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## **GORE-TEX® Technical Garments for the Workplace**

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### **1. “Our products do what we say they will do”**

Those who must decide today which weather- and work- protective clothing is most suitable for their company are not to be envied:

The market is often inscrutable. An increasing number of providers are promoting a huge range of textiles, and more and more material mixes are appearing on the market. Many promise superior weather protection and often other protective functions at increasingly lower prices. But often the quality levels and the durability are worlds apart.

How waterproof, for example, are the closures in a rain jacket? How long will the seams at the shoulders or hood resist a downpour? How many hours can people who are exposed to unsettling weather conditions in their daily work rely on their protective clothing?

With GORE-TEX® branded products Gore has, right from the start, pioneered waterproof, windproof and breathable high-performance textiles for protective clothing. For three decades, high-quality GORE-TEX® products have been valued in the most varied areas as best in class. Whether in competitive sports, on a building site or during a military operation, the extraordinary performance and durability of GORE-TEX® clothing is legendary, even under the most difficult conditions.

### **2. The “fit for Use” principle**

Whether or not weather-protective clothing can withstand the conditions in which it will be used depends, above all, on the precise laminate selection and its correct manufacturing into a garment designed to

meet the needs of the wearer. Waterproof, windproof and highly breathable materials alone cannot provide maximum functionality. Consideration has to be given to climatic conditions in the wearer's environment, as well as to the type and duration of the wearer's physical activities.

The special Gore product philosophy analyses the interdependency of all relevant protective clothing components, such as the material and the way in which it is crafted as well as the wearer's activity and environment. This is the only way for GORE-TEX® Technical Garments to fully satisfy the wearer's specific requirements and ensure that it is "Fit For Use". To fulfil this principle, Gore's development work concentrates on the following areas:

### **2.1 Building up a comprehensive knowledge base about the best materials, designs and technologies**

#### **2.2 Analysis of the end product (garment)**

#### **2.3 A highly detailed test and monitoring system that makes it possible to determine exactly what the performance potential is for each product and its specified requirements**

Gore products stand for innovation, integrity and being, quite simply, the best in class.

Physical activities Perspiration:

- physique heat balance;
- duration/type.

Clothing Environment:

- material properties - sun, wind, rain;
- cut, size - temperature;
- humidity.

### **3. Measures across the entire value chain**

To ensure that GORE-TEX® Technical Garments measure up to their promise Gore has established a comprehensive set of tools across the entire value chain. This is unique in the textiles and clothing industry. Gore produces high-performance GORE-TEX® fabrics, develops the corresponding processing technologies and accompanies GORE-TEX® Technical Garments at every stage of the value chain – from the raw materials to the manufacture of the end product and right through to its daily use in the work-place.

In this way, Gore takes care of important functions

of the end product on which the wearer and therefore the purchasing companies can rely in the workplace.

Part of this comprehensive product understanding are the binding standards for GORE-TEX® products, the "Gore Performance Standards (GPS)", as well as the licensing of Gore partners and the certification of GORE-TEX® garment manufacturers. Naturally, all of this is based on working in close partnership with everyone involved in production and further processing.

### **3.1 Knowledge of application areas and market requirements**

At the beginning of the development of a functional textile it is Gore's top priority to obtain in-depth understanding of the requirements of the end product. Apart from determining exactly what the wearer requires, this includes research and dialogue with purchasers, as well as a holistic analysis of the environment. Building on this foundation, Gore develops a product concept using best-in-class materials and technologies, and taking into account the specific market requirements, e.g. European standards for protective work clothing.

### **3.2 Supplier selection**

A key to GORE-TEX® Technical Garment's success is a long-term and positive cooperation with raw material suppliers. For this reason, Gore systematically carries out checks on suppliers in a multi-level selection process. In addition to the product portfolio and technical equipment, flexibility and service plus financial stability are included in the selection criteria. Each year Gore carries out detailed checks on all selected suppliers.

### **3.3 Laminate development and production**

Gore has a technical development laboratory unique to the textiles industry. The testing equipment is comparable to that of independent test institutes. Here new Gore laminates and suitable manufacturing technologies are developed and refined.

A GORE-TEX® laminate is a bonded textile consisting of the GORE-TEX® membrane, the core of every GORE-TEX® Technical Garment, and various upper and/or lining fabrics. Referred to as 2-layer laminate, 3-layer laminate or liner, laminates constitute the basis for functional clothing.

Standard tests are performed depending on the requirement/ application profile of the high-performan

ce textile to be developed. These include testing for:

- waterproofness;
- moisture vapour permeability (breathability);
- windproofness/air permeability;
- tear resistance, abrasion resistance, crease resistance;
- water- and oil-repellent properties;
- colour fastness, flammability and care behaviour.

If no standardised tests exist for the defined requirements the laminate has to fulfil, Gore develops the necessary test methods or, if needed, the required test equipment in order to

ensure the outstanding performance of GORE-TEX® laminates. Gore produces laminates in the USA, Scotland, Germany, Japan and China. In these production facilities, high-performance GORE-TEX® fabrics for clothing are manufactured, as well as laminates for shoes and gloves and windproof and breathable WINDSTOPPER® clothing.

