



## » HOW TO CONDUCT A SUCCESSFUL COMPRESSED AIR SYSTEM LEAKAGE ANALYSIS

Compressed air is one of the principal forms of energy used in industrial processes. It is often the most expensive when evaluated on a per-unit, energy delivered basis. In addition, compressed air systems typically develop operational issues and air leaks as they age. By implementing a thorough compressed air system analysis, the typical industrial facility can eliminate up to 22% of its compressed air energy costs.

### COMPRESSED AIR SYSTEM ANALYSIS – 12 STEPS

A compressed air system analysis consists of a complete review of the compressed air system from the air intake to the end users, plus a compressed air leak detection and correction program. A successful compressed air system analysis involves performing the following 12 steps.

#### STEP 1.

Conduct a walkthrough of the entire plant or specific areas to be reviewed. This will single out some of the issues or major areas of concern that demand a higher priority. Pay special attention to areas that require regular human interface, such as quick coupling points, regulators, oilers, drip traps, filters, and areas where plant personnel work. This is where high compressed air leakage typically occurs.

#### STEP 2.

Set clear goals for the analysis. Here are examples of some goals:

1. Get everyone involved. The most effective programs involve all levels of plant personnel.
2. Eliminate the need for one or more air compressors.
3. Understand the system's needs and requirements.

4. Determine the air pressure requirements of the system.
5. Benchmark the different components of the system.
6. Compare different types of connections. Different types of connections leak at different rates.
7. Determine the projected cost of the program and document the (loaded) cost to produce the compressed air.



How many goals is best? Define and document no more than three major objectives or goals to be accomplished during the system analysis. (Example: removing one or more air compressors from operation by increasing the reliability and efficiency of the compressed air system.) Define and document no more than four minor objectives or goals to be accomplished during the system analysis. (Example: documenting the performance of a component in the compressed air system.)

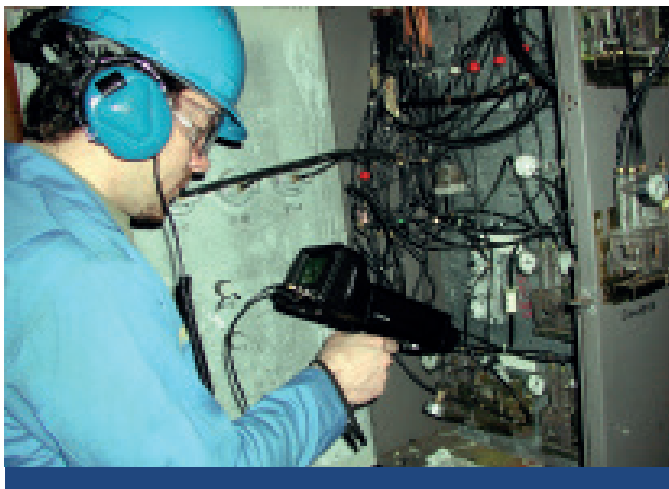
Sometimes a compressed air system analysis originates as a request from one area in a facility to overcome a specific problem or issue; therefore it may not focus on improving the overall efficiency of the system. If the facility does not possess all of the required basic information plus a clear focus on the system analysis's goals, the chances of success are greatly reduced.

### STEP 3.

Determine which methods will be used to accomplish the goals. And do not institute a program unless personnel are available to complete the task. The first question: Who will perform the work -- inhouse staff or a third party? There are benefits and detriments to both options.

**In house.** If the plant does the work in house, the person(s) involved are more likely to know the compressed air system. And the analysis will ultimately give plant personnel a greater knowledge of what is happening in the facility.

On the other hand, some specific skills are required



to conduct a proper compressed air system analysis, and if plant personnel are not completely dedicated to the program, there is a good chance the compressed air system analysis might fail. Also, the equipment needed for a compressed air system analysis can be expensive, with high-end ultrasound guns costing as much as \$15,000 to \$20,000.

**Outsourced.** Contracting the compressed air system analysis to an engineering or compressed air system analysis firm can ensure a positive outcome. The contracted firm will provide the necessary labor and testing equipment.

However, that contracted firm will not know the facility layout or operating conditions. As such, outside compressed air leak detection professionals will have a more difficult time defining the locations of leaks. It is always recommended that the facility assign someone to join the outsource team.

In either case, compressed air leak detection system analysis is typically the first objective or goal of a facility's compressed air system efficiency improvement program. Once the compressed air leaks have been identified, it is important to prioritize them for repair.

### STEP 4.

Sell the program to management to obtain funding for the project. Here are several ways to prepare for your meeting with management:

1. Know the cost of compressed air operation.
2. Define the objectives and goals.
3. Create a road map on how to accomplish the goals.
4. Articulate the expected results of the program.
5. Explain how the program will continue.

