

## RELY ON EXCELLENCE

# 10 years of reliability: Protecting the heart of Great Britain's natural gas infrastructure from failure

EagleBurgmann's innovative separation seal for gas compressors is running maintenance free for a decade

In Great Britain, a shortage in natural gas supply has severe consequences: Since the country switched from coal-fired to gas-fired power stations, a gas supply shortage makes households and industrial consumers not only vulnerable to failing heating and gas stoves, but also to power outages. Companies along the value and transportation chain of natural gas are therefore especially dependent on reliable equipment. National Grid, who operate Great Britain's gas transmission system, were often having problems with dry gas seals getting contaminated with bearing oil. This issue is common within the industry and associated with 21% of dry gas seal failures. Seal malfunctions result in high maintenance costs and compressor standstills, which can jeopardize the gas supply of entire regions. In 2011, National Grid decided to address this problem and consider alternative solutions. In a world first, they installed the CobraSeal in one of their compressor stations, an innovative separation seal from EagleBurgmann. In the decade that has passed since, the CobraSeal exceeded National Grid's reliability expectations.



National Grid operates Great Britain's gas transmission system that comprises 7,600 kilometers of high pressure pipelines. This grid supplies millions of consumers with natural gas. The pressure loss that inevitably occurs during transportation through the pipelines is compensated by two dozen compressor stations located all over Britain. The centrifugal compressors installed there are the beating heart of Great Britain's gas supply network and need to work reliably at any time.

EagleBurgmann serves customers in a wide variety of industries and is considered a solution expert to solve industry problems that can result in long operational downtime and high costs. One of these reoccurring "pain point" issues is the contamination of dry gas seals with bearing oil on compressors. This results in seal failure and requires the compressor to be shut down for repair work. Therefore, compressors for natural gas are usually equipped with a dry gas seal in tandem arrangement with a nitrogen-buffered carbon ring separation seal that protects the main shaft seal from bearing oil. In National Grid's compressor station in Nether Kellet, the dry gas seal got contaminated with bearing oil regularly and caused unplanned compressor downtime - despite adjustments to the carbon ring separation seal system.

### Advantages of the CobraSeal separation seal:

- Insensitive to oil contamination due to its special design
- Extremely low N<sub>2</sub> consumption compared to any other system
- Wear-free, non-contacting operation in all conditions
- Insensitive to radial vibrations due to axial sealing gap
- Slow-roll or turning operation capable (static lift-off)
- No limits regarding dew point of separation gas (silicon carbide seal face instead of carbon)
- Best in class oil sealing by extremely small sealing gap and sling effect of rotating ring



Compressor stations serve to increase the gas pressure after it decreased during transport in the pipelines. A seal failure typically leads to an unexpected machine shut down resulting in unavailability of that machine.

**Compressor downtime comes at a high cost**

Up until 2011, National Grid had to take the compressors off the network every two years for scheduled maintenance interventions related to the dry gas seals and separation seals. These maintenance activities resulted in high costs. Since failure of both compressors may impair the network's capacity and availability, National Grid had strong interest in reducing seal failures to increase compressor uptime.

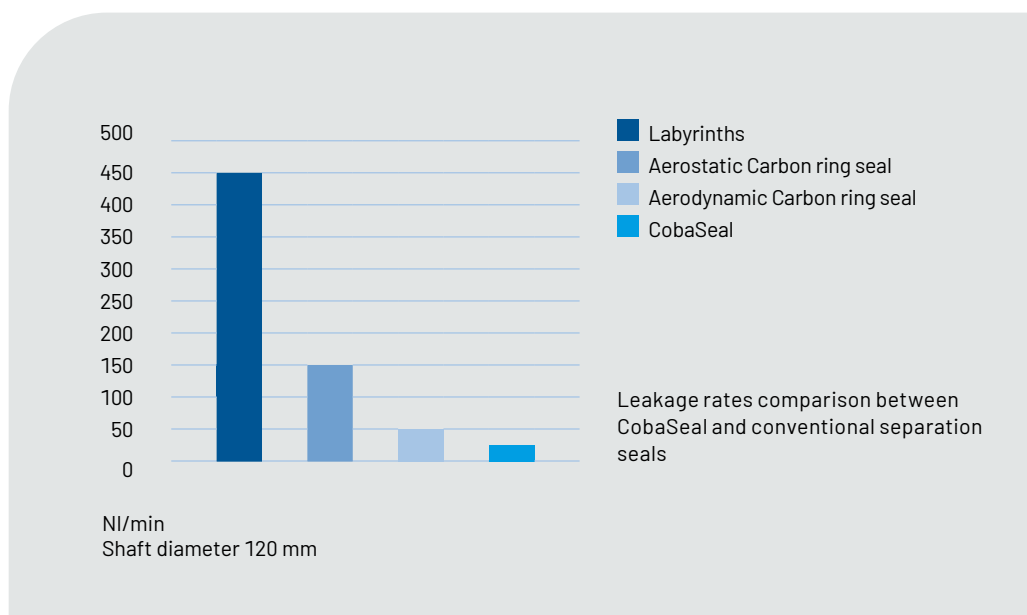
**Reliable performance no matter the operating condition**

In partnership with the compressor manufacturer, National Grid settled on a solution that EagleBurgmann specifically developed to address such problems. "One out of five dry gas seal failures is caused by a contamination with bearing oil", explains Alastair Dodd, key account and project development manager at EagleBurgmann. "To eliminate this problem, we developed the CobaSeal." The CobaSeal is a coaxial separation seal that is designed similar to a dry gas seal and replaces the existing carbon ring separation seal. It consists of a rotating ring made of stainless steel and a stationary face from silicon carbide. To achieve additional robustness, both sliding faces are coated with special EagleBurgmann high performance iDLC (in situ diamond-like carbon).

