ANSI/ASHRAE Standard 120-1999

ASHRAE® STANDARD

Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings

Approved by the ASHRAE Standards Committee June 19, 1999; by the ASHRAE Board of Directors June 24, 1999; and by the American National Standards Institute November 6, 2001.

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ISSN 1041-2336

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Approved American National Standard

ANSI

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.

1791 Tullie Circle, NE • Atlanta, GA 30329

Standard 120-1999
Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings
Cognizant TC: TC 5.2, Duct Design
Standards Project Committee Liaison: Frederick H. Kohloss

ASHRAE STANDARDS COMMITTEE June 1998 - June 1999

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CONTENTS

ANSI/ASHRAE Standard 120-1999
Method of Testing to Determine Flow Resistance of HVAC Ducts and Fittings

This standard establishes uniform methods of laboratory testing of HVAC ducts and fittings to determine their resistance to airflow.

2. SCOPE

2.1 This standard may be used to determine the change in total pressure resulting from airflow in HVAC ducts and fittings.

2.2 The test results can be used to determine duct flow losses in pressure loss per unit length. Fitting losses are reported as local loss coefficients.

2.3 This standard does not cover interpretation of test data.

3. DEFINITIONS, SYMBOLS, AND SUBSCRIPTS

3.1 Definitions. Refer to *ASHRAE Terminology of HVAC&R*[1] for the definitions of terms not shown in Clause 3.

duct, flexible: ducts constructed of flexible materials, such as polymeric films, metal foils, and impregnated fabrics.

duct, rigid: ducts constructed of rigid materials, such as metal and fiberglass duct board.

flow area, fitting inlet: measured total inside area determined at the plane(s) of the inlet connection(s). The area shall be based on physical measurements for rigid fittings and physical measurements minus twice the lining thickness for lined fittings.

flow area, fitting outlet: total inside area determined at the plane(s) of the outlet connection(s). The area shall be based on physical measurements for rigid fittings and physical measurements minus twice the lining thickness for lined fittings.

flow area, flexible duct: calculated using the nominal inside dimensions supplied by the manufacturer.

flow area, lined duct: calculated by subtracting the cross-sectional area of the liner from the flow area of the rigid duct envelope. The duct flow area shall be calculated from measured inside dimensions of the rigid duct envelope. For fully lined ducts, the nominal area is that calculated by reducing the cross-sectional dimensions of the rigid duct by twice the nominal liner thickness. The envelope dimensions shall be measured at a minimum of three representative sections of the test duct.

flow area, rigid duct: calculated by using the average inside duct dimensions determined by measurement of a minimum of three representative sections of the duct envelope.

pressure loss: decrease in total pressure due to friction and turbulence. It is a measure of the mechanical energy lost by the flow per unit volume of the fluid.

static pressure: pressure that exists only by virtue of the degree of compression. If expressed as gauge pressure, it may be negative or positive.

test: complete series of test points defining the flow behavior over a selected range of velocities.

test flow rate: volumetric flow rate entering the test duct or fitting at the test air density.

test pressure determination: complete set of measurements required to determine the total pressure loss at a test point.

test pressure loss: differential in total pressure between the inlet and the outlet sections of a test duct or across a test fitting. For test fittings, the fitting is assumed to have zero length. For multi-flow fittings, the total pressure loss shall be determined for each stream separately.

test system: prescribed flow rate measurement system and prescribed test setup for the duct or fitting test.

total pressure: sum of the static pressure and the velocity pressure. It is a measure of the mechanical energy per unit volume of the air. Air at rest has a total pressure equal to its static pressure.

velocity pressure: kinetic energy of the air motion expressed in pressure units. It is always positive.

3.2 Symbols and Subscripts

3.2.1 Symbols

Symbol	Description	Units
A_n	Nozzle throat area	m^2
A_o	Orifice area	m^2
A	Cross-sectional area	m^2
C	Loss coefficient	dimensionless
C_b	Branch loss coefficient	dimensionless
C_n	Nozzle discharge coefficient	dimensionless
C_o	Orifice discharge coefficient	dimensionless
C_s	Main loss coefficient	dimensionless
c_p	Specific heat at constant pressure	J/(kg·K)
c_v	Specific heat at constant volume	J/(kg·K)
D_h	Hydraulic diameter	m
D	Diameter	m
d	Nozzle throat diameter	m
d_o	Orifice diameter	m
d_t	Hole diameter of wall pressure tap	mm
e	Orifice thickness	mm
k	Uniform equivalent roughness	m
$L_{x-x'}$	Length of duct between planes	m
$\dot{m}$	Mass flow rate	kg/s
p	Absolute pressure of air	Pa
p_b	Corrected barometric pressure	kPa
p_e	Saturated vapor pressure at t'	kPa