policjantom)
i uwzględnić to podczas projektowania kamizelki oraz pokrowca, tworząc tym samym w pełni zintegrowane rozwiązanie. Powinno to znacząco poprawić ogólny komfort użytkowania sprzętu.

Decyzję, w jakich rozmiarach będą oferowane kamizelki należy podjąć, uwzględniając całą populację użytkowników, w tym kobiety pełniące służbę w policji. Alternatywnie, wiele dzisiejszych jednostek policji oferuje rozwiązania „na wymiar" zaprojektowane i wyprodukowane jako pojedynczy wyrób dla każdego funkcjonariusza danej jednostki. Oznacza to, że personel w każdej jednostce musiałby zostać przeszkolony i nauczyć się jak bierze się miarę i precyzyjnie zapisuje wymiary ciała.

Dzisiejsi funkcjonariusze Policji narażeni są na wiele zagrożeń. Materiały ochronne na kamizelki zabezpieczające przed wieloma rodzajami zagrożeń są dostępne u producentów włókien aramidowych. Użycie tych materiałów w zintegrowanym rozwiązaniu da policjantowi wiarę w siebie potrzebną, by sprostać wyzwaniom, wobec których staje on w czasie wykonywania codziennych zadań służbowych.

W niniejszym artykule ***William Cook***, niezależny konsultant ds. bezpieczeństwa i obronności, przybliża kwestie, które należy wziąć pod uwagę projektując kamizelki ochronne zabezpieczające funkcjonariuszy Policji przed zagrożeniami, z jakimi mają kontakt w czasie wykonywania zadań służbowych.

load carriage solutions are incorporated into the design of the vest and its cover so that provision is made from the outset for communications equipment, weapon if carried, and the other items that officers need, thereby producing a fully integrated item. This should greatly enhance the comfort and reduce the officers' burden – and hence the stress factor.

Today's police officers face a multiplicity of threats: their protective equipment must cater for the full spectrum that may confront any individual officer. Multi-Threat Protection solutions are widely available from the manufacturers of high quality aramid fibres. The incorporation of these materials into an integrated solution where the vest cover contributes to the wearer's comfort and provides the framework for optimum load carriage will give officers the confidence to meet the challenges that face them daily.

In this article ***William Cook***, an independent security and defence consultant, looks at some of the issues that should be considered when designing body armour that protects police officers against the threats that police officers face routinely.

Endurance Tests for Exacting Demands: How Gore retains its competitive edge and the quality of its GORE-TEX® duty shoes

Sven Seliger

W. L. Gore & Associates GmbH

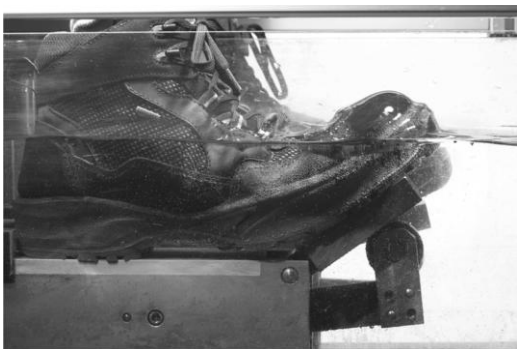
GORE-TEX® duty shoes are valued throughout the world because they keep your feet dry, well protected, and at a pleasant temperature. With the GORE-TEX® membrane built into them, they are durably waterproof and highly breathable, offering their wearers ultimate climate comfort. To ensure that this is always the case, membrane specialist W. L. Gore & Associates has put into operation a unique system of tests to consistently monitor the performance of GORE-TEX® footwear during and after its manufacture.

Waterproofness

Gore have developed a unique hot-air seam sealing machine to seal the seams. Thanks to its patented nozzle, this machine delivers a better sealing performance than conventional seam sealing machines. The **Suture Tests**, which are conducted at the Gore laboratories and in the production plants of Gore's partners, measure the waterproofness of the seams after they have been sealed with a special tape. This test subjects the seam to a water pressure of 1 bar over a period of

5 minutes which is almost 10 times the level of the 0.13 bar specified by DIN EN 20811. The GORE-TEX® lining laminate itself withstands a water pressure of 8 bar.

It is not only the GORE-TEX® lining that is crucial for the durable waterproofness of GORE-TEX® footwear but also the other materials used for the shaft. These must be treated with a water-repellent finish. The absorptive properties of upper leathers, textiles, shoelaces and sewing threads are determined by the **Hydro, or Wicking Test**. This test involves taking samples of the materials and subjecting them to mechanical stress before immersing them in water. They have passed the test when the water has not risen more than 1 centimetre after 2 hours.



