AUSTRALIAN INSTITUTE OF SPORT

Australian Government
Australian Sports Commission

ROWING AUSTRALIA

**- National Rowing Centre of Excellence -**

# Information for Athletes, Head Coaches, Coaches and Scientists

# Protocol: Distance-Power Ergometer Testing

(To be used from January 2009)


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## Introduction

The laboratory test protocol adopted firstly by Rowing Australia and now by the NRCE aims to provide very detailed physiological information of the rower's submaximal capacity and efficiency as well as measures maximal performance parameters as accurately as possible. To do this a 7 x 4 min protocol has been in use across the country since 2006. Unfortunately, given the relative time consuming nature of the protocol (i.e. a single athlete is able to complete the test every 45 min) it is undertaken only a few times each year. The information from the laboratory protocol gives a very accurate picture on the training and performance status of the rower but it is not conducive to measurements on a large group of individuals on a regular basis nor is it able to be conducted in the field environment when a crew may be training away from a SIS/SAS location. For these reasons among others the NRCE believe it is important to introduce a battery of ergometer measurements that address the limitations of the current laboratory protocol.

The battery of ergometer measurements will be completed by all aspiring Juniors, Under23 and Senior A athletes throughout the domestic and international season. The test battery (all out efforts at distances of 100m, 500m, 2000m and 6000m and a 30 min submaximal piece at stroke rate 20) would be completed within a one week period and would be undertaken in the same manner that the current 2000m and 6000m ergometer tests are i.e. at the rowing sheds while supervised by the coach or nominated individual.

The data from these ergometer tests provides highly useful information on the power / time continuum of each individual rower which can be used to infer changes in anaerobic capacity and maximal aerobic power as well as show direct changes in 100m, 500m, 2000m and 6000m ergometer performance. Importantly, the group data can be used by each coach to objectively assess the effectiveness of their training cycles since the last series of tests.

For the 2009-2012 Olympic cycle the standard ergometer protocols will change to reflect new information that has been presented by Ivan Hooper and others on the use of sliders and lower drag factors. The main aims of introducing sliders and lower drag factors are to;

1. more accurately reflect the stroke rate, drive: recovery ratio and 'feel' of on-water rowing
2. minimise the risk of injury that may result from considerable time being spent on the ergometer with significant lower back load

For the 2008-2009 season each SIS/SAS will be able to asked to complete the distance-power test battery in one of two ways;

1. If sliders are available then it is asked the entire group completes the test protocol using sliders and the updated drag factor settings
2. If sliders are not available then it is asked the entire group completes the test protocol using the old drag factor settings as per the previous Olympic cycle

***NB. Implementation of the new drag factor settings and sliders will be mandatory for all laboratory and field based testing from November 2009 onwards.***

## What are the advantages of adopting a regular ergometer test battery?

1. It will provide a more representative picture of short to medium term changes in all aspects of rowing fitness. Currently, laboratory tests occur twice in the domestic season with the timing of these tests aimed at ensuring adequate rowing specific fitness is in place ready to begin the next phase of training / competition. With the adoption of a more frequent ergometer test battery, coaches will gain a greater

