

Pipeline Inspection Services Non-Piggable?

PIGGING THE NON-PIGGABLE

A.Hak Industrial Services' versatile Piglet® system is aimed at inspecting the non-piggable pipelines.

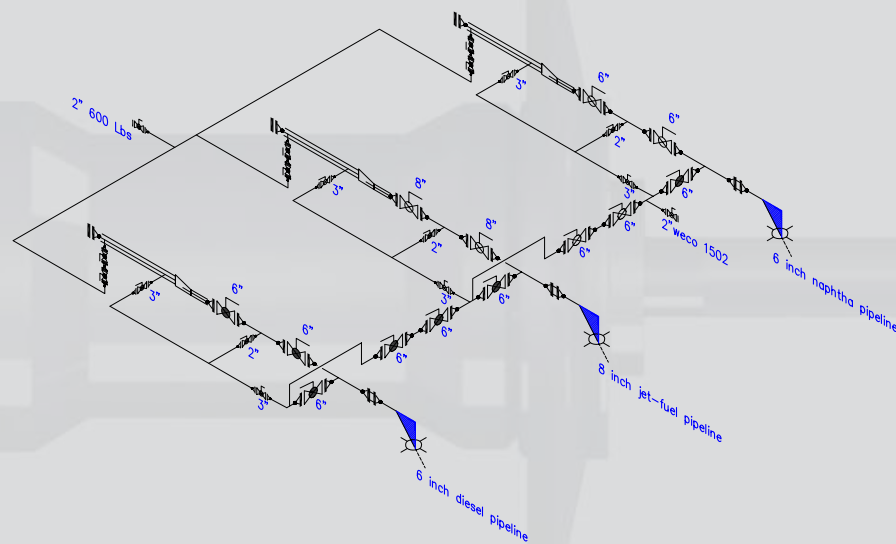
Usually unpiggable features – often found in relative short transfer pipelines – like dual diameter, mitred bends, full bore unbarred tee-pieces and single entry set-ups are within the capabilities of this system and can be inspected using regular, high and ultra-high resolutions. Combined with highly experienced field crews, a powerful integrated solution is available to warrant the integrity of previously non-piggable pipelines.



Real-time



**Multiple services, singular solutions
for the Oil, Gas & Petrochemical Industry**



Intelligent pig inspection systems are important tools to manage the integrity of pipelines. An intelligent pig survey enables the operator responsible for the integrity of the pipeline, to assess the failure risk due to metal loss corrosion using the findings of the inspection survey. However, depending on their origin, not all pipelines can be inspected using intelligent pig technology.

NON-PIGGABLE PIPELINES

At the time many pipelines were laid, pigging and inspection services were not considered. Pipes were laid to transport the product and how the pipeline was constructed was of minor importance. This means that the majority of these pipelines were built without launching/receiving facilities, were of varying diameters and contained mitred bends etc, making normal pigging techniques impossible. Modern day pipelines are constructed using special design codes (DEP's), which include such launching/receiving facilities and allow ultrasonic or other in-line inspection techniques to be utilized.

These codes have not commonly been applied for the relative short 'connection' lines like transport pipeline to storage tanks, which means that these lines, being of standard design, are not piggable. Incidentally, most of the problems occur in these relative short pipelines, due to lack of protection. In addition, the ownership of these pipelines is often not clearly defined and a lack of responsibility can be observed. This implies that the integrity program for these pipelines is of less importance than the larger/longer production pipelines.

INSPECTION

Policies have changed over the years. As uptime becomes increasingly precious, replacement increasingly expensive and external and internal integrity demands more stringent, inspection of these lines has become more important.

A.Hak Industrial Services has been active in the field of non-piggable pipeline inspection since the mid 90s and has developed specialized tools, methods and equipment to allow inspection of even the most challenging lines.

The most common components of non-piggable pipelines are:

- Pipeline dimensions (length, diameter, wall thickness, dual diameter)
- Pipe material (SS, ductile, exotic materials, GRE, coatings, linings)
- Bend restrictions (forged bends $\leq 1.5 D$, one cut mitre bends, mitred bends, back-to-back bends)
- Offtakes (unbarred tees, reduced tees, sphere, laterals)
- Offset junctions (diverters, convergence angle, bores)
- Valves (In-line block valves, check valves)
- No entrance point or single entry (availability of launchers and receivers)

Examples of such pipelines are:

- Loading lines
- Off-plot pipelines
- On-plot piping/pipelines
- Tankfarm connection lines
- Transfer piping in petrochemical plants



INTEGRATED SOLUTIONS

A.Hak Industrial Services offers a unique range of integrated services to provide each challenge a suitable solution. Since each pipeline is unique, standard technologies and services are not always adequate. The majority of pipelines have been designed without contemplation of intelligent pigging, or even any pigging at all.

