CINTEX News PLEVA
PLEVA Sales and Support in ASIA No. 09 SENSORS AND CONTROLS

Beneficial Retrofitting Strategy in the Textile Finishing Industry

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"Oktay Kirecci, assistant of the General Manager at company DEBA/Turkey has stated that exploding energy costs and more strict quality specifications from customers and retailers will burden the budgets of our company significantly if there is no action plan from the production floor which is implemented in a very short time".

Based on this outlook of significantly increasing energy costs in Turkey and the high pressure to fulfil the quality specifications from the customers and retailers a structured investment plan was realised over a period of nearly 2 years.

Primary objectives at company DEBA were as follows:
- Increase of productivity
- Energy saving based on efficient measuring and control systems
- Quality improvement

The improvement on quality is based on:
- Minimisation of tailing and listing in open width dyeing
- Elimination of distortion problems on stripe satin fabric before and after printing
- Minimisation on shrinkage variation on the final fabric

To reach the expected performance the following components were retrofitted with high priority.

Fig. 1: HeatSet Control on Krantz stenter frame in DEBA Turkey.

All stenters were equipped with "High Efficient PLEVA Sensors and Control Systems".

In addition the advanced PLEVA StraightLiner SL 1 (Inlet/Outlet) was installed at one of the stenters for precise straightening. Especially stripe satin fabrics and other complex fabric structures were the focussed material to minimise distortion before printing. This was not possible with the existing conventional weft straighteners.

In further more a precise density control system for the sanforising unit to improve shrinkage constancy in the final fabric was installed with outstanding practice results.

Results and advantages were highlighted from company DEBA

- Significantly increase of productivity in heatsetting processes (+25%)
- Significantly increase of productivity in drying (+30%, see Fig.6)
- Better and even wettability in open width dyeing (CPB) because of not overdried fabric
- Very short installation period per machine
- The Sensors and Control system were adaptable to all stenters
- Reproducible heatset processes for synthetic fibres for **"Right First Time"** philosophy to strengthen the internal quality systems in the plant
- Significantly energy saving by using controlled exhaust humidity system

Topic in this edition:

The high potential in retrofitting of existing equipments, with short pay back time.

In this edition

DEBA was looking to retrofit the most important elements on stenter

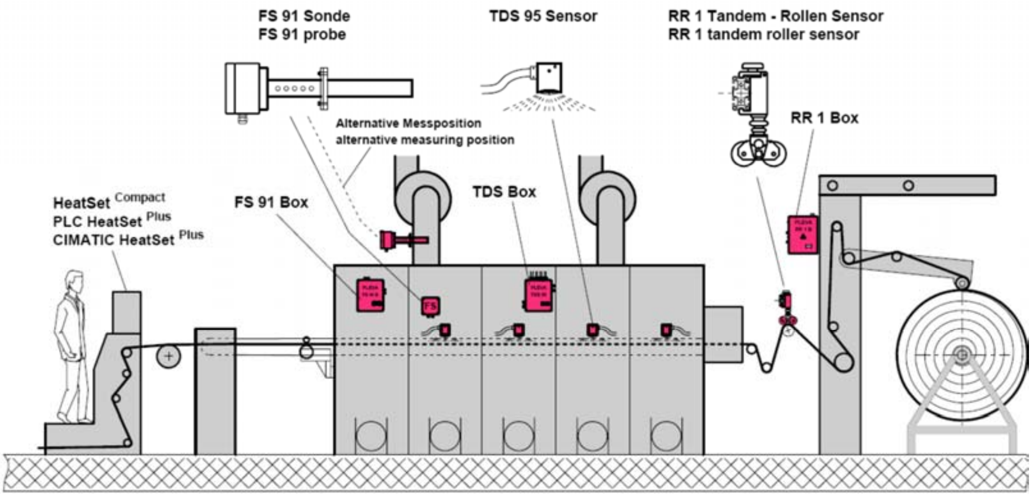

Fig. 2:
- Exhaust Humidity Control - PLEVA sensor FS 91
- Fabric Temperature Measurement - PLEVA TDS95
- Residual Moisture - PLEVA sensor RR 1.3

The PLEVA sensors shown in Fig. 2 are linked together at DEBA with the high efficient economic microprocessor controller PLC HeatSet (Fig. 1) and the HeatSetCompact Controller which will optimise the process requirements on the stenter in terms of dwell time, exhaust humidity and residual moisture of the fabric.

