AHRI Standard 1361-2022 (SI)

2022 Standard for

Performance Rating of Computer and Data Processing Room Air Conditioners

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ICS Code: 27.200

Note:

This standard supersedes AHRI Standard 1361 (SI)-2017.

For I-P ratings, see AHRI Standard 1360-2022 (I-P).

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Intent

This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, users, and regulators.

Review and Amendment

This standard is subject to review and amendment as technology advances.

2022 Edition

This edition of AHRI Standard 1361 (SI), *Performance Rating of Computer and Data Processing Room Air Conditioners*, was prepared by Datacom Standards Technical Committee. The standard was approved by the Applied Standards Subcommittee in November 2022.

Origin and Development of AHRI Standard 1361 (SI)

The initial publication was ANSI/AHRI Standard 1361 (SI)-2013, *Performance Rating of Computer and Data Processing Room Air Conditioners*. Subsequent revisions were:

ANSI/AHRI Standard 1361 (SI)-2013 (with Addendum 1), *Performance Rating of Computer and Data Processing Room Air Conditioners*
AHRI 1361 Standard (SI)-2014, *Performance Rating of Computer and Data Processing Room Air Conditioners*
ANSI/AHRI Standard 1361 (SI)-2016, *Performance Rating of Computer and Data Processing Room Air Conditioners*
AHRI Standard 1361-2017 (SI), *Performance Rating of Computer and Data Processing Room Air Conditioners*

Summary of Changes

AHRI Standard 1361-2022 (SI) contains the following updates to the previous edition:

- Added roof-mounted and wall-mounted units
- Modified ESP calculations for reduced heigh test chambers
- Added test requirements that are currently unreleased items in ASHRAE 37 and ASHRAE 127

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Committee Personnel

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Datacom Standards Technical Committee Scope:

The Datacom equipment (DCOM) Standards Technical Committee is responsible for the development and maintenance of AHRI standards and guidelines pertaining to Performance Rating of Computer and Data Processing Room Air Conditioners.

Out of scope for this STC include Chillers, Energy Recovery Ventilator (ERV), Variable Frequency Drives (VFD), Humidifiers, Air Distribution, Chilled Beam, Unit Ventilator, Room Fan Coils, Heat Exchange, Air Handling, Air Filters, Dehumidifiers, Air Cooling and Air Heating Coils (ACAH), and Thermal Storage Equipment not marketed for application in information technology equipment facilities.

Product definitions are as defined within AHRI 1360.

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This list represents the membership at the time the Standards Technical Committee and Standards Subcommittee were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. Membership on these committees shall not in and of itself constitute an endorsement by the committee members or their employers of any document developed by the committee on which the member serves.

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PERFORMANCE RATING OF COMPUTER AND DATA PROCESSING ROOM AIR CONDITIONERS

Section 1. Purpose

The purpose of this standard is to establish definitions, classification, test requirements, rating requirements, minimum data requirements for Published Ratings, marking and nameplate data, and conformance conditions for Computer and Data Processing Room Air Conditioners (CDPR).

Section 2. Scope

This standard applies to CDPRs specifically marketed for cooling Data Centers and Information Technology Equipment (ITE) and as defined in Section 3. This standard does not apply to the rating and testing of individual assemblies, such as condensing units or coils, for separate use.

Section 3. Definitions

All terms in this document will follow the standard industry definitions in the ASHRAE Terminology website unless otherwise defined in this section.

3.1 *Expressions of Provision*. Terms that provide clear distinctions between requirements, recommendations, permissions, options, and capabilities.

3.1.1 *"Can" or "cannot"*. Express an option or capability.

3.1.2 *"May"*. Signifies a permission expressed by the document.

3.1.3 *"Must"*. Indication of unavoidable situations and does not mean that an external constraint referred to is a requirement of the document.

3.1.4 *"Shall" or "shall not"*. Indication of mandatory requirements to strictly conform to the standard and where deviation is not permitted.