Nitrogen is guided between the faces through axial bores in the stationary face. It acts as a separation gas and flows off towards the inner as well as outer edge of the sealing rings, thereby creating a stiff gas film that prevents the sliding faces from touching. This coaxial design addresses many of the problems commonly associated with traditional carbon ring seals, allowing for wear-free operation with extremely low leakage. The gas film protects the sliding faces in all operating modes that occur during operation of a compressor connected to a major gas delivery network, such as "slow roll", "turning gear" and "coast down". Furthermore, vibrations at the compressor shaft that led to malfunctions at the previous separation seal are now compensated reliably.

**Extensive testing to simulate all operating scenarios**

In Nether Kellet, the CobaSeal saw its very first practical application. "You can understand that the customer was a little cautious", explains Alastair Dodd. "But our comprehensive research and development efforts as well as testing of the seal convinced National Grid that they weren't handed a prototype, but in fact a fully qualified and proven product." Another factor in favor of EagleBurgmann was the relationship to the customer that had grown over several decades since EagleBurgmann first delivered products to National Grid. "Due to the constantly high standard of our products and services, the client perceives us as a technology leader in the field of turbomachinery sealing solutions", summarizes Dodd.



### Close collaboration with the compressor manufacturer

National Grid demanded a solution that would improve reliability but required no modifications to the compressor. Therefore, the design of the CobaSeal was developed so that it can be easily adapted to all standard compressor seal cavities. By means of a close collaboration with the compressor manufacturer, EagleBurgmann made sure that the CobaSeal would be perfectly fit for use at the compressor's 102 mm shaft at Nether Kellet. "The success of this project is dedicated to the great team effort of all project stake holders within EagleBurgmann along with an open and constructive cooperation with the compressor manufacturer and end user", explains Jim O'Hare, technical sales support engineer at EagleBurgmann. "Since this would be our first field reference installation for the CobaSeal, we performed extensive testing to prove to National Grid that this seal would perform and meet the expectations once installed at Nether Kellet." This extensive testing not only included

different operating conditions but also operational upset conditions and emergency scenarios, such as loss of nitrogen. On completion of the extended testing and successful test runs, the very first CobaSeal was installed and commissioned in Nether Kellet in September of 2011 – just prior to the colder winter months, when a reliable gas supply network is subject to even higher demand.

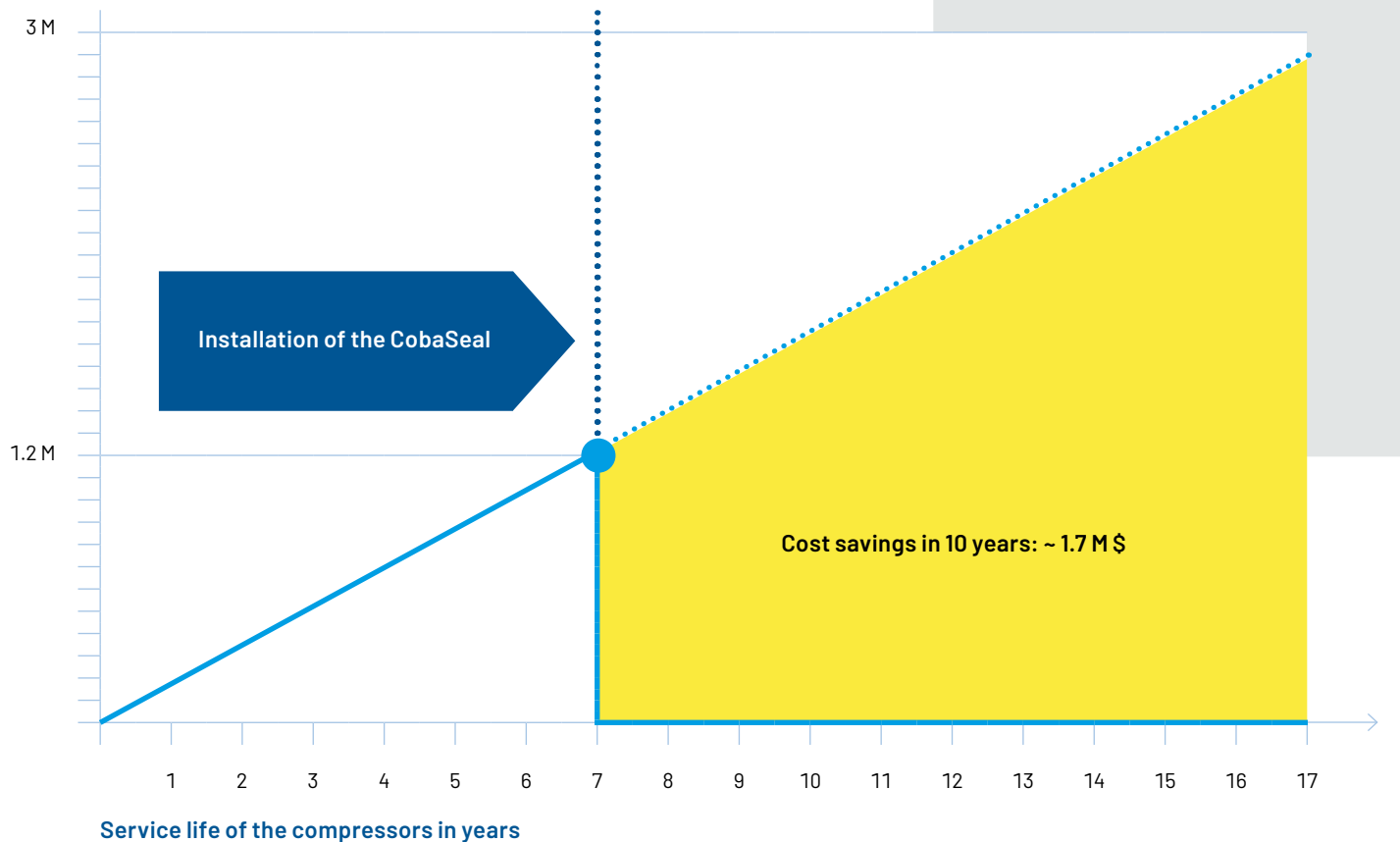
### CobaSeal runs maintenance free from day one

