# ENTANGLEMENT STRENGTH TESTER

## LH-485 EST

### EST SOFTWARE

- Easy to use menu structure
- Automatic Test Parameter Setup using camera wizard
- Entanglement per meter count, Entanglement Strength % (ES%), Entanglement Skip data including Skip Average length, Max Skip length, Skips CV% and Standard Deviation (SD) for each package
- All diameter data stored for each test, Easy to recall
- Ability to set reject limits to sort the packages
- Customizable summary reports
- Histograms and Skip distribution
- Graphs for Entanglement Strength and Entanglement Count
- Ability to export test data to common file formats

### MODEL

LH-485 Entanglement Strength Tester

| | |
|---|---|
| Speed | 50 to 400m/min |
| Yarn Count Range | 22 to 1500 denier entangled DTY, FDY, POY |
| Draw Zone | User selectable 20 Elongation steps with ± 0.1% precision |
| Max Elongation | 25% |
| Draw Zone Tension | 1000g ± 0.5g |
| Measuring Zone Tension | 500g ± 0.5g |
| Pretension | 5 to 45g |
| Imaging Device | CCD camera with 3.5micron precision |
| Scan Rate | 0.5 mm |
| Electrical | 115 or 230 VAC- 50-60 Hz (single phase power) |
| Power Concumption | 2.4 KW (EST machine & Computer/Printer) |
| Air | 100 psi (7 bar) Clean & Moisture Free Instrument Air |
| Dimensions | 76 x 155 x 61cm (30 x 61 x 24in) |
| Weight | 115 kg (250 lbs) |

**All specifications are subject to change.*

Contact us today for more information on any Lawson-Hemphill product!

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### FEATURES

- Entanglement Testing System for running and applying up to 20 Elongation steps to the yarn under test
- Dual Zone transport with Draw Zone and Measurement Zone tension monitoring
- Draw selectable in 0.5% Elongation steps
- Selectable testing speed 50 to 400m/min
- Draw Zone Accuracy ± 0.1% elongation
- Draw Tension measurement 0 to 1000 grams
- Pretension adjustable 5 to 45 grams
- CCD camera, capable of measuring every 0.5 mm of yarn with precision of 3.5 micron
- Self contained yarn waste bin

The Entanglement Strength Tester analyzes the yarn to simultaneously measure the number of entanglements per meter and length of the entanglement skips. The system uses a two zone transport system, first to remove the entanglements and second to provide constant tension for optimum entanglement count measurement.

The transport system uses state of the art control system to ensure the yarn is under precise elongation % that is desired by end user requirements in Zone 1, which is also known as Draw Zone.

As the yarn passes through the Draw Zone, the high resolution Tension device measures the tension developed on the yarn as the entanglement are being removed. Depending on the strength of the entanglement, this tension value can be high or low for strong or soft entangled yarns respectively.

As soon as the yarn leaves the Draw Zone, it enters the Entanglement Measurement Zone under controlled tension. In this zone, a CCD camera collects the yarn diameter information with precision of 3.5 micron. The diameter data is used to identify and count the entanglements and entanglement skips in the running yarn.

The complete EST test routine will include running the yarn at a reference condition, normally at 0% elongation and this test result will be used as the baseline for Entanglement Strength (ES%) calculations. After the reference step is finished, the EST will start drawing the yarn, up to 20 steps per test and will collect the entanglement data at each step. The Entanglement Strength will be calculated as the % entanglements remaining in the elongated yarn after it is subjected to the desired draw conditions.

A full statistical report for each bobbin is available at the end of each test.

This dual zone approach to measuring the entanglement strength automates the manual method, thus providing a highly efficient, repeatable, precise procedure that is free from the influence of human error.

## WHY IS ENTANGLEMENT STRENGTH IMPORTANT?

Synthetic yarns are comprised of multiple filaments forming a yarn. Entangling the yarn is one of the most common methods to provide cohesive structure to the filament bundle so that we can use the yarn during the fabric formation.

During beaming, weaving or knitting, the yarn will be exposed to various levels of tension. It is important that the yarn has not only sufficient number of entanglements, but also has entanglements of certain strength to resist opening up, thus losing the cohesive yarn structure to complete the weaving or knitting process with minimum machine downtime.

Soft Entanglements or Strong Entanglements are common terms to define the strength of the entanglements, whereas soft refers to the entanglements that are weak and can be easily removed and strong refers to the ones that resist removal.

