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Smartmesh

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Advanced Threads / Precision-Woven Screen Fabrics

Orientation

- *Understanding how SMARTMESH is woven and manufactured*
- *Threads and Weaving Pattern*
- *Fundamentals of Mesh Specifications*
- *Interpretation of Stress Strain Curve*
- *Elongation & Mesh Count – Stretching & Printing Variables*
- *Tension/Elongation & Printing Relations*
- *Stretching – Stress on mesh*
- *Quality Screens – Control factors*
- *Techniques and Tips*
- *Q&A*

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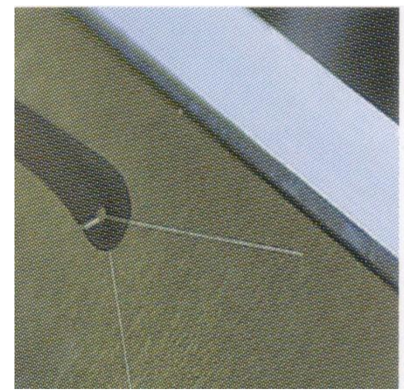
Mesh Manufacturing Process

Warping

Drawing in heald



Drawing in reed

Weaving

Inspection

Physical inspection

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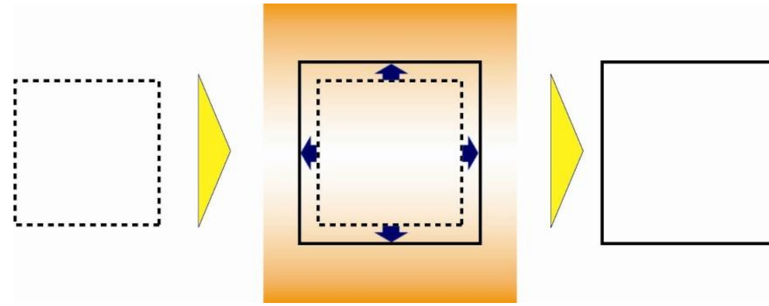
Rinsing & Cleaning


Finishing


Heat setting Process

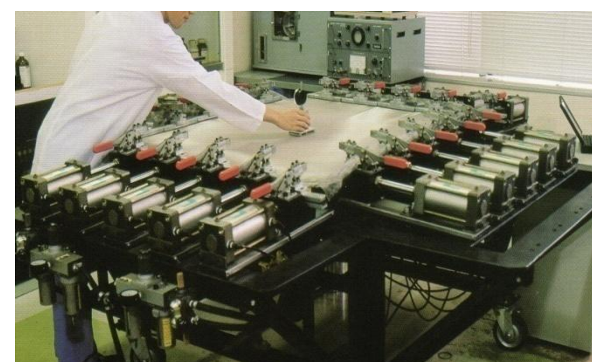
Finishing & Inspection


Visual Inspection


Final inspection


Thickness inspection


Physical Strength inspection


Stretching test

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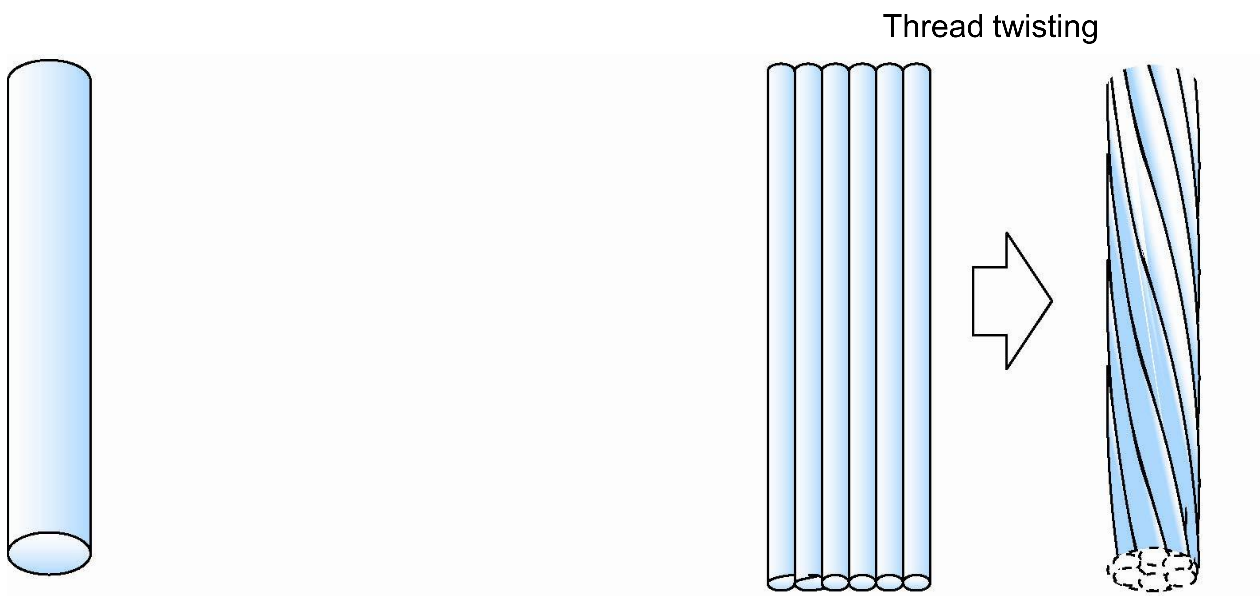
Threads & Weaving



Monofilament

A single one component thread

Multifilament

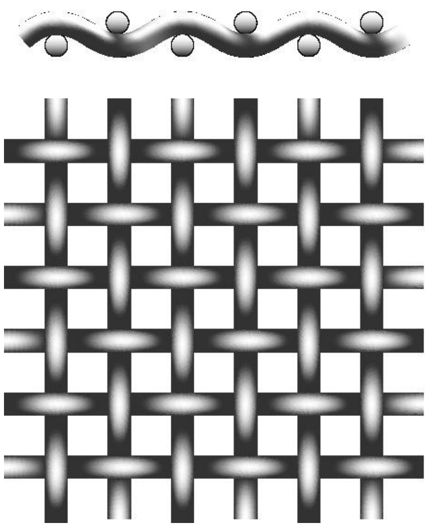
A bound thread composed of multiple threads

Using advanced quality thread is important. Thinner and heavier denier threads, LE monofilament threads, consistent thread batch consistency, along with advanced heat setting technology creates the quality.

Weaving Patterns

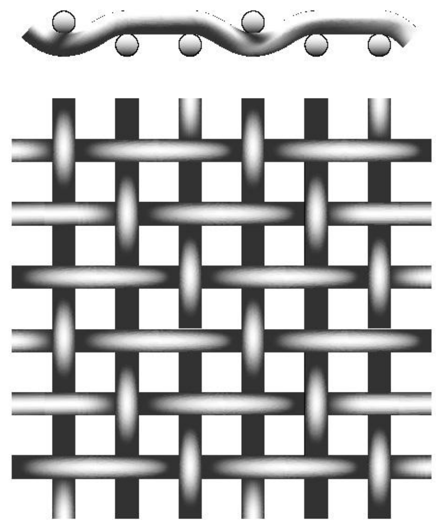
Plain Weave

(PW)



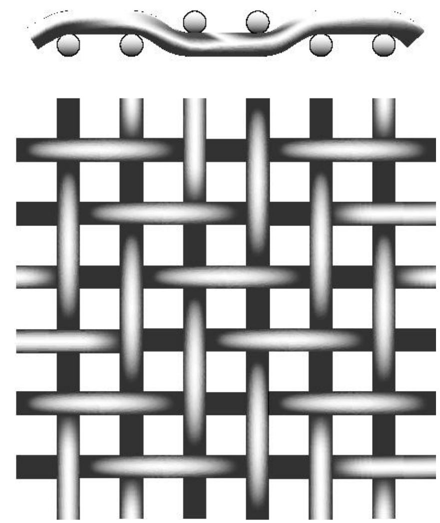
Twill Weave

(2／1 TW)



Twill Weave

(2／2 TW)



Currently the screen printing industry prefers PW, plain weave, over Twill weave mesh for 350/inch (140/cm) or higher mesh counts. S or thin threads with PW yields better print quality than thick TW mesh. Experience the new S thread for premium quality imaging.

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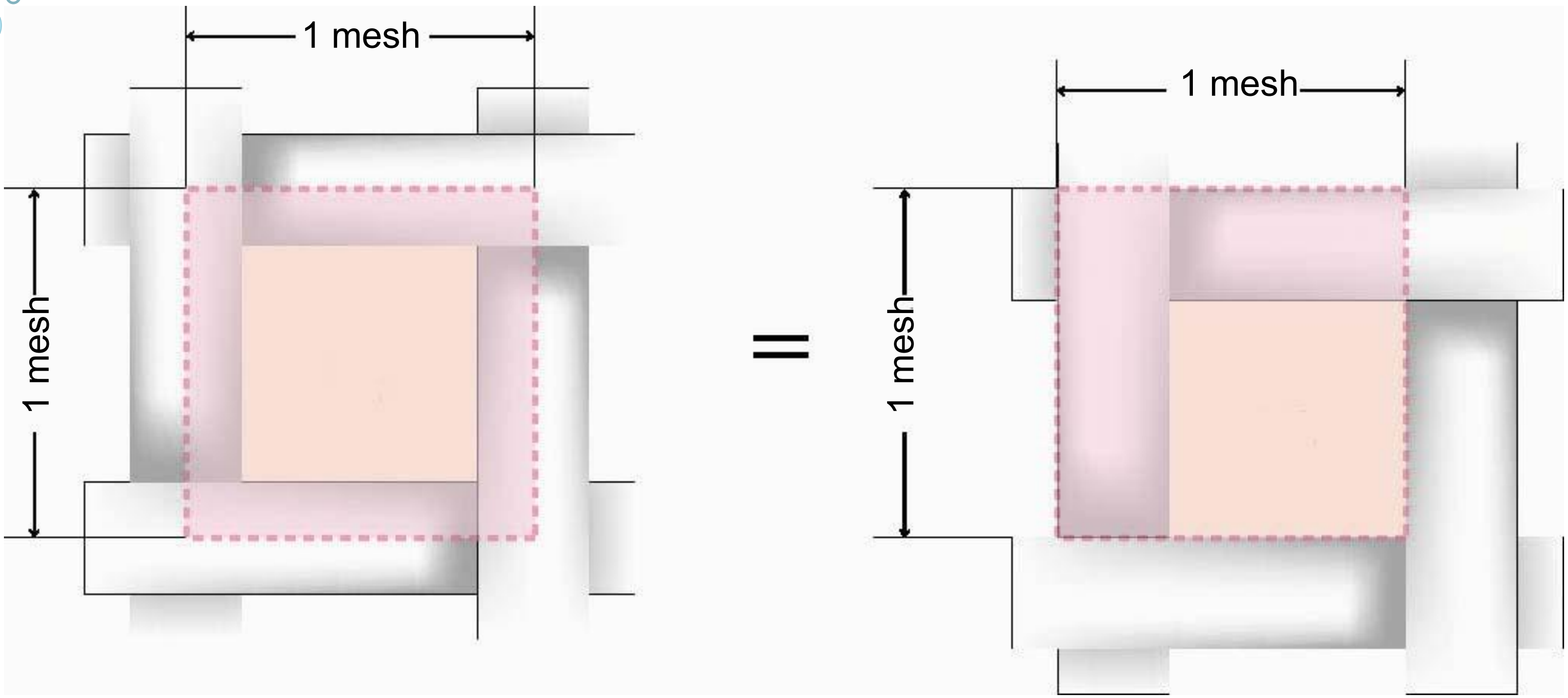
Fundamentals - Mesh Specifications



Mesh Count is measured by the number of threads per cm or per inch. Certain screens come in a different mesh count in warp and weft direction. Please note that the mesh count per inch or per cm will change after stretching the screen. Specifications on catalogues are nominal values.

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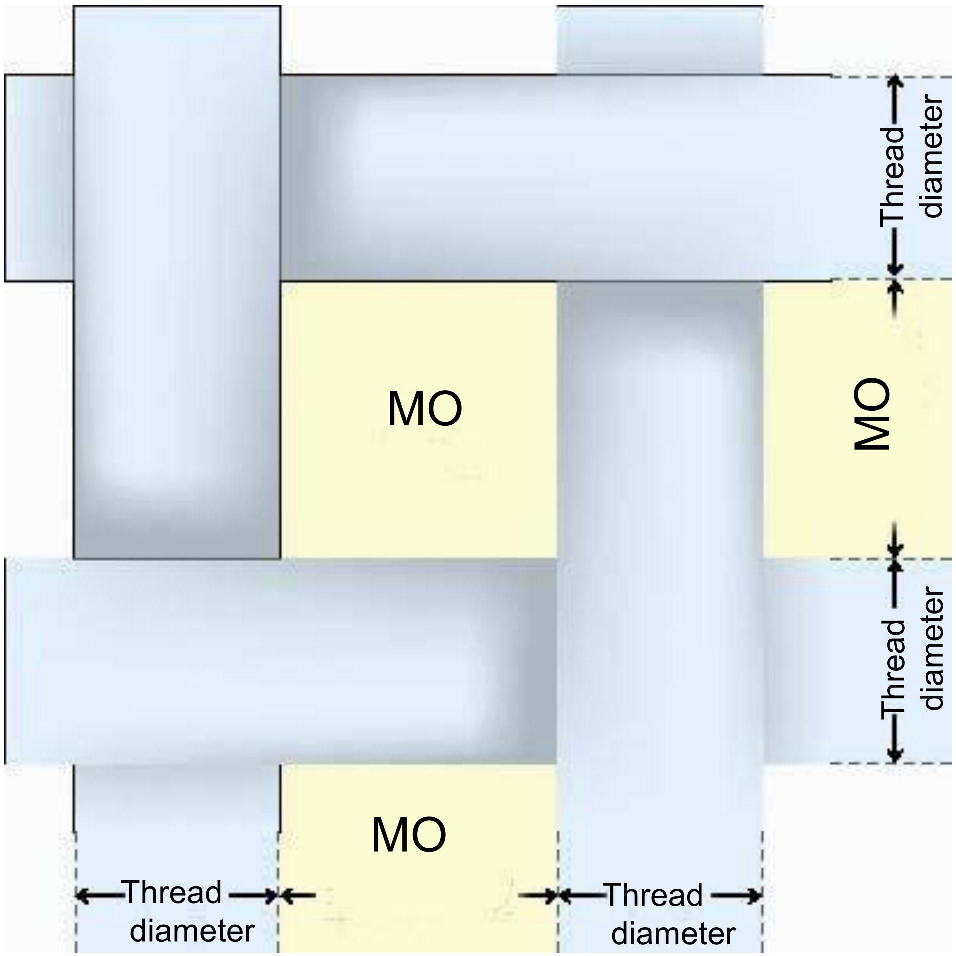
Thread Diameter & Mesh Opening



Thread Diameter (TD) represents the diameter of thread before weaving process.