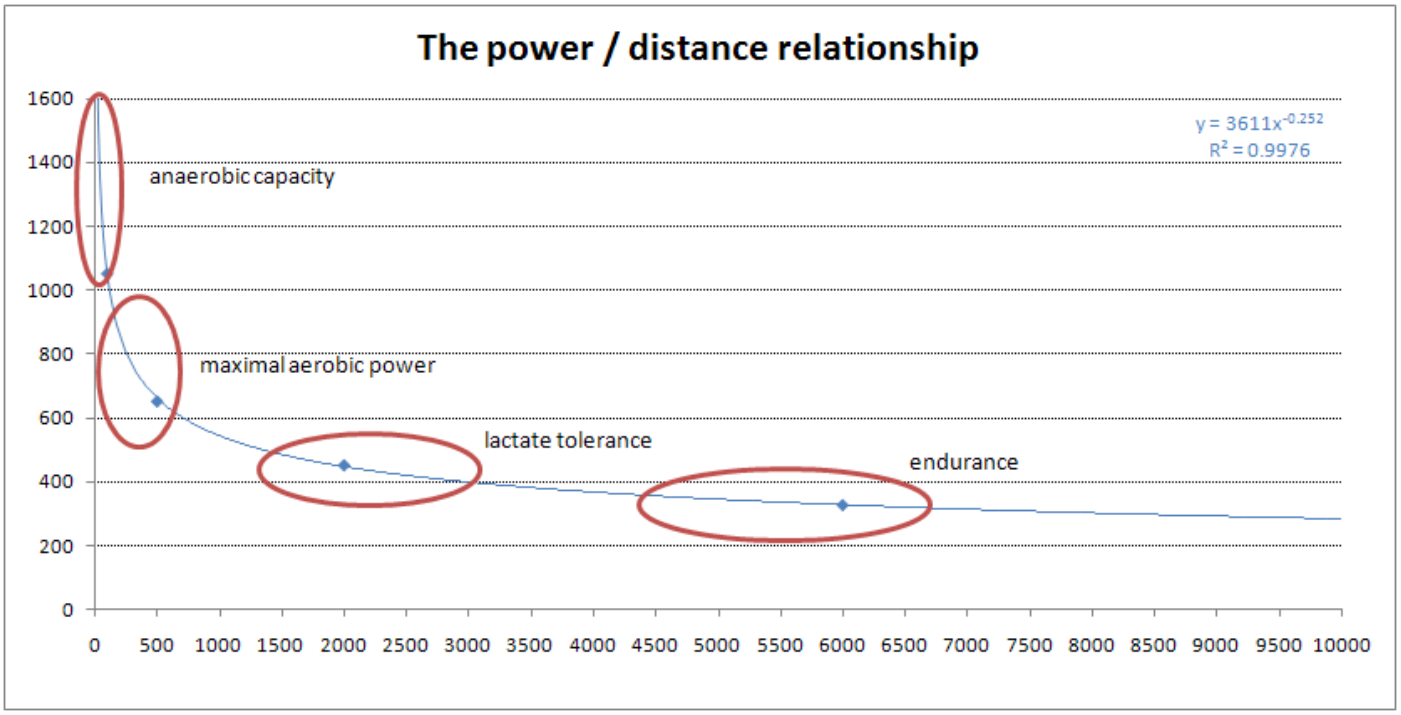
understanding of each individual's fitness traits and how they change through a training cycle as well as be able to accurately measure the net effect of shorter training cycles.

2. Athletes will be required to produce maximal efforts over all tests a number of times each season. One of the possible reasons for our inability to produce 'above expectations' performances on the world stage, could be linked to our reluctance to perform maximally on a regular basis. The ergometer tests are difficult and do require maximal efforts but the NRCE believe that this will help to improve our athlete's ability to 'learn to race' as well as reset or recalibrate the athlete's perceptions of their most current maximal capabilities across the test distances.

3. The more information we can gather about each athlete throughout the year can only serve us better in the future.

## How can the ergometer test battery assist with training prescription and modification?

The relationship between power output and time (or ergometer distance as it can be expressed in rowing) has been used for decades to measure shifts in a variety of fitness traits within an individual as a result of training or detraining. The power / time continuum (sometimes referred to as Critical Power) is currently used by the Danish rowing association to tailor training programs to meet the individuals strength and weaknesses of their elite rowers (http://www.concept2.co.uk/guide/guide.php?article=personalising) and is based on the assumption that different power outputs have varying levels of sustainability governed directly by the interrelated energy systems available to fuel mechanical work (i.e. alactic, lactic and aerobic). Quite simply the test battery asks the question; "Given full fuel reserves how quickly can an individual complete a set amount of work"? The Danish test battery requires each athlete to complete a maximal test over 10 sec, 60 sec, 2000m, 6000m and 60 min in a one week period. From the data, a power output / time relationship for each athlete is established and then compared with their previous data as well as with data from other athletes. In the diagrams below a power output / distance relationship (vertical axis and horizontal axis, respectively) is shown for four distances (100m, 500m 2000m and 6000m) and the curve fit demonstrates how the continuum is established.



The analysis of the data obtained from a power / distance continuum can be very powerful as it can show how specific fitness traits can change with specific training but how these traits in some cases have only a small, if any, transfer to other distances (i.e. 100m improvement will have little effect on 6000m performance).

