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Compressed Air Project Improves Efficiency and Production at Harland Publishing Facility

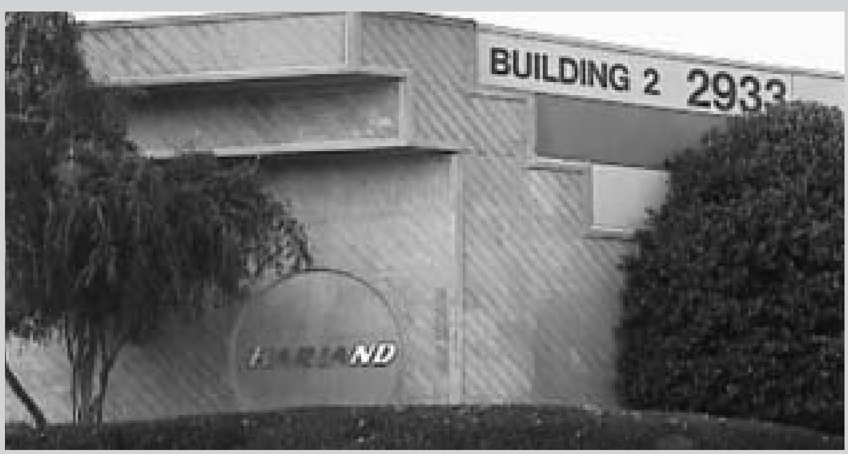
Summary

In 1999, a project was implemented on a compressed air application at the testing facility of the John H. Harland Corporation printing plant in Atlanta, Georgia. The project began with a system review by Air System Management, an Office of Industrial Technologies (OIT) BestPractices Allied Partner. It involved reconfiguring a new type of printing machine so that it would consume less compressed air and require lower pressure to operate effectively. Implementation allowed the site to significantly reduce the amount of compressed air the new printing machines require and to take those machines' onboard compressors offline. The project was replicated throughout the company the following year. The total cost of the project was $300,000; its success also allowed Harland to avoid spending more than $500,000 for additional compressors that would have led to over $200,000 per year in energy and maintenance costs and would have consumed 2.9 million kilowatt-hours (kWh). In addition, the project's implementation improved the performance of the new printing machines, which has led to better product quality and reduced production cycle time.

Plant Overview

Harland's facility in Atlanta, Georgia, employs about 225 people and prints personal and corporate checks for thousands of customers throughout the southeastern United States. The Atlanta site includes a test facility that applies new technologies and methods to the check printing process. In 1999, the

Harland Printing Plant in Atlanta, Georgia



Benefits

- Avoids annual energy consumption of 2.9 million kilowatt-hours (kWh)
- Avoids capital and energy costs of over $700,000
- Reduces energy waste
- Improves production

Applications

Compressed air systems are utilized extensively in industrial applications and are often the greatest source of electricity consumption in a plant. To reduce compressed air energy costs, it is important to properly configure compressed air end uses so that they consume the least amount of compressed air to achieve production requirements.

Atlanta site installed fifteen of the new printing machines and piloted the compressed air improvement project.

Before the installation of the new printing machines, one 60-horsepower (hp) rotary-screw compressor served the Atlanta site's compressed air system. This system generated between 200 and 300 standard cubic feet per minute (scfm) at 80 pounds per square inch gauged (psig), adequately serving the air guns, packaging equipment, cylinders and the existing printing machines.

When personnel at the Atlanta site installed the new printing machines, they discovered that these machines consumed significantly more compressed air than older ones. In order to satisfy the increased air demand and pressure requirements of the new printing machines, the Atlanta site had to bring online one 30-hp and one 40-hp compressor that had been used as backup compressors. As a result, engineers at the Atlanta test facility believed that similar, additional compressor capacity would have to be added to each of the company's printing sites to adequately supply the new printing machines throughout the company.

Project Overview

The new printing machines' greater demand for compressed air led the Atlanta facility to commission an independent review of these new machines to best determine how much additional compressor capacity was needed. This review was conducted by Air System Management, an OIT BestPractices Allied Partner.The operators felt that the review was particularly necessary because they planned to reconfigure the new printing machines to print at a higher rate, which would cause them to demand even more air.

The review began by base-lining the new printing machines' compressed air needs. The examination revealed that the machines had three components that consumed compressed air at differing volumes and pressure levels: batching modules (20 scfm at 130 psig), collators (1.1 scfm at 100 psig), and print engines (also 1.1 scfm at 100 psig). The machines came with one-hp onboard compressors that were intended to supply the collators and print engines. The batching modules' air demand required that they be supplied by the main compressed air system. Once installed, the new printing machines more than doubled the facility's compressed air demand to over 600 scfm, forcing an increase in the header pressure to 130 psig. In addition, the site planned to configure the printing machines to operate at 138 pages per minute, which would increase each batching module's consumption from 20 to 27 scfm.

