



The Conspiracy OutDry shoe from Columbia Sportswear. The brand believes OutDry's laminated membrane technology will help keep its footwear drier and more comfortable in wet conditions.

 Columbia Sportswear

FOOTWEAR TECHNOLOGY: TESTING

Keeping feet dry is the most obvious purpose of membrane technology in shoes and boots, but a new, faster test for water resistance, developed by SATRA, has raised questions about water-retention in some styles and the increase in mass and decrease in comfort that this inevitably causes.

A faster method for testing shoes for water resistance

Research and testing body SATRA has developed a new test method and machine, which, it claims, are “set to change the way footwear is tested for water resistance”. The new TM444 test method and test machine STM 640 can evaluate resistance to non-flex induced water penetration in all footwear products in just over ten minutes, and without causing damage to the materials or product, SATRA states.

“This makes TM444 ideal for production testing and sets it apart from existing water-resistance test methods that can be relatively time-consuming and cause damage and fatigue to the footwear being assessed,” the organisation said in a statement issued in May. “For manufacturers and suppliers of footwear claiming to offer water resistance, it is vital to have these claims assessed before placing the product on the market. SATRA’s TM444 and STM 640 will help them validate these claims.”

External pressure

TM444 is based on a centrifuge principle. A sample of footwear is weighed and securely placed in a container which is then filled with water to a known depth. The container is attached to a vertical shaft within the centrifuge and spun rapidly so that the water exerts pressure on the outside of the footwear. At the end of the test, the footwear is inspected and reweighed to determine the level of water penetration.

Commenting on the new test method and machine, SATRA’s head of research, Tom Bayes, says: “The new TM444 and STM 640 have come about through our commitment to research and innovation, with the ultimate aim being to help our members develop the best possible products in the shortest possible time.”

Lighter, drier shoes

One brand to have made early use of the new test is Columbia Sportswear. Owner of laminated membrane technology OutDry, Columbia intends to use TM444 to differentiate itself further from bootie-method membrane technologies because it believes demonstrating a substantial difference in weight between shoes equipped with OutDry and those equipped with bootie technology will turn many heads in the world of sports and outdoor activity.

Andy Robinson, a footwear expert who has been working with OutDry as a technical consultant since the start of 2013, says bootie constructions have been successful since their introduction 30 years ago. However, he points out that this type of footwear construction leaves a cavity between the outer shell of the shoe or boot and the bootie. If the outer shell becomes wet enough, water will gather in that cavity. The bootie will usually prevent this moisture from reaching the foot, but the moisture will remain trapped there for some time before evaporating back out through the upper.





Shoes in a spin

A demonstration of the new TM444 test at SATRA's laboratory in Kettering showed an outdoor boot with a bootie membrane to have a mass of 504.61 grammes before becoming wet. The OutDry boot used for comparison had a mass of 492.53 grammes. After submersion in 70 millilitres of water, with the water level coming just about the vamp in both boots, the footwear went into a centrifuge for ten minutes.

At the end of the test, the boot with bootie was shown to have gained 100 grammes, while the boot with OutDry was only 9 grammes heavier.

SATRA has correlated the new test to the more familiar TM230 flex test and says the ten-minute spin in the centrifuge equates to 30,000 TM230 flexes, which could take three days. The idea is not to replace TM230, because the flex test is an important way of imitating the effect of a moving foot on a shoe, but the research and testing body suggests that TM444 could prove to be an interesting test for footwear brands to carry out first.

"OutDry is a totally different system," Mr Robinson says. "Here, the upper is turned inside out and a membrane set, specifically designed for each style, is fitted to the upper. The membrane set has highly elastic properties, so the material will flex with the upper. With the membrane in place, the upper goes into a lamination chamber and, after 60 seconds of heat and pressure, you have a laminated upper, with the membrane becoming part of the outer shell. It forms a bonded, impenetrable membrane layer and there is no space in between, making the shoe drier, lighter and more comfortable."

According to results that have emerged from development work that Columbia and OutDry have done with SATRA, TM444 tests on a shoe with OutDry show a weight gain of less than 10%; Mr Robinson puts the figure at typically 6% or 7%. "With a bootie construction, it could be as high as 30%," he says. "And that means it would take a long time to dry out." He contends that even you left a pair of shoes or boots with conventional membrane technology for a whole day after getting them wet, they would still weigh 24% more than when dry.

Questions of comfort

As this is a scientific topic, SATRA's Tom Bayes prefers the term "mass gain", but he agrees on its importance. If shoes and boots retain the water trapped in the cavity between outer shell and bootie, they will become heavier (the beauty of the metric system makes it easy to remember that a litre of water weighs a kilo). There is another consideration. Mr Bayes says SATRA has subjected the footwear involved in this study to tests for thermal resistance, too, comparing the loss of thermal insulation a wearer could expect with a dry boot to the likely level when the same product, with the same construction from the same materials, is wet. It's the same as asking how much energy the wearer would expend in

keeping thermal comfort as high as possible in cold and wet conditions. Retained moisture between a bootie and the outer shell can leave the upper feeling damp for a lengthy period of time. Without a change in ambient temperature, Mr Bayes points out, footwear will feel cold and wet and, as a result, less comfortable.

Outdoors for longer

Columbia Sportswear's national manager for the UK, Darren Wilcox, contends that footwear fitted with OutDry will give consumers the benefit of greater comfort because the technology will allow the shoes to stay lighter and drier. "The bootie has worked for [more than] 25 years," he says, "because it keeps the foot dry. But a wellington boot does that, too, only without offering any breathability. Consumers who are more comfortable can keep on taking part in the outdoor activities they love for longer and enjoy them more. We've all been there. When you feel too tired or feel you're carrying too much weight, you're miserable, so anything technology can do to help prevent that, we're all for it."



The new STM 640 testing rig developed by SATRA.

SATRA.