Exhaust humidity control to save energy

"Up to 30% energy savings were realised at DEBA."

Drying processes on the stenter at DEBA had used up a lot of energy. Presently the increase in energy cost because of price explosion is dramatic. Large quantities of hot air were used in order to remove the evaporated water. The aim was therefore to charge the air to an optimum degree with water vapour (humidity).

The higher the humidity, the smaller the quantity of exhaust air and with that the energy consumption.

Fig. 3: Exhaust humidity measurement FS91 on stenter frame

A decisive factor is the precise measurement of the humidity, which will also work reliably in the event of very high temperatures, and the charging of the air with large amounts of dirt.

The FS 91 humidity measuring instrument (Fig.3) has been developed for this purpose. It reliably measures the humidity in the dryer in continuous industrial use and in the most severe conditions.

With the help of a control system, the optimum quantities of exhaust air can be obtained and energy savings of up to 30% were realised at DEBA.

At the same time, humidity control with the FS 91 guarantees a constant drying climate. It maintains the quality of the dried material at a consistently high level.

Textiles, for example, are given a better feel. Constant humidity is just as important when conditioning articles with high humidity.

Additional advantages of FS 91
At stops the exhaust air will be controlled automatically to the minimum value and thus additional energy savings will be gained. By controlling the humidity inside the dryer and therefore, of the drying climate the quality standards of the goods to be dried are essentially improved.

Applicability of FS 91
The technique is applicable both to existing and new installations of stenters, relaxdryers and hotflues.

On-line Residual Moisture Measurement

The residual moisture meter RR 1 (Fig. 4) is a contact measurement of running fabrics. The RR 1 is based on measurement of electrical resistance. This increases exponentially as the residual moisture decreases.

The RR 1 allows lower residual moisture contents to be measured than was previously the case (measuring range 10^{14}-10^{5} Ohms which means for example:
at cotton: 0,9...15%,
at synthetics: 0,1...5%).

The electrostatic charges occurring during such measurements are discharged by the RR1 itself, meaning that they do not impair measurement.

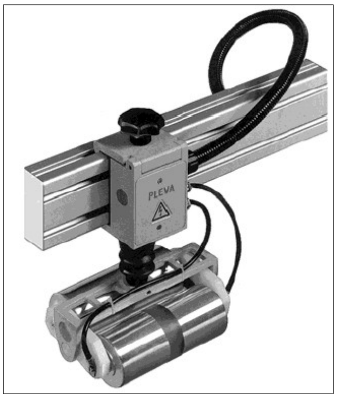

Fig. 4: RR1 Tandem Roller Sensor

The RR 1.3 version with 3 sensors measures the residual moisture profile left, centre, right over the width of the fabric.

If the residual moisture values over the width are too unequal before a dye-padder or if the values are too low (poor dye absorption capacity) then the dyeing process very often is impossible. In this case it is better to equalize the fabric at a stenter than to make a bad dyeing.

The special advantages of the tandem roller sensor RR1 are:

- Measurement of very low residual moisture values also on synthetic fibres (e.g. down to 0,9 % in the case of cotton)
- Integrated protective devices to counter interfering electrostatic charges
- Separate and simultaneous measurement by 3 tandem roller sensors, thereby allowing evaluation of the residual moisture profile across the fabric web width (version RR 1.3 see Fig.5)
- Self-cleaning of the isolation at the measuring roller because of small slippage
- Calibration curves of various materials can be called up.

Fig. 5: Residual moisture measurement RR1.3 (side/centre/side)

Residual moisture on the stenter

The measuring and control of the residual moisture content of fabrics is of considerable importance for company DEBA, both under technologic and economic aspects. In the usual practice at DEBA, the goods were over dried to a higher or lower extent. This has caused a rise in costs:

- By production losses, because the machines run slower than possible
- By additional energy consumption for drying, more water is evaporated than necessary
- By a decrease in the quality standard of the fabrics (hard handle, poor dye absorption capacity).

