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## **Questions and answers on performance metrics on Precor cardio equipment**

Cardio fitness equipment offers a variety of information about your workout. This group of commonly asked questions addresses how performance information is developed and displayed on Precor fitness machines, and recommendations on how to best use this information.

### **What's displayed on a piece of fitness equipment?**

In addition to displays of speed, incline, distance, resistance and time, up to five performance metrics are displayed on Precor cardio equipment: heart rate, total calories, calories per minute, watts and METs.

Two of the metrics – heart rate and watts – measure a single, specific value. Heart rate is self evident, while watts is the mechanical measurement of force required to move a machine's pedals – or maintain the pace of a belt – at a given speed and resistance, or incline.

The other metrics – METs and those related to caloric output – are generalized formulas established through clinical research, and adjusted for a specific model and type of machine.

### **Are formula-based performance metrics accurate?**

The direct answers are ambiguous: “Yes, formula-based metrics are extremely accurate” and, “No, in terms of the performance of a specific individual, generalized formula-based metrics are not accurate.”

First, the “Yes” answer: Generalized, formula-based caloric output and METs metrics on Precor equipment are accurate, based on decades of research. Medical and fitness experts universally accept these standards. Working from these standards, Precor teams with university researchers and sports medicine doctors to ensure the integrity and accuracy of our display metrics.

As to the reasons why formula-based metrics are not accurate on an individual level, a good place to begin is METS – or metabolic equivalents. METs is an established measurement based on multiples of oxygen consumed by an average person at rest. This base measurement has been correlated to predict oxygen consumption at other workloads – such as sprinting or jogging. Universally accepted by the physiology community, METS metrics on fitness equipment tell you the predicted amount of energy required to perform at that workload.

So, METs displayed on a Precor cardio machine such as a treadmill or elliptical crosstrainer is an estimate of the oxygen consumed by a statistically average person exercising at that work rate.

Once most people hear that explanation, the immediate question is “How does my ability to consume oxygen compare to the average that was used to establish METs?” Unfortunately, there are as many answers to that question as there are people.

The fact is, the only truly accurate way to gauge your oxygen consumption, performance or fitness level is to have a personal fitness test conducted at a medical or fitness facility, where professionals using medical diagnostic equipment can establish your personal performance in comparison to generalized metrics such as METs.

### **Who develops these generalized formulas and averages?**

On treadmills and cycles, caloric metrics are calculated using formulas developed by the American College of Sports Medicine (ACSM), with values including pedal or belt speed, incline or resistance, age and weight. For Precor EFX's, calories per minute is calculated using the ACSM formula as a basis, factoring in stride rate, resistance, weight and, on lower-body models, age and weight.

### **Precor now has fitness test programs on some machines. How accurate are they?**

The Precor Fitness Test course is a great example of how formula-based metrics are developed for a specific machine, and their accuracy.

This test predicts a user's fitness level by monitoring heart rate during a preprogrammed course. The basic protocol – including the course definition and the analysis algorithm – were developed in 1992 by Dr. Neil Gordon of the Cooper Clinic. In 2002, Dr. Emily Cooper, of Seattle Performance Medicine, assisted Precor to calibrate the Fitness Test to predict results shown through VO2 max testing.

As such, the test is clinically designed, extremely accurate as a model, and a great guideline to predict a person's fitness level. Because the exerciser's heart rate is a factor, this metric can be more specific to an individual than generalized formulas such as METs. While the fitness test provides solid information as a predictor of a person's fitness, the test still isn't the equivalent to tests such as gas-exchange or blood lactate protocols conducted at a medical or fitness facility.

### **What about the accuracy of caloric measurements?**

Again, caloric metrics are accurate as generalized formulas that translate mechanical output to human performance, based on scientifically accepted estimates of age, weight, exercise efficiency and fitness level. They are extremely accurate as general formulas based on the level of work being performed on the fitness equipment. Further, the qualifying factors of age and weight help narrow the general information to be more specific to you (again, based on established norms).

If you are seeking general direction, this is more than adequate. Or, if you've had a fitness test, you can factor your performance to formula-based measurements.

