AHRI Standard 610 (I-P)

2014 Standard for

Performance Rating of Central System Humidifiers for Residential Applications

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Note:

This standard supersedes ANSI/AHRI Standard 610-2004.
For SI ratings, see AHRI Standard 611 (SI)-2014.
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PERFORMANCE RATING OF RESIDENTIAL CENTRAL SYSTEM HUMIDIFIERS FOR RESIDENTIAL APPLICATIONS

Section 1. Purpose

1.1 *Purpose*. The purpose of this standard is to establish for Residential Central System Humidifiers: definitions; classifications; test requirements; rating requirements; minimum data requirements for Published Ratings; operating requirements; marking and nameplate data; and conformance conditions.

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

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as technology advances.

Section 2. Scope

2.1 *Scope.* This standard applies to factory-made Central System Humidifiers, as defined in Section 3.

2.1.1 *Energy Source.* This standard applies to electrically operated Central System Humidifiers that depend on the air stream of a central air system for moisture evaporation and distribution.

2.1.2 *Installation.* Central System Humidifiers are intended for installation in central air systems.

2.2 *Exclusions.* This standard does not apply to the following:

2.2.1 Self-contained Humidifiers as defined in ANSI/AHRI Standard 620

2.2.2 Portable Humidifiers as defined in ANSI/AHAM HU-1

2.2.3 Humidifiers for commercial and industrial applications as defined in ANSI/AHRI Standard 640

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the current edition of ASHRAE Terminology website (https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology) unless otherwise defined in this section.

3.1 *Humidification Capacity*. The capacity of a Central System Humidifier to add moisture to air expressed in gal/day of continuous operation.

3.2 *Humidifier*. A device designed to add moisture to air.

3.2.1 *Central System Humidifier (Humidifier)*. A class of Humidifier intended to be installed in or to discharge into the air stream of a central air system. It may be mounted in or on one of the following:

3.2.1.1 *Return Air Duct (RD)*. A Humidifier that is connected to a horizontal duct and has the function of returning humidified air to the central system.

3.2.1.2 *Return Air Plenum (RP)*. A Humidifier that is connected to a vertical duct and has the function of returning humidified air to the central system.

3.2.1.3. *Supply Air Duct (SD)*. A Humidifier that is connected to a horizontal duct and has the function of delivering humidified air from the central system.

3.2.1.4 *Supply Air Plenum (SP)*. A Humidifier that is connected to a vertical duct and has the function of delivering humidified air from the central system.

3.2.1.5 *By-pass (Supply-to-Return) (SR)*. A Humidifier that is connected to a central system and obtains its energy through a duct from the supply or return of the system.

3.2.1.6 *Heating or Cooling Unit (HC)*. An air-moving device used to supply heating and/or cooling to a residence or space.

3.3 *Humidistat*. A device that regulates moisture input by responding directly or indirectly to changes in the moisture content of the air.

3.4 *Published Rating*. A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a unit may be chosen to fit its application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. The term Published Rating 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.

3.4.1 *Application Rating*. A rating based on tests performed at application Rating Conditions (other than Standard Rating Conditions).

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

3.5 *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.

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

3.6 *"Shall" or "Should".* "Shall" or “should” shall be interpreted as follows:

3.6.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.6.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.7 *Standard Air*. Air weighing 0.075 lb/ft^3 which approximates dry air at 70°F and at a barometric pressure of 29.92 in. Hg.

3.8 *Supplementary Heat.* Heat used to enhance evaporation when used in the recirculating system or to heat the water for direct evaporation.

Section 4. Classifications

4.1 *Classifications.* Humidifiers within the scope of this standard shall be classified as shown in Table 1.

Table 1. Classification of Central System Humidifiers

Types of Central System Humidifiers		
Designation	AHRI Type	Arrangement
Return Air Duct	RD	Horizontal duct – returning air to central air system | Humidifier | Central air system
Return Air Plenum	RP	Vertical duct – returning air to central air system | Humidifier | Central air system
Supply Air Duct	SD	Central air system | Humidifier | Horizontal duct – delivering air from central air system
Supply Air Plenum	SP	Central air system | Humidifier | Vertical duct – delivering air from central air system
By-pass (Supply-to-Return)	SR	Horizontal / vertical duct – returning air to central air system | Humidifier | Horizontal / vertical duct – delivering air from central air system
Heating or Cooling Unit	HC	Humidifier | Central air system

Section 5. Test Requirements

5.1 *Test Requirements.* Published Ratings shall be verified by tests conducted in accordance with ANSI/ASHRAE Standard 164.1, except as noted below and as shown in Appendix C.

