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ADDENDA

ANSI/ASHRAE Addendum b to ANSI/ASHRAE Standard 41.2-2022

Standard Methods for Air Velocity and Airflow Measurement

Approved by ASHRAE and the American National Standards Institute on January 31, 2024

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (www.ashrae.org/continuous-maintenance).

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FOREWORD

Addendum b corrects and clarifies the method for determining the inlet air density for single- and multiple-nozzle chambers.

Informative 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 b to Standard 41.2-2022

Revise Section 9.3.6.1 as shown.

9.3.6.1 Measurements. Measurements required for nozzle airflow calculations are as follows:

a. Inlet duct geometrically equivalent diameter D_E, m (ft)
b. Nozzle throat diameter d, m (ft)
c. Nozzle inlet absolute pressure p_1, Pa (in. of water)
d. Nozzle differential pressure $\Delta p = (p_1 - p_2)$, Pa (in. of water)
e. Nozzle inlet dry-bulb temperature t_1, °C (F)
f. Nozzle inlet humidity measurement in the form of relative humidity, dew-point temperature, or wet-bulb temperature in compliance with ANSI/ASHRAE Standard 41.6[4] is required unless dry air is used for the test.

Informative Note: As prescribed in Section 5.3.2.9, obtain ~~Obtain~~ nozzle inlet density for dry and moist air from ASHRAE RP-1485 using nozzle inlet absolute pressure, temperature, and humidity.)

Revise Section 9.3.6.3.4 as shown.

9.3.6.3.4 Volumetric Airflow Rates for a Single-Nozzle Duct. Single-nozzle duct volumetric airflow rates shall be obtained from Equation 9-21 in SI units or Equation 9-22 in I-P units.

In SI units:

$$Q = CA\varepsilon\sqrt{\frac{2(\Delta p)}{\rho_1(1-E\beta^4)}} \tag{9-21}$$

where

Q = nozzle volumetric airflow rate, m^3/s
C = nozzle discharge coefficient, dimensionless
A = nozzle throat area, m^2
ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, Pa
ρ_1 = nozzle inlet air density for dry or moist air, kg/m^3
E = flow kinetic energy coefficient = 1.043[7]
β = d/D_h, dimensionless

Informative Note: The superscript "7" in "1.043[7]" above is reference number, not an exponent.

In I-P units:

$$Q = 1097.8CA\varepsilon\sqrt{\frac{\Delta p}{\rho_1(1-E\beta^4)}} \tag{9-22}$$

where

Q = nozzle volumetric airflow rate, cfm
C = nozzle discharge coefficient, dimensionless
A = nozzle throat area, ft^2

ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, in. of water
ρ_1 = nozzle inlet air density for dry or moist air, lb_m/ft^3
E = flow kinetic energy coefficient = 1.043[7], dimensionless
β = d/D_h, dimensionless
1097.8 = units conversion coefficient, dimensionless

Informative Note: The superscript "7" in "1.043[7]" above is reference number, not an exponent.

Revise Section 9.3.6.3.9 as shown.

9.3.6.3.9 Mass Airflow Rate for a Single-Nozzle Duct. The mass airflow rate for single nozzles shall be obtained from Equation 9-27, where ρ_1 is the nozzle inlet air density for dry or moist air, kg/m^3 (lb_m/ft^3) and Q is the volumetric airflow rate, m^3/s (cfm), using Equation 9-21 in SI units or Equation 9-22 in I-P units.

$$\dot{m} = \rho_1 Q \quad \text{kg/s (lb}_m\text{/min)} \tag{9-27}$$

Revise Section 9.3.6.4.7 as shown.

9.3.6.4.7 Volumetric Airflow Rate for Single- and Multiple-Nozzle Chambers. The volumetric airflow rate for single- and multiple-nozzle chambers shall be obtained from Equation 9-33 in SI units or from Equation 9-34 in I-P units where the area is measured at the plane of the throat taps or nozzle exit for nozzles without throat taps.[7] The denominator in these equations includes the term $(1-E\beta^4)$. However, $\beta = 0$ for single- and multiple-nozzle chambers, so $(1-E\beta^4) = 1$, and Equations 9-32 and 33 become Equations 9-34 and 9-35.

In SI units:

$$Q = \left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{2\Delta p}{\rho_1(1-E\beta^4)}} \tag{9-32}$$

where

Q = volumetric flow rate, m^3/s
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, m^2
ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, Pa
ρ_1 = nozzle inlet air density for dry or moist air, kg/m^3
E = flow kinetic energy coefficient =1.043[7], dimensionless
β = 0

Informative Note: The superscript "7" in "1.0437" above is reference number, not an exponent.

In I-P units:

$$Q = 1097.8\left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{\Delta p}{\rho_1(1-E\beta^4)}} \tag{9-33}$$

where

Q = nozzle volumetric flow rate, cfm
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, ft^2
ε = expansibility factor, dimensionless
Δp = nozzle differential pressure, (in. of water)
ρ_1 = nozzle inlet air density for dry or moist air, lb_m/ft^3
E = flow kinetic energy coefficient =1.043[7], dimensionless

β = 0

1097.8 = units conversion coefficient, dimensionless

Informative Note: The superscript “7” in “1.043^7” above is reference number, not an exponent.

In SI units:

$$Q = \left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{2\Delta p}{\rho_1}} \tag{9-34}$$

where

Q = volumetric flow rate, m^3/s
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, m^2
ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, Pa
ρ_1 = nozzle inlet air density for dry or moist air, kg/m^3

In I-P units:

$$Q = 1097.8\left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{\Delta p}{\rho_1}} \tag{9-35}$$

where

Q = nozzle volumetric flow rate, cfm
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, ft^2
ε = expansibility factor, dimensionless
Δp = nozzle differential pressure, (in. of water)
ρ_1 = nozzle inlet air density for dry or moist air, lb_m/ft^3
1097.8 = units conversion coefficient, dimensionless

Revise Section 9.3.6.4.8 as shown.

