Burckhardt Compression

IMPROVING SUSTAINABILITY – TACKLING FUGITIVE EMISSIONS FROM RECIPROCATING COMPRESSORS

Reciprocating gas compressors are used in many applications and their operators demand excellent reliability. Unscheduled downtime that causes a process to be halted can have very significant financial costs for the business. Therefore, most operators employ a proactive maintenance regime to ensure their compressors deliver reliable service between major overhauls.

At the same time, sustainability is an increasingly pressing issue and all major assets have a role to play in reducing their carbon footprint and the resources they consume. In a world that uses numerous gases in industrial applications, compressors play a vital role, and they need to make their contribution to process reliability and sustainability.

To that end, fugitive emissions from gas compressors represent a significant issue for operators, both in terms of sustainability and operational efficiency. While leaks will not result in immediate problems or incur unplanned downtime, they should be addressed at the earliest opportunity.

CURRENT PRACTICE

Industrial gas compressors are used across the world in many upstream, midstream and downstream applications to improve the efficiency of many processes. Gas leakage is inevitable to some degree, the aim of modern operators is to keep it to a minimum and optimize the sustainability of the process.

In many cases, any leaked gas is collected and sent to a flare stack, where it is burnt with no attempt to capture the inherent energy. This is not just wasteful; it has an associated impact on carbon emissions that could be reduced through improved working practices. In fact, many countries are banning the flaring practice as part of their drive for improved sustainability. Some refineries are even monitored by infra-red cameras to detect flaring events, which would result in considerable fines for contravention of environmental legislation.

IDENTIFYING SEALING ISSUES

Although gas leakage will not cause an immediate halt to the process, it will only get worse over time and it can cause other issues, such as a rise in operating temperatures. This can lead to reduced efficiency and reliability issues, so tackling the problem at the earliest opportunity is essential. The key to the most effective solution is to look at the complete sealing system in a holistic manner.

During the compression process, the majority of leakage occurs at the piston rod packing, and this should be the primary concerns for the operator. Tackling this issue and implementing a proactive maintenance program will not only ensure compliance with local environmental legislation, but also deliver a more reliable compressor that costs less to run.

The integrity of these seals is determined by several factors including the ring design, material and the surface finish of the piston rod. For reciprocating compressors, increased wear rates and therefore seal leakage can be identified using measurement of gas leakage flow, or by identifying a change in the leaking gas temperature.

Image 1: Careful inspection of compressor components, including sealing systems, is essential to identifying leaks

ESTABLISHING SCALE

During inspections, technicians can use gas leakage detectors or 'sniffers' to identify any leaks from areas such as cylinder covers, valve covers and other static seals on the compressor. Establishing the scale of the issue for an installation is not a simple task; precise figures can only be achieved by direct leakage measurements.

A more accurate representation of fugitive emissions can be achieved by collecting gas through leakage lines, enabling precise figures to be obtained on the extent of the issue. Flowmeters in the pipework that directs the gas to the flare stack can provide quite accurate data for gas leakage.

The extent of a leakage problem depends on the sealing system, which consists of many elements. The design of these systems is dictated by the gas itself, so seals for a larger molecule gas, such as methane, are easier to deliver, compared to a system for hydrogen, the smallest and lightest molecule on earth. Burckhardt Compression has considerable experience and success in working with industrial gases and creating durable sealing systems for these compressors.

Non-lubricated compressors offer some considerable challenges in terms of sealing, but Burckhardt Compression has a range of solutions that can be implemented, depending on the application.

In one example, a customer had measured a leakage rate of 7 Nm^3/h from a single-stage, non-lubricated compressor. Having assessed the current design, the best solution was to upgrade the three-ring piston seals to a four-ring design that added a support ring but made no changes to the materials used. The result was a very significant drop in leakage to 1.2 Nm^3/h on average, even after 7'600 hours of operation.

Image 2: Burckhardt Compression provides on-site support as well as advanced inspection equipment

MODELLING THE SOLUTIONS

Currently, it is very difficult to obtain accurate data on gas leakage and to precisely predict the improvements that can be achieved by replacement parts based on modelling alone. This is due in part to the large number of factors impacting packing leakage. However, it is possible to demonstrate reduced leakage and improved reliability using real-world examples, and this is where Burckhardt Compression is leading the field.

In one situation, a dry-running compressor working with 90% hydrogen and 10% methane exhibited a very high leakage rate with the packing not achieving the minimum of 4'000 hours required by the maintenance schedule. Burckhardt Compression suggested a proprietary solution that included a set of multi-piece rings made from Persisto 850, which has been developed by the manufacturer's in-house team of experts. This enabled the packing to significantly reduce gas leakage and achieve a minimum lifetime of 8'000 hours.

At the heart of any successful solution is years of experience and expertise that can be channeled into the development of new components and improved designs. This is now being enhanced by analysis tools that can optimize the performance of any compressor thanks to an assessment program that can be tailored to each application.

INDUSTRY CHALLENGES

Global targets for greenhouse gas (GHG) emissions and reducing the carbon footprint of industry in general have led to increased legislation, both local and international. The Global Gas Flaring Reduction Partnership comprises international oil companies (IOCs), national and regional governments as well as international institutions. An initiative to achieve zero routine flaring by 2030 was launched by the World Bank and the United Nations in 2015 and has been endorsed by various major energy companies and national governments.

Effectively, this means that any new installations must avoid non-emergency flaring, while existing plants need to eliminate it by 2030. In terms of the compressors, implementing actions to minimize fugitive emissions will optimize performance as well as enhance reliability and sustainability. However, there are many different designs of compressor depending on the application and the scale of the gas process, and they can be supplied by numerous OEMs.