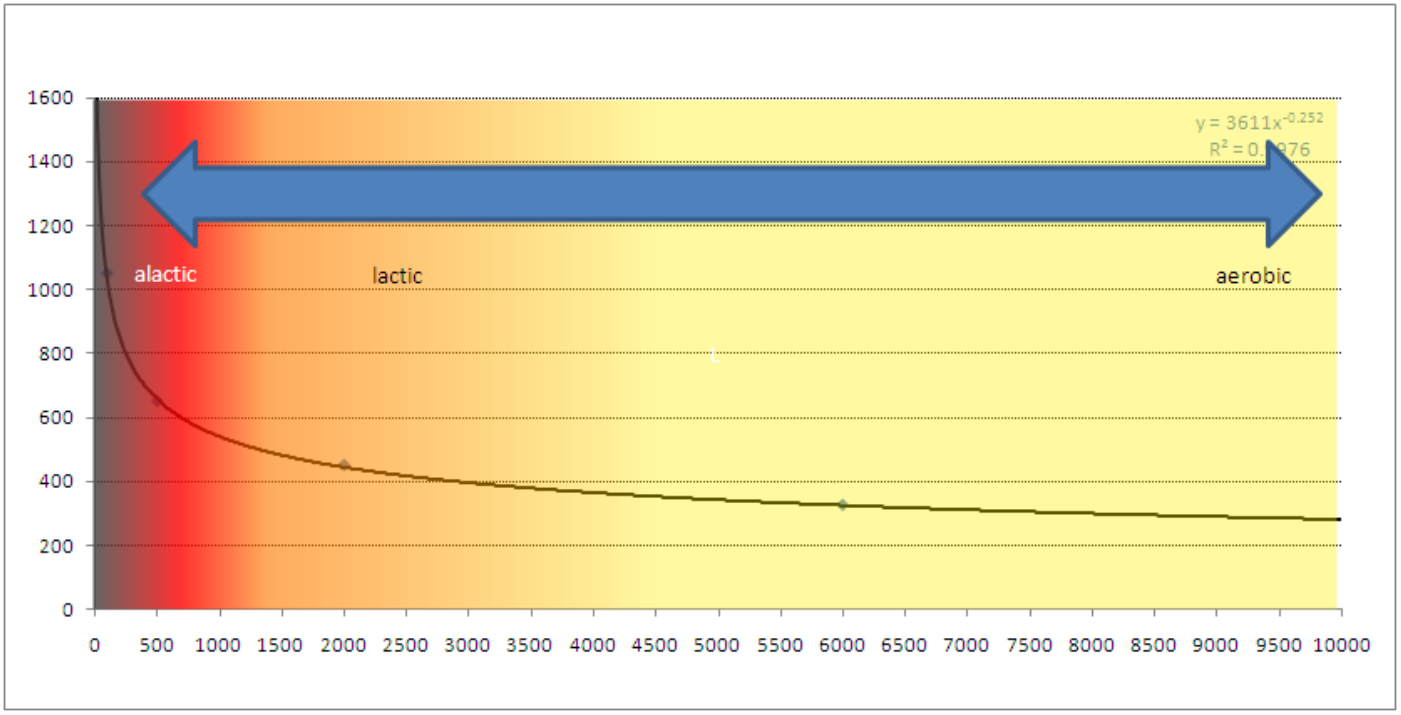
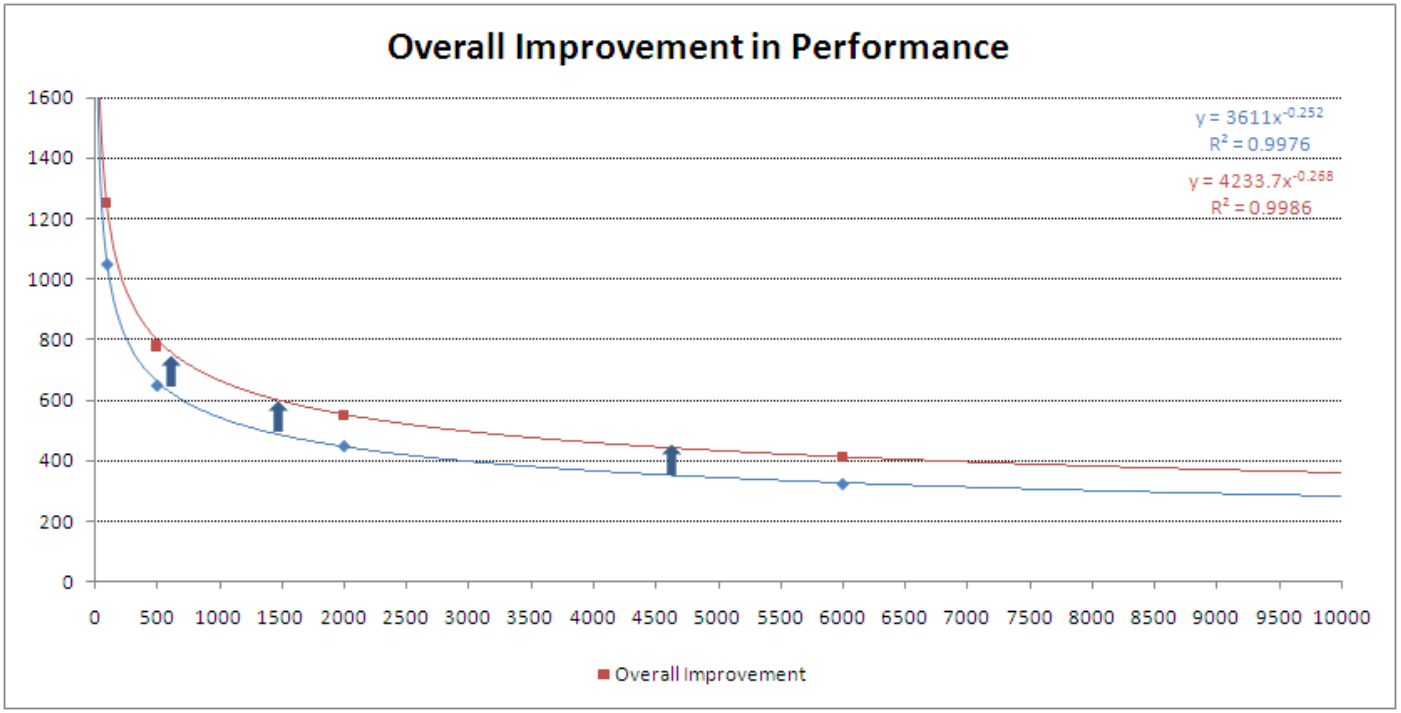
