





Full Exposure

U.S. Army data helps clear the view of waterproof/breathable

By R.J. Anderson

We've all heard our share of hype when it comes to new technology. From metals to fabrics, there is no doubt that during the last 10 years engineers have upgraded and improved virtually every nuance of technology associated with outdoor gear and apparel. That's especially true when it comes to fabrics and fibers. And there's rarely a shortage of trumpeters for this information.

With this in mind, **IO** queried a cross-section of retail readers about what aspects of newer technologies frustrated them the most. Despite having successful retail operations and many years of accumulated experience selling outdoor technology, retailers indicated that they still are having trouble cutting through the industry hype that accompanies the technological advancements that drive their sales.

"It's not that it's so hard to understand things, but sometimes it's hard to differentiate products," says one retail store manager.

In particular, most retailers mentioned waterproof/breathable fabrics as being an area ripe with hype and confusion, especially with competition for industry dollars within this segment tightening during the last five or so years.

"A Marmot Precip that sells for \$99 claims its waterproof, then I've got \$300 to \$400 Gore-Tex shells. Are you paying \$200 more for more waterproofing?" asks the owner of a shop in New York. "Doesn't waterproof mean waterproof? How can something be more waterproof than another?"

Twenty-five years ago, when W.L. Gore created a fabric that relied on stretched Teflon filled with tiny pores to allow water vapor to escape from one side of the fabric while inhibiting water's penetration on the other side, waterproof/breathable technology was born. Since that time, the market has seen a downpour of textile manufacturers staking their claim within this category. And as engineers have pushed the envelope on their competing technologies, their corresponding marketing departments have moved in kind.

As the influx of laminates and coatings have made garments

more breathable, and terminology more muddied, employees on the sales floor are struggling more than ever to decipher the differences and direct customers to products containing fabrics that best suit their outdoor needs. For the specialty stores we spoke with, an over-emphasis on explaining the "science" behind a garment or component, while placing less weight on describing the end-user benefits or what the ideal usage might be, makes sales floor comparisons and recommendations difficult.

"Often eyes just kind of glazes over," says the owner of a specialty store in Wyoming. "They've heard so many things, so nothing seems to resonate very well with my staff or my consumers."

"It is my suspicion," adds one 20-year veteran of specialty retail, "that if you gave an employee five different garments and asked them to rank them from most breathable to least breathable and most waterproof to least waterproof, there would be a whole lot of confusion as to which garments do what." Our industry vet believes this ignorance is fostered by the fact that there are no established ratings or industry-wide tests that yield objective breathability ratings.

What's more, retailers typically are provided only the information that manufacturers and suppliers want them to see. And, as could be expected, most manufacturers only are going to subscribe to tests containing variables that show their product among the top of its class. Meanwhile, as we all know, there's a wide array of climatic and usage scenarios, so logic tells us that no product can be everything to everyone.

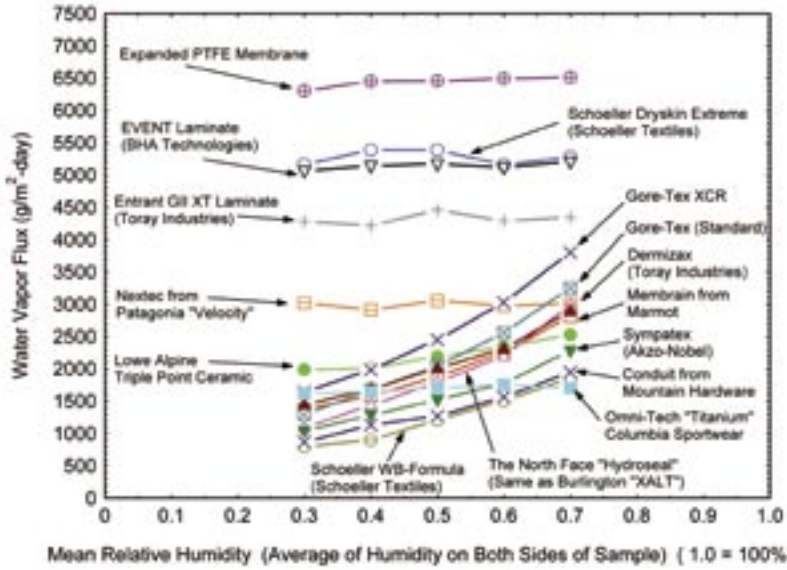
Getting Testy

One retailer has taken matters into his own hands. Prompted by a bad experience in which his performance underwear never seemed to dry out during a 1996 kayak trip through the Grand Canyon, Rod Johnson, president and owner of Midwest Mountaineering in downtown Minneapolis, began performing his own tests to determine the waterproofing, and more importantly

in his opinion, the breathability of the product on his store's sales floor.

By using a tea kettle to measure how quickly steam moves through fabric and shower tests to measure waterproofness, Johnson compiles his own data then organizes the information forming fabric comparison sheets

Breathability Comparison of Commercial Outerwear Pieces



for his employees. (Please see sidebar below.) Johnson also encourages his employees to field test product themselves and submit their own evaluation of its effectiveness.

Bob Sass, retail manager at Midwest Mountaineering, finds Johnson's

fabric rankings "amazingly effective" when giving recommendations to customers. "The list is compiled based on our experience with the product, which is how most stores form opinions," says Sass. "But we also are able to describe how fabrics fare in relatively controlled testing environments – like the steam tests. It reinforces to customers that our opinions are pretty objective."

Johnson's methods are by no means "pure" in a scientific sense, but they do provide his sales staff with another arrow in their quiver with which to better inform customers and fill individual needs. Another tool, one utilized by the United States military, is data compiled by the U.S. Army Soldier Systems Center lab, in Natick, Mass. The Natick lab is a large testing facility that evaluates clothing, food, parachutes and physiological reactions of soldiers in order to make gear recommendations to the military.

