BSR/ASHRAE Standard 127-2012R

Public Review Draft

Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces

Third Public Review (March 2020)

(Draft shows proposed Independent Substantive Changes to previous Public Review Draft)

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BSR/ASHRAE Standard 127-2012R, Method of Testing for Rating Air Conditioning Units Serving Data Center (DC) and Other Information Technology Equipment (ITE) Spaces
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This is a review of Independent Substantive Changes that were made since the last (second) Public Review. Text that was removed from the previous Public Review is provided for reference but is shown in strikeout, and text that has been added is shown with underlines.

Only these changes are open to comment at this time. All other material is provided for context only and is not open for Public Review comment except as it relates to the proposed changes.

(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, 2007, and 2012. Current revisions include changes to Title, Purpose, and Scope along with extensive changes to Sections 3, 4 and 5. The original Title, Purpose and Scope were determined to be limiting given evolution of cooling technologies currently being adopted for Data Centers and Information Technology Equipment Spaces. The revisions include adding new cooling types (i.e., Row Based Cooling, Rear Rack Door Heat Exchanger, and others). Substantial effort was given to Annex F providing illustrations of additional types of cooling technologies now included within the scope of this standard. These illustrations are not intended to be limiting.

The intent of SPC127 is to provide a recognized ASHRAE document to guide testing for rating of both existing and emerging cooling technologies that support DC and ITE systems. Regulatory agencies and industry advocates control precise efficiency ratings and performance requirements for identified product types. These requirements evolve with time and magnitude of installed base. Therefore, this document serves to provide overarching test methodologies for DC and ITE cooling technologies regardless of their state of adoption to support rapid product evolution.

Performance conditions and declaration requirements specified herein are for guidance in the absence of conditions from an applicable rating standard such as AHRI 1360.

3. DEFINITIONS

data center: A room or building or portions thereof not intended for human occupancy with a primary function to house equipment for the processing and storage of electronic data having a power demand greater than 10kW and 20 W/ft² (215 Watts/m²) of conditioned floor area.

5. RATING REQUIREMENTS

Section 5 describes all testing and rating requirements for this standard. A summary listing of the tests required is provided in Normative Annex A. The requirements of ASHRAE 37 and
ASHRAE 79\textsuperscript{12} shall be followed as applicable with exception of deviations stipulated within this standard.

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

5.1.2.2 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 Volt. 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 Volt may be published using this standard but are not required.

5.1.2.5 External Static Pressure for Ducted, Free Discharge, Downflow Floor Plenum units, Upflow Discharge Units where there is limited height in the test chamber and Packaged Air-to-air Heat Exchangers. For the appropriate conditioned air discharge described below, the external static pressure shall be as stated. For all but Downflow Floor Plenum units and those Upflow Discharge Units where there is limited height in the test chamber, follow the procedure in ANSI/ASHRAE 37\textsuperscript{2} and ANSI/ASHRAE 79\textsuperscript{12} exactly as written, without any modifications, including testing of free discharge units. Additionally, whenever ambient static pressure measurement is required, the tap location is critical and shall be placed in test chamber in an area out of direct airflow. Filters, heating devices, and other equipment recommended as part of the air conditioner shall be in place.

5.1.2.5.3 Downflow Floor Plenum. Air conditioners intended for use with field-installed raised floor plenums shall be tested at an external resistance of 50 Pa (0.2 in. w.c.). Follow the procedures in ANSI/ASHRAE 37\textsuperscript{2} and ANSI/ASHRAE 79\textsuperscript{12} as modified by the changes to the procedure that are shown in Normative Annex A per Figure A-1. Filters, heating devices, and other equipment recommended as part of the air conditioner shall be in place, and the net external resistance shall be available for the plenum system. Standard air quantity capacity is specified in Section 5.1.2.3.

\textit{Informative note:} Systems designed for floor plenum application, i.e., supply air discharged into a floor plenum for the purpose of air distribution within the conditioned ITE space, may also have return plenum connection, and such systems are not to be considered as ducted. The plenum connection having the same cross section dimensions of the air-conditioners return air opening may be considered as part of the air-conditioner not a duct.

5.2 Unit Efficiency Calculations

5.2.1 Net Sensible Coefficient of Performance Rating (NS\textit{Sen}COP). The efficiency rating (NS\textit{Sen}COP) is a measurement of net sensible cooling capacity kW/input power kW. It shall be published at five conditions: the “normalized zone condition” (iNS\textit{Sen}COP defined in Section 5.2.2) and at each of the four test points (A, B, C, and D) defined in Informative Annex E Performance Rating Table from AHRI 1360-2016. For tests B through D, net sensible cooling load produced by the test facility for the equipment under test shall be fixed at the sensible capacity established in Test A, within a tolerance of ±5%. During the test, the room temperature shall be
maintained by the automatic control features of the equipment under test to a tolerance of ±1°C (±
2°F). The process variable for automatic control feature of the equipment under test shall be either
return or supply air temperature. The heat capacity of the air within the conditioned air test loop
(external to volume of equipment under test) shall not exceed 23.6 kJ/°K (12.5 BTU/°R) per kW
of cooling capacity as determined during test A.