Mesh Opening (MO) represents the distance between each thread. Values or numbers specified in product specification chart represents nominal values, not actual measurements of final stretched screen.

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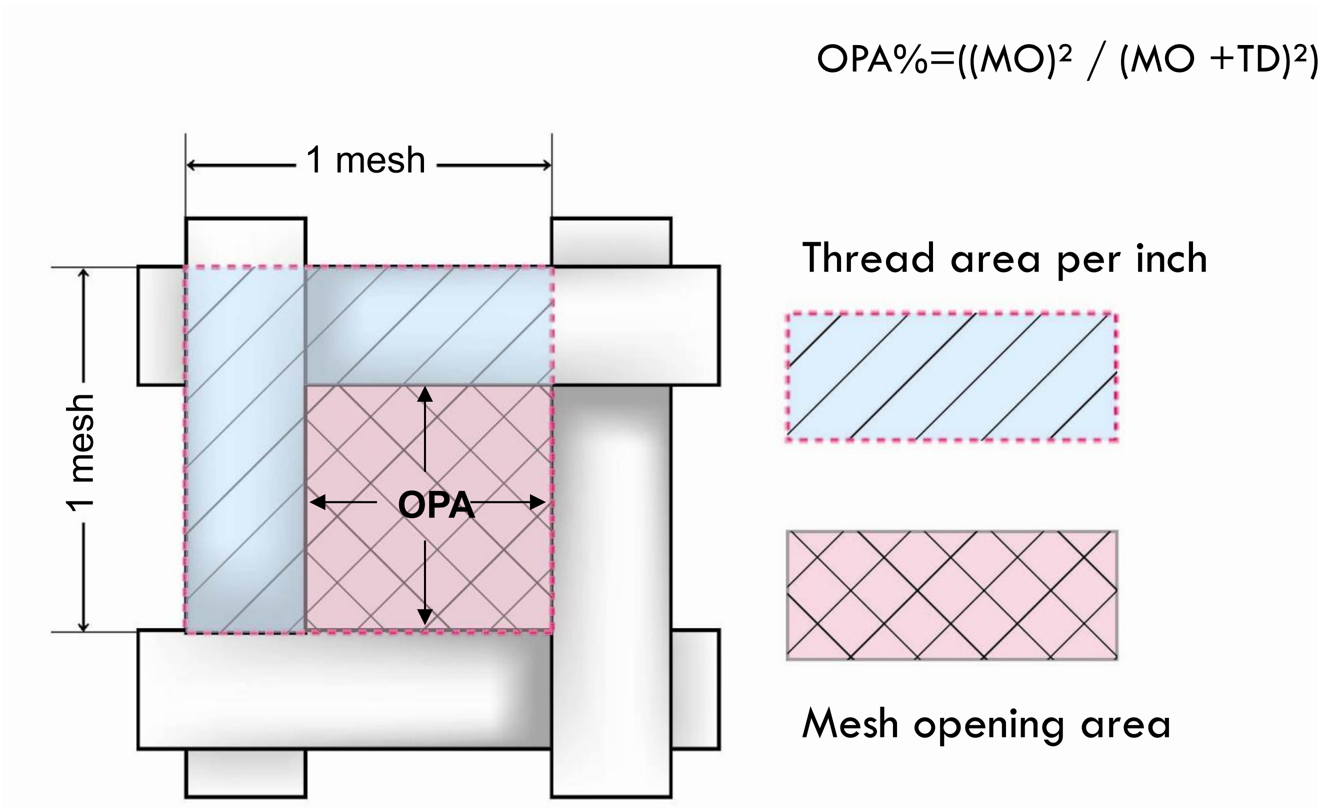
Open Area(OPA%)

$$OPA\% = ((MO)^2 / (MO + TD)^2) \times 100\%$$

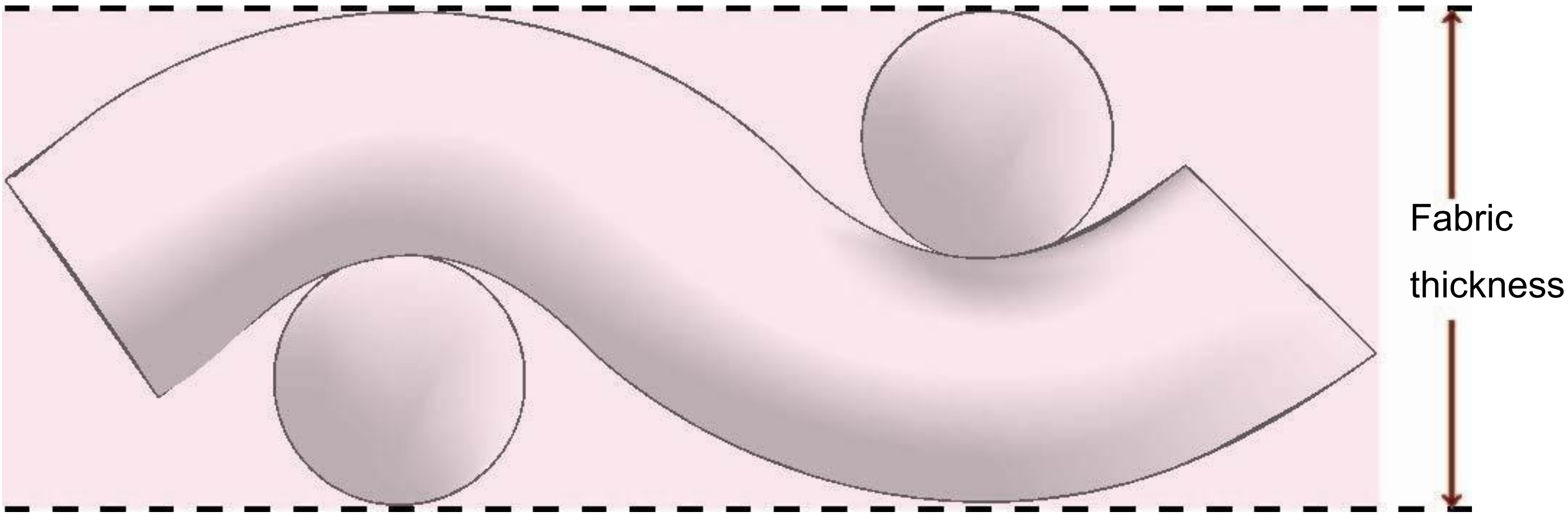


OPA% = open area / (thread area + open area)

The higher OPA % for a given mesh count corresponds to wider open area. Wider openings using a thin S thread provides better resolution power.

Fabric Thickness (FT)

- *Fabric thickness is determined by* ***Thread diameter, Weaving patterns Heat-setting conditions.***



For finer resolution, thinner meshes are preferred. Thicker meshes interfere more with images, causing dot loss, limiting printable line width and dot sizes in four color process printing.

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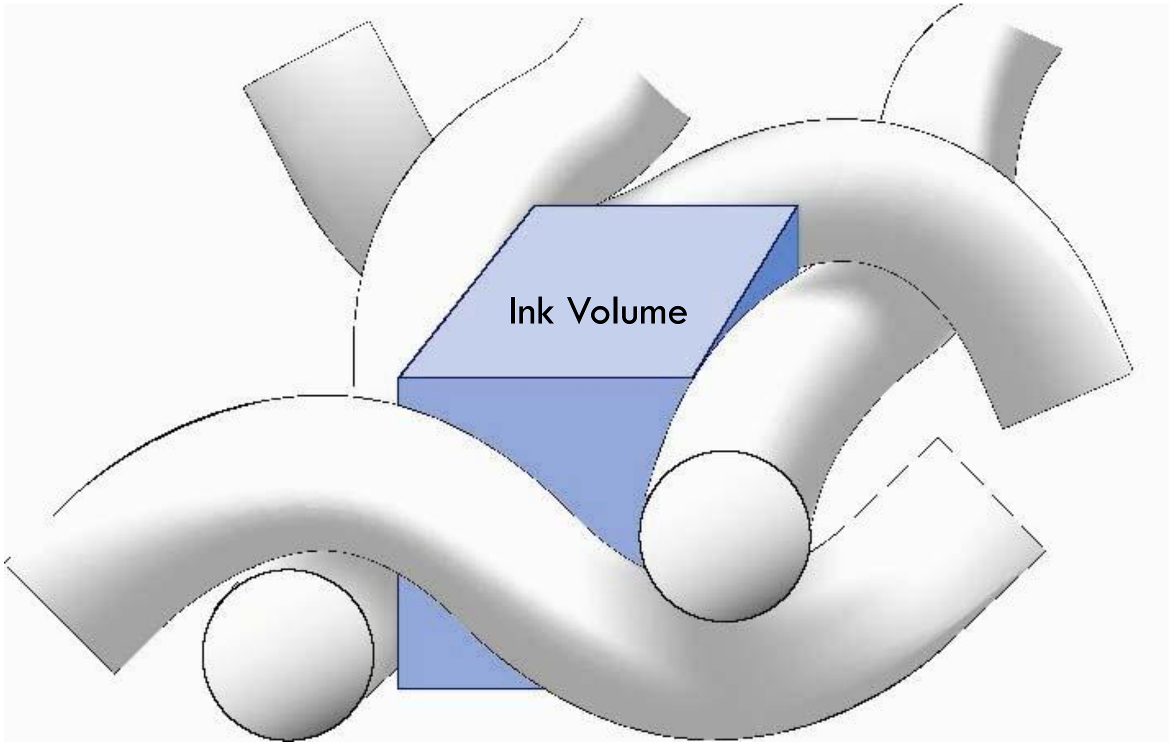
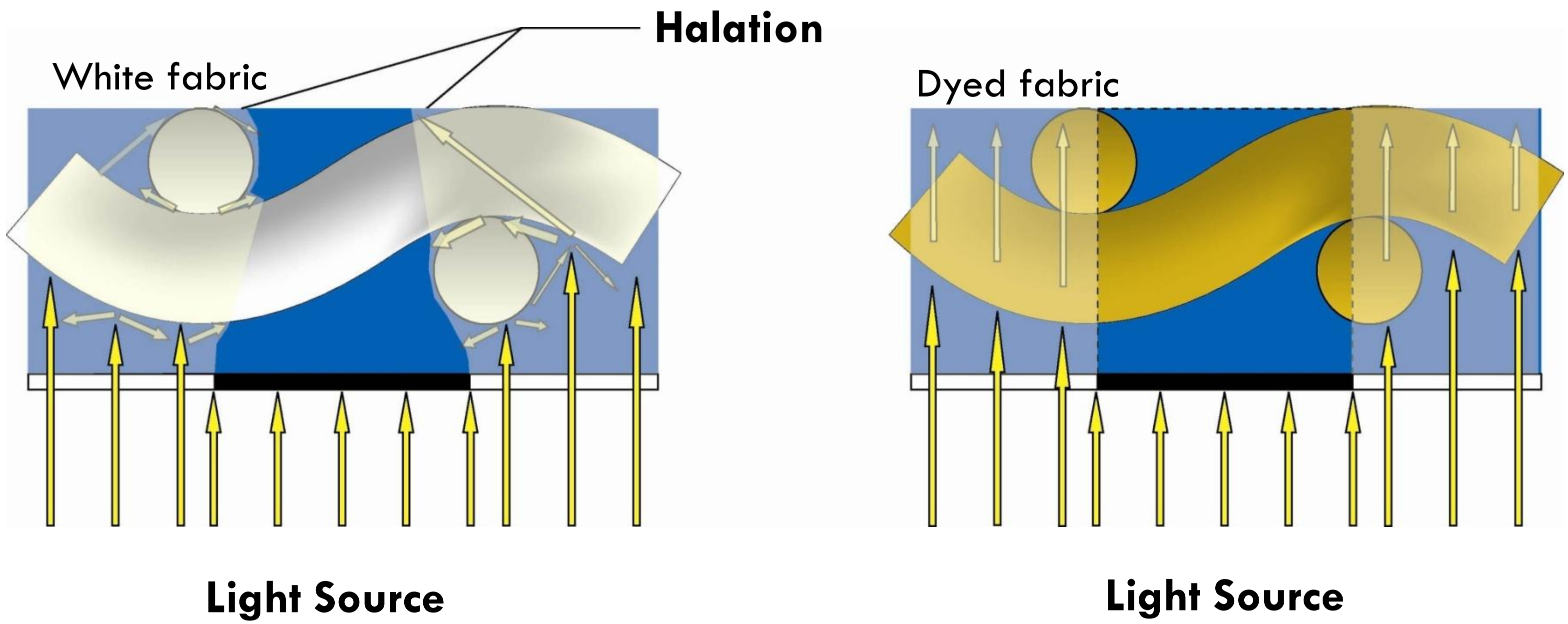
Ink Volume (TIV)



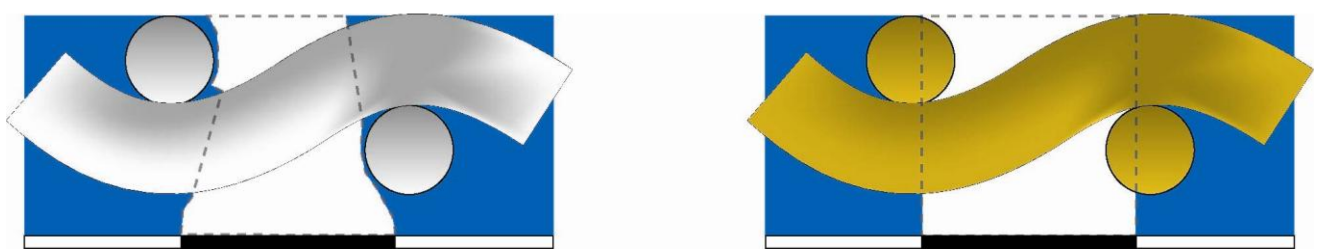
Theoretical ink volume (TIV) is shown in the above diagram. Actual ink volume printed on substrates may vary depending on many variables such as mesh count & type, tension level, ink flow characteristics, substrates, off contact or printing speed and so on.

