1 - Test Details & Procedures

Equipment

Manufacturer / Model	_____Lloyd LR / 10K Plus Materials Tester_____	
Test Method	Procedure (a)	Procedure (b)
Load Cell (kN)	10	10
Grips: Type	Vice Type	Self-Tightening Wedges
Jaw Size width x length (mm)	58,5 x 23,5	25 x 48

Sample Dimensions

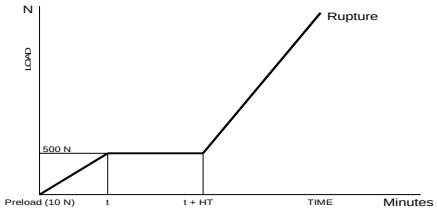
Width (mm)	50	25
Length Between Grips (mm)	320	260
Total Sample Length (mm)	390	350

Elongation Test

Head Speed (mm/min)	1	1
Zero Point Load (N)	10	10
Elongation Load (N)	500	500
HT - Hold Time @ 500 N (min)	10	2

Tensile Strength (TS)

Zero Point Load (N)	500	500
Head Speed (mm/min)	50	50



Auxiliary Data

Extension @ 10 N (mm)	L0	L0
Extension @ 500 N (mm)	L1	-
Extension @ 500 N after HT (mm)	L	-
Extension @ TS (mm)	LM	LM

NOTE: Test Parameters, such as Extension, Load, Stress, Time, ... borrow the notation used for Test Markers L0;...LM.
Thus Test Markers L0;...LM appear associated to the respective Parameter Unit: mm; N/mm; s;...

Test Results

Elongation (mm)	L - L0	-
Elongation (%)	[(L - L0)*100]/L0	
Yield (mm)	L - L1	-
Yield (‰)		[(L - L1)*1000]/L1-
Young's Modulus(*) (MPa)	Modulus	Modulus
Tensile Elongation(**) (mm)	LM - L0	-
Tensile Elongation (%)	[(LM - L0)*100]/L0	-
Tensile Strength (N/mm)	TS	TS
TT - Test Time (s)	LM - L0	-

(*) - Tangent modulus of elasticity is the slope of the stress-strain diagram taken at the maximum slope by the Materials Tester software. Sample length between grips and sample cross sectional area are used.

(**) - Elongation @ break gives just a general and useful indication of blanket stability. Neither test (a) does nor test (b) would return exact figures.

2 - Notes on Test Procedures

Carcass Fabrics and Blanket Stability

Unless special provisions are made otherwise, a common characteristic of woven fabric is that the warp threads will not be *perfectly* parallel to each other along their entire length as it is virtually impossible to feed large amounts of warp thread with exactly the same length from a warp reel obtained by the addition of several independently formed warp sections.

Thus the blanket manufacturers have invariably the fabric used in the blankets' carcass subject to a process where the fabric warp threads are subject to a pre-tensioning procedure, meant to keep blanket elongation within a conveniently low value range during its printing life and also on its fitting around-the-blanket-cylinder operation.

With the pre-tensioning operation the length of the shorter warp yarns will increase slightly and a more even fabric - with improved "Effective Cross-Section" - is conveniently obtained.

This process means that all warp yarns will exhibit some amount of cross-section variation as spot thread-length-adjustments will occur along their full length.

In order to minimize the resulting tensile strength loss of individual yarns due to pre-tensioning, high quality long staple Egypt cotton fibres are often specified for fabrics used in printers blankets carcass plies.

(A *perfectly flat fabric* with no excess length sections in each warp thread would be the best possible starting basis for the subsequent build-up of blankets with truly constant thickness and a minimum level of built-in tensions.)

During blanket manufacture, an adequate procedure must also be used to handle pre-tensioned fabric, as existing tension condition on individual warp threads and its respective fibres would be released on a loosely handled fabric roll.

Such cautious procedure will be particularly relevant and advisable when unsized(*) fabrics are used.

Some blanket manufacturers prefer to deliver instead blanket rolls that will enable a virtually distortion-free conversion into ready-to-use formats.

The behaviour of these formats during its printing life and more importantly its mounting requirements are predictably like to require specific study and consideration.

The effectiveness of fabric pre-tensioning will reflect on the dimensional stability behaviour of the finished blanket format, but, regardless of its dimensions and particular manufacturing technics, the blanket material adjacent to the edges of a format will release a part of the pre-tension added to the carcass fabrics and local blanket deformation shall occur.

Thus a careful choice of test sample dimensions and respective pre-conditioning and test procedures must be selected if laboratory test results are to usefully predict real blanket behaviour on the printing floor.

(*)Size - Common denomination of a range of chemical additives used to impart specific properties to textile fabrics.

Two examples of size:

- To reduce both fibre wear and the resulting loss of fabric tensile strength, the threads used in weaving contain size with a lubricant effect.

- Some blanket manufacturers add "gum", or size, in order to retain the properties imparted to the fabric by the pre-tensioning procedure.

3 - Test Equipment & Grip choice

A handy solution for the mechanical tests required by printing blankets is provided by twin column material testers with 10,000 N capacity.

