Compressors and Air Systems
by Peter Burke, P.E.

10 steps you should take to cost savings

Compressed air is a common utility found in most industrial facilities. In fact, it is often referred to as the "fourth utility," along with electricity, wafer and gas. In many plants, the electrical power cost for operating air compressors and air treatment equipment accounts for 30 to 50% of the total monthly electrical charges. For this reason, compressed air as a utility should be managed and conserved. Fortunately, compressed air management can begin with actions that produce immediate results. The biggest "bang" for the buck" principal certainly applies. First, tackle the action items that will get the ball rolling, produce significant results, and are the least difficult to implement. Here is a 10-step program in the order of this philosophy.

1. Educate personnel. Any successful program begins with defining the problem and explaining the tasks. In this instance, everyone in the plant using compressed air needs to understand how the cost of air is determined. (See Figure 1 - the cost of air calculation.) Also, explain how air is produced, treated, maintained, conserved and handled safely. One suggestion is to make compressed air users aware of the operating cost of individual pieces of equipment. By helping the equipment users to realize the cost, they may be more willing to apply recommended conservation methods. Better yet, they might suggest new methods not previously considered.
2. Eliminate air leaks. Leaks in compressed air systems result in significant operating expense. A 1/8-inch diameter hole in a 100-psig airline of a compressed air system costs nearly $2,000 annually for a 24 hour-per-day operation. Begin by issuing colored tags to all personnel using compressed air. When leaks are discovered, request that they be tagged and dated for prompt maintenance. Should leaks prove difficult to find, by strolling through the plant just after quitting time and listen carefully for the hissing sound of air leaks. Preciously unnoticed leaks may be more obvious with the absence of daily production noises. For facilities working around-the-clock, ultrasound detection may help locate the elusive leaks. A break in a water pipe would certainly be repaired immediately - air system leaks should receive the same treatment.
3. Prevent waste. Consider installing automatic traps to prevent loss of air through pet cocks and valves left open to bleed off condensate. If electric, timed traps are installed, readjust them periodically to compensate for seasonal changes of moisture content in the air. Use pressure regulators at the point of use to avoid over-pressurization and waste. Be certain to use good quality "quick disconnects" that prevent air loss when they are coupled and uncoupled.
4. Air system check-up. Check your plant air system's health. Obtain optimal operating data for your compressed air equipment. Some compressor manufacturers provide "start-up forms" that list important parameters such as amperage draw, operating temperatures, pressures, and cooling media data. Check equipment at regular intervals and compare your readings with the available base-line data. Any abnormal operating parameter is an indication of the need for corrective action.

5. Evaluate power costs. Review electric utility fee schedules and past bills to establish a baseline. Compressed air systems improvements can be evaluated monthly by comparing electricity costs against the established base line. Progress in cost reduction then should be reported to management. Some electric companies offer rebates for efficiency improvements. This may be useful in making decisions on system changes and equipment enhancements. Many equipment manufacturers offer options and sometimes retrofit kits for existing equipment such as Wye-Delta starting, high efficiency motors and power factor correction, which can significantly reduce electricity bills. Energy rebates and reduced electrical costs usually translate into very short payback periods of the initial investment.

Figure 1
COST OF AIR CIRCULATION
COA=16.6P x c / Q
Where:
COA = Cost of air, $ per 1,000 cubic feet.
P = Total electrical compressor power, kW
Q = Total capacity, cubic feet per minute
c = Cost of electric power, $/kWh
Example:
P = 275 kW
Q = 1,650 cfm
c = $ 0.09/kWh
COA = 16.6 x 275 x 0.09 / 1,650
COA = $ 0.25 per 1,000 cubic feet

6. Reduce pressure drop. Taking steps to reduce air pressure drop can ultimately result in improved productivity and reduced electrical power consumption. Change air filter elements when the pressure drop becomes excessive. Differential pressure gauges and/or alarm devices are available to detect and indicate high pressure drop. Replace undersized or obsolete system components and reroute and en large critical piping circuits as needed. Remember, compensating for every pound of pressure loss requires approximately 1/2% increase in power consumption, not to mention increased wear and tear on compressed air equipment.
7. Implement preventive maintenance. Preventive maintenance programs should be designed based on equipment manufacturers'recommendations and the equipment's operating environment. Typically, the program includes oil level inspection, filter cleaning, V-belt tensioning, connection tightening and strainer cleaning at scheduled intervals. Periodic oil analysis offers an inexpensive method to compare actual required maintenance intervals to the manufacturer's standard recommendations. Excessive filter blockage is the most common cause of low air pressure or insufficient air capacity. Be certain only genuine replacement filters are purchased and installed according to the equipment manufacturer's recommendation. Replicator parts may not meet the manufacturers product standards and therefore perform differently. Compressor lubricants are expensive. All oil leaks should be repaired promptly.
8. Install power reduction controls. Several control systems designed to conserve electrical power are offered by manufacturers of compressed air equipment. Consider motor idle time reduction circuits and desiccant dryer purge air savers. For multiple compressor installations, sequencers provide an excellent, low-cost means of minimizing electrical demand and operating power. Some sequencers are even capable of automatically tracking scheduled maintenance.
9. Replace compressed air system components. New technology has produced more efficient compressor airends, capacity controls, aftercooler and motors. Centralized and/or decentralized

plant air systems should be evaluated in terms of capital investment, depreciation, energy rebates, power consumption, cooling requirements, maintenance and downtime. Replacing obsolete equipment may provide a surprisingly quick payback period.

10. Install waste heat recovery. Some packaged air compressors are configured for recovering the heat generated during the compression process. This allows up to 94% of the total electrical power to be recovered in heat form and utilized for space hearing, hot water heating, or a combination of both. These systems result in maximum use of energy and, if properly designed, a full economic payback can be realized in less than one heating season.

Today's plant engineers and managers are constantly asked to find means to reduce expenses. Electric utility charges for compressed air systems should provide the motivation to initiate a program to improve the management of compressed air systems. A successful program will conserve energy, reduce maintenance and downtime, and extend equipment operating life.

For more Information call Kaeser Compressor at 1-800-777-7873. This article was submitted by Peter Haldimand of Central Air and Hydraulics. For more information contact Peter by phone: (403) 243-8003 or fax: (403) 243-8023.