

On-Line Quality Monitoring Systems in Spinning in Spinning



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Abstract

Rapid changes in technology also change every aspect of life. Technological changes in industries not only change productivity & Quality but also change work culture too. Technological up-gradation of spinning machineries also makes easy operation, higher productivity, user friendly maintenance and more informative production update at any moment. On-line Quality Monitoring systems are part of technological up-gradation of spinning machineries. All the new generation spinning machineries equipped with some special features of "On-line Quality Monitoring" devises. Most of these devices are integral part of machinery, however some systems available as optional attachment on extra cost. Information provided by the On-line systems may helpful, if it is properly processed and utilized in systematic manner. The purpose of this article is to elaborate various On-line monitoring systems available in modern spinning mills, systematic process approach and utilization of information obtained for effective monitoring. It's correlation with off-line laboratory test results and use of this information for customer and others stack holders references with full authenticity.

Introduction

Proper & systematic utilization of "On-line Quality Monitoring systems in spinning mills may improve Productivity & Quality level significantly. Most of the new generation machineries works on electronically computer base systems, this provide more & more online information for Quality & productivity. Information obtained from On-line systems is significantly differ with off-line or laboratory test results. Hence following guideline should follow for processing of On-line information:

1. On-line information may be more accurate for long term reports as compare to short term report.
2. A co-relation factor should be derived by comparing the On-line data w.r.t. off-line or laboratory test by comparing significant test samples.
3. It should be co-related periodically with off-line or laboratory test.
4. On-line sensors should check regularly for its accuracy and proper functioning. If require it should be calibrated.
5. Atmospheric condition to be monitor every time, when acquire the On-line data.

Following "On-line monitoring systems" are commonly used in spinning mills:

1. Cotton Contamination Sorter (CCS)

Cotton contamination sorters are optional online Quality monitoring devices, which detect & remove the foreign matter from cotton. CCS provides information that how many foreign matter points detected and removed by the systems and recorded into system PC as "Ejection / Minutes or "Ejection / Hrs." This information may obtain as Hours wise, Day wise or Month wise, based on programming available with system PC. CCS is very important ON-line monitoring devices for contamination removal. Accuracy of CCS may observe by putting colour paper pieces of one sq. cm. each into blow room pipe line just before CCS and see how much out of them ejected through CCS. This shows the CCS efficiency for different colours. Cleaning of CCS glasses, cameras & light source and cotton path affect the performance of CCS significantly, hence it should be maintained properly and operational instructions should be followed strictly.

$$\text{CCS Efficiency \%} = \frac{\text{No. of defects ejected through CCS} \times 100}{\text{No. of defects inserted before CCS}}$$

2. On-line monitoring systems at carding stage:

All the new generation carding machineries equipped with short term as well as long term autoleveller function. Autoleveller monitor the uniformity of feed material as well as delivered material and corrected whenever deviated from described value. Production monitoring sensor placed on delivery roll monitors the length of output sliver and calculate the production & machine efficiency. Following parameters may obtain and monitored with carding informatory:

- a. % Feed variation.
- b. Cv % with different cut length.
- c. A % deviation or actual sliver weight.
- d. No. of Breaks & its causes.

Rieter Q-pack also provides following additional Quality Data:

- e. On-line mass spectrogram.
- f. Slub / Thick places per kilometer in sliver w.r.t. different diameter i.e. + 15 % to 45 % in the step of 5 % diameter.

This information may be recorded shift wise or day wise for monitoring.

3. On-line systems for Br. DF's, Unilap / Lap Formers & Combers & speed Frames:

Normally these machines are equipped with production monitoring sensors only, hence only following information may be utilized:

- i. Machine & Production Efficiency.
- ii. Machine down times.
- iii. No. of breaks occurred.
- iv. Causes of breaks.

4. ON-line Quality Monitoring at RSB DF's:

After carding, Quality monitoring devices placed at RSB DF's only, where again autoleveller is functioning for better evenness and control of linear density of sliver. ON-line Quality monitoring systems at RSB DF's provides following information:

- a. % Feed variation.
- b. Cv % with different cut length.
- c. A % deviation or actual sliver weight.
- d. On-line mass spectrogram.
- e. Slub / Thick places per kilometer in sliver w.r.t. different diameter.

According to Quality requirements warning & stop limit may set for different quality parameters. Machine warning lights blinks, when any quality parameter goes beyond the set warning limits, while machine stop immediately if any quality parameters crosses the described stop limit.

Setting of QMS at RSB DF's:

RSB DF's are very sensitive machine for Quality aspects. Hence the setting of ON-line Quality parameters is a very precious matter. It should be very perfect & accurate. Warning limit & stop limit of systems should be treated as "Action Limit" & "Control Limit".

