

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>1 OF 22</b>

## Contents

- 1.0 Purpose/Scope**
- 2.0 Responsibilities**
- 3.0 Definitions**
- 4.0 Prerequisites**
- 5.0 Precautions**
- 6.0 Procedure**
- 7.0 Implementation and Training**
- 8.0 References**
- 9.0 Attachments**
- 10.0 Documentation**



### **1.0 Purpose/Scope**

The purpose of this document is to provide a link to the procedures for operating the air testing meters used for exhaust ventilation testing. The procedure is based and supplements on information provided in the operation and service manual.

### **2.0 Responsibilities**

- 2.1 This procedure will be implemented through the SHSD Industrial Hygiene Group Leader. Members of the SHSD Industrial Hygiene Group, Safety & Health Services Representatives and other organizations can perform tasks in this program.
- 2.2 The persons using these meters are responsible to:
  - Ensure the integrity of the data and proper transfer to the IH Group database.
  - Maintain training for the appropriate personal protective equipment needed for areas entered.
  - Complete all required training and qualification for other hazards that may be present in areas (such as respiratory protection or radiation contamination)
  - Comply with all work planning and work permit system requirements.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>2 OF 22</b>

- Request and check the instrument in and out following the SHSD IH Group lab procedures.

### 3.0 Definitions none

### 4.0 Prerequisites none

### 5.0 Precautions

#### 5.1 **Hazard Determination:**

- 5.1.1 These meters may be used in areas where chemical contamination may be present. These contaminants can have significant health effects and must receive a hazard evaluation by a cognizant ESH professional. These meters do not generate a hazard to the operator or occupants.
- 5.1.2 Smoke generating devices such as candles, matches, or smoke generators may be used in conjunction with these meters for visual observation of airflow patterns. Although the smoke is hazardous it is typically used in small quantities and controlled by the ventilation system being tested.
- 5.1.3 Using this procedure does not generate Hazardous Wastes or have negative environmental consequences.
- 5.1.4 The test equipment design does not cause significant ergonomic concerns in routine use. The meter does not have a noise hazard.

#### 5.2 **Personal Protective Equipment**

- 5.2.1 These meters are primarily used for measuring airflow velocity and volume flow rates where there is some risk to the sampler from hazardous chemicals or radiological contamination. Personal Protective Equipment may be needed as appropriate to the task.
- 5.2.2 Eye protection is required.

### 6.0 Procedure

- 6.1 Inspect the meter: Visually inspect the meter to ensure all parts are working, undamaged and the batteries are good. Each unit has a calibration sticker, which shows the past calibration date and the due date for the next calibration. Do Not use a

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
<b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	DATE <b>09/16/09</b>
	PAGE <b>3 OF 22</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	

meter that is out of calibration.

- 6.2 See Attachment 9 or the meter Instrument Manual/ Operating Instruction for guidance on operation of the meters.
- 6.3 Record testing/measuring results on the appropriate sampling form in SHSD IH procedures, such as IH62200 HEPA filter Testing and IH62400 for Local Exhaust Ventilation Testing. Forms are available in the SHSD SOP web page in Series IH62.

## **7.0 Implementation and Training**

- 7.1 Using these meters is to be performed only by persons who have demonstrated competence as evidenced by experience and/or training. The qualification to use these meters is documented using Attachment to this SOP: *Job Performance Measure*.

## **8.0 References**

- 8.1 TSI Incorporated Operation and Service Manual Model 8355 Series VelociCalc Air Velocity Meter.
- 8.2 TSI Incorporated Operation and Service Manual Model 9555 Series VelociCalc Air Velocity Meter.
- 8.3 Alnor P-600 Velometer Manual.
- 8.4 Alnor EBT-721 Operation Manual
- 8.5 Testo 510 and 511 Instrument Manual

## **9.0 Attachments**

- 9.1 VelociCalc 9555 Air Velocity Meter
- 9.2 VelociCalc 8355 Air Velocity Meter
- 9.3 Alnor P-600 Velometer
- 9.4 Alnor EBT-721 Manometer
- 9.5 Testo 510 and 511 Manometer
- 9.6 Atari Smoke Generator
- 9.7 *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.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>4 OF 22</b>

Document Development and Revision Control Tracking		
Prepared By: <i>(signature/date on file)</i> W. Litzke 11/19/07	Reviewed By / Date: <i>(signature/date on file)</i> R. Selvey 11/19/07 Certified Industrial Hygienist	Approved By / Date: <i>(signature/date on file)</i> R. Selvey 11/19/07 Industrial Hygienist Group Leader
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: <b>IH52.05</b>
Facility Support Rep. / Date: <i>none</i>	Environ. Compliance Rep. / Date: <i>none</i>	Effective Date: <b>11/19/07</b>
ISM Review - Hazard Categorization <input type="checkbox"/> High <input type="checkbox"/> Moderate <input checked="" 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: 09/16/09 Hard Copy files updated: 09/16/09 Forms Updated: 09/16/09

Revision Log
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input 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 type="checkbox"/> none of the above Section/page and Description of change: Rev0- This procedure is a merger of IH62640 and IH62690 which are now rescinded. Significant changes have been made in the text of this SOP in the merger. Attachments have been created from the former meter operation procedures and JPM has been renumbered and updated to expand the scope. SME Reviewer/Date: R. Selvey 09/16/09 <i>(signature/date on-file)</i>

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>5 OF 22</b>

## Attachment 9.1

### VelociCalc 9555 Air velocity Meter

The procedure for operating the *TSI VelociCalc*<sup>®</sup> 9555 is based on information provided in the operation and service manual. The data collected with this meter may be used to determine acceptable airflow in chemical hoods as well as local exhaust ventilation and HVAC systems.