Over the years, A.Hak Industrial Services has specialized in non-piggable pipelines and has formed a unique concept, based on extensive experience in the field. Our highly skilled and knowledgeable team aims to find one solution for any challenge a client presents to us.

Decades of experience combined with cutting edge technology allows us to find creative solutions for specific challenges, while simultaneously providing customized technical solutions and adaptive field application. High-end engineering enables us to develop custom tools and equipment, while a certified, well trained and seasoned group of field engineers can apply these solutions anywhere in the world.

ADAPTIVE APPROACH

A wide variety of pigging materials is available on stock, including temporary pig traps ranging from 4" to 44", as well as a wide variety of pumping equipment to allow pigging of small to large diameter pipelines. Customized equipment for project-specific solutions can be designed, engineered and fabricated in-house and is aimed at a safe, efficient and adaptive fulfilment of our client's requirements.

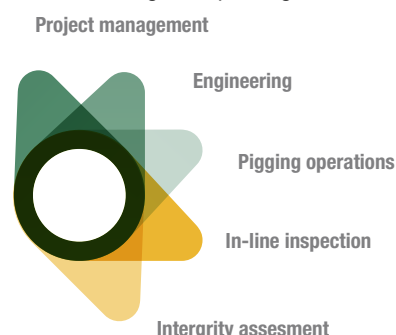
In-house training solutions and pigging facilities allow applications to be tested and staff to be trained, thus providing a complete package to the field. Since documentation of non-piggable pipelines is rarely documented, our field engineers are trained to provide on-site solutions to the pipeline's specific challenges.

AIMING FOR RESULTS

Field crews provide a critical link to allow high-tech equipment to be effective in challenging conditions. The highly motivated and skilled field crews of A.Hak Industrial Services are regarded among the best in the world in pigging project management and adaptive pigging solutions. Each challenge adds to our extensive experience with non-piggable pipelines.

Solutions include chemical and mechanical cleaning to allow the best possible inspection results as well as an integrated approach throughout the pipeline's lifecycle, from pipeline commissioning to de-commissioning and abandonment. A.Hak Industrial Services provides custom engineering, pigging solutions, high-tech research and software solutions to match our client's needs. This has led to the ongoing development of pigging and inspection equipment and services which are aimed at providing insight into the integrity of non-piggable pipelines, ranging from 4" to 64" and located from subsea offshore to remote areas around the world. This includes dual diameter solutions, single entry configurations, as well as ultra-high-resolution equipment that can be applied anywhere in the world at any time.

As a result, our services, including custom pig design, fabrication and engineering, project management, on-site pumping and pigging, subcontracting, ultrasonic inspection, defect assessment, FFP reporting and pipeline integrity management solutions, can all be provided as one integrated package.



One solution - worldwide

Integrity assesment



PushPull®
Can be used without launcher.



EFFECTIVE SOLUTIONS

To provide a suitable solution for the inspection of non-piggable pipelines, A.Hak Industrial Services has developed the Piglet® – a highly versatile inspection tool on a mobile platform for use anywhere in the world on short notice.

For maximum flexibility, the system applies a contact-free ultrasonic measuring head that is able to scan the full surface of the pipe wall, whereby high-resolution options can be realized seamlessly.

