International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 03, March-2019

Compressed Air Monitoring System for Textile Industry

Vikas Sharma, Paurush Godhar, Saurabh Kr. Rajput
Northern India Textile Research Association,
Sector-23, Rajnagar, Ghaziabad-201002,
U.P, India

***Abstract*:- Air Compressed air is one of the essential requirements of textile industry, with the increase in modernization and automation the use of compressed air is increasing rapidly. Compressed air is used in almost all the process machines from blow rooms, carding, spinning, winding, weaving and other machineries for both controlling and operations.**

Only 20-30% of energy reaches the point of end-use and balance 70-80% of energy of the power of the prime mover being converted to unusable heat energy and other system losses. In a modern mill, compressors accountfor 8-9% of total power consumption. Leakages can be a significant source of wasted energy in the compressed air system, sometimes wasting 20-50% of a compressor's output.

NITRA has developed a compressed air monitoring system to optimize energy consumption in textile industry, the project was funded by Ministry of Textiles, Government of India, to identify the losses occurring due to compressed air leakages, to assess the real-time performance of the compressors, and to develop a software to proactively assess the compressed air losses.

INTRODUCTION

Air compressors are used to supply for process requirement, to operate pneumatic tools and equipment, and to meet instrumentation needs and consume significant amount of electricity used in textile industry. Measuring the efficiency of compressor on a running plant is not possible without installing flowmeter. Free air delivery test, pump-up test, requires the compressor to be cut-off from the system and also does not provide the real-time performance of the compressor. It is equally important to relate the power consumption of the compressor with the compressed air generation to measure the energy performance of the compressor.

Compressed air leaks are the significant sources of energy wastage in compressed air systems. Compressed air leaks can also contribute to problems with system operations, including:

- Fluctuating system pressure, which can cause air tools and other air-operated equipment to function less efficiently, possibly affecting production
- Excess compressor capacity, resulting in higher than necessary costs
- Decreased service life and increased maintenance of supply equipment due to unnecessary cycling and increased run time.

Although leaks can occur in any part of the system, the most common problem areas are: couplings, hoses, tubes, fittings, pipe joints, quick disconnects, FRLs (filter, regulator, and lubricator), condensate traps, valves, flanges, packings, thread sealants, and point of use devices.

Fixing the compressed air leaks once is not enough. It is essential to incorporate a leak prevention program into the facility's operations. It should include identification and tagging, tracking, repair, verification, and employee involvement.

Leakage detection methodology comprises two components one is to quantify the total system leakages, and the second is to identify the area of leakages, and accordingly making an action plan to mitigate compressed air leakages.

Following are the details of losses occurring due to compressed air leakages in textile mills (Table-1):

Table-1: losses occurring due to compressed air leakages in textile mills

Location	Compressed air Generation	Leakages (%)	Annual Loss (in Lakh Rs.)
Mill 1	1400 ft^3/min	53	67.32
Mill 2	3800 ft^3/min	21	72.99
Mill 3	1900 ft^3/min	36	61.02
Average			**67.11**

So, it is clear from the above that on an average, compressed air leakages are causing loss of Rs. 60-72 Lacs per annum. Due to unavailability of compressed air flow meters and monitoring system it is very hard to assess the performance of the compressors and leakage losses. This monitoring system will help in continuously monitoring of compressed air generation, consumption, and quantification of energy losses due to compressed air leakages.

Daily performance evaluation is necessary for immediate finding out the problems and for assessing the efficiency of compressor in real-time. Benchmark of the performance for different conditions can also be established and the performance can be improved accordingly.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 03, March-2019

METHODOLOGY

NITRA compressed air monitoring system is advanced, yet easy-to-use system for controlling and monitoring compressed air in textile industry, in multiple air compressor system. It is a computerized system that centrally monitors the performance of air compressors and overall compressed air system 24 hours a day. This system can monitor, record and analyze compressed air system health while significantly reducing energy costs, maintenance costs and downtime.

NITRA compressed air monitoring system works on industrial grade Wi-Fi protocol and connects to a central unit. Each measurement unit comprises flow sensor, temperature sensor and pressure sensor and send the measured data to the central unit through Wi-Fi. Measured data can be seen in both graphical and numerical values and recorded for further data analysis and logging purposes.

