clear that the efficiency is based upon the same value.*

A definition for sensible COP (SCOP) *has been added and subsequently used as the basis for all energy-efficiency ratings. This recognizes that the primary load in a computer and data processing room (CDPR) is a sensible load. As new loads are added to the space, these new loads are 100% sensible. A typical CDPR room today is 90% sensible and that ratio is increasing. In data processing rooms, units with too much latent capacity waste energy.*

A definition for adjusted sensible COP (ASCOP) *has also been added. Data processing equipment typically operates year round, and so a method for documenting a seasonal efficiency rating based on the climate data for a particular city has been established.*

Rating Requirements

The primary rating point (the Full Cooling Test A of Table 1) has been redefined at 23.9°C/45 RH (75°F/45 RH) verses the prior revision rating point of 22°C/50 RH (71.6°F/ 50 RH). The change was made to align the test conditions with the recommendations published in ASHRAE's Thermal Guidelines for Data Processing Environments*. In addition, test points are defined in Table 1 for establishment of the ASCOP.*

The system static pressure requirements (Section 5.1.4.5) have been adjusted as well as the physical unit arrangement required for testing in order to better reflect the three different types of units found in CDPR rooms. The orientation of a down-flow raised floor plenum CDPR unit during test has been defined according to how units are typically installed in actual applications.

Other key changes are as follows: standards for the testing and rating of the humidification and dehumidification systems have been added or clarified (Section 5.5), a minimum MERV rating for the air filters has been established (Section 5.6), a standard method for the test and rating of the noise emitted by the units has been established (Section 5.9), and the tolerance of the unit rating verses the test results has been tightened (Section 5.11).

The project committee is appreciative of the contributions Mukesh Khattar made in revising this standard.

1. PURPOSE

The purpose of the standard is to establish a uniform set of requirements for rating computer and data processing room (CDPR) unitary air conditioners.

2. SCOPE

This standard applies to classes of unitary equipment that are used to air condition a computer room and data processing equipment. This standard does not apply to the rating of individual assemblies, such as condensing units or direct expansion fan-coil units, for separate use.

3. DEFINITIONS

computer and data processing room (CDPR) unitary air conditioner: a computer and data processing room unitary air conditioner consisting of one or more factory-made assemblies, which include a direct expansion evaporator or chilled-water cooling coil, an air-moving device, and air-filtering devices. The air conditioner may include a compressor, condenser, humidifier, or reheating function. Where direct expansion equipment is provided in more than one assembly and the separate assemblies are to be used together, the requirements of rating outlined in this standard are based upon the use of matched assemblies. The functions of a CDPR air conditioner, either alone or in combination with a cooling and heating plant, are to provide air filtration, circulation, cooling, reheating, and humidity control.

cooling system energy coefficient of performance (COP): a ratio calculated by dividing the net total cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at any given set of rating conditions. The net total cooling capacity is the total gross capacity minus the energy dissipated into the cooled space by the blower system.

sensible coefficient of performance (SCOP): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding reheaters and humidifiers) at any given set of rating conditions. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system. (This is further explained in Section 5.1.)

adjusted sensible coefficient of performance (ASCOP): a SCOP value that provides a consistent evaluation of the energy efficiency of a unit operated in different ambient temperatures. It is calculated by the method defined in Section 5.2.

fluid economizer: a system configuration potentially available when an external fluid cooler is utilized for heat rejection. It utilizes a separate cooling coil within the unit for cooling and the cooled fluid returning from the external fluid cooler to provide cooling much like a chilled-water unit (i.e., without the use of compressors). This process is sometimes referred to as *free cooling*.

standard rating: a rating based on tests performed at standard rating conditions (see Section 5.1).

application rating: a rating based on tests performed at application rating conditions (i.e., conditions other than standard rating conditions). Application ratings do not require retesting, but can be extrapolated from standard rating tests. Application ratings are not required, but may be published at the manufacturer's option (see Section 5.8).

rating conditions: any set of operating conditions under which a single level of performance results, and which causes only that level of performance to occur.

standard rating conditions: rating conditions used as the basis of comparison of performance characteristics.

