



**ARMADILLO**  
MERINO



This fact sheet  
covers the softness  
and handle  
properties of  
ZQ Merino

*made from*

**ZQ**<sup>TM</sup>  
**MERINO FIBRE**  
zqmerino.com



# SOFTNESS

# INTRODUCTION

Softness in apparel can be described as a pleasing or agreeable sensation, bringing feelings of ease and comfort, smooth or fine, as opposed to rough, rugged or harsh. Softness is a critical determinant of wearer comfort, particularly when the apparel is worn next to the skin.

Comfort is defined as a state of satisfaction indicating physiological, psychological and physical balance among the person, their clothing and their environment (Branson and Sweeney, 1991). The feeling of comfort with respect to clothing relies on a number of factors such as thermal comfort, moisture management and next to skin softness.

Specific next to skin softness is referred to prickle or itchiness. Prickle in a garment is most often caused by coarse, unyielding fibres pressing into the pain receptors of the skin.

## WHY SOFTNESS IS IMPORTANT

The skin is the largest organ of the human body and when a person is wearing clothing there will always be a significant percentage of their skin that is in constant contact with the fabric. The fabric to skin relationship is significant in terms of wearer comfort, and comfort is significantly affected by the relative softness of the fabric.

The unpleasant scratchiness, commonly known as 'prickle', or 'itchiness', that is often attributed to wool clothing is widely misunderstood. Common misconceptions relate prickle or discomfort to a wool allergy or the scales of the wool fibre. Both of these explanations are incorrect.

An allergy to wool is very rare and studies have shown a lack of any correlation between a subject's fabric prickle response and their response to wool allergen extracts via a standard scratch test. In other words, people who showed an allergic response to wool found the prickliness of a particular fabric sample no worse than those who did not show an allergic response.

The scales of the wool fibre are also unlikely to cause prickle as they are far too small, protruding less than one 1000th of a millimeter from the surface of the fibre. The degradation of the wool fibre scales, routinely carried out as part of the process to make wool machine washable, also has no impact on the relative 'prickliness' of the garment.

Fabric prickle, scratchiness or itch is directly related to fibre diameter, as it is the thickness of the fibre that dictates how easily it will bend when pressed into the skin.

It is worth noting that variability between humans also plays a role. Some people are less sensitive to prickle than others, because they either have pain receptors (Figure 1) that trigger only at higher forces or they are protected by a thicker layer of skin..

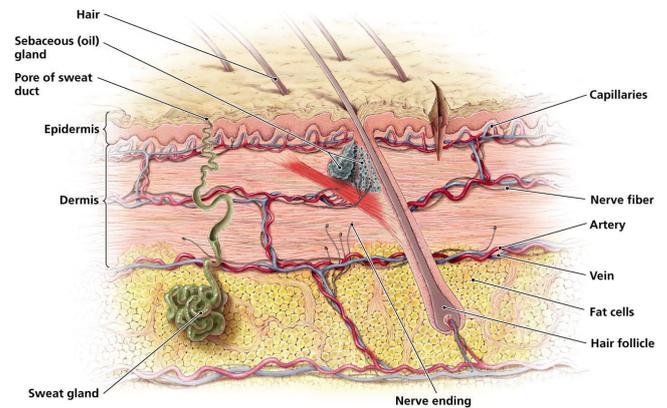


Figure 1. Skin layer diagram

## PREVIOUS OPTIONS

(LIMITATIONS OF OTHER FIBRES)

Historically, apparel was manufactured using coarse fibre types greater than 24 micron. This was particularly the case for wool apparel and as such this fibre has struggled with the age old perception of being itchy and scratchy and not the fibre of choice to wear next to skin.

The misconceptions surrounding wool apparel are now being challenged with the availability of fine merino next-to-skin base layer garments. These garments can be worn with a high degree of comfort and no unpleasant prickle sensation.

## MERINO FIBRE SOLUTION

Merino fibres are so fine that when pressed against the skin they simply bend, meaning there is no sensation of prickle, only softness.

The cause of prickle in wool fabrics (and in fabrics made from any fibre) is the presence of relatively coarse fibres that are stiff enough to poke into the surface of the skin (like pinpricks). Finer fibres tend to buckle under pressure and do not press into the skin. The skin's pain receptors respond only if sufficient force is applied to them, and for thick fibres this force is reached before the fibre bends over and buckles. For thinner fibres, the pain receptor threshold is not reached before the fibre collapses (Naylor, Veitch and Mayfield, 1997, Garnsworthy, Gully, Kenins, Mayfield and Westerman, 1998).

The merino fibres typically used in next-to-skin apparel are around 17 to 23 micron in diameter, where one micron equals one millionth of a meter. For comparison, human hair is typically around 50 micrometers in diameter.



