

German weavers embrace automatic on-loom inspection



Fig. 1: Cyclops is mounted on the off-loom take up and uses one or two moving camera units scanning the fabric for possible defects. A data unit serves as interface between Cyclops and the loom.

Weaving companies in Germany face tough competition from low priced imported fabrics. Only with the production of specialized industrial fabrics of the highest quality can a German weaver continue to produce in a high cost country with a sustained profitability. Germany benefits from a high skilled and efficient labor force, unfortunately this goes hand in hand with one of the world's highest manufacturing labor cost. The use of modern high speed weaving machinery and in depth automation of processes is prevalent in all German weaving mills.

Fifteen years ago, the German weavers were amongst the first to invest in automated fabric inspection systems. These systems were for the inspection of fabric after weaving, thus to replace the manual fabric inspection. Further German weavers laid the basic for the concept of computerized manual on-loom fabric inspection. In this concept a patrolling fabric inspector goes from loom to loom checking the fabric, declaring defects when spotted or otherwise

declaring the fabric defect free. The aim of this idea is clearly to skip the grey cloth fabric inspection for a high percentage of cloth rolls all together.

During the 1999 Paris ITMA two exhibitors showed a working prototype of an automated on-loom inspection system. Four years later, at ITMA Birmingham, 3 serious contenders showed proof of a working automatic on-loom inspection system. The interest of the German weavers for automated on-loom inspection came as natural. Manual inspection, be it off or on-loom is a process they cannot afford given the labor cost they are faced with. Automated inspection after weaving reduces labor cost a great deal, but still involves transportation and manipulations of the doffed cloth rolls. Even with an automated inspection system, the inspection department remains in existence and there is still a high work in process in inspection. Furthermore inspection after weaving

still allows the production of cloth rolls with meters of running defects, the inspection comes after weaving, thus way too late to avoid off quality fabric.

BMS's automated on-loom inspection system was one of the systems shown at the above referenced ITMA's. Unlike other proposed solutions BMS positioned its Cyclops system (Fig. 1) not only as a defect detection system but also as a defect data entry system for its quality management software system called QUALIMASTER. The combination Cyclops and QUALIMASTER allowed processing the defect data so that cloth rolls could be automatically graded. For the identification of the cloth rolls a link with the monitoring system was established and this allowed label printing with an automatic feed back message for the ERP system containing all quality related data of the doffed cloth roll. Quickly it became abundantly clear that an automatic on-loom inspection system cannot be

isolated from the logistics and information stream of the weaving mill.

Since its introduction BMS's Cyclops has known a constant further development.

The speed of the moving camera has quadrupled, offering a 100% inspection coverage. The scanner is now available for widths up to 560 cm featuring a dual camera approach for such wide looms.

In this article 4 German weavers explain how they have introduced automatic on-loom inspection in their weaving mill.

Spinnweberei Uhingen

Spinnweberei Uhingen, Uhingen, Germany, has 45 BMS Cyclops systems. The first was delivered in February 2000. It is installed on a batcher. The company was impressed with the system and purchased a second system in February 2001. After extensive trials, it was decided to equip all Dornier looms with Cyclops. "The camera is today traveling with double the speed as in the first installation," said Georg Mayer, Dipl.-Ing. weaving mill manager for Spinnweberei Uhingen. "The training is very simple because everything works on a Microsoft Windows® user interface. Every software upgrade made the system easier to work with. To get someone trained on the system requires less than one week."

