and the mass flow as

$$w = \rho Q_s = KA_2\sqrt{2gv_f(\rho_f - \rho)\cdot\rho/A_f} \qquad (76)$$

The flow for any selected fluid is accordingly very nearly proportional to the area so that a convenient calibration of the tube may be obtained. The behavior of the flow coefficient, K, has been investigated[6] and the action of the flow meter as just outlined, experimentally confirmed. The flow coefficient variation for any float must be known in order to use the meter for different fluids. Some developments have been carried out in the design of the float to reduce the variation of the flow coefficient with Reynolds number, and also on float materials to reduce the dependence of mass flow calibration on fluid density.

This type of flow meter is usually furnished in standard sizes calibrated for specific fluids by the manufacturer. The compactness, reliability, and ease of installation are particularly advantageous when many measurements of essentially the same type are to be made.

LETTER SYMBOLS USED IN CHAPTER 4

β = ratio, throat or orifice diameter to pipe diameter.
μ = absolute viscosity in pounds per foot second.
μ/ρ = kinematic viscosity in square feet per second.
ρ = density of flowing fluid in pounds per cubic foot.
ρ_w = density of water at 60 F, (62.37 lb per cubic foot).
ρ_f = density of fluid over mercury in a manometer.
φ = expansion factor for nozzles.
a = velocity of sound in feet per second.
A = cross-sectional area of flow, in square feet.
C = correction factor (coefficient of discharge) for flow through orifice, nozzle or Venturi.
c_p = specific heat of gas at constant pressure.
c_v = specific heat of gas at constant volume.
D = diameter of fluid stream in feet.
d = internal diameter of pipe in feet.
e = absolute roughness of pipe surface, in feet.
f = dimensionless friction coefficient.
g = gravitational acceleration in feet per (second) (second).
g_c = gravitational conversion factor = 32.174 (pounds mass per pound force) × feet per (second) (second).
G = specific gravity of gas referred to air.
h = enthalpy, Btu per pound of fluid.
h_w = loss of head in inches of water.
h_f = loss of head in feet of fluid.
h_t = total head in feet of fluid.
h_w = differential pressure in inches of water.
J = mechanical equivalent of heat = 778 foot pounds per Btu.
K = flow coefficient (correction factor), including velocity of approach correction factor, for flow through orifice, nozzle or Venturi.
k = ratio of specific heat at constant pressure to specific heat at constant volume.
L = perpendicular distance from axis of pipe in feet.
l = length of pipe in feet.
M = Mach number.
N_{Re} = Reynolds number.
P = correction factor for expansion of orifice plate with temperature.
p = pressure in pounds per square foot.
p^0 = stagnation pressure.
p_c = critical pressure.
P_b = standard pressure to which correction is to be made, pounds per square inch, absolute.
P_f = pressure of gas flowing, pounds per square inch, absolute.
Q_b = rate of flow in cubic feet per hour under standard conditions of pressure and temperature.

Q_f = rate of flow in cubic feet per hour.
Q_s = discharge rate in cubic feet per second.
Q_w = rate of flow in gallons per hour.
q = heat transferred to the fluid per pound of fluid flowing.
R = gas constant.
R_H = hydraulic radius = ratio of area of cross-section to wetted perimeter.
r = radius of pipe in feet.
s = entropy of fluid in Btu per (pound) (Fahrenheit degree)
T = temperature, Fahrenheit degrees, absolute.
T_b = standard temperature to which correction is to be made, Fahrenheit degrees absolute.
T_f = temperature of gas flowing, Fahrenheit degrees, absolute.
u = internal energy, Btu per pound of fluid.
V = velocity in feet per second.
V_c = critical velocity, feet per second.
V_{so} = velocity of sound, feet per second.
V_m = velocity in feet per minute.
v = specific volume, cubic feet per pound.
W = mechanical work in foot pounds per pound of fluid flowing.
w = weight of gas flowing, pounds per second.
w_h = weight of gas flowing, pounds per hour.
Y = expansion factor—correcting for expansion of gas under reduced downstream pressure.
z = elevation above some arbitrary datum, in feet.

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