Relations - Fabric Color & Exposure

For finer line or halftone art, use yellow colored mesh.



After image development



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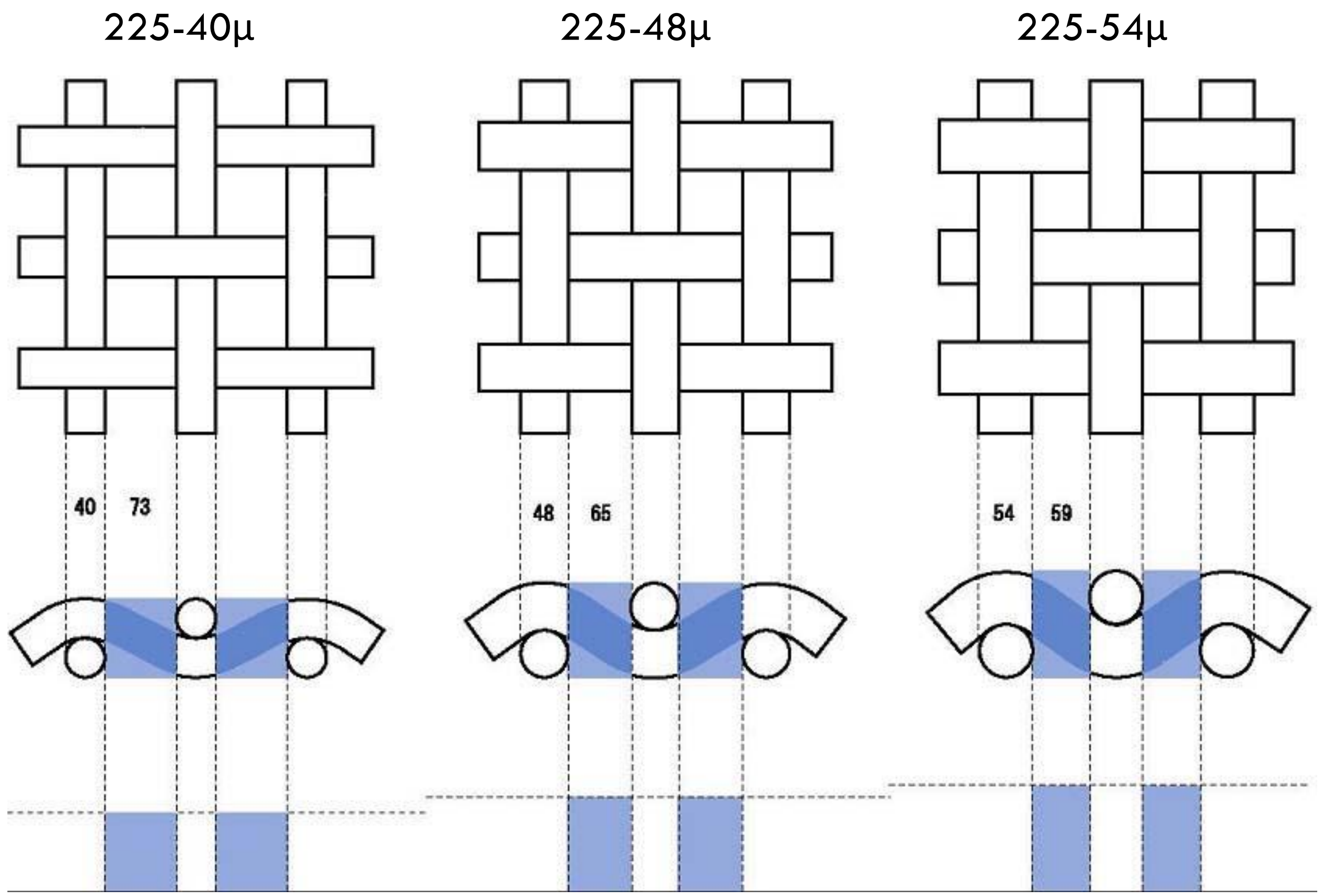
Relations- Ink volume & Thread diameter



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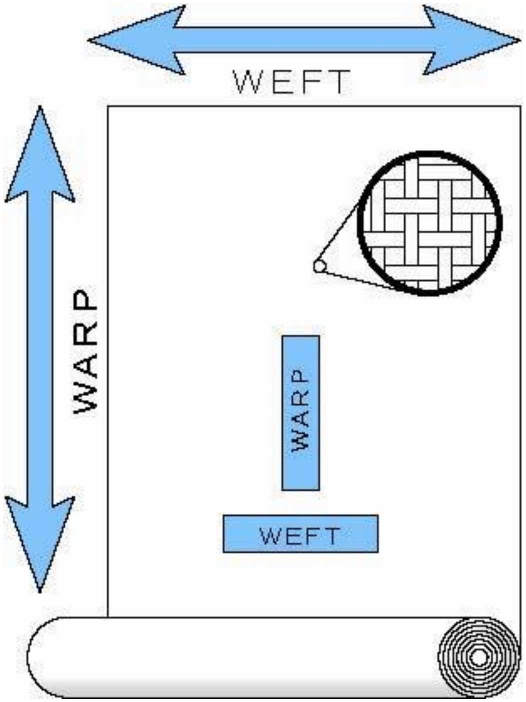
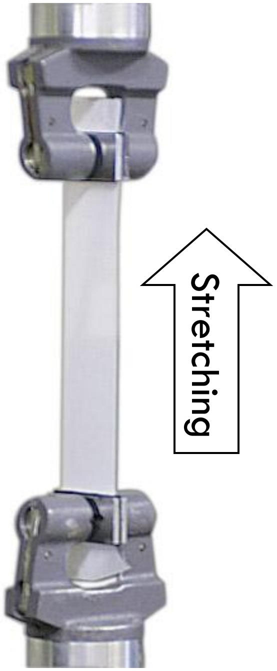
Stress Strain Test – Physical Strength

Physical strength is measured by an internationally standardized method called SS testing. A strip of woven mesh is stretched by the testing instrument. High quality standard woven mesh demonstrates equal stretch behavior in elongation % between warp and weft directions.





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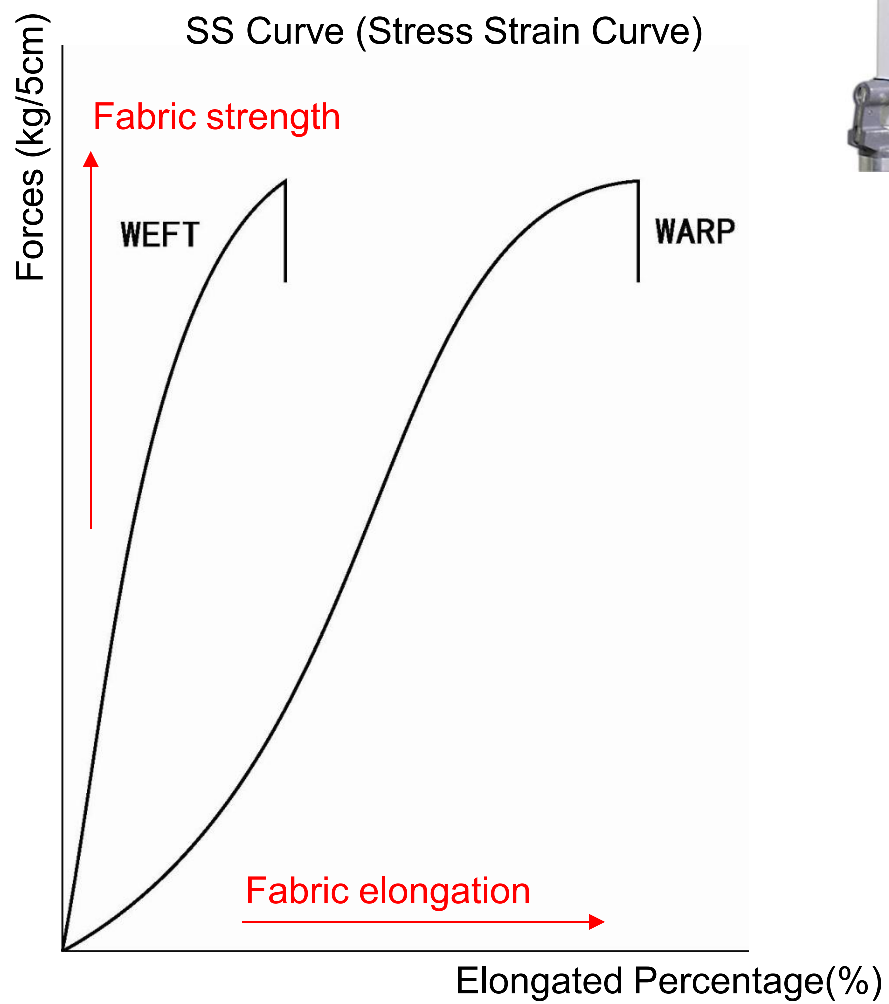
Measuring SS Curve

Stress Strain (SS) test is performed on both warp and weft directions. Testing provides the relationship between elongation % and loaded forces.

More gaps in graphs between warp and weft indicate that the woven mesh tends to behave differently during stretching or printing process.



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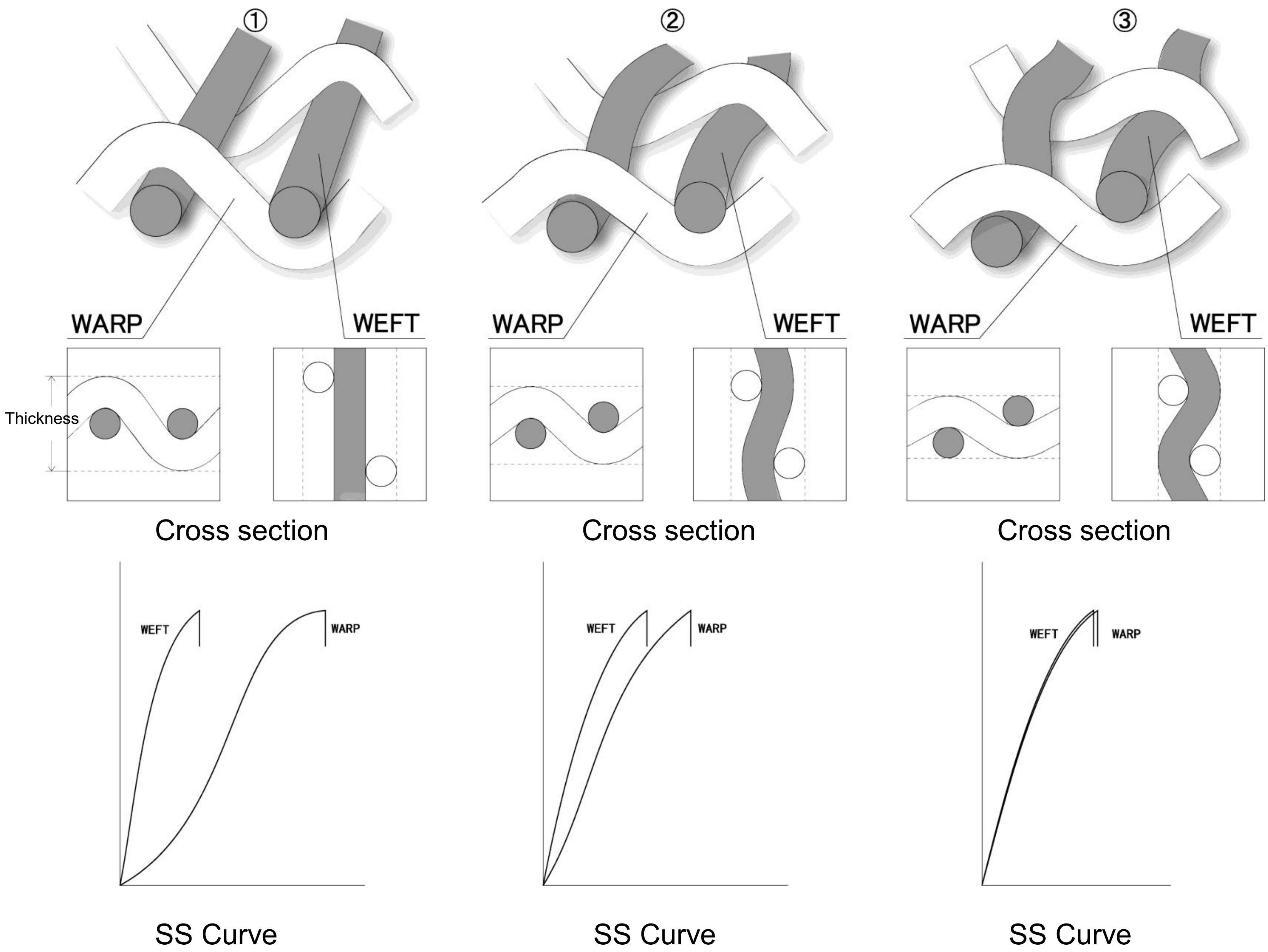