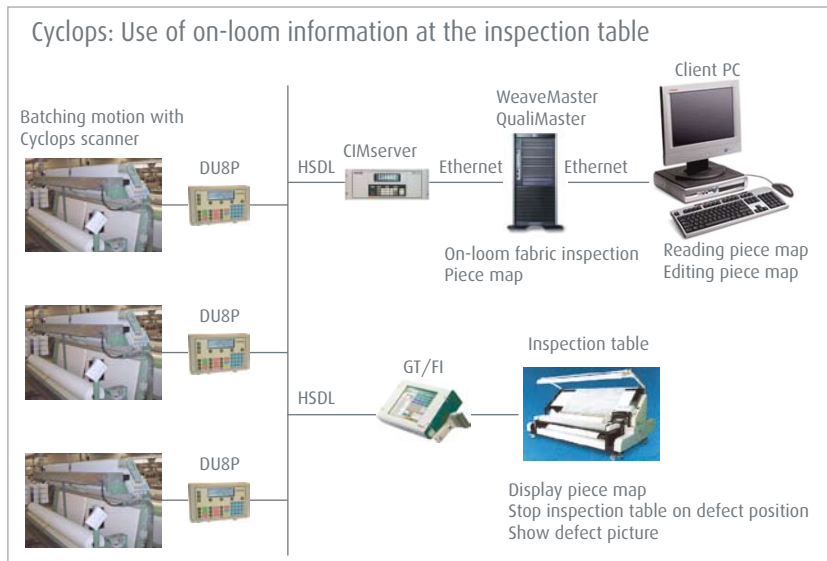
The on-loom camera system stops the loom if a defect is detected. This avoids the production of many meters of second quality. The inspection report shows the defect quantity and for every defect there is a picture available. This means, it is very easy for the operator to have a precise quality overview of the piece of fabric. "The systems detect about 70 percent of all the defects in the fabric," Mayer said. This is much more than an operator can ever see. We have eliminated manual inspection in spite of a very sensitive type of technical fabric." The company realized a payback time of less than 30 months.

To get someone trained on the system requires less than one week.

Cost savings come from producing less second quality fabric and reduced labor costs by the elimination of 5 fabric inspectors.

Fabric rolls with a too high defect level are automatically assigned for manual re-inspection. QUALIMASTER helps the operator during re-inspection. The speed of the re-inspection frame is controlled by QUALIMASTER. The inspection frame is stopped at the defect location and the defect picture is shown to the inspector (Fig. 2). If possible, defects are mended allowing QUALIMASTER to assign a better grade to the fabric roll.

Fig. 2: Defect information from Cyclops is used to control the mending table, as set up at SWU, Uhingen.



Spinnweberei Uhingen produces cotton yarns in its ring-spinning mill in Waldkirch, Germany. The plant has 12,200 spindles and produces 2,300 tons of 100 percent cotton yarn a year. The weaving mill in Uhingen produces more than 10 million square meters of cotton fabric a year on 45 Dornier air-jet looms. The looms are equipped with dobby heads and cam motions. The company produces technical fabrics mainly as abrasive carriers and rubber blankets, which are used in offset printing machines. Needless to say that because of the nature of the end use of the fabrics and the weaving machines being air jets, that the detection by Cyclops of the defect "kinky filling" needed to be 100% assured.

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Gebrüder Colman

Located in the city of Essen, Colman produces various types of technical textiles as well as interior decoration and lining fabrics. All styles are based on synthetic yarn. In weaving a group of about 100 very recent Picanol air jet machines are in use. Most of the looms have off loom take ups by Neuenhauser.

The company started testing Cyclops early 2005. Four scanners were purchased to

verify that Cyclops would prove capable of handling the variety of styles that Colman has to deal with. Although all the weaving machines are of the same type, the reed width of the machines varies a great deal. Colman widest machines are of 340 cm. For this width Cyclops with double camera has been selected. For all the other machines (250 cm, 220 cm and 190 cm) the one-camera version of Cyclops guarantees 100% inspection coverage.

By the end of 2006 Colman had a total of 24 units. Early 2007 a further 40 Cyclops scanners were put on order.

Because of the nature of some of the Colman styles, Cyclops inspection software had to cope with weft skewing and arching.

Anton Cramer

Founded in 1898, Anton Cramer, located in Greven / Westphalia is one of Germany's leading textile mills, exporting to 48 countries all over the world. The main products are fashion fabrics, down proof fabrics and mattress ticking. When deciding to invest in a new weave room for one of the product lines 28 Picanol Omni+ and 12 Picanol GammaX machines were installed. Anton Cramer also chose to go for automatic on-loom inspection. As Mr. Runge, plant manager of Anton Cramer explains: "Investments in textile production in Germany can only be justified if we guarantee top quality fabrics at the lowest possible cost and with the highest possible flexibility towards our customers. Therefore we need to avoid the production of off-quality fabric and reduce the work-in process. Automatic inspection of the fabric on the weaving machine is the way to achieve this target".

