



Tech Note

The GAK-100 Gas Analyzer Accessory Kit

Overview

The GAK-100 is an accessory kit for use with iWorx kits, such as the MC-214 Metabolic Cart, that are capable of measuring basal and resting metabolic rates using the GA-200 Gas Analyzer and the SP-304 Spirometer.

The GAK-100 contains the necessary components to measure the volumes of oxygen consumed (VO_2) and carbon dioxide produced (VCO_2) during the segments of light, moderate, and strenuous exercise that are part of an aerobic fitness test. The components include: a mixing chamber, a 1000 Liter/min capacity flow head, a non-rebreathing valve, a mouthpiece, head gear, smooth interior tubing, and nose clips (Figure 1).



Figure 1: The GAK-100 Gas Analyzer Accessory Kit.

GAK-100 Accessory Kit

How It Works

The GAK-100 contains components that permit the measurement of VO_2 , VCO_2 , and other metabolic parameters during exercise without the need for expensive heated flow heads and heater controllers.

When using the GAK-100 with a spirometer, the subject breaths directly through a non-rebreathing valve, and not a flow head. The non-rebreathing valve permits the subject to inhale fresh air from environment, as it prevents the rebreathing of exhaled air. When the subject exhales, the valve directs the expired air through the outlet of the valve and down a large tube to a mixing chamber.

As the capacity of the mixing chamber fills with the expired air, air is pushed out of the mixing chamber as the expired air from new breaths enters the chamber. The volume of air that moves out of the mixing chamber is measured by the flow head and spirometer attached to the outlet of the mixing chamber. The volume of air expelled from the mixing chamber is equal to the volume of expired air entering the chamber from each new breath.

Since the mixing chamber has a capacity that is 5 to 10 times larger than the tidal volume of the subject, the concentrations of oxygen and carbon dioxide in the mixing chamber are the averages of the concentrations of those gases in the last 5 to 10 breaths exhaled into the chamber. When these concentrations are joined in an algorithm with the volumes of air expired by the subject, accurate values for the subject's rate of oxygen consumption and carbon dioxide production can be calculated.

Equipment Setup

1. Connect the airflow tubes from the SP-304 spirometer to the inlets of the A-FH-1000 flow head that comes with the GAK-100 kit (Figure 2).



Figure 2: The A-FH-1000 Flow Head from the GAK-100 kit connected to the SP-304 Spirometer with a pair of airflow tubes.

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2. Connect the inlet of the A-FH-1000 flow head to the outlet of the mixing chamber (Figure 3).



Figure 3: The inlet of the A-FH-1000 Flow Head attached to the outlet of the mixing chamber.

3. Connect the 35mm I.D. smooth interior tubing from the GAK-100 kit to the inlet of the mixing chamber (Figure 4).



Figure 4: The spirometer circuit used to measure the volume of air exhaled by the subject, and provide oxygen and carbon dioxide samples from the exhaled air to the gas analyzer.

4. Connect the other end of the smooth interior tubing to the outlet of the non-rebreathing valve (Figure 4).

5. Connect the mouthpiece in the GAK-100 kit to the side port of the non-rebreathing valve (Figure 4).

6. Connect the braided end of the Nafion sampling tubing to the Luer-Lock sample port on the side of the mixing chamber (Figure 4).

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7. Connect the other end of the Nafion sampling tubing to the filter on the inlet of the GA-200 Gas Analyzer (Figure 5).



Figure 5: The front panel of the GA-200 gas analyzer showing the filter and Nafion sampling tubing connected to its inlet.

8. Connect the SP-304 spirometer to DIN8 input of an iWorx recorder or amplifier.

9. Connect the outputs of the GA-200 Gas Analyzer to the inputs of an iWorx recorder.

Experiments

Experiments using the GAK-100, with the iWorx metabolic cart, can be found in the iWorx Newsletter archive which is available from the iWorx website:

www.iworx.com/newsletter/default.htm.

Directions for programming the LabScribe2™ software to complete exercises with the GAK-100 and the MC-214 Metabolic Cart are included in each experiment.

Components of the GAK-100

- (1) 5 liter mixing chamber
- (1) Non-rebreathing valve with 35mm O.D. openings
- (1) Headgear for supporting the non-rebreathing valve and mouthpiece
- (1) 6 ft section of smooth interior tubing with 35mm I.D. openings
- (1) Reusable mouthpiece with saliva trap
- (1) 1000 Liter/min flow head
- (5) Noseclips

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