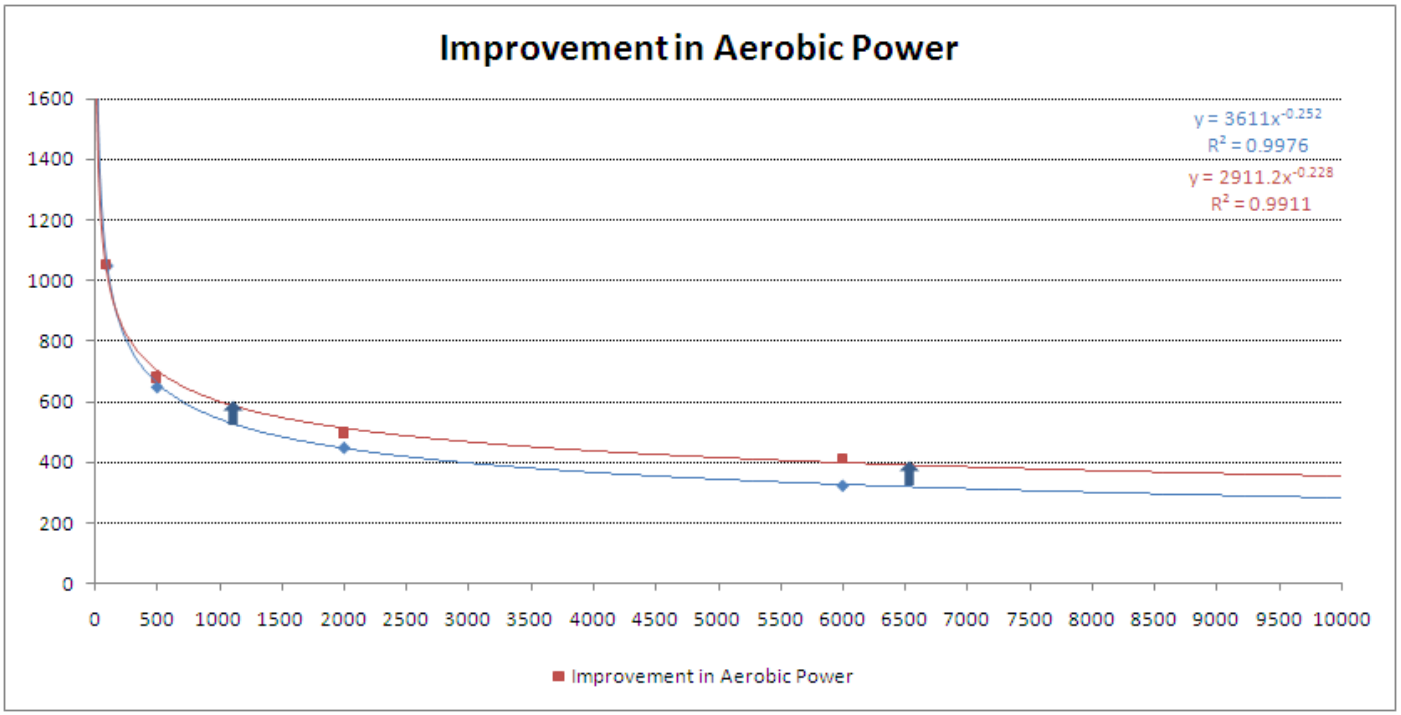