To achieve high efficiency during fabric production, the entanglements need to be evenly distributed and of similar strength levels. Problems develop when bobbins from the same lot have different entanglement strength levels or entanglement strength changes due to variations in air pressure through the entanglement jets within the same yarn package.

Missed or weak entanglements result in Entanglement Skips, where the yarn cohesiveness is no longer maintained. In addition to creating fabric production problems, Entanglement Skips are also known to cause streakiness in knit and woven fabrics. Therefore, it is critical to measure the entanglement strength and skip distribution in the yarns to provide similar quality yarns to fabric process to minimize machine down time, thus resulting a highly efficient fabric production.

***Summary of Test Results for yarns entangled at different air pressure levels***

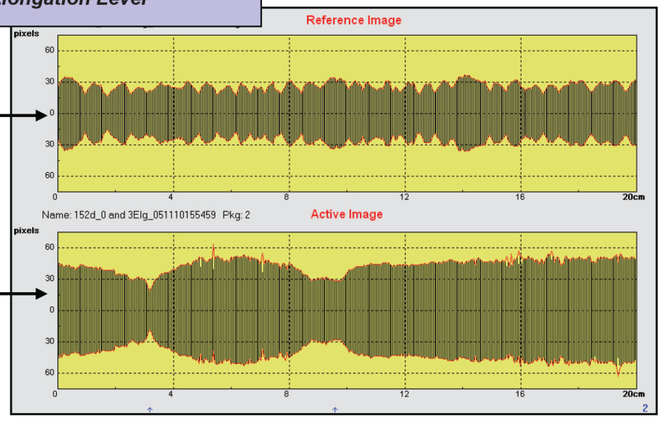
Summary Data

| ID | Pkg ID | E% | T1 (gr) | ES% | ENT/m | Ave Skip (cm) | Max Skip... | SD... | CV% | Date/Time |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 1bar | 0.0 | 8.0 | 100.0 | 14.8 | 6.2 | 42.7 | 5.4 | 86.9 | 05/11/10,15:54 |
| | | 3.0 | 75.9 | 16.2 | 2.4 | 21.2 | 82.3 | 16.9 | 79.4 | 05/11/10,15:54 |
| 2 | 2bar | 0.0 | 7.8 | 100.0 | 28.4 | 3.4 | 26.3 | 2.8 | 81.7 | 05/11/10,15:52 |
| | | 3.0 | 77.5 | 48.2 | 13.7 | 6.8 | 33.9 | 5.7 | 84.9 | 05/11/10,15:52 |
| 1 | 3bar | 0.0 | 7.8 | 100.0 | 43.7 | 2.2 | 13.7 | 1.6 | 72.2 | 05/11/10,15:37 |
| | | 3.0 | 80.8 | 60.9 | 26.6 | 3.7 | 27.3 | 3.0 | 81.9 | 05/11/10,15:37 |

