

This review summarizes a 13 week test of the Footwarmer Plus product between the months of November and January 2003. My goal with the Footwarmers was to determine if I could extend my cycling season into the winter. Without Footwarmers, when I ride more than 1 hour in temperatures below 40 degrees my toes become cold and numb. This ends my ride. I also wanted a product that would be economical given that I ride about 4 times a week. Since my shortest ride distances are 40 miles, I needed a solution that would allow me to cycle for more than 3 hours outdoors in temperatures below 40 degrees Fahrenheit.

I've cycled 43 times and covered over 2,200 miles with the Footwarmer Power Plus product. I've ridden mostly a Trek 2300 road bicycle. About 8 days during the test when there was snow cover on the roads I rode a Trek 990 mountain bicycle. Temperatures in Fahrenheit ranged from 15 degrees to 49 degrees and averaged 30 degrees over this timeframe. This overall review is based on detailed daily logs of each ride, the temperature, distance of ride, and product performance.

<b>Temperature (Fahrenheit)</b>	<b>Days Cycling</b>	<b>Miles Cycling</b>	<b>Average miles/day</b>
10 – 19 Degrees	7	327	47
20 – 29 Degrees	18	1,007	56
30 – 35 Degrees	13	687	53
36 – 49 Degrees	5	220	44
Totals:	43	2,241	52

**Heat generation** – The product really works! Just as the manual states, the product creates imperceptible heat to maintain comfort and warmth. That is all you need. I rode very comfortably in 25 degree Fahrenheit temperatures at heat level setting 2, where level 1 is the lowest heat generator and level 4 is the highest. The product generates a sufficient amount of heat to keep warm blood circulating to the toes. You don't notice any warmth from the heating pad or any discomfort from the cold.

**Product performance** – Most of my miles were logged in temperatures around 30 degrees. The product performed exceptionally well. For virtually all of the rides, I adjusted the heat level setting to level 2. Only on one or two rare occasions did I need to switch to the higher heat level setting 3 for a brief period of time. I rode 100 mile trips that took 7 and 8 hours outdoors in temperatures less than 30 degrees at heat level setting 2 and my toes felt great and the batteries worked the entire time.

**Extreme (for cycling) temperature testing** – There were 7 days during the review period where the temperature ranged from 15 to 19 degrees Fahrenheit. As the temperatures dropped below 30 degrees I needed to add insulation to my cycling shoes to prevent the transfer of cold from the metal pedal to the plastic Look cleats and plastic soles. In these low temperatures, I could feel the cold transferring to the balls of my feet. I added one eighth inch of rubber gasket material and one quarter inch of EVA material between my Look cleat and shoe sole. I also added a one eighth inch thick piece of Frost King pipe insulation underneath the insoles. The combination of these insulating materials worked great. I completed 50 mile rides at 20 degrees Fahrenheit with the Footwarmer Plus set at heat level setting 2 and my toes stayed warm. In hindsight, I probably didn't need the insulation between the cleat and the shoe.

It became difficult to test the Footwarmers below 20 degrees because the gloves I used failed to keep my fingers warm. I used lobster style gloves with separate Polypro liners. The combination worked great down to 20 degrees.

**Feel while cycling** – I did not even notice or feel the product while cycling. One might think that you would feel the weight of the batteries that were clipped on the outside of the booties. Not so. The battery clips are wide and fit nice and tightly to the booties. The batteries remained fixed in place and don't move even when going over multiple sets of railroad tracks at 25 MPH. On a rainy day, I took a fall on those railroad tracks at about 20 MPH. The batteries remained in position and firmly affixed to my booties.

**Type of Shoes used** – I used New Balance cycling shoes with Look Cleats. These shoes are typical cycling shoes with no special insulation for cold temperatures.

**Shoe covering used** – I used Bellwether booties and toe booties to cover the New Balance cycling shoes.

**Battery Performance** – The batteries performed very well. I rode 5 100+ mile rides in temperatures ranging from 25 to 33 degrees. Each ride lasted about 8 to 9 hours outdoors and included rest and refueling stops. The batteries lasted the entire duration of each ride. I also rode 7 times in temperatures below 20 degrees with each ride lasting 3 hours. Low temperatures didn't seem to hamper the batteries performance.

**Insole selection** – I tested all 3 insole options offered by Hotronic. They all work very well. I first tried the semi-custom insoles that had a special groove underneath the insole to channel the power wire under the foot so that the user with sensitive feet wouldn't feel the wire while participating in physical activity. Great idea! I next tried the regular insole offered by Hotronic that contained the heating element where the user trims the insole to their foot size and then slips it into the shoe. Lastly, I tried the custom insoles that are essentially using my own shoe insoles and adding heating elements to them. I didn't notice the power wire underneath any of the insoles. After logging hundreds of road miles on each insole, my preference was for the custom insoles. I was cycling over 50 miles at a time in 15 degree Fahrenheit temperatures. I found that with the custom insoles I could place the heating elements exactly under the pads of my toes. This seemed to provide maximum heat transfer.

