Wool testing and certification

Mr Ian Ashman

Australian Wool Testing Authority Ltd

(Written by Mr Tim Steere, AWTA)

Australian Wool Testing Authority (AWTA) Ltd

Wool testing and certification

Company structure

The Australian Wool Testing Authority (AWTA) was established in 1957 by the Commonwealth Government in response to requests from the Australian wool industry. It was created as a statutory authority reporting to the Minister for Primary Industry. The first meeting of the Authority was held on 12 December 1957.

Following the formation of the Australian Wool Board in 1962, AWTA became a separate division within that organisation on 1 July 1963. AWTA retained the same status within the Australian Wool Corporation when it was formed by the amalgamation of the Australian Wool Board and the Australian Wool Commission on 1 January 1973.

AWTA Ltd became a company limited by guarantee on 14 May 1982 to enable the functions of the statutory AWTA to be transferred to the private sector. AWTA Ltd commenced operation on 1 July 1982.

AWTA Ltd's company structure is unique within the wool industry; it is a company limited by guarantee but without shareholding. A board of directors, representing all sectors of the wool industry, governs the operations of AWTA Ltd, ensuring the continued impartiality of the company. The sectors represented are:

- Australian Council of Wool Exporters Inc.
- Australian Wool Processors Council Inc.
- Wool Scourers and Carbonisers Group of Australia
- Wool Textile Manufacturers of Australia Group
- Australian Wool Research and Promotion Organisation
- Private Treaty Wool Merchants of Australia Inc.
- The National Council of Wool Selling Brokers of Australia Ltd
- wool producers.

Due to the absence of shareholders, AWTA Ltd retains all profits within the company. The benefit of this is that it allows AWTA Ltd to minimise fee increases, invest in new technology and continue to conduct valuable research and development.

AWTA Ltd has played a major role in providing a bridge between research and the commercial application of testing technology, by facilitating further research and development, sponsoring and participating in practical trials and developing and implementing relevant national and international standards, procedures, methods and technology. This provides major benefits to all segments of the wool industry in Australia and overseas.

This has had the following effects:

- Virtually all Australian Wool is now measured prior to sale.
- Wool is prepared for sale according to objective, rather than subjective, clip preparation standards, with some growers preparing classed lines on the basis of individual fleece measurements.
- Wool is generally displayed for sale in sample boxes rather than using the old show-floor technique.
- Wool is valued and bought with the aid of actual measurements for Fibre Diameter, Yield, Vegetable Matter Content, and Staple Length and Strength. Tests for Colour and Coefficient of Variation of Fibre Diameter are also available.
- Virtually all Australian wool is now measured prior to sale.

Today, wool processors can confidently expect that wool purchased to their price and processing specifications, with the benefit of AWTA Ltd certification, will perform to their requirements, and growers are assured of being paid according to the objective specification of their wool.

Operations and services

AWTA Ltd has three raw wool testing laboratories. These are situated in Melbourne, Sydney and Fremantle. The Melbourne laboratory services the Southern Region (Victoria, Tasmania and South Australia); the Sydney laboratory services the Northern Region (New South Wales and Queensland) and the Fremantle laboratory services the Western Region (Western Australia).

Each laboratory operates 24 hours a day, five days a week and, throughout Australia, nearly 800 people are employed to provide services to customers.

Our principal business is the certification of greasy wool for trading. Bales are sampled and weighed, and the samples tested for clean fibre content (Yield), Fibre Diameter, Vegetable Matter content, Staple Length and Strength, and Colour. Sampling and testing is conducted in accordance with International Wool Textile Organisation (IWTO) regulations and methods, and results are issued as IWTO Certificates.

The integrity of AWTA Ltd Certificates is maintained by the company only certifying tests on samples that have been taken by AWTA Ltd Sampling Officers, or where sampling operations have been supervised on a full-time basis by AWTA Ltd Sampling Officers. The Australian National Committee of IWTO endorses this policy. Sampling is conducted in 38 cities and towns throughout Australia.