#### Definitions:

*Sample:* Consists of all of the measurement parameters stored at the same time.

*Test ID:* This consists of a group of samples. The Model 9555 calculates the statistics (average, minimum, maximum, and count) for each test ID. The maximum number of test IDs is 100.

*Time Constant:* The time constant is an averaging period and is used to dampen the display. A longer time constant will slow the fluctuations. The display will update every second, but the displayed reading will be the average over the last time constant period. For example, if the time constant is 10 seconds, the display will update every second, but the displayed reading will be the average from the last 10 seconds.

*Logging Interval:* This logging interval is a frequency period that the instrument will log readings. For example, if the logging interval is set to 30 minutes, each sample will be the average of the last 30 minutes.

#### Equipment:

- *TSI VelociCalc*<sup>®</sup> 9555 air velocity meter
- Static pressure tip
- Rubber tubing
- Probe with sensors
- Four (4) AA batteries or AC Adapter
- Source of smoke, for visual observation of airflow patterns.

#### Method:

1. Do Not Use a meter that is out of calibration. **CALIBRATION:** To maintain a high degree of accuracy in your measurements, the Model 9555 may be returned to TSI for annual recalibration. Refer the User's Manual for instruction on doing so. The Model 9555 can also be recalibrated in the field using the 'Calibration' menu. These field adjustments are intended to make minor changes in calibration to match a user's calibrations standards. The field adjustment is NOT intended as a complete calibration capability. For complete, multiple-point calibration and certification, the instrument should be returned to the factory.
2. Using the Probe: The telescoping probe, mounted on the side of the unit contains the velocity, temperature and humidity sensors. You can use the probe either mounted on the side or hand held. To

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>6 OF 22</b>

extend the probe, hold the handle in one hand while pulling on the probe tip with the other hand. Do not hold the cable while extending the probe as this prevents the probe from extending. To retract the probe, hold the handle in one hand while gently pushing on the probe tip with the other hand. If you feel the probe antenna binding, pull gently on the probe cable until the smallest antenna section is retracted. Collapse the rest of the antenna by pressing the probe tip.

**WARNING:** Excessive heat can damage sensor. The range of operation is 14 to 140 °F (-10 to 60 °C). The pressure sensor is protected from damage up to 7 psi (48kPa or 360 mmHg).

- When using the probe, make sure the sensor window is fully exposed and the orientation dimple is **facing upstream**.

**NOTE:** For temperature and humidity measurements, make sure that at least 3 inches (7.5 cm) of the probe is in the flow to allow the temperature and humidity sensors to be in the air stream.

- The probe is marked in inches for conducting traverse measurements. Make sure all necessary sections of the probe are extended for the depth to be measured.
- Using the Keypad Functions

Key	Function
ON/OFF	Press to turn the unit ON. During power up the display will show: Model No. and Serial No., Software Rev., and Last Date Calibrated.
Arrows (▲▼)	Scroll to set parameters. Pressing both keys simultaneously locks the keypad to prevent unauthorized adjustments to the instrument. To unlock the keypad, press both keys again simultaneously.
<↵ (Enter)	Press to accept a value or condition
Arrows (◀▶)	Press arrows keys to change choices while setting parameters. Press the Menu soft key to select: Display Setup, Pressure Zero, Settings, Flow Setup, Actual/Std Setup, Data Logging, Applications, Calibration, and Printer.
<b>DISPLAY SETUP</b>	This sets up the desired parameters to be displayed on the running screen. The ON soft key selects the highlighted parameter; the OFF soft key turns off the parameter. Use PRIMARY soft key to select the larger display of the parameter. Only one parameter can be selected as a primary, and up to 4 secondary parameters can be selected at one time.
<b>PRESSURE ZERO</b>	To zero the pressure reading, select Pressure Zero menu. The meter will indicate if the pressure zero was successful.
<b>SETTINGS</b>	Settings menu is where you can set the general settings. These include Language, Beeper, Select Units, Time Constant, Contrast, Set Time, Set Date, Time Format, Date Format, Number Format, Backlight, and Auto OFF. Use the ◀▶ soft keys to adjust the settings for each option and use the <↵ (Enter) key to accept settings.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>7 OF 22</b>