Vice type grips able to accept 50 mm width test pieces are used to determine the Elongation, Yield and Young's Modulus values as described in test Procedure (a).

Vice Type Grips

During the tensile test and due to stress concentration at the grip jaws, rupture of the test piece invariably occurs adjacent to the grips and Tensile Strength cannot be accurately determined with this configuration.

Self-Adjusting Wedge Jaw Grips

Spring load assisted self-adjusting wedge jaw type grips able to handle 25 mm width test pieces are used in procedure (b).

Now, with the vast majority of blanket model samples, rupture will conveniently occur in the central area of the test pieces.

And it is easy to understand from the design and proportions of these grips that it would not be straightforward to extend the same concept to 50 mm width samples.

Another characteristic of these grips is that the test piece will accommodate in the grips as the applied load increases, meaning that during the test there will exist a minor but definite displacement between the test piece and the grip jaws.

Thus when very minute elongation values are to be measured, these grips may only be used together with Bench Marks.

4 - Elongation Test

Following ISO12636 Standard, a 50 mm width test piece with a minimum length of 300 mm between grips is pulled at a speed of 1 mm/minute up to a load of 500 N that is held for 10 minutes and the total length increase of the blanket during that period is registered. *However Bench Marks are not being used*.

Resulting length increase - **Elongation** - measured during the a.m. test procedure must lie under 1.5 %.

This result may be linked to the blanket behaviour during its dressing operation on the blanket cylinder.

Please note that 500N load applied on a 50 mm width test sample is equivalent to ~1 Ton /m of blanket width, which is in line with what most blanket manufacturers would expect printers to use during the blanket dressing procedure into the press.

A further result - **Yield** - may be obtained, measuring blanket's test piece length increase under the constant load of 500 N during the above mentioned period of 10 minutes. Expected Yield value should lie under 2 ‰.

This result may be related to the register and dimensional stability behaviour of the blanket on the press during its printing life.

5 - Tensile Strength Test

5.1 - ISO12636 test procedure

Test piece dimensions: width: 50 mm; length: 300 mm (minimum).

Minimum Jaw separation: 200 mm.

Head speed: 50 mm/min.

Increase load until the test piece breaks.

Read the force at break.

Tensile Strength (TS) to be registered in N/mm.

(Minimum TS = 40 N/mm for blankets 1.68 mm thick or more)

5.2 - Iberográfica method details

Tensile Test starts in the sequence of the final stage of the Elongation Test which is used as a pre-conditioning.

The grips of the equipment resume the movement apart at a speed of 50 mm/minute, while the load applied to the blanket is increased from 500 N initial load until the test piece is broken.

With the pre-conditioning included in test procedure (a) it becomes true for a large proportion of blanket models that the tensile test is applied to a dimensionally stabilised blanket structure, thus allowing to obtain an useful *Young's Modulus* relatable to blanket stiffness and register behaviours, as it supposed to happen on a properly dressed blanket cylinder.

The use of Young's Modulus comes as the natural complement to Yield, as considered previously. (*)

By contrast the Tensile Strength relates to the type of raw material and the warp threads structure, section and count, being hardly dependent from a particular conditioning procedure, provided the sample breaks away from the grips.

Tensile Strength is determined at the *rupture point*, which is defined at even a partial structural failure of the test sample with a corresponding load reduction reading on the Load = f (Elongation) graph.

Accordingly procedure (b) was added as an alternative, including the use of self-adjusting wedge jaws and specific conditioning details, allowing to determine respectively the Tensile Strength for all blanket models and also an Young's Modulus figure with meaning for those blanket models that enable a virtually distortion-free conversion into ready-to-use formats.

(*) - The details of procedure (a) relative to the Elongation Test follow ISO12636 prescriptions and reflect the experience of the members of the respective Technical Committee.

The pre-conditioning provisions of procedure (a) relative to the Tensile Test as developed in our laboratory are intended to counter the inevitable tension release associated to the format conversion, aiming to replicate a stabilised blanket structure in its ideal press operation condition.

However, procedure (a) does not provide enough structure stabilisation for those blanket models known to provide *a virtually distortion-free conversion into ready-to-use formats*. In these cases the maximum graph slope used to define the Young's Modulus occurs at a higher load value during the Tensile Test.

When a higher tension is required to achieve a stabilised blanket test piece (or format), as with procedure (b), additional post-tensioning is being added to the blanket structure when compared with the manufacturing conditions.

The action of post-tensioning the blanket during the dressing operation of the blanket cylinder would have no draw-back if it were not for the fact that the fabrics constitute now the plies of the blanket and whenever a warp thread experiences a spot length increase, the affected composite volume will change its shape involving a thickness reduction. As a randomly distributed number of spot length adjustments of warp threads will exist, the blanket will correspondingly exhibit a number of low gauge spots and will probably have a poorer printing performance.

And although blanket dimensional stabilisation may be achieved by post-tensioning the blanket plies and this measure may eventually mend an insufficient fabric pre-tensioning operation, the effect of post-tensioning falls short of obtaining a permanent fabric stabilisation.