Many customers require a quick return of certified test results so that they can trade the wool. We provide three different levels of service to meet customer needs:

- express service – 95% of certificates are available the following morning
- fast service – 95% of certificates are available within three days
- normal service – all certificates are available within five days.

Electronic data processing

Computers play an integral part in AWTA Ltd operations. Specialised software integrates online data from the sampling line, through the testing process to the issue of Certificates. Laboratory instruments and balances are connected to the computer system. Samples, sub-samples and specimens required for the testing process are identified by barcodes. Virtually all presale test information is transmitted electronically to wool brokers for inclusion in sale catalogues. At the conclusion of the sale, brokers advise AWTA Ltd electronically who purchased each lot and the test data is then transferred electronically and/or in hard copy to the buyer.

Textile testing

AWTA Textile Testing is the largest independent supplier of testing services to the textile industries and is certified to ISO 9001 and accredited ISO Guide 25 by NATA. It is able to provide a comprehensive range of textile and materials testing services on a wide variety of wool and non-woollen products, for example:

- semi-processed wool and yarn
- carpets, curtains, garments and interior textile fabrics
- flammability tests on building materials, interior textiles and garments, such as children's nightwear
- geotextile testing, flexible air-conditioning duct testing and component testing for the automotive industry.

AWTA Textile Testing has also developed a number of innovative packages for its clients. These include:

- RAPITEST® which provides fabric and garment manufacturers with rapid information on a number of fabric qualities critical to the garment manufacture
- LAUNDRYWATCH which gives commercial laundries quality control data to assist the monitoring of their performance.

Staff also provide consulting services and may be asked to give expert evidence in commercial/legal disputes.

The division also acts as a major source of supplies and materials for quality control laboratories at textile processing operations throughout Australia and New Zealand.

Research and development

Research and development plays a major role in the business of AWTA Ltd. The Research and Development Division is based in Sydney and is the largest privately operated group of its kind in the wool industry. Its work falls into four main areas:

- development and enhancement of test methods and regulations
- participation in industry trials designed to evaluate the role of raw wool measurements in the prediction of processing performance
- development of the fundamental understanding of the physics of specific measurement systems where required to better enable the company to improve existing test methods and to develop new test methods
- development, design and construction of testing equipment for in-house use and for sale. Most testing equipment at AWTA Ltd has been built and/or designed by AWTA Ltd staff.

Research is often conducted in conjunction with other research organisations such as CSIRO, commercial processors, industry bodies and non-competing laboratories such as New Zealand Wool Testing Authority Ltd (NZWTA Ltd) and the Wool Testing Bureau South Africa (WTB SA).

AWTA Ltd played a major role in the Australian Objective Measurement Project (AOMP), which led to the introduction of Sale by Sample and Presale Testing in 1972, the Trials Evaluating Additional Measurement (TEAM) and the Australian Staple Measurement Adoption Programme (ASMAP).

Results of our research are normally reported at the twice-yearly International Wool Textile Organisation (IWTO) meetings and in appropriate journals.

The Development or Engineering Group is responsible for manufacturing equipment for use by the company's own laboratories as well as for sale to others. Although the group does manufacture the full range of AWTA Ltd's equipment, its principal activity over recent years has been the manufacture and sale of the LASERSCAN instrument.

Testing equipment built by AWTA Ltd has been exported to Argentina, Belgium, China, New Zealand and South Africa.

Technical standards

AWTA Ltd has achieved an international reputation for its technical standards. Its technical performance is monitored externally by the National Association of Testing Authorities, Australia (NATA) and by participation in inter-laboratory trials for Fibre Diameter and Fibre Length in wool tops conducted by Interwoollabs.

AWTA Ltd is:

- licensed by International Wool Textile Organisation (IWTO) to issue IWTO Test Certificates

- accredited by Interwoollabs for the measurement of Fibre Diameter and Fibre Length in Tops
- ACCREDITED by NATA to the international standards for laboratory performance, ISO Guide 25 and certified by NATA to the international Quality management standards, ISO 9001.