Key	Function
<b>FLOW SET UP</b>	In Flow Setup mode, there are 5 types: Round Duct, Rectangular Duct, Duct Area, Horn and K-Factor. Use the ◀or ▶ soft keys to scroll through the types and ten press the <⏏ (Enter) key to accept the desired type, To change the value, highlight the 'Enter Settings option and press the <⏏ (Enter) key.
<b>ACTUAL/ STANDARD SETUP</b>	Choose Actual/ Standard measurements and parameters in the Act/Std Setup menu. Within this menu, the user can also select Standard Temperature, Standard Pressure and a source for the actual temperature. The Model 9555 measures the actual barometric pressure.
<b>DATA LOGGING</b>	Measurements to be logged are independent of measurements on the display, and must therefore be selected under Data Logging → Measurements. Refer to the User's Manual for Log Settings. Logging Intervals can be set from 1 second to 1 hour.
<b>APPLICATIONS</b>	Choose Draft Rate, Heat flow, Turbulence and % Outside Air in the Applications menu.
<b>PRINTING</b>	To print logged data, first enter the 'Data Logging' menu. Then, use the 'Choose Test' time to select the data to be printed. After selecting the test, use 'View Stats' and 'View Samples' to select statistics or individual data points to view and print. Press 'Print' key to print the data.
<b>TRAKPRO™ SOFTWARE</b>	<p>VelociCalc Model 9555 comes with software on a CD-ROM for data analysis. Refer to the software's Help function for information on its use. Updates are available from the TSI website at <a href="http://software.tsi.com">http://software.tsi.com</a>.</p> <p>To download data from the Model 9555, connect the supplied computer interface USB cable to a computer USB port.</p>

6. Measuring Velocity: The unit automatically starts in the velocity mode. When using the probe, make sure the sensor window (tip of probe) is fully exposed and the orientation dimple is facing upstream. When the tip is not visible (eg. inside a duct) slowly rotate the probe to get the highest reading. Fluctuating velocity readings mean the probe is in a turbulent flow area. Find another location for testing or adjust the time constant (see Time Constant adjustment later).
7. Measuring Flow Rate
  - 7.1. Press the Menu soft key to select 'Display Setup.' The 'Flow' option should be set 'ON.' Return to the Menu and select 'Flow Setting.' This is where you can set up the shape and size of the duct. Under 'Flow Type' you can select round duct, rectangle duct, duct area, horn, and k-factor.
  - 7.2. You can enter the dimensions under 'Enter Settings.' For a circular duct enter the inside *diameter* of the duct.
  - 7.3. For a rectangular duct the first size is the horizontal width. Use the ◀or ▶ soft keys to adjust the internal duct size to that of the duct being measured. Press 'Enter' to accept setting. Now adjust the vertical dimension and press 'Enter' to accept.
  - 7.4. Press 'ESC' to exit the 'Flow Setting,' and again to exit the 'Menu'. The flow rate reads in cubic

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>8 OF 22</b>

feet per minute (CFM).

8. Selecting the Time Constant

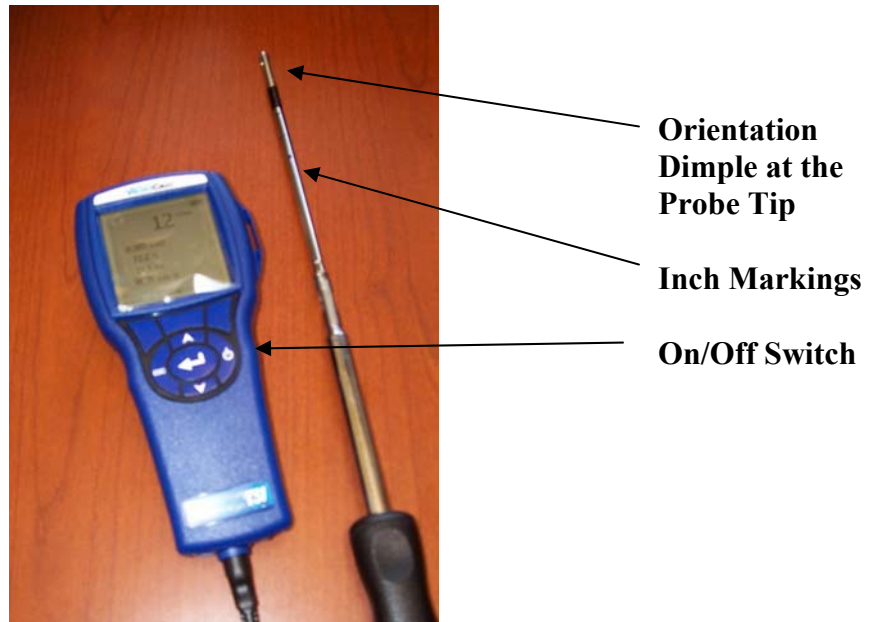
8.1. The time constant can be set from the Menu by selecting 'Settings,' then 'Time Constant.' This value is an averaging period. It is adjusted when velocity, flow rate or pressure levels are fluctuating. A longer time constant will slow down fluctuations. The display will update every second, but the displayed reading will be the average over the last time constant period. For example, if the time constant is 5 seconds, the display will update every second, but the displayed reading will be the average from the last 5 seconds. This is also referred to as a "moving average."

