

Preparing (Gilling)

Gilling, prior to combing (preparing) is a very important step in the process chain. There are a number of purposes for preparation

1. Blending of fibres through the doubling process
2. Aligning the fibres through the gill head
3. Ensuring an even weight per unit length of sliver to facilitate comb setting
4. Contentiously, to ensure the hooks produced in carding are aligned the correct way to minimise breakage in the comb. The hooks need to be in the trailing position.

There are several types of gill box, and many variations within types, depending on where in the system drafting occurs.

(see: <http://www.finlane.com>, or <http://www.nsc.fr/us/accueil/index.asp>)

1 Gilling Principles

However, very simply, a gill box has two sets of rollers and the slivers are dragged from one to another through a bed of moving pinned combs. The feed rollers pick up the slivers and the delivery rollers, that rotate far faster, draw out the combined slivers into a lighter weight single sliver.

The comb pins are pushed into the sliver and move forward at an even speed with the fibres which controls the acceleration of the fibres between the sets of rollers. When the pins are first thrust into the sliver the feed rollers are still gripping the fibres. The pins are drawn through the fibres and comb them.

At the other end, the delivery rollers pull the fibres faster than the pins are moving so the sliver is drawn through the pins, giving another combing effect. A single sliver comes out of the gill box and is coiled into a can. A variant on the delivery may have two slivers being delivered into a single can. Additionally extra drafting may be achieved by installing a roller drafting system before the gill head. This is often used when the wool has been backwashed or superwashed as it minimises breakage of fibre in the gill head. The speed differential between the first and second rollers is the draft. Maximum input roller speeds on modern gill boxes is 90m/min whilst output speeds can be as high as 450 m/min.

It is normal for a wide range of wool types to have 3 gill passages between the cards and the combs. Although there is a great deal of science in the measurement of 'hooks' and their effect on top length and romaine, some processors do not consider it important. A hook or bend in the fibre is formed by the action of the metallic card wire on the fibre. The friction of the fibre being drawn past the wire creates a bend (hook) at an end of the fibre. If this fibre is presented to the comb with its hook in the advanced position the fibre is likely to break. If the fibre is presented in the trailing position it is likely to be straightened. The difference could be 3mm in length and 0.5% romaine.

The number of gill passages has an impact on the presentation of hooks to the comb. An uneven number presents the majority of hooks in the trailing position whilst an even number would have the opposite effect. In coarse wools $> 26\mu$ it maybe immaterial for length and romaine considerations so often a gilling passage is left out. For fine long tops however the amount of gilling and the total draft through the gilling process has a significant impact on the combing results. The total draft through the preparing area is calculated by multiplying successive drafts. Thus a draft in the first position of 5:1 followed by a draft of 6:1 followed by a draft of 8:1 in the third passage would give a total draft of 240:1. Experimentation has shown that for fine long tops the higher the draft the better the length and the lower the romaine. For very fine wool, a fourth draft has been shown to be beneficial. It is felt that the additional benefits from the parallelisation of fibres overcome the disadvantages of leading hooks after the fourth drafting. Most mills however would not find the fourth draft acceptable in terms of machinery and operator costs.

The gauge on a gill box measures the distance between the drawing off rollers and the faller bed at its closest approach. Between the pins and the drawing off roller there is a space where the fibres are no longer constrained and can move relative to the direction of the acceleration. Normally this does not present a problem as the fibres are long enough either to be influenced by the faller bed or controlled by the drawing off roller. With long fibres the fibre to fibre friction will keep the shorter fibres basically aligned. However when producing short blends i.e. open top $< 50\text{mm}$ this distance becomes critical. The bulk of the fibres at some point will not be controlled by anything but the fibre to fibre friction and this can lead to large problems. Over drafting of short fibre blends can result in very uneven slivers.

The gilling stage also allows extra processing oil and moisture to be added prior to combing. This is normally applied as an emulsion sprayed between layers of slivers at the first and/or second gill passage. On high speed gilling machines regain can be increased by approximately 2% on each application. Because of the speed of modern processing machines, regain loss can be as high as 2% on each passage, so moisture needs to be added when possible particularly in dry climate areas.

2 Additional Processes requiring Gilling

2.1 Backwashing

Wool scouring removes most of the contaminants contained in greasy wool but there is always a residual level of wool wax, suint and dirt. Contaminants may also be redeposited on sliver during processing through a combing mill. This is caused by build up on machines from previous batches.

A spinner may require an exceptionally clean sliver so the sliver may be backwashed. This can be carried out either after preparing or after the final finishing gill.

There are purpose built machines that feed the sliver through a weak detergent water solution then through a drier or a Superwash line can be employed to do the job using only water and detergent.

Backwashing adds large processing costs to a batch so is only carried out when absolutely necessary.

2.2 Superwashing

Scales on wool fibres entangle and cause products to felt when machine washed so a treatment was developed to prevent this happening.

Finished wool sliver is treated with chlorine and then coated with a resin. The chlorine removes a small portion of the offending wool scales and the resin coating forms a smooth fibre that will no longer felt.

This is a permanent process that will last the life of a product. See www.tft.csiro.au for more information.