3.1.5 *"Should" or "should not"*. Indication of recommendations rather than requirements. In the negative form, a recommendation is the expression of potential choices or courses of action that is not preferred but not prohibited.

3.2 *Standard Specific Definitions*

3.2.1 *Air Economizer*. An automatic system that enables a cooling system to supply and use outdoor air to reduce or eliminate the need for mechanical cooling during mild or cold weather. Provides energy efficiency improvements on an annualized basis and is a function of regional ambient conditions and is not part of the NSenCOP metric.

3.2.2 *Air Sampling Device(s)*. A combination of Air Sampling Tree(s), conduit, fan and Aspirating Psychrometer or Dew-point Hygrometer used to determine dry-bulb temperature and moisture content of an air sample from critical locations.

3.2.2.1 *Air Sampling Tree*. An assembly consisting of a manifold with branch tubes with multiple sampling holes that draws an air sample from a critical location from the unit under test (such as an indoor air inlet, indoor air outlet, or outdoor air inlet).

3.2.2.2 *Aspirating Psychrometer*. An instrument used to determine the humidity of air by simultaneously measuring both the wet-bulb and dry-bulb temperatures. The difference between these temperatures is referred to as the wet-bulb depression.

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3.2.2.3 *Dew-point Hygrometer*. An instrument used to determine the humidity of air by detecting visible condensation of moisture on a cooled surface.

3.2.3 *Application Configurations.* Unit configurations other than Standard Configurations.

3.2.4 *Ceiling-mounted Unit*. A type of CDPR with an Indoor Unit marketed to be installed above a dropped ceiling inside a building with one airflow direction through the unit (horizontal) and multiple airflow connections. Discharge from the unit consists of either Ducted Discharge or Free Air Discharge. Return to the unit consists of either Ducted Return or Free Air Return.

3.2.5 *Coils*

3.2.5.1 *Chilled Water Dual Cooling Coil*. A secondary chilled water coil added in the indoor air stream of a CPDR for use as the primary or secondary cooling circuit in conjunction with a separate chiller.

3.2.5.2 *Coated Coils*. An indoor coil or outdoor coil whose entire surface, including the entire surface of both fins and tubes, is covered with a thin continuous non-porous coating to reduce corrosion.

3.2.5.3 *Hydronic Heat Coils (Steam or Hot Water).* Heat exchanger coils and controls that are located downstream of the cooling coil that can heat the air using building steam or hot water during the dehumidification process.

3.2.5.4 *Refrigerant Reheat Coils*. A heat exchanger located downstream of the indoor coil that heats the Supply Air during cooling operation using high pressure refrigerant to increase the ratio of moisture removal to Cooling Capacity provided by the equipment.

3.2.6 *Compressor Variable Frequency Drive (VFD)*. A device connected electrically between the equipment's power supply connection and the compressor that can vary the frequency of power supplied to the compressor to allow variation of the compressor's rotational speed for capacity control.

3.2.7 *Computer and Data Processing Room Air Conditioner (CDPR)*. An air conditioning unit specifically marketed for cooling Data Centers and ITE that consist of one or more factory-made assemblies, that include a direct expansion evaporator or chilled water-cooling coil, an air-moving device(s) and air-filtering device(s). The air conditioner can include a compressor, condenser, Humidifier, or reheating function. Functions alone or in combination with a cooling plant, can include providing air filtration, air circulation, cooling, and humidity control if the necessary options are included for humidity control.

3.2.8 *Computer Room Air Conditioner (CRAC)*. A CDPR that utilizes dedicated compressors and refrigerant cooling coils rather than chilled-water coils.

3.2.8.1 *Air-cooled*. A CRAC refrigeration system that has an Air-cooled condenser heat exchanger.

3.2.8.2 *Glycol-cooled*. A CRAC refrigeration system that has a Glycol-cooled condenser heat exchanger.

3.2.8.3 *Water-cooled*. A CRAC refrigeration system that has a Water-cooled condenser heat exchanger.

3.2.9 *Computer Room Air Handler (CRAH).* A CDPR that utilizes chilled-water coils for cooling rather than dedicated compressors.

