

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division INDUSTRIAL HYGIENE GROUP Standard Operating Procedure	NUMBER IH75150
	REVISION: Final Rev3
SUBJECT: Air Sampling Pump Calibration for the Bios DryCal® DC-1, DC-2, DC Lite	DATE 05/24/07
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1.0 Purpose & Scope

This document documents a standardized procedure for calibrating air pumps using the DryCal® DC-1, Dc-2, or DC lite Flow Calibrator. The methodology is based on the procedure described in the DryCal Operating Instruction Manual, NIOSH methodology, and established BNL mechanisms for pump calibration and record-keeping.

The DryCal calibrators were developed to provide an automated technique for calibrating flow measurements of personal and environmental area pumps. This field-portable airflow calibrator utilizes a near-frictionless piston to give either single-reading flow rates or an average of up to ten readings. This method is applicable for sampling equipment with sampling rates in the range of 10 cc/min to 20 liters/min. The typical equipment calibrated by this method is battery operated sampling pumps used for the collection of volatile organic and particulates.

2.0 Responsibilities

2.1 Program Administration: This procedure is administered through the SHSD Industrial Hygiene Group.

2.2 Members of the SHSD Industrial Hygiene Group are required to follow this procedure.

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2.3 Other BNL organizations that provide BNL with field monitoring or other hazard assessment services are required to follow this SOP or an equivalent document that ensures an equal or superior method of assessment documentation and recordkeeping.

2.4 Only those personnel who have been trained and have demonstrated competence to the satisfaction of their supervision in the use of this procedure are authorized to complete air pump calibrations.

3.0 Definitions

3.1 *Media*: An assortment of sample devices designed to collect particulate, gases, and vapors into or onto a filter surface, sorbent, or liquid. The most common sampling media include sorbent tubes, filter cassettes, gas sampling bags, cyclones, and impingers.

3.2 *In-Line*: Refers to the scenario when sampling medium (such as a filter cassette or sorbent tube cassette) is connected to the sampling device (air-sampling pump) via a piece of flexible tubing.

4.0 Prerequisites

4.1 Training prior to using this procedure:

4.1.1 Demonstration of proper operation of the procedure to the satisfaction of the line supervision or the appropriate SHSD IH Program Administrator. See Section 7 for qualification requirements.

4.1.2 Other appropriate training for the area to be entered (check with ESH coordinator or FS Representative for the facility).

4.2 To compensate for sample media resistance and environmental influences on pump flow capacity, sampling pumps with sample media in-line are calibrated before and after use in the field. The policy of the IH group is average of the pre- and post-calibration numbers as the pump capacity. To minimize the effect of pump and meter variability, take a total of at least 6 (six) pre- and post-calibration readings (minimum 3 pre and 3 post readings) to determine the average pump flow rate.

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4.3 Calibrations should be done as soon before and after sampling as possible, but in all cases within 24 hours of sampling (exception is line voltage powered pumps). Post calibration must be done prior to recharging battery-operated pumps.

4.4 To insure that the dry test meter makes accurate measurements, the meter should be calibrated by a NIST traceable source or primary standard annually.

5.0 Precautions

5.1 Avoid operating the sampling equipment in excessive chemical or water vapor atmospheres.

5.2 Air containing cigarette smoke and/or other excessive dust and particulate should be filtered from the DryCal using filters on the entry side of the calibrator.

5.3 **Hazard Determination:** The operation of this test meter in itself does not involve any potential hazards. In the use of the meter to calibrate chemically exposed media, there is a very low potential for exposure to a chemical hazard. The level of exposure does not result in the potential for exposure above occupational exposure limits, but handling of exposed media should be minimized.

5.4 **Personal Protective Equipment**

5.4.1 Hand: Under normal use, hand protection is not required. Contact with highly contaminated media requires the use of disposable gloves. Exam-style, splash gloves are acceptable. Acceptable elastomers are: Nitrile, PVC, and Natural Rubber.

5.4.2 Body: Under normal use, body protection is not required.

5.4.3 Foot: Under normal use, foot protection is not required.

5.4.4 Respiratory: Under normal use, respiratory protection is not required.

5.4.5 Eye: Safety Glasses with side shields are required.

5.5 **Waste Disposal/ Environmental Impact:** Hazardous Waste is not generated in the use of this meter. This meter has no adverse environmental impact.