AWTA Ltd also participates in the inter-laboratory round trials organised by the Independent Laboratories Round Trial Group (ILRT). This is the only significant trial of its kind that monitors the performance of Test Houses that issue IWTO Certificates for Raw Wool.

The five laboratories currently participating in the ILRT are:

- Australian Wool Testing Authority Ltd, Sydney
- Australian Wool Testing Authority Ltd, Melbourne
- Australian Wool Testing Authority Ltd, Fremantle
- New Zealand Wool Testing Authority Ltd, Napier
- Wool Testing Bureau South Australia, Port Elizabeth.

The ILRT group members represent the largest independent wool testing laboratories in the world and are collectively responsible for the testing of approximately 40% of the world's greasy wool production, and in excess of 80% of all greasy wool tested.

The objects and aims of the group are:

- to develop co-operation between the members' laboratories with a view to ensuring the most correct and uniform application of approved sampling and testing methods as may be set out in the specifications of IWTO and in any associated IWTO Regulations
- to ensure that the members' laboratories obtain accurate test results, having a high level of precision, in their application of those specific IWTO test methods and procedures relevant to the group's agreed annual work program
- to collect such precision data, with respect to those IWTO specifications being utilised in the ILRT program, as is required or desirable, but having regard to the principal ILRT functions of harmonising and monitoring the technical performance of the members' laboratories
- to assist members' laboratories in resolving disputes arising from differences in test results by ascertaining the causes of any discrepancies
- to the extent feasible, to allow non-competing commercial laboratories to become participating laboratories in the inter-laboratory round trials from time to time.

The ILRT Group Report is presented to every IWTO conference, thereby placing the performance of each of the participating laboratories under regular technical and commercial review by the industry.

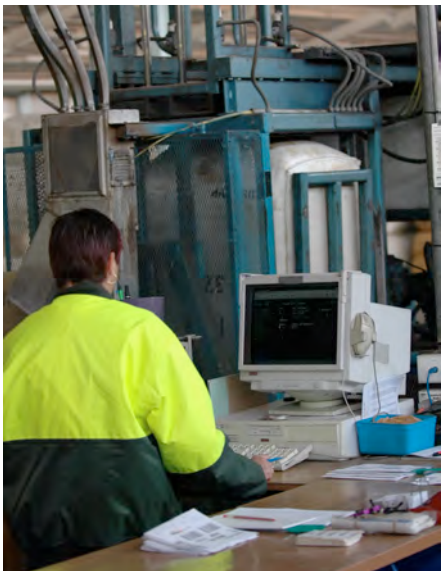
Presale testing for Yield and Mean Fibre Diameter has been an integral part of the Australian wool selling system since the introduction of Sale by Sample in July 1972. Today, virtually all Australian wool is tested for Yield and Diameter, irrespective of the method of marketing, and is sold to the processor on test results. In fact, failure to provide presale test information results in reduced competition and severe price penalties.

Presale test certificate procedure

Steps in determining yield

1. Coring

Under the supervision of AWTA Ltd Sampling Officers, a core sample of approximately 1000 grams is taken from each sale lot. All bales in the lot are sampled and the bale weights recorded at the time of sampling. At the same time, a grab sample is taken from the side of each bale for Length and Strength testing. The role of the Sampling Officer is to ensure that sampling is conducted in accordance with IWTO standards and that the samples are secured and returned to the laboratory.



2. Batching

Once samples are received in the laboratory, AWTA Ltd Testing Officers place samples with similar testing requirements into a 'batch'. The batches then go through the testing process as a group.

3. Greasy sub-sampling

The core samples are tipped into a bucket where they are weighed, blended by air, and weighed again. The difference between the first and second weights is used to calculate a correction factor to compensate for any weight change as a result of the blending process.

Testing Officers then remove two or three sub-samples that weigh 150 grams each. Classed grower lots require only two sub-samples. However, bulk class, interlots and lots containing 40 bales or more have three sub-samples taken because of their increased greater variability.

The sub-samples are put into containers, together with their accompanying paperwork and sent onto scouring. From then on each sub-sample is treated individually.