Fig. The energy supply continuum displaying the energy systems which are utilised across different ergometer distances

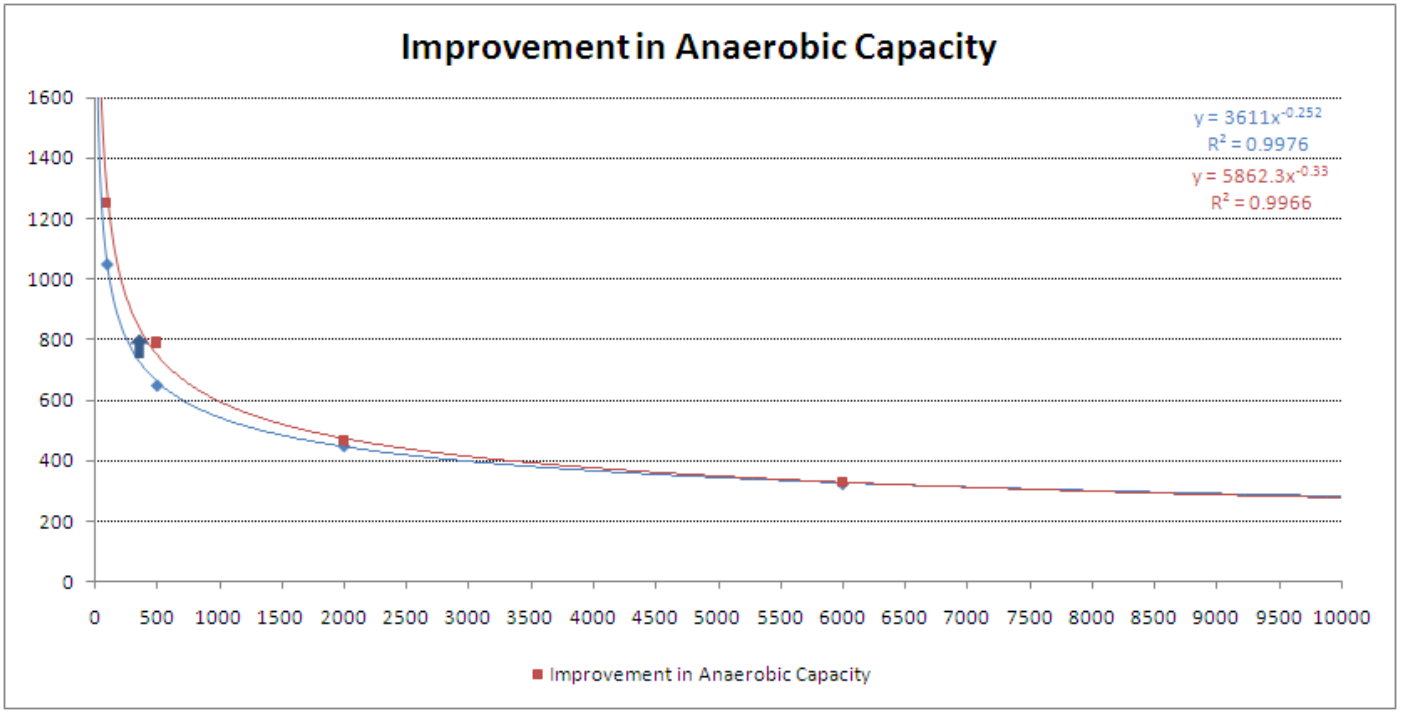
Consider the 3 examples below; the first graph shows an upward shift in the entire curve suggesting that all fitness traits (alactic, lactic and aerobic) have shown a significant improvement as a result of training.