3.2.10 *Condensate Pump*. A device used to pump condensate or Humidifier drain water, or both from inside the unit to a customer drain outside the unit.

3.2.11 *Connections to Condenser or Condensing Unit*.

3.2.11.1 *Ducted Condenser*. A condenser or condensing unit that Manufacturer's Installation Instructions indicate is intended to exhaust condenser air through a duct(s).

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3.2.11.2 *Free Air Discharge Condenser.* A condenser or condensing unit that Manufacturer's Installation Instructions do not indicate is intended to exhaust condenser air through a duct(s).

3.2.12 *Data Center*. A room or building, or portions thereof, including computer rooms being served by the data center systems, serving a total ITE load greater than 10 kW and 20 W/ft^2 (215 W/m^2) of conditioned floor area.

3.2.13 *Discharge.*

3.2.13.1 *Ducted Discharge.* A configuration of unit that is marketed for use with discharge ducting and is not Raised Floor Plenum Discharge.

3.2.13.2 *Free Air Discharge.* A configuration of unit that is marketed only for use without discharge ducting and is not Raised Floor Plenum Discharge.

Note: Can be referred to as non-ducted discharge.

3.2.13.3 *Raised Floor Plenum Discharge.* A configuration of unit that is marketed to discharge air into an opening in a raised floor plenum.

3.2.14 *Electric Reheat Elements*. Elements and controls that are located downstream of the cooling coil that can heat the air using electrical power during the dehumidification process.

3.2.15 *Fire/Smoke/Isolation Dampers*. An assembly including means to open and close the damper mounted at the supply or return duct opening of the equipment.

3.2.16 *Flooded Condenser Head Pressure Controls*. An assembly, including a receiver and head pressure control valve, used to allow for unit operation at lower outdoor ambient temperatures than the standard operating control system.

3.2.17 *Floor-mounted Unit***.** A type of CDPR with an Indoor Unit that is marketed to be installed on a raised floor, floor stand, or a solid floor inside the building. These have two airflow configuration options: direction and connection. Each unit can be a combination of one direction and two connections (one Discharge from unit and one Return to unit). Discharge from the unit consists of either Ducted Discharge, Free Air Discharge, or Raised Floor Plenum Discharge. Return to the unit consists of either Ducted Return, Free Air Return, or Raised Floor Plenum Return.

Flow direction of the unit consists of either**:**

3.2.17.1 *Downflow.* A Floor-mounted Unit where return air enters above the top of the cooling coil and discharge air leaves below the bottom of the cooling coil.

3.2.17.2 *Horizontal-flow.* A Floor-mounted Unit that is neither a Downflow nor an Upflow unit.

3.2.17.3 *Upflow.* A Floor-mounted Unit where return air enters below the bottom of the cooling coil and discharge air leaves above the top of the cooling coil.

3.2.18 *Fluid Economizer.* An option provided in a CRAC or CRAH system where a fluid (other than air), cooled external from the unit, provides cooling of the indoor air to reduce or eliminate unit compressor operation when outdoor temperature is low. The fluid can include, but is not limited to, chilled water, water/glycol solution, or refrigerant. An external fluid cooler such as, but not limited to a dry cooler, cooling tower, or condenser is utilized for heat rejection. Note: Can be referred to as a free cooling coil, econ-o-coil, or economizer.

3.2.19 *Harmonic Distortion Mitigation Devices*. A high voltage device that reduces harmonic distortion measured at the line connection of the equipment that is created by electronic equipment in the unit.

3.2.20 *High-Efficiency Indoor Air Filtration.* Indoor air filters with a specification greater than MERV 8 for ducted units and MERV 1 for non-ducted units.

3.2.21 *Humidifier*. A device placed in the supply air stream for moisture evaporation and distribution.

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3.2.22 *Indoor Unit*. Refers to the part of the system that removes heat from the indoor air stream in split systems and refers to the unit in single package units.

3.2.23 *Information Technology Equipment (ITE).* Includes computers, data storage, servers, and network/communication equipment.