**Informative - The B, C, and D tests are required to operate at the same cooling load as the A
test, given the Data Center cooling load is constant year around. Since the compressor is
oversized and economization means may be included for the B, C, and D tests, it should be
understood that it could be difficult to maintain test conditions within the tolerances of the
current test method.**

**Informative – The prescribed testing conditions (A, B, C, and D) may benefit from enabling
economizer of equipment under test, if such a feature exists. Any test results using operation of
an economizer shall should indicate such and shall should include a record of all necessary
settings required to replicate the specific performance observation during the test with
economizer.**

If the test tolerance cannot be maintained, use the values from Test A for that test. An NSenCOP
ratio shall be established at the defined test points by dividing this net sensible capacity by the
average kilowatt per hour input power over a two-hour period. Air flow rate is allowed to deviate
from Test A provided that the net sensible capacity is held constant.

Standard input power rating shall be the total power input to the compressor(s), fan(s), control(s),
air-cooled condenser fan(s) if used (excluding rehetaters and humidifiers), and any other items
included as part of the model number(s). The values of NSenCOP and iNSenCOP should not be
used to compare between system classifications (air-cooled versus water-cooled versus CW, etc.),
since the accuracy for estimating the power of some of the external system components (pumps,
cooling towers, etc.), are just estimates and could vary from job to job.

5.2.1.1 **Minimum Data Collection Requirements.** Either power (in W) or energy (in W·h) shall
be measured. Power measurements shall be made with a sampling rate of no less than 1 per second
and shall be timestamped. Energy measurements shall be made with an integrating watt-hour meter
with a sampling rate of no less than 1 per 15 seconds.

5.5 **Humidification and Dehumidification System Standard Ratings.** Standard ratings shall be
established at the rating conditions specified in Annex E.

5.5.1 **Humidification Systems.** Standard humidification capacity shall be stated as both total and
net humidifier capacity. The system net humidification capacity shall reflect total humidifier
output minus the unit dehumidification as a result of operating the cooling system at conditions
for Test A of AHRI 1360 (see Annex E). The air conditioner shall be operated as described in the
manufacturer’s literature for the function of “humidifying with rated cooling.”

The measurement procedure shall be as specified in AHRI 640. The room conditions and entering
water temperature are as stated in Annex E.
5.5.1.1 Values of Standard Humidification System Capacity Ratings. These ratings shall be expressed only in terms of kilograms per hour kg/h in multiples of 250 g/h.

5.5.1.2 Values of Humidifier Standard Input Ratings. Standard input ratings shall be expressed in kilowatts with three significant digits (e.g., 10.2 kW) except for steam humidification systems, where input shall be expressed in kilograms per hour kg/h in multiples of 250 g/h.

5.5.2 Dehumidification Systems. Standard dehumidification capacity shall be stated as the total latent removal when in the full dehumidification mode of operation with no cooling required. Standard input ratings shall be the total power input to the fan motor(s) and any other components required for the dehumidification function (compressors, dampers, controls, etc.).

5.5.2.1 Values of Standard Dehumidification System Capacity Ratings. These ratings shall be expressed in kilograms per hour kg/h in multiples of 250 g/h.

5.9 Method for the Measurement and Designation of Noise Emitted by CDPRs. This section specifies the requirement for publishing sound power levels. One, two, or three measurement positions are required for each unit depending on the unit configuration as shown in Annex F. The measurement procedure shall be as specified in AHRI 260 or AHRI 370. Sound power levels shall be obtained using the comparison method and a reference sound source calibrated per AHRI Standard 250.7
NORMATIVE ANNEX A - TEST DUCTS FOR MEASURING AIR FLOW RATE AND STATIC PRESSURE ON ALL DOWNFLOW UNITS AND THOSE UP-FLOW UNITS IN LIMITED HEIGHT TEST CHAMBER

Notes
1. Return duct may be partitioned to reduce value of $\sqrt{C \times D}$. If partitioned, the separation between the two sections must be less than 10 cm (3.9 in).
2. Unit shall be mounted on manufacturer's approved floor stands without turning vane.
3. Supply duct may be partitioned, into two sections of equal width, to reduce the value of $\sqrt{A \times B}$. If partitioned, the separation between the two sections must be less than 10 cm (3.9 in).
4. Dimension is maximum dimension. Distance between bottom of unit and duct is not less than 5 cm (2 in).

$A = $ Width of coil section of unit under test
$Z = 1.2 \times $ width of unit under test minimum
$+$ Denotes Static Tap

Figure A-1 Test duct for measuring air flow and static pressure on Downflow units
Figure A-2 Test duct for measuring air flow and static pressure on those Up-flow units in limited height test chamber

Notes

1. Test duct elbow shall fit over provided duct flanges. If no flanges are provided, elbow entrance shall match dimensions of unit blower section.
2. Supply duct may be partitioned into two sections of equal width, to reduce the value of \( \sqrt{AXB} \). If partitioned, the separation between the two sections must be less than 10 cm (3.9 in).
3. Dimension is maximum dimension. Distance from top of unit to bottom of horizontal test duct is not less than 5 cm (2 in).

\[ A = \text{Width of coil section of unit under test} \]
\[ Z = \text{Width of unit under test} \]

+ Denotes Static Tap