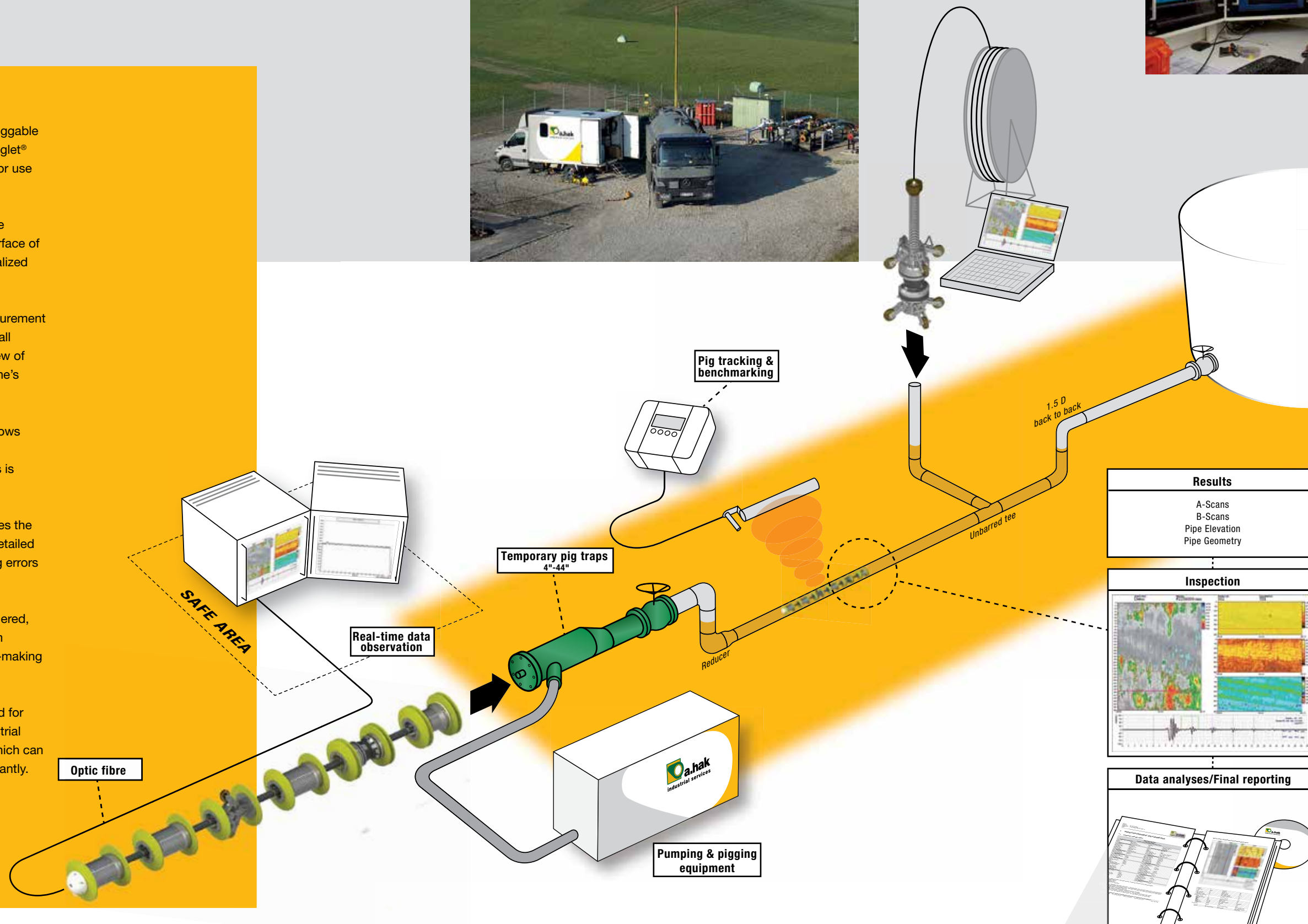
The ultrasonic system is based on direct ultrasonic measurement with time of flight (TOF) measurement so that absolute wall thickness data can be gathered. This allows a full overview of any wall-thickness reductions that may impact the pipeline's integrity.

Simultaneously, the centralized set-up of the UT-head allows measurement of the pipeline's geometry, detecting any deformation (like ovalities, dents and buckles) easily. This is critical when third-party damage may be applicable.

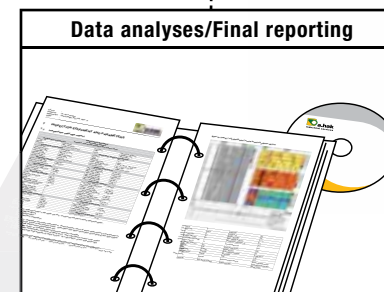
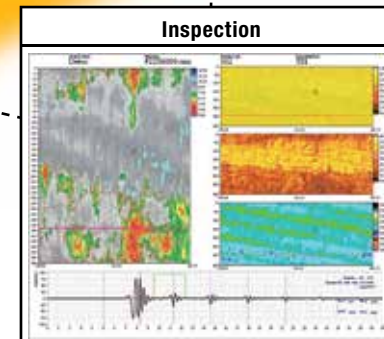
To allow the best possible interpretation, the system stores the raw A-scan data of each measurement. This enables a detailed analysis of defects, allowing re-evaluation and preventing errors due to algorithm induced analysis.