3.2.24 *Integrated Net Sensible Coefficient of Performance (iNSenCOP)*. A value that provides a standardized evaluation of the annualized cooling energy efficiency of a unit operated across the specified range of outdoor ambient temperatures (see Table 1 and Informative Appendix G).

3.2.25 *Manufacturer's Installation Instructions***.** Manufacturer's documents that come packaged with or appear in the labels applied to the unit(s). This includes online manuals if referenced on the unit label or in the documents that come packaged with the unit, and certification reports (information provided to authorities having jurisdiction concerning testing) provided by the manufacturer.

3.2.25.1 *Supplemental Test Instructions (STI).* Additional instructions developed by the manufacturer and certified to the United States Department of Energy (DOE).

3.2.25.2 *Manufacturer-specified.* Information provided by the manufacturer in the Manufacturer's Installation Instructions.

3.2.26 *Net Sensible Coefficient of Performance (NSenCOP)*. A ratio of the Net Sensible Cooling Capacity in kilowatts to the total power input in kilowatts (excluding reheaters and Humidifiers) at any given set of Rating Conditions.

3.2.27 *Net Sensible Cooling Capacity.* The rate, expressed in kW, where the equipment removes sensible heat from the air passing through the unit under specified conditions of operation, including the fan energy dissipated into the conditioned space.

3.2.28 *Net Total Cooling Capacity*. The rate, expressed in kW, where the equipment removes total heat from the air passing through the unit under specified conditions of operation, including the fan energy dissipated into the conditioned space.

3.2.29 *Non-standard Control Valve*. A pressure or electromechanical water control valve or component in chilled water units used to control unit operation to meet customer specific requirements (such as a three-way valve or a high-pressure valve).

3.2.30 *Non-standard Power Transformer*. A device applied to a high voltage load that transforms input electrical voltage to that voltage necessary to operate the load.

3.2.31 *Powered Fans.*

3.2.31.1 *Powered Exhaust Fan*. Transfers a portion of the building air that is returning to the unit directly to the outside, rather than allowing the air to recirculate to the indoor coil and back to the building.

3.2.31.2 *Powered Return Air Fan*. Draws building air into the equipment.

3.2.32 *Process Heat Recovery / Reclaim Coils / Thermal Storage.* A heat exchanger located inside the unit that conditions the equipment's supply air using energy transferred from an external source using a vapor, gas, or liquid.

3.2.33 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated Rating Conditions, where a unit can be chosen to fit the application. These values apply to all units of same nominal size and type (identification) produced by the same manufacturer This includes the rating of all performance characteristics shown on the unit or published in specifications, advertising, or other literature controlled by the manufacturer, at stated Rating Conditions.

3.2.33.1 *Application Rating.* A rating based on tests performed at rating conditions other than Standard Rating Conditions.

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3.2.33.2 *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.

3.2.34 *Rating Conditions*. Any set of operating conditions where a single level of performance results that causes only that level of performance to occur.

3.2.34.1 *Standard Rating Conditions.* Rating Conditions used as the basis of comparison for performance characteristics.

3.2.34.2 *Application Rating Conditions*. Rating Conditions other than Standard Rating Conditions.

3.2.35 *Return.*

3.2.35.1 *Ducted Return.* A configuration of unit that is installed to return air from ductwork or a return plenum.

3.2.35.1 *Free Air Return.* A configuration of unit that is installed to not return air from ductwork or a return plenum.

Note: Can be referred to as non-ducted return.

3.2.35.3 *Raised Floor Plenum Return.* A configuration of unit that is installed such that it takes in return air from an opening in a raised floor plenum.

3.2.36 *Roof-mounted Unit.* A type of single-package CDPR that is not wall-mounted and is marketed for outdoor installation (such as on a roof or a slab).

3.2.37 *Standard Air.* Air weighing 1,2 kg/m^3 that approximates dry air at 21°C and at a barometric pressure of 101,3 kPa.