In the next example there has been a greater upward shift in the longer distances than in the shorter distances suggesting an important improvement in aerobic and lactic energy systems but not so in the alactic. This may be representative of what Australia typically sees in the 1st phase of the domestic season (Sept to Jan).




In the final example there has been no shift in the medium and long distance power outputs but an important upward shift in the power outputs that can be exhibited over the shorter distances. This would suggest an improvement in alactic and lactic systems but no improvement in aerobic pathways. This example would represent improvements in rowing specific fitness that we may see later in the international season although this is purely speculation as we have never before measured such things.




Given these examples, it is hopefully clear how regular measurement of ergometer performance of our rowers can guide and individualise training prescription and well as assist with evaluation of the success of a specific training block. Quite simply, the test battery does a simple strength and weakness assessment across the specific fitness traits required by rowers without the need to undertake laboratory tests or time out from the routine training environment. This battery has the ability to display changes that are expected to occur in a rower's fitness throughout both the domestic and international preparations. Importantly, the rower and coach are able to immediately gauge their progress and the data will allow senior coaching staff to determine each athlete's specific improvement as well as benchmark them against traits that are believed to be Gold Medal standard at World Championships and Olympic Games.

## When will ergometer testing be done during domestic and international seasons?

The power / distance based ergometer test battery will complement the current 7 x 4 min laboratory test protocol which will continue to be conducted a minimum of two times during the domestic season with the option for a third laboratory test while athletes are preparing in Australia for the international season. The power / distance ergometer tests will absorb the standard 6000m test in November and 2000m test in March / April such that at these time points each rower will complete all 4 ergometer distances. There will be a further two series of the power / distance ergometer tests completed with one occurring near the end of January and the final required block being completed during the international preparation.

## How will the data be used?

As part of our aim to 'Performance Manage' our best athletes, the collection, analysis, interpretation and evaluation of the data gained from the complete testing regime will be done by the Sports Science Coordinator in conjunction with the relevant National Head Coach and National High Performance Director. Routine dialog between the NRCE and SIS/SAS Head Coaches and Physiologists will ensure that all parties agree on how the athlete is progressing. If required, a specific meeting with the athlete, SIS/SAS Head Coach, Physiologist and NRCE will be used to re-evaluate the benchmarks and objectives set for the medium to long term time frame for that particular athlete. In addition, the SIS/SAS squad results will be also be

evaluated to assist the National Head Coaches and SIS/SAS Head Coaches with modification of the training plan if required.

SIS/SAS Head Coaches and / or Physiologists will be required to send in summary data on designated NRCE specific templates from each testing time point. This is no more than is currently required for either National Selection ergometer tests (2000m or 6000m) or the 7 x 4 min laboratory protocol. Summary data will then be generated and analysed by the NRCE Sports Science Coordinator and disseminated back to the SIS/SAS groups. Timely and accurate completion of these templates will form part of the regular review of each States SIS/SAS program.

**The following information is designed as a detailed guide to the testing methods.**

## Power-Distance Ergometer Test Battery

For consistency and comparability it is vital that the power-distance ergometer test battery is completed in an identical manner each time. This includes the training undertaken on the days in between ergometer measurements as well as the order in which the tests are completed. As such and to avoid any confusion, the NRCE believes it is imperative that the training for the 2 days prior to the testing week and the majority of the testing week itself is prescribed. The testing week will occur within a rest/recovery week and frequency and duration of activities are programmed accordingly. There will be minimal, if any, flexibility on the dates of the testing week and to ensure comparability both within and across programs all training groups will be asked to present to the testing week in similar physical states each time.

