



Tech Note

The GAK-800 Heated Exercise Gas Analyzer Accessory Kit

Overview

The GAK-800/801 are heated pneumotach and controller kits for use with iWorx kits, like the MC-214, that are capable of measuring basal and resting metabolic rates using the GA-200 gas analyzer and the SP-304 spirometer.

The GAK-800/801 contain the necessary components to accurately measure the volumes of oxygen consumed (VO_2) and carbon dioxide produced (VCO_2) during more active metabolic tests, like a breath by breath aerobic fitness test, where condensation in the spirometer circuit presents a problem. The components include: a heated 800 Liter/min capacity pneumotach (flow head), a heater controller for operation on either 115V (GAK-800) or 230V (GAK-801), a mouthpiece with a gas sampling port, head gear, and nose clips (Figure 1).



Figure 1: The GAK-800 Gas Analyzer Accessory Kit.

GAK-800 Accessory Kit

What the Kit Does

During long-term metabolic testing conducted at room temperature (21-24°C), there is about a 10-12°C difference between the temperature of the air inhaled and exhaled by the subject. This temperature difference causes condensation to develop on critical elements inside the flow head. Condensation reduces the flow of air through the flow head, which affects the accuracy of volume measurements made with the spirometer. Inaccuracy in the volume measurements affects the accuracy of the metabolic parameters measured during an evaluation like an aerobic fitness test.

During these types of tests, condensation in the spirometer circuit can be eliminated by having the subject breathe through a properly adjusted heated pneumotach, like the A-HFH-800 Model 3813 heated pneumotach that is included in the GAK-800/801 kit along with the A-HC-115/230 Model 3850A heater controller. The heated pneumotach replaces the typical unheated flow head that is used with a flow spirometer like the iWorx SP-304.

Equipment Setup

1. Connect the Model 3813 heated pneumotach (Figure 2) to the spirometer by attaching the two airflow tubes of the spirometer (Figure 3) to the two sampling ports of the pneumotach.
2. Connect the 5-pin connector on the end of the pneumotach cable to the matching PNT connector on the rear panel of the heater controller (Figure 4).
3. Check the voltage selector on the back panel of the pneumotach heater controller. Make sure it is set to the correct voltage for use in your country, 115V or 230V.
4. Plug the power cord of the pneumotach heater controller into a 3-prong polarized AC outlet to assure the heater controller and the pneumotach are grounded properly to reduce the danger of electrical shock.

Warning: Do not connect the heater controller to the AC power using a 2-prong adapter.

5. Attach the mouthpiece to the inlet of the heated pneumotach so that the sampling port will be on the top of the mouthpiece when the pneumotach is used.
6. Attach the headgear to the brackets on the heated pneumotach. The pair of straps with the narrowest spacing go over the top of the subject's head.
7. Instruct the subject to try on the pneumotach assembly. Adjust the straps so that the mouthpiece fits the subject comfortably. Make sure there are no leaks between the mouthpiece and the flow head, or around the mouthpiece.
8. Instruct the subject to remove the pneumotach assembly keeping all the components intact.
9. Press the power switch on the front panel of the heater controller to turn it on.

Warning: Always turn the heater controller on and off using the power switch.

10. Flip the PNT selector switch on the front of the heater controller to the left, which is the position used with the Model 3813 heated pneumotach included in the iWorx kit.



Figure 2: The A-FH-800 Flow Head Model 3813 Heated Pneumotach.



Figure 3: The SP-304 Spirometer with the air-flow tubing attached.

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11. Use the knob on the left side of the heater controller to set the temperature of the heated pneumotach to the maximum temperature found in the spirometer circuit. In testing conducted at room temperatures (21-24°C), the temperature of the exhaled air in the mouthpiece and the attached flow head are the highest in the spirometer circuit. The range of temperature of the exhaled air is usually 32-37°C. This temperature will depend on the metabolism of the subject, the level of activity performed during the test, and the temperature of the inhaled air.
12. Initially, set the temperature of the heated pneumotach to either 34°C or 35°C. In typical testing, condensation should not develop when the temperature of the heated pneumotach is set to these values.
13. During normal usage, the pilot light on the heater controller cycles on as the heated pneumotach warms up to the desired temperature. The pilot light turns off as the pneumotach reaches the desired temperature.
14. Warm up the heated pneumotach for 15 minutes before taking measurements.
15. Use the heated pneumotach just like a flow head.