Dr. Phil Gibson, a materials science engineer for the Natick lab, has tested apparel from the outdoor industry for more than 10 years. In that time he has conducted thousands of tests measuring waterproofing and breathability. One test that Gibson considers particularly effective – and objective – is the "Water Vapor Diffusion Test."

As can be seen in the table above, the vertical axis measures water vapor flux, which is the actual quantity of water vapor that evaporates through the material. It measures how many grams went through one square meter of fabric in one day. The higher number is equivalent to more water vapor escaping, which translates into a material being more breathable.

The horizontal axis is the mean relative humidity, which represents the amount of water vapor available to be dispersed, which in a real-

Rod's Results

As president and owner of Midwest Mountaineering in Minneapolis, Rod Johnson has seen nearly every fabric imaginable come in and out of his shop. Like other retailers, Johnson for years found himself at the mercy of manufacturers' marketing materials when it came to figuring out which fabrics worked best.

Then in 1996, during a kayak trip through the Grand Canyon, Johnson was wearing underwear from a leading manufacturer underneath a Gore-Tex drysuit. "It would get wet and take forever to dry," says Johnson. "I thought there must be something better, and I decided to start conducting my own tests."

Base Layer Brand/Material	Drying Times
100-percent cotton	110 minutes
SmartWool underwear	91 minutes
Micro fleece	85 minutes
The North Face polyester base layer	67 minutes
Marmot polyester base layer	67 minutes
Terramar polyester base layer	67 minutes
Patagonia polyester base layer	55 minutes
Lifa polypropylene base layer	48 minutes
Brynje polypro fishnet base layer	24 minutes

To test the mid-weight base layers, Johnson would wet each garment (by holding it under a faucet), run it through the spin cycle of his store's washing machine, and then wear it with a shirt over top while walking around his office and record the drying times. He then passed out a list of the results for the employees to consider when making recommendations to customers. At bottom left is a list of his results.

Johnson's W/B Results

- eVENT ("I have found that it breathes so well, armpit zippers are not necessary," says Johnson.)
- The North Face Atmosphere (Hydro Gore-Tex)
- Marmot Oracle; Gore-Tex XCR; Marmot Precip
- Gore-Tex PacLite
- MontBell Versalite
- The North Face HyVent
- Marmot Chinook (Seams not sealed, water repellent/breathable)
- Patagonia Velocity (Seams not sealed, water repellent)

In order to determine approximate breathability of a waterproof-breathable jacket, Johnson held various jackets and materials over a steamer. The amount of steam observed passing through created the above results, with rankings from best to worst.

world application could be viewed as increasing perspiration levels.

Looking closely, one will notice that for a number of materials there is a curve in their water vapor flux performance at the different humidity intervals. What this suggests is that as perspiration increases so does the fabric's breathability, making them more breathable at higher levels of perspiration when the user is working harder.

On the other hand, there are slight drop-offs for these materials at lower levels of water vapor flux (perspiration). These materials, such as Gore-Tex XCR and Sympatex, tend to be polyurethane-coated (PU) PTFE membranes, whose technology depends on water vapor dissolving into the PU polymer film before it can wiggle through the pores in the PTFE membrane. So the more water vapor available in that fabric, the easier it is for that water vapor to push through the membrane and evaporate.

Other membranes show relatively straight lines across the variable humidities, indicating more consistent performance. These materials tend to be either woven fabrics or, such as eVENT and Entrant GII XT, are microporous laminates that aren't coated by an additional polymer.

In the Water Vapor Diffusion Test, these membranes function equally well at high and low levels of humidity, meaning a user doesn't have to be perspiring heavily for the fabric to breathe at its peak level. One advantage to these types of materials is that at lower levels of resistance, they function better than the PU-PTFE membranes, allowing the fabric to breathe better during early phases of perspiration, hopefully avoiding compromising of the breathability by eventually overwhelming the fabric with perspiration. The same holds true during the user's cooldown periods – the fabric continues to breathe at the same high level even though the level of perspiration is declining. This property is especially helpful when the user is operating in cold, wet conditions or seeks to dry out a wet glove or shell.

"The curve of each line is very interesting," says Gibson. "Some of those materials look better than the other materials under one set of test conditions than another. It's interesting to see where the lines cross, which is where you can see one material outperforming another."

"Ideally, some of those materials that have the very low values for resistance all the time should be the best," continues Gibson. "But with something like a Gore-Tex XCR, as long as the material's curve doesn't go up too sharply, it's going to be pretty breathable in pretty much all conditions. Though it may take a little longer to dry out than some of the other fabrics."

Gibson notes that all of the materials in the plot are fairly good performers and all work well enough for most applications. He also points out that breathability is the only property measured in this particular plot.

"This test doesn't measure air permeability or ventilation," says Gibson. "It is important to remember that something may be breathable but impermeable to air. The Schoeller and Malden Mills fabrics, and even the eVENT laminate, which has a little bit of air permeability, actually allow for some ventilation through the fabric itself, which also helps regulate perspiration."

Data from the Water Vapor Diffusion Test is simply one piece when it comes to breaking down the waterproof/breathable puzzle. Other tests exist for breathability and measuring waterproofness, and there are many more variables, such as venting and efficient design, that determine how effective a garment containing any waterproof/breathable fabric is going to be.

So retailers would be best served by tempering the information provided by sources such as Natick with their own critical reasoning and experiences. If nothing else, at least making sure employees understand the difference between a store's top-selling fabrics and technologies should go a long way in buffering end-users from the marketing buzz. **10**

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