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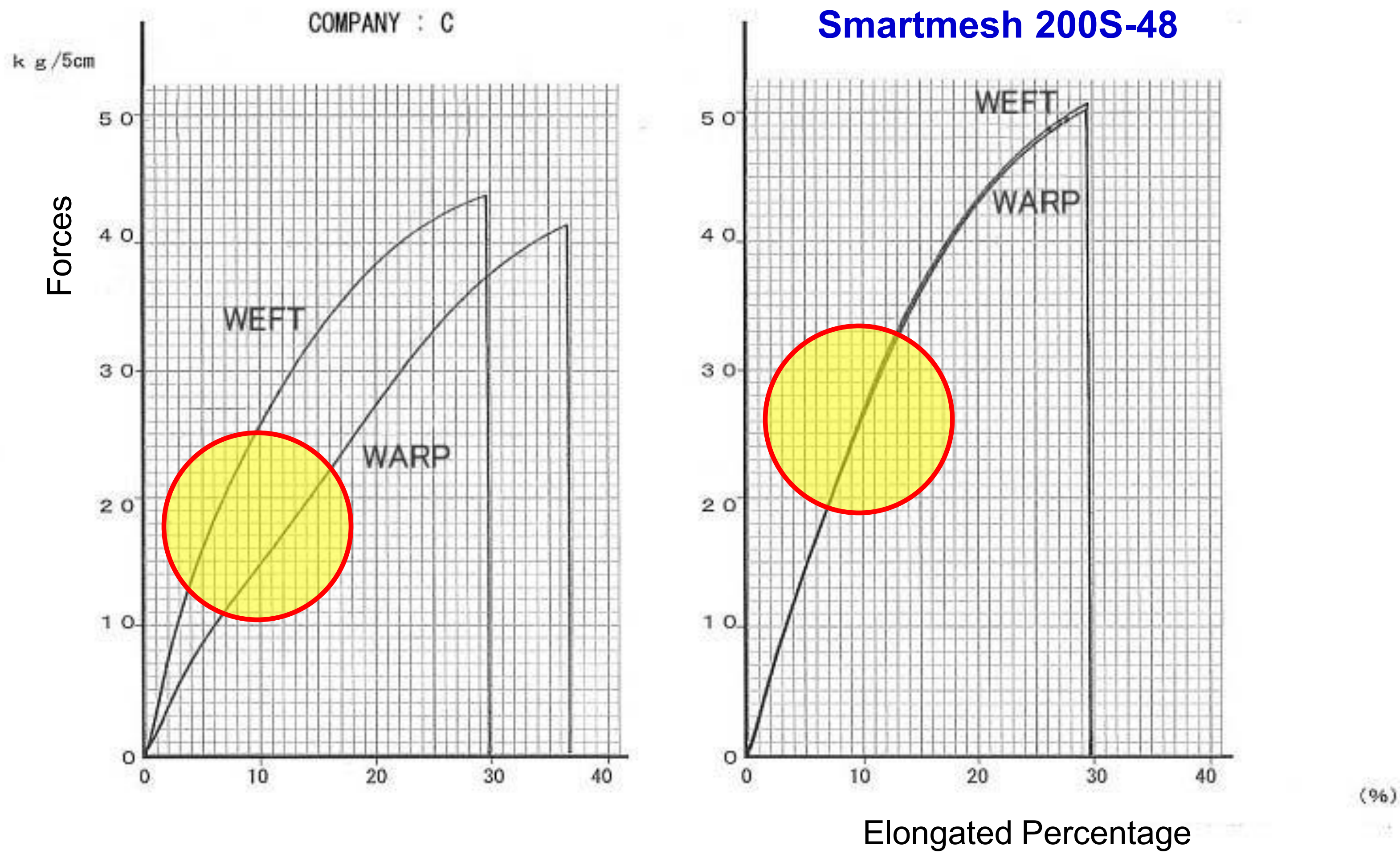
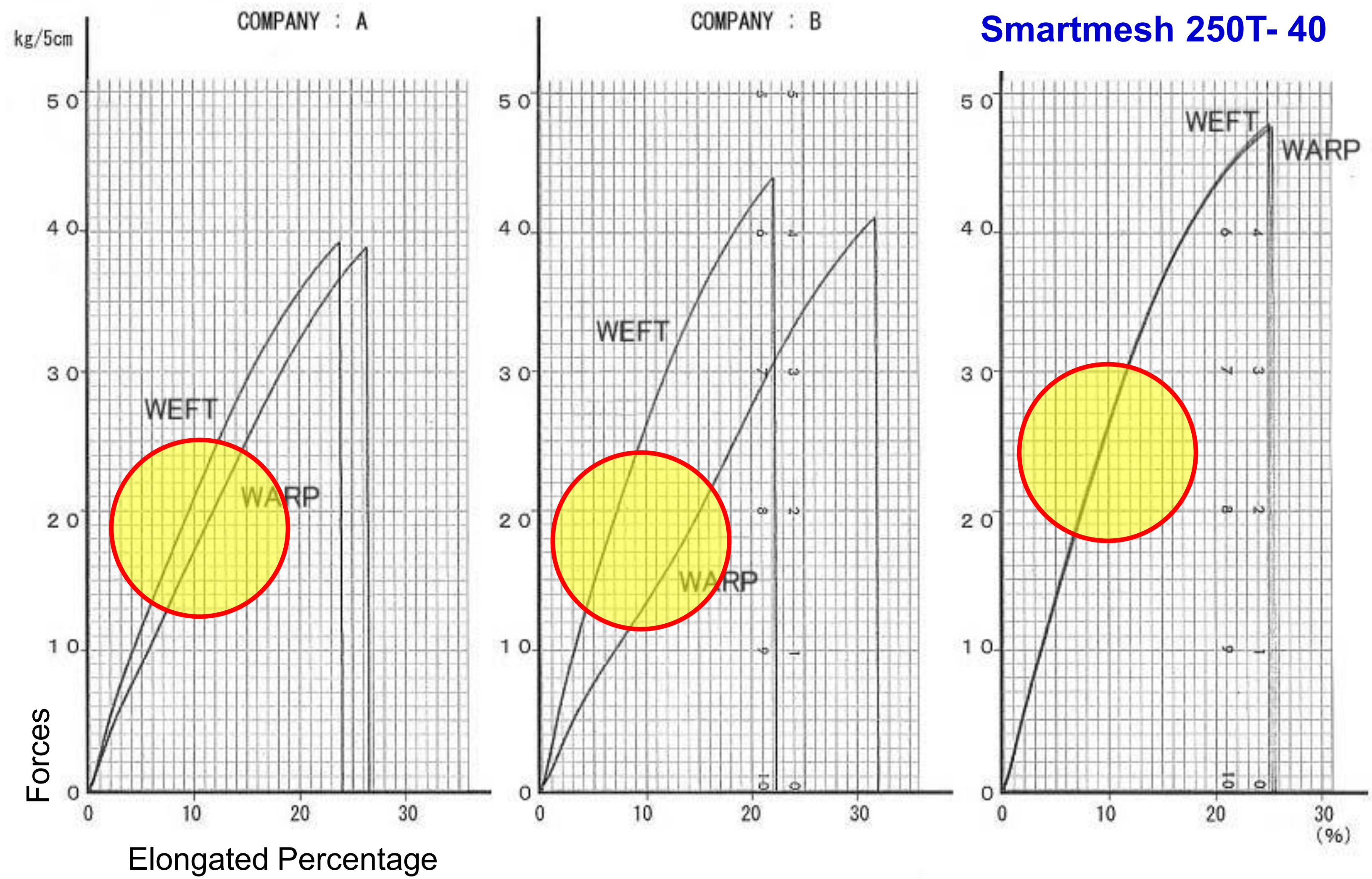
Elongation & Stretching Forces



Data values measured by Nittoku Laboratory. Not absolute values guaranteed.



Different behavior between warp and weft threads would cause different mesh count values after stretching or during printing. Mesh moiré also frequently occurs in unbalanced warp and weft.

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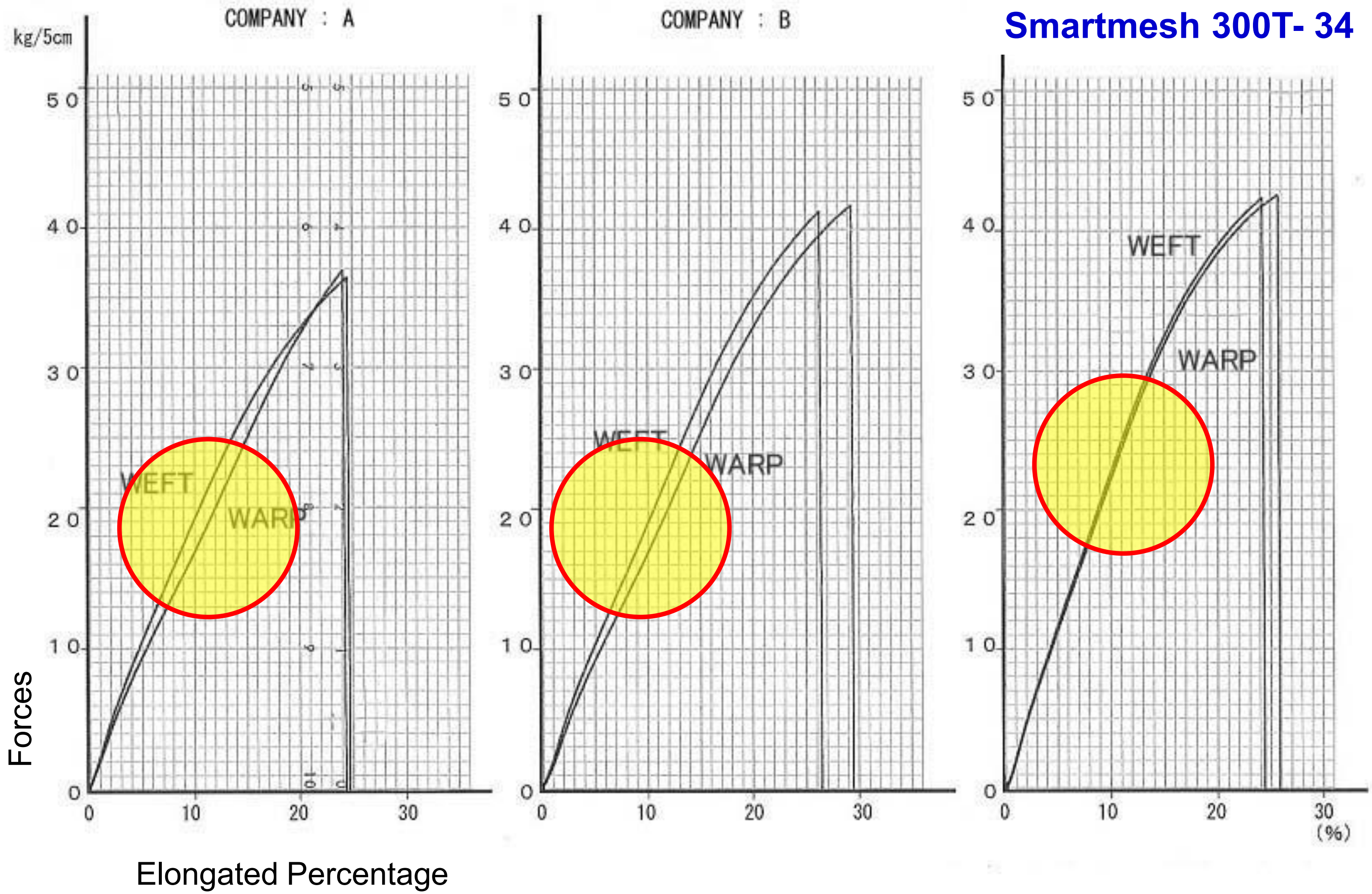
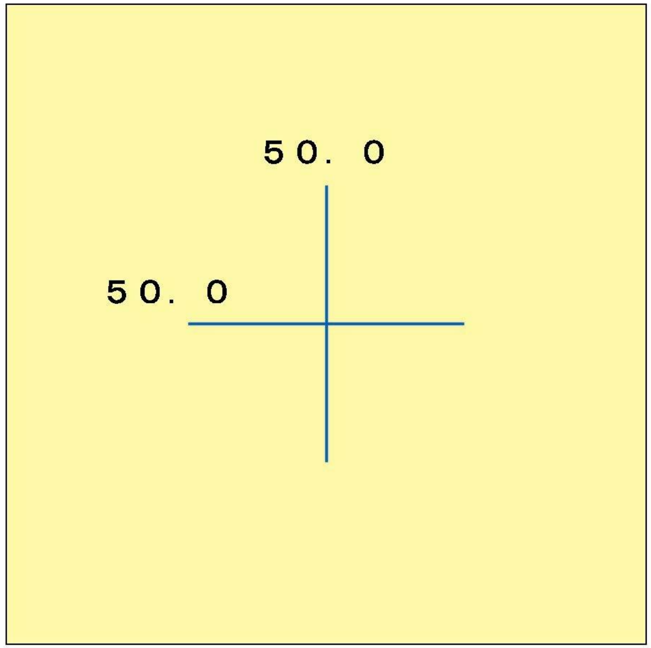


COMPANY : A
COMPANY : B
Smartmesh 300T- 34
kg/5cm
50
40
30
20
10
0
WEFT
WARP
0
10
20
30
(%)
Forces
Elongated Percentage

250T-40µm Elongation Comparison



		Before stretching		Stretched to 30N	
COMPANY:A 250-40μ	WARP	５０．０	→	５２．７０	(cm)
	WEFT	５０．０		５２．９５	
COMPANY:B 250-40μ	WARP	５０．０	→	５４．９５	(cm)
	WEFT	５０．０		５２．６０	
NITTOKU Smartmesh-P 250T	WARP	５０．０	→	５２．３０	(cm)
	WEFT	５０．０		５２．２５	

Elongation % is measured at a 30N/cm tension level. A 50cm (19.69inch) line is drawn on each direction of the mesh before stretching. The mesh is then stretched to 30N/cm. Then the linear length of the original 50cm line is re-measured. The increase in the line length represents the elongation degree.