After removing the 150-gram sub-samples from the bulk core sample, the remainder is packaged into an air-tight container and stored along with 30,000 other samples. Known as 'keeper samples', they allow further testing, if required, on the lot without the need to re-core the bales.

4. Scouring

Sub-samples are placed in a washing machine that operates on the same principles as a commercial scour. Sub-samples are washed in hot water and detergent before being rinsed twice in cold water.

Scouring removes all the suint and 98% or so of the mineral content (sand and dirt) and wool grease. A fine mesh at the base of the scour retains all the wool and all the vegetable matter (VM). After washing, all the wool fibre and VM are removed from the scour and placed in a drying can. The cans are loaded into a centrifuge, which operates like the spin cycle on a washing machine, and spun to remove excess water.

5. Drying

The drying cans are then loaded onto ovens that force hot air through the sample at 105°C. Electronic dryer monitors indicate when all the moisture has been removed from the wool. Each sub-sample is then removed from the oven and weighed, and the oven-dried scoured weight recorded. By this stage the weight of the sub-sample is approximately 90 grams, with about 60 grams having been removed from the wool as dirt, suint, grease and moisture.

6. Residual sub-sampling

After the wool has been scoured and dried, three contaminants remain in the wool. These include all the VM that was in the sub-sample, and a small amount of residual grease and residual dirt not removed during the scouring process. In order to determine Wool Base (WB), these three contaminants need to be quantified. At residual sub-sampling, specimens are taken from the dry scoured sub-sample and sent to the relevant area for further testing.

7. Dissolving and vegetable matter (VM) dissection

Forty-gram specimens of wool are placed into each bowl of a dissolver. 600 ml of a 10% solution of boiling caustic soda is injected into each bowl and agitated for three minutes. After this time, the wool has completely dissolved, but the VM is relatively unaffected. The solution is poured through a sieve to retain the VM. After rinsing, the VM is dried in an oven at 110°C.

The caustic soda affects the VM. The finer and softer particles of VM are more affected by the caustic soda than the harder ones. To correct for this, the VM, after drying, is separated into three categories:

- Burrs (B)
- Seed and Shive (which lose most weight during dissolving) (S)
- Hard Heads and Twigs (which are less affected by caustic soda) (H).

Correction factors for each category have been pre-determined and are applied to the weights of the three categories identified so as to gain an estimate of the percentage of each VM category present. The total weight is used to calculate the Vegetable Matter Base (VMB).

In addition to the above VM categories, Testing Officers also identify and separate dag, sand, other alkali insolubles, for example, lamb marking rings, and pack material contamination. If Testing Officers find traces of contamination in the VM specimen (such as baling twine or pieces of cloth), action is taken with the broker that may require the offending bales to be unpacked in an attempt to find the source of the contamination.

8. Grease

About 99% of the grease present in wool is removed during the scouring process. Near Infrared Reflection (NIR) spectrophotometry is used to determine the quantity of residual grease remaining in the scoured wool. The NIR instruments are calibrated to a range of samples with different grease values. Thus, when an unknown sample is presented to the NIR, it rapidly predicts the grease value of that sample.

9. Wool and VM ash

As with grease, about 99% of dirt present in a wool sub-sample is removed in the scouring process. To determine the quantity of residual dirt (mineral content) remaining in the scoured wool, a 10-gram specimen is removed from the dry scoured sub-sample. The specimen is packed into a crucible and then combusted in a furnace at a temperature of 800°C. The crucibles take about two to three hours to pass through the furnace, during which time all organic matter is burned off, leaving only the mineral matter in the ash. The crucible contents are weighed and expressed as a percentage of the wool specimen weight.

10. Wool base calculation

Having accounted for all the residual contamination in the wool, the amount of clean, dry wool fibre or Wool Base (WB) in each sub-sample can now be calculated. The WB is calculated by expressing the weight of wool with all impurities removed as a percentage of the original greasy wool weight. The WB results of the two or three sub-samples are then averaged to give a final result for that particular sale lot. If the range in test results between the sub-samples is excessive, a check test will be initiated from the 'keeper sample'. By using this procedure, AWTA Ltd is automatically putting a quality control check in place to minimise errors.