3.2.38 *Standard Airflow*. The volumetric flowrate of air corrected to Standard Air conditions expressed in standard cubic meter per hour (m^3/h of Standard Air).

3.2.39 *Standard Configuration.* A specific configuration for rating of the CDPR basic indoor cooling unit types as defined below and as shown in Appendix C.

3.2.39.1 *Ceiling-mounted Unit–ducted Standard Configuration*. A Ceiling-mounted Unit with Ducted Discharge and Ducted Return.

3.2.39.2 *Ceiling-mounted Unit–nonducted Standard Configuration.* A Ceiling-mounted Unit with Free Air Discharge and Free Air Return.

3.2.39.3 *Downflow Unit Standard Configuration*. A Floor-mounted Unit with Downflow, Raised Floor Plenum Discharge, and Free Air Return.

3.2.39.4 *Horizontal-flow Unit Standard Configuration*. A Floor-mounted Unit with Horizontal-flow, Free Air Discharge, and Free Air Return.

3.2.39.5 *Roof-mounted Unit-ducted Standard Configuration.* A Roof-mounted Unit with Ducted Discharge and Ducted Return.

3.2.39.6 *Upflow Unit–ducted Standard Configuration.* A Floor-mounted Unit with Upflow, Ducted Discharge and Free Air Return.

3.2.39.7 *Upflow Unit–nonducted Standard Configuration.* A Floor-mounted Unit with Upflow, Free Air Discharge and Free Air Return.

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3.2.39.8 *Wall-mounted Unit Standard Configuration*. A Wall-mounted Unit with Free Air Discharge and Free Air Return.

3.2.40 *Total Humidification Capacity*. The unit's total humidification output operating at Standard Rating Conditions (see Table 3). The mechanical cooling system is disabled to establish this rating.

3.2.41 *Wall-mounted Unit.* A type of CDPR where the Indoor Unit is marketed for installation on or through a wall.

Section 4. Classifications

CDPR units within the scope of this standard shall be classified as shown in Table 1.

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Table 1. Classification of CDPR			
Designation	**AHRI Type[1,2]**	**Arrangement – Indoor (ID)**	**Arrangement – Outdoor (OD)**
Air-cooled Indoor Package with Remote Condenser	CRC-A[3] CRC-A-FC[3]	EVAP ID FAN COMP REHEAT[4] HUMIDIFIER[4]	COND FAN COND REFRIGERANT PUMP[4,5]
Air-cooled Indoor Package with Remote Condensing Unit	CRCU-A[3] CRCU-A-FC[3]	EVAP ID FAN REHEAT[4] HUMIDIFIER[4]	COND FAN COND COMP REFRIGERANT PUMP[4,5]
Air-cooled Indoor Package Self-Contained	CSP-A[3] CSP-A-FC[3]	EVAP ID FAN COND FAN COND COMP REHEAT[4] HUMIDIFIER[4] REFRIGERANT PUMP[4.5]	
Air-cooled Outdoor Package Self-Contained Wall-mounted	CSP-A		ELEC/GAS HEAT[4] ID FAN EVAP COND FAN COMP COND REFRIGERANT PUMP[4,5]
Air-cooled Outdoor Package Self-Contained Roof-mounted	CSP-A		ELEC/GAS HEAT[4] ID FAN EVAP COND FAN COMP COND REFRIGERANT PUMP[4,5]
Fluid-cooled Indoor Package (attached to customer fluid heat rejection)	CSP-W[3] CSP-W-FC[3]	EVAP ID FAN COMP[6] FLUID COND[6] ECONOMIZER COIL[4] REHEAT[4] HUMIDIFIER[4]	CUSTOMER COOLING TOWER OR DRY COOLER[7]
Indoor Fan Coil	CFC-C	COIL ID FAN REHEAT[4] HUMIDIFIER[4]	CUSTOMER CHILLER

Notes:

1. A suffix of "-O" following any of the above classifications indicates equipment not intended for use with field-installed duct systems.
2. A suffix of "-A" indicates Air-cooled condenser, "-W" indicates Water-cooled or Glycol-cooled condenser, "-C" indicates indoor chilled-water coil, and “-FC” indicates free cooling coil (can be additional).
3. For a ducted indoor condenser/condensing unit, append “-DD” and outdoor arrangement moves from outdoor side to indoor side.
4. Optional component.
5. Refrigerant economizer pump can be indoors or outdoors and is only included in “-FC” units.
6. Component can be remote.
7. For "-W" products, outdoor arrangement can move from outdoor side to indoor side.