9.3.6.4.8 Standard Airflow Rate for Single- and Multiple-Nozzle Chambers. The standard airflow rate for single- and multiple-nozzle chambers shall be calculated in compliance with Section 4.5 using Equation 9-34 in SI units or Equation 9-35 in I-P units where ρ_1 = air density for dry or moist air, kg/m^3 (lb_m/ft^3)

$$\text{Standard cubic metres/second} = \rho_1 Q/1.202 \tag{9-36}$$

$$\text{Standard cubic feet/minute (scfm)} = \rho_1 Q/0.075 \tag{9-37}$$

Revise Section 9.3.6.4.9 as shown.

9.3.6.4.9 Mass Airflow Rate for Single- and Multiple-Nozzle Chambers. The mass airflow rate for single- and multiple-nozzle chambers shall be obtained from Equation 9-38, where ρ_1 is the nozzle inlet air density for dry or moist air, kg/m^3 (lb_m/ft^3) and Q is the volumetric airflow rate using Equation 9-34 in SI units or Equation 9-35 in I-P units.

$$\dot{m} = \rho_1 Q \quad \text{kg/s } (lb_m/\text{min}) \tag{9-38}$$

In Normative Appendix F, revise Section F3.1 as shown.

F3.1 Measurements. Measurements required for nozzle airflow calculations are as follows:

a. Inlet duct geometrically equivalent diameter D_E, m (ft)
b. Throat diameter d, m (ft)
c. Inlet absolute pressure p_1, Pa (in. of water)
d. Differential pressure $\Delta p = (p_1 - p_2)$, (in. of water)
e. Inlet dry-bulb temperature, t_1 °C (°F)

f. Inlet humidity measurement in the form of relative humidity, dew-point temperature, or wet-bulb temperature in compliance with ASHRAE Standard 41.6[5] is required unless dry air is used for the test.

In Normative Appendix F, revise Section F4.7 as shown.

F4.7 Volumetric Airflow Rate for Single- and Multiple-Nozzle Chambers. The volumetric airflow rate for single- or multiple-nozzle chambers shall be obtained from Equation F-8 in SI units or from Equation F-9 in I-P units where the area is measured at the plane of the throat taps or nozzle exit for nozzles without throat taps.[7] The denominator in these equations includes the term ($1-E\beta^4$). However, $\beta = 0$ for single- and multiple-nozzle chambers, so ($1-E\beta^4$) = 1, and Equations F-8 and F-9 become Equations F-10 and F-11.

$$Q = \left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{2\Delta p}{\rho_1(1-E\beta^4)}} \quad \text{m}^3/\text{s} \tag{F-8}$$

where

Q = volumetric flow rate, m^3/s
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, m^2
ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, Pa
ρ_1 = nozzle inlet air density for dry or moist air, kg/m^3
E = flow kinetic energy coefficient=1.043 [7], dimensionless
β = 0

(***Informative Note:*** The superscript "7" in "1.043 [7]" above is reference number, not an exponent.)

$$Q = 1097.8\left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{\Delta p}{\rho_1(1-E\beta^4)}} \quad \text{cfm} \tag{F-9}$$

where

Q = nozzle volumetric flow rate, cfm
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, ft^2
ε = expansibility factor, dimensionless
Δp = nozzle differential pressure, (in. of water)
ρ_1 = nozzle inlet air density for dry or moist air, $\text{lb}_\text{m}/\text{ft}^3$
E = flow kinetic energy coefficient =1.043 [7], dimensionless
β = 0
1097.8 = units conversion coefficient, dimensionless

(***Informative Note:*** The superscript "7" in "1.043 [7]" above is a reference number, not an exponent.)

$$Q = \left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{2\Delta p}{\rho_1}} \quad \text{m}^3/\text{s} \tag{F-10}$$

where

Q = volumetric flow rate, m^3/s
N = number of nozzles in use, dimensionless
C = discharge coefficient, dimensionless
A = nozzle throat area, m^2
ε = nozzle expansibility factor, dimensionless
Δp = nozzle differential pressure, Pa
ρ_1 = nozzle inlet air density for dry or moist air, kg/m^3

$$Q = 1097.8\left[\sum_{i=1}^{N}(C_i A_i \varepsilon_i)\right]\sqrt{\frac{\Delta p}{\rho_1}} \quad \text{cfm} \tag{F-11}$$

where

Q	=	nozzle volumetric flow rate, cfm
N	=	number of nozzles in use, dimensionless
C	=	discharge coefficient, dimensionless
A	=	nozzle throat area, ft^2
ε	=	expansibility factor, dimensionless
Δp	=	nozzle differential pressure, (in. of water)
ρ_1	=	nozzle inlet air density for dry or moist air, lb_m/ft^3
1097.8	=	units conversion coefficient, dimensionless

In Normative Appendix F, revise Section F3.1 as shown.

F4.9 Mass Airflow Rate for Single- and Multiple-Nozzle Chambers. The mass airflow rate for multiple-nozzle chambers shall be obtained from Equation F-14, where ρ_1 is the nozzle inlet air density for dry or moist air in SI units or IP units, and Q is the volumetric airflow rate in SI units in Equation F-10 in SI units or F-11 in IP units.

$$\dot{m} = \rho_1 Q \quad \text{kg/s } (\text{lb}_m/\text{min}) \tag{F-14}$$

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ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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