The goal at DEBA was therefore to control the speed of the dryer to achieve the regain moisture after the drying process.

Especially the drying before Cold Pad Batch dyeing has to be done very carefully not influencing the shade in the dyeing process and to avoid tailing and listing. In addition lower residual moisture values on blends with synthetics can be measured accurately with the tandem roller system RR1 from PLEVA.

These low residual moisture set points (< 4%) can be controlled by PLEVA sensors (RR1) only and will minimize the drying costs and increase the productivity significant.

Residual moisture meters are used as well at humidifying processes of dry fabrics before sanforizing or compacting. In these cases the residual moisture is measured before or after the humidifier and controlled to the required value (e.g. 12-14% at sanforizing of cotton).

Other application examples of RR 1:

Stenter, cylinder dryer, entry moisture in a padder, minimum application, compacting machine, sanforizer, decatizing machine, sizing machine (spun yarn), sizing machine (single-end sizing of filament yarn), paper, tobacco foil, use for humidifying for weight.

“Reliable measurement of the residual moisture is an essential operation on drying process .”

On-line Residual Moisture Measurement

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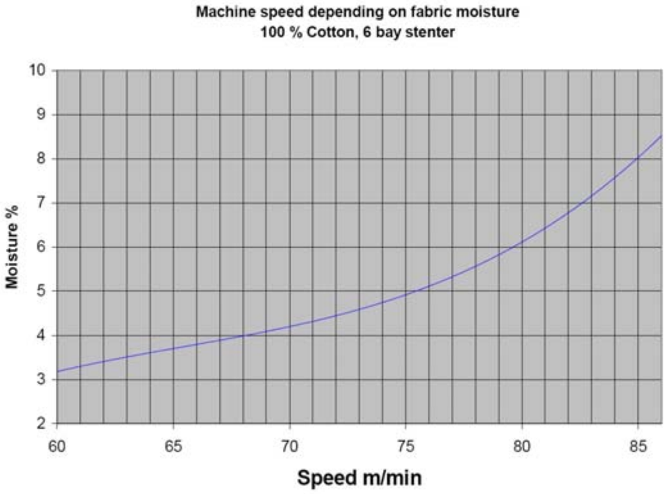

Fig. 6: Graph machine speed versus residual moisture

"Energy consumption will be reduced significantly by increase production speed of 15% ."

Main achieved economical benefits of RR 1
Energy consumption will be reduced significantly and in practice an average increase of 15% production speed in drying is observed on the stenters. Drying cylinder will show much higher effects because they are mostly oversized in their drying capacity.

Applicability of RR 1
The technique is applicable both to existing and new installations.

The installation of PLEVA RR 1.3 (Fig. 5) on the Krantz stenters at DEBA helps to improve shade continuity in dyeing because the fabric wettability is more constant before dyeing.

DEBA has implemented the measured fabric data perfectly on the production floor to guarantee a reproducible production. Every operator has to observe and report the setpoint and the measuring results of residual moisture over the length of the fabric for each batch.

At DEBA setpoints of residual moisture between 4 and 7 % were used to get a very even result over the width.

Depending on the setpoint of residual moisture in % for cotton fabric the production speed increase in m/min at Denizli Basma is shown on the graph (Fig.6).

Combined with the economic controller **HeatSetCompact** this is a very low investment with large profit.

Fabric temperature measurement for dwell time control

Heat treatment process (e.g. drying, fixing, condensing, vulcanising, cross-linking, shrinking) can only be optimally achieved if temperature patterns of products being heated in the dryer (e.g. tendering frames, multi-deck dryers, hot flues) can be measured accurately and continually.

To measure the temperatures of the products in the dryer, the contactless working TDS 95 sensors have proved most successfully.