8.2. Displayed values are not accurate until at least one time constant has elapsed.

9. Batteries/ AC Adapter

9.1. The Model 9555 is designed to operate with either alkaline or NiMH rechargeable batteries. Battery life will be shorter if NiMH batteries are used. If NiMH batteries are used the DIP switch inside the back of the unit will need to be changed. Refer to the User's Manual, Appendix B for instructions on doing so.

9.2. When using the AC adapter, the batteries (if installed) will be bypassed.



<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
<b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	DATE <b>09/16/09</b>
	PAGE <b>9 OF 22</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	

## Attachment 9.2

### TSI VelociCalc® 8355 Air Velocity Meters

The procedure for operating the *TSI VelociCalc*® 8355/8357/8360 is based on information provided in the operation and service manual. The data collected with this meter may be used to determine acceptable airflow in chemical hoods as well as local exhaust ventilation and HVAC systems.

#### Equipment:

- *TSI VelociCalc*® 8355/8357/8360 air velocity meters.
- Probe with sensors.
- (4) AA batteries.
- A source of smoke may be required for use with this equipment for visual observation of air flow patterns.

#### Procedure:

1. Inspect the meter: Visually inspect the meter to ensure all parts are working, undamaged and the batteries are good. Each unit has a calibration sticker, which shows the past calibration date and the due date for the next calibration. Do Not Use a meter that is out of calibration.
2. Using the Probe: The telescoping probe, mounted on the side of the unit contains the velocity, temperature and humidity sensors (humidity sensor, Model 8360 only). You can use the probe either mounted on the side or hand held. Pulling the probe to extend the tip or pushing it back into the handle moves the wire cable as well. Do not hold the wire while trying to extend or retract the probe. To extend the probe hold the handle in one hand and pull on the knurled tip with the other. To retract the probe, hold the handle in one hand and push on the probe tip with the other.
3. When using the probe, make sure the sensor window is fully exposed and the red orientation dot is facing upstream.
4. The probe is marked in inches for conducting traverse measurements. Make sure all necessary sections of the probe are extended for the depth to be measured.
5. Check Units of Measurement: The units of measurement may be changed. Check the units and if you need to change them, please have the IH lab technician make the changes before use.



<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
<b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	DATE <b>09/16/09</b>
	PAGE <b>10 OF 22</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	

6. Turn the Unit On: Move the power switch on the side of the unit, which is located between the probe brackets. The meter immediately begins an internal self-check. If any problems are encountered the word Cal is shown on the display and the unit should be returned for calibration or adjustment.
7. Measuring Velocity: The unit automatically starts in the velocity mode. Make sure the sensor window (tip of probe) is fully exposed and the red orientation dot is facing upstream. When the tip is not visible (eg. Inside a duct) slowly rotate the probe to get the highest reading.

Fluctuating velocity readings mean the probe is in a turbulent flow area. Find another location for testing or adjust the time constant (see Time Constant adjustment later).

8. Measuring Flow Rate
  - Press the FlowRate button on the keypad. If during set up of shape and size you make a mistake, continue to the end of the procedure then start again.
  - The display shows a rectangle and a circle. Press the Shape Key to select the shape of the duct.
  - Press Enter to accept the shape and move to the size criteria.
  - For a circular duct enter the inside *diameter* of the duct.
  - For a rectangular duct the first size is the horizontal width. Use the Larger/Smaller buttons to adjust the internal duct size to that of the duct being measured. Press enter to accept and move to the vertical size.
  - Use the larger/smaller buttons to adjust the internal duct size to that of the duct being measured.
  - Press Enter to accept the vertical size and begin flow measurements. The readings are in cubic feet per minute (ft<sup>3</sup>/min).
  - To make multiple point flow rate measurements, it is necessary to use the store and averaging functions.
  - Pressing the Store key at any time will store the display reading. Pressing the average key will display the number of readings being averaged (stored values) and then the average Flow Rate. This does not affect the stored data. Additional readings may be stored and averaged into the overall Flow Rate.
  - Pressing the Clear key on the keypad erases all stored values in the storage register for the current activity. Set the meter in the mode desired and press clear to delete the readings in that mode. Pressing the Clear key in the velocity mode does not affect readings stored in the temperature/humidity/pressure modes.
9. Measuring Temperature.
  - Press the Temperature button on the keypad to select the temperature measurement.
  - Allow approximately 30 seconds for the temperature sensor to stabilize from the velocity measurement mode.
10. Selecting the Time Constant
  - The time constant Key on the keyboard may be adjusted when velocity, flow rate or pressure levels

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.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>11 OF 22</b>

are fluctuating. The meter takes a reading every second and remembers the last 20 readings. Depending on the time constant a certain number of these readings are used for averaging. For instance, if the time constant is set to 5, the newest 5 readings are averaged together and the other 15 readings are ignored.