5.1.1 Section 6.3.1 of ANSI/ASHRAE Standard 164.1, Nozzle *Construction*, shall apply, except that nozzles shall be sized for a throat velocity not less than 2800 ft/min nor more than 7000 ft/min.

5.1.2 Section 7.6.2 of ANSI/ASHRAE Standard 164.1, *Supply-to-Return Test Section*, shall apply, except that the supply-to-return test section shall be constructed as shown in Figure 1.

5.1.3 Section 8.2 of ANSI/ASHRAE Standard 164.1, *Test Requirements*, shall apply, except that the locations of the planes shall be as shown in Figure 1.

5.1.4 Section 8.2.1.3 of ANSI/ASHRAE Standard 164.1, Water Supply, shall apply, except that the temperature of the feed water entering the water control device shall be 60.0°F ± 2.0°F.

5.1.5 Section 8.2.1.4 of ANSI/ASHRAE Standard 164.1, *Air Temperature and Pressure*, shall apply, except that air pressure in the test plenum shall be 0.05 ± 0.01 in H_2O below atmospheric pressure.

5.1.6 Section 8.2.2.1.e of ANSI/ASHRAE Standard 164.1, *Test Apparatus*, shall apply, except that the humidifier test section shall be as shown in Figure 1.

5.1.7 Section 8.2.3.1.e of ANSI/ASHRAE Standard 164.1, *Test Apparatus*, shall apply, except that the humidifier test section shall be as shown in Figure 1.

5.1.8 Section 8.2.4.c of ANSI/ASHRAE Standard 164.1, *Supply-to-Return Test Method*, shall apply, except that surfaces of the supply and return plenums shall be as shown in Figure 1.

5.1.9 Section 8.2.4.1.e of ANSI/ASHRAE Standard 164.1, *Test Apparatus*, shall apply, except that the humidifier test section shall be as shown in Figure 1.

5.2 *Equipment.* Humidifiers shall be tested using all components as specified by the manufacturer.

5.3 *Electrical Conditions.* For all dual nameplate voltage equipment covered by this standard, tests shall be performed at both voltages or at the lower voltage if only a single rating is to be published.

