Patient Testing – Pneumotach Calibration

Audience All personnel in the Pulmonary Function Clinic.

Purpose To describe the procedure for performing correct Pneumotach calibration on the Profiler and Elite in the Pulmonary Function Clinic.

Background Pneumotach calibration is a two-step procedure.

Set a zero reference to ensure that the system is reading zero flow when no flow is being introduced. The Pneumotach must be zeroed before each test. It is also zeroed as part of the automatic gas analyzer calibration.

Perform a volume calibration to match the volume being introduced with an actual syringe volume. Volume calibration of the pneumotach is required only once per day. It does not need to be performed on each new pneumotach after the initial daily calibration. The calibration routine consists of introducing a known calibration volume into the Pneumotach several times at different flow rates from slow to fast. You should perform five injections and withdrawals. These signals are measured by the pneumotach system (Pneumotach and transducer) and sent to the waveform analyzer. The waveform analyzer converts the analog signal to correlate with flow. Integration of flow relative to time is volume. This volume is then compared to the actual volume to calculate a calibration factor.

Initial Set-up Prior to performing the Pneumotach calibration, be sure that the following items are complete:

- Allow the system to warm-up and stabilize for 30 minutes.
- Install the Pneumotach into the clip and connect it to the gray coupler (screen toward coupler).
- Connect the gray coupler/Pneumotach assembly to the calibration syringe.
- Click Calibrate to begin calibration.

Tip: Set the syringe on a solid surface during calibration to ensure accurate results.

- Enter the appropriate syringe size in liters.
- Enter the current Temperature, Pbar, and Humidity at the bottom of the screen.

Zero Calibration Note: When adjusting for zero flow, it is important that no flow is introduced inadvertently. Due to the extreme sensitivity of the flow transducer, breathing near the Pneumotach or other air movement, such as from an overhead fan or vent, may introduce flow. Connecting the Pneumotach to the calibrating syringe
before zeroing can eliminate such effects. It is important that the Pneumotach is stationary during zero adjustments.

Click Zero Flow to zero the Pneumotach. A prompt reminds you to ensure that there is no flow through the Pneumotach. If the calibration is unsuccessful, a message appears stating that Flow Offset is Out of Range. If this happens, repeat the procedure. If the zero continues to fail, try a different Pneumotach and verify that the umbilical tubing is not occluded. After successfully zeroing the Pneumotach, you can begin calibration of the Pneumotach volume.

### Pneumotach Volume Calibration

The following steps ensure proper Pneumotach calibration:

- Click Start of press the spacebar to begin volume calibration.
- A message appears prompting you to withdraw, or pull back, on the syringe plunger. Pull back smoothly on the plunger being certain to withdraw the complete volume of the syringe. During the withdrawal, the flow should trace downward. If it does not trace downward, the Pneumotach or pneumotach umbilical are incorrectly connected.

**Note:** On the Volume-Time graph, the rate of flow is shown by the slope of the injection line: the faster the flow, the steeper the line. On the Flow-Volume Loop graph, the depth of the tracing indicates the rate of flow.

- A message appears prompting you to inject, or push forward, on the syringe plunger. Push in smoothly and evenly on the plunger, being certain to inject the complete volume of the syringe.
- Repeat the above until five injections and withdrawals are recorded or until you are satisfied that the pneumotach is performing adequately. The injections should be performed at different flows, from slow to fast, to demonstrate the linearity of the flow device.

**Tip:** The injection flow rates should be specific to those anticipated during the ensuing study. For example, for canopy or low-flow studies, injection rates of 3 liters/3 seconds to 3 liters/10 seconds would be appropriate.

- The sequence stops automatically after five injections and withdrawals. Click stop or press the spacebar to stop the sequence before five excursions if the results are satisfactory or if you wish to start over.

### Results

The calibration results are shown in the data tables at the tope of the screen.

**Average Volume** – The average of the sampled volumes in liters.

**Percent Error** – The percent error of the average measured volume from the actual syringe volume. The calibration will fail if the percent error is +/- 2%.
Cal Factor – The number by which the measured volume must be multiplied to arrive at the actual volume during calibration of the pneumotach.

Pneumotach Failure
There are two reasons why the pneumotach might fail:

- If the mean measured volume for either inspiratory or expiratory differ from the syringe size by more than 2%. You can perform a second volume calibration to have the computer adjust the Cal Factor and accept the pneumotach. If the mean measured volume was incorrect because of an incomplete volume excursion, you can reject the excursion by selecting it in the Trial Table and pressing the delete key.

- If the range of recovered volumes is greater than 3% of the syringe size, i.e., 0.09 liters for a 3-liter syringe size. If the mean measured volume was incorrect because of an incomplete volume excursion, you can reject the excursion by selecting it in the Trial Table and pressing the delete key.

This form documents the approval and history of the policies and procedures for the Pulmonary Function Laboratory. The Medical Director signs all policies verifying initial approval. Annually thereafter, the Director and/or designee may approve reviews and revisions.

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