- Check the Time Constant by pressing the Time Constant key and release it as soon as the first value is displayed. The current Time Constant is always displayed first.
- Use the Time Constant key to set the reading to 1, 5, 10, 15, or 20 seconds. Press and hold the Time Constant key until the desired time constant is displayed then release the key.
- Displayed values are not accurate until at least one time constant has elapsed.

#### 11. AC Adapter

- The AC adapter allows the meter to run with or without batteries. This is not a battery charger.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>12 OF 22</b>

## Attachment 9.3

### Alnor 600-P Velometer

This document describes how to use the *Alnor*<sup>®</sup> *Velometer* meter for collecting air velocity and duct static pressure data. The procedure is based on information provided in the operating instructions manual. The data collected with this meter may be used to determine acceptable airflow and duct pressure measurements for chemical hoods as well as local exhaust ventilation and HVAC systems. The unit is an analog meter and has no data logging capabilities.



#### Definitions:

*Pitot Probe*: a general purpose measuring probe suitable for velocity measurements at supply openings, return openings and within ducts. The principle is to measure differential pressures and use these to calculate the air velocity.

*Low Flow Probe*: Attached directly to the meter body this probe is intended to measure velocity ranges of 30-300 feet per minute (fpm). This is particularly suited for: drafts in rooms or open spaces; ventilating hood/spray booth face velocity; and similar applications.

*Diffuser Probe*: This probe is designed to measure the output of HVAC supply/return diffusers. A manufacturer's "K" factor is required for each type of diffuser tested.

*Static Pressure Probe*: This probe measures static pressure of a duct by securely placing over a one-quarter inch hole drilled in the side of the duct. There are two static pressure probes. The first measures up to 1" wg. The second measures up to 10" wg.

*Range Selector*: Two range selectors are available for the *Alnor*<sup>®</sup> *Velometer*. The first selector may be switched for ranges 0-1,250 and 0-2,500 fpm. The second selector may be switched for ranges 0-5,000 and 0-10,000 fpm. These scales are directly read from the meter body.

*K Factor*: Each manufacturer of supply/return diffusers for HVAC systems develops this factor for adjustments to air velocity readings to calculate flow rates.

#### Equipment:

- *Alnor*<sup>®</sup> *Velometer* meter.
- Measuring Probes (4): Lo-Flo; Pitot; Diffuser; Static Pressure
- Range Selectors: (2)
- Connecting Hoses (2)
- Range Selector Filters

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>13 OF 22</b>

- A source of smoke may be required for use with this equipment for visual observation of air flow patterns.

**Procedure:**

1. Inspect the meter and accessories: Visually inspect the meter to ensure all parts are working and undamaged. There are no batteries with this unit. There is no manufacturer's recommended calibration for this unit. Check the hoses for cracks and leaks.

2. Using the Probes Probe selection is based on the task to be conducted and the range of expected values. There are four (4) probes and two range selectors provided with the kit.

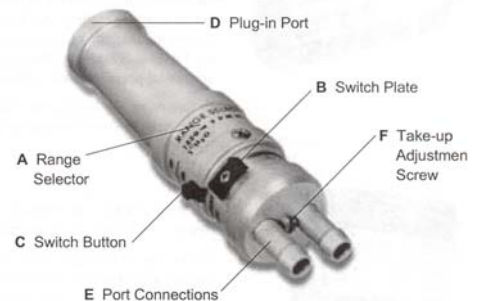
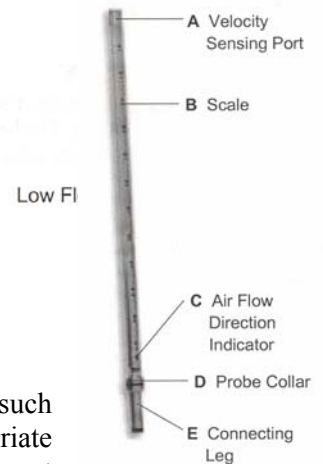
3. Units of Measurement The unit is set to read in feet per minute for air velocity and inches wg for pressure with multiple scales on one meter. There are no internal mechanisms for averaging or calculating air flows (cubic feet per minute).

4. Using the Velometer There is no on/off switch. The unit is ready for measuring as soon as the correct probe and accessories are attached.

5. **Lo-Flow Probe:** Measuring Velocity: low flow applications such as: open areas; hood face velocities; and spray booths. Connect the Lo-Flow Probe directly to the meter. No hose is necessary and the probe only fits on one way. A filter is built in to protect the velometer. Measurements should be in the range of 30-300 fpm and the reading is taken directly from the 0-300 scale on the meter. The instrument should be held so the pointer on the head of the probe points in the direction of air flow. In cases where the direction of air flow is unknown, slowly turn the instrument until the maximum reading is obtained.

6. **Pitot Probe:** Measuring Velocity: high flows in ductwork and at openings such as slot intakes and grinding wheels. The pitot probe is attached to the appropriate Range Selector. The range selector slide switch should be moved to the correct position indicating the maximum velocity anticipated. The knurled knob on the range selector should be in the **"OUT"** position. Note: If the knob does not turn in either direction it is in the out position.

