Dollar$ From "Thin" Air

Eliminate Needless Costs By Improving Your Compressed Air System

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By Tim Erdman

Photo courtesy of ITW Vortec.

Discretionary spending dollars have a way of hiding themselves under the "rock" of needless energy costs. One of those rocks is your compressed air system. If you take a little time to turn it over, you might be surprised at what you'll find. Begin by asking yourself: How much am I paying for my compressed air? How much of it is really required for my shop (or plant)? Do I monitor my compressed air usage? Should I? And finally, the Big Question: Is my compressed air equipment energy-efficient?

Why Care?

Compressed air can require 7 to 8 horsepower of electricity for every 1 hp of air force, according to Kaeser Compressors, Inc. The Fredericksburg, Va., firm says that a 100 hp compressed air system that cost $40,000 10 years ago will accumulate up to $800,000 in electricity costs.

A few simple actions, however, can reduce those energy costs by as much as 35 percent.

"Air is critical to shop operation, and downtime is money," says Kaeser spokesperson Angela Kelly. Kaeser and Kelly peg energy costs at almost 70 percent of the total compressed air cost – the other 30 percent is split between initial purchase price and maintenance. "Many just assume that such dollars spent represent the cost of doing business," says Kelly.

"However, there are significant advantages to purchasing quality compressed air equipment." If your compressed air is clean, dry, and efficiently delivered, for instance, it can also improve your shop's operations by eliminating downtime and extending service life on tools and pneumatic equipment.

It pays to see to it that your system is maintained in good working order. "Routine maintenance" should include a periodic filter replacement, oil level checks, and drain trap tests. Checks like these can help maintain efficiency and productivity. (If your shop doesn't have the resources to carry out its own maintenance plan, compressor distributors can offer you one of their own.)

Routine Maintenance? Go Figure

If some end users pay attention to their compressed air systems (maybe your competing shop owner is one), others tend to ignore. Manufacturers call it "The Fourth Utility," and for good reason: compressed air, like water, gas and electricity, is typically taken for granted; that is, until the system dies or shop operations cease.

Steve Broerman concurs. "As long as the compressor can keep up with demand," says the engineering manager at ITW Vortec in Cincinnati, "smaller shops don't care how much compressed air they're using."

Joe Fumo, regional manager at Ingersoll Rand Air Division, reasons that such indifference is due to a lack of knowledge on the subject, and because the compressed air system itself can be out of sight and out of mind. In shops where he's had a chance to evaluate such systems, Fumo estimates the potential for cost-savings ranges from 30 percent to 50 percent.

Maintenance corrections can mean significant cost savings. In a typical plant setup, a 10-psig increase of pressure requires about 5 percent more power to produce. A 520 cfm compressor delivering air at 110 psig needs approximately 100 hp. At 100 psig, however, only 95 hp is necessary. Figure, say, 10 cents per kWh and 8,760 hours, and the potential for such power cost savings is about $3,750 per year. (Large-scale plants tend to be more aware of such savings possibilities, because power companies target compressors and their efficient use as a prime method

for reducing energy consumption. Sometimes they will visit such a facility and make recommendations to improve efficiency, says Kelly.)

When you conduct a maintenance check, use an ultrasonic leak detection device to detect leaks. And don't be surprised to find some leakage—every shop experiences it, say the experts.

Leaks & Tweaks

"Studies indicate that approximately 35 percent of all compressed air produced is lost to leaks," says Kelly. "That's incredible! You look at the cost it takes to produce air and realize that more than a third is sheer waste." Both Kelly and Broerman strongly advise to first identify the leak, then repair it.

Broerman adds that the compressed air line itself can be a culprit if not sized correctly. "An undersized compressed air line can cause too much pressure drop, resulting in less-than-optimum efficiency. "That's costly," he continues. "You create all the pressure at the air compressor, but by the time you're actually using it, say 100 feet away, you've lost a lot of that pressure. Imagine trying to run a pneumatic impact wrench with just a tiny one-eighth inch hose attached. You're starving it!" (Vortek's literature and website both include charts that match compressor and pipe length and size to the application.)

