



CREDIT: COLUMBIA SPORTSWEAR

Shoes in a spin

One of life's major discomforts is cold and wet feet. Up until comparatively recently and, depending on where in the world they lived, this was however often the lot of anyone involved in outdoor activities for much of the year. The invention of vulcanised rubber 'Wellington' boots in the late 1800s was a major step forward but, although they resisted water from the outside, they did the same from the inside causing the feet to sweat, making the boots uncomfortable to wear for long periods. They also offered poor thermal insulation in cold weather.

The development of polyurethane-based breathable membrane technology some thirty years ago changed all that as it combined resistance to water from the outside and also allowed moisture vapour to escape from the inside. The result has been a huge variety of footwear and clothing that will keep feet and bodies dry and comfortable in almost any

adverse conditions. As far as footwear is concerned, the past few years have also witnessed an on-going debate over which is the most effective way to incorporate membrane technology into boots and shoes.

One is to use a separate internal 'bootee' made from cut, seamed and sealed sections of membrane. This leaves a cavity between it and the outer shell of the upper. Another is for the membrane to be laminated three-dimensionally to the reverse side of the upper as in the Italian OutDry system. This effectively makes it an integral part of the upper shell. The third, Ion-Mask developed in the UK by P2i, involves the application of a nano-coating of water repellent fluorinated acrylate monomer to the whole shoe. This allows the upper to be made in the same way as any conventional type of footwear.

While the last two are designed to keep water out of the outer upper shell, the aim of the first is to merely keep it

outside the membrane bootee. Although it does this admirably, it does not prevent it from penetrating the upper and accumulating in the cavity between the two, and this has an important bearing on foot comfort.

A QUESTION OF COMFORT

As this accumulation increases, so the boots or shoes concerned will weigh more and, the longer they are worn in wet conditions, the worse the position will become. A more scientific term for this is 'mass gain'. They will also take longer to dry out so, on a week's hiking holiday for instance and, if it was unfortunately wet all the time, they would become gradually heavier as the week progressed and therefore more tiring for the wearer.

There is a further consideration. Tests have shown that a wet boot offers less thermal insulation than when it is dry. It is much the same as asking how much energy the wearer would expend in keeping thermal

SATRA'S LATEST FLEX TEST

A demonstration of the new TM444 test at SATRA's UK laboratory showed an outdoor boot with a bootee membrane to have a mass of 504.61 g before becoming wet. An OutDry boot used for comparison had a mass of 492.53 g. After submersion in 70 millilitres of water at just over the level of the vamp, both boots went into a centrifuge for ten minutes. At the end of the test, the one with the bootee membrane was shown to have gained 100 g, while the one using OutDry was only 9 g 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 as the flex test is an accurate and proven 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 a quick and easy test to carry out first.



THE NEW STM 640 TEST RIG. CREDIT: SATRA

comfort as high as possible in cold and wet conditions. Retained moisture between the inner bootee and the outer upper shell can leave the latter feeling damp for a lengthy period of time. Without a change in ambient temperature, the boot will feel cold and wet and, as a result, less comfortable. The thought of putting on cold damp boots at the start of a potentially long day is not very appealing.

A QUESTION OF TESTING

Simple tests that check for water penetration in footwear based on the centrifuge principle have been around for some time. One example is the machine developed by US Centrifuge some six or seven years ago for use on military boots. All involve filling the test shoe or boot with a measured quantity of water and then spinning it for a given length of time after which any leak will become apparent. While this type of test is very effective in showing whether the foot will remain dry or not, it does not indicate the amount of water that is penetrating the shell of upon itself.

A new test method developed by SATRA looks set to change the way

footwear is tested for water resistance in future. The organisation says the new TM444 test method and STM 640 machine can evaluate resistance to non-flex induced water penetration in all footwear products in just over ten minutes, and without causing damage to either materials or product. While still based on the centrifuge principle, there is a fundamental departure from previous practice.

The shoe or boot to be evaluated 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 re-weighed to determine the level of water penetration. So, the degree of water resistance is measured from the outside rather than the inside with the obvious implication on the comfort factors mentioned earlier.

PLAIN FACTS

One brand already using the new test is Columbia Sportswear. Columbia uses OutDry membrane technology

and is a great believer in the 'less weight equals greater comfort' equation. It intends to use TM444 to differentiate itself further from bootee-method membrane technologies because it believes that demonstrating a substantial difference in weight between shoes equipped with OutDry and those with bootee technology will strike a positive chord with purchasers of sports and outdoor footwear.

According to results that have emerged from development work that Columbia has done with SATRA, TM444 tests on a shoe with OutDry showed a weight gain of less than 10%. A spokesman for OutDry put the figure at typically 6% or 7% whereas with a bootee construction, it could be as high as 30% and take a long time to dry out. Furthermore, a pair of shoes or boots of this type left for a whole day after getting wet could still weigh as much as 24% more than when dry. So, not only does the OutDry approach appear to be extremely effective in keeping wet out and weight down, but the new TM444 test would seem to be a quick and cost effective method of proving whether footwear is water resistant or not. 