

ERRATUM

LEAK DETECTION LIMIT OF COUNTER-FLOW TYPE LEAK DETECTOR

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Due to a mistake, the formula next to Eq. (4) should be read as

$$p_4 = \frac{1}{\Delta} \left\{ Q_1 \frac{CS_A S_B}{R_B} + Q_4 \left[\left(S_C + \frac{S_B}{R_B} \right) (CS_A + CS + SS_A) + \frac{CSS_A}{R_A} \right] \right\}$$

where

$$\Delta = S_B \left(CSS_C + CS_A S_C + SS_A S_C + \frac{CSS_A}{R_A} \right).$$

In accordance with this mistake, Tables 2 and 3 should appear as

TABLE 2. Quantities and notations used for system B (Fig. 5).

Item	Notation	Value used in example			
		kind of gas species considered			
		H ₂	He	water vapour	N ₂
Pump. speed of auxiliary vac. pump	S	300 l s ⁻¹			
Pump. speed of TMP-A	S_A	100 l s ⁻¹			
Pump. speed of TMP-B	S_B	100 l s ⁻¹			
Flow conductance of connecting tube between test chamber and LD (l s ⁻¹)	C	7.5	5.3	2.5	2.0
Ultimate compress. ratio of TMP-A	R_A	650	5500	1×10 ⁸	1×10 ¹⁰
Ultimate compress. ratio of TMP-B	R_B	25	74	1×10 ⁴	1×10 ⁵
Pumping speed of forepump (l s ⁻¹)	S_C	0.01			
Pressure in test chamber (Pa)	p_1	3.31 ×10 ⁻¹⁰	3.28 ×10 ⁻⁹	3.31 ×10 ⁻⁵	3.31 ×10 ⁻⁵
p of pump mouth of TMP-A (Pa)	p_2	–	–	–	–
Pressure of common backside of TMP-A (Pa)	p_3	1.11 ×10 ⁻⁷	1.51 ×10 ⁻⁶	1.81 ×10 ⁻²	3.65 ×10 ⁻²
Pressure in sensor manifold (Pa)	p_4	6.40 ×10 ⁻⁹	2.05 ×10 ⁻⁸	2.81 ×10 ⁻⁶	3.36 ×10 ⁻⁶
Volume of test chamber	V_1	100 l			
Volume of pump mouth of TMP-A	V_2	0.2 l			
Volume of common backing line and TMP-B	V_3	0.2 l			
Volume of sensor manifold	V_4	0.3 l			
Quantity of gas generation in test chamber (Pa l s ⁻¹)	Q_1	1×10 ⁻⁷	1×10 ⁻⁶	1×10 ⁻²	1×10 ⁻²
Quantity of gas generation in sensor manifold (Pa l s ⁻¹)	Q_4	1×10 ⁻⁹	–	1×10 ⁻⁴	3×10 ⁻⁴

TABLE 3.

Signal, noise and minimum detectable leak in both cases of system A and system B.

		System A	System B ($S_C = 0.01$)	System B ($S_C = 0.03$)
Partial pressures of main gases in sensor manifold (Pa)	H ₂	3.20×10 ⁻¹¹	6.40×10 ⁻⁹	3.24×10 ⁻⁸
	He	1.65×10 ⁻¹	2.05×10 ⁻⁸	7.21×10 ⁻⁹
	H ₂ O	1.78×10 ⁻⁶	2.81×10 ⁻⁶	1.60×10 ⁻⁶
	N ₂	3.59×10 ⁻⁶	3.36×10 ⁻⁶	3.12×10 ⁻⁶
Sensor output due to each gas (reduced to helium pressure in Pa _{He})	H ₂	1.63×10 ⁻¹⁴	3.20×10 ⁻¹³	1.62×10 ⁻¹³
	He	1.65×10 ⁻¹⁰	2.05×10 ⁻⁸	7.21×10 ⁻⁹
	H ₂ O	1.66×10 ⁻¹¹	1.41×10 ⁻¹²	8.00×10 ⁻¹³
	N ₂	1.66×10 ⁻¹³	1.68×10 ⁻¹⁴	1.56×10 ⁻¹⁴
Electronic fluctuation (Pa _{He})		3×10 ⁻¹³	3×10 ⁻¹³	3×10 ⁻¹³
S/N ratio		9.83	1.0×10 ⁴	5640
Minimum detectable leak L_{min} (Pa l s ⁻¹)		1.02×10 ⁻⁷	1.0×10 ⁻¹⁰	1.77×10 ⁻¹⁰
Response time constant τ (s)		0.33	8.26	3.58
$(\text{Detectability})^{-1} = \tau L_{min}$		3.63×10 ⁻⁸	8.26×10 ⁻¹⁰	6.35×10 ⁻¹⁰