5.6 **Job Risk Assessment:** Consult the [Job Risk Assessment SHSD-JRA-03](#) for the hazards and controls of this SOP.

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6.0 Procedure

6.1 Equipment

Sample Pump (either):

- High volume air pump for environmental work area sampling (such as the Gast® DOL-101-AA).
- Personal air-sampling pumps (such as the SKC-224-43XR or the Low flow pump 222-3-Low Flow) for breathing zone sampling.

Sample Media (any of these depending on the contaminant)

- Cassettes (such as 37mm or 25 mm filter media)
- Various sorbent tubes
- Culture media for microbial impaction samplers

Tubing (for connection between the calibrator, sampling media and the pumps). Typical tubing is 0.25" ID PVC (Tygon®) tubing.

Calibrator: Bios International, Inc. DryCal Model DC-1, DC-2 or DC-Lite.

6.2 Preparation of Media and Calibrator

- 6.2.1 Plug in the DryCal flow calibrator twenty minutes prior to use to ensure that the battery is sufficiently charged.
- 6.2.2 Prior to calibrating any air-sampling pump, verify the operability of all sampling pumps and the DryCal DC-1, DC-2 or DC-Lite.
 - 6.2.2.1 Fully charge the pump unit according to the instrument manual.
 - 6.2.2.2 Remove both black inlet and outlet dust caps on cassettes or break off tips of tubes. Remove the end plugs from filter cassettes or break off the ends of glass tubes before attaching to the sampling hose. Use the actual media to be sent to the field.
 - 6.2.2.3 Let the pump run for at least five minutes before calibrating (to stabilize flow rate).
 - 6.2.2.4 Using tubing, attach media end that will be open to the environment directly to the DryCal flow calibrator. See the figure in Attachment 91.
 - 6.2.2.5 Attach the other end of the sample media, with tubing, to the pump.

6.3 Flow measurement with the DryCAL. (Done prior to field sampling-)

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6.4 Pre-calibration: Automatic Cycle Mode (Recommended Mode): To take automatic readings, first press and hold the <MODE> button and then the <READ> button and release simultaneously.

- 6.4.1 Let the calibrator run through a minimum of 3 cycles while in this mode to ensure that the calibrator and pump have stabilized.
- 6.4.2 Record the average from the meter for each 10 readings.
- 6.4.3 Record on the pump calibration log the average flow rates for a minimum of three cycles of 10 reading (See Attachment 9.2.)
- 6.4.4 To stop the calibrator cycling, push the <MODE> button until the piston stops.

6.5 Pre-calibration: Manual Cycle Mode: To take manual readings, press the <READ> button once. A flow measurement reading will appear on the LCD display.

- 6.5.1 Press <READ> again to continue this procedure to obtain the required number of flow readings.
- 6.5.2 All successive readings will automatically be used to calculate the average flow rate.
- 6.5.3 Record on the pump calibration log the average flow rates for a minimum of three cycles of 10 readings (See Attachment 9.2.)

6.6 Send sample media attached to pump, a blank set of media, temperature recording device (for organic vapors) and sample data sheets to the field with the sampler.

6.7 Post Calibration: Flow Measurement with DryCal (Done after field exposure-)

- 6.7.1 Verify the samples are not contaminated by questioning the person taking the samples. Do not accept contaminated samples without permission of the IH Group Leader.
- 6.7.2 Follow the procedures in Step 6.4.

6.8 Handling the sample(s) after Post-Calibration

- 6.8.1 Remove the sample media from the sample hose and replace end plugs on cassettes or put caps on tubes.
- 6.8.2 Place cassettes or tubes in plastic bags and seal with tamper proof tape. Place all paper work with samples.
- 6.8.3 Follow the SHSD Chain of Custody Procedure to process the sample for analysis.
- 6.8.4 Clean surfaces all pumps and hoses as needed.

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6.9 Documentation:

- 6.9.1 Average the pre-calibration and post calibration flow rate values and record on Air Sampling form from IH75140. Maintain the pump Calibration Records (IH75140) for 75 years.
- 6.9.2 Attachment 9.2 may be used as an optional aid in calibration. It is not retained after information is stored on IH75140.
- 6.9.3 Document that all battery checks have been done on all personal area sampling pumps.