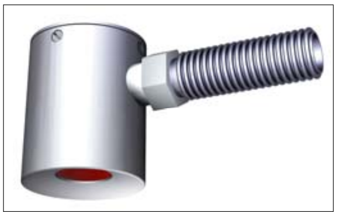

Fig.7: TDS95 fabric temperature sensor

For processes involving a dwell time it is of utmost importance that the product reaches a certain temperature, and that it remains at this temperature for a certain time.

Using the dwell time controllers HeatSet COMPACT (Fig.8) or PLC HeatSet plus, the speed of the dryer is controlled in such a way that the preset dwell time is attained automatically.

As a result of attaining the optimal temperature and dwell time for the product, the rate of production at the dryer increases, energy requirement is reduced and a high quality reproducibility of the products can be attained.

The TDS 95 sensor is a low cost system for a large number of measuring points. Capable of fully recording a heat-treatment process over the length and width.

Fig.8: CP35 HeatSet COMPACT

There are no condensation problems on the sensors since it is mounted in the hot environment (up to 400 °C). TDS 95 sensors have high accuracy (better than ± 1 % of measuring range) and they are optionally exchangeable against one another.

“Reliable measurement of fabric temperature in hot environment (up to 400°C) .”

Main achieved economical and environmental benefits

Without information about the temperature patterns of the product, the product may well be left in the dryer too long, in order to be on the safe side.

Using the dwell time controller, these excess periods in the dryer are avoided. Decrease of energy consumption and significant increases in production of 30 % are reported from DEBA.

Product quality increases, because the product is not exposed for excessively long periods at high temperatures. Effects of finishing chemicals are better because of less evaporation.

- Significant reduction of emissions into the ambient
- Less chemical usage in finishing (less evaporation)
- Significant reduction of energy consumption
- Early detection of malfunctions in the dryer.

Fig. 9: TDS95 temperature sensors for profile side/centre/side retrofitted on an old Krantz stenter

DEBA was focussed also on the sensitive:

Pigment dyeing process on the stenter which is monitored with TDS 95 sensors over length and width of the fabric.

There were two information given from the TDS 95 sensor:

- Fabric temperature side/centre/side and over the length
- Air temperature very close to the fabric side/centre/side and over the length

With this information DEBA has optimized the pigment dyeing results in getting very special washout effects with highest reproducibility.

“Fabric temperature sensors TDS95 with fast response time and not sensitive to soiling.”

“ *Advanced Structure Detection on woven and knitted fabrics.*”

Precise Fabric Straightening and Density Measurement (Pick/Course)

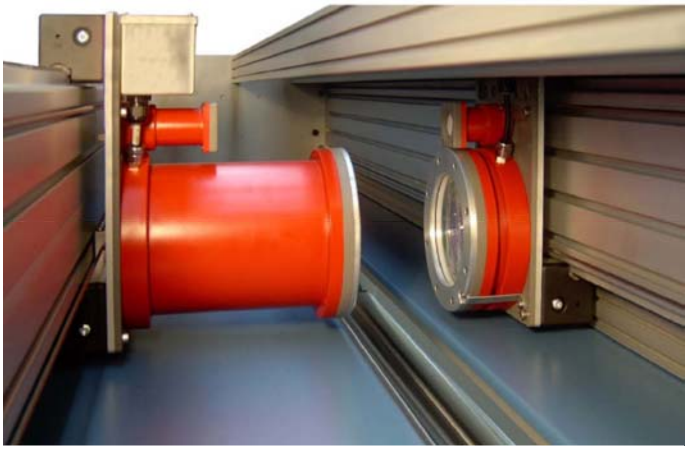

Fig. 10: Structure Detector SD1 - Traversierung CCD camera system

DEBA was looking for a straightening machine, which is capable to analyze complex fabric structures. In this case DEBA was looking for a problem solving technology for “Stripe Satin” fabric and a special material, which has some wavy weft distortion.

Therefore DEBA has decided to invest and retrofit the PLEVA Structure Detector SD 1. This system combines the following three fundamental online measuring techniques in one system the “**Traversing Triple Detection”**

1. Overall and sectional distortion analysis in bow and skew direction
2. Structure frequency (pick/ course count) in weft and warp direction (up to 220 picks/cm)
3. Fabric width measurement

The CCD Camera electronics automatically analyses the fabric structure and for most of the fabrics the “Standard Mode” for parameter settings is used.