## Laboratory Environment and Subject Preparation

### Training

The athlete must **not** train on the Sunday preceding the first test on Monday morning. The table below outlines the time or distance, modality and intensity of the training in the sessions between each ergometer test.

### Diet

A normal meal (incorporating a high carbohydrate component) should be eaten on the evening preceding each test and, if scheduling allows, also on the day of the test. No alcohol should be consumed in the 24 hours preceding the test. The athlete should give special attention to ensuring good hydration in the lead-up to each test.

***Special Note: In order to make accurate comparisons within an individual across testing dates it has been decided that NO ergogenic aids will be permitted prior to undertaking any of the ergometer tests. Opportunities for Senior A athletes to trial ergogenic aids (caffeine, sodium bicarbonate, pseudoephedrine etc) or perfect previous ergogenic strategies will be encouraged to occur during internal training sessions or regattas only.***

**Testing order**

| Day | Time | Requirement |
|---|---|---|
| **Saturday** | PM | 1. 60 min T2-T3 |
| **Sunday** | All day | 1. No training – only active recovery/stretching etc |
| **Monday** | After 8:00 AM | 1. 100m all-out followed in 20 min by 500m all-out<br>2. 10 km T2 row |
| | PM | 1. 30 min maximum distance (rating capped at 20 spm)<br>2. S+C (no new exercise or changes in weights program) |
| **Tuesday** | AM | 1. 15 km T2-T3 row |
| | PM | 1. 30 min T2 cross training (no new modality) |
| **Wednesday** | AM | 1. 6000m all-out |
| | PM | 1. 60 min T2 cross training (no new modality) |
| **Thursday** | AM | *OFF* |
| | PM | 1. 10-12 km T2 row (tech) / ergo prep |
| **Friday** | AM | 1. 2000m all-out<br>2. Resume normal training |
| **Saturday** | AM/PM | Resume normal training |
| **Sunday** | AM/PM | Resume normal training |

**Preparation**

Equipment Checklist

- Concept IID or IIE rowing ergometer
- Heart rate monitor (can provide very useful information for some individuals)
- Stopwatch
- Lactate Pro analyser (can provide very useful information for some individuals)

**Table 1: Old Ergometer Drag Factor Settings**

| Category | Drag Factor |
|---|---|
| Junior Female | 110 |
| Lightweight Female | 110 |
| Heavyweight Female | 120 |
| Junior Male | 120 |
| Lightweight Male | 120 |
| Heavyweight Male | 130 |

**Table 2: New Ergometer Drag Factor Settings**
**(only to be used if tested on sliders – see Introduction)**

| Category | Drag Factor |
|---|---|
| Junior Female | 95 |
| Lightweight Female | 95 |
| Heavyweight Female | 105 |
| Junior Male | 105 |
| Lightweight Male | 105 |
| Heavyweight Male | 115 |

**Power-Distance Test Administration:**

Athletes will be allowed to individualise their warm-up prior to each ergometer measurement but are asked to replicate as closely as possible the same specific warm-up adopted for each distance the next time they undertake the test.

The following list represents the order in which each test should be completed.

1. The athlete should weigh-in and report the weight to the supervising coach or scientist
2. Attach a heart rate monitor (if required) and ensure it is working correctly
3. Adjust the ergometer drag factor to that appropriate to your category (see Table 1 or Table 2, depending on whether sliders are being used)
4. Undertake individual warm-up
5. Select the appropriate distance (or time for the 30 min test) for the ergometer test on the Concept work monitor
6. Start rowing when instructed by the coach or scientist
7. Complete the required distance in the shortest possible time
8. At the end of the test, the coach or scientist will record the relevant data from the work monitor (see Table 3)
9. An earlobe or fingertip blood sample can be collected and analysed at the completion and 4 min post completion of the test (if requested)

| | |
|---|---|
| Name | |
| Category | HWT / LWT |
| Drag Factor | |

| Date | Weight (kg) | Test Distance (m) | Time (mm:ss.s) | Av. Power Output (W) | Av. Stroke Rate (spm) | Av Pace (mm:ss.s) |
|---|---|---|---|---|---|---|
| | | 100 | | | | |
| | | 500 | | | | |
| | | | 30:00.0 | | 20 | |
| | | 2000 | | | | |
| | | 6000 | | | | |

Table 3 – Individual data sheet to be completed at the end of each ergometer test