Gore is the only global supplier of high-quality, high-performance protective fabrics that develops and manufactures membranes and laminates as well as the associated processing technologies themselves.

### 3.4 GORE-TEX® membranes

At the heart of every GORE-TEX® Technical Garment is an application specific, wafer-thin (0.02 to 0.05 mm) and very light microporous GORE-TEX® membrane based on ePTFE (expanded polytetrafluoroethylene). It is:

- absolutely waterproof, as a water droplet is 20,000 times larger than the diameter of a single pore in the membrane;
- windproof, as the grid-like structure of the membrane blocks out wind;
- highly breathable, as the diameter of a membrane pore is about 700 times bigger than a single water molecule (= moisture vapour or sweat);
- permanently crease resistant under mechanical stress;
- thermally durable between minus 250 °C and plus 280 °C;
- resistant to chemicals with pH values between 0 and 14.

### 3.5 Seam sealing – GORE-Seam® Tape sealing

Even the best laminate alone does not constitute a waterproof garment if critical points, such as fabric joins or seams, are not given special attention.

For this, Gore has engineered more than 40 differ-

ent seam sealing tapes, known as GORE-SEAM® Tapes, and a special seam sealing process. This enables certified partners to seal the seams on GORE-TEX® Technical Garments effectively, leaving them durably waterproof. This is made possible by the GORE-SEAM® Tape Sealing Machine which is especially designed for Gore purposes.

This innovative GORE-SEAM® Tape Sealing Technology is made available to the clothing manufacturers at their production sites. Gore specialists support the manufacturers throughout the entire manufacturing process and help ensure the correct use of the technology on site.

### 3.6 Garment Design & Engineering

In addition to seam sealing, Gore is careful to ensure that the clothing construction is also durably waterproof. That is why Gore constantly develops new accessories that are functional, but nevertheless allow protective clothing in the workplace to look fashionable. Special collar solutions, waterproof pocket interiors, ready-made front closures, patented draw cord tunnels and specific wicking barriers have been designed for this purpose.

These are available to certified manufacturers of GORE-TEX® Technical Garments as pre-manufactured accessories.

If required, Gore also works together with end users to develop solutions such as easy access to equipment (e.g. gun openings). In addition, Gore experts advise on the improvement of existing styles as well as on the development of new garments or clothing concepts.

Furthermore, an ergonomic style ensures the wearing comfort that sets GORE-TEX® Technical Garments apart throughout their entire life. After all, the most functional clothing is only useful if it is comfortable and designed to be worn regularly.

### 3.7 Gore performance standards

Gore Performance Standards (GPS) define the performance of GORE-TEX® products. They distinguish between GORE-TEX® clothing (such as jackets, trousers and overalls), gloves and shoes.

Gore Performance Standards for protective clothing in the workplace (GPST) are uniformly defined throughout Europe and are an important element for implementing the "Fit For Use" principle. The selection of a specific standard depends on the circumstances under which each garment will be used. There are currently twelve different standards. Four of them relate

exclusively to the primary task of weather protection. They are classified into “light use”, “medium use”, “rugged use” and “enhanced performance”.

The most important factors for classification into one of the four standards are:

- the wearer’s activity;
- the weather conditions to which the wearer is potentially exposed ( > influences the clothing construction and defines the type of Gore Rain Test).
- the period of activity under the given weather conditions ( > defines the requirements for waterproofness);
- the intensity of work ( > defines the requirements for breathability).
- special requirements for the clothing design (e.g. gun openings).

In addition to this, there are eight further standards tailored to the requirements for protection in special areas of use, such as protective fire-fighting garments, permanently flame retardant suits for police forces, electrostatically dissipative and flame-retardant high-performance clothing as well as immersion suits or sleep systems for soldiers.

Each respective Gore Performance Standard for protective clothing in the workplace (GPST) specifies which laminate construction (2-layer, 3-layer or liner) is possible for the end application and defines the criteria for selecting the inner lining and/or outer material. This affects the degree of breathability (resistance to moisture vapour transmission = Ret) and the extent to which the outer material repels dirt and water (= spray rate).

There are test methods for all these performance standards to ensure that GORE-TEX® Technical Garments always fulfil the required functions in the end application. If the garment presented for testing satisfies all the GPST requirements, it is given a prototype certificate. This confirms to the partners in the value chain that this prototype is released for mass production. At the same time, this released prototype serves the manufacturer as a master sample to ensure quality during production.

### 3.8 Gore Rain Tower Test

Within the Gore Performance Standards for protective clothing in the workplace (GPST) the test in the Gore rain tower is the most important test method for checking if GORE-TEX® Technical Garments are waterproof under even the most difficult practical conditions.

