

The Hidden Costs of Compressed Air/Gas Leaks

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Most companies do their best to conserve energy; most energy engineers realize the high cost of energy drain due to how much extra horsepower air compressors waste while trying to maintain pre-set air pressures. Likewise, they realize how costly leaks in their nitrogen, carbon dioxide, and freon systems can be. This article will focus on not only how leaks can negatively impact the system as a whole, but also how leaks can affect the environment and quite possibly the wellbeing of the personnel that have to work around them.

Air Leaks: Negative Impacts on Process Control

Air leaks can impact processes negatively. Control and pressure-reducing valves are relied upon to control the manufacturing process. Precise control is critical to the product we produce and to the indoor environments we seek to maintain. Air operated for a heating and ventilating system needs to accurately control the heating and/or cooling process. For example, in biotech facilities, compressed air may control environments where maintenance of humidity and temperatures are an utmost priority. If the degree of humidity in a controlled bio-genetic research facility goes awry, it can ruin months or years of research. Loose connections or splits in the tubing can adversely impact proper control. Obviously a ruptured diaphragm in a control valve cannot be properly controlled by a computer. Therefore, it should be apparent that facilities need to perform compressed air /gas leak audits on a regular basis, or make arrangements with a competent and professional firm to have audits performed periodically.

In a compressed air and gas system, many critical components require validation of proper operational capabilities. Non-critical system components likewise need to be scanned and tested for leakage. They include, but are not limited to: relief valves, solenoid valves, flange gaskets, thread connections, filter/lubricator/regulators, weld, thread and quick connection devices. At any given time they may not only be wasting energy but sacrificing proper process control.

Compressed air systems depend on supplying clean, dry air to their equipment and components. Separators, receiver vessels, compressors, and other components in a compressed air system depend on drain traps to automatically discharge the condensed water from the system. When a drain trap fails in the closed position, it causes a backup of condensate. The air fed to the system will contain water that can be detrimental to the equipment. Rust, dirt, and corrosion are additional consequences of not replacing these failed drain traps in a timely fashion. Ignorance of plugged drain traps also contributes to other portions of the system becoming adversely affected. If a drain valve fails in the open position, large quantities of energy are wasted. Since most drain traps are piped into discharge manifolds and then to waste drains, it is not generally visually apparent that they might have failed in the open position. Therefore, it is essential that regular ultrasonic tests be performed on these drain traps.

Valves, solenoids, and other sensitive equipment can plug or stick in an open position and eventually fail. Many times the gaskets between banks of solenoids begin to leak when water has not been drained from the compressed air system. Sometimes oil in compressed air systems can cause o-ring or gasket failures. If part of the system is outdoors and is subject to low temperatures, the air lines and the equipment to which it leads can freeze. Once frozen, the portions that freeze can crack and be permanently damaged. A proper air leak audit should identify the components that are causing energy loss. As you can see, the air/gas system is like a food chain, in that any one portion of the system that has failed will impact the others.

Gas Leaks: Costly and Dangerous

Other gases are quite a bit more expensive than compressed air. The rule of thumb for contrasting a compressed air leak vs. a nitrogen leak, for example, is that typically, nitrogen is 10 times more expensive than air. So who wants to live with even tiny nitrogen leaks? The cost of living with many nitrogen leaks will without doubt take a big bite out of your profits. If the leaking gas is volatile, such as natural gas, identifying and repairing the leak becomes an urgent priority. In one plant 22 natural gas leaks were found in one section of piping near the ceiling. The gas line was feeding an oven that had ignition points every 10 feet along the length of the equipment. The potential safety hazard of these leaks far outweighs the actual cost. Should an explosion have occurred, aside from the physical harm it could cause workers in the immediate area, it would have shut down the plant for quite some time. In a parts manufacturing plant an audit uncovered a huge argon leak. The feed line had a hairline split that was carrying the gas to a welder.

Inert gases such as argon, helium, and nitrogen are non-toxic and do not burn or explode. However, they can cause injury or death at high concentrations by displacing oxygen in the air. Should oxygen levels fall too low, individuals in the area or entering the area can lose consciousness or die from asphyxiation.

It is crucial that leaks be found and corrected before a small problem becomes a severe problem. In this business there is an old truism: "Everything leaks, it is just a matter of when."

Leaks Are Like a Wallet with a Hole in It

Leaks translate into cold cash. Allowing leaks to exist without a leak identification and repair program will add a hidden cost to the products your company produces, which can negatively impact the ability of the company to compete and can affect profitability. These leaks can be likened to having small pinholes in your automobile gas tank. After a while, you'll notice how they've created a hole in your wallet. The time to stop them is now. Energy is not going to get less expensive.

If you are an employee in a plant where leaks are not addressed, safety and your environment can be an unintended consequence. Many potentially explosive gases, such as hydrogen and natural gas, can leak. In addition, gas leaks such as the "greenhouse gases" can also impact the environment. Did you know that something as apparently innocuous as compressed air leaks can have environmental consequences?