The inimitable **Traversing Triple Detection** opens up new vistas by monitoring the distortion across the fabric width of the fabric in up to 6 sections.

The patented **SD 1** (Fig.10) is the only system worldwide with this capability. This outstanding system is used in many textile processes to control and monitor important quality parameters. Integrated in the worldwide established **S**traight**L**iner (**SL 1**) highspeed and precise straightening action is guaranteed.

The traversing camera is the heart of the **SD 1**. The system is monitoring distortion and picks/courses based on a fast high resolution CCD-camera. An intensive and colour neutral infrared-flash for transmitted and reflected light and additionally a fabric sensor.

Thanks to digital camera technology and the use of

Fig. 11: High resolution camera

high energy, infrared flash (1000 watt) woven and knitted fabric density can be analysed precisely. The fully automised brightness control guarantees highest quality of the pictures constantly. The extremely short exposure time of 10 micro seconds (= 0,00001 second) is responsible for highest picture quality up to a speed of 300 m/min.

This picture is used to evaluate the angle of the weft or the course which are calculated time saving directly in the camera.

The picture analysis of the complex textile structure allows the precise determination of fabric density (picks/ courses per cm) in weft and warp direction additionally. The very specific evaluation algorithm guarantees highest detection capability on almost all fabric structures, particularly very complex ones, too.

The above picture (Fig. 12) shows an example of complex wavy fabric structures

Fig. 12: Wavy fabric structure

detectable with the **Traversing Triple Detection** system only. This capability has enabled DEBA to get special orders on this type of fabric as well.

For distortion analysis and width measurement the **SD 1** is traversing from one selvedge of the fabric to the other. This traversing unit will adjust the camera automatically to changing fabric widths (new articles).

The weft angle is evaluated each 5 cm across the fabric width. Picture for picture (4 x

Precise Fabric Straightening and Density Measurement

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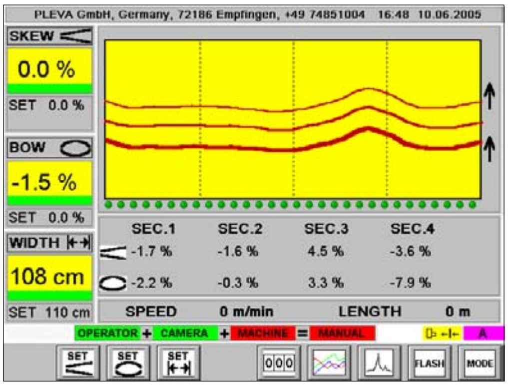

Fig. 13: Traversing Triple Detection PLEVA SD1
36 measuring points on 1800cm fabric width

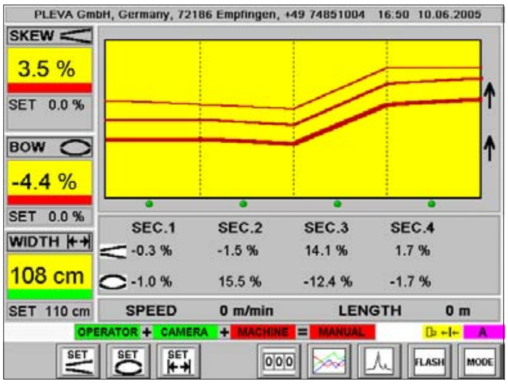

Fig. 14: Conventional Detection with 4 points
4 piece of fixed sensors over the fabric width

3 cm) is pieced together within extremely short time and the result is shown on the visualisation to get the most precise run of skew and bow distortion over the full width.

This valuable information of the weft is responsible for most precise distortion analysis and is essential for straightening with highest accuracy and speed.

The comparison of different detection systems (Fig.13,14) shows the significant advantages impressively using the traversing CCD camera system from selvedge to selvedge for detection.

The high number of measuring points over the full width is a key factor for this most accurate distortion calculation in the market and in combination with the high speed **S**traight**L**iner (SL) perfect straightening results are realised.

As mentioned above sectional calculation of distortion in individual zones (typically 30 cm wide and 5 m long) are monitored individually.

