



Interpreting Results from Cadence's Blood Lactate Threshold Test

By Chad Butts, MSC

Exercise Physiologist, Cadence Cycling & Multisport Centers of New York

Congratulations! You have just taken the first step toward increasing your performance as an endurance athlete. Testing your ability is important in order to train correctly and determine if you are getting the benefits you are looking for. Knowing your ability and periodically testing your progress will help you get the most out of your training. Not everyone reacts to a period of training in exactly the same way. Periodic testing allows us to determine what training style leads to results.

If you are new to Blood Lactate Threshold Testing there is no doubt you had a lot of information thrown at you from this experience. At Cadence we know it can be daunting with lots of new information so we developed this guide to explain the results you obtained during your testing session.

This guide is to help explain the testing results you received from your Blood Lactate threshold test. Please follow along with your own results and handouts obtained during your testing session. Within your Blood Lactate testing packet you should have a summary Lab Test Data Sheet page, Lactate Graph, and Training Zone Table. You should also have a copy of the testing protocol and a small printable version of your training zones that can be cut-out and laminated to take with you on your workouts for reference.

Below we will explain each of the 3 main pages in your Blood Lactate results to help give you a fresh understanding of the concepts involved and what this means for your training.



CADENCE ATHLETE LAB TEST DATA SHEET: LT/VO2 Max

Name	Test	Test Date	1/23/08
Weight (lbs)	165	Height (inch)	70
Weight (kg)	75	BMI	23.7
LT HR	173	% Max HR	#VALUE!
LT Speed	7.5 #DIV/0!	% VO2 Max	#VALUE!
LT VO2	NA		
Max VO2 HR	NA		
Max VO2 Grade	NA		
VO2 Max Absolute	NA		
VO2 Max Relative	#VALUE!		

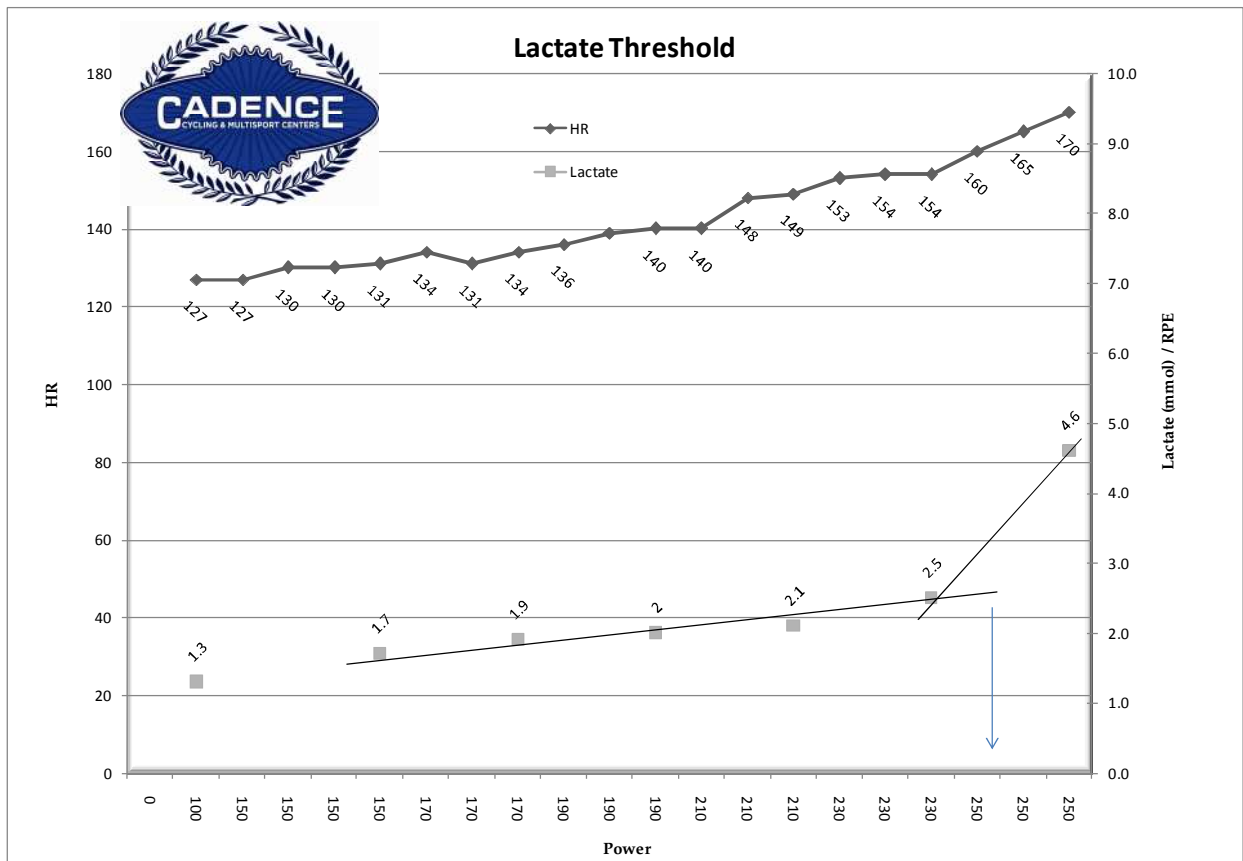
	Zone	Number	PE	HR		MPH		Pace	
				Min	Max	Min	Max	Min	Max
	Recovery	1	<3	N/A	118	N/A	4.1	N/A	14:33
	Endurance	2	4-5	119	143	4.2	6.2	14:17	9:38
	Sub-LT	3	6	144	164	6.3	7.1	9:31	8:25
	LT	4a	7-7.5	166	171	7.2	7.4	8:20	8:05
	Super-LT	4b	8	173	182	7.5	7.9	7:60	7:37
	VO2 Max	5	9	183	N/A	8.0	9.0	7:33	6:40
	Sub-Maximal	6	9.5	N/A	N/A	9.1	N/A	6:37	N/A
	Maximal	7	10	N/A	N/A	N/A	N/A	N/A	N/A