Kelly notes that if the piping is cast iron, it will oxidize and release rust and scale into the compressed air, along with unwanted build-up at various points throughout the system. "This not only degrades air quality," she points out, "it also reduces the effective internal diameter of the pipe and obstructs air flow, resulting in unwanted pressure drops and velocity problems."

Fumo notes that the market potential for a systems retrofit is significant, and that even the Department of Energy thinks an air audit could improve 50 percent of all shop owners' compressed air systems. "I see a lot of compressors running at modulating conditions and higher-than-necessary pressures," he adds. A Kaeser pamphlet entitled "Energy Savings in Compressed Air Systems," states that the air system will automatically use more air at higher pressures.

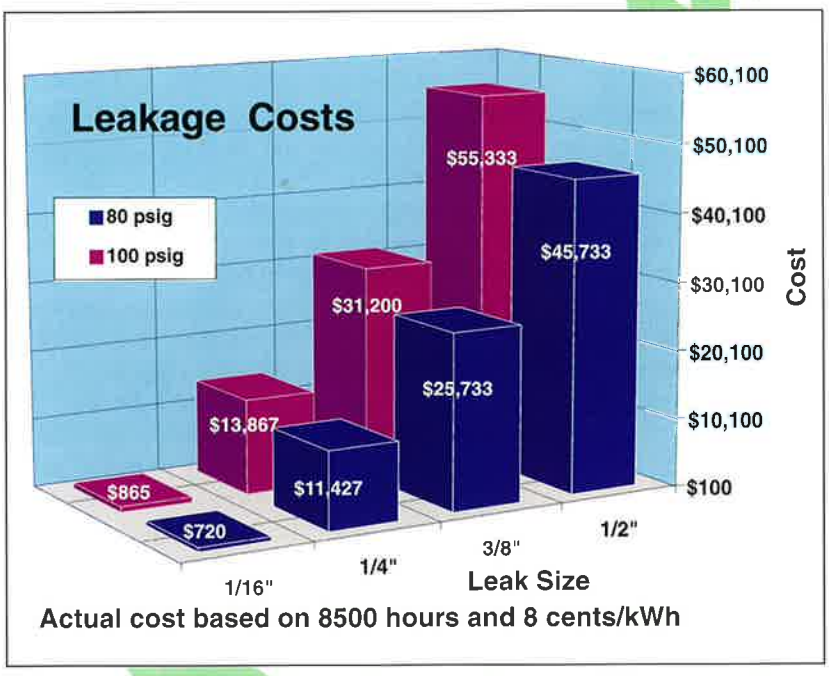
If there is no resulting increase in productivity, air is wasted, pure and simple. For example, a system that uses 520 cubic feet of air per minute

SIDETALK

Compressor Check

Kaeser's Angela Kelly says that owners and end-users should have a basic understanding of compressor function. Here are some tips for keeping your compressor in good working order:

1. Place the compressor in a relatively clean area that's well ventilated.
2. Set the compressor pressure according to the tool manufacturer's guidelines. Do not over-pressurize or increase the compressor's pressure setting in hopes of getting more flow! "This will actually exacerbate capacity deficits and increase the amount of air lost to leaks," she says.
3. Adhere to the manufacturer's recommendations for routine oil and filter changes.
4. Routinely change system filters. Routinely drain manual drain traps. Responsibly dispose of compressor condensate.
5. Review your system periodically to ensure it is meeting your facility's requirements.



These figures are based on 8,500 operating hours and 8 cents per kwH. Image courtesy of Kaeser Compressors.

This compressed air system features a 20 hp rotary screw compressor, refrigerated dryer, receiver tank, as well as the necessary filtration and drains to provide clean, dry air to machining centers and finishing tools. Photo courtesy of Kaeser Compressors.

