



What is EPOC and How Does Tracking it Help You?

Obviously Epoc Performance Training thinks EPOC is a key component to structuring and implementing training - It is so important we named our company after it!

Jim Galanes has been working with Firstbeat's EPOC training systems for several years and has first hand knowledge how it helps athlete's train better and smarter. EPOC allows us to objectively quantify the training load of each and every workout. This fosters (1) more effective implementation of daily training plans; (2) more accurate tracking of changes in training performance; and (3) closer and more accurate monitoring for either undertraining or overtraining.

Why is EPOC Better than Heart Rate?

Cross-country skiers have been using heart rate monitors for about forty years. Jim and I were early converts. I recall well returning from Polar Cup races in northern Sweden in the spring of 1984 with Polar's first generation heart rate monitors. Skiers to his day are relying on heart rate to prescribe the limits of their daily training. But today we can do better than heart rate.

Why is heart rate variability (HRV) and EPOC better?

The simplest answer is that during two separate training sessions of equal status one may be harder on the body than the other, even when the heart rate is the same for both sessions. The difference is accumulated fatigue, which HRV can detect and convert into an EPOC value. The body may appear to recover rapidly from a training session (short-term fatigue) but carry accumulated (long-term) fatigue from training session to training session. So when comparing sessions using HRV and EPOC, the amount of accumulated fatigue affecting each session can be seen by the difference in EPOC value

What is EPOC?

Let's take a step back now and define EPOC. EPOC is a measure of physiological training load and accumulated cardiovascular fatigue. EPOC is defined as the amount of oxygen your body needs to recover after a training session. It is measured in milliliters of oxygen per kilogram of body weight (ml/kg).

Until recently there were no useful methods of monitoring fatigue accumulation during training. Firstbeat's scientists demonstrated that excess post-exercise oxygen consumption (EPOC) can be predicted from heart rate variability (HRV) data recorded during exercise. Consequently, EPOC prediction serves as a tool for monitoring fatigue accumulation during exercise.

EPOC describes and quantifies the stress caused to the body from endurance activities like running and cross-country skiing. The higher the intensity of training, the greater the fatigue and the more oxygen is consumed during and immediately after the training session. Simply put, a higher EPOC value means that the body is more

physiologically tired.

EPOC accumulates faster as training intensity increases but not necessarily when duration is increased, so low-intensity training may not result in a high EPOC value, even if the duration of the training is exceptionally long. With high-intensity training, high EPOC values can be reached even in a short period of time. The figure below illustrates the rates of accumulation for different intensity exercises.

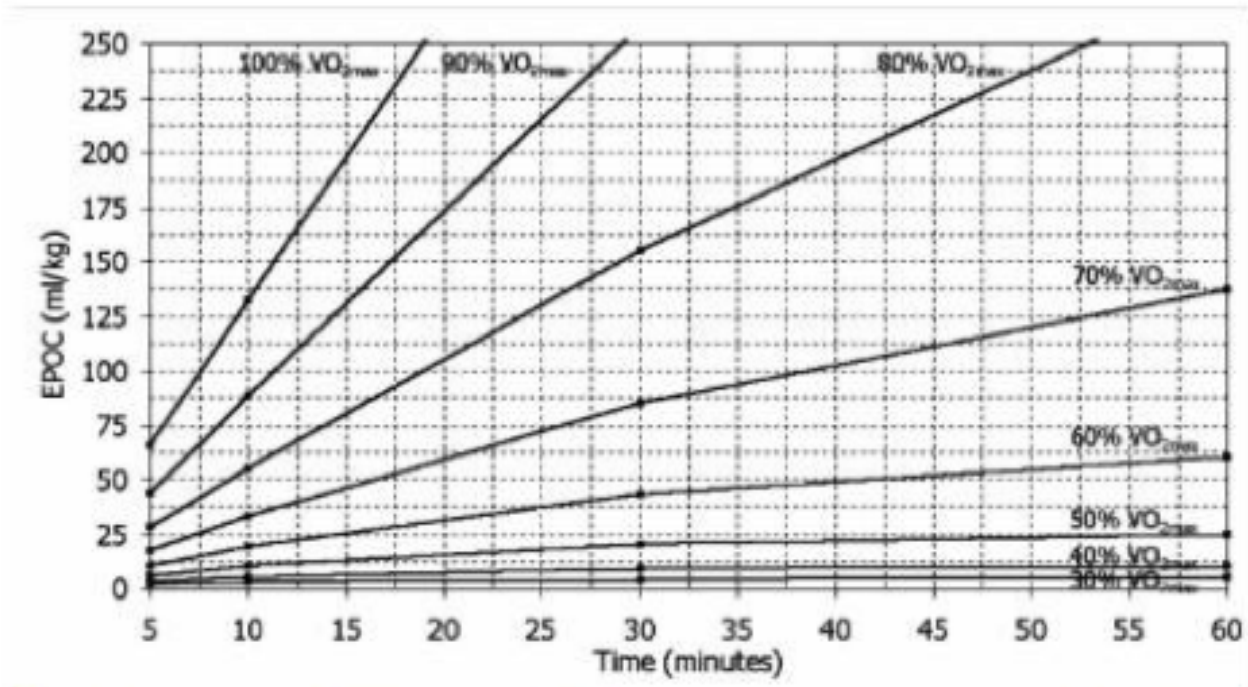
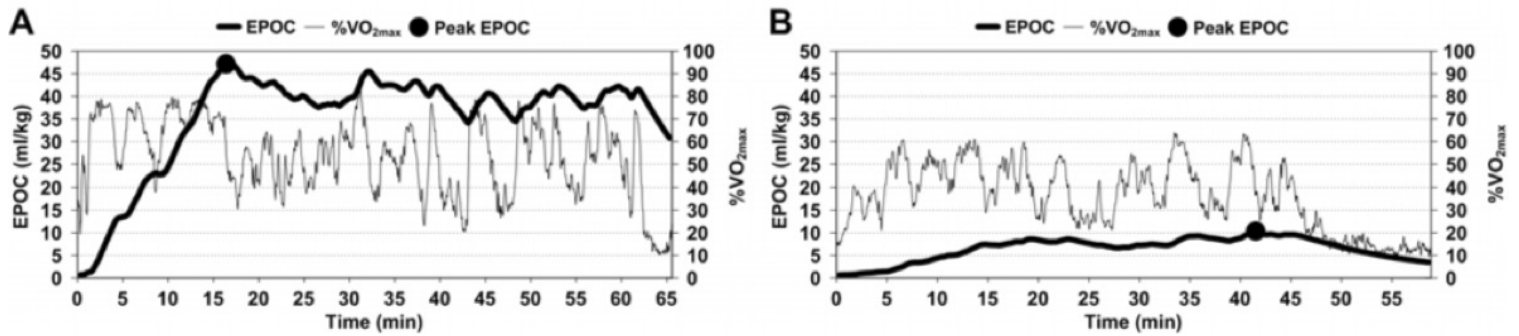