Warning Limit = Action Limit

Stop Limit = Control Limit

For example if in a spinning mill allowable Fin. DF sliver hank limit is +/- 2.0 % and beyond this limit being treated as "Non-confirm product", then

- Warning limit should be set on +/- 1.5%, where warning lights will blink for A % deviation.
- Stop limit to be set at +/- 2.0 %, where no production will allow beyond this limit and machine will stop immediately.

- Similarly warning & stop limits may be decided for CV %, Thick places & Spectrogram.

ON-line monitoring system at Ring Frame:

On-line monitoring systems available for Ring frames are optional attachments only. This is very unique and important system for measurement & monitoring of Ring frame performance. System monitors Quality & productivity of ring frames continuously round the clock. This system works in a combination of two different sensors located at different positions at ring frames for monitoring the various functions. These are Single spindle monitoring (SSM) & production monitoring (PM). A travelling sensor performs the Single spindle monitoring function while production monitoring sensor placed on the front delivery roll of machine.

1. Travelling Sensor:

One travelling sensor moves from one end to another end of ring frame and monitors the ring traveller motion and sends the information to CPU. CPU processed the information received with traveling sensor and calculates the following parameters:

- i. **Ends down:** Ends down at any instance obtain through systems PC.
- ii. **End Breaks Rate:** No motion of ring traveller recorded as end breaks of particular spindle position. It may obtain End breaks per 1000 Spindles Per hours for a particular ring frame. End breakages classified into three types:
 - 1) **Start up Breaks (STU):** Breaks recorded at the start of the machine after doffing within a preselected time.
 - 2) **Normal Breaks (EB):** Breaks recorded after startup till the doff is over.
 - 3) **Other Breaks (PRT):** Breaks other than STU & EB, normally idle spindles.
- iii. **End mending time (EM):** Mean duration of normal end breaks in minutes. This indicates operator efficiency.
- iv. **Momentary Stops Positions (MSP):** Momentary stops positions at any instance.

- v. **Idle spindles:** Spindles which do not produce anything for a "set of time" are listed as idle spindles. Usually spindles stopped for more than 30 Minutes are consider as idle spindles.
- vi. **Rogue Spindles:** Enables the user to detect spindles which end breaks rate lies significantly above the machine average.
- vii. **Worst Spinning Positions:** This report shows a maximum of 10 spindles with spindle number / machine number with the higher number of breaks.
- viii. **Actual Spindle Speed:** Rotational speed of each & every traveler is measured by the travelling sensor and the mean RPM of the machine stored in system.
- ix. **TPM / TPI:** Twist per meter / twist per inch.
- x. **Slip Spindles %:** The individual traveler speed is compared with the "Mean RPM" of the machine. A spindle will be recorded as a slip spindle, if it's traveler speed observed less than the limit set (i.e. 3 – 5%) for more than the number of times set.
- xi. **Stationary Single spindle monitoring system:** Now days some machinery manufactures also developed inbuilt stationary single spindle monitoring sensors, which placed at each spindles.

2. Production Monitoring sensor:

Production monitoring sensor attached at delivery roll of ring frames, monitor the front roll speed, and after processed through CPU following parameters calculated:

- i. **Front Roll Speed:** Actual front roll delivery speed in RPM.
- ii. **Delivery speeds:** Yarn delivery speed in meters per minutes calculated from front roll speed.
- iii. **Total Ring frame production:** Total ring frame production at any instance and for defined shift duration in Kg. /Hrs or Kgs.
- iv. **Gms per Spindle per shift:** Shift wise GPSS for count-wise, group-wise & ring frame wise.
- v. **Total Down times (STM):** Total down time minutes since the beginning of the shift.

- vi. **Efficiency:** AEF % i.e. Actual efficiency, PEF % i.e. production efficiency, NEF % - Now efficiency may get through system.
- vii. **No. of Doffs in a shift:** Total No. of doffs since the beginning of the shift. This report helps to monitor doffing load of ring frame doffers.
- viii. **Doffing time (DFM):** Total doffing time in minutes since the beginning of the shift. This report helps to monitor the ring frame doffing team efficiency.
- ix. **Type of Reports:** Various types of reports may generate through system for analysis & monitoring purposes. These are as follows :
 - 1) **Instantaneous value Report:** Shows the status of the machine(s) at the moment of call-up (i.e. instantaneous). No period is applicable for this report.
 - 2) **Shift Reports:** Automatic shift report may obtain at the end of shift with defined parameters.
 - 3) **Stoppage Reports:** Overall analysis based on stop causes possible with or without reference to the machine number. Reports may obtain in form of Stop summary, stop history & stop diagram.
 - 4) **Long term Reports:** Long term reports for a fix interval i.e. on weekly basis or monthly basis may obtain.
 - 5) **Article Wise:** In this report machines processing the same count / material are listed together.
 - 6) **Operator / Supervisor section wise:** This report provided an overview of the machine data as per work assignment allotted to Operator / Supervisor section.
 - 7) **Group Report:** Any number of machines can be put together into as many groups as possible.