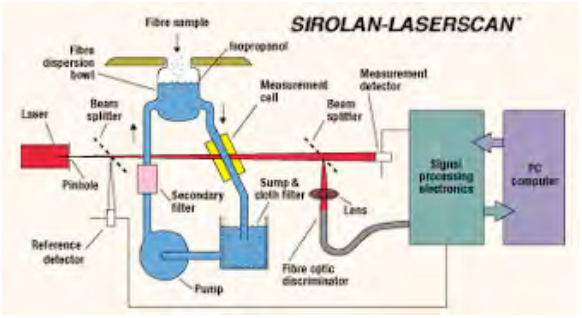
Fibre diameter measurement

During the residual sub-sampling process for yield determination, 20 grams of scoured wool is removed for Fibre Diameter measurement.

1. Conditioning

The scoured wool sample is left in a controlled atmosphere room to condition to an environment of 20°C and 65% RH. Because wool swells as it absorbs moisture, the fibre diameter is dependent on atmospheric moisture content. Hence, for consistent measurement for certification purposes, the fibres must adjust to these standard conditions before measurement and certification.

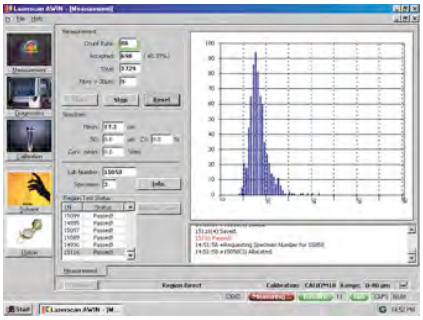
2. Measurement



Mean Fibre Diameter is measured by Laserscan. Results are reported as micrometers (microns). The conditioned sample is measured across four Laserscan instruments. Each sample is split into four portions and each portion is measured on a separate Laserscan. The portion of sample is placed into a mini-core set above the Laserscan and a mini-core sample or snippets obtained. The cored snippets fall into the Laserscan and are automatically mixed into a solution within the instrument.

The slurry of fibre snippets moves through tubing into a measurement cell where a laser beam shines on the individual fibres. The shadow cast by the fibre is measured electronically and stored in a "bin" representing the micron grouping measured by the instrument. After measurement, the fibres are caught in a filter for subsequent removal. Each snippet is only measured once.

Each Laserscan is calibrated to an international series of wool tops that have been measured by the 100 or so laboratory members of Interwoollabs. Consequently, the 'bin' to which an unknown fibre is allocated can be directly related to a micron value.



A total of 1000 snippets are measured on each Laserscan. The results from each instrument are then combined; hence, 4000 fibres are measured for the certified Mean Fibre Diameter result. Because the measurements are made on individual fibres, a distribution of the diameters in the sample can be accumulated and graphed as a histogram. Also the Coefficient of Variation of Fibre Diameter can be calculated. In addition, for appraisal purposes, the certificate can show the Mean Curvature of the fibres in the sample and the Comfort Factor of the sample.

Staple length and strength measurement

After Yield and Diameter, one of the most important characteristics that determine the value of combing wool is the average fibre length which will be achieved after processing. This length is known as Hauteur. Research has shown that Hauteur is closely correlated to the staple length and staple strength of the greasy wool.

Prior to the measurement of Staple Length and Strength, three levels of sampling occur:

- grab sampling
- tuft sampling
- staple preparation.

1. Grab sampling

Grab sampling is conducted at the time of core sampling, under the supervision of AWTA Ltd Sampling Officers. Every bale is sampled with a minimum of 20 grabs taken from each sale lot, ensuring that the grab sample taken is representative of the wool that constitutes the sale lot. A reduced grabbing schedule can be used for one, two and three bale grower lots.

2. Mechanical tuft sampling (MTS)

AWTA Ltd has mechanical tuft sampling (MTS) machines located throughout Australia in brokers' stores as well as in the testing laboratories.