More than 20 years ago, Gore installed their rain

tower, the first high-performance textile manufacturer in the world to do so. This enabled the first controlled and reproducible rain test for the waterproofness of finished garments.

In order to simulate rainfall as closely as possible, GORE-TEX® Technical Garments are pre-washed, put onto a test manikin, and then exposed to artificial rain. Moisture sensors at critical points beneath the clothing such as at the shoulders, chest, wrist, stomach, back and front closure, measure in-coming moisture, and indicate any area in the clothing’s construction that is not waterproof. A special software records the test’s progress.

Depending on the defined GPST for GORE-TEX® Technical Garments different rain conditions are used. By varying the time, amount of water and the droplet size it is possible to simulate different types of rain ranging from a dense drizzle to a heavy cloudburst. Additional side nozzles simulate windblown rain or storm conditions. Gore rain tower test:

- amount of water: 450 l/m<sup>2</sup> h ;
- test duration 60 minutes;
- spraying from the top and additionally from side nozzles;
- rotating test manikin.

### 3.9 Gore climate chamber

The wearing comfort of clothing made with high-performance Gore textiles is as important for the Gore philosophy as its respective protective functions. Following the “Fit For Use” principle, Gore has made it their task to research the physiological interaction between person and clothing on a scientific basis, subjecting it to practical tests.

For this reason, Gore carries out physiological clothing tests on a wide variety of clothing systems in the company’s own climate chambers, and scientifically evaluates the clothing’s effects on the human body and physical well-being. Inside the Gore climate chambers the most varied climatic conditions are easily created.

The temperature range extends from -20 °C to +45 °C, the humidity is adjustable from 20% to 95%, and varying wind strengths can be simulated. Electrodes attached to the body collect data relating to the core body temperature, heart rate and sweat rate.

Changes in the weight of the clothing and test subject are also measured. The test subject also completes a questionnaire evaluating their perceived subjective experience of heat and moisture. The results of these series of tests provide valuable information for material selection and the construction of the tested clothing.

### 3.10 Field tests

To Gore, field tests are an additional indispensable measure for testing the performance of GORE-TEX® Technical Garments under practical conditions, whether the test is on commercialised products or prototypes.

The length and depth of the evaluation for this type of practical test vary. Even after field tests Gore maintains regular contact to the wearers and the purchasing companies. This gives Gore the opportunity to obtain valuable suggestions concerning further product developments.

### 3.11 Certification of manufacturers

Anyone who manufactures clothing with GORE-TEX® Technical Garments has to be certified by Gore. The clothing manufacturers oblige themselves to only use GORE-TEX® laminates for clothing systems whose design and construction fulfill the prescribed

Gore Performance Standards (GPST) based on the Gore approved prototype. If required, specialised Gore associates assist with process optimization, advising on how to achieve the precisely defined Manufacturing Standards more easily. Only when the manufacturer masters all the processes, following the successful implementation of the Factory Support's recommendations, the manufacturer or production site will receive the certification as a certified manufacturer of GORE-TEX® Technical Garments. This certification has to be confirmed annually.

### 3.12 Gore factory support

Certified manufacturers of GORE-TEX® Technical Garments can rely on the Gore Factory Support Team during production to ensure that the agreed Gore Performance Standards (GPST) and Manufacturing Standards (MS) are continuously achieved.

In addition to carrying out the certification process and annual auditing, Gore specialists are also responsible for advising the management and for training production staff on-site. They pass on specialist knowledge for the correct handling and processing

of GORE-TEX® laminates and GORE-SEAM® Tapes. The Factory Support team also assists partners in optimising their processes – whether in warehouse organisation, production flow or in equipping cutting and stitching departments.

But above all, it is the continual on-site tests that ensure adherence to Gore standards. Product samples are regularly taken from the ongoing production line for comparison with the approved prototype. Gore specialists' tasks extend from the continuous monitoring of the manufacturer's quality assurance system through to setting the correct parameters for the GORE-SEAM® Tape Sealing Machines.

### 3.13 Brand licensing

One essential pillar of the Gore product philosophy is licensing. It contributes decisively to the fact that the GORE-TEX® brand has enjoyed its high reputation for so many years – because only garment manufacturers and distributors selected according to clearly defined criteria are licensed for GORE-TEX® products.

A company is only entitled to sell articles containing GORE-TEX® products if it has a license contract. The granting of a trademark license is linked to a series of conditions determined in the contract, for example for precisely defined areas of application such as fire and safety or police work.

The requirements for licensing include regular training of the relevant sales and service personnel. In addition, the licensee may only use the GORE-TEX® brand in connection with products that satisfy the required Gore Performance Standards in terms of style and construction, and that have been approved by Gore before the start of production.

High-performance Gore materials and technologies have proven their worth in clothing for fire fighters, rescue services, the military, police, security services, construction workers and service providers, traffic and logistics as well as the forestry, energy and waste disposal industries.

Gore brands used in the world of work are WINDSTOPPER®, CROSSTECH®, GORE™ CHEMPAK® and GORE™ Medical Fabrics.