

Title: Standard Operating Procedure for Flow Measurement Using a Primary Flow Meter		
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1. INTRODUCTION AND SCOPE

This procedure describes the operation and maintenance of the BIOS DC-2 flow meter. This device is used to measure air flow rate either from vacuum or pressure flow sources. This device can be setup to measure one reading at the time or up to 99 readings on an averaging sequence. It displays both Standardized and Volumetric flows on the front display. The unit also includes an RS232 port and a Parallel printer port for computer interface.

This method adheres to the requirements of the current Air Monitoring Directive (AMD). In some cases the limits and specifications exceed the requirements of the current AMD. It should be considered that the current and any future amendments of the AMD will be used as the benchmark for requirements and criteria for ambient air monitoring practices conducted in the Province of Alberta. Information used to write this procedure was also taken from sources identified in the reference section.

2. PRINCIPLE OF THE METHOD

The DryCal is a true primary gas standard capable of measuring both vacuum and pressure flow sources. The time required for a frictionless piston to traverse a known volume is precisely measured and an internal computer calculates the flow. The accuracy of the instrument is built into its dimensions, sensors and timing crystal. When in use, gas flows from the inlet fitting through the internal cell valve to the outlet fitting. When a reading is begun, the valve closes and gas is diverted into the flow-measuring cell. The piston rises at the rate of gas flow. A photo-optic sensor reads a precision encoder attached to the piston and a crystal clock measures the time between encoder windows after a suitable acceleration interval. When a reading is completed, the valve is opened and the piston resets. The DC-2 instantaneously displays the calculated flow reading on its LCD display.

3. MEASUREMENT RANGE AND SENSITIVITY

The DC-2 flow meter utilizes three cells to measure different flow ranges. The ranges for the three available cells are listed below. Associated with each cell is the sensitivity as each flow cell range inherently produces a different sensitivity.

DC-LC-1 – low range – 10 to 300 ml/min, resolution - $\pm 1\%$

DC-MC-1 – mid range – 100 to 5000 ml/min, resolution - $\pm 1\%$

DC-HC-1 – high range – 0.5 to 30 L/min, resolution - $\pm 1\%$

For further information, please refer to the operations manual.

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4. EQUIPMENT AND APPARATUS

The BIOS DC-2 flow system is the only system applicable to the procedure. Associated equipment includes:

Various sizes of tubing

Power supply to charge the internal battery

Flow adaptors to connect to various fittings

5. INTERFERENCES

There are two external influences on the performance of the DC-2 flow meter.

1 – sunlight can interfere with the optical sensors measuring the time of piston travel. If used outside ensure it is shielded from direct sunlight.

2 – ambient temperature – if the DC-2 is used outside, ensure the ambient temperature is not below 5 degrees C. Operating the unit at temperatures lower than this temperature interferes with the proper travel of the piston up the cylinder.

6. PRECISION AND ACCURACY

The measurement precision is generally considered to be the “repeatability of the measurement”. The manufacturer guarantees the performance of the BIOS DC-2 in this area. It can be tested using a dry test meter in a laboratory environment or returned to the manufacturer for re-certification

The accuracy of the sensor is generally considered the “deviation from true”. This means how close it is to what it should be. The manufacturer specifies $\pm 1\%$ of scale accuracy for the BIOS DC-2 in this area. This can be tested using a dry test meter in a laboratory environment or returned to the manufacturer for re-certification.

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7. SITE REQUIREMENTS

This meter is a portable device and is not intended to be permanently installed. As discussed in section 5, it is best to make measurements indoors in a temperature-controlled environment.

8. INSTALLATION REQUIREMENTS

This meter is a portable device and is not intended to be permanently installed. When using the DC-2, it should be located on a solid surface like a table or bench top free from vibration. As discussed in section 5, it is best to make measurements indoors in a temperature-controlled environment.

9. OPERATIONAL REQUIREMENTS

The BIOS DC-2 flow meter is capable of measuring external flows from pressure or vacuum sources using a choice of three different flow cells connected to the system base. In order to measure flows effectively, complete the following steps:

Determine the approximate flow to be measured in order to select the proper flow cell. The selected cell should be able to easily handle the flow to measure. If the flow is too low for the range of the cell, the piston will take a very long time to traverse the required distance of the cell. If the flow is too high, the piston will be traveling the distance too fast and will result in inaccurate readings.

When connecting the flow cell to the base unit, ensure the base unit power is turned off.

Connect the line of the flow to be measured to the vacuum or pressure port on the flow cell. The direction of flow across the cell is represented by an arrow on the top of the flow cell. If the cell does not indicate the direction of flow, consult the manual to ensure the proper port is being used.

The main display shows V (volumetric) and S (standard corrected) flows for each reading or average. Consult the manual for further details on these flows and set-up of the operating parameters of the flow meter.

When not in use the flow cell ports must be capped to prevent foreign matter from entering the cell. Heat generated during battery charging may affect the internal temperature reading and therefore the corrected flow. Do not use this during or immediately after prolonged battery charge.

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10. OPERATIONAL REQUIREMENTS

On site calibration of the DryCal flow meter cannot be completed. The manufacturer recommends returning the flow meter to the factory on an annual basis for cleaning and recertification.

11. CALIBRATION

The manufacturer recommends the leak test procedure be performed periodically to ensure the integrity of the piston and cell system. Procedures to complete this test can be found in section 11.1 of the manual.

12. APPLICABLE DOCUMENTS

- **EM-032a** BIOS Drycal DC-2 Manual

13. LITERATURE REFERENCES

None

14. REVISION HISTORY

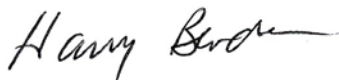
Revision 0 (new document)

Revision 1.0 – Section 7 & 8 – reword, repetition

Section 9 – Additions to operational requirements.

Changed Team Leader to Manager

15. APPROVAL



Approved by: Harry Benders
Title: Air Monitoring Manager

Date: February 1, 2011