Typically, when looking for technical support, the first port of call is the OEM and responses can vary depending on the age of the compressor and the ability of the manufacturer to deliver local support. Burckhardt Compression not only has decades of experience in compressors from numerous OEMs, but also has the ability to provide in-person assistance as well as live, one-to-one support using advanced equipment.

DATA IS KING

As with any key equipment, process data is essential to establishing important operating characteristics. The amount of information available from gas compressors fluctuates wildly, depending on the operator.

However, in situations where a minimal amount of data is available, additional sensors and data recording equipment can be temporarily installed as part of the performance analysis to enable the current operating conditions to be established. Going forward, the new data will enable the investigation as well as support continued, efficient operations.

Process data is essential to identifying any issues with existing operations. Analysis can highlight problems that have gone unnoticed and been exacerbated by the passage of time. The same data can also be used to make comparisons between the periods before and after any engineering modifications have been implemented, to establish the degree of improvement.

MANAGING CHANGE

Establishing baseline data for a compressor is the first step in identifying any issues. This enables the objectives of the revamp project to be determined and how they will be best achieved. This is especially important for industrial compressors, which have been designed to offer decades of service. However, over this time, applications can change, process parameters adjusted and surrounding infrastructure replaced.

Furthermore, after years of service, compressor efficiency will be reduced without major corrective actions. This will directly impact energy efficiency and operating costs, but without careful analysis of the operating data, these insights can be lost.

A thorough survey should highlight any bad actors, the potential for energy savings and the possibility of reducing gas emissions, as well as generating a process review to identify any changes in sealing and lubrication. It should consider the goals of the operator and set out a comprehensive proposal to address the issues. For Burckhardt Compression, this is all achieved using the BC ACTIVATE program.

TAILORED SOLUTIONS

Every application is different, so there is no single solution that can be applied to all equipment. By assessing every compressor individually and creating a unique set of improvements, it is possible to deliver the optimum performance from that machine.

The BC ACTIVATE program offers a structured assessment for any reciprocating compressor, using advanced measurement techniques and data analysis to identify potential issues, enhancing efficiency, reliability and sustainability. OEM expertise and decades of experience have been combined to deliver a comprehensive assessment process that reveals bad actors, gas leakages, excessive vibration and energy usage.

Taking the time to examine existing data, complete a thorough inspection and collect additional process data allows the full picture of an installation to be established. The BC ACTIVATE program identifies issues and presents a structured solution tailored to the application. Solutions can range from sealing material upgrades to adjustments in alignment and geometry as well as major compressor upgrades including the primary drive and new cylinders.

The immediate achievements can be seen in decreased gas leakage, which has a direct impact on sustainability as well as operational efficiency. In the longer term, evidence of improved reliability and energy efficiency will become clear, enabling a reduced carbon footprint and lower operating costs.

Image 3: Structured solutions, including sealing material upgrades, can be delivered on site.

FUTURE CONSIDERATIONS

As national governments increase their attention on sustainability, there could well come a point where operators will be required to provide evidence of the measures they are implementing to reduce emissions. As discussed, data is essential, and the ability to highlight improvements and demonstrate improved efficiency as well as optimized performance will be very important.

The advent of the industrial metaverse, the use of cutting-edge communication technologies and engineering processes offer a great opportunity to optimize equipment performance. Moving from a preventative maintenance model to a predictive one will also support greater sustainability and longevity.

For equipment that may have been manufactured 20 or 30 years ago, there are many benefits to be gained from modern materials and the addition of data gathering devices. Greater levels of information enable any issues to be quickly identified and resolved, leading to better reliability and overall performance.

Image 4: Thermal imaging is one of the methods of identifying gas leakage, which can lead to reduced efficiency and reliability in a compressor

CONCLUSIONS

The increased focus on corporate sustainability requires businesses to look at every aspect of their operations and determine the improvements that can be achieved. Cutting emissions and waste, lowering energy usage and optimizing machine performance - all support the goal of minimizing the overall carbon footprint.

To address any current issues and work towards new legislation, taking time to properly plan and implement a series of actions will be far more cost-effective than rushing the process to meet a looming deadline. With a combined approach to improve reliability and performance, it is possible to reduce operating costs while supporting sustainability goals.

The introduction of new materials or improved component designs can take time, but by planning the implementation properly and looking at the project in the whole, many savings can be achieved, and work can be completed during planned outages. Selecting a maintenance partner that has OEM expertise as well as experience in all other brands of compressors, is the first step. Taking advantage of cutting-edge technology and advanced analysis techniques can deliver detailed proposals for an optimized compressor that makes the best possible contribution to improved sustainability.

WE LOVE TO PROVIDE SERVICES THAT MATTER. HANDS-ON.

Personal, passionate, powerful: At Burckhardt Compression, you'll meet technical experts with an outstanding customer-first mentality who turn partnership into success.

Rooted in over 175 years of engineering competence as an OEM, we offer the full range of services for your compressors throughout the entire life cycle – regardless of brand, application or issue.

We do everything to keep your compressors running as efficiently as possible. Anywhere in the world. At any time.

Burckhardt Compression

Burckhardt Compression AG
CH–8404 Winterthur
Switzerland
Tel.: +41 (0)52 261 55 00
24-hour emergency tel.: +41 (0)52 261 53 53
aftersales@burckhardtcompression.com
www.burckhardtcompression.com