CYLINDER K-FACTOR CALCULATION

This document describes the formula used to compute the K-factor for a gas cylinder for the Series 2000 and Series 4000 line of instruments.

X = Subscript which refers to a particular gas component in the cylinder. Each gas component is numbered from "1" to "n". The reference gas (Flow controller calibration gas) is referred to as "ref".

P_x = Percent concentration of gas x, from 0.0 to 1.0 (1.0 = 100% gas)

N_x = Molecular structure correction factor for gas x:
Monatomic = 1.01 , Diatomic = 1.00 , Triatomic = 0.94 , Polyatomic = 0.88

D_x = Density of gas x (grams / liter @ 0 ºC)

H_x = Specific Heat of gas x (cal. / gram ºC @ 25 ºC)

$$C_{cyl} = \frac{(P_1 * N_1) + (P_2 * N_2) + ... + (P_n * N_n)}{(P_1 * D_1 * H_1) + (P_2 * D_2 * H_2) + ... + (P_n * D_n * H_n)}$$ (Cylinder conversion factor)

$$C_{ref} = \frac{N_{ref}}{D_{ref} * H_{ref}}$$ (Reference gas conversion factor)

$$\mathbf{K_{cyl} = \frac{C_{cyl}}{C_{ref}}}$$ **(Cylinder K-factor, relative to reference gas)**

Example: Cylinder contains 10% C02, 20% SO2, in balance of N2. Flow controller calibrated in AIR.

Gas	Mol. structure (N)	Density (D)	Specific Heat (H)
Gas 1 = 10% C02	0.94	1.964	0.2017
Gas 2 = 20% SO2	0.94	2.858	0.1489
Gas 3 = 70% N2	1.00	1.25	0.2486
Reference gas = AIR	1.00	1.293	0.2389

$$C_{cyl} = \frac{(0.1 * 0.94) + (0.2 * 0.94) + (0.7 * 1.00)}{(0.1 * 1.964 * 0.2017) + (0.2 * 2.858 * 0.1489) + (0.7 * 1.25 * 0.2486)} = 2.8692$$

$$C_{ref} = \frac{(1.00)}{(1.293 * 0.2389)} = 3.2373$$

$$\mathbf{K_{cyl} = \frac{C_{cyl}}{C_{ref}} = 0.8863}$$