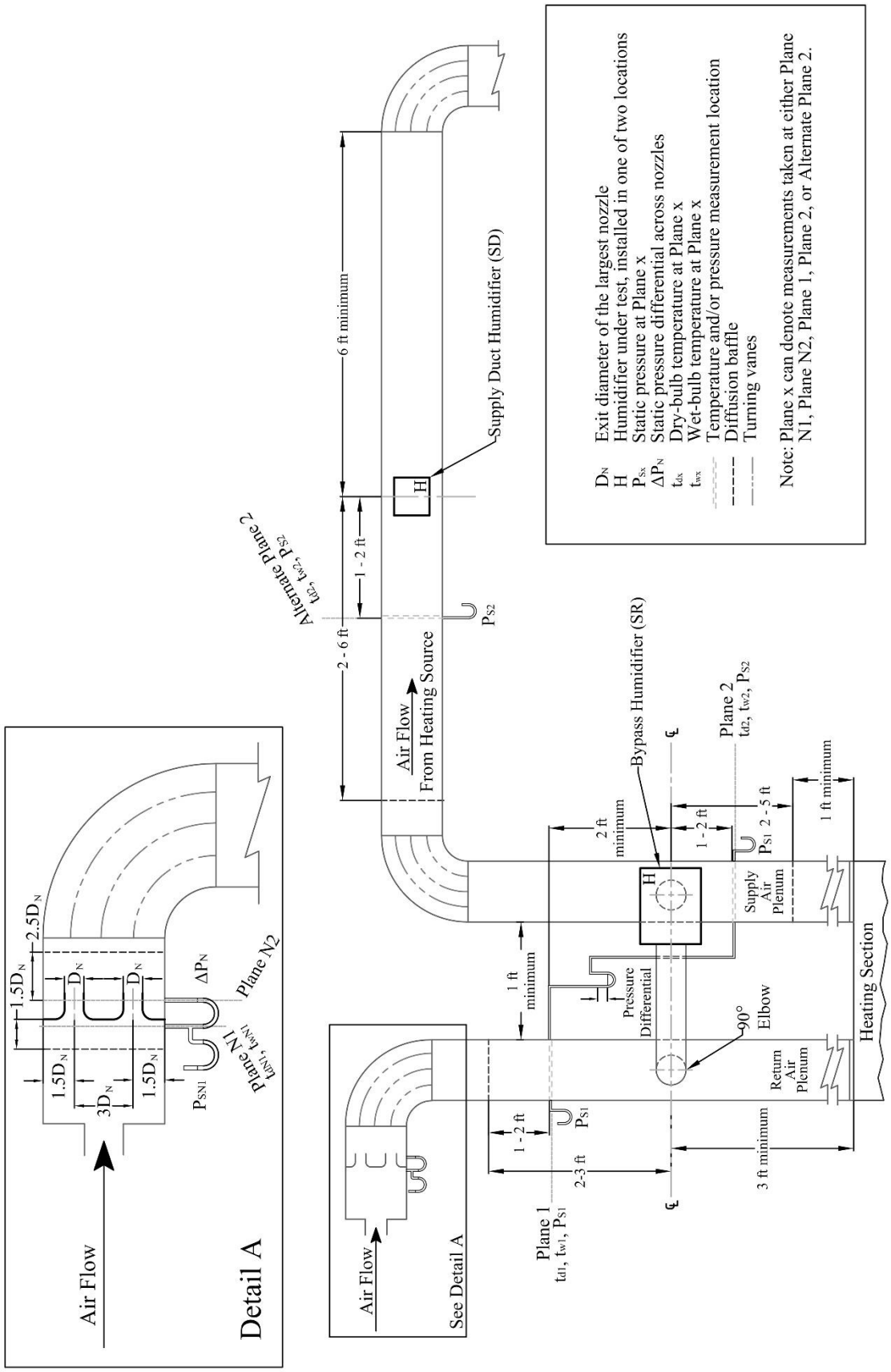

Figure 1. Return Air or Supply Air (Duct or Plenum) and By-pass (Supply-to-Return) Test Section

Section 6. Rating Requirements

6.1 *Published Ratings.* Published Ratings shall include Humidification Capacity, power input, energy input of Supplementary Heat, and air pressure drop across the Humidifier. Humidification Capacity shall be expressed in terms of gal/day and stated to the nearest 0.1 gal/day. Power input shall be expressed in Watts stated to the nearest 5 Watts. Energy input of Supplementary Heat shall be expressed in Btu/h or Watts stated to the nearest increments of 100 Btu/h or 30 Watts. Air pressure drop across the Humidifier shall be expressed in terms of in H_2O stated to the nearest increment of 0.01 in H_2O.

$$Humidification\ Capacity\ \left(\frac{gal}{day}\right) = H_M \times \left(\frac{t}{\rho}\right) \quad (1)$$

Where:

H_M = Humidification Rate in lb/h, from Equation 18 in ASHRAE Standard 164.1-2012
ρ = 8.34, lb/gal
t = 24, hr

6.2 *Standard Ratings*. Ratings based on data determined by the test requirements prescribed in Section 5 shall be published as Standard Ratings when conducted at the following Standard Rating Conditions as shown in Table 2.

Table 2. Standard Rating Conditions[1]

Standard Rating Conditions	Air Velocity, fpm	800
	Water pressure entering water control valve, psi	60.0
	Water temperature entering water control valve, °F	60.0 ± 2.0
Supplementary Heat (Water) Test Conditions	Water pressure entering water control valve, psig	15.0 ± 5.0
	Water temperature entering water control valve, °F	120.0
Supplementary Heat (Steam) Test Conditions	Steam pressure entering water control valve, psig	2.0

Note 1: Lower velocity may be used if so recommended by the manufacturer. The air velocity in the return air plenum or return air duct shall be maintained at 800 fpm or the manufacturer's recommendation based on 75.0°F dry-bulb and 56.5°F wet-bulb at the temperature and pressure measuring station, with an allowable test tolerance of ± 20 fpm. The air velocity in the supply air plenum shall be that which occurs as a result of maintaining the specified air velocity in the return air plenum.

