

# THE PRESSURE IS ON TO SAVE ENERGY

**LEE ALEXANDER**, PRODUCT MANAGER WITH COMPRESSOR PRODUCTS INTERNATIONAL, AND **ANDY ANTHONY**, OPERATIONS DIRECTOR OF MONITRAN, EXPLAIN HOW WORN COMPRESSOR VALVES WASTE POWER AND MONEY – AND WHAT TECHNOLOGY EXISTS TO HELP IDENTIFY PROBLEMS

**M**any industrial applications require pressurised gas. Compressors, which are typically driven by electric motors or engines, are used to pressurise the gas, and there are a number of types of compressor available, including centrifugal, axial, lobe, rotary and reciprocating.

Of these, reciprocating compressors are particularly popular, as they can achieve high pressure ratios between the inlet and the exhaust. They range from small units driven by motors rated at just a few kW, as might be used in a small workshop, to multi-cylinder industrial compressors that work 24/7.

Reciprocating compressors have one or more cylinders, each with a piston and at least one inlet and one exhaust valve. Some might also have a pressure reservoir in instances where high-pressure air or other gas might be required infrequently, and it is the compressor's job to maintain this reservoir's pressure.

## Working too hard?

Compressor efficiency depends on the health of a number of critical sealing components. For example, as valve seals wear less high-pressure gas is delivered for the mechanical energy (piston movement) expended. Gas does not physically escape the system but is recycled. Inlet valve wear results in higher pressure gas leaking into the low or atmospheric side of the system only to be drawn in again, while exhaust valve wear results in high-pressure gas leaking back into the cylinder.

While the manufacturers of compressors take a scientific approach to the design, production and use of critical sealing components, once a compressor is installed and operational the onus is very much on the user to monitor its health. Monitoring the high-pressure gas flow is of course an option, as is monitoring the power (or fuel)

consumption, provided the power or fuel can be monitored in isolation. However, on a multi-cylinder compressor, neither strategy would indicate which parts are wearing.

Physical inspection during maintenance routines is of course possible, but there is a fine line between risking unexpected failure if maintenance intervals are too long and costly 'over-servicing', which can never guarantee against unexpected failure in any event.

## Acoustics have the answer

As a result of recent industry developments, suitable monitoring equipment can now be used to assess the health of the valves while the compressor is running. This assessment can be used to underpin a site's formal condition-based predictive maintenance (CBPM) routines.

*"IDEAL FOR SPOTTING WEAR TRENDS AND ENABLING OPERATORS TO SCHEDULE MAINTENANCE BEFORE THE COMPRESSOR STARTS USING MORE POWER OR FUEL THAN NECESSARY"*

Specifically, much work has been done on the measurement of the 'acoustic profiles' of compressor valves. Sensors, similar to vibration sensors but adapted to frequencies higher than typical mechanical vibrations, can be used to acquire acoustic data. This is the principle on which Compressor Products International's Valve alert is based. It is available as a handheld unit for manual inspections or as a permanently installed system accessible via the web.

In the handheld configuration, a bespoke sensor (manufactured by UK based company Monitran) is used to



*Above, a six cylinder reciprocating compressor, used to compress natural gas for piping over long distances. All six cylinders must remain healthy to maintain the required pressure and flow rate*

pick up acoustic emissions and temperature data. The sensor is attached to a quick-release connector bonded to the valve cover.

Once collected and stored in the handheld unit, data can be transferred to a computer and analysed. The algorithms in CPI's ValveAlert software automatically detect valve anomalies such as leaking valves, stiff or weak springs, slamming, valve flutter, late or early openings and closings, and can also give early indications of valve crack propagation and sticking valves.

The condition of the valves can be displayed through a series of graphical displays, ideal for spotting wear trends and enabling operators to schedule suitable maintenance before the compressor starts using more power or fuel than necessary.

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