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Section 5. Test Requirements

5.1 *Test Requirements.* All tests shall be conducted in accordance with ASHRAE 127 and ASHRAE 37. In the event of conflicting instructions between test standards, this standard takes precedence. Any deviations shall be described and documented in a test report

5.2 *Heat Rejection Loop Components for Water-Cooled and Glycol-Cooled Units*. Heat rejection loop components other than the fluid-refrigerant condenser coil are not part of the unit or system under test. Electric energy input of Air-cooled fluid coolers, cooling towers or pumps, or both are not included in system power measurements. Instead, water or glycol, as applicable, shall be supplied to the condenser heat exchanger at the temperature conditions specified in Section 6.1.

5.3 *Compressors in the Indoor Unit.* To account for compressor heat, in the following cases:

For systems where the compressor(s) is housed in a part of the unit that the Manufacturer's Installation Instructions indicate is intended for indoor installation, and the compressor(s) is separately ventilated from the evaporator or condenser airstream (meaning, there is a separate airpath for heat to escape the compressor compartment to outside the unit) the enclosure shown in Figure 3 of ASHRAE 37 shall be used.

For systems with the compressor(s) housed in a part of the unit that the Manufacturer's Installation Instructions indicate is intended for indoor installation, but the compressor(s) is not separately ventilated from the evaporator or condenser airstream, the enclosure shown in Figure 3 of ASHRAE 37 is not required unless the required heat balance between primary and secondary capacity measurements (see Section E3) cannot be achieved. In that case, the enclosure shall be used.

When using the refrigerant enthalpy method as a secondary test method for such systems in accordance with Section 7.5 of ASHRAE 37, the temperature and pressure of the refrigerant leaving the indoor side shall be made downstream of the compressor (meaning, discharge measurements rather than suction measurements). Further, for such systems the compressor power shall be included in the "power input, indoor side" term used to calculate total cooling capacity in the equations specified in Section 7.5.4.1 of ASHRAE 37.

5.4 *Installation Instruction Priority.* Units shall be installed per Manufacturer's Installation Instructions. In the event of conflicting instructions regarding the set-up of the unit under test (excluding charging instructions for split systems, see Section 5.4.1), priority shall be given to installation instructions that appear on the unit's label over installation instructions that are shipped with the unit.

5.4.1 *Instructions for Split Systems.* In the event of conflicting charging instructions for split systems, priority shall be given to the Manufacturer's Installation Instructions that are shipped with the unit over the Manufacturer's Installation Instructions that appear on the unit's label. For split systems other than mix-matched systems (see Section 5.4.2), if the Manufacturer's Installation Instructions for the components conflict, priority shall be given to the unit that houses the compressor, except for provisions regarding setting indoor airflow and external static pressure (ESP). For setting indoor airflow and ESP for such a split system, priority shall be given to the Indoor Unit Manufacturer's Installation Instructions.

5.4.2*Mix-Matched Systems*. The following provisions apply for split systems consisting of units from different manufacturers. If instructions for the two units differ, priority shall be given to the Manufacturer's Installation Instructions for the unit that is from the manufacturer that distributed in commerce the tested system. If Manufacturer's Installation Instructions are provided for only one of the units, then use the provided instructions.

5.5 *Special Test Duct Setup for Certain Upflow Units.* For Upflow Units where there is limited height to meet the ducting requirement of ASHRAE 37 in the test chamber, set up the unit for testing in accordance with Section E2.

5.6 *Test Setup for Free Air Discharge Unit.* Follow the instructions for testing free air discharge units specified in Appendix E, Section E6.