6.2.3 *Additional Standard Rating Conditions.* In addition, Standard Rating Conditions shall include the applicable additional Standard Rating Conditions, as shown in Table 3, depending upon the specific test method used to determine Humidification Capacity as described in ANSI/ASHRAE Standard 164.1. Where a heating only central air system is involved, 120.0°F dry-bulb temperature shall be established at the Supply Air Plenum prior to allowing water to enter the Humidifier.

Table 3. Additional Standard Rating Conditions

Return Air Duct and Return Air Plenum	Dry-bulb air temperature entering test section, °F	75.0
	Wet-bulb air temperature entering test section, °F	56.5
	Air pressure in test section, in H_2O below atmospheric pressure	0.05
Supply Air Duct and Supply Air Plenum	Dry-bulb air temperature entering test section, °F	120.0
	Air pressure in test section, in H_2O above atmospheric pressure	0.15
By-pass (Supply-to-Return)	Dry-bulb air temperature entering Return Air Plenum, °F	75.0
	Wet-bulb air temperature entering Return Air Plenum, °F	56.5
	Dry-bulb air temperature entering Supply Air Plenum, °F	120.0
	Air pressure in Return Air Plenum, in H_2O below atmospheric pressure	0.05
	Air pressure in Supply Air Plenum, in H_2O above atmospheric pressure	0.15

6.3 *Application Ratings.* Ratings based on data determined by test requirements prescribed in Section 5 and conducted using Rating Conditions other than those specified in Table 2 shall be published as Application Ratings.

6.4 *Tolerances.* To comply with this standard, measured test results shall not be less than 95% of the Published Ratings for Humidification Capacity and shall not exceed 110% of Published Ratings for power input or energy input of Supplementary Heat. Where Supplementary Heat (water) is used, the energy input from this source shall not be more than the rated power input.

Section 7. Minimum Data Requirements for Published Ratings

7.1 *Minimum Data Required for Published Rat*ings. As a minimum, Published Ratings shall consist of the following information:

7.1.1 Humidification Capacity, gal/day
7.1.2 Power input, W
7.1.3 Energy input of Supplementary Heat, Btu/h or W (where Supplementary Heat is used)

As a minimum, Published Ratings shall include all Standard Ratings. All claims to ratings within the scope of this standard shall include the statement "Rated in accordance with ANSI/AHRI Standard 610 (I-P)". All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of ANSI/AHRI Standard 610 (I-P)". Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

Section 8. Operating Requirements

8.1 *Operating Requirements.* To comply with this standard, any production unit shall meet the minimum operating requirements detailed in this section.

8.2 W*ater-trace Test.* The Humidifier shall pass a water-trace test for each classification designation as specified in the manufacturer's installation instructions at Standard Rating Conditions for air velocity and for water pressure and temperature entering the water control valve as determined in Table 2 and at the appropriate air temperature and pressure specified in Table 3.

8.2.1 *Procedure*. The water entering the Humidifier's water control valve shall be shut off and water remaining in the reservoir shall be drained, if required, to cease evaporation. Air velocity shall be maintained for 30 minutes.

8.2.2 *Voltages*. Tests shall be run at the nameplate voltage and at rated frequency.

8.2.3 *Requirements*.

8.2.3.1 During the test, water shall not drip or run off the test section.

8.2.3.2 After the test, the interior of the test section and all test section surfaces shall be free from water.

8.3 *Operating Conditions Test*. The Humidifier shall pass the following operating conditions test for each classification designation as specified in the manufacturer's installation instructions at Standard Rating Conditions for air velocity and for water pressure and temperature entering the water control valve as determined in Table 2 and at the appropriate air temperature and pressure specified in Table 3.

8.3.1 *Air Temperature Conditions*. In the case of a Humidifier that, under normal operation, will be exposed to air discharged from a heating unit, the air temperature entering the test section shall be maintained at 160.0°F. In the case of a Humidifier that, under normal operation, will be exposed to air returned to a heating unit, the air temperature entering test section during the test shall be maintained at 160.0°F.

8.3.2 *Procedure*.

8.3.2.1 The water supply entering the water control valve shall be shut off. The unit shall be operated continuously for one hour.

8.3.2.2 After the one-hour period, the water pressure shall be restored to 60.0 psi.

8.3.2.3 For units exposed to air discharged from a heating unit, the air temperature shall be raised to 200°F. The unit shall be operated continuously for an additional five minutes at the elevated temperature before restoration of the water pressure.