Figure 5. The accumulation pattern of EPOC at various intensities as a function of exercise duration.

How Do We Use EPOC in Training

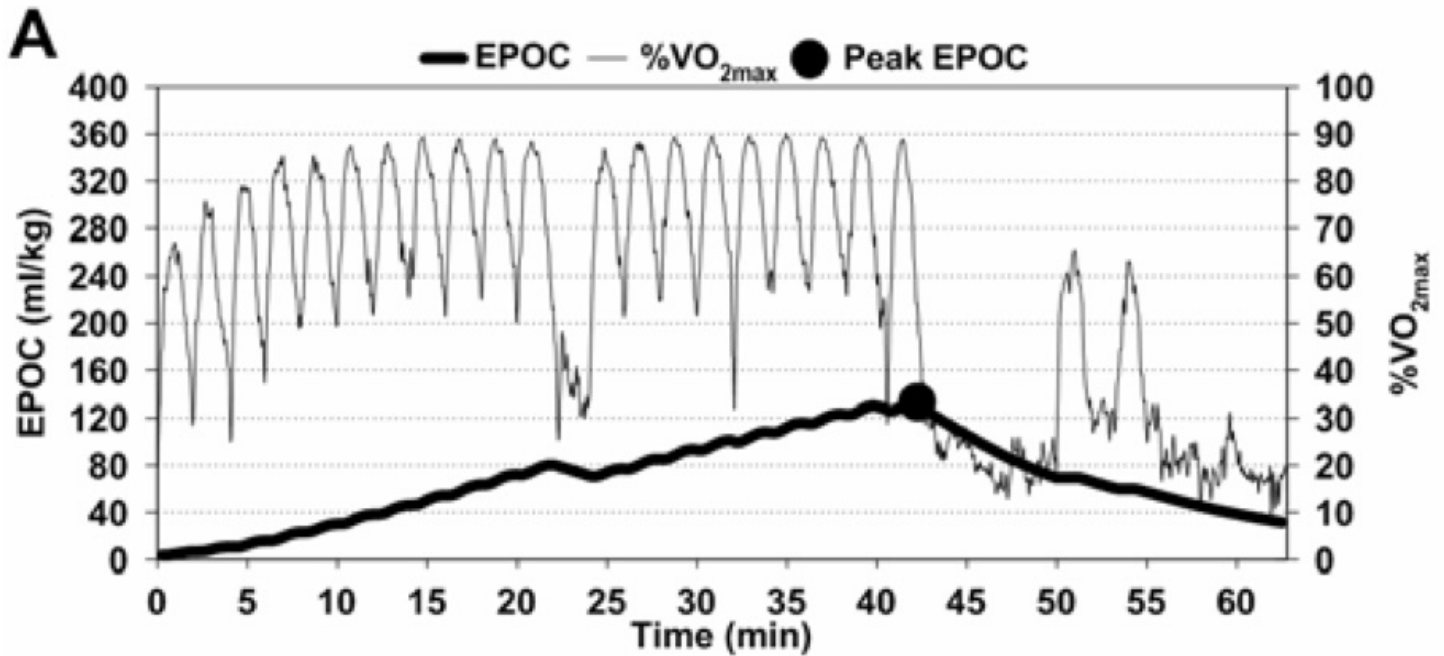
Let's look at an example. Below is a figure showing two athletes implementing a recovery training.