### STEP 5.

Benchmark the compressed air system to later determine whether the program is a success or failure. This benchmark will also define the road map for improving the compressed



air system. Review the standard operating procedures (SOPs) for the compressor operation. If SOPs do not exist, then institute a program to write them. Without SOPs, the success of the compressed air program could be jeopardized.

### STEP 6.

Determine the “equipment” or method to be used for leak detection. There are three options

## The Human Ear

This is the most common process for finding leaks. One negative to using the human ear is the inability to pinpoint the leak area. Also, background noise will decrease the ear’s effectiveness. If the background noise is too loud, use an ultrasound unit to find the compressed air leakage.

## Liquids

Liquid detectors are inexpensive and easy to use, but they can be more time consuming than, say, ultrasonic detectors. One benefit to liquid: it can often be purchased in a low-temperature version if leak detection is done outside in colder weather. Another benefit: bubble size can help determine the size of the leak.

## Ultrasound

The average human threshold for sensing high-frequency sounds is 16,500 Hz or 16.5 kHz. Some will not hear signals this high, while others are capable of detecting even higher-pitched sounds. The highest frequency most humans can detect is 20 kHz (20,000 Hz). Airborne ultrasound technology is the solution for sounds at frequencies ranging from 20 kHz through 100 kHz.

### STEP 7.

Prioritize the larger leaks. With a compressed air leak detection and correction program, what degree of leakage will be corrected and what degree will not? Obviously, the larger the leak, the more energy is wasted. Some leaks may require lines to be shut down, so it will also be important to determine when that can be done to avoid affecting production. Once the compressed air leaks have been fixed, maintenance personnel should remove the tags and return

them to the system analysis coordinator. The tags can then be cross-referenced back to the leak system analysis sheet to confirm that the repairs were made.

### STEP 8.

Prioritize the areas to be tested based on the following criteria:

1. Ease of getting access
2. Highest concentration of equipment
3. Increased ability to document cost savings or production

### STEP 9.

Determine what documentation will be required. The program’s success depends on documenting the compressed air system and quantifying aspects of the system that require corrective action. Vague reports or documentation will discourage plant personnel and typically lead to program failure. Include the following information in the documentation:

1. Item that is leaking
2. Degree of leakage
3. Location

### STEP 10.

Find a qualified contractor. When evaluating a contractor for the purpose of conducting a compressed air system analysis, a number of points will need to be addressed. Will the compressed air system analysis be a total system review, or will the system be reviewed in sections? A common area for review is detecting



and correcting compressed air leaks. Companies that do compressed air leak surveys typically do not have full compressed air system analysis capabilities.

The first item to complete is the pre-system analysis checklist. This allows a more defined selection of objectives and goals. This will help develop the road map from the beginning to the end of the system analysis process.

Here's a checklist of things to look for in an outside contracting firm:

- 1.** Can the firm do all the work that you require? Or will you have to hire another company to finish a section of the project?
- 2.** Does the firm have a good safety record?
- 3.** Has the firm done this type of work before in your sector, and does it have references?
- 4.** Does the firm have an ulterior motive for doing the survey? That is, is it trying to sell a new compressor, filter, piping system, or the like?
- 5.** Is the firm involved in organizations or groups that work toward energy efficiency?

As mentioned earlier, the plant should also assign someone to join the system analysis for the duration. This will ensure that the areas you want to review are covered, and that any issues that arise can be dealt with in a timely manner. The person who joins the system analysis team can also help clarify questions about the system's operation or procedures. Assigning someone to the system analysis team will help ensure that the team is operating in a safe manner and not doing anything that may cause a problem or shut down your operation.

When selecting your contractor, make sure you have a clear understanding of the scope of the work, and that your contractor knows what is expected of it. If you have any specific site requirements for training or safety certificates, make sure that the contractor knows and has the appropriate training. First aid, WHIMIS, and H2S Alive are all courses commonly required when working in an oil and gas environment.

Firm dates should be set for the system analysis and delivery of the report. Try to get the report within a week of the system analysis. That way, any questions or issues that

arise will be easier to remember and resolve.

### **STEP 11.**

Conduct the compressed air system analysis and make the corrections to the system. Pay particular attention to safety and verification.

How often should you conduct a compressed air system analysis? Set up continuing leak inspection by maintenance personnel so that, for a while, each primary section or plant is inspected to identify and repair leaks once a month or at least every six weeks. Keep a record of findings and results. Qualify and measure each leak to estimate its flow and assign a measurable cost value to it.

Consider setting up programs where production personnel (particularly operators and supervisors) are positively motivated to identify and repair leaks. Establish and monitor continuing air conservation programs.

### **STEP 12.**

Market the program's results to the plant. This will keep the program top of mind, keep the program moving forward, and ensure continuing success.

- 1.** Benchmark the system.
- 2.** Document the results.
- 3.** Calculate the energy savings.
- 4.** Determine the improvements in product quality.
- 5.** Resolve any issues with equipment.