Is an Air/Gas Leak Audit Cost Effective Even in a Smaller Plant?

Yes. Leak detection is important in any size plant. In a smaller plant your financial survival and competitiveness are that much more important. For larger plants, the impact may be exponentially more costly.

In a typical audit in a large plant, auditors will find between \$5-10 thousand or more per day of loss through leakage. Once you get a handle on your leaks, it is not unusual to be able to shut down the operation of an extra compressor.

How often should a leak audit be performed? Most customers want the audit done semi-annually or at least once a year.

Enlist the Help of Department Employees

When leaks become large enough, they become audible without the need for ultrasonic scanning. Heighten the awareness of all individuals in each department. Ask them to report leaks that may be audible. If you do not already own ultrasonic leak detection equipment, consider purchasing it and train one or more individuals in each department to perform their own leak audit. These air/gas leak auditors should be recognized as "energy conservation

champions.” As energy continues to become extraordinarily expensive, we must take steps to conserve. Our very manufacturing existence might depend on it. It is that important.

Experience and Proper Equipment Matter

Many of us are taught that in some cases you can get by with less. However, to do the best job, sometimes you need the best. An investment in good equipment makes your job easier and you ultimately save time. Time, as they say, is money. In the end you will thank yourself for using a reliable instrument.

A professional will keep equipment properly calibrated and take all steps to maintain the instrumentation.

Performing a Leak Survey

A successful leak survey requires three major elements: knowledge, planning, and follow-through. The knowledge component includes an understanding of the compressed air system, including all the subsystems and components. What are the sizes, types, and ages of the compressors? Have they been properly maintained? What about your traps and drains? Are your pressure gauges working and if so, is there adequate pressure for the various areas of use? What are the assigned pressures for these areas? Are there compressed air applications that can be replaced by alternative, less energy-intensive methods? For example, instead of using compressed air for cooling, drying, or cleanup, try using low-pressure blowers or fans.

Knowledge can also include the understanding of your ultrasound instrument, how it works, and the techniques of inspection. If you are not too sure about the technology or how to use the instrument, training courses are available that can help make you and other inspectors in your facility more competent and effective in your inspections.

Planning incorporates a number of facets such as a map of the compressed gas system and its various components. If none exists, try taking digital photographs of each section, using long range and close-up views, and labeling them. Planning also includes scheduling the survey. Don't try to do it all at once. Break it up so that the survey can be performed without negatively affecting other maintenance responsibilities of the personnel assigned to the leak team.

Before the survey begins, have the inspectors walk through the various sections to review their route. The walk-through can help in a number of ways: it can help identify potential safety issues, note any changes needed to the planned route, identify obvious leaks, and help the team understand what equipment to bring along, such as flashlights, keys, or specialized leak inspection attachments.

Another component to planning includes a leak tag/identification method. Once a leak has been located, it should be tagged. The tag number can be used, along with a photograph of the leak in your report. The identification process is extremely important. The leak rate can be assigned to the leak in a report that can then be used to demonstrate the cost savings and potential environmental impact of the leak. In addition, the leak identification process can be used to be sure a leak is repaired. It is very costly to leave an identified leak unrepaired. Money is wasted due to the cost of the personnel used to locate the leak. In addition, the cost of the leak will increase for every second it continues without repair.

Follow-through is another important factor. If a leak is not repaired, all the effort and cost of the survey will be wasted. Therefore it is important to use a follow-up method to assure all identified leaks are repaired. In addition, when a leak has been reported as fixed, the repair should be checked. Sometimes the repair might cause another leak to manifest or the wrong component is “repaired.” Follow-through includes review of the survey, cost analysis and, when possible, environmental impact analysis. A report can then be generated to demonstrate the effectiveness of the survey and the related cost savings benefits.

Follow-through includes leak management. Whenever a survey is complete, many leaks have often been identified. The problem is that the sheer volume of these leaks can seem overwhelming to a maintenance department that is already working hard at meeting the daily maintenance requirements they are normally assigned. It is important to work a system that will allow for the leaks to be repaired: one method is to prioritize the leak repair so that the most costly leaks or leaks that can affect production are repaired first, the next most important later, and so on.

Record keeping is another important element to the follow-through part of a survey. Some companies provide software that can help. One such program is freeware offered by UE Systems, Inc. This is a two-stage software that combines data management and comprehensive compressed gas survey analysis. Users can review annualized and monthly data that includes leak cost and greenhouse gas savings.

Conclusion

Compressed gases can be costly in more ways than the obvious. The cost of producing or purchasing the gas is one factor. Safety, the environment, and equipment degradation caused by leaks and equipment inefficiencies can all add up in many ways that can impact on a company's ability to compete and maintain profitability. A planned, comprehensive leak survey program can provide savings that can improve plant-wide productivity and profitability.

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