Figure 4: The A-HC-115/230 Model 3850A Heater Controller

Cleaning the Pneumotach

A. Disassemble the heated pneumotach

1. Turn off power to heater controller by pushing the power switch to the OFF position. Disconnect the cable of the heated pneumotach from the controller.

3813 Heated

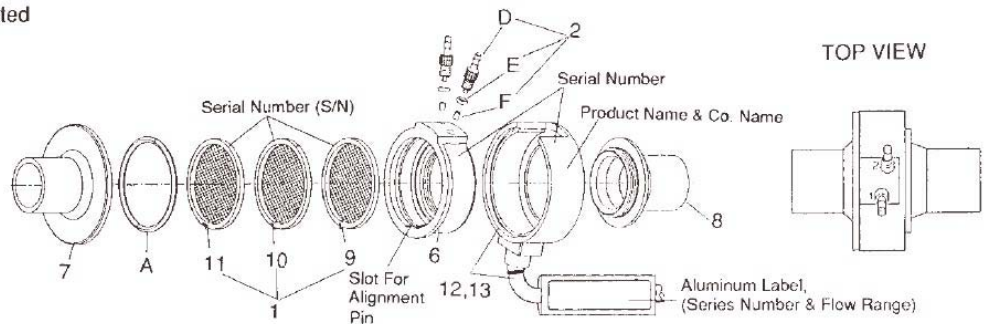


Figure 5: Schematic Diagram of Model 3813 Heated Pneumotach.

2. Unscrew/loosen (3 turns ccw) the pressure taps (Items 2).
3. Unscrew/remove small flange port tube (Item 8).
4. Pull heater shell (Items 12 & 13) from body (Item 6) gently.

Warnings: Do not use tools or force. Do not submerge heater shell (G) or heater controller in water, detergent or any other liquid. Do not autoclave.

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5. Unscrew large flange port tube (Item 7).
6. Carefully remove O-ring (A) with O-ring removal tool (dental pick).
7. Remove screen/spacer subassembly in sequence: Item 11 (3 dots), Item 10 (2 dots), and Item 9 (1 dot) by tapping open body (Item 6) on flat surface such as table top.

Note: Each screen subassembly is marked by dots designating the location number of the screen subassembly. Each screen is engraved with the pneumotach serial number (S/N) to assure reassembly in the correct housing.

B. Inspection of the PNT Components

1. Check all parts for foreign matter.
2. Check screen sub-assemblies for entrapped particles by holding them to light.
3. If parts are clean, reassemble the pneumotach according to the instructions in Section E.
4. If dry dust particles appear on screens, blow air through screens from both ends. When screens are clean again, reassemble the pneumotach according to the instructions in Section E.
5. If screens are encrusted proceed to Section C.

C. Manual Cleaning of Pneumotach Components

1. Manual cleaning of the pneumotach components is done in warm water using a neutral mild detergent. Soft brushes can be used to scrub the components where necessary. The screen assemblies may have to be soaked in an enzymatic detergent if the detergent does not breakdown the debris buildup.
2. Rinse all components thoroughly. Deionized water is preferred over tap water.
3. Completely dry all components.
4. Heater shell and cable assembly do not require high level disinfection. This assembly should be wiped cleaned with mild detergent or disinfection solution.

D. High Level Disinfection of the Pneumotach Components with Liquid Chemical Glutaraldehyde

1. The disinfection solution must contact all surfaces of the components to ensure disinfection.
2. Only use liquid Glutaraldehyde disinfection solutions approved as disinfectants/sterilants by EPA and cleared for marketing use on medical devices by the FDA.
3. Determine the required soak temperature and time.
4. Activate the Glutaraldehyde solution per the manufacturers' instructions.
5. Completely immerse all the PNT components in the Glutaraldehyde solution. Cover the disinfectant soaking basin to minimize chemical vapor exposure.
6. Soak the components for the required time to achieve high level disinfection.
7. Rinse all components thoroughly. Deionized water is preferred over tap water.
8. Dry all components thoroughly prior to reassembly and storage.
9. Inspect all components for cleanliness, proper function, and defects.