This is the test summary page and displays your testing results and Cadence training zones. This form also includes maximal aerobic test results if you have recently done a max test. Both tests are important if you have never had them before because they complete the picture of you as an athlete and where you are currently. These tests also help decide what direction your training should go based on your goals.

Your name, height, date, weight, and BMI are all noted at the top of the page. Along the left column you have your LT HR, LT Power/LT Speed (depending on if it was a run test or bike test), and LT VO₂ (if you also had a VO₂ test) which are all determined based on the results of your lactate threshold graph. VO_{2max} HR and VO_{2max} Grade/Power (depending on if it was a run test or bike test) results are next, assuming you had a VO_{2max} test. If not, ignore these boxes. Your Absolute VO_{2max}, expressed in ml is next followed by relative VO_{2max}, which is your Absolute VO_{2max} divided by your body mass in kilograms. Since most athletes decide to do both tests, and because this option provides a more comprehensive



view of you as an athlete, we can determine what percentage of your max your current LT is. The results from your max test represent your current maximal ability to perform aerobic exercise. VO_{2max} is largely a function of your genetics which can account for 40-50% of the variability. VO_{2max} is determined by the size of your heart, lungs, the types of muscle fibers you were born with, etc. No amount of training can change this. As such VO_{2max} is less trainable than LT. Now, think of your LT as the percentage of your VO_{2max} you can hold for an extended period of time, generally 40-90 minutes. The higher the power or workload a person can hold at threshold and the higher the percentage of VO_{2max} the better the athlete. Someone whose lactate threshold is at 70-80% of their VO_{2max} can expect some improvement with proper training. An individual already exercising at 90-93% of their max will have to increase VO_{2max} , pedaling efficiency, etc. if they want to see more improvement. As your LT approaches 90% of VO_{2max} it gets harder and harder to increase because you are bumping up against your ceiling, VO_{2max} . Not only are elite athletes blessed with good genetics and a high VO_{2max} but they also have trained for many years to be able to exercise for a long period of time at 90-95% of their max. We are not all blessed with great genetics, but we can always strive to increase as high as possible with what we are given.



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This graph depicts heart rate (bpm) and blood lactate levels (mmol) for each stage of the test. HR is recorded for every 1 minute of the test and 1 lactate sample for each stage (every 3 min) of the test. During this graded exercise test we slowly increased the exercise intensity while tracking your HR, perceived exertion, and blood lactate levels.

As exercise intensity increases your body is increasing energy flux to meet the increasing demands. Burning fat and carbohydrate aerobically (using oxygen) is the best and most efficient means to do so. You produce more calories per unit of substrate and there is no significant increase in metabolic byproducts that cause fatigue. However, there will come a point where the intensity of the exercise and the demand for energy is greater than your body's ability to supply energy for it primarily by aerobic metabolism. This is the point you start to rely more heavily on anaerobic metabolism. This form of energy production only uses carbohydrates and is very quick in supplying the much needed energy but at a cost. For a given amount of carbohydrates you will get less energy to fuel your muscles via anaerobic metabolism. You will also produce by-products that if allowed to increase, cause fatigue. So as exercise intensity increases, metabolism shifts from mainly aerobic to anaerobic energy supply. The workload this occurs depends on your fitness and genetic potential.

Anaerobic metabolism produces lactate and other byproducts within the muscle cells. It is these metabolites that cause fatigue and inhibition of energy supply if their levels increase beyond a critical point. Contrary to many thoughts, lactate per se is not the cause of fatigue, but the increase in hydrogen ion and other by-products associated with this increase are.