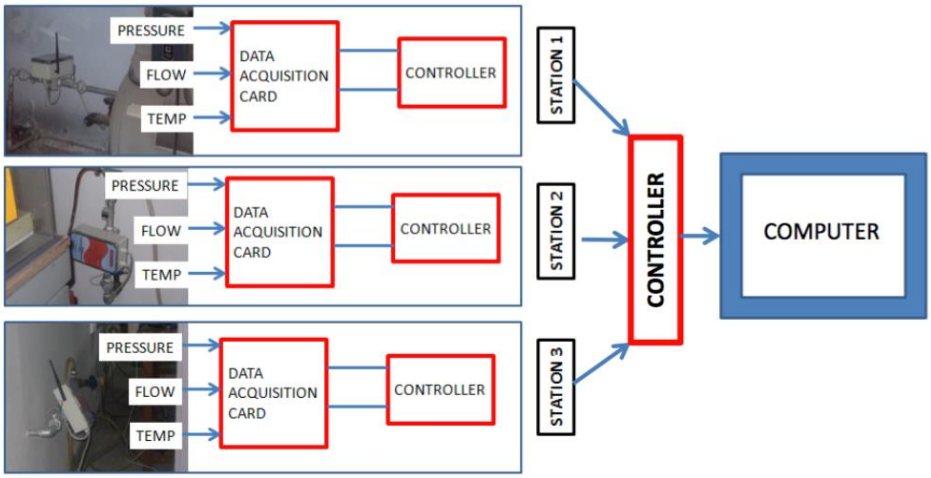

Fig. 1 - Compressed air monitoring system block diagram

Measurement units can be installed on outlet of compressor along with energy meter to measure the compressed air generation as well as specific power consumption i.e. kW/CFM. kW/CFM is the energy performance indicator of compressor and is broadly used in the software.

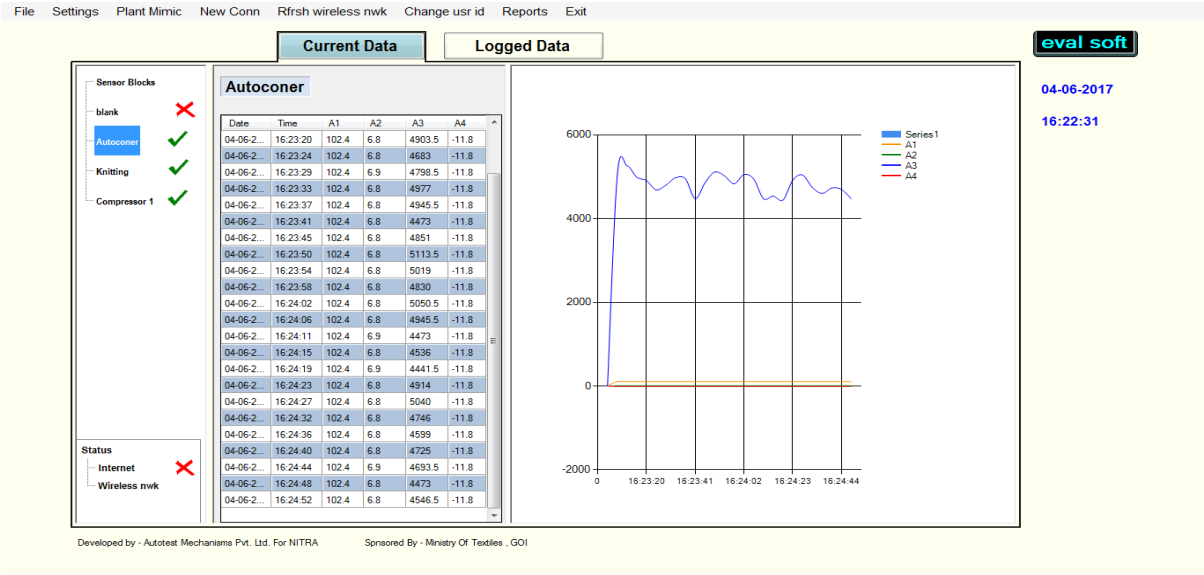

Fig. 2- Compressed air demand profile

Demand of the compressed air varies along with the production, break time and during peak load conditions. Monitoring system can plot the demand graph and the demand variations across a pre-defined interval, that can be seen on the software itself. Software also provides the use to select the sampling period as per their requirements.