Figure 2. Bending modulus of Merino versus non-Merino

Wool fibres come in various degrees of fineness, and even the fleece from a single sheep will have fibres across a range (Figure 3). This means that only the fibre from sheep that produce fine wools (breeds such as merino) are suitable for wearing next to the skin. Unfortunately, it takes only a few coarse fibres (5% greater than 30 micron) amongst fine fibres to create a prickly sensation on the skin. This means that appropriate quality control and the selection of fibre going into the processing chain is of critical importance. ZQ Merino fibre is custom selected according to the end product, helping to produce soft, non-prickly, next-to-skin merino garments.

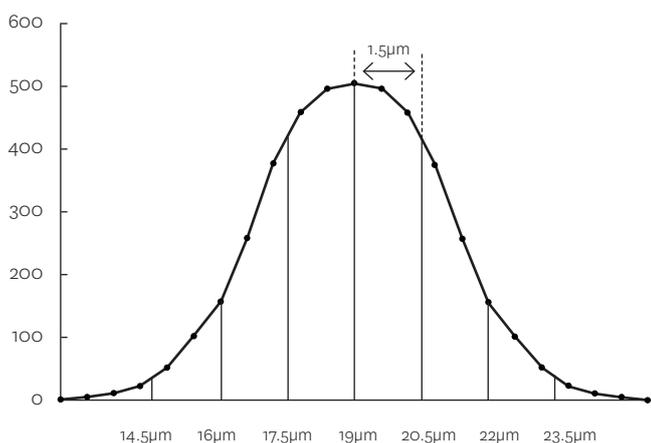


Figure 3. Wool fibre distribution curve

Another important factor influencing how 'prickly' a fabric feels (other than fibre diameter) is fabric construction. Knitted fabric, which is the primary construction method used in next-to-skin merino apparel, has been shown to have a much higher comfort factor associated with it than woven fabric constructed from fibres of the same diameter (Figure 4).

The ability of a textile to manage moisture is also an important factor in enhancing wearer comfort. Textiles that are effective at moisture management actively move excess moisture away from the body and transfer it to the external environment. This process of managing the environment between the skin and inner fabric surface enables heat and moisture to be buffered to acceptable levels, providing a micro-climate for the body. If moisture is not managed effectively, a number of factors come into play and affect wearer comfort and performance (Laing et al, 2007). Merino fibre has the ability to actively absorb moisture from the atmosphere and/or body, and its absorption properties are much greater than most synthetic fibres.

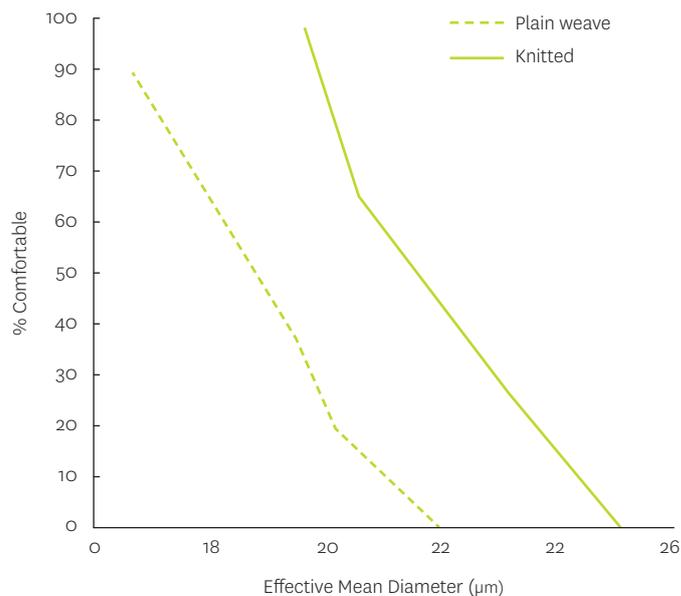


Figure 4. Comfort factor of knitted versus woven Merino fabric as a function of fibre diameter (Naylor and Phillips 1995).

Several factors external to the fabric also influence the sensation of 'prickle'. These factors include the thickness of an individual's skin (which varies with age and location on the body) and environmental conditions (with high humidities and temperatures softening the skin and increasing its sensitivity). Merino fibre has a unique ability to buffer temperature and humidity in the space between the garment and wearer, providing a form of natural air-conditioning.

# SUMMARY

- Fabric induced prickle is caused by the mechanical stimulation of superficial skin pain receptors by fibre ends on the fabric.
- Prickle is not wool-specific and can be caused by coarse synthetic fibres
- Merino fibres typically used in next-to-skin apparel are around 17 to 23 micrometers in diameter and do not stimulate the skin nerve receptors in the same way as coarser fibres.
- Merino fibres are so fine that when pressed against the skin they simply bend, meaning there is no sensation of prickle, only softness.
- Knitted fabric, which is the primary construction method used in next-to-skin merino apparel, has been shown to have a much higher comfort factor associated with it than woven fabric constructed from fibres of the same diameter.

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