7.0 Implementation and Training

Prior to using this procedure, the user:

- 7.1 Demonstrates proper operation of this instrument to the satisfaction of line supervision or SHSD IH Program Administrator.
- 7.2 Completes other appropriate training for the area or hazards to be handled (check with ESH coordinator or FS representative for the facility).
- 7.3 Completes qualification on this procedure listed in *Attachment 9.3 Job Performance Measure* on at least a 3 year basis.
- 7.4 Personnel are to document their training using the Qualification Criteria listed in *IH50300 Industrial Hygiene Service Delivery Basic Qualification Requirements*.

8.0 References

- 8.1 DryCal DC-1 Operating Instructions: Primary Air Flow Meters, Form #MANDC1-Word7, Rev. A, 02/05/97

9.0 Attachments

- 9.1 Photo of DryCal Apparatus
- 9.2 DryCal Pump Calibration Record
- 9.3 Qualification Record- Job Performance Measure

10.0 Documentation

The only official copy is on-line at the SHSD IH Group website.
 Before using a printed copy, verify that it is current by checking the document issue date on the website.

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Document Development and Revision Control Tracking

PREPARED BY: A. Sells Date 07/01/00	REVIEWED BY: <i>(Signature and date on file)</i> R. Wilson IH Lab Date 02/08/01	APPROVED BY: <i>(Signature and date on file)</i> R. Selvey SHSD IH Group Leader Date 02/07/01
ESH Coordinator/ Date: <i>none</i>	Work Coordinator/ Date: <i>none</i>	SHSD Manager / Date <i>none</i>
QA Representative / Date: <i>none</i>	Training Coordinator / Date: <i>none</i>	Filing Code: IH52
Facility Support Rep. / Date: <i>none</i>	Environ. Compliance Rep. / Date: <i>none</i>	Effective Date: 03/08/01
ISM Review - Hazard Categorization <input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input type="checkbox"/> Desk Top Review <input type="checkbox"/> SME Review Name / Date:	Implementation: Training Completed: Tracked in BTMS Procedure posted on Web: 05/24/07 Hard Copy files updated: 05/24/07 Document Control: 05/24/07

Revision Log

Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Revised format and added SBMS header, added PPE, Hazard Assessment sections, overall update of text in all sections.		
R. Selvey 02/07/01 <i>(signature/date on file)</i> SME Reviewer/Date:	Reviewer/Date:	Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Revised SOP number from UH-CP-20.1 to new system IH75150, Re-titled IH75150 Rev0.. Reviewed text contents, no changes needed.		
R. Selvey 03/08/01 <i>(signature/date on file)</i> SME Reviewer/Date:	SME Reviewer/Date:	SME Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input checked="" type="checkbox"/> Periodic review <input type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Rev1: Revised to include Section 7 Implementation and Training. Text added to Section 2, 4, 5, 6, and 7.		
R. Selvey 03/29/05 <i>(signature/date on file)</i> SME Reviewer/Date:	SME Reviewer/Date:	SME Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Added Attachment 9.3 Job Performance Measure		

