

Worsted Carding

After scouring, despite advances in design and operating procedures, the wool is presented to the carding machine in an entangled state.

The purpose of the card is twofold:

1. To individualise the fibres by breaking up the flocks of wool,
2. To remove the majority of the vegetable matter in the wool mass.

As in all of the operations involving wool, there are compromises to make in the carding process.

- Burr removal efficiency comes with an increased fibre loss and the more working points on the card the greater the chance of breaking fibres.
- The more water added to the wool mat the better the static control but the worse the burr removal efficiency and the greater the chance of producing neps.
- The faster the main cylinder of the card is run the greater the output but the more chance of increased fly production.
- The choice of wire for the card cylinder surfaces is a trade off between machine efficiency (time taken to clean the card) and fibre damage.

Thus; the specific design of the card, the production capacities and the types of wires used on the cards will depend upon the type of wool being processed and the specific configuration of the subsequent machines in the mill.

Configurations of carding machines may be found at the following sites:

http://www.nsc.fr/us/nscfibretoyarn/fiche_gabarit4.asp

<http://www.fincarde.com/for/index.html>

1 Feeding

The majority of the fibre damage occurs in the carding machine as the entangled fibres are opened by the wire elements on the card. However, it is important to have as even a feed as possible to the licker-in of the card; therefore some pre-opening of the fibre is advisable prior to carding. This opening maybe in the form of stepped openers or double/triple drum opening but should be as gentle as possible. Excessive felting in the scour and excessive opening after scouring will lead to fibre damage, decreased Hauteur and increased noilage.

2 Lubrication and Water Addition

A lubricant needs to be added prior to the carding of the wool. The purpose of the lubricant is to reduce the fibre to metal and fibre to fibre friction forces within the card and prevent excessive fibre breakage. Wool grease is not a good lubricant and scouring needs to reduce the level of wool grease below 0.5% DCM WIRA rapid test for best results. Additional oil, purpose designed for the job, needs to be added at an optimum level of between 0.5% and 1% o.w.w. Less than this will cause fibre damage but conversely so will too much lubricant. Levels over 1.2% o.w.w. have been shown to decrease length and increase noil. A secondary purpose of the oil is to provide some anti static control on the card to stop the web catching on the outlet of the card. However most commercial lubricants trade off lubricity for anti static properties so each mill must determine the correct formulation for their circumstances. Incorrect oil choice and quantity applied can result in losses of up to 8mm in Hauteur length and a 4% increase in romaine.

Oil can be added neat to the fibre prior to carding or sprayed on as an emulsion. The important issue is getting the oil onto the carding wire, not covering the fibre in oil. Both application methods have been shown to be effective and choice will depend upon systems within the factory.

Regain is an important consideration for the correct preparation of the fibre. The amount of water in the wool impacts on the formation of neps in the card. The amount of water in the vegetable matter impacts on the ability of the card to remove it. Clover burr that is too wet will not be cleanly removed from the fibre but will unravel causing it to become very difficult to remove in subsequent processing. Wool that is too dry creates static problems and is difficult to run efficiently. Correct regain will depend upon the amount and type of VM in the wool. For FNF wools regains up to 16% are acceptable, whereas wool with 4% or more of clover burr should not be processed over 12%.

Some combing oil manufacturers:

www.cognis.com/cognis.html

www.huntsman.com

www.corporate.basf.com

3 Wire

The majority of cards today use a metallic rather than a flexible wire. The trade off is between length and NEP vs. ease of maintenance and life of wire. Wire choice will depend upon wool types and quality levels required and should be discussed with the card manufacturer and wire supplier. High efficiency doffer wires are now available which improve the doffer stripping efficiency. This reduces the recycled fibre on the swift or main cylinder and reduces fibre breakage.

4 Settings

Settings within a carding machine are varied and complex and have a lesser or greater impact on the result depending upon the nature of the setting. Burr beaters should be run at maximum speeds and be set close to the morels. The closer to the morel the better the VM removal efficiency, however the greater the fibre loss carried with the burr. Vegetable matter type will also play a role in the settings. Burr rollers need to be sharp for best effect and should be rotated on a regular basis to keep the edges worn at an even rate. Worker / stripper pairs should be set closer to the cylinder as the clumps are progressively opened. Fresh fibre density (calculated by dividing the production rate of the card by the width of the card times the m/min of the main cylinder) is an important setting for a card. Fine wool should be set at an FFD of between 0.5 and 0.75gms/m with coarser types being set at 1.2-1.5 gms /m². Settings beyond these ranges will result in excessive fibre breakage and increased noilage. Swift to doffer speed ratios also plays an important role in fibre breakage. The faster the doffer is relative to the speed of the swift the better the transfer efficiency from one cylinder to the other. The higher the transfer efficiency the less recycled fibre on the main cylinder. These recycled fibres stand a chance of being broken at the stripper/worker interface. Thus the more recycled fibre the greater the chance the fibre will be broken on successive workings. SDSR ratios of around 13: 1 are considered appropriate for fine wool. Ratios above 17:1 will show significant decreases in fibre length. NB the advent of double doffer cards has allowed both SDSR and FFD settings to be increased due to the diminution of recycled fibre.

5 Double vs. Single Doffer

The biggest change in carding design in recent years has been the implementation of double doffers. The double doffer configuration reduces the amount of fibre recycled on the main cylinder thus allowing for increased loading with no detriment to the fibre length. This gives a significant increase in the productive capacity of the card. It also allows for better tuning of the SDSR and the FFD which means that there is much more flexibility in the result obtained by varying input wool.

Wool of lower NPK can be processed to significantly longer tops if we are willing to sacrifice productive capacity.