Compressed Air System Audits

Office of Industrial Technologies

Compressed Air Systems Fact Sheet #3

A compressed air system audit can highlight the true costs of compressed air and identify simple opportunities to improve efficiency and productivity. In some cases, the local electric utility will help finance such an audit.

Compressed air system users should consider using an independent auditor to examine their compressed air system. Several firms exist that specialize in compressed air system audits. Audits are also performed by electric utilities, equipment distributors and manufacturers, energy service companies, and engineering firms. An informed consumer should be aware that the quality and comprehensiveness of audits can vary. Independent auditors should provide recommendations which are systems-neutral and commercially impartial. Independent auditors should neither specify nor recommend any particular manufacturer's products.

A comprehensive compressed air system audit should include an examination of both air supply and usage and the interaction between the supply and demand. Auditors typically measure the output of a compressed air system, calculate energy consumption in kilowatt-hours, and determine the annual cost of operating the system. The auditor may also measure total air losses due to leaks and locate those that are significant. All components of the compressed air system are inspected individually and problem areas are identified. Losses and poor performance due to system leaks, inappropriate uses, demand events, poor system design, system misuse, and total system dynamics are calculated, and a written report with a recommended course of action is provided. Important aspects of a basic compressed air system audit are discussed below.

System Issues

System issues go beyond examining the performance of an individual compressed air system component and, instead, examine how components on both the supply and demand side of the system interact. Auditors typically address a number of systems issues. These are discussed below, and many are addressed in more detail in other Compressed Air Systems Fact Sheets.

Level of Air Treatment. The auditor typically examines the compressed air applications and determines the appropriate level of air treatment required for proper operation of the equipment. Actual air quality levels are then measured. If the air is not being treated enough, alternative treatment strategies are recommended. If the air is being over-treated (an indication of energy being wasted), recommendations are made to modify the system. In some cases, only certain end-use equipment requires highly treated air, and the auditor may recommend a system that allows for different treatment levels at different points in the system.

Leaks. The auditor should identify and quantify leaks in the system and recommend a leak management program.

Pressure Levels. An auditor also typically determines the lowest possible pressure level required to operate production equipment effectively. In many cases, system pressure can be lowered, thereby saving energy. Most systems have one or more critical applications that determine the minimum acceptable pressure in the system. In some cases, the application of dedicated storage or differential reduction on the critical applications will allow a reduction in overall system pressure.

Controls. The existing control system is evaluated to determine if it is appropriate for the system demand profile. Performance gains available from operating the system in a different mode or using an alternative control strategy should be estimated.

Heat Recovery. Auditors will identify potential applications for the use of heat recovery, if it is not already being used.

Demand Side Issues

The demand side of the system refers to how compressed air is actually used in the plant.

Distribution System. The overall layout of the distribution system (piping) is examined. Pressure drop and efficiency are measured or estimated, and the effectiveness of the condensate removal system is evaluated. Simple changes that can enhance system performance are suggested if appropriate.

Load Profile. Auditors typically estimate the compressed air load profile in terms of how the demand in cubic feet per minute (cfm) changes over time. A facility with a varying load profile will likely benefit from advanced control strategies. A facility with short periods of heavy demand may benefit from implementing storage options.

To establish the load profile, an auditor will measure system flow and pressure across the system under different demand conditions, while observing the loading effect on the existing compressors. This may require a number of measurements over a 24-hour period (or even several days) if demand varies significantly over time. Some auditors may use data logging equipment to obtain both demand and power consumption profiles.

End-Use Equipment. The equipment and processes that use compressed air will also be examined. In some cases, recommendations such as specifying equipment that operates at a lower pressure will be made. An auditor may also recommend replacing existing compressed air-powered equipment with equipment that uses a source of energy other than compressed air (see the Fact Sheet titled *Inappropriate Uses of Compressed Air).* Critical pressure applications are examined in detail. Local storage and other modifications may be recommended.

Supply Side Issues

The supply side refers to how the compressed air is generated and treated.

Compressor Package. The compressors are evaluated in terms of appropriateness for the

application and general appearance and condition. Compressor efficiency is usually estimated based on manufacturer-supplied data, corrected to site conditions. The installation is also evaluated in terms of its location, connection to cooling water, and ventilation. A general appraisal and any recommendations for alternative systems are also made.

Filters. Filters are examined for cleanliness and suitability for the application. Pressure drop across the filters is measured to estimate energy losses from the filter. A maintenance schedule for changing the filters, and possibly higher performance filters, may be recommended.

Aftercooler. Aftercooler and separator efficiency, cooling effectiveness, and condensate separation effectiveness are all measured and evaluated, and feasible modifications or alternative systems are recommended.

Dryer. Dryer appropriateness is assessed based on the facility's end-use applications. Dryer size, pressure drop, and efficiency are measured and evaluated. Modifications and replacements are recommended if needed.

Automatic Drains. Location, application, and effectiveness of both supply-side and demand-side drains are evaluated and alternatives recommended if necessary.

Air Receiver/Storage. The effectiveness of the receiver tank is evaluated in terms of location and size, and the receiver drain trap is examined to see if it is operating properly. Storage solutions to control demand events should also be investigated.

More Comprehensive Evaluations

System audits are designed to identify system inefficiencies. If a system is found to be poorly designed, in unsatisfactory operating condition, or in need of substantial retrofit, a more detailed analysis of the system may be recommended.

A comprehensive evaluation may also include extensive measurements and analysis of supply and demand interactions. Some auditors will also prepare a detailed systems flow diagram. A financial evaluation may also be performed, including current and proposed costs after retrofits are taken.