8.3.3 *Requirements*. During the test and after completion of the test, the equipment shall operate without damage or failure of any of its parts (regardless of its performance level).

8.4 *Water Flow Control Test.* The Humidifier shall pass the following water flow control test at Standard Rating Conditions for air velocity and water temperature entering the water control valve as determined in Table 2.

8.4.1 *Water Pressure Conditions*. Water pressure at the water control valve shall be maintained at 20.0 psi.

8.4.2 *Procedure*. The unit shall operate continuously for 30 minutes. The water pressure shall then be raised to 120.0 psi, and the unit shall then operate continuously for an additional 30 minutes. Operation and resetting of the water control valve prior to establishment of continuous operation shall be permitted.

8.4.3 *Requirements*. During the test there shall be no dripping or run-off of water from the Humidifier.

Section 9. Marking and Nameplate Data

9.1 *Marking and Nameplate Data.* As a minimum, the nameplate shall display the manufacturer's name, model designation, and electrical characteristics.

Nameplate voltages for 60 Hz systems shall include one or more of the equipment nameplate voltage ratings shown in Table 1 of ANSI/AHRI Standard 110. Nameplate voltages for 50 Hz systems shall include one or more of the utilization voltages shown in Table 1 of IEC Standard 60038.

Section 10. Conformance Conditions

10.1 *Conformance.* While conformance with this standard is voluntary, conformance shall not be claimed or implied for products or equipment within the standard's *Purpose* (Section 1) and *Scope* (Section 2) unless such product claims meet all of the requirements of the standard and all of the testing and rating requirements are measured and reported in complete compliance with the standard. Any product that has not met all the requirements of the standard shall not reference, state, or acknowledge the standard in any written, oral, or electronic communication.

APPENDIX A. REFERENCES – NORMATIVE

A1 Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standard. All references in this appendix are considered as part of the standard.

A1.1 ANSI/AHAM HU-1-2006 (R2011), *Household Humidifiers*, 2011, Association of Home Appliance Manufacturers, 1111 19th St., NW, Suite 402, Washington, DC 20036, U.S.A.

A1.2 ANSI/AHRI Standard 110-2012, *Air-Conditioning, Heating and Refrigerating Equipment Nameplate Voltages*, 2012, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A..

A1.3 ANSI/AHRI Standard 611 (SI)-2014, *Performance Rating of Central System Humidifiers for Residential Applications*, 2014, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

A1.4 ANSI/AHRI Standard 620 (I-P)-2014, *Standard for Self-Contained Humidifiers for Central System Application*, 2014, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

A1.5 ANSI/AHRI Standard 640-2005, *Commercial and Industrial Humidifiers*, 2005, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

A1.6 ANSI/ASHRAE Standard 164.1-2012, *Method of Test for Residential Central-System Humidifiers*, 2012, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.7 *ASHRAE Terminology*, https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology, 2014, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.8 International Standard IEC 60038, *IEC Standard Voltages Edition: 7.0*, 2009, International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

APPENDIX B. REFERENCES – INFORMATIVE

B1 Listed here are all standards, handbooks, and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered part of the standard.

B1.1 ANSI/AHRI Standard 210/240-2008 with Addenda 1 and 2, *Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment*, 2008, Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

B1.2 ANSI/ASHRAE Standard 41.1-2013, *Standard Method for Temperature Measurement*, 2013, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

B1.3 ANSI/ASHRAE Standard 41.2-1987 (RA 1992), *Standard Method for Laboratory Airflow Measurement*, 1992, American Society of Heating, Refrigerating and Air-Conditioning Engineers, 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

B1.4 ANSI/ASHRAE Standard 41.3-1989, *Standard Method for Pressure Measurement*, 1989, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

APPENDIX C. METHOD OF MEASURING AIRFLOW RATE THROUGH A BY-PASS HUMIDIFIER - INFORMATIVE

C1 *Method of Measuring Airflow Rate Through a By-pass Humidifier.*

C1.1 A By-pass Humidifier shall be installed as shown in Figure C1 or C2 to measure airflow rate through a By-pass Humidifier, cfm.

The temperature of the air shall be room temperature, (75.0 ± 10.0)°F, (30 ± 10) % relative humidity, and the static pressure in the supply shall be adjusted to 0.15 in H_2O above atmospheric pressure and in the return to 0.05 in H_2O below atmospheric pressure.