***Entanglement Strength Comparison at 3% Elongation Level***

**Profile of yarn entangled at *3bar***

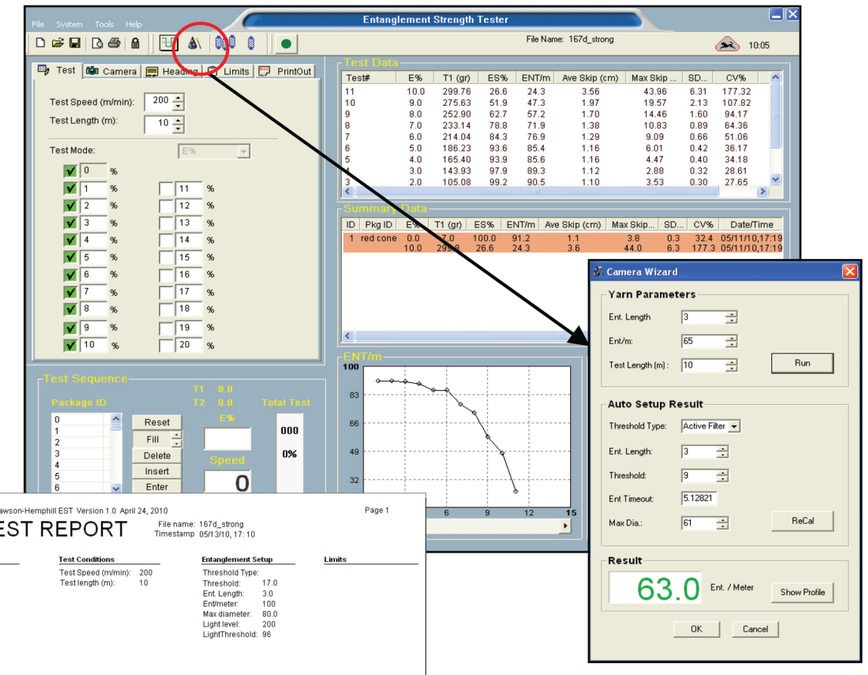
**Profile of yarn entangled at *1bar***

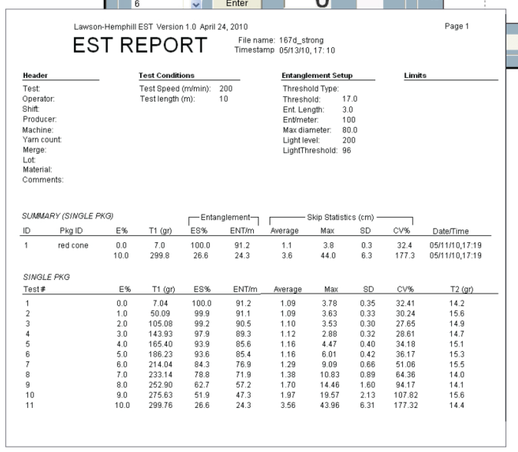





## EST GRAPHICS

- Ability to store and view yarn images
- Ability to view and compare different sections of the yarn with reference yarn
- Ability to save the yarn image in common file formats



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EST REPORT

File name: 167d_strong
Timestamp: 05/13/10, 17:10

**Header**
Test:
Operator:
Shift:
Producer:
Machine:
Yarn count:
Merge:
Lot:
Material:
Comments:

**Test Conditions**
Test Speed (m/min): 200
Test length (m): 10

**Entanglement Setup**
Threshold Type:
Threshold: 17.0
Ent. Length: 3.0
Ent/meter: 100
Max diameter: 80.0
Light level: 200
LightThreshold: 96

**Limits**

*SUMMARY (SINGLE PKG)*

| ID | Pkg ID | E% | T1 (gr) | Entanglement ES% | Entanglement ENT/m | Skip Statistics (cm) Average | Max | SD | CV% | Date/Time |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | red cone | 0.0 | 7.0 | 100.0 | 91.2 | 1.1 | 3.8 | 0.3 | 32.4 | 05/11/10,17:19 |
| | | 10.0 | 299.8 | 26.6 | 24.3 | 3.6 | 44.0 | 6.3 | 177.3 | 05/11/10,17:19 |

*SINGLE PKG*

| Test# | E% | T1 (gr) | ES% | ENT/m | Average | Max | SD | CV% | T2 (gr) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0 | 7.04 | 100.0 | 91.2 | 1.09 | 3.78 | 0.35 | 32.41 | 14.2 |
| 2 | 1.0 | 50.09 | 99.9 | 91.1 | 1.09 | 3.63 | 0.33 | 30.24 | 15.6 |
| 3 | 2.0 | 105.08 | 99.2 | 90.5 | 1.10 | 3.53 | 0.30 | 27.65 | 14.9 |
| 4 | 3.0 | 143.93 | 97.9 | 89.3 | 1.12 | 2.88 | 0.32 | 28.61 | 14.7 |
| 5 | 4.0 | 165.40 | 93.9 | 85.6 | 1.16 | 4.47 | 0.40 | 34.18 | 15.1 |
| 6 | 5.0 | 186.23 | 93.6 | 85.4 | 1.16 | 6.01 | 0.42 | 36.17 | 15.3 |
| 7 | 6.0 | 214.04 | 84.3 | 76.9 | 1.29 | 9.09 | 0.66 | 51.06 | 15.5 |
| 8 | 7.0 | 233.14 | 78.8 | 71.9 | 1.38 | 10.83 | 0.89 | 64.36 | 14.0 |
| 9 | 8.0 | 252.90 | 62.7 | 57.2 | 1.70 | 14.46 | 1.60 | 94.17 | 14.1 |
| 10 | 9.0 | 275.63 | 51.9 | 47.3 | 1.97 | 19.57 | 2.13 | 107.82 | 15.6 |
| 11 | 10.0 | 299.76 | 26.6 | 24.3 | 3.56 | 43.96 | 6.31 | 177.32 | 14.4 |