The lot report marks places which are out of tolerances as NOK (not ok) and this helps to find critical parts in the fabric length immediately.

“ Pick/Course counting to control overfeed, compaction, stretching .”

The traversing Triple Detection System

Fig. 15: Inlet/Outlet display of distortion on a stenter (Structure Detector SD1 traversing)

Fig. 16: Outlet reading bridge SD1 on a stenter (Structure Detector SD1 traversing)

The Traversing Triple Detection system as a quality control system is without competition. It is implemented in a lot of high value added processes like:

- Flame laminated car seats
- “Twisting or Preskewing “ of DENIM
- Counting of picks or courses on stenters
- Density measurement on compacting units or sanforising machines
- Measuring the knitting angle on Single Jersey fabric
- Detection of most complex textile structures like corduroy, jacquard, stripe satin or laminated fabric and many others.

The **S**traight**L**iner **SL 1** with the patented detection system **SD 1** has a modular design and gives highest flexibility in the alignment of the machine.

Automatic Weftstraightener StraightLiner SL1

The **S**traight**L**iner **SL 1** with the patented detection system **SD 1** has a modular design and gives highest flexibility in the alignment of the machine.

Fabric tension control by means of supporting drive for the bow rollers and adjustable compensator with large storage content is available for tension sensitive and knitted fabrics.

Computer Controlled Servo-Drives:
Max. bow roller adjustement < 2.0 sec
Max. skew roller adjustement < 2.5 sec

Fig. 17: PLEVA Weftstraightener SL1

Pick counting with SD1 static and SD1 Traversing on the Sanforising unit Outstanding practical results with highest precision at DEBA

During the last 2 years the digital camera technology has developed rapidly and especially the distortion analysis and the accuracy of pick or course counting has improved significantly.

With the accuracy of 0,1 picks/cm all physical actions onto the fabric like overfeed, compaction or stretching can be monitored precisely and this information can be used in many finishing processes to control machinery parameters.

Feedback from the market is that a constant fabric density will lead to more constant final warp shrinkage.

The Traversing Triple Detection is established on DEBA Sanforizing Units.

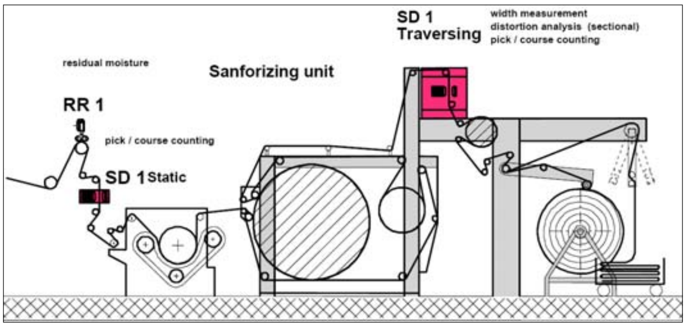

Fig. 18: SD1 static + SD1 traversing (Inlet/Outlet system on sanforising unit)

The compaction (in mm) and the speed difference between the compaction unit and the felt calander (-%) are two major parameters to adjust the sanforising unit.

Changing these conditions will influence the picks/cm in weft and therefore the fabric density significantly. With the special “DEBA know how” the control can be switched automatically.

- Inlet - Outlet fabric density measurement (.%) and control for better consistency
- Sectional skew and bow distortion to avoid manual quality checks and cuttings for preskewing
- Online width measurement

Summery

This example of interchange of ideas between an ambitious textile finisher and a competent partner in the field of measuring and control systems has demonstrated the high potential of retrofitting existing equipment in an ambient where net investments are extremely difficult to get through.

Priorising the key factors for improvement and high professionalism during implementation of the equipment combined with a strict cost controlling were the key factors for success.

The acceptance from the top management during the 2 year investment plan was increased because the calculated pay back times were reached within an extremely short period of time and the top management could find the real figures in significantly reduced monthly costs.

Oktay Kirecci, assistant of the General Manager at DEBA, could convince the top management that it´s worthwhile to retrofit in older equipment and getting the pay back.

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