C2 *Calculation of Airflow Rate.*

C2.1 The airflow rate through the measuring apparatus installed in accordance with Section C1 shall be calculated in accordance with Section 9.2 of ANSI/ASHRAE Standard 164.1.

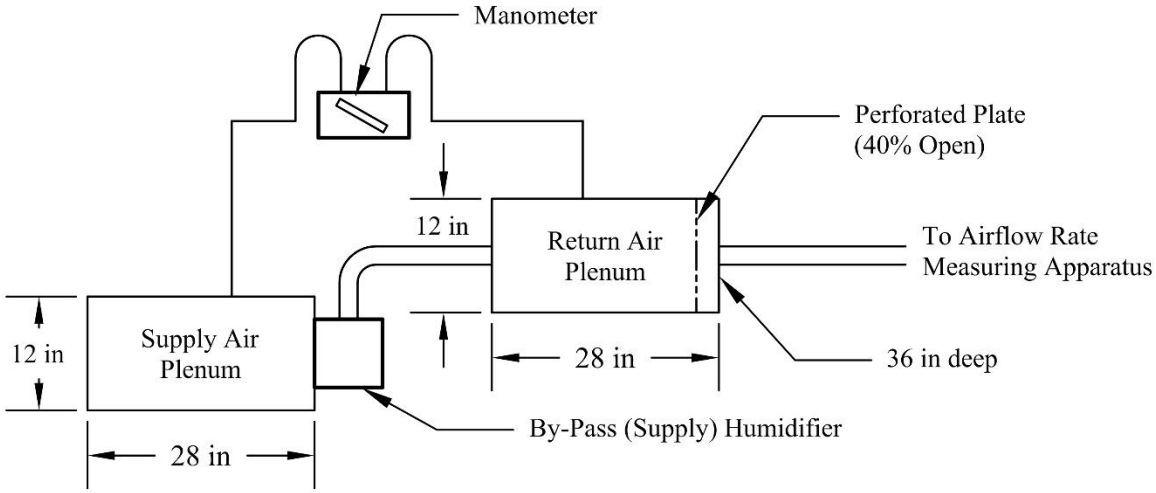

Figure C1. By-pass (Supply) Humidifier Test Section for Airflow Rate Measurement

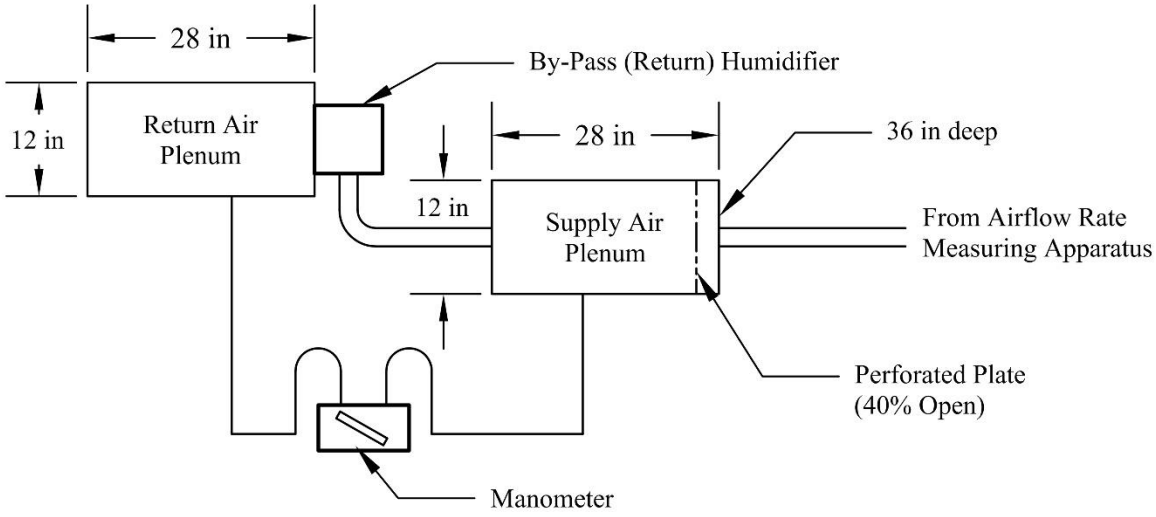

Figure C2. By-pass (Return) Humidifier Test Section for Airflow Rate Measurement