

## Dishwasher Test of Bike and Skate Helmets



### The Experiment

BHSI bought a number of helmets to test in an attempt to establish whether or not being washed in a dishwasher can affect the performance of a helmet.

**Warning: no manufacturer recommends washing helmets in a dishwasher!**  
Some consumers do it anyway, so we are exploring how it might damage the helmet.  
We do not recommend washing a helmet in a dishwasher. Follow the manufacturer's instructions for cleaning.

### The helmets

Colors were noted to make sure the helmets were identifiable after labels washed off.

- Bell Next - road helmet molded in the shell. (yellow/red)
- Bell Rally Little Sport - toddler helmet with glued-on shell. (pink/yellow)
- Giro Section - skate-style helmet molded in the shell, thin-shell. Minimal vents to facilitate consistent testing. We have baseline test results on this helmet from previous testing of sunscreens. We included four of the Giros.
- Huffy Cruiser - skate-style helmet with hard shell.
- Schwinn - road helmet with glued-on shell. Model #SW77362-2 (purple/silver)
- Schwinn - road helmet with taped-on shell. Model #SW74240 (gray)
- Schwinn - toddler helmet with taped-on shell. Model #SW77729-2 (red/green)
- Zéfal Artica - road helmet molded in the shell. Model 5778 Ref#150025

## **The testing**

The helmets were washed as they came from the box, with interior fit foam pads and visors. They were first placed on the top and bottom racks of a Bosch residential dishwasher with no exposed heating coil and run through the Auto cycle with no other options selected. Straps were knotted to prevent them from falling through the racks and halting the rotating spray arms. Incoming water was at just over 125 degrees. At the end of the rinse cycle the enclosed heater had heated the final rinse to 146 degrees, but there was no heating in the extended drying cycle while the dishwasher was still closed and no air was blown into the room. Water and helmet temperature were measured inside the dishwasher with a digital infrared thermometer and recorded. In all tests we loaded 20 ML (4 tsp) of Cascade Advanced Power dishwashing detergent. An automatic dispenser added a very small dose of Jet-Dry rinse agent. We washed the helmets in the Bosch dishwasher three times with several days between washings to allow them to dry. Then we repeated the washings three times in the top rack of another dishwasher with an exposed central heating coil and blower for drying. Exposed heating coils can catch helmets on fire if the helmet or straps touch the coil.

We then sent some of the most-affected models to be crashed in an accredited independent testing laboratory at Southern Impact Research Center to determine if the washings affected the helmets' performance.

SIRC had previously tested four of the Giro Section helmets in their lab to establish a performance baseline at five helmet locations. Two of the Giro helmets were tested dry at ambient lab temperature. Two were tested wet in case wet samples of the treated helmets proved more prone to impact performance changes. Another sample was tested hot, and one tested cold. Test locations were front crown (to avoid the single vent), each side, rear and on the crown. We did not attempt to establish baseline performance for the additional helmets.



After the washing treatments were finished BHSI shipped some of the helmets with apparent degradation to the lab. The lab tested the straps, then tested the same five locations on one each of the Giro Section helmets to determine if their performance had changed. One sample was tested wet to see if water infiltration could be a factor. All impacts were on the flat anvil at 6.2 m/s, corresponding to the flat anvil drop of the CPSC bicycle helmet standard.

The lab test results showed that even the most apparently affected helmets still met the CPSC impact standard. That included models with taped-on and glued-on shells that had warped or even detached. Surprisingly, the taped-on shell models held up better under the washing regimen than the glued-on shells, where some shells warped apart from the liner in spots.



Damage to the helmet stickers and fitting foam was extensive. Some stickers came off in the initial washings, and most had come off when the tests were done. Fitting foam detached from the inside of the helmet liners in all cases, and some disintegrated .



Since the stickers are essential to identifying the helmet and the standard the manufacturer certifies it to, we consider sticker loss as substantial damage. Fitting foam is required to keep the helmet in place for a crash, so losing it is critical to performance.