„Fit and forget“, is what comes to mind for Alastair Dodd when summarizing the CobaSeal's performance over the past ten years. "The first CobaSeal is still in service and requires no maintenance at all. That's five times as long as the previous seal and one worry off the operators' minds." In 2013, the second compressor in Nether Kellet was upgraded with a CobaSeal. After six years of continuous operation, this seal had to be replaced, as the compressor was removed for inspection. The subsequent inspection at EagleBurgmann stands as proof for the

effectiveness of the CobaSeal's design. "Upon inspection of the disassembled CobaSeal, our expectations were confirmed in that the seal face and rotating seat were as new", Jim O'Hare remembers. "After six years of operation, the seal was in more than satisfactory condition. The unit was damage-free, contact marks or scratches to the sliding faces were nowhere to be seen." The CobaSeal's condition after more than 17,000 operating hours and over 700 start/stops proved to the customer that they had found the ideal solution for the reliability problem at the compressor shaft seal.

Estimated cost savings through installation of the CobaSeals in Nether Kellet. With the two previously installed seals, each of the two compressors faced at least four standstills each due to seal failures between 2004 and 2011. The costs per failure amounted to approximately \$ 150,000. Since the CobaSeals are used, no seal-related failures were reported.

### Accumulated costs due to failures [€]



- Accumulated costs due to failures
- ⋯ Extrapolated costs without CobaSeal

### Advanced construction reduces nitrogen consumption and increases compressor availability

The CobraSeal's narrow manufacturing tolerances reduce the distance between the sliding faces to only a few micrometers. Compared to other separation seal designs, this reduces the nitrogen consumption by up to 90 %. Additionally to higher economic efficiency, this also increases the overall compressor availability and extends maintenance intervals. "In the past, maintenance work on the nitrogen gas supply system for the separation seal inevitably meant shutting down the compressor, due to the seal's high nitrogen consumption", explains Jim O'Hare. "With the CobraSeal, this has changed. The vastly reduced nitrogen consumption ensures seal and compressor can continue operation while the system is serviced."

The innovative CobraSeal has proven itself worldwide in original equipment and retrofits since its market launch.



## Positive feedback from client and other compressor manufacturers

"The CobraSeal has exceeded expectations and has delivered upon its promise of increased reliability and reduced nitrogen consumption, in a unit that experiences a high number of start/stop operations and previously had low start reliability", says National Grid's mechanical ops-support engineering and asset manager.

The design of the CobraSeal was qualified and certified for use in gas compressors from most major compressor manufacturers. It is now successfully used in oil and gas applications around the world.

## EagleBurgmann – at the leading edge of industrial sealing technology

Our products are used wherever safety and reliability count: in the industries of oil & gas, refineries, petrochemicals, chemicals, pharmaceuticals, food, power, water and many more. About 6,000 employees contribute their ideas, solutions and dedication every day to ensure that customers around the globe can rely on our seals. With our modular TotalSealCare Service, we emphasize our strong customer orientation and offer custom-tailored services for every need. [Rely on excellence.](#)

[eagleburgmann.com](http://eagleburgmann.com)  
[info@eagleburgmann.com](mailto:info@eagleburgmann.com)