Typically, but not always, there will be 2 major shifts in lactate production. However, the detection of two distinct shifts is not always easy and straight forward. The first initial rise in lactate is gradual and slowly increases with each stage. The 2nd shift in lactate production in the muscle, and in the blood, is big, often 1.5-2 mmol higher than the previous stage. This 2nd increase will usually occur at or slightly below your time-trial pace. This 2nd big shift in the slope of our lactate levels is considered your lactate threshold. Determination of this point is the workload that elicits such a large jump in lactate levels. This is considered your threshold before lactate begins to accumulate faster than your body can get rid of it. Typically, this deflection occurs at 4 mmol of Blood Lactate, but not always.



NAME: Test
 Weight: 165
 Height: 70



Session Date 1/23/2008

TRAINING ZONES - CYCLING

Training Zone	HR		Power		PE	Zone Description
	Min	Max	Min	Max		
Recovery Zone 1	Rest to 116		N/A to 139		<3	Active Recovery Very low level exercise. Easy spinning on the bike with very light pedal pressure, possibly only with the weight of the legs. Recovery rides are done to accelerate the Recovery process by flushing lactate from the muscles and stimulating blood flow without causing any muscle damage. Heart rate is below 68% of LT HR and power is below 55% of LT Power. Perceived Exertion (PE) is less than 3 out of 10.
Endurance Zone 2	117 to 140		140 to 209		<5	Endurance The HR Zone that a rider will be in for base mileage. Training at this level should increase aerobic Endurance. Sensation of leg effort and fatigue is generally low, though it may occasionally rise to higher levels. Heart rate is below 68% of LT HR and power is 56-82% of LT Power. PE = 4-5 out of 10. Some training areas are very hilly and the athlete must go outside their personal Endurance HR Zone for a short period of time to get over a hill and into an area that they can sustain their Endurance Zone HR.
Sub-LT Zone 3	141 to 162		210 to 238		6	Sub Lactate Threshold The HR Zone below Lactate Threshold, but above average Endurance pace. Represents the typical intensity of a "spiroed" (steady paced) group ride or a briskly moving pace line. Heart rate is 83-95% of LT HR and power is 84-95% of LT Power. PE = 6 out of 10
LT Zone 4a	163 to 169		239 to 251		7	Lactate Threshold Just below Lactate Threshold, training in this Zone should increase power output at LT. Heart rate is 96-99% of LT HR and power is 96-99% of LT Power. PE = 7-7.5 out of 10. Lactic acid produced at this level but usually is not sufficient enough to impair performance. Training in this zone increases your tolerance and ability to metabolize lactic acid.
Super - LT Zone 4b	170 to 179		252 to 264		8	Super Lactate Threshold Just above your LT, this is the HR Zone in which most climbs and time trials should be done in, though intervals will be shorter than in the LT Zone. Heart rate and power are 100-105% of LT. PE = 8 out of 10. Training in this zone increases your tolerance and ability to metabolize lactic acid. Conversation difficult at best, due to depth/frequency of breathing. These efforts are typically performed in training as multiple repeats of 10-30 min duration.
VO2 Max Zone 5	180 to N/A		265 to 300		9	Max Intervals This zone is designed to increase power output at VO2max. Typical intervals are (3-8 min) intervals intended and there is strong to severe sensations of leg effort/fatigue, such that completion of more than 30-40 min total training time is difficult at best. Heart rate is above 106% of LT and power is 106-120% of LT Power. PE = 9 out of 10. Conversation not possible due to often "ragged" breathing. Should generally be attempted only when adequately recovered from prior training - consecutive days of level 5 work not necessarily desirable even if possible.
Sub-Maximal Zone 6	N/A to N/A		301 to N/A		10	Sub-Maximal Short (30 s to 3 min), high intensity intervals designed to increase anaerobic capacity. Heart rate generally not useful as guide to intensity due to non-steady-state nature of effort. Severe sensation of leg effort/fatigue, and conversation impossible. Consecutive days of extended level 6 training usually not attempted. Power should be over 121% of LT Power. PE = 9.5 out of 10.
Maximal Zone 7	N/A to N/A		N/A to N/A		NA	Maximal Extremely short (less than 25 second) efforts at Maximal intensity. Heart rate is not a useful guide because of the short length of the intervals and power is useful only as a reference point to prior similar efforts. PE = 10 out of 10.

The last page of your Blood Lactate handouts is your training zones. Each of these training zones is based on a percentage of your lactate threshold heart rate and power output that we determined in the test. Each specific zone trains a certain physiological system and each of these systems combine to determine your strengths and weaknesses. However, even though the training adaptations you receive from staying within a specific zone are maximized while in that zone, training slightly above or below that zone is still giving you some of the same adaptations. So don't think of your zones as concrete and that all the benefits of training in Z3 stop when you move to Z2 or Z4a. Think of your zones rather as a sliding scale and each zone you are in determines what system you are "MAXIMALLY" stressing. Different zones train different systems in your body and your goals, strengths, weaknesses, experience, etc. will determine where you should spend most of your training time.