E. Reassembly of the Pneumotach

1. Place the body (Item 6) on table with large hole opening upward (left end with alignment slot in exploded view in Figure 5).
2. Select the screen sub-assembly (Item 9) with 1 dot. Place it into body (Item 6) face up, with alignment pin that is on circumference of the screen sub-assembly (Figure 5) mating with slot in body (Item 6).
3. Repeat the same with the 2-dot screen sub-assembly (Item 10).
4. Repeat the same with the 3-dot screen sub-assembly (Item 11).

Warning: Screen sub-assembly must be placed in flat to avoid binding against the body. Do Not Use Force. If screen sub-assembly does not drop flat, tap the circumference of the screen sub-assembly lightly until it lies flat. Do Not Push on the Screen Mesh.

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5. Insert O-ring (Item A) in the groove above the stacked screen sub-assemblies within the body (Item 6).
6. Screw the large Flange Port Tube (Item 7) tightly to the body (Item 6).
7. Replace heater shell (Items 12 & 13) on body (Item 6).
8. Screw small flange port tube (Item 8) finger-tight, to body (Item 6).
9. Screw in two pressure tap assemblies (Item 2) until O-ring (Item E) is compressed 1/2 turn.

NOTE: If the pneumotach was heavily encrusted, and the quality of cleaning is questioned, the assembly is questionable, two or more PNT parts are mixed together and crossed or the screens or other components are damaged, the PNT should be recalibrated. Contact Hans Rudolph, Inc. to arrange the return of the pneumotach for calibration.

F. Verifying the Operation of the Heated Pneumotach and Controller

1. Connect the heated pneumotach to the heater controller.
2. Plug heater controller power cord into electrical outlet.
3. Turn the control knob for the temperature of heated pneumotach to maximum, fully clockwise.
4. Set the pneumotach selector switch to the correct model. The heating pilot light should brighten.
5. Take pneumotach into your hand and confirm that the body (housing) is heating up.
6. Turn the control knob for the temperature of heated pneumotach to maximum, fully counter-clockwise. The heating pilot light should go out if the ambient temperature is greater than the lower setting.

Note:

- If the light does not go out and the ambient temperature is greater than the lowest setting, the unit is not operating properly and should be returned for repair.
- If the light does not go on and the pneumotach is warm to the touch, it should be returned for repair.
- If the light does not go on and the pneumotach does not feel warm, check the fuses and the electrical service outlet for the appropriate voltage. If fuses and voltage are matched correctly contact Hans Rudolph, Inc. for authorization to return the pneumotach for repair.

G. Cleaning the Heater Controller

The heater controller does not require high level disinfection or sterilization. This control enclosure can be wiped clean with a mild spray disinfectant or a water damp cloth. Wipe dry thoroughly.

Experiments

Experiments using the GAK-800/801, with the iWorx metabolic cart, can be found in the iWorx Newsletter archive which is available from the iWorx website:
<http://www.iworx.com/newsletter/default.htm>.

Directions for programming the LabScribe2™ software to complete exercises with the GAK-800/801 and the metabolic cart are included in each experiment.

Components of the GAK-100

- (1) A-HFH-800 Model 3813 heated pneumotach
- (1) A-HC-115/230 Model 3850A heater controller
- (1) Headgear for supporting the heated pneumotach
- (1) Reusable mouthpiece with gas sampling port
- (1) Noseclips

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Specifications

Model 3813 Heated Pneumotach

Calibrated Flow Range:	0-800 Liter/minute
Dead Space Volume:	88 milliliters
Signal Pressure:	16mm H ₂ O/(800L/min)
Flow Calibration Factor:	0.02mm H ₂ O/(L/min)
Back Pressure	
Low Flow:	0.3cm H ₂ O at 80L/min
Medium Flow:	2.8cm H ₂ O at 400L/min
High Flow:	8.2cm H ₂ O at 800L/min
Flow Bore Diameters	
Flange Inside Diameter:	28.6mm
Screen Inside Diameter:	50.8mm

Model 3850A Heater Controller

Operating Voltage (Selectable):	115VAC 60Hz or 230VAC 50Hz
Power Requirement:	25 Watts
Leakage Current:	Less than 100 Microamps
Operating Temperature:	18-45°C
Warm-up Period:	15 Minutes
Thermal Cutoff Fuse	
Cutoff Temperature:	98°F
Holding Temperature:	76°F
Humidity:	Up to 95% at or below 40°C, at or below 65°C

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