We can see from the accumulation of EPOC that Athlete A started his recovery training too hard and as a result accumulated EPOC rapidly at the beginning of the training session. As a result, we can conclude that this workout probably did not increase recovery. With an EPOC load close to 50 ml/kg this workout surely did not enhance recovery and likely increased cumulative fatigue albeit slightly. Athlete B on the other hand managed her training well. EPOC accumulation remained low throughout the training. It is important to note the small difference in intensity as a percentage of %MaxVO₂ as between Athlete A and Athlete B but the significant difference in the accumulated training load measured as peak EPOC.

Graphic demonstrations of EPOC workload help our athletes focus on the purpose of the workout. It provides objective accurate measures indicating whether an athlete achieved the purpose of the workout. In the example above, we can know that Athlete A did not enhance his recovery. We will need to monitor his training closely to see whether the lack of recovery and additional fatigue limits his ability to execute future training sessions and how he is handling the cumulative fatigue.

Similarly, we can look at more intense training and determine whether the training was “hard enough”. The figure below shows HRV data from a high intensity interval training session. We can evaluate that session by looking at three pieces of information: (1) total EPOC accumulation; (2) the rate at which EPOC is accumulating during the session; and (3) the % of MaxVO₂ the athlete reached during the session.



In addition to the daily analysis of training, EPOC provides a more effective way of evaluating workload over days, weeks and months far more accurately than simply counting the number of hours or miles trained.

Below is a figure demonstrating an endurance athlete's training load over an 8 week period.

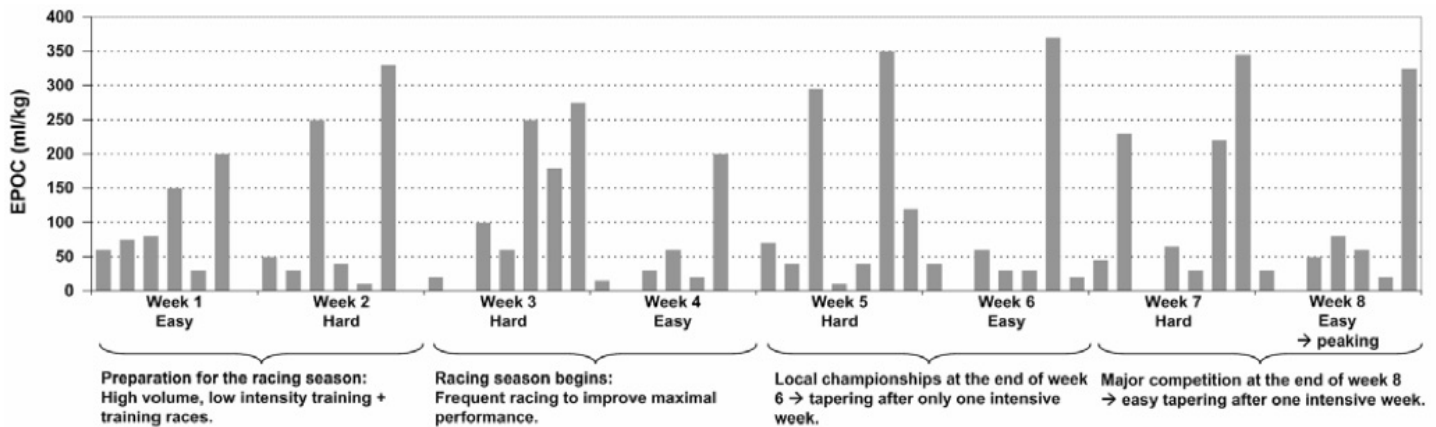


Figure 10. A schematic representation of an endurance athlete's training load during eight successive weeks (the columns represent daily values of EPOC). This two-month period prepares the athlete for the most important races of the season. The daily values are highest during weekends mainly due to races. Note also the less loading days before race days.

We hope that gives you a small window into how Jim Galanes and EPT are using HRV and EPOC to more effectively plan and implement training for its athletes.

As always we welcome questions and comments.

(All of the diagrams in the post come from Firstbeat's white paper entitled **Indirect EPOC Prediction Method Based on Heart Rate Measurement** which can be found here:

http://www.epocperformancetraining.com/pdf/white_paper_epoc.pdf)