- On the bottom of the range selector are two fittings labeled + and -. Remove the red caps and securely attach the tubing to each fitting then the corresponding fitting on the meter body (+ to + ; - to -).
- The Probe is now ready to measure air velocity.

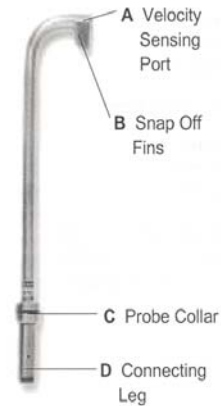


<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>14 OF 22</b>

- Using the range selectors and the multiple scales on the meter, the pitot probe can be used to measure air velocities from 100-10,000 fpm (0.5-50 meters per second).
- In case the direction of flow is unknown, rotate the pitot probe slowly to obtain the maximum reading and the arrow on the probe will then indicate the direction of flow.
- Directly read the air velocity on the instrument meter using the scale corresponding to the range chosen on the range selector.
- When measuring air flows inside ducts, it is necessary to have a 5/8 inch hole in the side of the ductwork. The pitot probe is inserted with the arrow pointing in the direction of flow inside the duct.
- The pitot probe is marked to indicate the insertion depth for readings at various depths. Record both the velocity and the depth for calculating the average air velocity across the duct.

7. **Diffuser Probe:** Measuring Velocity: high flows such as at HVAC supply/return diffusers and supply openings.

- The diffuser probe is attached to the appropriate Range Selector. Push down firmly until the probe collar rests against the range selector.
- The range selector slide switch should be moved to the correct position indicating the maximum velocity anticipated. The knurled knob on the range selector should be in the **“IN”** position. Press the knob into the range selector and turn clockwise to lock in place.
- On the bottom of the range selector are two fittings labeled + and -. Remove the red caps and securely attach the tubing to each fitting.
- For supply diffusers and supply openings,** attach the tubes to the corresponding fitting on the meter body (+ to + ; - to -).
- For return diffusers,** attach the tubing in the reverse order (+ on range selector to - on velometer body; and - on Range Selector to + on the velometer body)
- The Probe is now ready to measure air velocity.
- Using the range selectors, the diffuser probe can be used to measure air velocities from 100-10,000 fpm (0.5-50 meters per second).
- The diffuser probe has snap off fins to accurately position the probe vertically, horizontally and radially.
- When determining diffuser air flows the manufacturer’s “K” factor should be used to correct the readings. Multiply the average velocity reading by the “K” factor to calculate the air flow.  $Q=KV$



**Static Pressure Probe:** Measuring Static Pressure at the exterior duct surface.

- There are two static pressure probes. Select the probe and attach to the appropriate Range Selector pushing down firmly until the probe collar rests against the range selector. The 1”wg probe should be attached to the Range Selector, which shows 1”wg.
- The range selector slide switch should be moved to the left indicating the maximum pressure anticipated. The lower range selector may be used up to a maximum of 1 “wg. The higher range selector may be used for a maximum



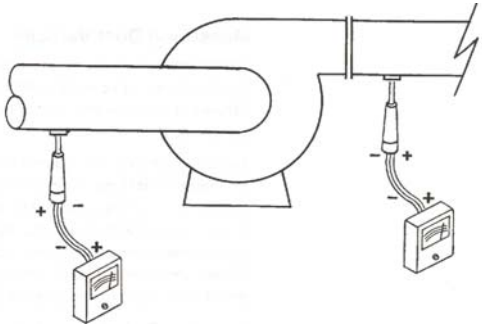
<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>15 OF 22</b>

pressure of 10”wg.

- The knurled knob on the range selector should be in the **“IN”** position. Press the knob into the range selector and turn clockwise to lock in place.
  - On the bottom of the range selector are two fittings labeled + and -. Remove the red caps and securely attach the tubing to each fitting.
  - ***For positive pressures (downstream of the fan)***, attach the tubes to the corresponding fitting on the meter body (+ to + ; - to -).
  - ***For negative pressures (upstream of the fan)***, attach the tubing in the reverse order (‘+’ on range selector to ‘-’ on velometer body; and ‘-’ on Range Selector to ‘+’ on the velometer body)
  - The Probe is now ready to measure static pressure.
  - Static pressure readings are read directly from the meter scale on the appropriate scale matching the probe.
  - ***Note: the Alnor<sup>®</sup> Velometer is not intended for use in corrosive atmospheres.***
8. ***Maintenance:*** The Alnor<sup>®</sup> Velometer requires very little maintenance. If any difficulties in the operation of the velometer should develop, return the instrument to the IH lab for necessary maintenance.

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.