On-line monitoring system at Winding:

Spinning winding system is totally equipped with On-line Quality & production monitoring systems. This works very effective and replaced traditional off-line monitoring system. There are two type of monitoring systems that works at autoconer

control panel. These both system works independently for Quality & production monitoring and exchange their information with each other. These are:

1. Electronic Yarn clearer for Quality monitoring.
2. Autoconer M.I.C. systems works for production monitoring.

Electronic Yarn Clearer:

Electronic yarn clearers are the most effective On-line Quality monitoring tool in spinning. It is not only monitoring the yarn defects but also removes objectionable defects and improves the yarn Quality. It's measure the various yarn defects very preciously and classify. Following parameters may be monitored through electronic yarn clearers:

1. Classification of Seldom occurring yarn defects
2. Periodic defects
3. Classification of Foreign matter
4. Classification of Yarn Joints & it's Quality
5. Detection of Count Variation
6. Winding Defcets
7. On-line Yarn Imperfection
8. Alarms due to bad Quality or Off Standard Cops

Autoconer Informator:

Latest autoconer systems provide detail On-line information for running production as follows:

1. Single drum or machine Production at any instance.
2. Machine & Production Efficiency
3. Cause wise production down times

Detail causes wise production down time available with autoconer systems in duration and in percentage of total losses as below:

- a. Red light: Drums stopped due to operational or mechanical failure.

- b. Yellow light: Drum stopped for package doffing.
- c. Recycling or Repeaters Cycles: Repeater cycling for splicing.
- d. Splice failure: No. of splice failures
- e. Bobbin change cycles: No. of bobbin changes
- f. Rejected Bobbins: No. of rejected bobbins
- g. Clearer cuts per 100 Km. of yarn
- h. Clearer cuts per kg. of yarn
- i. Clearer cuts per bobbin
- j. Tension Breaks
- k. Yarn Breaks: Clearer cuts + Tension Breaks + Stop Cuts
- l. Total Yarn Joints

Most of above information may obtain in their specified units or in percentage.

Responsibility for On-line Monitoring systems:

All the on-line monitoring systems either available as an integral part of machine or optional retrofit attachments are very expensive parts which should be properly utilized for its purpose & in favour of organization. Usually responsibility of On-line monitoring systems is not clear in spinning mills, which lead ignorance of these multifunction important systems. Hence responsibility for "On-line Monitoring systems" may be distributed as below:

- **All Quality Monitoring System:** Quality Control / Assurance department is responsible to utilized all the information produced by On-line Quality monitoring systems such as Cotton Contamination sorters, Different Cv 's, A% deviation, Spectrogram analysis & Thick places monitoring through carding & RSB DF's, End breaks monitoring in throughout processes, Electronic yarn clearer cuts, classification & online Imperfection report from autoconer etc.
- **All Production Monitoring systems:** All production monitoring reports should be utilized by production supervisor for their reference as instance production figures, causes of detention and Quality deviation etc. Shift wise – Machine wise summary report should be prepared with all relevant information

and should be presented to Spinning master or Spinning Manager for detail analysis & action. Machine operators may also educate to read the Production efficiency & down time report.

- **Maintenance Activities with the help of On-line systems:** Maintenance activities may synchronize with On-line reports. Maintenance team should continuously monitor Cause wise breaks of various processes and efficiency losses due to mechanical failures. Shift wise report may help maintenance manager for planning of preventive maintenance activity.

Advantages of On-line monitoring systems:

On-line Monitoring systems have following advantages:

- a. Quick & instance report at any moment for Quality & Productivity Performance.
- b. Monitoring of whole production Quantity, assure 100 % Quality control.
- c. As sample size is too large hence more reliable & accurate measurement.
- d. Quality stops ensure that no defective quality will be produced.
- e. Easy for monitoring, anybody can see results at any time.
- f. May get better Quality & production by educating machine operators.
- g. By taking proper monitoring & taking timely appropriate corrective actions machine down times may reduce significantly.
- h. Significantly reduce calculation & clerical job of technical person, also reduce load of Quality control team.
- i. Dependences on human and human errors avoided.
- j. Large scale data storage for future reference may be possible.

Conclusion:

Technological up gradation introduced fast, accurate and instance On-line monitoring systems. Some on-line monitoring systems available with spinning machineries are integral part of machines and some available at optional retrofit attachment. Accuracy & authenticity of On-line systems should be check periodically. Cotton Contamination sorters, Carding & RSB DF's & Winding electronic yarn clearers systems works as effective Quality Monitoring tools, while single spindle monitoring & production monitoring at ring frame and windings provide lot of information related to each

position for Quality & production. Properly & systematic utilization of On-line monitoring provide significant improvement in Quality & productivity with reduction in monitoring cost.

Image Courtesy:

1. Ksml.in

Mr. Sunil Kumar Sharma is the Dy. General Manager of Loknayak Jayprakash Narayan Shetkari Sahakari Soot Girni Ltd.