Further examination of the batching modules revealed that within their pneumatic systems, a series of open-blowing air bars caused the greatest demand for compressed air. The evaluation also found that two of the other components in the batching modules, the joggers and lift cylinders, were unable to work properly at the manufacturer's recommended pressure levels. The manufacturer's recommended pressures for the joggers and lift cylinders were 65 psig and 80 psig, respectively. However, the Atlanta facility had to supply them at no less than 118 psig and 125 psig because the air feeding those bars was taken upstream of the lubricator and regulators for use by the joggers and lift cylinders. To the main compressed air system, this situation was similar to a leak and meant that the header pressure had to be increased to satisfy the pressure and volume requirements downstream. In addition, the hoses supplying the batching modules from the airdrops were too small for the volume of air they had to accommodate, and there was a leakage rate of 2 scfm within the batching modules.

The evaluation also found some issues that prevented the onboard compressors from operating efficiently. For example, compressed air was sent to the collator at 100 psig solely to pull down a nip roller, which seemed like an excessively high-pressure requirement. The evaluation also found that the collator and print engine components had many push-to-connect tube fittings, which tend to leak upon start-up. The onboard compressors were small, and they could not adequately supply the print engine and collator because they could not overcome the excess air demand that these leaks caused. Furthermore, condensation was collecting on the metal components of the print engines, causing the engines to shut down.

Project Implementation

To optimize the new printing machines, the Atlanta site personnel decided to have the machines redesigned to reduce their compressed air consumption. Working with the Original Equipment Manufacturer (OEM), Harland was able to configure the batching module so that the air bars would not require compressed air. Instead, each module was fitted with an onboard, two-stage, 2-hp blower. The air coming from the blowers would be pulsed through a series of solenoid-operated air valves for the air bars to use.

The Atlanta plant personnel also replaced the distribution hoses between the batching modules and the main header, and the hoses between the control valves and components within the modules. The replacement hoses were shorter and wider, allowing for better airflow. In addition, lubricators were reinstalled downstream of the air regulators to prevent the regulators from getting dirty and operating poorly. Finally, each module was provided with a dedicated storage tank.

The storage tanks were added because the different pressure requirements of the joggers and lift cylinders would cause compressed air to be diverted from one application when another one actuated. When the new printing machines had first been installed, the site overcame this problem by increasing pressure to the entire machine. Now, the pressure to this machine could be lowered to 80 psig or less.

Testing revealed that the minimum pressure needed to pull down the nip roller was 76 psig. Installation of a new sleeve on the roller was the only moment in which a pressure level of 100 psig was required. To accommodate this periodic need, the onboard compressors were left

THE COMPRESSOR ROOM

in the print machine for manual activation. With modifications to the batching module and discontinued use of onboard compressors for routine operations, the Atlanta site was able to supply the collator and print engine with 80-psig plant air.

Locating and repairing leaks in the batching modules and in the plant's compressed air distribution system further reduced energy consumption.

Results

The printing machine redesign, and the measures to lower end-use pressure requirements, allowed Harland to reduce the new printing machines' compressed air needs and increase their efficiency. Once the OEM reconfigured the printing machines at the Atlanta site so that the air bars no longer required compressed air, each machine's air demand declined from 27 scfm to only 4.5 scfm. In addition, the need for high-pressure air was eliminated. The storage for the joggers and lift cylinders, along with appropriately sized distribution hoses, further helped stabilize the pressure within the batching modules. This reduced the site's total air demand to approximately 300 scfm at 81 psig, allowing the facility to take 70 hp of compressor capacity offline.

The redesigned printing machines, with onboard compressors taken offline, have an annual compressed air energy cost of $310 per machine, or $21,700 for the company's 70 machines. Had the printing machines not been redesigned, and the onboard compressors left online, the annual compressed air energy costs would have been $3,103 per machine, and $217,210 company-wide. As a result, Harland avoided having to purchase between 500 and 600 hp of compressor capacity, which would have cost $500,000. The avoided costs more than offset the $300,000 spent to redesign the 70 printing machines. Because fewer compressors were needed, Harland was able to spend less on maintenance. The company gained backup compressor capacity and reduced the possibility of production downtime. Harland also benefited from increased product quality and decreased production cycle time.

Lessons Learned

Configuring end-use applications so that they use the minimum amount of compressed air at the lowest necessary pressure is an effective way to control compressed air energy costs. In the case of the Harland's check production facility in Atlanta, a new printing machine's initial configuration more than doubled the entire site's compressed air demand. After a thorough review, Harland personnel realized that it would be more cost-effective for the new machines to be redesigned to consume less air at lower pressures than to increase compressor capacity company-wide.

High-pressure air should only be used when absolutely necessary. In this case, assumptions regarding the pressure level for a nip roller, and the inappropriate positioning of an air feed, led site personnel to maintain a system pressure level that was higher than necessary. If the nip roller had been a valid high-pressure application, the onboard compressors would have been an efficient solution. Instead, the assessment found that the nip rollers could operate satisfactorily at the plant's normal pressure level. Proper configuration of compressed air end-use equipment, and optimal adjustment of pressure levels, saves energy and improves productivity.

BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together emerging technologies and best energy management practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

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