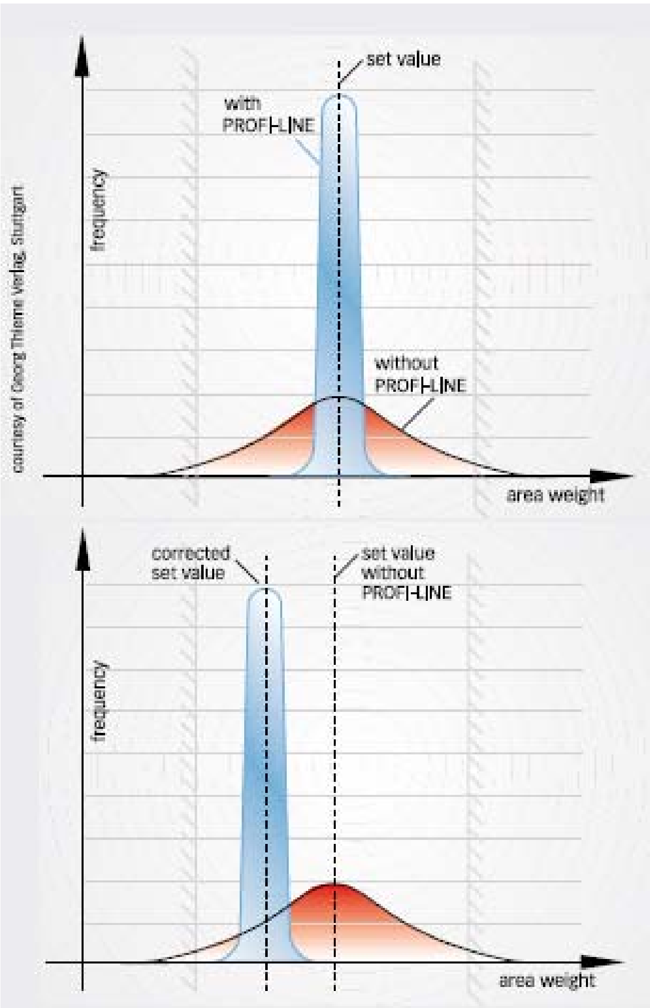
„DILO – Isomation“

Even web mass for reduced fibre consumption

Textile machine builders and producers have traditionally made great efforts to achieve an even fibre mass flow and thus a reduction of the fibre mass variations in textile products. The main target is to reduce fibre consumption based on the logical basic consideration that the medium fibre mass may be reduced and still meets quality requirements for the textile product. This principle applies for yarns as well as for textile sheets.



Reduction of the medium area weight at low variation without falling below minimum requirements

In case of web forming machines, creative solutions have been in demand for the last decades resulting for example in a better quality of card feeding, higher layering precision and improved web edge lay down to improve the web evenness. It is not until the delivery of coordinated production installations that the single solutions at the different components of fibre preparation, web forming and consolidation are considered more and more holistically and are integrated in a closed loop by the operation, drive and automation technology.

MultiFeed – Doubling of the fibre mass by “Twinflow” for a more homogeneous flock mass flow, additional pneumatic compression of the flock mass in the lower trunk

Using the example of a web forming and consolidation installation, we may discuss the different elements available for homogenizing the fibre mass flow and for reducing fibre mass variations. Which basic textile technological considerations can be taken into account?

1. Draft minimizing

When transporting fibre mass, draft occurs in the fibre mass at the transfer points from one stage to the next because drive forces are necessary to overcome friction and adhesive forces. Speed variations in the transport means induced draft in the fibre mass which creates the necessary transport forces. Unfortunately, these drafts often exceed the elastic range of the fibre mass and result in permanent elongations. Consequences are additional irregularities in the fibre mass distribution as thin areas are more elongated than thick areas.

This conclusion leads to efforts to either reduce drafts necessary for the fibre mass transport or – if possible – to eliminate them by using “positive transport”. Positive web transport means to bring in transport forces at the points of motion resistance. Examples for this are needling on a running brush apron and elliptic needle movement.

If drafting and the resulting elongation is used to change the quality as for example fibre reorientation, drafts have to be controlled by minimizing the drafting zone lengths.

2. Compression

Every kind of planar compaction or compression results conversely to the impact of the draft and to an increased homogeneity of the fibre mass as thin or hollow areas are filled in at least partially.

