

## **Video 7 - Cardiorespiratory fitness – The Astrand Ryhming Cycle Ergometer test**

*'All information contained in these videos is taken from the ACSM's Guidelines for Exercise Testing and Prescription, 10<sup>th</sup> Edition'*

Increases in cardiorespiratory fitness are associated with a reduction in death from all causes. A VO<sub>2</sub>max test using open circuit spirometry is the gold standard measure of cardiorespiratory fitness; however, this involves laboratory equipment, significant levels of expertise, and can be unpleasant for participants. A number of submaximal field tests are available using a range of modes of exercise including treadmill, cycle ergometer and step tests, which allow the estimation of VO<sub>2</sub>max.

This video describes the procedures for conducting the Astrand-Ryhming submaximal cycle ergometer test.

As explained in other videos, prior to testing, a preparticipation health screening must be carried out, informed consent must be gained, basic resting measurements should be taken, and pre-testing participant instructions should be given.

The goal of this test is to obtain heart rate values of between 125 and 170 bpm by the end of a 6-minute single-stage test.

### **Protocol**

1. If using a HR monitor, put on the chest strap as described in the Heart Rate measurement video.
2. Obtain resting HR and BP immediately prior to exercise in the exercise posture.
3. The client should be familiarized with the ergometer, and seat should be adjusted so that there is approximately a 25° angle in the knee at maximal extension.
4. Begin with a 2-3 minute warm up to acquaint the client with the ergometer.
5. Select an appropriate work rate according to sex and fitness status as follows:
  - a. Unconditioned men – 50 or 100 Watts
  - b. Conditioned men – 100 or 150 Watts
  - c. Unconditioned women – 50 or 75 Watts
  - d. Conditioned women – 75 or 100 Watts
6. After setting the appropriate resistance, instruct the client to maintain a pedal rate of 50rpm.
7. If, after 3 minutes, the heart rate is under 125bpm or over 170bpm, adjust the work rate accordingly.
8. The test should be terminated if the client reaches 85% of age-predicted maximum heart rate.
9. Once a steady state heart rate is achieved between 125 and 170 bpm, measure the heart rate at the end of the 5<sup>th</sup> and 6<sup>th</sup> minutes and average the two values.
10. An appropriate cool down period should be initiated after the test.
11. Keep monitoring the client for at least 5 minutes after the test.

## Test interpretation

Once you have a final heart rate value, you must multiply this value by the relevant age correction factor as outlined in table?? (P87)

The age-adjusted heart rate figure, along with the workload value, is plotted on the nomogram (p89) in order to estimate the VO<sub>2</sub>max score for the individual. The heart rate is plotted on the left-hand side, and the workload is plotted on the right-hand side (note that the workload on the nomogram is in kg per meter per minute – 50W is equal to 300 kg meters per minute). A line is drawn between the two, and where it intersects the VO<sub>2</sub>max line is the estimate value for that individual.

In order to make comparisons between individuals and with normative data, absolute VO<sub>2</sub>max values are usually converted into relative values by dividing by the individual's body weight, and multiplying by 1000 to convert from Liters to ml, as shown in the following equation:

$$\text{Relative VO}_2\text{max (ml/kg/min)} = \text{Absolute VO}_2\text{max (L/min)} / \text{body weight (kg)} \times 1000$$

The relative value can then be compared to normative data in the table 4.7 (p93)