The two Gore test devices which are primarily used to test the durability of the waterproofness of the GORE-TEX® duty shoes in the laboratory and during series production are the **Walking Simulator** and the **Centrifuge**. Both of these tests were developed by Gore itself and have since been patented.

The **Walking Simulator** monitors the „total" waterproofness of GORE-TEX® duty shoes simulating walking in rain over a longer period of time. This is done by submerging the shoe in a five centimetre deep water basin and subjecting it to half a million flex movements, which corresponds to a walking distance of about 500 km.[1] Aspects such as the body weight and walking speed of the wearer can also be simulated. Sensors mounted on an artificial foot positioned in the shoe react as soon as the smallest amount of moisture enters the shoe. Any flaws in the construction of the prototype or which are discovered during the production of the shoes can be analysed and rectified immediately. This piece of test equipment is now also being used by several European test institutes.

Every GORE-TEX® footwear manufacturing plant in the world that has been certified by Gore is equipped with the **Gore Centrifuge**. Every day 2% of all shoes produced have to pass this centrifuge test. The shoes are filled with water, mounted on the centrifuge device and spun for half an hour at approximately 240 revolutions a minute. The centrifugal forces are so strong that water is forced outwards through any areas that are not watertight. Blotting paper placed under the test specimens enables any leakage to be accurately located. This test procedure makes it possible to test the 100% waterproofness of the day-to-day assembly line production 30 times more quickly than previous methods. It is also used for the testing of prototypes, which are tested for 60 minutes.

The stability of the GORE-TEX® laminate when subjected to flexing and folding is determined by the **Gore Crumple Test** which simultaneously compresses and twists the laminate. Subsequently the **Suter Test** is used to measure the waterproofness of the seams.

Water vapour transmission performance (breathability)

[1] To compare: shoe standard EN 20 345 requires that 1,000 steps (= 500 m) be taken through shallow water and permits 3 cm^3 to enter the shoe.

Alongside waterproofness, the outstanding breathability of the materials used in its GORE-TEX® duty shoes is also of crucial importance for Gore. After all, it is only when all of the layers that make up the shoe can ‘breathe’ that the sweat produced by the foot can easily escape to the outside in the form of water vapour.

The **Whole Boot Comfort Test** serves the purpose of determining the water vapour transmission rate which is ultimately an indication of the climatic comfort of the GORE-TEX® duty shoe as a whole. Under controlled climatic conditions "sweating" artificial feet are used to establish how much moisture can escape through the shoe. With the help of a correlation model developed by Gore and Munich University of Technology, the data on moisture vapour diffusion and water absorption acquired during the test is used to determine the climatic comfort value of the GORE-TEX® shoe.

New standards are also being set by the **Gore Climate Guide** which is a special programme which can calculate the climatic comfort of GORE-TEX® footwear. Using this programme it is possible to put together different combinations of materials, components, technologies and shaft constructions for a particular area of application and determine their influence on the climatic comfort of the whole shoe. This computer programme thus makes it possible to predict precisely which shoe with which types and qualities of material will achieve which climatic comfort values under which conditions. If, for example, we take individual parameters such as the lining material, the toe cap, the foam or the adhesive, etc., the programme can calculate the moisture vapour permeability for the entire shoe based on the breathability values that are stored in the system for the particular shoe component. This makes the **Gore Climate Guide** a key instrument for evaluating shoes before they go into series production.

Abrasion Resistance

Abrasion testing is carried out by the **Martindale Abrasion Tester** in accordance with DIN 53 863. Gore tests its lining laminates and recommended upper fabrics for abrasion resistance in accordance with the standard number of revolutions specified by the performance guidelines of SATRA, an independent high-tech shoe technology institute in England. For heavy use this institute stipulates more than 50,000 revolutions. Gore shoe laminates have to resist at least 100,000 revolutions. This guarantees that all of these textiles satisfy the most rigorous of demands in the field.

Every year some 18,000 GORE-TEX® shoes are tested at various stages of their development and manufacturing processes. As a shoe can only function as well as its weakest component, in addition, more than 14,000 footwear components are tested a year - from the leather to the sewing thread. Field tests with different groups of users round off these test procedures. In this way Gore ensures that its shoes are precisely engineered to the needs of the respective job and that they live up to Gore's claim to manufacture shoes which are „fit-for-use”.