

Definition of a Primary Flow Standard

The DryCal is a primary standard:

The accepted definition for gas flow measurement

$$\text{flow} = \frac{\text{volume}}{\text{time}} \quad \text{or} \quad \text{flow} = \frac{\text{area} \times \text{distance}}{\text{time}}$$

Area = Borosilicate glass cylinder

Distance = Precision photoetched stainless steel or mylar encoder system

Time = Precision crystal controlled oscillator

The DryCal is a true primary flow meter. BIOS provides NIST traceability certification from the measured volume and the timing device of each unit.

DryCal NIST Traceability

Time	The precision crystal controlled oscillator used for timing in the DryCal is tested with a NIST traceable frequency counter, which is periodically recertified by a NIST traceable laboratory.		
Volume	The Borosilicate glass cylinder is manufactured and characterized to +/-0.00005" tolerance. At BIOS each cylinder is re-measured with transfer standards and NIST traceable gauge blocks. The nature of the high quality glass ensures dimensional stability. BIOS provides dimensional certification with each unit.		
Accuracy	DCL500	DCL12K	DCL20K
Volumetric Flow Accuracy	+/-1.0% +/-0.05 ml/min	+/-0.5 ml/min	+/-1.0 ml/min

Note: the error potential is the sum of the percentage for all ranges plus a specific error associated with each flow range, representing the space between the piston and the glass.

Self-Test for Leakage

With its close clearance tolerance, DryCal's overall unit leakage is only 0.005% (maximum) of full scale. the BIOS DryCal is the only available flow meter that offers a leakage self-test for determining flow cell integrity.

Vapor Pressure Effect

Water vapor pressure is the pressure exerted by water on the ambient air as it tries to

evaporate. Vapor pressure increases the volume being measured by increasing the contained volume and accelerating the speed of the bubble. Consequently bubble flow meters generally will provide flow readings that have an error to the high side of the actual flow rate. Users of bubble flow meters rarely correct for vapor pressure even through it can inflate the air flow readings by 1-3%.

Many companies, until they switched to the DryCal, used a standard correction factor of 1.5%. to calculate the effect that water vapor pressure has on most bubble meters we use the following formula:

$$\text{Vapor Pressure Error} = \frac{(\text{vapor pressure}) + \text{current ambient atmospheric pressure}}{(\text{current ambient atmosphere pressure})}$$

Temperature °C	Vapor Pressure of Water, mmHg
15	12.788
16	13.634
17	14.530
18	15.477
19	16.477
20	17.535
21	18.650
22	19.827
23	21.068
24	22.377
25	23.756
26	25.209
27	26.739
28	28.349
29	30.043
30	31.824
31	33.695
32	35.663
33	37.729
34	39.898

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