The Cyclops system stops the loom if a severe defect is detected. This avoids many meters of second quality being produced.

After six months of benchmarking, with different types of fabric in the plant, Anton Cramer selected BMS's Cyclops system for its overall technical performance. 40 Cyclops scanners have been purchased. The Cyclops units are mounted in the Neuenhauser batching motion. The batching motions make it possible to weave a full warp onto one big roll of fabric. The Cyclops scanners are equipped with a special "backlight" module for enhanced detection of start marks. Through the VDI interface, the Cyclops system stops the loom if a severe defect is detected. This avoids many meters of second quality being produced.

Some looms have been equipped with 2 Cyclops scanners allowing double sided fabric inspection. Anton Cramer has a few styles for critical applications which required an inspection from both sides of the fabric. The Cyclops software merges the detected defects in one piece map with the indication of the

visibility for each defect (visible on one side or visible on both sides).

The system generates a piece map showing the defect location in the fabric and for each defect a picture is available (Fig. 3). This gives quality control management a precise overview of the quality of each woven piece. All Cyclops units are connected to BMS's QUALIMASTER system, which makes quality information available in real time. Further Anton Cramer also uses BMS's WEAVEMASTER system for monitoring and planning. The 40 Cyclops have been installed in 2005 and are in operation in a 24 hour 7 days a week schedule. The scanners proved to be reliable. Anton Cramer experienced an important reduction in quality complaints, proving that off quality fabric is greatly reduced and also that the automated inspection is a trustworthy tool.

Fig. 3: QualiMaster generates a piece map for each individual piece inspected by Cyclops, showing all defects with their locations. For each defect, a picture is stored in the database.

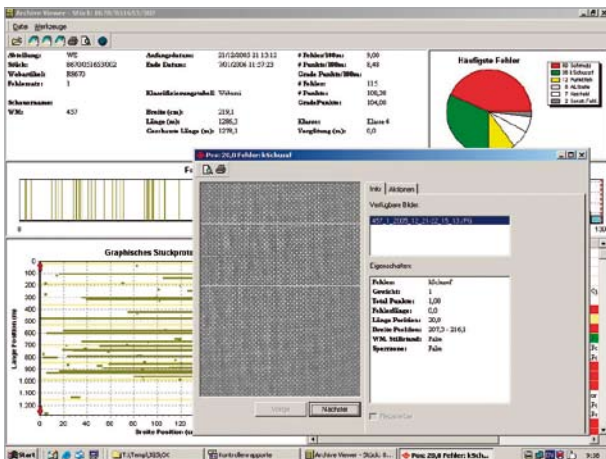


Fig. 4: Air jets weaving air bag fabric, equipped with Cyclops at UTT.

UTT Technical Fabrics

In Krumbach, about in the middle between Munich and Stuttgart, UTT produces industrial fabrics on Dornier rapier and air jet weaving machines. For its high tech fabrics UTT has weaving machines equipped with Cyclops. The Cyclops scanners are installed on the Neuenhauser off loom take up (Fig. 4). Normally the Cyclops is equipped with infra red (invisible) illumination. However at UTT, the illumination is

assured through 2 boards of blue LED diodes and thus visible light is used. The blue light makes a better detection of stains and dark ends possible. The QUALIMASTER software allows UTT to grade the pieces automatically right after doffing. The method of grading is identical to UTT's grading method. A defect map is printed for each piece and even the piece tickets are printed by the QUALIMASTER software. The piece

tickets or labels mention the fact that the fabric has been Cyclops inspected.

UTT was one of the early adopters of automatic inspection after weaving. They installed a system and it works very well for them. However when the market started to ask for fabrics with more than 250 cm width, their automatic inspection system could not handle the wider fabric. UTT had

to make a decision. One option was to invest in a wider automatic off loom inspection system or to go for automatic on-loom inspection.