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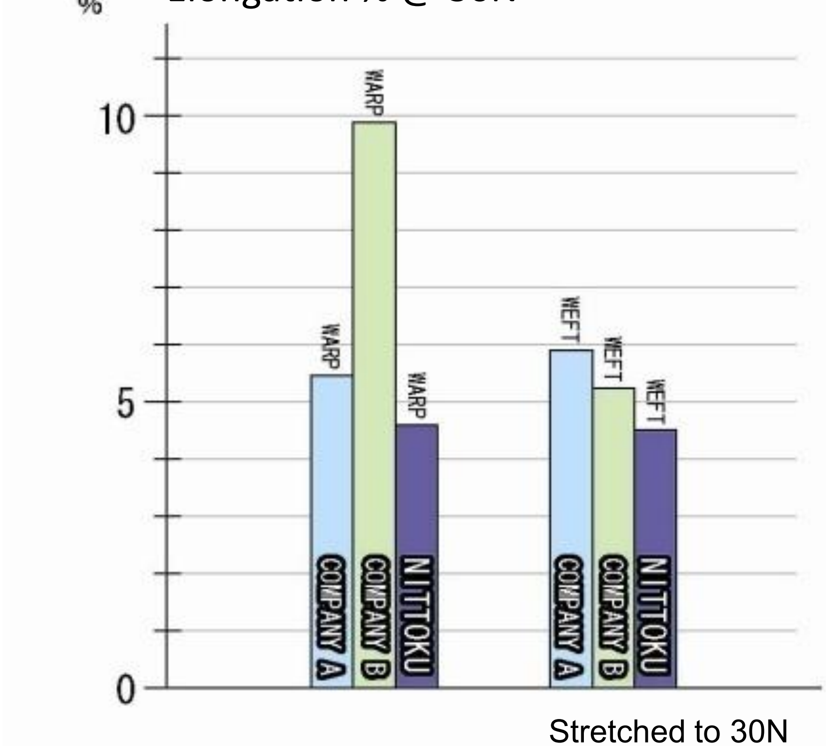
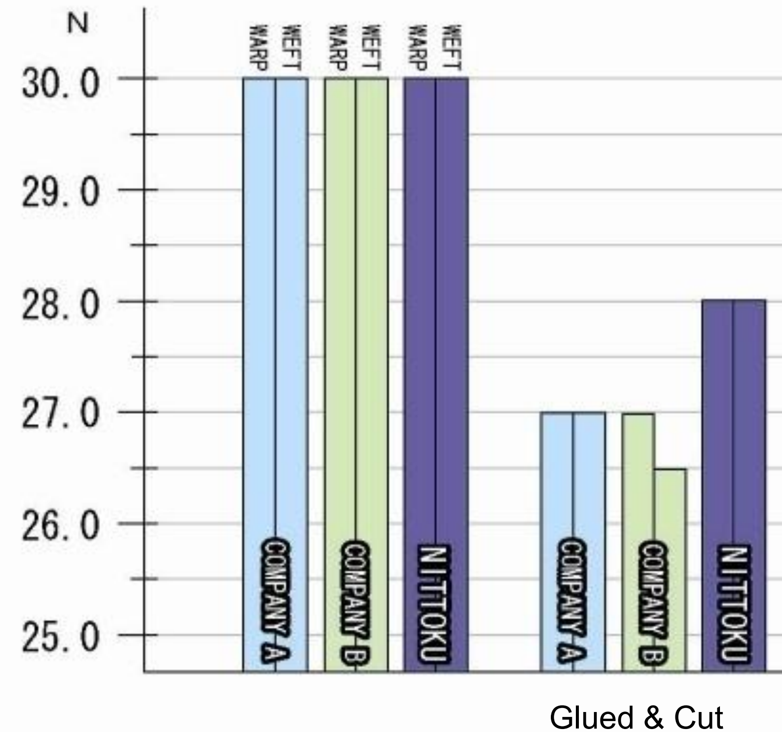
250T-40µm Elongation & Tension Loss

Elongation % @ 30N



Tension level after cut & release



COMPANY A 250-40µ	WARP 5.4	WEFT 5.9	(%)	WARP	30.0	→	27.0	(N)
				WEFT	30.0		27.0	
COMPANY B 250-40µ	WARP 9.9	WEFT 5.2	(%)	WARP	30.0	→	27.0	(N)
				WEFT	30.0		26.5	
SmartMesh **250T-40µ**	WARP 4.6	WEFT 4.5	(%)	WARP	30.0	→	28.0	(N)
				WEFT	30.0		28.0	

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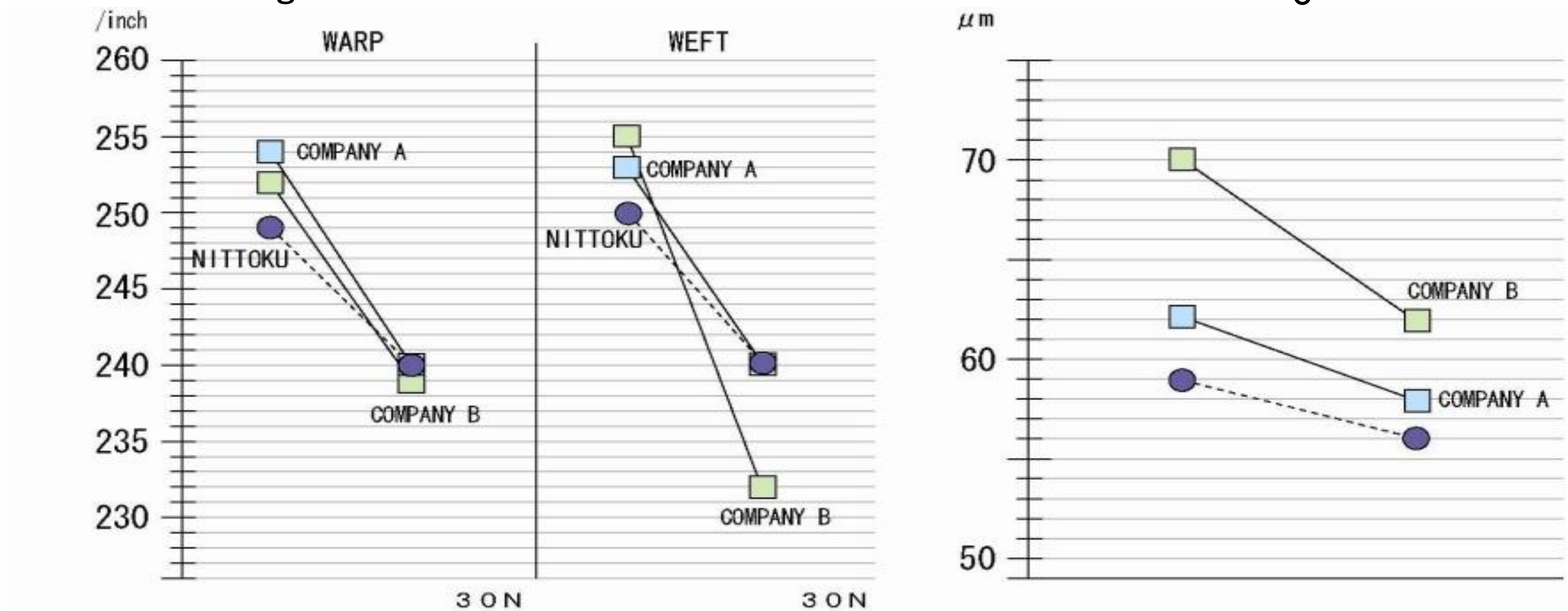
Changes in Actual Mesh Count & Thickness (250T-40μm)

Change of mesh count

Thickness change



	WARP	WEFT				
COMPANY A 250-40μ	254 → 240	252 4 → 240	(/inch)	62 → 58	(μm)
COMPANY B 250-40μ	252 → 238 40	254 6 → 232	(/inch)	70 → 62	(μm)
NITTOKU 250-40μ	248 50 → 240	250 → 240	(/inch)	59 → 56	(μm)

Mesh count & Thickness changes before tensioning and after tensioning to 30N/cm.

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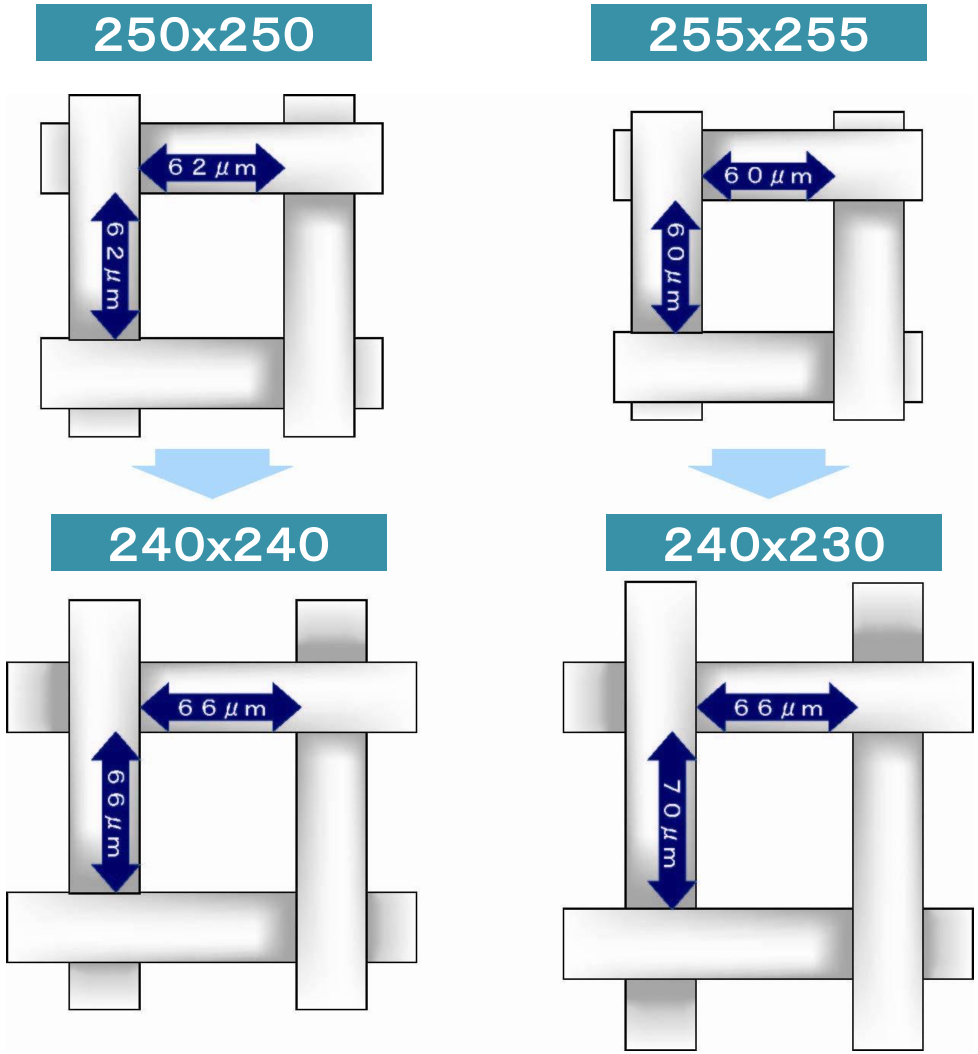
Stretched Mesh Count & Mesh Openings(250T-40μm)



Before Stretching

After Stretching to 30N/cm

Uneven mesh count on warp and weft after stretching may cause mesh interference with images. SMARTMESH elongates proportionally in warp and weft directions assuring square openings.

