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How softshells breathe and protect

Our cut-out-and-keep series to assist retailers with product knowledge

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Humans produce more moisture when they are more active. A trail runner would, for example, produce double the volume of sweat than someone taking a leisurely stroll.

As outdoor activities like trail running, mountain biking, adventure racing, etc. became more popular, a growing demand developed for a lightweight, non-bulky outdoor garment that is water-resistant as well as breathable. Softshells became the optimum garment.

Softshells are lightweight enough to allow you freedom of movement during any activity – whether running, rowing, cycling, climbing or hiking briskly – yet provide protection against wind and rain.

Softshells combine qualities offered by fleece and water repellent garments to keep the wearer warm and dry in damp and cold conditions, and offer the breathability necessary to maintain a natural body temperature while active.

Creating a softshell is, however, not as easy as combining a string vest, which is highly breathable, with a black refuse bag, which is highly waterproof.

While the black bag may protect you from moisture/rain, it will cause you to perspire and get as wet on the inside as on the outside, because it is not breathable. The breathability of the vest will offer no benefit if the moisture cannot escape through the outer layer.

Softshell describes a woven material used to manufacture a garment that offers breathability, water- and wind resistance.

Softshell manufacturers also use coatings, membrane laminates, fabric treatments, etc. in order to create a garment that offers breathability as well as waterproofness.

How does a softshell work

In order to keep the wearer dry and comfortable, softshells are made from fabrics with a special weave, coating or membrane that have pores that are too small for water to penetrate from the outside, but are large enough for water vapour – from sweat – to escape from inside.

- The level of breathability, waterproofness or windproofness it will offer depends on combinations used in the manufacturing process and the wearer must determine their needs based on the activity they will be used for.
- The same can be said of the design of the softshell; the wearer will decide the optimum design for themselves based on the activity as the use of a membrane instead of a coating and vice versa may be more beneficial to the activity they are performing.

Woven Fabrics

Softshells made of densely woven fabrics use long staple cottons with small spaced fibres.

- The fibres are processed into combed thread that is woven with an Oxford weave, where two threads form a warped shape.
- When the fabric's surface comes into contact with liquid, the cotton fibres swell and reduce the pore size of the fabric, effectively blocking liquid from entering the garment.
- Densely woven fabrics can also be made from synthetic microfilament yarns, like polyamide or polyester, that have a diameter of less than 10mm, which allow fabrics to have tiny pores. Softshells made with these fabrics are windproof, but not waterproof, as pores do not minimise when they come into contact with water. Their water penetration resistance can be improved by the use of a silicone or fluorocarbon finish.
- Tightly woven fabrics have a very dense construction that creates pores, which are approximately six times smaller than conventional non-waterproof or windproof fabrics'.

DWR

Softshells' face fabric can be treated with a Durable Water Repellent (DWR), which prevents water droplets from soaking into the garment, by causing it to bead and roll off. A DWR is usually applied towards the end of the fabric production process.

- The DWR can repel moisture from light rain and keep the wearer dry, but it will not withstand a heavy downpour.
- The DWR's performance can be reduced by grime build up, cuts, or if cleaned with unsuitable detergents. Therefore garments should be treated with technical cleaning products specifically made for this purpose.

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- If a garment does not have the DWR application, its outer surface will become soaked and cause the wearer to feel cold, or make the garment feel as if it is leaking.
- To ensure the DWR remains in working condition, it needs regular cleaning and care, such as using spray-on or wash-in products. It can also be reapplied to the garment.

Membranes

The use of a membrane can improve a softshell's breathability.