3. Doubling

Also at doubling, the principles for increasing the homogeneity for yarn and textile structures are the same and are based on the conclusions of Martindale. Based on the mathematic interrelation that individual values of the mass distribution of various layers of fibre mass do not add up linearly but only geometrically via the radical of the sum of the square numbers of the standard variations, homogenization is achieved by matching one or more fibre mass layers on each other.

$$s_{ges} = \sqrt{\sum_{i=1}^{n} s_i}$$

$s_{ges} =$ standard deviation of the fibre mass variation of the web

$n =$ number of layers

$s_i =$ standard deviation of the fibre mass variation of the individual web layer

This becomes evident when considering the variation coefficient of the complete web compared to the CV value of the single layer.

$$CV_{ges} = \frac{CV_i}{\sqrt{n}}$$

$CV_{ges} =$ variation coefficient of the web

$CV_i =$ variation coefficient of the web layer

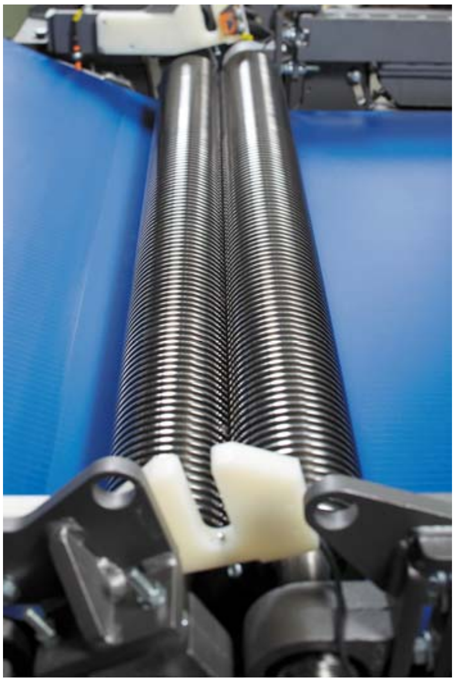
A classical example for this method is the cross lapper which does not only fulfil its basic task by building up a web width and a web mass but at the same time helps homogenizing the web efficiently

Many actions aimed at reducing fibre mass variations can be traced back to these three basic principles of reducing drafts, planar compression and the use of the doubling effect.

Prerequisite for homogenizing the fibre mass flow is of course the fibre preparation for staple fibre. Opening and blending systems that meet the high requirements for an optimum flock size and homogeneous blending incorporate modern electronic drive technology that allows an efficient speed synchronization of the different line components. Following these common considerations, a short list of the special components within an installation for the production of nonwovens which help reduce fibre mass variations is shown below:

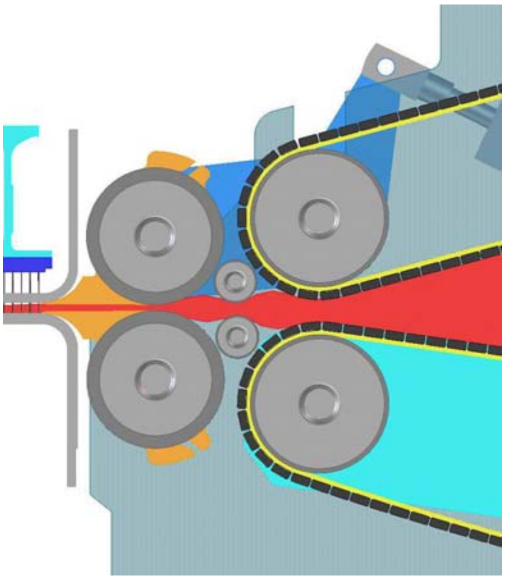
1. Controlled dosing of the flocks
2. Card feeding with flock doubling, flock compression and belt weighing
3. Web compression

4. Control of longitudinal web profile to pre-compensate thick edges in the batt cross profile (CV1-system)



CV1-System – Pre-compensation of thick edges to get an even cross profile

5. Precise cross lapper kinematics at reduced dimensional variations of the web
6. Web drafter with controlled draft for fibre mass reduction
7. Batt feeding system for needling with compression



CBF-System – Homogeneous batt feeding to the needle loom at minimum draft

8. Positive web transport within the needling zone (brush apron, Hyperpunch)
9. Controlled felt drafting for fibre reorientation

10. Closed loop control system for fibre mass flow by using an area weight measuring unit

Thus Dilo has all specific, technical and technological solutions to achieve a more homogeneous fibre mass flow within the complete production line. Drafts are either eliminated, reduced or controlled. Compression of the flock mass or within the web structure supports homogenization. Also, the classical means of doubling results in very good homogenizing effects when applied in the card feeder. The variety of solutions of special web forming and consolidation components aimed at reducing fibre mass variations are considered under the term “DILO-Isomation” and are further developed.