

Taking the air

For plants using compressed air, energy wastage through leaks has always been an issue. But now emissions compliance legislation is about to get tougher, warns Brian Wall

Energy sustainability is one of the hottest topics on the political agenda – closely linked to environmental concerns. Combine these with soaring energy costs and it's no surprise that reducing consumption on plant is right up there for industrial operations. However, in many plants, energy in the form of compressed air is simply being allowed to leak away.

Although typically small, collectively leaks can cost companies hundreds of thousands of pounds per year. They can also cause accelerated corrosion of equipment and early failure, as well as presenting health and safety risks. Moreover, increasingly punitive legislation is hitting hard at businesses that fail to put their houses in order.

By far the largest proportion of the total lifecycle costs of a standard compressor is energy consumption: on average, it accounts for 79%. Yet, on poorly maintained plant, the air leak rate may equate to a staggering 20–30% of capacity. By comparison, proactive leak detection and repair can reduce that figure to less than 10%, according to best industry estimates.

Sound advice

So what techniques are available to help? Despite popular belief in the approach, detecting leaks by visual or audible methods can be ineffective. However, ultrasonic techniques provide a powerful alternative for unearthing leak problems, as Mark Oliver, regional manager in the condition monitoring division of AV Technology (AVT), explains. "During a leak, a fluid moves from high pressure to low pressure and, as it passes through the leak site, generates turbulent flow. This has strong ultrasonic components and, typically, the larger the leak, the greater the ultrasound."

But while leak detection is clearly essential, there are other important ways to minimise energy consumption – principal among them, considering usage at source. It starts with compressor sizing. All consumers – tools, machines and processes – determine the nominal compressed air requirement, but the size of compressors should be based on usage. There is no point in sizing a workshop compressor to run both a spray gun and a sander simultaneously, if only one person is operating the

equipment. The golden rule is to size the compressor to the largest air-using equipment.

Atlas Copco recommends carrying out an air audit, such as its AirScan, to get a true picture of how much compressed air is being used on site and how much energy is wasted in producing it. Its audit, like others, is applied in two stages: consultant engineers conduct an initial diagnostic check to determine efficiency of the air system, including all pipework. The second phase reviews every element with the system in operation. Analysis of usage patterns and a report then show precisely where the system could be improved.

Northern Foods' Riverside Bakery in Nottingham used Inverter Drives Systems (IDS) for a review – and says it has been saving nearly £2,500 annually on its compressed air system since installing a 45kW ABB variable speed drive (VSD). Compressed air is used in many of the bakery's processes and James Whieldon, maintenance analyst for Northern Foods, says: "Our monitoring and targeting software gives us profiles of the compressors and indicated that there were definite opportunities to improve the amount of energy they were using."

IDS confirmed that and recommended the VSD for the bakery's 45kW duty compressor –



Pointers

- At the end of this year, the next stage of the Tier 3/Stage 3A directive will move on to targeting engines between 37 and 74.9kW.
- From 1 January 2008, anyone purchasing a compressor with engines in the 37 and 74.9kW size range will need to ensure that it meets the new standard.
- Good operations and maintenance require clear real-time visualisation, feedback alarms and performance monitoring



Carrying out a compressed air energy audit may reveal huge scope for improvement

leaving its two associated 30kW compressors to run fixed-speed for assist and standby duties. Says Whieldon: "The drive is now operational and we calculate the payback time for the project is one and a half years. But, with energy prices rising, the savings will increase."

John Forman of Atlas Copco agrees that VSDs can make a significant difference. "In 80% of all installations, air demand shows important fluctuations; in 70% of installations, load cycle lies between 40 and 80%. As a consequence, there is a big potential for energy savings, if VSD compressors are applied." Indeed, he reckons that savings averaging 35% are achieved by matching the speed of the compressor motor to the air demand.

"In contrast, traditional regulators do not possess the accuracy to track demand pattern variations, so substantial amounts of energy are wasted," he says. What's more, with a VSD, the air demand profile of a compressor is smoothed, so there is no unwanted overshoot in pressure, further improving energy savings. And he adds that up to 22% can be saved on the total compressor lifecycle cost.

Incidentally, he also recommends considering intelligent remote controls in multiple compressor

installations, in order to optimise the total system for minimal pressure band and maximum energy savings. Atlas Copco's AirConnect is an aftermarket service that links compressed air installations to an automated 24/7 Internet-based monitoring system, and the claim is increased availability and reliability.

The hardware monitors all devices in the compressor room and gives access to the Internet. But AirConnect software also includes a configuration program for compressor room layout and measurement points during commissioning, and aims to manage the entire air network.

Optimal treatment


Its program also looks at air treatment at generation and throughout the factory to ensure high quality air, cut downtime for production equipment and minimise product spoilage. The aim is to provide a single source for service of all a user's compressed air equipment, irrespective of its manufacturer. That, says the company, is another way to achieve significant reductions in operating costs.

What about regulations? Emissions compliance legislation has been in place for some time, aimed at tightening standards on, in particular, diesel



BETTER CONNECTED BY FAR

engine-driven equipment, including compressors – setting new limits on NO_x, CO₂ and hydrocarbons emitted in exhausts. Tier 3/Stage 3A level of the directive that came into force in 2006 is currently in place and runs to 2010. The directive also sets transient test procedures to better represent real conditions and engines must maintain their emissions performance throughout their lifetimes – and that has to be demonstrated as part of the approval process. For operators looking for compressors able to operate more efficiently and cleanly, this is an approval to watch.

CompAir is one compressed air equipment manufacturer that has been successful in utilising new, greener technologies that go beyond the current legislation. According to the company's Gerry McGettigan: "[Our] C35-10 and C50 compressors feature a water-cooled Cummins engine that conforms to the latest emissions regulations, as well as offering low fuel consumption and automatic bleeding of the fuel system. On the larger outputs, for example, the machines are fitted with a Cummins QSB 4.5 engine that not only complies with the directive, but provides superior performance, durability and reduced noise." 

Challenge conventional thinking

Plant engineers must challenge thinking with air systems to achieve energy savings, according to Peter Tomlins of EnerAir. "The majority of compressor houses still employ fixed-speed compressors and a cascaded pressure switch. That is outdated, inefficient and needs to be changed.

"Second, operators are receiving mixed messages from compressor manufacturers. While most branded air compressors are good machines, an incorrectly sized unit can have a negative effect on overall system efficiency.

"Third, the current trend towards buying variable speed drive [VSD] compressors does offer the potential to generate compressed air more efficiently, but a VSD compressor that is not controlled as part of a management system ... is unlikely to deliver any energy savings.

"Other conventions about sizing compressors can also have a big impact on system efficiency. Air demand tends to be erratic, follows shift patterns and, in some cases, seasonal trends. We've seen hundreds of sites where the demand for compressed air falls between the generating capacity of compressors. This leads to increases in offload running, in the case of fixed-speed units and, where VSD compressors are installed, some hunting or dead banding can occur."

When selecting VSD compressors, users should pay close attention to minimum, as well as maximum speed, output span and the inverter reaction time, he concludes.



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