The purpose of the MTS machine is to randomly draw approximately 60 tufts of wool from the grab sample and then package the tufts in a form suitable for transportation. This is achieved by spreading the grab sample in an even layer over the conveyor belt so the full sample is conveyed under the sampling head in 20 equal steps. At each step, three tufts are mechanically drawn from the sample by jaws and blown onto a flyscreen belt which is wound onto a reel for shipment to the laboratory.

The jaws withdraw slowly for the first 200 mm to ensure that tender staples are not broken. In addition, the jaws are heated to 60°C, which is beyond the melting point of wool grease so as to reduce the risk of greasy tufts sticking to the jaws.

After tufting, the grab is placed in a sample box on the show floor where it becomes the display sample for buyers to appraise.

3. Staple preparation

The purpose of this sampling stage is to randomly take one staple from each tuft and prepare it to a standard suitable for the measurement of its Length and Strength. A variety of staple shapes are acceptable, as are second cuts.

Of all the functions in the laboratory, staple preparation is the most manual and therefore requires the most stringent quality control. Testing Officers are trained to grasp the first staple end they identify in the tuft and, having done so, remove any wispy fibres from either end and place it in the staple tray. Strict adherence to this procedure ensures that staples are chosen at random. Four Testing Officers prepare a single lot, further ensuring randomness of staple selection.

To confirm that operators are not imparting any bias on the results, they participate in regular quality control trials. In these trials the same lot is prepared by each operator, and any who differ significantly from the overall average are retrained and re-trialled before returning to commercial work.

Staple trays containing the staples are then moved to a controlled atmosphere room (20°C, 65% RH) and conditioned for eight hours prior to measurement. The design of the trays allows the staples to relax while keeping them straight. This procedure ensures staples from all types of wool are measured under the same conditions.

4. Measurement (ATLAS)

Length and Strength are measured using an instrument called the Automatic Tester of Length and Strength (ATLAS). These machines were originally designed and built by CSIRO. Manufacture is now undertaken by AWTA Ltd's Research and Development division.

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 that 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 50 mm are measured for Strength. This is due to the fact that 25 mm of the staple is held in the tip and base jaws and cannot be broken, so only the middle 25 mm is measured on a 50 mm staple. Strength measurements on staples shorter than 50 mm 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, 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 processor's 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 measurement in processing

Several major trials have been conducted since the 1980s by the Australian wool industry, together with many local and overseas processors. Known as the Trials Evaluating Additional Measurement (TEAM), these trials demonstrated that processing performance can generally be predicted from Staple Measurement together with the Core Test results.

The current generation of the TEAM general formula (TEAM 3) for estimated Fibre Length in the top (Hauteur) derived from these trials is:

$$H = 0.43L + 0.35S + 1.38D - 0.15M - 0.45V - 0.59CVD - 0.32CVL + 21.8$$

where: H = Hauteur (mm)

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 Staple Length (%).

AWTA Ltd test certificates

Yield, VM and Fibre Diameter

IWTO Test Certificates for commercial yield must show the Wool Base (WB) and the Vegetable Matter Base (VMB) (including the percentage of Hard Heads and Twigs (HH)) as well as the particular commercial yield calculation relevant to the wool trading negotiation.


AUSTRALIAN WOOL TESTING AUTHORITY LTD

IWTO TEST CERTIFICATE ORIGINAL

SPECIMEN ONLY

Unless a particular commercial yield basis is requested, the AWTA Ltd Certificate will include the four commercial yields that appear in the auction sale catalogues:

SCH DRY	IWTO Schlumberger Dry Top and Noil Yield (1%TFM)
SCD 17%	IWTO Scoured Yield, 17% regain
JCSY	Japanese Clean Scoured Yield
ACY	Australian Carbonising Yield

IWTO Schlumberger Dry Top and Noil Yield (1%TFM)

IWTO Schlumberger Dry Top and Noil Yield (1%TFM) is the most commonly used commercial core test yield and predicts the amount of Top and Noil that can be combed from the greasy wool. It is the main yield basis for wools traded in Western Europe.

