Breath of fresh

Plant engineers looking to slash utility bills are increasingly targeting energy-hungry compressed air systems. Steed Webzell examines the options

Pointers

- Energy accounts for 80% of compressor cost, so savings can be significant
- New designs with, for example, electromagnetic bearings, can transform cost and maintenance
- Compressed air audits commonly reveal problems with an ancillary plant
- Challenge air demand, supply, storage, distribution and quality assumptions
- Moisture is still the most commonly reported problem, so check your filters, drains, dryers etc

It is not uncommon for organisations to report that up to a third of their total factory energy bill can be attributed to compressed air plant. No surprise then that, with energy prices at record highs, reviews of compressed air systems are yielding significant returns.

Understandably, perhaps, the first port of call for many is to consider replacing ageing compressors. And that could be more worthwhile than some think – because, although technology has remained largely unchanged for several decades, few would argue the bar wasn't raised by the launch of CompAir's Quantima, earlier this year. Five years in development, this oil-free machine has just one moving part and is claimed to consume a full 20% less energy than conventional compressors.

How? At the heart of the unit is a rotor that floats on electromagnetic bearings, reaching speeds up to 60,000rpm. Also, a direct-drive, inverter-controlled asynchronous induction motor, that varies its speed to match airflow demand, spins that rotor.

And get this: given that energy typically accounts for more than 80% of a compressor's total cost over its lifetime, CompAir's estimate of a 20% saving against conventional screw designs means a £385,000 saving over a typical 10-year cycle. That's based on a 300kW machine operating for 8,000 hours a year on electricity costing £0.08/kWh.

That said, no matter how good a new compressor might be, replacement is not always something that a stretched capital equipment budget can sustain. So plant engineers are also forced to consider alternative approaches, such as intelligent air management programmes, to cut bills without compromising the air supply.

These typically consider a range of factors, including air demand, supply, storage, distribution, quality, maintenance and condensate management.

Free health check

Compressed air audits can help manufacturers improve energy efficiency. As part of its commitment to minimising energy and production costs, Atlas Copco is offering a free compressed air system health check. The check is non-intrusive and examines the entire air supply system, highlighting all energy-consuming assets.

It also involves monitoring and inspecting compressor running, as well as the capacity and fitness of the dryers and ancillary equipment, such as receivers, filters, drains, oil/water separators and pipework. It also examines the state of the monitoring and control system.

And it's well worth it. When assessing air demand, for example, it's not uncommon to find that a large percentage of apparent demand is artificially created by factors such as inappropriate production usage, open blowing, leaks, faulty pneumatic tooling, or regulators at the point of use at their maximum setting. Addressing each of these can have a significant impact on energy usage.

Equally, with supply, it's not just about meeting demand: storage and distribution need to be synchronised to avoid pressure fluctuation and associated energy losses. Adequate storage is also key, since that dictates the energy available when it's needed. The air receiver tank normally accounts for most capacity, but as facilities outgrow their air systems, they expand their pipe runs, so it makes sense to install additional receivers to handle distant demand.

Pressurised demand

Remember, total storage capacity required is dependent upon the volume of excess demand, available pressure differential, the compressor start-up time and the time available to replenish stored compressed air. Then, since distribution is the link between supply, storage and demand, it needs to allow air to flow with minimum pressure drop – and that, while friction is a factor here, up to 1.7bar can be caused by pipe corrosion. Which is why some plant engineers are adopting aluminium pipe runs, such as the Transair system from Legris, which has been installed on plant ranging from Ford to News International, instead of galvanised push-fit systems.

Moving on to quality, going up the levels directly impacts the cost of compressed air production, so it is prudent to meet, not exceed, the level you require. Also, if different levels are needed on plant, it is more cost-effective to treat smaller amounts of compressed air for the applications with the highest requirements than to treat the whole air supply.

And finally, on maintenance, moving to a preventive approach is arguably the most important step that plant engineers can take. Leaks are one of the biggest issues and can be very expensive. For example, one 6.35mm diameter opening equals

air

Almost every industrial site in the land could benefit from a full air system review

2.8m³/min at 6.2bar – equivalent to running and venting an 18kW compressor.

One of the most common problems associated with compressed air systems, though, is moisture. Purification devices help to remove contaminants, but it's all about proper selection. Main units for condensate control are coalescing filters, drain valves, air dryers and after-filters – but, if in doubt, advice is available. Thorite, for example, is working with air dryer manufacturer SMC, offering a free on-site dewpoint test, followed by installation of a refrigerated air drier from the latter, if required.

John Hill, marketing services manager for Parker Hannifin's pneumatics division, which recently launched its Moduflex air filtration, is also adamant that new filtration technology can reduce energy consumption and costs. "Firstly, it is important to ensure that the compressor intake filters are clean and in good working order," he says. "Failure to do so can lead to falling pressures and increased energy usage. Likewise, fitting temperature gauges can optimise the efficiency of after-coolers. They should be installed on the after-cooler at both the cooling water inlet and the compressed air outlet."

Beyond all that, though, the value of implementing compressed air management should not be underestimated – as one of the UK's largest printing works, Trinity Mirror in Oldham, can testify. The company recently shaved a staggering 46% (£115,000 per annum) from its energy bill as a result of such an exercise. Energy consultant David Jeffs of Energy Matters, who worked with Trinity's commercial director Kieran Flemming on the project, recommended a site review by air specialist Maziak.

Its four compressors (one variable speed, three fixed speed) had been installed in 2004 and included sophisticated controls, but the configuration had not been optimised for efficiency. In fact, Trinity's variable speed compressor was always the lead unit – meaning that, during low demand, it could adjust flow and energy consumption effectively. But, as demand rose and the fixed speed compressors kicked in, control effectiveness was compromised.

Maziak's solution was to replace the existing OEM control unit with a Metacentre intelligent controller from EnergAir. Flemming explains that the unit now monitors pressure and demand, and 'learns' from events to make decisions about the optimum combination of compressors under varying conditions. Most importantly, by changing the lead compressor, it ensures that the variable speed unit always fine-tunes production, while also minimising costly on-off events by the other compressors.

He also says that adding an intelligent flow control valve to the facility's existing compressed air accumulator system made further improvements possible. "This is a large plant and some of the air travels more than 600m from the compressor house to its point of use," he explains. "This caused a substantial pressure drop, meaning we had to supply compressed air at 9bar to be sure of delivering a consistent 7bar, regardless of demand." The team has now been able to reduce delivery pressure to 7.2bar. PE