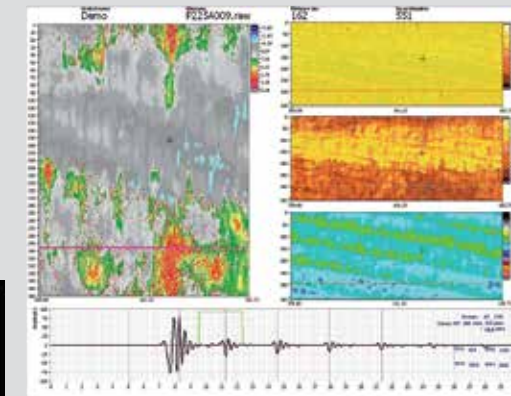
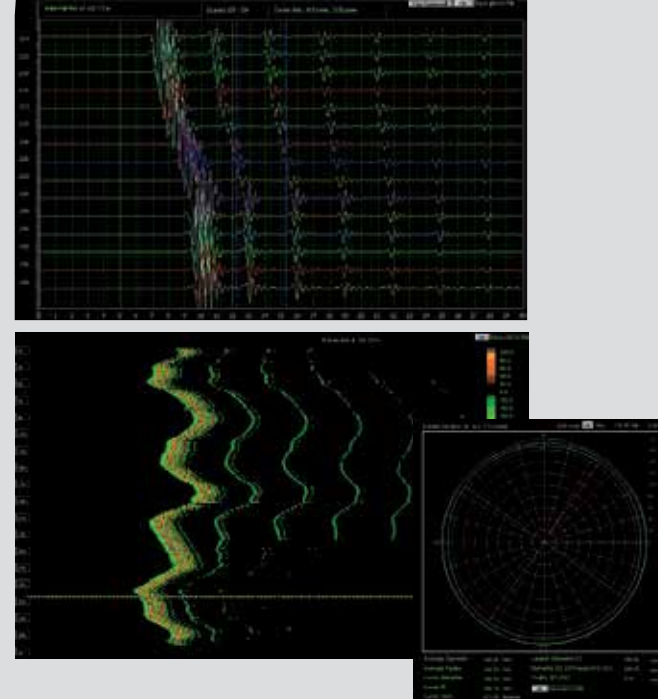
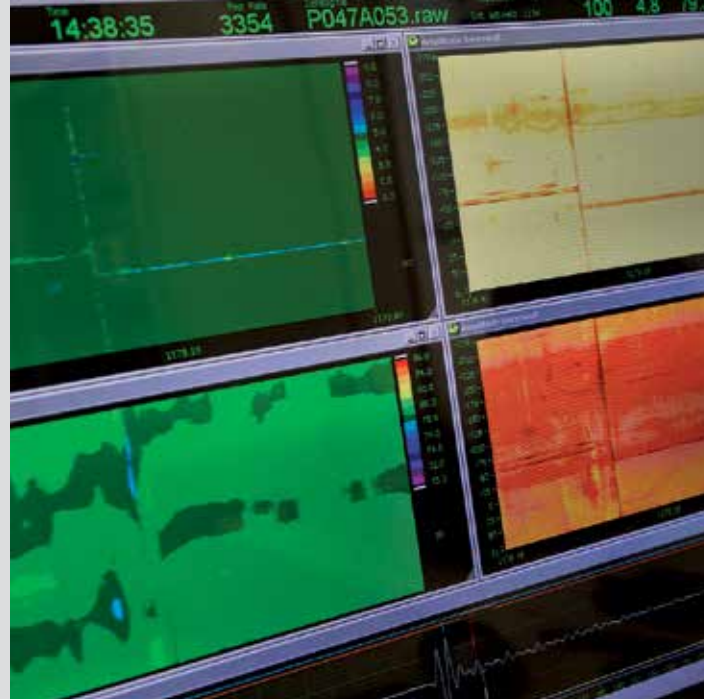
The system can be utilized free-swimming as well as tethered, for real-time observation of the inspection and short-term feedback on the results. This means immediate decision-making on-site is possible.