4. CLASSIFICATION

4.1 Normally, CDPR units within the scope of this standard can be classified as shown below. There are five basic types of unitary air conditioners:

1. *Single-Package Unit.* A complete stand-alone unit.
2. Condensing Unit with Separate Coil and Fan. The remote part of this unit contains the compressor and condenser while the indoor part of the unit is an evaporator and blower.
3. *Unit with Remote Condenser.* The remote part of the unit is an air-cooled condenser only, while the indoor part of the unit contains the compressor(s), evaporator coils, and fan.
4. *Unit with Remote Air-Cooled Fluidcooler or Cooling Tower.* The indoor part of the unit contains the compressor(s), evaporator coil, fan, and condenser. The heat rejection is by means of a remote device (a cooling tower or air-cooled fluidcooler) that uses water or glycol to transfer the heat.
5. *Chilled-Water Unit.* The indoor part of the unit is an air handler with a water-cooled coil that is connected to the building chilled-water system.

Note: Any of the above types may utilize a second, or dual, cooling coil that provides cooling by means of a free cooling liquid economizer or a separate building chilled-water system. Any of the above types may contain an internal humidifier and/or reheat capabilities.

5. RATING REQUIREMENTS

Section 5 describes all of the testing and rating requirements for this standard. A summary listing of the tests required is provided in Normative Appendix A.

5.1 Cooling System Standard Ratings and Sensible Cooling Efficiency Rating (SCOP). Standard rating capacity shall be established at the standard rating conditions specified in Full Cooling Test A of Table 1. Standard cooling capacity shall be stated as total (sensible plus latent) cooling capacity and sensible cooling capacity and shall be net values, reflecting the effects of circulating fan heat.

The efficiency rating (SCOP) shall be published at each of the four test points defined in Table 1. For Tests B through D the unit's net sensible cooling load shall be fixed at the sensible capacity established in Test A. During the test, the room temperature must be maintained to a tolerance of ±1°C (±2°F). If the test tolerance cannot be maintained, use the values from Test A for that test. A SCOP ratio shall be established at the defined test points by dividing this sensible capacity by the average kW/h input power over a two-hour period. Fan cfm is allowed to deviate from Test A provided that the sensible capacity is held constant.

Standard input ratings shall be the total power input to the compressor(s), fan(s), control(s), air-cooled condenser, or air-cooled fluidcooler fan(s) if used (excluding reheaters and humidifiers), and to any other items included as part of the model number(s). The values of SCOP and ASCOP should not be used to compare between various system classifications (air-cooled vs. water-cooled vs. CW, etc.) since there is no proper way to account for the unmeasured parts of the system. The air-cooled unit is the only complete system being analyzed. The other classifications are missing power consuming items, such as cooling towers, water pumps, fluid coolers, and chillers, to name a few.

5.1.1 Values of Standard Cooling System Input Ratings. These cooling ratings shall be expressed in terms of kW with three significant digits (e.g., 10.2 kW and 105 kW).

5.1.2 Value of Standard Capacity Ratings. These ratings shall be expressed in terms of kW with three significant digits (e.g., 10.2 kW and 105 kW).

5.1.3 Values of Standard Cooling System Coefficient of Performance Ratings. Coefficient of performance (COP) in kW per kW shall be expressed with three significant digits. (e.g., 3.35) This also applies to sensible coefficients of performance (SCOP) and adjusted sensible coefficients of performance (ASCOP).

5.1.4 Standard Rating Conditions. The conditions of test for standard ratings shall include the following.

5.1.4.1 Standard Cooling System Rating Temperatures. All indoor and outdoor conditions for testing are defined in Table 1. Also defined in Table 1 are the various fluid temperatures that may be used for heat rejection purposes.

5.1.4.2 Voltage and Frequency. Nameplate voltages for 60 Hz shall be one or more of the following utilization voltages: 115, 200, 208, 230, 265, 460, and/or 575. Standard rating tests shall be performed at the unit nameplate rated voltages and frequency. For air conditioners with dual voltage ratings, standard rating tests shall be performed at both voltages or at the lower of the two voltages if only a single standard rating is to be published. If desired, 50 Hz ratings at 230 and/or 400 volts may be published using this standard, but are not required.

5.1.4.3 Cooling Coil Air Quantity. Standard cooling system ratings shall be determined at a total air quantity (cooling coil plus bypass) delivered against at least the minimum external resistance required by Section 5.1.4.5, as outlined below.

Air quantities shall be expressed as cubic meters per hour (cmh) of standard air (density = 1.2 kg/m^3). If desired, the cfm of standard air may also be expressed as defined in the *2005 ASHRAE Handbook—Fundamentals*, Chapter 2 (e.g., 164.2 cmh [5800 cfm]).