5.7 *Test Setup for Downflow Units.* The unit shall be mounted on a floor stand that is either supplied by the manufacturer or meets specifications provided in the Manufacturer's Installation Instructions. When setting up the unit, the floor stand shall have discharge out the front, and with the other three sides enclosed and sealed to prevent air leakage. To minimize duct losses, the enclosed sides and bottom of the floor stand shall be insulated externally (meaning, insulation outside of the floor stand)

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with thermal insulation having an R-value of at least 2,3 $m^2 \cdot K/W$. Refer to Figure A-1 of Normative Annex A of ASHRAE 127 for test duct requirements. All duct measurements shall be exclusive of thermal insulation.

5.8 *Refrigerant Charging.* Unless the unit does not require charging (per Section 5.9), use the tests or operating conditions specified in the Manufacturer's Installation Instructions for charging. If the Manufacturer's Installation Instructions do not specify a test or operating conditions for charging or if Manufacturer's Installation Instructions are not provided, charging shall be conducted at Standard Rating Conditions. If the Manufacturer's Installation Instructions contain two sets of refrigerant charging criteria, one for field installation and one for lab testing, use the field installation criteria. Perform charging of refrigerants only with refrigerant in the liquid state.

If the Manufacturer's Installation Instructions give a Manufacturer-specified range for a charging parameter (such as superheat, sub-cooling, or refrigerant pressure), the average of the range shall be used to determine the refrigerant charge.

If Manufacturer's Installation Instructions are not provided, or the Manufacturer's Installation Instructions do not provide parameters and target values, or both, set superheat to a target value of 6,7°C for fixed orifice systems or set subcooling to a target value of 5,6°C for expansion valve systems.

In the event of conflicting information between charging instructions, use the instruction priority order indicated in Section 5.4. Conflicting information is defined as multiple Manufacturer-specified conditions given for charge adjustment where all Manufacturer-specified conditions cannot be met. If such instances of conflicting information occur within the highest-ranking set of instructions where refrigerant charging instructions are provided, follow the hierarchy in Table 2, as appropriate, unless the manufacturer specifies a different priority in the Manufacturer's Installation Instructions. Unless the Manufacturer's Installation Instructions specify a tighter charging tolerance, the tolerances specified in Table 2 shall be used.

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Table 2. Tolerances for Charging Hierarchy					
Fixed Orifice			Expansion Valve		
Priority	Parameter	Tolerance	Priority	Parameter	Tolerance
1	Super-heat	± 1,1°C	1	Sub-cooling	± 1,1°C
2	High Side Pressure or Saturation Temperature	± 28 kPa or ± 0,6°C	2	High Side Pressure or Saturation Temperature	± 28 kPa or ± 0,6°C
3	Low Side Pressure or Saturation Temperature	± 28 kPa or ± 0,6°C	3	Low Side Pressure or Saturation Temperature	± 14 kPa or ± 0,5°C
4	Low Side Temperature	± 1,1°C	4	Approach Temperature[1]	± 0,6°C
5	High Side Temperature	± 1,1°C	5	Charge Weight	± 57 g
6	Charge Weight	± 1% of nominal charge or ± 57 g, whichever is greater	-	-	-

Note:
1. Approach temperature means the refrigerant temperature at the outdoor liquid service port minus the outdoor ambient temperature.

5.9 *Refrigerant Charge for Single Package Unit.* Install one or more refrigerant line pressure gauges during the setup of the unit unless either

1) the Manufacturer's Installation Instructions indicate that pressure gauges shall not be installed; or
2) charging is based only on parameters, such as charge weight, that don't require measurement of refrigerant pressure.

Use methods for installing pressure gauge(s) at the required location(s) as indicated in Manufacturer's Installation Instructions if specified.

The refrigerant charge obtained as described in this section shall then be used to conduct all tests used to determine performance. All tests shall run until completion without further modification. If measurements indicate that refrigerant charge has leaked during the test, repair the refrigerant leak, repeat any necessary set-up steps, and repeat all tests.