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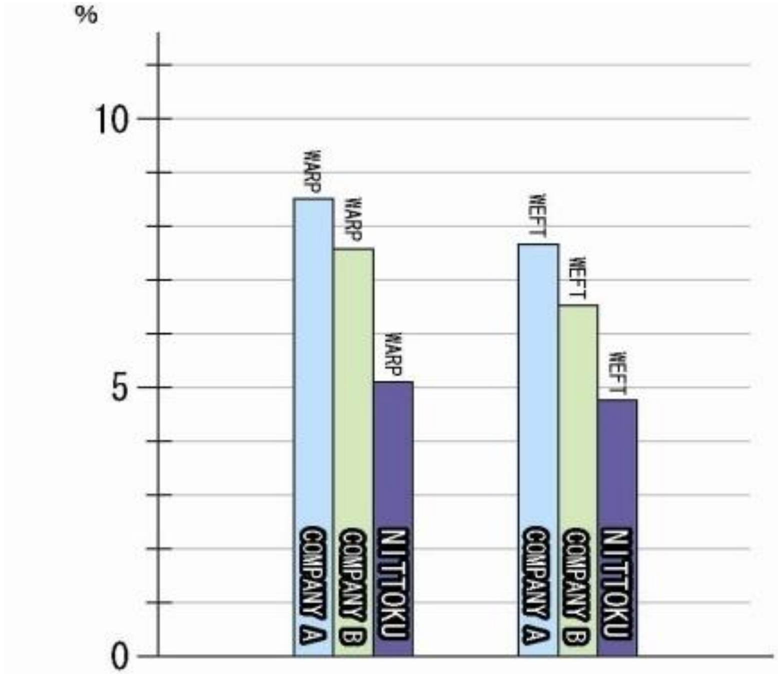
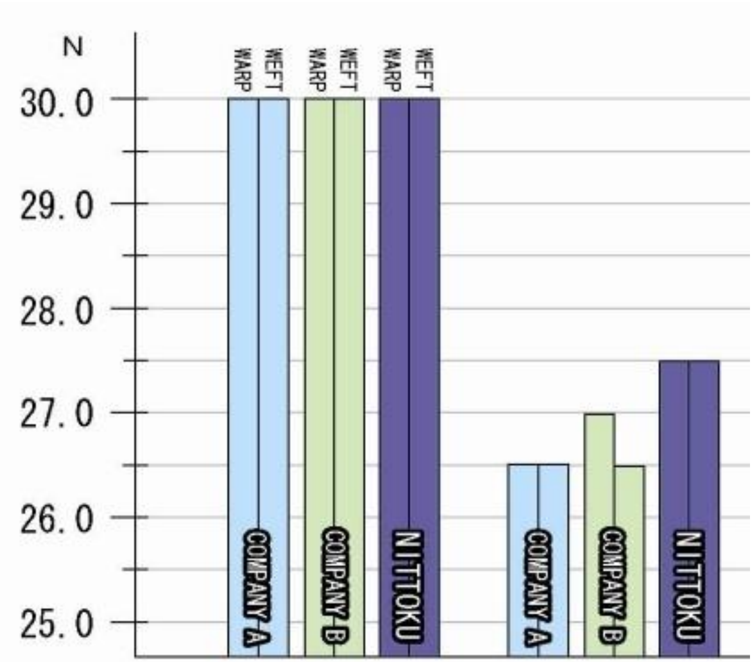
300T-34µm Elongation & Tension Loss

Elongation % @ 30N



Tension level after cut & release



COMPANY A 300-34 µm	WARP 8.5	WEFT 7.7	(%)	WARP	30.0	→	26.5	(N)
				WEFT	30.0		26.5	
COMPANY B 300-34 µm	WARP 7.6	WEFT 6.5	(%)	WARP	30.0	→	27.0	(N)
				WEFT	30.0		26.5	
SmartMesh 300T-30µ	WARP 5.1	WEFT 4.8	(%)	WARP	30.0	→	27.5	(N)
				WEFT	30.0		27.5	

Stretched to 30N

Glued & Cut

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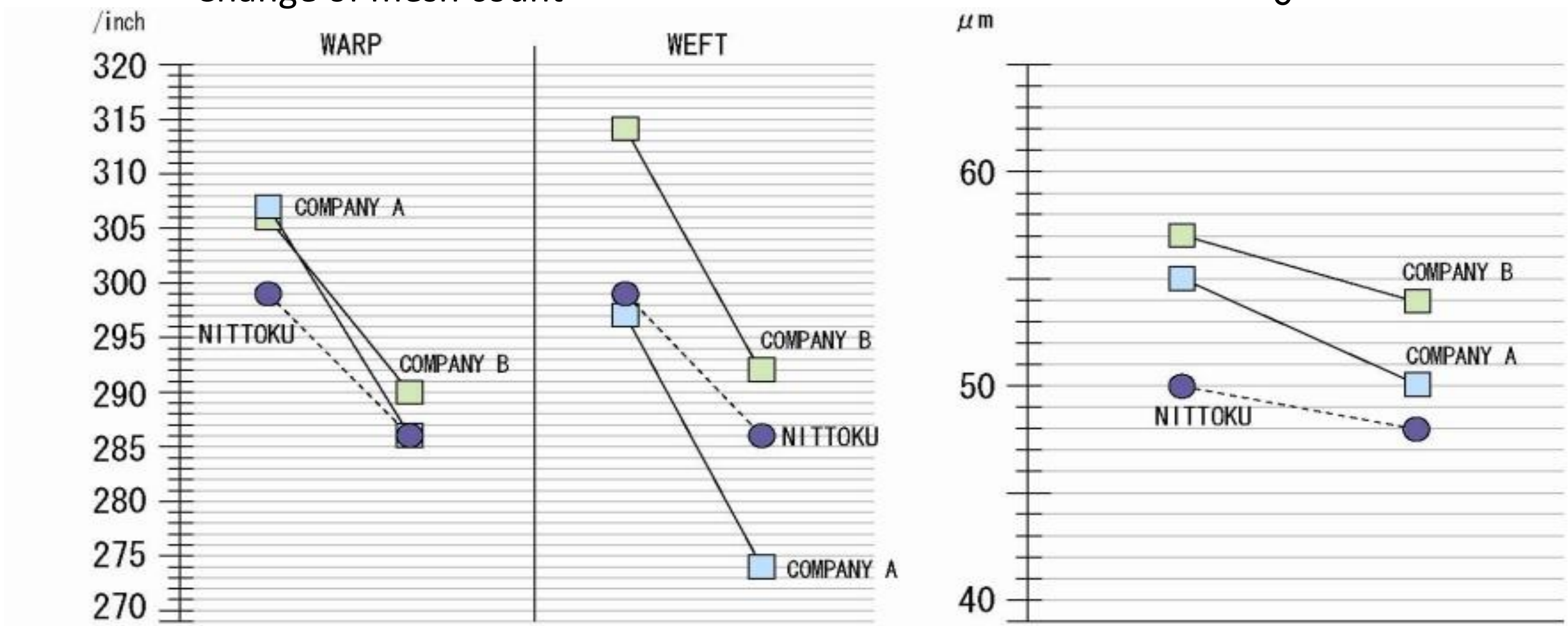
Changes in Actual Mesh Count & Thickness (300T-34µm)

Change of mesh count | Thickness change



	WARP			WEFT						
COMPANY A 300-34µm	306 8	→	284 6	296 8	→	274	(/inch)	55	→	50 (µm)
COMPANY B 300-34µm	306	→	288 90	314	→	292	(/inch)	57	→	54 (µm)
300-34µm	298 300	→	286	298 300	→	286	(/inch)	50	→	48 (µm)
	No Tension		Tension @ 30N	No Tension		Tension @ 30N		No Tension		Glued & Cut

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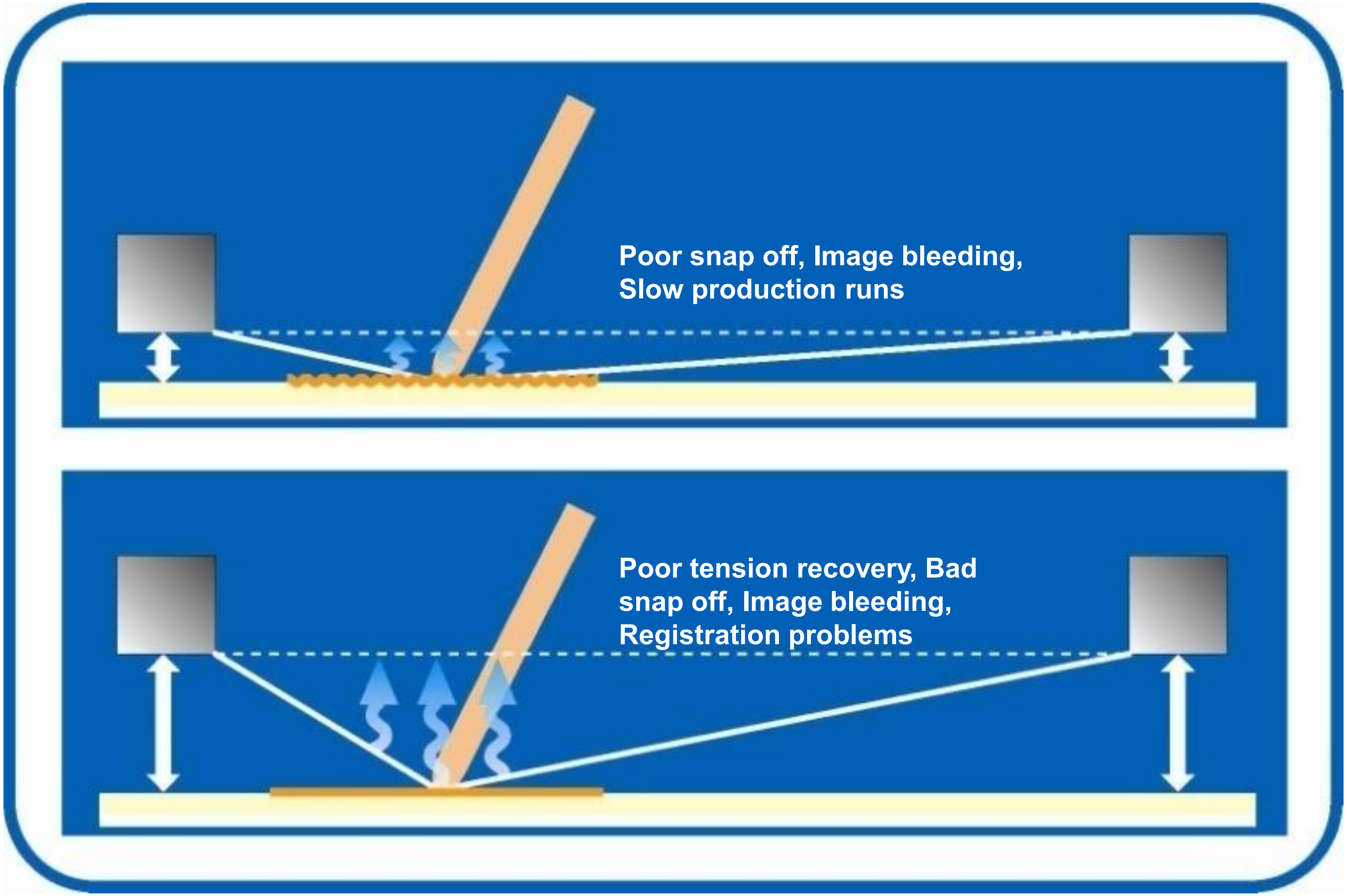
Tension & Off contact - 1

Low Tension & High Elongation Mesh



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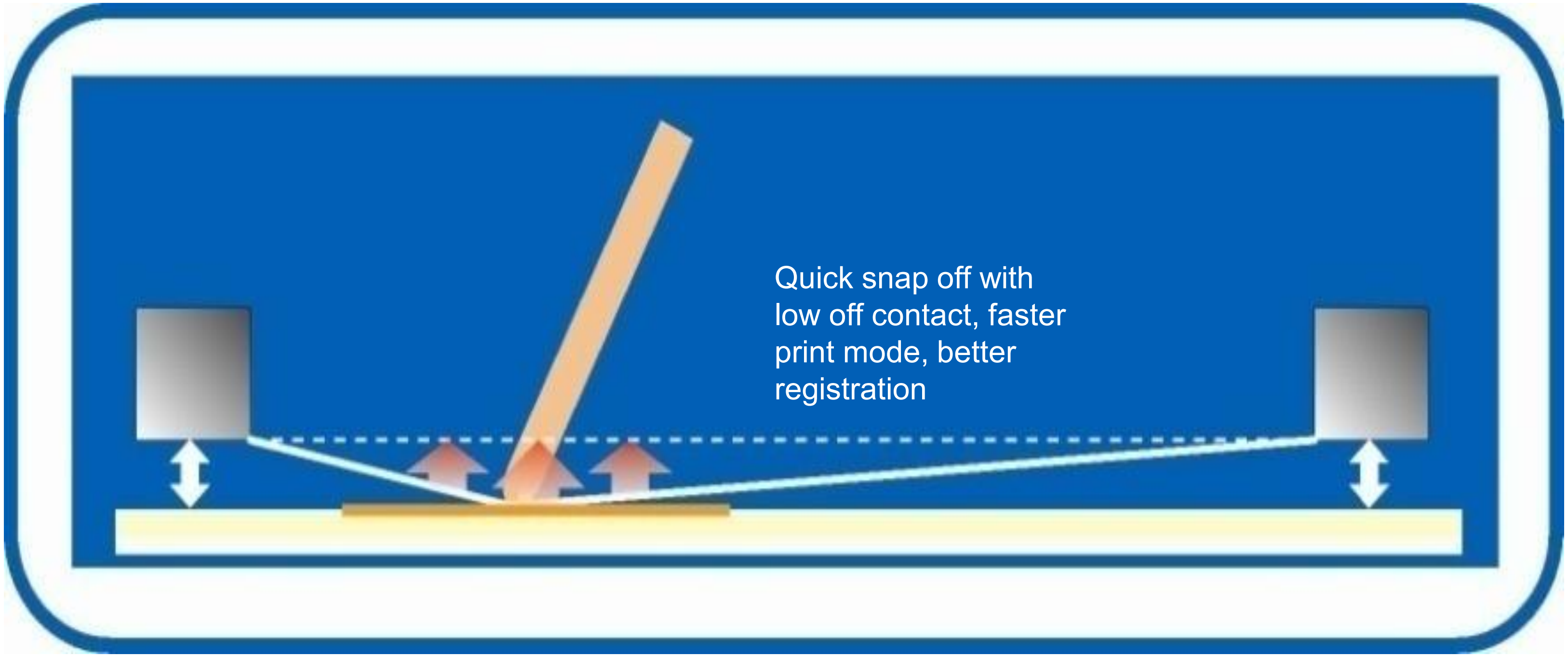
Tension & Off contact - 2

Low Elongation & High Tension Mesh



Often high tension is a buzz word for many printers. But a low elongation % is another important aspect. Initial high tension yet increasing elongation % during printing will result in registration problems, image distortion, slower production run.