The expanded polystyrene liners (picnic cooler foam) in some models had turned fuzzy by the end of the washing regimen, but did otherwise lose integrity.



Some helmets held up very well. The molded in the shell helmets have polycarbonate shells to withstand the heat of the molding process. The glued-on or taped-on shells typically have thinner PET or other plastic shells and are more prone to warping in heat. But even some of those held up well.





Some helmets were ruined:

- On the first wash in the Bosch, the helmets were not damaged much. On subsequent washes, labels disappeared and fitting foam began to disintegrate. In the exposed heating coil dishwasher, taped on shells came loose and even separated. Glued-on shells warped around the edges. Only the molded in the shell helmets had no visible damage at the end of the washings
- When they dried, deteriorating foam pads spread tiny specks of sticky black everywhere.
- As labels washed off, they left sticky adhesive patches capable of pulling out hair.
- Surfaces degraded, and glossy helmets became faded and matte. You would probably not want to wear one.
- Some liner foam got fuzzy on the surface.
- Some buckles, visors and stabilizers oxydized and got a white film on their surface.

## Conclusions

We believe that manufacturers have a good reason to recommend hand washing. We would use a brush with long, soft bristles, or a sponge, and mild dishwashing liquid soap with lots of water. Then let the helmet dry normally at room temperature. If you feel the need to freshen the helmet after every ride, you can take your helmet into the shower and rinse it, then let it dry.

## Test Detail

### First Round

On July 25, 2015 we ran the first tests, with a total of eight helmets: Bell, Giro, Huffy, Schwinn and Zefal. The next day we washed three more Giros.

**Batch 1**

| <u>Cycle</u>        | <u>Water temp (F)</u> |
|---------------------|-----------------------|
| • Pre-wash          | 96                    |
| • Wash              | 111                   |
| • Rinse             | 125 rising            |
| • Final rinse temp. | 146                   |
| • 30 min. after     | 120                   |

**Batch 2 – All Giro**

| <u>Cycle</u>    | <u>Water temp (F)</u> |
|-----------------|-----------------------|
| • Pre-wash      | 102                   |
| • Wash          | 125                   |
| • Rinse         | 113 rising            |
| • Final         | 148                   |
| • 45 min. after | 113                   |

After three washes, all helmets survived intact with no visible effects except loss of labels. The Zefal sample lost all of its labels. The Schwinn labels began coming loose but were still hanging onto the helmets. The Huffy sample lost all exposed labels, keeping those that were behind the internal fitting foam. The Bell and Giro labels showed little effect, with a slight rumpling.

When the dishwasher was opened after the second rinse at 125 degrees and after the final rinse at 146 degrees there was a strong odor of plasticizers gassing off due to the heat of the water. We don't know which helmets were gassing off. When we ran the second batch with just Giros, there was no smell of plasticizers. The Giros had polycarbonate shells, the normal plastic for molded in the shell models.

**Round Two**

The helmets were shipped to ASTM member Dorothy Bedford, who continued the test washing with a dishwasher equipped with a central heater coil. By the end of that testing, visible external damage was apparent in about a third of the helmets, including loosening of the outer shell. All of the helmets had lost some or all of their stickers and fitting foam. The most durable models were those that were molded in the shell, showing no external damage, although fitting foam and most stickers were lost.

**Round Three**

Four of the helmets with the most external damage were shipped to Southern Impact Research Center and tested, dropping them at 6.2 m/s onto a flat anvil as required in the CPSC standard. All four passed the test.

**Conclusions**

Do not wash a helmet in a dishwasher! It takes only three minutes to wash it in the sink with a sponge or soft brush and mild dishwashing liquid. Or take it in the shower with you and shampoo it. The loss of stickers affects your ability to be sure the helmet meets current standards. The loss of fitting foam affects the helmet's stability on your head in a crash. And if the shell warps and detaches it can affect the helmet's basic integrity, possibly affecting its protection, making it fragile in daily use and certainly making it look ridiculous to wear.