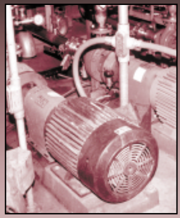
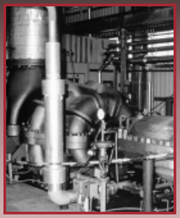
Energy Tips

Steam



Motors



Compressed Air

Suggested Actions

- Fixing leaks once is not enough. Incorporate a leak prevention program into your facility's operations. It should include identification and tagging, tracking, repair, verification, and employee involvement. Set a reasonable target for cost-effective leak reduction—5-10% of total system flow is typical for industrial facilities.
- Once leaks are repaired, re-evaluate your compressed air system supply. Work with a compressed air systems specialist to adjust compressor controls. Also look at alternatives to some compressed air uses. If a compressor can be turned off, benefits include cost savings and a system backup.

References

Improving Compressed Air System Performance: A Sourcebook for the Industry, Motor Challenge and Compressed Air Challenge, April 1998.

Training

- *Fundamentals of Compressed Air Systems* - 1 day
- *Advanced Management of Compressed Air Systems* - 2 days

Offered by the Compressed Air Challenge. Call the OIT Clearinghouse or visit the BestPractices Web site (www.oit.doe.gov/bestpractices) for the latest schedule and locations.

For additional information on industrial energy efficiency measures, contact the OIT Clearinghouse at (800) 862-2086.

Minimize Compressed Air Leaks

Leaks are a significant source of wasted energy in a compressed air system, often wasting as much as 20-30% of the compressor's output. Compressed air leaks can also contribute to problems with system operations, including:

- Fluctuating system pressure, which can cause air tools and other air-operated equipment to function less efficiently, possibly affecting production
- Excess compressor capacity, resulting in higher than necessary costs
- Decreased service life and increased maintenance of supply equipment (including the compressor package) due to unnecessary cycling and increased run time.

Although leaks can occur in any part of the system, the most common problem areas are: couplings, hoses, tubes, fittings, pipe joints, quick disconnects, FRLs (filter, regulator, and lubricator), condensate traps, valves, flanges, packings, thread sealants, and point of use devices. Leakage rates are a function of the supply pressure in an uncontrolled system and increase with higher system pressures. Leakage rates are also proportional to the square of the orifice diameter. (See table below.)

Leakage rates[a] (cfm) for different supply pressures and approximately equivalent orifice sizes[b]

Pressure (psig)	Orifice Diameter (inches)					
	1/64	1/32	1/16	1/8	1/4	3/8
70	0.3	1.2	4.8	19.2	76.7	173
80	0.33	1.3	5.4	21.4	85.7	193
90	0.37	1.5	5.9	23.8	94.8	213
100	0.41	1.6	6.5	26.0	104	234
125	0.49	2.0	7.9	31.6	126	284

[a] For well-rounded orifices, multiply the values by 0.97, and for sharp-edged orifices, multiply the values by 0.61.

[b] Used with permission from *Fundamentals of Compressed Air Systems Training* offered by the Compressed Air Challenge™.

Leak Detection

The best way to detect leaks is to use an ultrasonic acoustic detector, which can recognize high frequency hissing sounds associated with air leaks. These portable units are very easy to use. Costs and sensitivities vary, so test before you buy. A simpler method is to apply soapy water with a paintbrush to suspect areas. Although reliable, this method can be time consuming and messy.

Example

A chemical plant undertook a leak prevention program following a compressed air audit at their facility. Leaks, approximately equivalent to different orifice sizes, were found as follows: 100 leaks of 1/32" at 90 psig, 50 leaks of 1/16" at 90 psig, and 10 leaks of 1/4" at 100 psig. Calculate the annual cost savings if these leaks were eliminated. Assume 7000 annual operating hours, an aggregate electric rate of $0.05/kWh, and compressed air generation requirement of approximately 18 kW/100 cfm.

Cost savings = # of leaks x leakage rate (cfm) x kW/cfm x # of hours x $/kWh

Using values of the leakage rates from the above table and assuming sharp-edged orifices:

Cost savings from 1/32" leaks = 100 x 1.5 x 0.61 x 0.18 x 7000 x 0.05 = $5,765

Cost savings from 1/16" leaks = 50 x 5.9 x 0.61 x 0.18 x 7000 x 0.05 = $11,337

Cost savings from 1/4" leaks = 10 x 104 x 0.61 x 0.18 x 7000 x 0.05 = $39,967

Total cost savings from eliminating these leaks = $57,069

Note that the savings from the elimination of just 10 leaks of 1/4" account for almost 70% of the overall savings. As leaks are identified, it is important to prioritize them and fix the largest ones first.

About DOE's Office of Industrial Technologies

The Office of Industrial Technologies (OIT), through partnerships with industry, government, and non-governmental organizations, develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications. OIT is part of the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

OIT encourages industry-wide efforts to boost resource productivity through a strategy called Industries of the Future (IOF). IOF focuses on the following nine energy and resource intensive industries:

- Agriculture
- Aluminum
- Chemicals
- Forest Products
- Glass
- Metal Casting
- Mining
- Petroleum
- Steel

OIT and its BestPractices program offer a wide variety of resources to industrial partners that cover motor, steam, compressed air and process heating systems. For example, BestPractices software can help you decide whether to replace or rewind motors (MotorMaster+), assess the efficiency of pumping systems (PSAT), or determine optimal insulation thickness for pipes and pressure vessels (3E Plus). Training is available to help you or your staff learn how to use these software programs and learn more about industrial systems. Workshops are held around the country on topics such as “Capturing the Value of Steam Efficiency,” “Fundamentals and Advanced Management of Compressed Air Systems,” and “Motor System Management.” Available technical publications range from case studies and tip sheets to sourcebooks and market assessments. The *Energy Matters* newsletter, for example, provides timely articles and information on comprehensive energy systems for industry. You can access these resources and more by visiting the BestPractices Web site at **www.oit.doe.gov/bestpractices** or by contacting the OIT Clearinghouse at **800-862-2086** or via email at **clearinghouse@ee.doe.gov.**

BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small and medium-size manufacturers.

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