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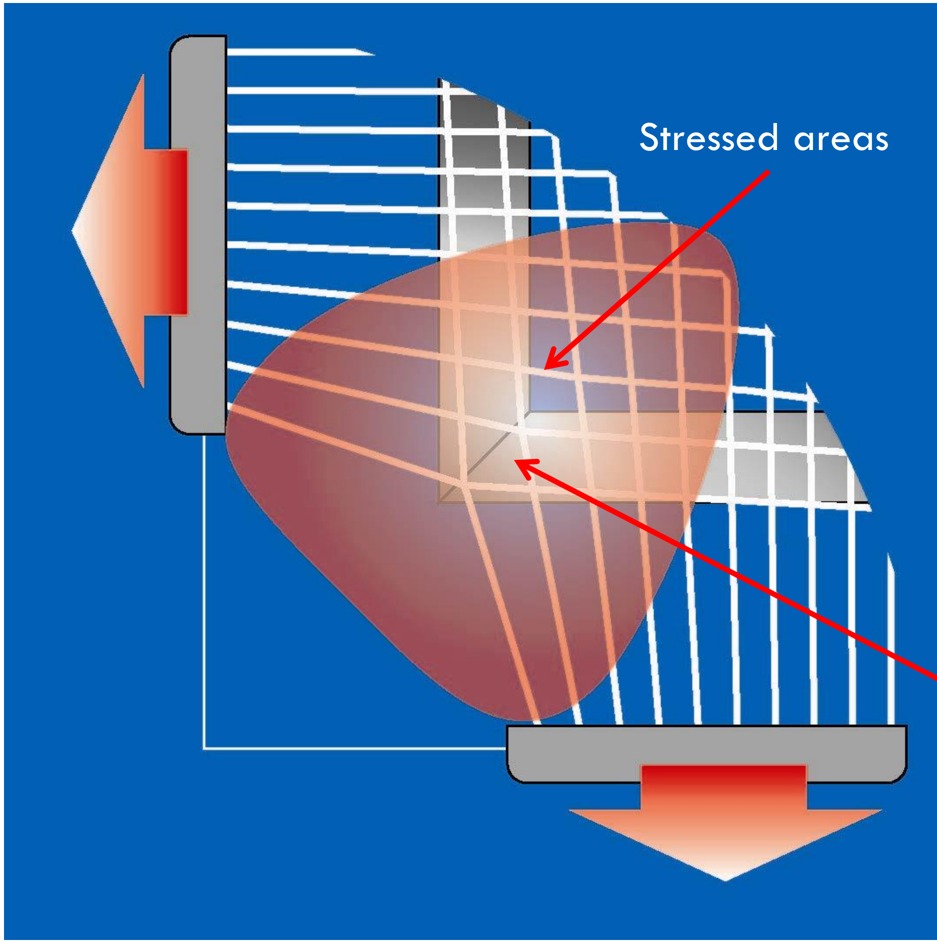
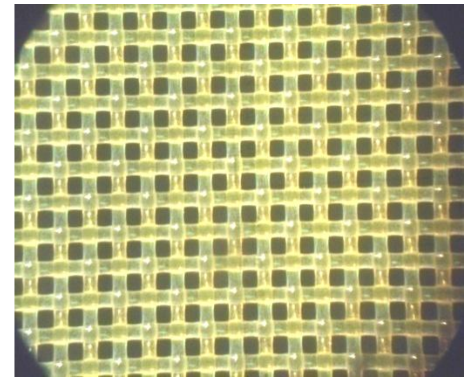
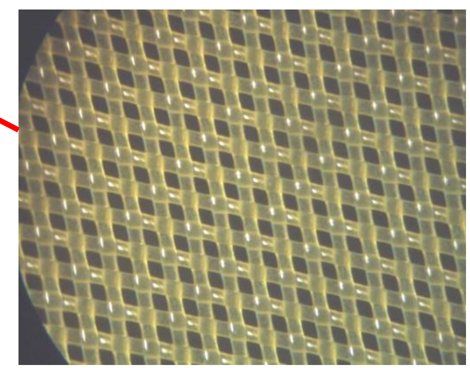
Stress on corners





Tensioned Mesh without Stress

Tensioned Mesh with Stress



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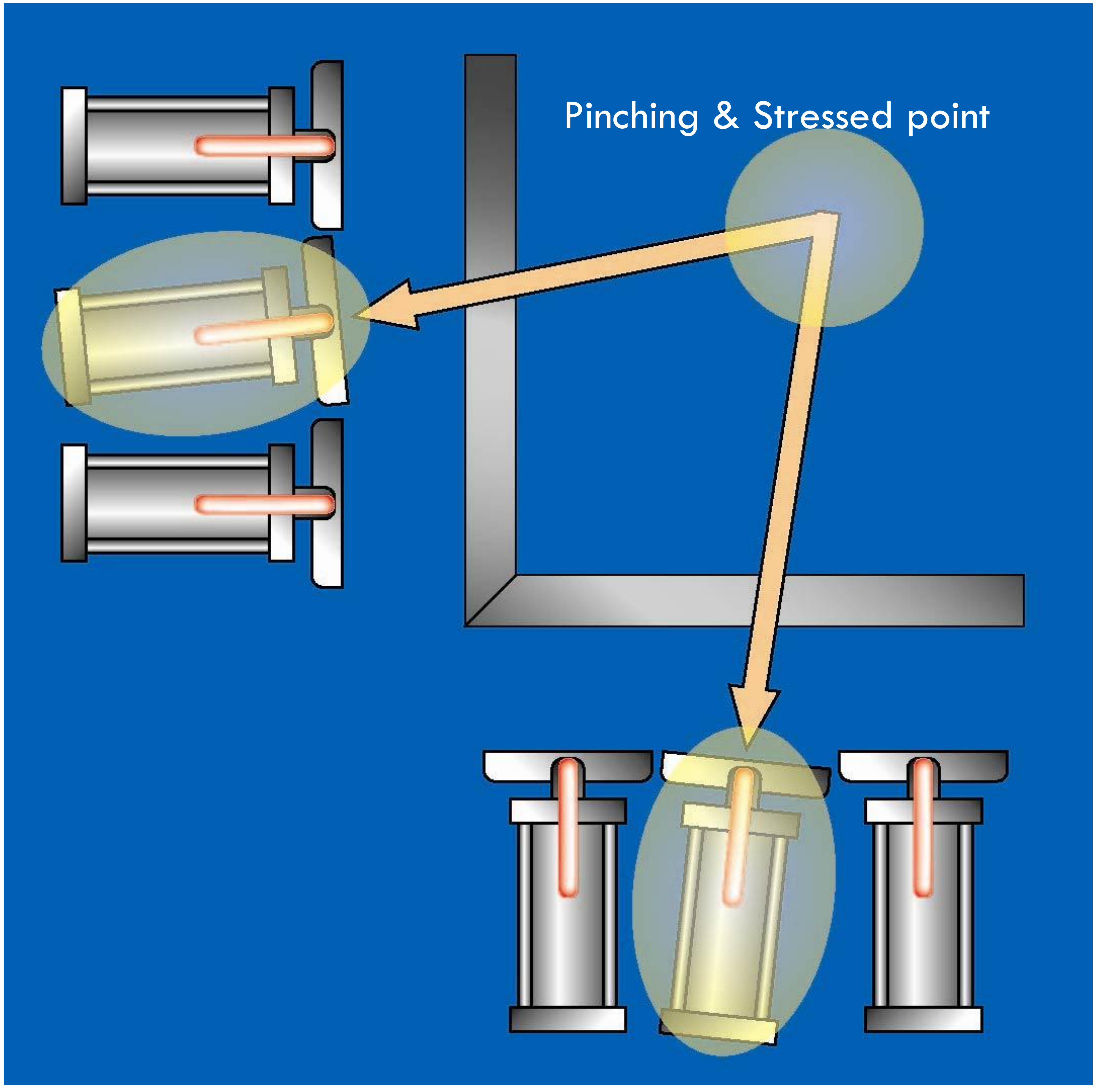
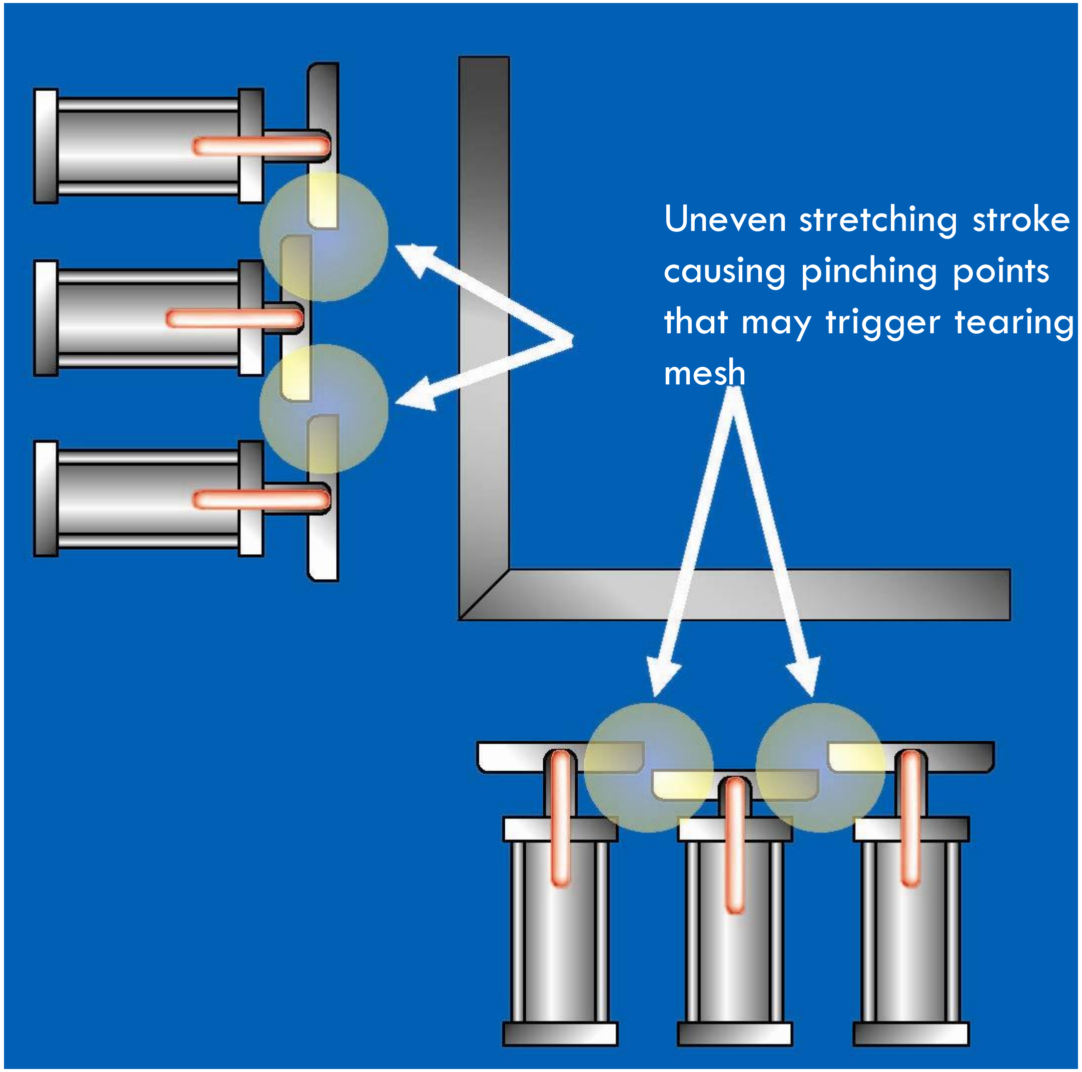
Common Problems in Stretching - Misalignment of clamps



