New Snorkel for enhanced Breath-by-Breath Gas Analysis during Swimming

Aquatrainer is an easy-to-mount swimming snorkel connected to a mobile metabolic cart (K5, K4 b²) that allows to perform gas exchange analysis during swimming. Swimming with the snorkel is considered a valid field condition to measure swimmers’ cardio-respiratory response. Researchers and coaches can now acquire an incredible number of information on athletes tested in real conditions (swimming pool or flume).

In the Aquatrainer swimming snorkel the inlet and outlet tubes are connected to the turbine through a connecting unit that allows the system to distinguish expiration from inspiration, thus allowing the definition of tidal volume and respiratory frequency for BxB analysis. Gas sampling and turbine flowmeter are positioned at the output of the tube far enough from the water surface to guarantee reliability and subject’s safety.

The snorkel is light, hydrodynamic and designed to suit swimmer’s natural movements in different swimming styles (either front crawl or backstroke). Ergonomically designed components allow special protection to prevent water inhalation during test. Kit includes also a special water-resistant HR belt and probe to measure heart rate frequency during swimming.

The new Aquatrainer system has been recently validated (C. Baldari et al. 2013) and it is considered suitable for steady state measurement and incremental tests of 200m each (Fernandes RJ et al. 2012; de Jesus K et al. 2014). Moreover, Aquatrainer does not lead to an increase in active drag during front crawl performed at a large range of velocities (Ribeiro J et al. 2016).
Technical Specifications

Hardware specs

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Dead space (mouthpiece)</td>
<td>11.3 ml</td>
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<tr>
<td>Canalization tubes (INS/EXP) length</td>
<td>86 cm</td>
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Modules:

- **C04470-01-11** AquaTrainer Module (requires product kit)
  - Contains: AquaTrainer unit, AquaTrainer silicone mouthpiece (2 pcs), corrugated pipe (L:1000m, 2 pcs), tube holder (3 pcs), AquaTrainer upper bracket assembly, Y fitting assembly, AquaTrainer rod assembly and case, AquaTrainer backpack, user manual.

- **C04480-02-11** AquaTrainer K5 Product kit
  - Contains: K5 support AquaTrainer assembly, K5 AquaTrainer HR receiver probe, noseclip for swimming.

- **C04480-01-11** AquaTrainer K4 b² Product kit
  - Contains: K4 support AquaTrainer assembly, BNC/RF headed cables, AquaTrainer HR/TA receiver probe, mouthpiece adapter, noseclip for swimming.

Validation Studies


Option 1:
The metabolic system (K5 or K4 b²) can be hung on a cable to be placed above the swimming pool lane.

Option 2:
An operator can follow the swimmer by holding the metabolic system (K5 or K4b²) using a special rod (rod and harness are included in the standard packaging).