**Fit** – Product fit in the shoe was very good. Each insole fit very well into my cycling shoes.

**Routing power cable** – I routed the power cable under the insoles, behind the back of my heel, up the back of my leg, and out of the shoe bootie. This routing worked out very nicely and I clipped the batteries to the outside of my booties (on the outside side of my bicycle). The wires just arched over and down into the tops of the batteries. The wires stayed very close to my legs. I felt sure that they wouldn't get caught on anything that might brush up against the outside of my leg.

**Battery charging experience** – Charging the batteries was very simple. The manual suggests fully discharging the batteries after every use and then use the 12 hour charger. I did that prior to 100 mile bike rides to ensure fully charged batteries. To save time between other bike rides, I used an inexpensive timer and calculated how much power I used on a ride and set the timer to provide the appropriate charge. For example, if I used the product for 4 hours at heat setting level 2 and the Hotronic manual states that at heat setting level 2 the batteries will last 8 to 9 hours, I would set the timer to provide a 5 hour charge. The calculation I used was 4 hours divided by 9 hours multiplied by 12 hours, which is the full charge time. It worked very well and saved me some time during the week.

**What I liked** – Aside from keeping my toes warm on rides in temperatures lower than 40 degree Fahrenheit, I really like two features. First, the light on battery charger is a good idea. It lets you know that the charger is receiving power. Second, I liked the wide clip on battery. The clip ensures that the battery won't move around on the bootie and makes secure fit.

**Areas for improvement** – There was only one area that I thought could use improvement. The battery heat level setting switch is not water resistant. With the battery clipped to a cycling bootie, the heat level setting switch is exposed to the elements. Once I got caught out in the rain and shorted out the switch. I followed the directions in the Hotronic booklet and let the switch dry out overnight. The next day the switch worked fine. However, this is a good opportunity. I used a self sealing plastic snack bag to cover each battery. It worked great.

**New product ideas** – There were two new product ideas I came up with. The first idea is battery booties. After I got caught out in the rain once, I made battery booties out of self sealing snack bags. I cut 2 small slits in each bag. One slit for the battery clip and the other for the power cable. The bags worked well and I used them on every ride for rain and water protection. The bags were fairly durable and lasted about 6 rides before needing to be replaced. Better battery booties could be made of more durable material and would ensure battery protection while cycling.

The second idea is insulation strips. The problem is that at temperatures below 20 degrees Fahrenheit, cold transfers from the metal pedal to the plastic shoe insoles and makes the balls of the feet cold. As of this writing, there really aren't any great cycling shoes available for winter riding. Regular cycling shoes work well down to 15 degrees Fahrenheit with some additional inexpensive insulation to prevent cold transfer from the metal pedals to the cycling shoes. I used a thin strip of fleece under the insoles and one eighth inch of rubber gasket material and one quarter inch of EVA material between the Look cleat and the cycling shoe. It worked very well and was inexpensive. Creating a product that provides this type of insulation will enable regular cycling shoes to be used down to 15 degrees and probably below.

**Product instructions** – The directions were simple, clear, and straightforward. The booklet that came with the product had many pictures and charts that allowed me to find the information I was looking for very quickly. Information covered included battery performance at different heat level settings, suggested heat level settings by temperature, what to expect from each heat setting, tips on using the product, recharging the batteries, how to install the insoles, and other very useful information. Clearly a lot of time, information, and careful thought were put into the development of the booklet.

**Ease of assembly** - Assembling and charging the product was very easy. The entire process took about 12 minutes. I selected the semi -custom insoles that fit best in my shoe and then inserted the heating elements and placed the covering over the wires. Slipped the insoles in the shoe. Done. Plugging the charger into the batteries was simple and visually easy.

**Workmanship/Quality** – The battery clips, power supply clips, battery heat level switches, power wires and heating elements are all quality components. I've used the product over 29 times, logging over 1,600 cycling miles and each and every part looks and performs as it did when new.

**Overall** – I like this product for cycling because it is simple, high quality, economical, and it works! Within eight weeks from November to December I've ridden over 29 times and covered over 1,600 miles using the Footwarmer Plus product. Most of my rides were in 30 degree Fahrenheit temperatures. My shortest rides were 45 miles and I rode several 100 mile rides. I've also used the product on 50 mile rides in 15 degree temperatures at heat level setting 2 and the product kept my toes warm (read Extreme section above). The product and its components look and perform as if they were new. Best of all, the product is economical. Compared to chemical toe warmers costing \$1.50 a pair for each ride, the Hotronic Footwarmer Plus only costs \$.69 a ride. That assumes a retail price of \$165 and use of 80 times per winter season over the product's 3 year warranty.