Otherwise, consider this scenario: two similar people are exercising side-by-side on a Precor EFX®. They have the CrossRamp incline and resistance at identical settings, and are moving at the same stride rate. Experts will tell you that the difference in caloric expenditure for one "like" person to another easily can be in the double digits – just because one person is more fit than the other. In this case, the person who is less fit will exert a greater energy cost to generate the same workload as the person who is more fit.

Biomechanical efficiency – a combination of technique, fitness and genetics – can create a similar disparity, with under-predicted caloric expenditure for someone who is biomechanically inefficient, and over-predicted caloric expenditure of someone who is biomechanically efficient.

With this in mind, a natural question is "How does my fitness level and biomechanical efficiency compare to established averages for my height and weight?" Again, there are as many answers as there are people.

Another consideration for those looking to match daily caloric intake against caloric output is that your body doesn't necessarily burn the calories eaten that day. Based primarily on heart rate, your body fuels activity by using a variety of fats, carbohydrates, and nutrients stored in muscles. Unless you've worked with a sophisticated personal trainer or sports medicine professional to establish a detailed understanding of your fitness level, fuels you burn at different workloads, and diet, a person only can make general correlations between calories eaten and burned in a workout on any given day.

### **But, I'm trying to manage calories I eat, against calories I burned in my workout . . .**

If you are counting calories of your diet, and looking to match that against your workout, again, you owe it to yourself to get a fitness test by a qualified fitness or medical professional. Only with that detailed information can you make tight correlations to generalized formulas displayed on fitness equipment.

On the other hand, if you are comfortable using fitness equipment metrics as a general guidepost, a machine's display is a great place to begin.

### **Why do some machines seem to produce different readings?**

Despite the best efforts of the fitness equipment industry, it's true that in the real world, display metrics can vary, depending on model, brand, age, usage history and type of machine.

Also, due to the machine's design, your sense of exertion can also vary. For example, if you are used to using an elliptical or climber made by one manufacturer, you may find the experience on another manufacturer's machine to be more or less difficult. For example, different manufacturers' ellipticals have a different motion path, and climbers can have varying levels of "spring back" after the pedal has reached its end point. The best recommendation is to consistently use a single model and brand of equipment for that part of your workout.

### **This all seems confusing. So how should I use performance metrics on fitness equipment?**

Common sense dictates that you establish a point of view that works for you. Some options are:

- **Accept the fact that you're working with generalized metrics** – METs and caloric output may not perfectly capture your individual performance, but they certainly can provide good information – take advantage of them! For example, track total calories METs or calorie-per-minute levels in each session of a consistent workout program. Are the numbers you're generating greater or less than the previous day, week or month? Are you showing improvement?

The idea is that it doesn't matter which metric you follow, as long as you stick to it and track your performance by that metric, consistently using the same type and brand of equipment. These are generalized metrics, but they were attained through a great deal of scientific diligence. How is your performance tracking over time against those metrics?

- **Focus on the "direct" metrics, such as heart rate** – Another approach that is more direct is to set a target of strides or distance for a set time within certain heart-rate levels. Or, track your heart rate against a given workload, and measure your ability to maintain or lower your heart rate against that consistent regimen. By the way, many Precor machines feature the ability to control equipment speed and resistance to maintain your heart rate within a target range.

Or, focus on watts, which is the actual mechanical power required to power or maintain pace with a machine at a given speed and resistance. Factors such as weight, age or fitness level play no role in the watts measurement – it's strictly a function of power required to move the equipment's belt or pedals at that speed, resistance or incline.

Working with a sports medicine doctor or personal trainer, you can gain a greater understanding of exercise physiology and how your own body works.

**Where can I go for more detailed information?**

Personal trainers at clubs or fitness facilities are a natural place to begin, as are medical professionals at sports medicine clinics.

Also, a number of web sites provide valuable information on how you can individualize your workout. Here are a few sites to consider:

- The American College of Sports Medicine, at [www.acsm.org](http://www.acsm.org), with information on health and fitness, as well as information on calculating target heart rate.
- The Centers for Disease Control site includes metabolic expenditure of common activities, at <http://www.cdc.gov/nccdphp/dnpa/physical/stats/mets.htm>, while another page has information on calculating target heart rate, perceived exertion and METs, [www.cdc.gov/nccdphp/dnpa/physical/measuring/index.htm](http://www.cdc.gov/nccdphp/dnpa/physical/measuring/index.htm).

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