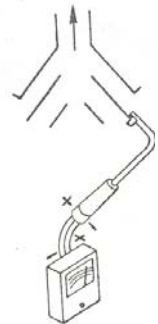
<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>16 OF 22</b>



**Measuring Static Pressure**



**Supply**

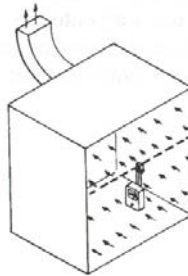


**Return**

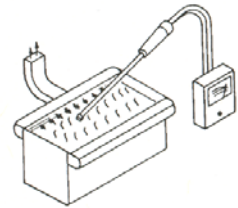
**Measuring Diffuser Air Velocity**



**Measuring Grinding/Buffering Wheel Velocity**



**Measuring Hood Face Velocity**



**Measuring Slot Velocity**

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
<b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	DATE <b>09/16/09</b>
	PAGE <b>17 OF 22</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	

## Attachment 9.4

### Alnor EBT721 Balometer®

When placed over a diffuser or grille, an Alnor® ABT Balometer® Capture Hood can measure the air volume and trend the flow rate.

#### Procedure:

- 1. Power the Micromanometer with the AC Adapter or Batteries:**  
When the AC adapter is plugged into the micromanometer, the unit automatically turns on, runs a brief diagnostic check, and briefly lights all segments of the display. It then displays the type of batteries the unit is set to use (alkaline or rechargeable NiMH) and turns itself OFF. The Electronic Balancing Tool or ProHood requires four AA-size alkaline batteries or rechargeable NiMH batteries. Whenever the AC adapter is plugged into the micromanometer, the rechargeable batteries are recharged.
- 2. Connecting the Pitot Tube to the Micromanometer** The static pressure port (-) on the pitot tube connects to the negative pressure (-) port on the micromanometer, and the total pressure port (+) on the pitot tube to the positive (+) port on the micromanometer.
- 3. Connecting the Static Pressure Port to the Micromanometer** The static pressure port on the static pressure probe connects to the (+) port on the micromanometer. The (-) port on the micromanometer is left open to atmosphere.
- 4. Connecting the Velocity Matrix to the Micromanometer** Connect the positive port (+ located opposite the handle assembly on the Velocity Matrix to the (+) port on the micromanometer, and the negative port (-) on the Velocity Matrix to the (-) port on the micromanometer. Standoffs can be screwed together to make different lengths and are used to maintain a fixed and level orientation away from a filter. The standoffs are attached to the positive (+) side of the velocity matrix.




- 5. Attaching the Micromanometer to the Capture Hood Base** Tilt the meter forward and align the tabs in the base of the meter with the two matching slots in the bottom of the recessed area at the front

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division  <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>18 OF 22</b>

of the base . Attach the temperature cable and the back pressure flap switch cable to the right side of the meter.

6. **Operation** To take Samples while in the pressure mode:
- Turn on the micromanometer by pressing the I/O key. The unit displays INIT (initializing) and runs a brief diagnostic test. If the display mode is set to SINGLE, the unit will stop and show READY on the display.
  - Pressing READ will begin a reading, which stops automatically when the reading is done.
  - If the display mode is set to RUNAVG, the micromanometer will start measuring continuously, and pressing READ will pause and resume the measurement. While the unit reads the measurements, it makes a “clicking” sound. When data collection is finished, the display shows the pressure reading.
  - Press the SAVE key to save the displayed reading to the currently selected Test ID. (If the SAVE key is pressed before the micromanometer has collected enough data to save, NO.DATA is displayed.)

**Keypad Operation** The keypad enters the following functions:

<b>I/O</b>	The ON/OFF key is used to turn the micromanometer on or off.
↑ ↓ ← →	The arrow keys let you navigate through menus or select options.
↵	The ENTER key is used to accept the present value or move to the next level of a menu.
☀	The BACKLIGHT key turns the display’s backlighting on and off. Use backlighting only when working in areas where you cannot read the display with existing light. Backlighting has a significant impact on battery life.
<b>ESC</b>	The ESCAPE key is used to cancel or end an operation or back up to the last screen of displayed information. The ESC key is useful if you press and realize you meant to use one of the other keys.
<b>READ</b>	If the display mode is set to SINGLE, pressing the READ key begins a reading, which stops automatically when the reading is done. If the display mode is set to RUNAVG, the micromanometer will measure continuously, and pressing READ will alternately pause or resume the measurement.
<b>SAVE</b>	The SAVE key is used to save the currently displayed measurement to the data logging memory.
<b>NEXT TEST</b>	The NEXT TEST key is used to select a new unused Test Id for saving Samples when logging data.
<b>STATS</b>	The STATISTICS key lets you display COUNT, Minimum, Maximum and Average for the Test ID currently selected for logging data.
	The PRINT key downloads data to an optional printer or to a computer.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>19 OF 22</b>







## Attachment 9.5

### Testo 510 & 511 Pressure Manometer

510: Differential Pressure manometer- measures the difference in pressure between to sampling ports.