Monitoring system can suggest to select the best combination for each unique air demand situation and identify which compressor is the appropriate compressor to bring on or turn off, thereby assuring best energy results.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 03, March-2019

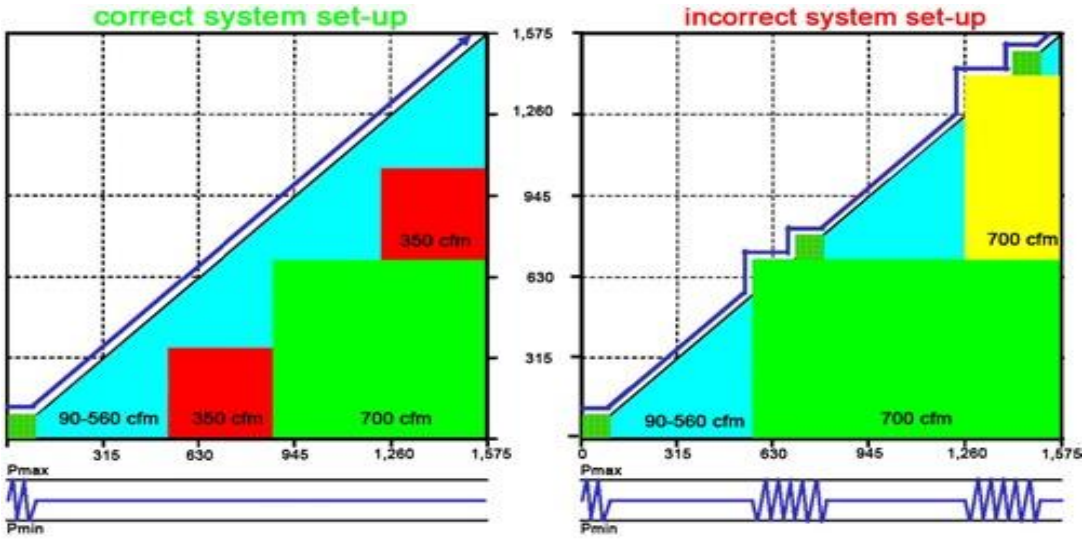

Fig. 3 – Best selection of compressor as per the air demand

Measurement units could be installed for entire section, like spinning, weaving or winding etc., on the individual machines or on the combination of machines. Installing measurement unit on individual machine can profile the compressed air consumption, over the period of time, benchmarks can be established to identify the increased compressed air demand and accordingly maintenance needs can be identified.

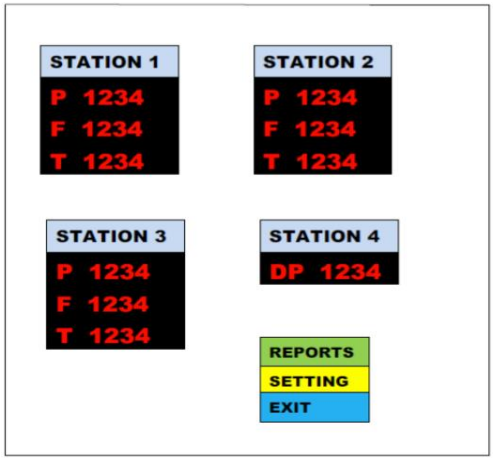

Fig. 4 – Measurement screen

Measurement units can be used for maintenance as a very effective tool to verify the effectiveness of maintenance by checking the compressed air consumption of individual machines before and after the maintenance.

It is very essential for a monitoring system to be able to export the data in different popular formats for report generation, data analysis and integration with other MIS systems. Hence, the measured and logged data can be exported to MS Excel, PDF and TXT formats etc.

CONCLUSION

NITRA Compressed air monitoring system to optimize energy consumption in textile industry is an effective tool developed for measuring the energy performance of compressed air generating system and compressed air utilization. This tool provides the losses occurring due to compressed air leakages, losses occurring due to poor efficiency of the compressors, and quantify the losses at the same time, and keeps track of system performance and cost information. It shows the results of improvement efforts and immediately verify the savings, e.g. from a leak detection and mitigation project.

Plant managers can monitor the system and charge different departments appropriately for their air consumption based upon flow. Energy Performance Indicator kW/CFM can be monitored and managed and alarms can be set for notification of system malfunctions or of increases in costs.

ACKNOWLEDGEMENT:

Authors are thankful to Ministry of Textiles, Govt. of India for sponsoring the project on " Designing a Compressed air monitoring system to optimize energy consumption in a textile mill". Authors are highly indebted to Dr. Arindam Basu, Director General NITRA, for his extreme support and guidance.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 8 Issue 03, March-2019

REFERENCES

[1] Bureau of Energy Efficiency reference books for Energy Auditor & Energy Certification Examination.

[2] R. Saidura, N.A. Rahimb, M. Hasanuzzamana, A review on compressed air energy use and energy savings, ELSEVIER, Volume 14, Issue 4, May 2010.

[3] Tu Xuyue, Design of Air Compressor Monitoring System Based on Modbus Protocol, IEEE, ICECE 2010.