

Breathability

What is breathability?

A breathable fabric is one that allows the warm moist air created by your body to pass through the material rather than build up as condensation on the inside of the garment.

There are varying degrees of breathability and whether condensation will occur can depend as much on the aerobic activity of the wearer as the conditions the garments are being used in. There is no such thing as a condensation-free fabric.

With moderate exertion our bodies give off about half a litre of moisture vapour in one hour. This is the body's natural cooling system. To prevent discomfort this moisture must evaporate and not be build up inside the clothing system.

The most breathable materials are micro-fibres, which do not have a waterproof coating on them. They are water and wind resistant because the fibres are so finely woven. They are not however truly waterproof. For that you need a waterproof coating or membrane to be added to the base fabric.

How is it measured?

Fabric manufacturers tend to use the test method that suits their particular fabric the best. Microporous fabrics for example, work best in low humidity and at high temperatures. To get the best results these will be tested using BS(DIN)31092 or the "Skin Model/Sweating Guarded hot plate" test method, more commonly known as the R.E.T test. This simulates waterproof fabric next to the skin and tests at 35 °C and 40% humidity; in my experience not normally the conditions in which we wear foul weather gear. I believe a more realistic test is **BS 7209** which tests the fabric at 20° C and 65% humidity, replicating the conditions in which products are used. The test method measures the evaporation of distilled water over a given period by very accurately weighing a control dish before and after. This is then represented as a percentage. (I believe everyone can relate to a percentage whereas if we talk about 6,000 g/m²/per 24 hours you are likely to say "so what?")

A fabric is considered breathable under BS 7209 if it is higher than 50%. In reality not many companies quote percentages so it is not always a help.

So what should you look out for when considering breathable garments. Firstly, is the whole garment made from breathable fabrics? I am aware of a drysuit on the market which is sold as breathable, in reality only the top half is made from breathable fabric and when tested that came out at 45%. Not a very breathable garment at all. The answer is that you have to trust the brand you are buying. As there are no recognised ways of testing and assessing garments as a whole we have developed our own grading system with the yellow dot chart. The more dots, the more breathability and durability, taking into account the end use and the price point of the garment.

Garment breathability

Whenever you see a sailing jacket or salopettes in a shop you will see reference to the garments breathability. Beware however, because this actually means the breathability of the fabric that the garment is made from as opposed the breathability of the garment itself. The design of the garment is crucial to the level of breathability it offers.

Breathability is reduced by linings and areas of double thickness of fabrics, such as pockets, flaps over zips and collars, reflective panels etc. So whilst we might start with a very breathable fabric we have already reduced its effectiveness by the time it has been made up into a garment. Breathability is then reduced further by what is being worn underneath. For example, wearing chest high trousers can result in another two layers of fabric that, in the middle of the garment, are doubled up. Under these there could be a mid-layer and thermal underwear. All this layering is technically correct to maintain body temperature and move moisture away from the body however, at the same time, it reduces the overall breathability of the system.

Don't be put off by a simply designed garment. Garments without linings will be more breathable than those with linings. The less pockets and flaps, the more breathable it could be, i.e. quite a different way of thinking

Waterproof



When we talk about the word 'waterproof', are we talking about the fabric or the garment? Quite often the manufacturer is talking about the fabric but you mean the garment. Making a waterproof fabric is relatively easy, but it doesn't end there. It must stay waterproof over the life of the garment and the garment needs to be as watertight as possible.

BS 3546 states that a fabric must resist water to a pressure of 100cm. This may be satisfactory for walking in wet conditions but not for the Southern Ocean. One of the big differences is that on a boat you actually sit in water and in the case of a Volvo 60 the crew are literally fire hosed. The words of the crew of illbruck, not mine.

We set a minimum resistance of 500cm or five times the minimum standard for BS 3546.

Having selected a fabric that is waterproof and will stay waterproof, we then have to make the garment as watertight as possible. It starts with the seams, which are literally punctured by the sewing needles. These are sealed with a tape that is applied using hot air to melt the adhesive onto it. The picture on the left shows how the garment is fed between two rollers with the hot air nozzle above it. The taping machine transformed the industry in the early eighties improving both waterproofness and reducing manufacturing time.

Durability

It is one thing to make a fabric that is waterproof and breathable when it comes off the roll but to make it last for the life of the garment is a different matter. We have a range of tests that artificially age and wear fabrics and these are covered earlier within this guide.

In the early days fabrics tended to have coatings on the outside of the fabric such as PVC. However these were easily abraded away on rough decks so today, the outer layer is always a nylon fabric with the coating on the inside. Different fabrics can be used in different parts of the garment. Light fabric is used where flexibility is wanted and heavier patches of high tenacity nylon are used for seats and knees, the high wear areas.

Durability can also be improved further by laminating a thin scrim fabric onto the inside. This reduces abrasion on the coating from clothing and is known as a three-layer fabric.

What should you particularly look for as far as durability is concerned? If you are particularly tough on garments then reinforced seats, knees and elbows will be important. Look at the type of fabric used. It should be heavier than the rest of the garment. Also generally a three layer fabric will last longer. Dinghy sailing tends to be particularly tough on garments but lightness and flexibility is important. Therefore linings and heavy fabrics are not an option. This can be overcome by using a more durable coating. This will not be easy to assess on the shelf and again comes down to trust and guidance from the experts.

Coatings

Waterproof fabrics always start with a base fabric or substrate. In the early days the fabric was impregnated or coated with a heavy non-porous material such as PVC or Neoprene. They tended to be heavy, inflexible and certainly not breathable. Today most fabrics are breathable and are made in one of two ways.

I. Microporous coated and laminated fabrics

This works on the principle that water molecules are larger than air molecules and as long as the size of the holes is less than 10 microns, moisture vapour can escape without letting in water. It can be in the form of a membrane, which is laminated to an outer fabric or a coated polyurethane fabric. Gill's Key West Offshore garments are an example of a microporous membrane.



The diagram on the left shows the coating film from the Key West range. There are tiny holes in the ceramic coating of between 5 and 10 microns, larger enough to let moisture escape but far too small to let in raindrops which are nearer 100 microns.

II. Hydrophilic coated and laminated fabrics

Hydrophilic-coated fabrics are made up of a mixture of hydrophilic and hydrophobic chemicals. Hydrophilic means water loving and hydrophobic means water fearing. By mixing the coating so the hydrophilic layer is on the inside, moisture vapour is absorbed through the coating structure and out the other side without letting water in. Hydrophilic fabrics have the advantage of working well in high humidity. Some fabrics can be a combination of the two and it is not a case that one is better than the other. It is more to do with how well it has been manufactured, how many coating layers there are and how durable it is.