ADDENDA

ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 52.2-2017

Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

Approved by ASHRAE on August 30, 2018, and by the American National Standards Institute on August 30, 2018.

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FOREWORD

Because a psychrometric chart is difficult to read, and acceptable equations exist and are easy to program, Addendum a deletes Figure 9-2 and adds equations to the text.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum a to Standard 52.2-2017

Modify Section 9 as follows (I-P and SI units).

9. MEASUREMENT OF RESISTANCE VERSUS AIRFLOW

9.1 Install the device in the test duct.

9.2 Establish and record airflow rates measured by the flow nozzle. Refer to Figure 9-1. For the purposes of this standard, airflow rate shall be defined by the following equations 36:

$$Q = 1.1107 \times 10^{-6}\, CD^2\, \{\Delta P/[\rho(1-\beta^4)]\}^{0.5} \quad \text{(SI units)}$$

$$Q = 5.9863 \times CD^2 \{\Delta P/(\rho[1-\beta^4)]\}^{0.5} \quad \text{(I-P units)}$$

where

Q = test airflow rate, m^3/s (cfm)

C = coefficient of discharge = $0.9975 - 6.53\ \mathrm{Re}^{-0.5}$

D = nozzle throat diameter, mm (in.)

W = duct width, mm (in.)

β = D/W

ΔP = nozzle pressure drop, Pa (in. of water)

ρ = humid air density at nozzle inlet, kg/m^3 (lb/ft^3) (Refer to Section 9-3~~2~~ for calculation~~e~~ method in accordance with Reference 1 ~~the value in accordance with Section 9 [Reference 11].~~)

μ = humid air dynamic viscosity; for the purposes of this standard, it is a constant: $1.817 \times 10^{-5}\ N{\cdot}s/m^2$ ($1.22 \times 10^{-5}\ lb_m/ft{\cdot}s$)

Re = $K\rho Q/\mu D = K_R \rho Q/D$, where $K_R = 5.504 \times 10^7$ (16,393)

9.3 The humid air density at the nozzle inlet is governed by the properties of the air at the inlet to the test duct and the air resistance devices upstream of the nozzle inlet.

9.3.1 Density of Duct Inlet Air. The humid density of the air entering the test duct is dependent on the wet-bulb temperature, the dry-bulb temperature, and the barometric pressure at the air inlet.

The saturated vapor pressure P_e at the inlet wet-bulb temperature is

$$P_e = 3.253(t_{wo})^2 - 1.86(t_{wo}) + 692 \text{ Pa} \quad \text{(SI)}$$

$$P_e = 2.96\text{E-}4(t_{wo})^2 - 1.59\text{E-}2(t_{wo}) + 0.41 \quad \text{(I-P)}$$

where

P_e = saturated vapor pressure at t_{wo}, Pa (in. Hg)

t_{wo} = wet-bulb temperature of duct inlet air, °C (°F)

The partial vapor pressure P_p is

$$P_p = P_e - P_b[(t_{do} - t_{wo})/1500] \quad \text{(SI)}$$

$$P_p = P_e - P_b[(t_{do} - t_{wo})/2700] \quad \text{(I-P)}$$

where

P_b = corrected barometric pressure at duct inlet, Pa (in. Hg)

t_{do} = dry-bulb temperature of duct inlet air, °C (°F)

t_{wo} = wet-bulb temperature of duct inlet air, °C (°F)

The density of the duct inlet air ρ_o is

$$\rho_o = (P_b - 0.378P_p)/[R(t_{do} + 273.2)] \quad \text{(SI)}$$

$$\rho_o = [70.73(P_b - 0.378P_{po})]/[R(t_{do} + 459.7)] \quad \text{(I-P)}$$

where

P_b = corrected barometric pressure at duct inlet, Pa (in. Hg)

R = 287.1 J/kg·K (53.35 ft·lb/lbm·R)

9.3.2 Density of Duct Air at Orifice Inlet. The density of air in the duct immediately upstream of the orifice ρ_{orf} is calculated by correcting the density of the inlet air ρ_o for the pressure and temperature of the air at the orifice.

$$\rho_{orf} = \rho_o [(t_{do} + 273.2)/(t_{dorf} + 273.2)] \times [(P_{sorf} + P_b)/P_b] \quad \text{(SI)}$$

$$\rho_{orf} = \rho_o [(t_{do} + 459.7)/(t_{dorf} + 459.7] \times [(P_{sorf} + 13.63P_b)/(13.63P_b)] \quad \text{(I-P)}$$

where

t_{dorf} = air dry-bulb temperature immediately upstream of the orifice inlet, °C (°F)

P_{sorf} = static pressure immediately upstream if the orifice inlet, Pa (in. of water)

The ρ_{orf} calculated in the above equations shall be used as ρ in the equations presented in Section 9-2.

~~**9.3**~~ **9.4** The pressure drop across the nozzle shall be at least 100 Pa (0.4 in. of water) at the test airflow rate, and the nozzle position and static taps shall conform to Figure 4-1.

~~**9.4**~~ **9.5** Measure and record the resistance of the device at a minimum of four airflow rates: 50%, 75%, 100%, and 125% of test airflow rate. Resistance shall be measured between the static taps.

Modify Section 9 as follows (I-P and SI units).

INFORMATIVE APPENDIX G
INFORMATIVE REFERENCES

~~10. ASME. 1989. ASME Standard MFC-3M, *Measurement of Fluid Flow in Pipes Using Orifices, Nozzles and Venturi*. New York: American Society of Mechanical Engineers.~~

10. ASHRAE. 2016. ANSI/ASHRAE Standard 51 (AMCA Standard 210-85), *Laboratory Method for Testing Fans for Rating*. Atlanta: ASHRAE.

Delete Figure 9-2 in its entirety

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