5.10 *Break-in Period*. Conduct a compressor break-in period prior to conducting the test if there is a Manufacturer-specified break-in period. Conduct the break-in period using the Manufacturer-specified duration and conditions; however, the duration shall not exceed twenty hours. When there is a Manufacturer-specified break-in period, each compressor of the unit shall undergo this break-in period. Testing shall not commence until the Manufacturer-specified break-in period is completed.

5.11 *Steady-state Operation*. Steady-state operation shall be achieved for a valid cooling capacity test. Steady-state operation is achieved when two consecutive thirty-minute data measurement periods (the latter constitutes the official test when cooling capacity is measured) meet the following criteria:

1) The difference between the total input power meaning, the cumulative unit input power consumption) measured throughout each data measurement period shall not be greater than 2% of the value measured during the latter of the two data measurement periods.
2) The difference between the total net capacity meaning, the cumulative total net capacity calculated using the primary capacity measurement method) measured throughout each data measurement period shall not be greater than 2% of the value measured during the latter of the two data measurement periods.
3) All measurements required by the cooling test shall meet the applicable tolerances specified in Table 7.

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5.12 *Test Duration.* Test duration shall be thirty minutes for all cooling capacity tests.

5.13 *Total System Power Measurement.* Total input system power, kW, shall be measured at the electrical source connection (such as main power circuit breaker(s), main power distribution block(s), main power disconnect(s)) of the CRAC or CRAH under test.

5.14 *Units Having a Variable Speed Drive*. The unit shall be tested using a digital power analyzer.

5.15 *Head Pressure Control*. For units with condenser head pressure controls, the head pressure controls shall be enabled and operated in automatic mode. Set head pressure controls as specified by the Manufacturer's Installation Instructions. If instructions are not provided, use the as-shipped setting.

5.16 *Standard Air Determination.* When correcting measured airflow to Standard Air the correction shall be based on the air density at the airflow measurement test station.

5.17 *Air Condition Measurements.* Instructions for indoor and outdoor air condition measurements are given in Appendix F of this standard.

5.18 *Atmospheric Pressure.* For all tests, the ambient conditions shall have a minimum atmospheric pressure of 94,5 kPa.

5.19 *Total Humidification Capacity Test*. The Total Humidification Capacity measurement shall use the indoor air enthalpy method as prescribed in Section 7.3 of ASHRAE 37. The Humidifier entering water conditions shall be referred from AHRI 640. Testing for Total Humidification Capacity shall be sampled at five-minute intervals for a total of thirteen readings in one hour.

5.20 *Instrumentation Accuracy*. In addition to the instrument accuracy requirements specified in Section 5 of ASHRAE 37, measurements shall be made in accordance with the following provisions.

5.20.1 *Atmospheric Pressure.* Atmospheric pressure measuring instruments shall be accurate to within ± 0,5% of the reading.

5.20.2 *Electrical Frequency*. Measurement devices used to measure electrical frequency shall be accurate to within ± 0,2 Hz.

5.21 *Supplemental Test Instructions (STI).* STI shall include all instructions that do not deviate from Manufacturer's Installation Instructions but provide additional specifications for test standard requirements allowing more than one option, and all deviations from Manufacturer's Installation Instructions necessary to comply with steady state requirements. STI shall provide steady operation that matches the average performance that can be obtained without deviating from the Manufacturer's Installation Instructions. STI shall not include instructions that deviate from Manufacturer's Installation Instructions other than those necessary to comply with steady state requirements.

Section 6. Rating Requirements

6.1 *Standard Ratings*. Standard Ratings shall be established at the standard Rating Conditions specified in Table 3 and Table 4. These standard Rating Conditions are based on different design operating temperatures for different types of CDPR units. Where direct expansion equipment is provided in more than one assembly and the separate assemblies shall be used together, the requirements of rating outlined in this standard are based upon the use of matched assemblies.
Minimum external static pressure requirements are specified in Table 5. Outdoor air external static pressure requirements for units with ducted condensers are specified in Table 6.

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