TABLE 1 Standard Rating Conditions (Cooling/Efficiency)

		Base Rating (see Note a)	Rating Tests for Energy Calculations Only		
		A (Full Cooling)	B	C	D (see Note b)
All units: air temperature surrounding indoor part of unit	Return dry-bulb temperature	23.9°C (75.0°F)	23.9°C (75.0°F)	23.9°C (75.0°F)	23.9°C (75.0°F)
	Return dew-point temperature	11.1°C (52.0°F)	11.1°C (52.0°F)	11.1°C (52.0°F)	11.1°C (52.0°F)
	Return relative humidity	45%	45%	45%	45%
Air-cooled units: temperature surrounding remote air-cooled condenser	Dry-bulb temperature	35.0°C (95.0°F)	23.9°C (75.0°F)	12.8°C (55.0°F)	1.7°C (35.0°F)
Water-cooled units (connected to cooling tower)	Entering water temperature	30.0°C (86.0°F)	21.1°C (70.0°F)	12.8°C (55.0°F)	4.4°C (40.0°F)
	Leaving water temperature	35.0°C (95.0°F)			
	Fluid flow rate		Max = Test A (see Note b)	Max = Test A (see Note b)	Max = Test A (see Note b)
Glycol-cooled units (connected to a common glycol loop with a solution of 40% propylene glycol by volume)	Entering glycol temperature	40.0°C (104.0°F)	29.4°C (85.0°F)	18.3°C (65.0°F)	7.2°C (45.0°F)
	Leaving glycol temperature	46.0°C (115.0°F)			
	Fluid flow rate		Max = Test A (see Note c)	Max = Test A (see Note c)	Max = Test A (see Note c)
Chilled-water air-handling units	Entering water temperature	7.2°C (45.0°F)		10.0°C (50.0°F)	
	Leaving water temperature	13.9°C (57.0°F)		16.7°C (62.2°F)	
Reheating		**Base Rating**			
All units	Return dry-bulb temperature	23.9°C (75.0°F)			
Steam reheat units	Entering steam supply conditions	100 kPag (14.5 psig) and 121°C (250°F)			
Hot-water reheat units	Water temperature entering unit	80.0°C (176.0°F)			
	Water temperature leaving unit	70.0°C (158.0°F)			
Humidification/Dehumidification		**Humidification**		**Dehumidification**	
All units	Return dry-bulb temperature	23.9°C (75.0°F)		23.9°C (75.0°F)	
	Return dew-point temperature	9.5°C (49.0°F)		12.8°C (75.0°F)	
	Return relative humidity	40%		50%	
Steam humidifier units	Entering steam supply conditions	19 kPag (2.76 psig) and 105°C (221°F)			

Note a: The control is set to maintain the return dry-bulb temperature.
Note b: Test D is optional. If Test D is not performed, the results for Test D are the same as for Test C.
Note c: Test setup is as in Test A, but the head pressure control may lower the flow rate.

Air conditioners shall be rated at those air quantities specified by the manufacturer while in the full cooling mode at conditions in Test A of Table 1. Once these conditions are established for this standard rating test, no further adjustment to the drive or circuit shall be made.

5.1.4.4 Condenser/Air-Cooled Fluidcooler Air Quantity. Standard ratings for units that are air-cooled, evaporative-cooled, or glycol-cooled with an air-cooled fluidcooler shall be determined at the condenser/air-cooled fluidcooler air quantity that is inherent to the air conditioner when operated with all the resistance elements associated with the inlet or discharge attachments that the manufacturer considers normal installation practice. If fan speed control, or partial fan operation in a multifan condenser, is utilized for condensing temperature control, it may be utilized in this test as defined by the manufacturer. Air quantities must be expressed as cmh of standard air (density = 1.2 kg/m^3). If desired, cfm of standard air may also be expressed as defined in the *2005 ASHRAE Handbook—Fundamentals*, Chapter 2. **Example:** 164.2 cmh (5800 cfm).

5.1.4.5 External Resistance, Duct Connected, Floor Plenum and Free Air Discharge. For the appropriate system configuration described below, power consumption kW shall be as measured at the input terminals to the unit(s) and shall include power to the condenser/air cooled fluidcooler units. Compressor and/or motor nameplate data shall not be used.