A first Cyclops was purchased and at that time a senior in college studied the system and wrote her thesis on automatic on-loom inspection. After

Conclusion

The 4 weaving mills mentioned in this article are not the only Cyclops users in Germany. Other users of BMS's automated on-loom inspection system include Delcotex, Ettlin, Heywinkel, C.Cramer, and others.

When it came to making the investment decision many of them followed the same pattern of thinking:

- Manual inspection is a very costly and unreliable process.
- Automated inspection after weaving comes too late! In case of a quality problem, the defect can run over many meters.
- Automated inspection after weaving still requires a certain infrastructure and handling. Doffed cloth rolls must be stored, loaded and unloaded in the inspection system.
- Automated inspection after weaving is not very flexible when it comes to fabric width. If the market dictates a wider fabric, the automatic inspection system may not be able to handle it.

graduation Mrs. Bock joined UTT and a first set of 10 Cyclops scanners together with QUALIMASTER was installed. Together with UTT the software and detection capabilities of Cyclops have been further enhanced to bring the system to its current performance on technical fabrics. As more new wider looms were purchased more Cyclops scanners were

added to bring the total to its current significant high number of installed scanners.

At UTT QUALIMASTER is also linked with the WEAVEMASTER production management system and the Navision ERP system the company has recently rolled out.

When thinking in the direction of automated on-loom inspection the following comes to mind:

- The inspection is at the weaving machine. In case of a defect the weaving machine is stopped and the defect cause can be eliminated.
- There is no infrastructure required. Inspection takes place at the weaving machine and not in an inspection department.
- There is a Cyclops for every reed width up to 560 cm.

Regardless of the inspection method, a software package must be available to collect the defect information, to produce the defect maps and piece labels, to update the ERP system on the inspected cloth roll. BMS's QUALIMASTER package fulfils this role and integrates perfectly with the MES (WEAVEMASTER) and the ERP system.

Finally the key for making any investment decision is the return on investment. Based on a reduction of the inspection cost, the reduction of off quality fabric, a reduced work in process and some other factors, the ROI for an on-loom automated inspection project ranges between 15 and 24 months, in fact a better ROI than for an "after weaving" automatic inspection system.

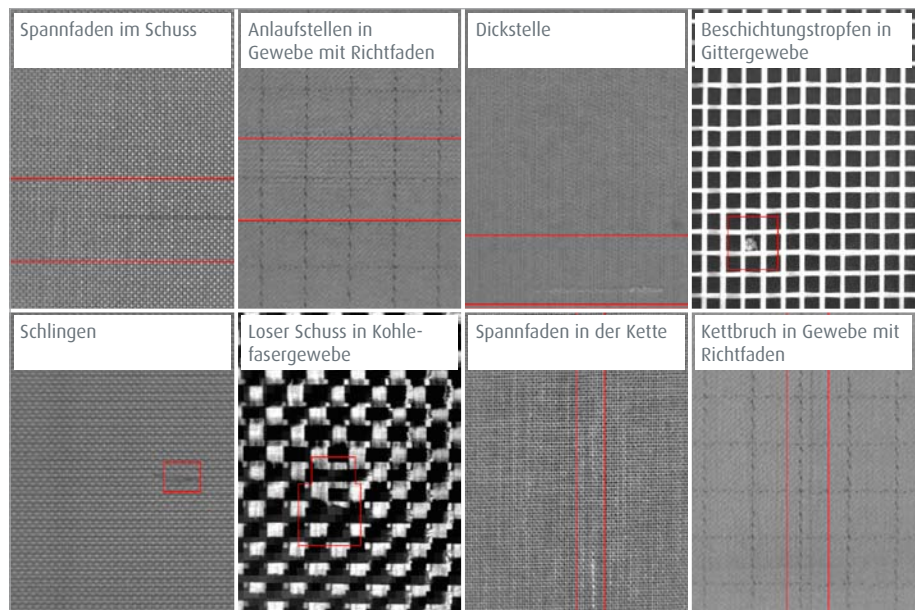


Fig. 5: Typical defects in fabric detected by Cyclops.

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