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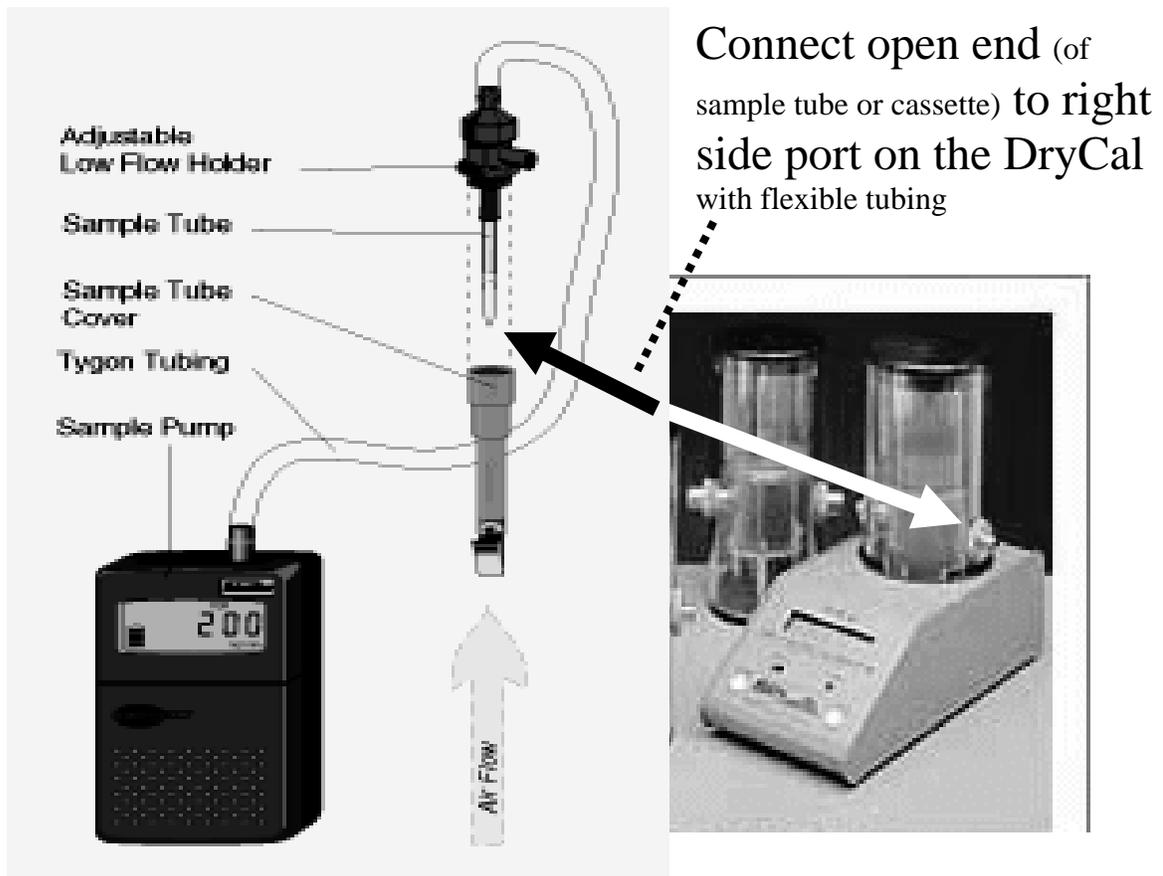
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<i>R. Selvey 08/30/06 (signature/date on file)</i> SME Reviewer/Date:	SME Reviewer/Date:	SME Reviewer/Date:
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Revised Section 7.4 for the correct SOP#. Added Attachment 9.3 Job Performance Measure		
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Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input checked="" type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input checked="" type="checkbox"/> none of the above Section/page and Description of change: Revised Section 7.4 for the correct SOP#. Revised the document storage in Section 6.5 regarding IH75140 and IH75150 Attachment 9.2. Updated Attachment 9.2 to be an unofficial record used as an aid in calibration.		
<i>R. Selvey 05/24/07 (signature/date on file)</i> SME Reviewer/Date:	SME Reviewer/Date:	SME Reviewer/Date:

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Attachment 9.1 Photo and Diagram of the Bios Calibrator



Temporary Processing Sheet for DryCal Pump Calibration

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Pump Identifier	Pre-exposure			Post- exposure		
	Date	10 Reading Set Average		Date	10 Reading Set Average	
		1	2		1	2
		3	Avg		3	Avg

Bios Drycal® Operation
Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:
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Practical Skill Evaluation: Demonstration of Evaluation Methodology by Oral Exam

Criteria	Qualifying Performance Standard	Unsat.	Recov.	Satisf.
1. Personal Protective Equipment	Understands the need to be aware of the potential surface contamination, airborne levels of contaminants, radiological hazards, and noise hazard. Knows how to determine the need for PPE.			
2. Sampling Equipment	Knows where equipment needed for the procedure is located and how to properly sign it out.			
3. Pre-Testing Inspection	Verifies the system to be calibrated is operational and represents operation that will be or has been used during sampling.			
4. DryCal Set up	Knows how to turn on, warm up and operate the Drycal®.			
5. Measurement of flow	Knows how to properly measure the flowrate of the sampling equipment,			
6. Documentation	Demonstrates correctly filling out IH monitoring forms.			
7. Risk Assessment	Understand the risk assessment and controls described in Job Risk Assessment SHSD-JRA-03 .			

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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