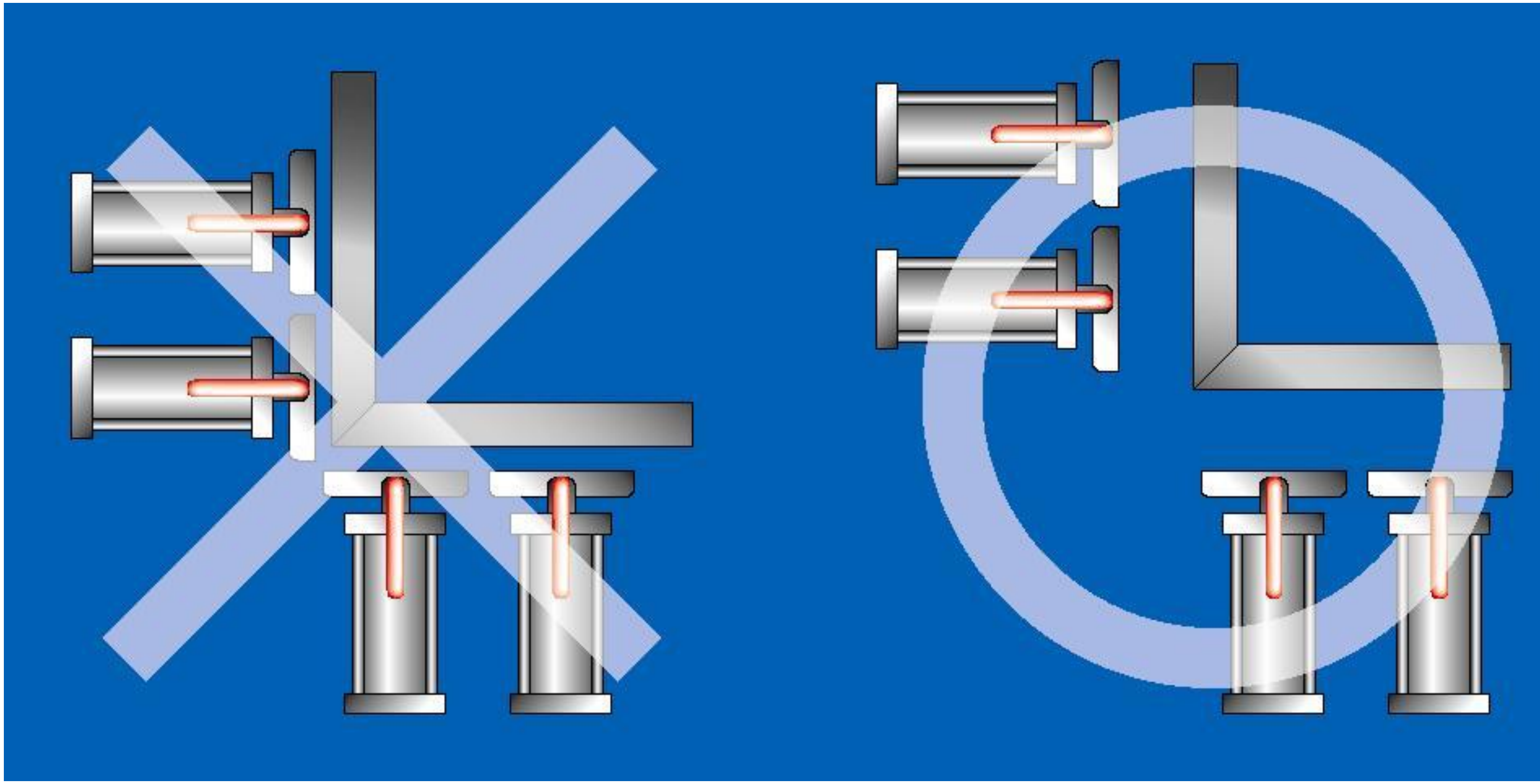
Misaligned clamps may cause pinch points and cause excessive stress on certain areas. Mesh can be ripped during or after stretching.

Common Problems - Uneven Stretching Stroke Mechanism



Make certain that each cylinder clamp is in good working condition. Uneven or unsynchronized stretching pull will cause mesh to rip due to excessive stress.

Proper Configuration for Clamp Setting



Proper spacing between clamps and frames is required. Clamps set too closely to frame corners will cause many pinch or stress points that may cause mesh ripping.

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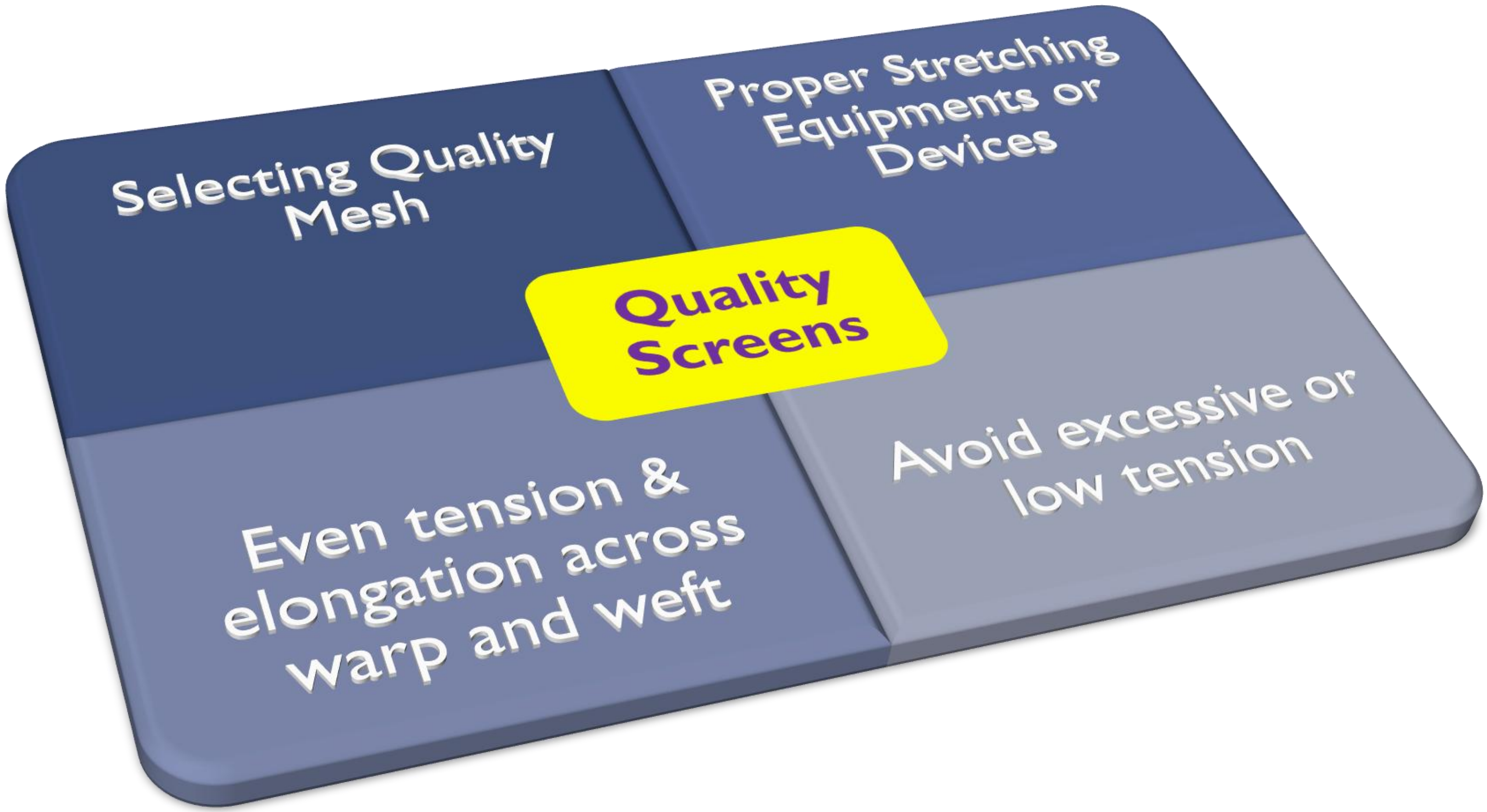
Quality Screens – Control Factors



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Technical Session

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Techniques and Tips

Preference towards higher tension should be re-examined closely based on press set-up such as squeegee or flood bar pressure and print speed. Also off-contact can affect mesh behavior extensively during contact and snap-off mechanism. Excessive tension is not recommended.

The advantage of roller frames can be maximized if automatic set-up table allows roller frames stretching warp or weft side on both end directions simultaneously. Incremental tensioning on one end over the other end may cause unwanted pinching points or uneven tension across the print area.

When using a pneumatic stretcher, be certain that stretching forces over warp and weft directions are loaded in proportion to the width/length ratio. When air pressure (pulling forces) are not proportionally adjusted, poor tensioning or excessive stress on one side may cause mesh distortion and mesh ripping.

Using wooden frames or thin profile aluminum frames may cause warping on one side. Pay extra attention to the wall profiles of aluminum frames. Warped wooden or aluminum frames should be replaced.

Thicker threads are stronger, is a myth. Thread strength is measured by the weight of threads and resistance to physical stress.

Using a poor quality glue may cause mesh slipping during printing process.

Techniques and Tips

Leave at least 2 inches or wider space between both insides of frame and squeegee ends so that no excessive stress is loaded along squeegee lines during printing strokes.

Spend some time for evaluating tension level at various different stages; stretching, glue and cut-off, before printing, during printing, after printing and during or after a storage period. Contact Murakami to obtain more technical support if any improvements should be made.

For better printing quality or a successful long run production, remember that the mesh is one of the most important components to a quality stencil. With poor mesh memory (in elongation and tensile strength), the printing process can be very costly and face a variety of different irreparable problems on the production run. Always use a quality mesh with a proper technique and devices.

In essence, elongation is more important than tension level itself. Do not fool yourself by trying to obtain inadequately high tension on the stretching step only to lose more tension next day or on the press run.

A rapid tensioning technique is recommended but only with a well designed stretcher. Poor cylinders or stretchers are not geared up for rapid tensioning. Please consult with Murakami staff.

For faster and easier ink penetrations, use SmartMesh S threads over conventional threads. S threads allow printers to avoid multiple pass with certain art and inks.

Common Problems & Troubleshooting Guide

Problems	Causes	Solutions
Dot Loss	*Dot size too small* *Bad film positives* *Overexposure* *Inadequate washout*	*Eliminate 0~5%, 95~100% dots from original arts. Increase mesh count or use thinner thread mesh.* *Use a quality film with 3.0 dMax +* *Re-check exposure time.* *Avoid too much of water pressure.* *Reduce washout time when developing.*
Tension Drop	*Too much off contact* *Improper Gluing* *Too vertical squeegee angle set-up*	*Reduce off contact distance.* *Avoid improper glues, causing slipping.* *Avoid stiff squeegee angle.* *(Also leave the screen 10+minutes after gluing step or stretching)*
Mesh Ripping	*Poor corner softening* *Creating pinching or excessive stress points* *Inadequate tensioning* *Poor mesh quality*	*Loosen corners at initial mesh locking.* *Be certain to avoid misalignment of stretching bars, clamps, retensionable frames. Free from knick and cuts.* *Obtain proper tensioning skills.* *Avoid low quality mesh.*

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Common Problems & Troubleshooting Guide

Problems	Causes	Solutions
Mesh Moiré	*Inadequate combination of mesh count & art* *Inaccurate dot angles*	*Select a right mesh count/thread. Use 4.5 times of halftone line count as your mesh count.* *For garment thin process, use one of 7, 7.5, 22, 22.5 angles. For process work, apply other angles that works the best with mesh count.*
Poor Tension	*Poor quality mesh* *Inadequate devices or equipments* *Bad frames*	*Use a quality mesh.* *Re-examine stretching set-up, parts, cylinders, clamps causing mesh ripping.* *Avoid warped and damaged frames*
Poor Print Registration	*Unbalanced mesh tension* *Screen unparallel to press bed* *Hard durometer squeegee, pulling mesh on strokes* *Registration on films*	*Stretch the screen evenly across areas.* *Double-check if lined up parallel.* *Avoid 90 or hard durometer squeegee.* *Be certain that film positives are generated with accurate registration.* *Certain inkjet films or direct imging devices requires extra attention.*

Right questions to ask

Self Questionnaires	*Y/N*
Do we see frequent mesh ripping on our production floor? If so, do we know what causes the problem?	
Based on what criteria, are we choosing mesh count, thread diameters? Any guidelines are set up internally?	
What is a standard tension level on screens? Is there any standardized techniques or guidelines provided to stretching staffs in charge?	
Are we taking any standard staging steps during stretching?	
Are we cutting off fabrics immediately after gluing mesh on frames?	
Do we have a proper scope to measure mesh openings and thread diameter if needed?	
Have we ever checked the elongation performance of mesh during stretching or after printing?	
Do we actually re-tension the screen if necessary? If so, how do we do it? Any guidelines or trainings are updated?	

Right questions to ask

Self Questionnaires	*Y/N*
Does our art department understand that there are a limitation on printable dots? If yes, what is the standards of selecting printable dots and mesh count?	
Are we facing frequently a registration problem? If so, how do we resolve the challenge?	
What is the expected tension loss between each steps after stretching? Are there any screens showing below 16 N/cm after printing?	
Are we experiencing mesh ripping on squeegee lines? Are we setting squeegee ends too close to inside of frames causing excessive stress?	
Do we have to run multiple passes on base color to transfer inks on substrates? Have we tried a thinner thread mesh?	
Are we degreasing the mesh prior to coating emulsions?	
Are we periodically check all the parts and equipments in a good working condition? Knick, damages, vacuum pressure, even bars, frames and others.	

Right questions to ask

Self Questionnaires	*Y/N*
Have we examined how much of materials and time were lost due to mesh related issues	
Are we facing frequent registration problem? If so, how do we resolve the challenge?	
What is the expected tension loss between each step after stretching? Are there any screens showing below 16 N/cm after printing?	
Are we experiencing mesh ripping on squeegee lines? Are we setting squeegee ends too close to inside of frames causing excessive stress?	
Do we have to run multiple passes on base color to transfer inks on substrates? Have we tried a thinner thread mesh?	
Are we degreasing the mesh prior to coating emulsions?	
Are we periodically checking all parts and is the equipment in a good working condition? Knick, damages, vacuum pressure, even bars, frames and others.	

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Review & Summary

- *Selecting a quality mesh and understanding how it works is the key to a successful printing operation.*
  Compromising with lower standards or price-driven solution without obtaining a proper training or technical support is not recommended.
  Run your production flawlessly without extended down time involved and / or causing hidden costs behind the scene.

  A high tension but lower elongation is the most important aspects for your production. Often overdoing with high tension does not yield any better print results than a reasonably tensioned, stabilized screen tension.

  Key Words; Repeatability, Consistency, Low Elongation, Excellent Mesh Memory, Thinner Thread Technology, Optimum Tensioning.

Advanced Threads / Precision-Woven Screen Fabrics

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