



Newbury District Swimming Club.

Training Information Sheet 09/05

Introduction to Training Zones and the Anaerobic Threshold(AT)

1. Energy Systems

When we swim, energy is supplied to the muscles by three systems:

- a. ATP-CP which lasts for only a few seconds and is important for short sprints
- b. Anaerobic – Lactate which lasts several 10s of seconds and dominates short middle distance events
- c. Aerobic which derives energy from oxygen (breathing) and dominates in the endurance events

If you are a sprinter you need to exercise a; if you are a middle distance b is important and distance swimmers need to concentrate on c. However it is important to realize that whatever type of swimmer you are you will need to exercise all of these systems to some degree ie sprinters need to do some endurance and distance swimmers need to do some sprints. Young age group swimmers need to concentrate on endurance because their anaerobic metabolism (lactate system) has not matured sufficiently.

2. The Training Zones

To exercise these energy systems we divide training intensities into zones. There are different systems for doing this. I used the simpler US system (E1 E2 Sp1 Sp2 etc) up to about 2003, but I now use the British/Australian system as everyone else seems to be going that way since Bill Sweetenham's arrival as National Director of swimming. These training zones are as follows:

Zone	Zone 1			Zone 2	Zone 3		Zone 4			Zone 5	
divisions	A1	A2	A3	AT	Cr-Sp	MVO2	LT	LP	PL	HVO	SP
Heart rate: (BBM)	50-70	40-50	30-40	20-30	10-20	Max-10	Various – depending upon set				

Key:	BBM	Beats below maximum heart rate
Zone 1: Aerobic	A1, A2, A3	Different aerobic intensities
Zone 2:	AT	Anaerobic Threshold
Zone 3: High Performance Endurance	Cr-Sp	Critical Speed
	MVO2	Maximum Volume of Oxygen Uptake
Zone 4: Anaerobic Race Pace	LT	Lactate tolerance
	LP	Lactate production
	PL	Peak lactate
Zone 5: Sprint	HVO	High Velocity overloads (very short sprints)
	SP	Speed

3. The Anaerobic Threshold (AT)

These zones and divisions are used by coaches to construct training programmes and to individualize training sessions. Some of these zones are used more than others; it largely depends upon the coach and the age and level of the swimmers. However most coaches use the Anaerobic Threshold (AT) as a fundamental indicator of training intensity.

The Anaerobic Threshold is the level of training intensity at which lactate in the blood stream starts to accumulate appreciably faster than your metabolism can get rid of it. This is what causes the muscular pain in races and intensive training sessions. An appreciable proportion of swimming training is done at or near the anaerobic threshold. If we train too much below this level we can undertrain and lose

aerobic fitness. If we do too much training above this level there is a danger of overtraining leading to fatigue. It is therefore important that we each know where our anaerobic threshold lies. It is of course individual – it depends upon many factors such as age, physical make up and whether you are an endurance swimmer or a sprinter. So how do you determine your anaerobic threshold speed?

4. Determining your Anaerobic Threshold

The main methods are:

- a. A fixed time or distance test e.g. a T20/T30
- b. A test relating heart rate to speed e.g. a 7 X 200 step test
- c. Derived from your PB times
- d. Lactate testing

a is the easiest to do but the least accurate. It really gives a measure of a swimmer's aerobic capacity which is related and close to the anaerobic threshold, but not the same. b can be used to relate swimming speed to heart rate to obtain AT. c is basically a set of rules that have been obtained by lactate testing swimmers and relating these tests to their PB times. Finally d is the most accurate but the most time consuming and expensive. Top international swimmers and clubs with the resources will use d.

For the purpose of this note I'm going to talk about method a. I'll talk about the others in a later note

5. Getting a measure of your Aerobic Capacity from a T20/T30.

For those who don't know a T30 is simply a f/s swim as fast as you can for 30 mins. Younger (age group) swimmers can do a T20 which will cover a distance of about 1500 metres. The principle is that if you can maintain a constant maximum effort for a period of time you will be working to your maximum aerobic capacity. Some sports physiologists maintain that this will correspond to the aerobic threshold (slightly lower than anaerobic threshold). Here's how we do a T30:

Step 1 Do the swim maintaining a constant speed at maximum effort.

Step 2 Record distance swum (d) metres

Step 3 Time in (t) = 30 X 60 seconds

Step 4 Swimming speed = d divided by t in metres per second V_A

6. Obtaining Individual Training Repeat Times from V_A

Adjustments have to be made for training at different distances. Tables exist but very good guideline is as follows:

400m use 99.3% of V_A ; 200m use 102.2% V_A ; 100m use 107% V_A ; 50m use 108.4% V_A

Example

Find 100m repeat times using T20 speed

T20 test 62.5 lengths in 20 minutes

$V_A = (62.5 \times 25) / 20 \times 60 = 1.302$ metres/sec = swimming speed for T20

100m repeat speed = $1.302 \times 1.07 = 1.393$ metres/sec

100 metre time = distance/speed = $100 / 1.393 = 71.77$ sec

Round down to nearest second (71.0) – because T20/30 swims are not quite AT speed

Allow 20 seconds rest – so repeat time is 1:11 +20 = 1:31

So for example 16 X 100 RO 1:31 is a good aerobic conditioning set (A3/AT) for this swimmer

But remember:

- a. **The important thing is the swim speed** – this is what you've got from the T20 – not the repeat time. It's no use swimming it on 1:30 and getting 1 second rest – you will be working in a different training category – probably A2.
- b. If you can reduce the rest time by say 5 seconds and maintain the swim speed that's OK. However if you can significantly reduce the rest I'd strongly suspect that you were not swimming at maximum effort in the T20.

Have fun

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