BSR/ASHRAE Addendum a to
ANSI/ASHRAE Standard 145.2-2016

Public Review Draft

Proposed Addendum a to Standard 145.2-2016, Laboratory Test Method for Assessing the Performance of Gas-Phase Air Cleaning Systems: Air Cleaning Devices

First Public Review (July 2019)
(Draft shows Proposed Changes to Current Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

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(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

ASHRAE 52.2 recently removed the Figure cited in 145.2 and replaced it with these calculations. This change proposal updates 145.2 to keep the method viable.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum a to Standard 145.2-2016

Make changes to Section 9 as follows.

9. MEASUREMENT OF RESISTANCE VS. AIRFLOW

9.1 Install the test air cleaner; this may be performed as part of the equilibration period.
For the purposes of this standard, airflow rate shall be defined by the following equations from ASME Standard MFC-3M-1989:

$$Q = 1.1107 \times 10^{-6} C \times D^2 \{\Delta p / [\, p \times (1 - \beta^4)]\}^{0.5} \qquad \text{(SI)}$$

$$Q = 5.9863 \times 10^{-6} C \times D^2 \{\Delta p / [\, p \times (1 - \beta^4)]\}^{0.5} \qquad \text{(I-P)}$$

where

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

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

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 9.2 for calculation method in accordance with Reference 1.) ~~(Standard 52.2, Figure 9-2)~~

μ = humid air dynamic viscosity, Ns/m^2 ($lb_m/ft \cdot s$); at 25°C and 50% rh, μ has the value of 1.817×10^{-5} Ns/m^2 (1.22×10^{-5} $lb_m/ft \cdot s$).

Re = Reynolds number = $K\rho Q/\mu D$; at 25°C, 50% rh, and the units above, the conversion constant in the expression for Re, K, has the value of 5.504×10^7 (SI) or 16,393 (I-P).

9.2 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.

9.2.1 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:

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

$P_e = 2.96E\text{-}4(t_{wo})^2 - 1.59E\text{-}2(t_{wo}) + 0.41$ (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, Pp, is:

$P_p = P_e – P_b((t_{do}-t_{wo})/1500)$ (SI)

$P_p = P_e – P_b((t_{do}-t_{wo})/2700)$ (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:

$\rho_O = (P_b – 0.378P_p)/[R(t_{do} + 273.2)]$ (SI)

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

Where

P_b = Corrected Barometric Pressure at duct inlet, Pa (in. HG)

R = 287.1 J/kg·K (SI)

R = 53.35 ft-lb/lbm·R (I-P)

9.2.2 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.

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

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

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

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

The ρ_{orf} calculated in the above equations shall be used as ρ in the equations presented in Section 9.1.