511: Absolute Pressure manometer- measure the difference between the sample port and background (atmospheric pressure)



1. Turn on by pressing the  button.
2. To change the *unit of measure*: With the meter off, press and hold the  button to change the units of the display. Toggle between the *unit of measure* with the  button. When the desired *units of measure* is flashing, press [Mode] to confirm. Units of measure:  
510 Differential: hPa, mbar, Pa, mmH<sub>2</sub>O, mmHg, psi, inH<sub>2</sub>O, inHg, m/s, fpm  
511 Absolute: hPa, mbar, Pa, mmH<sub>2</sub>O, mmHg, psi, inH<sub>2</sub>O, inHg,
3. Zero: Press . The meter will Zero the sensor.
4. The meter will automatically begin displaying the current pressure level and will be recording the Minimum and Maximum levels also.
5. Press [Mode] to toggle thru the setting of: **Hold / Max / Min/ Hold/**
6. To Clear the stored values for Minimum and Maximum: Press and hold [Mode] until “- - -” displays. Then release [Mode].
7. Briefly Press the  button to activate the backlight for 10 seconds.
8. The meter will also automatically clear the stored values when turned off.
9. Turn the meter off by holding the  button for 2 seconds.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>20 OF 22</b>

## Attachment 9.6

### Antari Smoke Generator (Mobile Fogger)

#### Precautions:

- Always remove the battery or unplug the power adaptor before filling the liquid tank.
- Keep fog machine upright.
- Remove the battery or unplug the power adaptor when not in use.
- *Danger of burns* Keep nozzle & output at least 50 cm (20 in.) away from contact with anything while in operation. The fog vapor at point of release is under pressure and is extremely hot. Never aim the output nozzle directly at people.
- Use only the high quality, water/glycol based fog liquid. Always make sure there is sufficient liquid in the fog liquid tank. The fluid level can be monitored via the window at the back of the machine. Operating this unit without liquid will cause damage to the pump and the heater.

#### Equipment:

M-1 Mobile fogger  
12V – 2.3Ah rechargeable battery  
Rechargeable battery charger  
Power cable for the battery charger  
500 cc bottle of Antari fog liquid



1. Fill with Antari Fog Liquid or dealer recommended high-quality water-based fog fluid.
2. Charge the battery. The green light on the battery charger will light up when it is connected to the power supply. Then connect the charging head to the battery. Please note the battery required 8hr charging time on first charge. The battery will be fully charged in approximately 2~3 hr.
3. Plug the charged battery into the bottom of the M-1 Mobile Fogger with the label face up. Lift-up the plate before inserting the battery.
4. The green light by the front of the handle will flash when the button is first pressed. This indicates the battery has enough charge to power the M-1. When the red light starts to flash, the battery needs to be charged.
5. To generate smoke, press the red button on the handle. There are two operation modes that can be selected for the M-1.
  - Operation mode 1. Allows the fog machine to fog as long as the handle's button or the remote control's button is pressed down. To stop fogging, stop pressing the button.
  - Operation mode 2. Works on a press once to start and press again to stop basis. In this mode, start fogging by pressing the button. The M-1 will fog continuously until the button is pressed a second time.

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.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division	NUMBER <b>IH62900</b>
	REVISION <b>FINAL Rev0</b>
SUBJECT:  <b>Air Testing Meter Operation</b>	DATE <b>09/16/09</b>
	PAGE <b>21 OF 22</b>

- Use the small switch on the right side of the M-1. The switch is inside the case and is adjusted through the small hole on the side of the case.
  - To select operation mode 1. Slide the switch towards the back of the M-1 (towards the cap on the liquid tank). To select operation mode 2. Slide the switch towards the front of the M-1 (towards the nozzle).
6. The machine will fog until the battery charge runs down or the M-1 runs out of fog liquid. When the M-1 is connected to the optional power adaptor, carefully monitor the level of the fog liquid to make sure the machine does not run out of liquid. Operating continuously, the machine will run out of liquid in approximately 50 minutes. A full battery charge will power the M-1 for a period of 10-12 minutes before needing to be recharged.

Note: There is no warm-up time with the M-1 Mobile Fogger. Unlike most other fog machines, you do not have to wait for the heater to warm-up before fogging. The machine can be held or installed at any angle. After refilling the liquid tank, screw the cap on tightly. Failing to do so will result in leakage if the machine is placed at an angle.

# IH62690 Attachment 9.6 HP-IHP-62900

Environmental, Safety, Health & Quality Directorate  
SHSD Industrial Hygiene

## Operation of Exhaust Ventilation Meters Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:
------------------	--------------

### Knowledge of the Principles of IAQ Investigations

Criteria	Qualifying Standard	Unsatisfactory	Recovered	Satisfactory
<b>Sampling Equipment</b>	Knows where equipment needed for the procedure is located and how to properly sign it out.			
<b>Meter Operation- TSI 8355-8360 Anemometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- TSI 9555 Anemometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- TSI EBT721 Balometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- TSI EBT721 Matrix Manometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- Alnor P-600 Velometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- Testo 510 Absolute Pressure Manometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			
<b>Meter Operation- Testo 511 Differential Pressure Manometer</b>	<input type="checkbox"/> Demonstrates the proper way to set up, turn on, change settings, store data, and retrieve data from the meter.			

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

Candidate Signature:	Date:
----------------------	-------

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

Evaluator Signature:	Date:
----------------------	-------