

Compressed Air

Key information

Almost all industrial SME's use compressed air within the production process and few employ even simple controls to ensure that waste and misuse is kept to a minimum. Approximately 10% of the electrical energy supplied to industry is used to compress air and typically some 30% of this is energy is lost due to leaking systems. The electrical losses each year due to air leaks, is equivalent to the entire output of a medium size power station. Even worse, a much larger sum is wasted each year due to compressed air misuse and general complacency. In particular most businesses ignore the potential for energy recovery from their compressed air systems.

Major opportunities for savings

Good Housekeeping:

Who carries the overall responsibility for the compressed air system on your site? The quickest and simplest way to save energy is to adopt the following plan.

- Appoint a person to take overall responsibility for the system.
- Walk the system - outside normal production hours - listen for leaks, valves left open and faulty fittings. If your production runs for 24 hours a day, consider buying or hiring an ultrasonic leak detector to help you locate leaks. Repair all leaks immediately.
- A loaded compressor has a different tone to an unloaded compressor. Run your compressor out of production hours and listen to the changes in tone, you will quickly establish which tone represents a loaded machine and which tone represents an unloaded machine. Over a period of ten minutes, time how often the compressor runs at the two different tones. If the compressor runs 'on-load' for a total of say three minutes and 'off-load' for a total of seven minutes, this means that 30% of the air being generated is supporting leaks and wastage - because there is no production. Target those leak reductions.
- Make sure that compressors and associated equipment are turned off when they are not in use. SWITCH IT OFF!!
- Fit isolating valves to air operated equipment. This may not cure any leaks in the equipment but shutting the valve when the machine is not in use will stop the leak just the same..• Ideally you should monitor how often the compressors run on a week-by-week basis. Fit an electrical meter to the supply, or read the 'hours-run' meter fitted to most modern compressors. Abnormal increases usually indicate new leaks.

Good Maintenance:

Although it is a statutory requirement to maintain compressed air equipment in accordance with a manufacturers recommendations, an equally good reason for good maintenance is the increase in efficiency.

- Blocked intake filters reduce efficiency. Throttling the air going into a compressor can increase power absorbed by 4%. Therefore saving a few pence by not changing an intake filter will cost a few pounds in energy.
- Poor ventilation has exactly the same effect as a blocked intake filter as this starves the compressor. Make sure that ventilation grills are kept clear from obstruction.
- Blocked or dirty intercoolers will increase the power used by the compressor. The dirtier the production process, the more regularly these items need to be cleaned.
- Start a compressor maintenance log. Proactive maintenance is always cheaper than reactive repairs and a well maintained compressor uses less energy.

Energy recovery:

All compressors generate heat and many industries can benefit from some form of heat recovery system. It is a simple task to obtain either hot water or hot air from a compressor, irrespective of whether the machine is air-cooled or water-cooled. The following list of suggestions would afford significant opportunities for energy recovery.

Hot Air

- Full ducted space heating. Compressor cooling air can be 20 – 25 °C warmer than ambient air. If the flow is great enough, hot air can be ducted into a workshop or warehouse to provide 'free' space heating.
- Air tempering. If the hot air flow is insufficient for full space heating, it can still be ducted into the existing space heating system to provide pre-heating.
- Keeping product and packing materials dry. Simply placing a compressor in a warehouse may provide sufficient heat to stop cardboard boxes from becoming damp.
- Providing combustion air to boilers. If the cooling air is 22 °C above ambient, ducting the air to a boiler can increase boiler efficiency by as much as 1%.

Hot Water:

- Sanitary water to washrooms, canteens & showers. Compressors can provide hot water up to 80 °C, quite warm enough for most sanitary applications.
- Central heating.
- Boiler feed water. An increase of 6 °C in boiler feed water temperature can increase boiler efficiency by as much as 1%.
- Hot water for washing product.

Having established a use for the hot air or hot water (the heat sink) it becomes perfectly possible to recover 80% of the electrical energy consumed by the compressor as heat. A quick calculation based upon *your* electrical usage will determine how much you can save, however most heat recovery systems offer a payback within 18 months.

Storage

Most compressed air systems contain at least one air receiver and the purpose of the receiver is to iron-out fluctuations in air demand. If you can hear fast and frequent changes in tone from the compressor, this indicates that it is hunting between an 'on-load' and 'off-load' condition. It is likely that the air receiver is too small. A system with inadequate storage will also show the following symptoms:

- Standby compressors turn on when they are not necessary.
- Pressure losses increase down the distribution pipe so that the pressure at point of use is much lower than at the compressor.
- Product spoilage may occur.

Installing additional air receiver(s) is a fairly low cost exercise, typically about 5%-10% of the cost of the relevant new compressor.

Air Treatment:

It is not possible to define an ideal level of treatment as this varies from site to site, however in some extreme cases air treatment will reduce system efficiency instead of increasing it.

- Always treat the compressed air to the lowest acceptable level. Contact the suppliers of your production machines or tools and ask them what is the *minimum* air quality the equipment needs.
- If only a few pieces of equipment require high quality air, spot treat the compressed air at point of use instead of treating the whole air supply.
- Change in-line filter elements regularly.

- Remember that refrigerated air dryers use less energy than desiccant air dryers.
- Remember that heat-regenerated desiccant dryers use less energy than heatless dryers.

Because air treatment systems are expensive, make sure you choose the right one first time.

Distribution Systems

Although most air compressors eventually get replaced by bigger compressors, the original pipework usually remains in place. Over the years a pipe system may end up carrying two or three times the original design load, resulting in excessive pressure drop and high energy bills.

- Keep air velocities in the main header system below 6 m/sec. If in doubt, ask your compressor supplier to calculate the correct pipe size to suit your compressor(s).
- Keep the system pressure drop below 0.2 bar. Measure the pressure at the compressor house with a gauge, then using the same gauge measure the pressure at the farthest point on the site. High pressure drops indicate that the air pipe is too small, stifling the air flow.
- Add to pipe systems to create 'ring mains' wherever possible.
- Replace rusty pipe.
- Use long radius bends instead of elbows.

System Control:

One of the most obvious savings to be made is to generate compressed air at the minimum pressure that a production process requires. To keep safely above the minimum pressure requires an adequate control system than not only measures system pressure accurately, but can also control the compressor(s) within the pre-set pressure band.

- Determine the minimum pressure for the system. This can be accomplished by asking equipment and tool manufacturers to specify the minimum air pressure needed by their equipment.
- Install a controller that uses either a pressure transmitter or a pressure transducer. These are more accurate than pressure switches and will save energy by controlling the operating pressures of the compressor more closely.
- Set the lower limit marginally above the minimum required pressure.
- Set the upper limit to a point that does not result in the compressor(s) hunting. This may require larger or additional air receivers to be installed, however the costs will be quickly recouped by energy savings - typically within 18 months.
- Monitor the system to make sure that site pressure is acceptable for all of the production processes. Modify the operating pressure if necessary.

Compressed air is a safe source of energy with a reputation for being expensive. Take control of your system now and put in place some simple steps that will have a positive effect upon your energy costs.

Reference:

www.actionenergy.gov.uk