These blowoff nozzles and jets are designed to reduce compressed air consumption and noise, compared to open jets. Photo courtesy of ITW Vortec.

Round Transvectors® use a small amount of filtered compressed air to deliver a large airflow for a wide range of conveying, ventilation, drying, and cooling applications. Photo courtesy of ITW Vortec.

(cfm) at 110 pounds per square inch gauge (psig) inlet pressure, will consume only 400 cfm at 80 psig. The potential power cost savings is $18,000 per year, clearly illustrating that more pressure is not always better, it can just mean more money.

Just think of this as money in the bank, or maybe used as pay raises for your valued employees.

Be Storage-Wise, Then Accessorize

Another issue is storage. The air receiver tank should be sized as accurately as possible. Besides storing and delivering compressed air to help meet periods of peak demand and prevent excessive compressor cycling, the tank can provide a first stage of moisture separation for air quality. When sizing your storage receiver, experts recommend two to four gallons for every one cfm of compressor capacity for optimum efficiency.

SIDETALK

Baseline & Save

Baselining your compressed air system is a way to measure the raw data that tells what shape your compressed system is in and what changes (hopefully inexpensive ones) to implement that can greatly reduce energy usage. If you think that such measuring is about as exciting as watching paint dry, consider that a good baseline and minimal effort can lead to a 15 percent to 25 percent energy savings. For more information on how to obtain a good baseline, contact Kaeser Compressors via editorial@magellanpubs.com.

Broerman says that the shop owner who decides to add more demand to his or her compressor system should consider blowoff products like nozzles, jets, and air amplifiers for point-of-use applications. "One way to save air, for example, is to replace the copper tube with a nozzle. If you do that at, say, a large number of work stations, you can save quite a bit of air," says Broerman. (Hmm, more pay raises.)

Using a large air stream to blow at small targets is wasteful, so it's important to match the blowoff product to what it is you're trying to cool, dry, or clean. A number of products are available that can save on CA usage, starting with air amplifiers. These round-throated, relatively inexpensive devices connect to a container or drum near the work area and accelerate the airflow. They work by squeezing compressed air out of a .002" gap through a nozzle or jet, amplifying air output up to 20 times. For broadly dimensioned work pieces, try an air knife, which functions along the same principle.

A Change In The Air?

Enough of the small stuff—how about the compressor itself? Perhaps it's time for a major compressor change. As you might have guessed, there are several types of air compressors out there, beginning with positive displacement compressors. These mechanically reduce the space occupied by the air to increase its pressure. The reciprocating type compress air through the action of a reciprocating piston. Rotary screw compressors use precision machined, male and female rotors that mesh – but do not touch.

"Rotary screw compressors are up to 20 percent more efficient than reciprocating compressors," notes Kelly. They are significantly more quiet and offer 100 percent duty cycle with less oil carryover at lower operating temperatures. So, maybe it's time to overhaul the entire system.

Then again, maybe it's not. After all, your compressed air system might just be the one place where you won't have to spend much to get a lot back. While an upgrade to something like a rotary screw compressor can yield excellent and immediate results, Kelly thinks that it's just as critical to examine your system's present components and condition first. Is the compressor appropriately sized for the application? Is the equipment monitored and routinely maintained? Is the air system designed to meet all of the application requirements or only select portions? Is the air quality sufficient to avoid quality control issues? "They are all system design considerations that qualified air system professionals can answer," says Kelly.

So, get busy and turn over that "rock." Ask questions, get answers, take action. Your employees will thank you.

Tim Erdman has written extensively about CNC cylindrical grinding, as well as specialty steels used in the machine tool industry. Many of his articles have appeared in metalworking magazines on emerging and existing technologies helping to maintain the American metal-producing industry's presence at the global forefront. He resides near Reading, Pa., teaches at Lebanon Valley College, and plays trumpet professionally.

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