- Membranes can be microporous or hydrophilic — moisture-attracting — and moves vapour from inside, to outside, the softshell, while preventing liquid from entering the garment.
- Membranes are thin films of polymeric material, such as expanded polytetrafluoroethylene (PTFE) polymer or Polyurethane (PU) that are approximately 10mm thick. These membranes are fragile and therefore have to be laminated to face fabric.
- Expanded polytetrafluoroethylene (PTFE) polymer membranes are microporous and have microscopic holes (estimated at 1.4-bn per m^2) that are too small for liquid water to penetrate, but large enough for water vapour molecules (in the form of sweat) to pass through.
  - o Due to its porous nature, a PTFE membrane, can become soiled by dirt, oil, salt, etc.
  - o If a membrane is soiled it may be penetrated by water or if the force of liquid is great, it may be penetrated. Therefore, although softshells can be worn in light rain, these membranes will not withstand a downpour.
  - o The use of microporous membranes are not recommended for activities where the wearer will come into contact with salt sprayed air — as with sea-related activities — because salt can penetrate its pores. Salt crystals' sharp-edged construction could cause grazing and enlarge pores, hindering them over time and may cause them to allow water to enter the garment.
- Membranes may also be hydrophilic and are made from polyester or polyurethane, which have no pores.
  - o Moisture vapour is moved from inside to outside the softshell (by diffusion) where the temperature is lower.
  - o If conditions are hot and humid and this temperature gradient does not exist, a softshell's breathability may be compromised.
  - o The hydrophilic membranes' no-pore nature means it can resist water and wind penetration.

  The bonding of the fabric to the membrane is a crucial part of ensuring that the garment maintains its breathability, as well as windproofing and waterproofing capabilities. Membranes are bonded to the softshell's fabric by means of lamination.
- Membranes are kept in place by dots of glue to avoid negatively affecting the garment's breathability. Glue is not a breathable substance and therefore it is used strategically to keep the membrane attached. Approximately 15-20% of the membrane is covered by glue, as less or more glue may compromise the garment's overall breathability.
- When membranes are laminated to the softshells' outer fabric, it offers good wind resistance and waterproofing properties.
- When using a liner, the holes created by stitching the garment, have to be seam-sealed in order to prevent leaks within the softshell.

Coatings

A coating can also be microporous or hydrophilic liquid solutions, such as polyurethane that are thinly sprayed onto the face of the fabric with micro-jets.

- Microporous coatings have a channel structure that is smaller than water droplets, but large enough for water vapour to enter.
- It can also be monolithic and have a solid nonporous surface that attracts vapour from the skin and transfers it through the fabric's outer surface, where it can evaporate.
- Its solid nature also prevents wind penetration or dirt clogging.

  Coating applications requires skill as it cannot be thicker than 30 microns. If it is any thicker, it may impede the shoftshell's ability to allow water vapour to escape — or if it is too thin, it may cause the garment to leak.

Water- and wind protection

Softshells are designed to be water resistant, rather than waterproof, as they keep water out to a certain degree, or pressure point. Softshells are, however, designed to withstand light water pressure, while still maintaining a level of breathability.

Softshells are also designed to protect the wearer from windy and chilly conditions and the weaves, coatings and membranes used to waterproof them, also improve their windproofness.

- An air-trapping weave is often used to reduce air flow into the garment, which causes heat to remain inside the garment for longer. It has a tight, compact weave structure that has no pores and does not allow air to penetrate.
- Some outer materials may be made from polyamide or polyester microfilaments, which are windproof.
- The use of an ePTFE or PU hydrophilic membrane or coating helps improve the garments' waterproof capabilities, as well as improve its ability to block wind and insulate the wearer. These type of coatings and membranes have no pores and therefore cannot be penetrated by wind.

Smelly smart fabric offers branding opportunities

A NEW smart fabric, with a whisky smell that won't wash out, was developed for Johnnie Walker Black Label and Harris Tweed Hebrides by Heriot Watt University's School of Textiles and Design in Edinburgh and Galashiels. This type of development opens up many opportunities for the sport, outdoor and leisure industry, such as using scents that suit individual brands' personalities to create a direct link in consumers' minds with a smell and the brand, for example.

The Aqua Alba scent used smells of rich malt, golden vanilla, red fruit and dark chocolate tones that are layered into the fabric throughout the finishing process and therefore infuses the fabric permanently, as opposed to only being able to last up to one dry clean or wash. The fabric also has the colours of ingredients used to produce Johnnie Walker Black Label.

Developing products with this micro-encapsulated fragrance technology would allow manufacturers to create fabrics with fragrances that they feel represent their brands. Any brand could be more unique by adding a signature smell, which would cause people to associate a certain brand with a certain smell. This technology could also be used to their advantage by using fragrances that evoke certain associations, such as happy, energised, etc., which could increase favour toward products even more.

Brands have already successfully introduced smells into other areas to work with their branding, for example smells developed for certain brands' stores. Consumers start to associate a brand with a smell and when they smell that particular scent, they think of the brand.