FACT SHEET

STAPLE LENGTH & STRENGTH

Service Summary

One of the most important characteristics for determining the value of greasy wool is the average fibre length that will be achieved when the wool has been processed or combed into wool top. This length is known as the Hauteur (fibre length in the Wool Top). Research has shown that Hauteur is closely correlated with the average Staple Length and Staple Strength of the greasy wool measured prior to processing.

Prior to the measurement of Staple Length & Strength three levels of sampling need occur:

- Grab sampling from the bales of wool in the lot
- Tuft sampling from the grab sample
- Staple preparation of the tufts

Once the above steps are complete, the staples of greasy wool are measured on an instrument called the Automatic Tester of Length and Strength (ATLAS). This instrument measures:

- The Mean Staple Length of the staples (mm)
- Coefficient of Variation of Staple Length (CV%)
- Mean Staple Strength (N/ktex)
- Distribution of Position of Break (POB%)

Background

While the availability of objective measurements for Yield and Fibre Diameter improved many aspects of the prediction of processing performance, it was acknowledged that it is also influenced by other parameters, of which Staple Length & Strength are considered to be the most important.

In the late 1970's research work at AWTA Ltd and CSIRO Division of Wool Technology led to the development of sampling procedures and instrumentation for the measurement of Staple Length & Strength. By 1985 commercial testing of Staple Length & Strength had commenced.

Demand for this new service grew rapidly as industry understanding of the role the new measurements for Staple Length & Strength play in predicting processing performance. Research projects involving AWTA Ltd, AWC and CSIRO Division of Wool Technology were conducted during the 1980's and early 1990's and involved an 8 year project involving 20 mills throughout the world. The project was known as Trials Evaluating Additional Measurement (TEAM) and led to the development of predictive formulae for Hauteur (fibre length in the Wool Top), Coefficient of Variation of Hauteur, and Romaine (percentage of Noil produced). These formulae have become benchmarks for individual mills to develop formulae which best suit their purchases and processing performance.

Commencing in 2001 AWTA Ltd funded the TEAM-3 trial. This was essentially a repeat of the earlier TEAM trial, but aimed at providing data to update the TEAM formulae to reflect improvements in combing performance that have occurred since the original formulae were derived.

Sampling and Testing Procedure

Sampling

Display samples, better known as grab samples, are placed onto a mechanical device known as a Mechanical Tuft Sampling machine (MTS). This piece of equipment automatically and randomly selects 63 tufts of wool rather than individual staples from the display sample.

From these tufts of wool an individual staple of wool is manually drawn at random from each tuft. These staples are placed into trays and are conditioned in a controlled atmosphere room for a period prior to measurement.

Testing

Length and Strength is measured using an instrument called the Automatic Tester of Length and Strength (ATLAS).

Length is measured by conveying the staple; tip first, through a vertical array of eight light beams and then electronically measuring the distance the conveyor moved while the light beams were interrupted by the staple. All staples are measured for Length regardless of the staple dimensions. Length is measured in millimetres. The IWTO standard requires that a minimum of 55 staples are measured for Length to produce a certified result.

After Length measurement, the staple is picked up by two rubber belts which feed it through to a jaw which grips the tip of the staple. A jaw then moves away until the base of the staple is clear of the rubber belts. The base jaw then grips the base of the staple. The tip jaw moves away and the staple is broken in two. The peak force required to break the staple is measured in Newtons (N) by a force transducer attached to the stationary (base) jaw.

On its own, this information is of little value since the staples that are measured vary in thickness. All things being equal, thick staples require a greater force to break than thin staples. Therefore, the force required to break a staple must be related to staple thickness before it can be used more meaningfully.

Staple thickness is determined from the weight of the staple and the Length of the staple. That is, the more grams of weight per millimetre of Length, the thicker the staple. Staple thickness is measured in kilotex (ktex). The total Newtons of force is divided by the number of kilotex to give a Strength value per unit of thickness (N/ktex). This figure is known as the greasy Staple Strength because it was derived from the greasy staple weight. This is then converted to a measure of clean Staple Strength using the Wool Base and VM Base information.

Only staples longer than 50mm are measured for Strength. This is due to the fact that 25mm of the staple is held in the tip and base jaws and cannot be broken, so only the middle 25mm is measured on a 50mm staple. Strength measurements on staples shorter than 50mm are of very little value. A minimum of 40 staples must be measured for Strength in order to produce a certified result.

The weights of the tip and base portions are measured and are used to determine the weight of the staple and the Position of Break (PoB). For example, if the tip is very light and the base is very heavy, then the PoB is close to the tip.

The PoB is reported as the percentage of staples which break in the tip, middle and base thirds of the staple. From the processors point of view, the worst case is to have the majority of staples breaking in the middle, as this reduces the fibre Length in the processed top (Hauteur). However, this is only of major importance to the processor if the Staple Strength of the sale lot is low.

Applying Staple Length and Strength Measurement in Processing

TEAM 3 formulae

$$\textbf{Hauteur} = 0.43xL + 0.35xS + 1.38xD - 0.15xM - 0.45xV - 0.59CVD - 0.32CVL + 21.8$$

Where:

- L = Staple Length (mm)
- S = Staple Strength (N/ktex)
- D = Fibre Diameter (microns)
- M = Middle Breaks (%)
- V = Vegetable Matter Base (%)
- CVD = Coefficient of Variation of Diameter (%)
- CVL = Coefficient of Variation of Length (%)

CONTACT US

For more information on this service contact **AWTA Raw Wool** on:

Melbourne Laboratory: +61 3 9371 2100 or lab.mel@awta.com.au
Fremantle Laboratory: +61 8 9418 5333 or lab.fre@awta.com.au