An allowance of 2.27% is made for residual ash and grease, 18.25% moisture regain is added to the Top and 16% moisture regain is added to the Noil. The Total Fatty Matter content (TFM) is 1% and a tear ratio (the conditioned weight of Top to the conditioned weight of Noil) of 8:1 is assumed. The conversion factor of 1.207 applied to WB takes account of these factors.

The yield includes an allowance (Processing Allowance) for fibres lost during processing. This fibre loss is directly related to the VMB minus the HH and is calculated according to the following formula:

SCH DRY = (WB x 1.207) – Processing Allowance

where

Processing Allowance = 7.7 – 40.6 / (7.8 + VMB – HH)

IWTO Scoured Yield, 17% regain

IWTO Scoured Yield, 17% regain is calculated from WB and VMB. An allowance of 2.27% is made for residual ash and grease and 17% moisture regain is included. This yield estimates the ‘washing yield’, that is, the yield of product obtained after scouring but before any processing occurs to remove VM. It is commonly used in trade with Eastern Europe.

SCD 17% = (WB + VMB) x 1.1972

While not shown in the catalogue, an IWTO Scoured Yield, 16% regain is commonly used in trade with China.

Japanese Clean Scoured Yield

Japanese Clean Scoured Yield (JCSY) is the normal basis for trade with Japan. An allowance of 1.5% is made for residual ash and grease, and 16% moisture regain is included. Although this yield has the VM deducted, no allowance is made for fibre loss that could occur during processing.

JCSY = WB x 1.1777

Australian Carbonising Yield

Australian Carbonising Yield (ACY) is popular in Australia, Japan, Korea and Europe as the basis of trade in carbonising and carding types (locks, crutchings, lambs etc.). An allowance of 2.27% is made for residual ash and grease and 17% moisture regain is included. The yield calculation for WB and VMB allows for expected processing losses during carbonising.

ACY = (WB x 1.1972) + (VMB x 0.162) – 5.12

Fibre Diameter

The AWTA Ltd certificate normally includes Fibre Diameter results with the commercial Yield results. Consequently, the Certificate will also show Mean Fibre Diameter and Coefficient of Variation of Mean Fibre Diameter as measured by Laserscan. There is also a separate page of the certificate repeating the Diameter results and showing a histogram graph of the fibre diameter distribution.

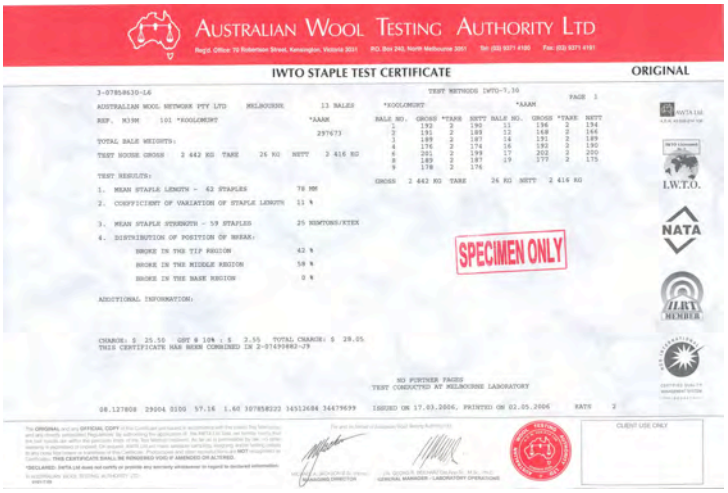

AUSTRALIAN WOOL TESTING AUTHORITY LTD

IWTO TEST CERTIFICATE (CONTINUED) ORIGINAL

SPECIMEN ONLY

Staple Length and Strength

IWTO Staple Test Certificates must show the Mean Staple Length, Coefficient of Variation of Staple Length, Mean Staple Strength and the Percentage of Breaks in the Tip, Middle and Base regions of the staples.


AUSTRALIAN WOOL TESTING AUTHORITY LTD

IWTO STAPLE TEST CERTIFICATE ORIGINAL

SPECIMEN ONLY