

PIG Trap Door Seal Failure

PREMTECH LTD



Pipeline Inspection Gauges (PIGs) are essential for National Grid to monitor the integrity of its transmission network - to ensure it is safe, secure and fit for purpose.

The pipelines are pressurised with natural gas up to 94 barg, and PIGs are loaded and unloaded at points known as PIG traps.

Historically, the polyurethane seals in PIG trap doors have been prone to damage and between 2008 and 2013, an upward trend was seen in the number of seal failures, causing natural gas release to the atmosphere.

Premtech Ltd manages infrastructure projects in the Energy sector and was asked by National Grid to look at the unpredictable failure of pig trap door seals and the fitness for purpose of the seals currently in use. BHR Group undertook a desk study on behalf of Premtech as part of this project.

“This programme has highlighted how innovation can be applied to enhance the performance of mature assets thus improving capability and efficiency. It is important to remember how the application of good fundamental elastomer science by the BHR Group has had a significant impact on PIG trap asset maintenance. This approach has provided a blueprint as to how National Grid can utilise a targeted scientific approach to provide holistic benefits across the network.”

Quentin Mabbutt
 INNOVATION DELIVERY
 MANAGER
 GAS TRANSMISSION ASSET
 MANAGEMENT
 NATIONAL GRID

There are many potential seal failure mechanisms in high pressure gas application, the two commonest being rapid gas decompression and extrusion.

BHR experts proposed a holistic approach, acquiring and utilising information about seal failures, new and used seals data, inspection, servicing and operating procedures.

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Taking into account the combination of facts available and linking them to the failure statistics, enabled BHR engineers to identify the potential failure modes and quantify the risks of seal failures. Evaluation of the available evidence suggested that:

- Extrusion played a part in the seal failure modes for 5 cases
- Mechanical misalignment was responsible for 2 cases
- New seal failures happened at 3 sites

Overall, the PIG trap door Ringlock enclosures are ageing, increasing the effort required to maintain them as functional units. Exceeding allowed limits is becoming more and more frequent.

“The BHR team has specialist sealing knowledge that was ideally placed to help us to assess the challenge and propose an optimum solution. The team worked with us collaboratively to resolve this complex issue on seal design, specification and management. We are delighted with the result and the measurable improvements that can be achieved through the implementation of BHR’s advice.”

Ian Butt
DIRECTOR
PREMTECH

BHR experts proposed a holistic approach, acquired and utilised the following information:

- Seal failure statistics / frequency
- Seal enclosure design (including drawings)
- New seals data, (including material data sheets, section sizes and designs with drawings)
- Available used seals data, (e.g. changes in dimensions, mass and material properties after known exposure times)
- Existing seal selection criteria
- Seal inspection and servicing procedures
- Seal replacement procedures (instructions from manufacturer)
- Door operating procedures
- In-service operational environment, including duty cycle (pressures, temperatures, and number of depressurisation cycles and decompression times)
- Gas composition (significant components in addition to methane)

Each PIG trap door size can also have different section size seals. National Grid personnel need to understand the sealing mechanism of the door, the reasons and key measures required in fixing exceeded limits.

Based on BHR’s recommendations, National Grid acted to avoid future failures. These included improving the level of training provided to their operational staff and updating inspection and maintenance procedures. A new PIG trap maintenance training package was developed that all pipeline and compressor mechanical technicians now complete. Newly installed PIG traps at the National Grid Training Academy provide employees with practical, hands-on experience. These better equip employees to maintain and monitor PIG trap door seals, thus reducing the likelihood of future failures and improving safety.

As a result, no further door seal failures have been reported. Assuming three incidents are avoided a year across the network, this adds up to cost savings of £10,000 pa.

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