For the inspection of short pipe sections without the need for temporary pigging and pumping equipment, A.Hak Industrial Services has developed a hand-fed, push-pull system which can be applied with minimum downtime and yield results instantly.



Results
A-Scans
B-Scans
Pipe Elevation
Pipe Geometry





REAL-TIME INSPECTION DATA

A.Hak Industrial Services' versatile inspection platform Piglet® allows a tethered application using a fiber optic umbilical. This allows inspections of up to 29 km or 18 miles* to be observed and assessed in real-time.

Since the Piglet® uses a hair-thin umbilical, the usual restrictions do not apply – the system can negotiate the most complex pipelines while maintaining a real-time connection. The number of bends and fixtures through which the system can pass is limitless.

The real-time observation of the inspection means that an immediate assessment of the inspection can be made as well as providing instant access to the inspection data. In this way, a review can be made on-site and any significant defects that could impact on the line's production capability and safety can be reported.

The system allows configurations to cope with inherent non-piggable features like pipeline bore restrictions (dual diameter), full bore unbarred tee-pieces, mitred bends and so on. It can be configured in bi-directional mode to allow single-entry usage, all while maintaining the capability to fully inspect the pipeline's wall and geometry.

FREE-SWIMMING APPLICATION

The system allows application in batches or other situations where an umbilical is impractical or impossible to use. It is fitted with onboard memory for the storage of all raw measurements, therefore providing the flexibility to evaluate the measurement manually if needed.

Since the umbilical length is not a restriction in such situations, longer lines can be inspected while maintaining the full capabilities to review the A-scans of all measurements.

In case of hard-to-reach or undocumented pipelines, a combination with above-ground markers (AGMs) makes it easy to find defect locations. This prevents the need for large dig-ups to allow for repairs or replacement.

ON-SITE AND FINAL REPORTING

A.Hak Industrial Services can offer fast, on-site reporting of your pipeline's condition as well as the final report, which will be carried out afterwards.

The data recorded during the inspection is verified in multiple independent stages for completeness and quality. The data contains the raw ultrasonic signal for highly accurate data analysis and it is only after data post processing that the data can be presented in a comprehensive way to the client. This processing takes place in several phases:

1. Automated data analysis and wall thickness measurements using advanced software algorithms.
2. Detailed analysis of features and anomalies.
3. Corrosion growth analysis (in case of a repeated inspection)
4. Report compilation (digital and hardcopy)

Detailed analysis utilizes various tools to optimize the reliability of the information extracted from the data, such as A-, B- and C-scans as well as radial cross-section views.

The data analysis software has been built in-house and is improved on continuously. All analysis and reporting functionality complies with the Pipeline Operator Forum's specifications and requirements.

A client version of the data analysis software is supplied to the customer together with the report and with this software, the inspection results can be reviewed.

After data post processing of a project is complete, all data is backed-up on tape for future analysis, including corrosion growth analysis in case of re-inspections.

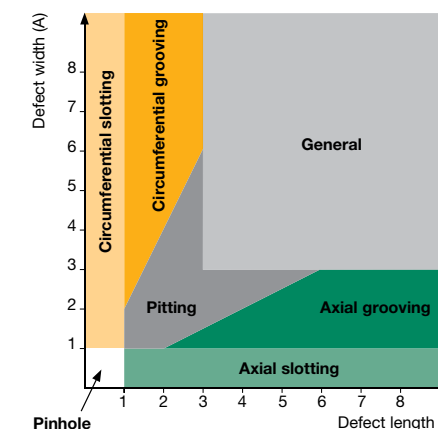
FIT-FOR-PURPOSE AND DEFECT ASSESSMENT

During data analysis and final reporting we carry out a defect assessment as standard, and can also offer fit-for-purpose reporting if required.

The most commonly used defect assessment method is ASME B31.G, the purpose of which is to calculate the safe operating pressure (Psafe) of each corrosion anomaly. Using these safe operating pressures and the maximum allowable operating pressure (MAOP), an estimated repair factor (ERF) of each corrosion anomaly is reported to the client, which indicates the necessity for intervention.

A corrosion anomaly is acceptable if the ERF is equal or less than one, and requires repair or de-rating (lowering of the MAOP) if the ERF is greater than one.

The anomalies are plotted along with a defect assessment curve, where the curve represents an ERF of one. All anomalies below the curve are acceptable and anomalies above the curve require repair or pressure de-rating. The defect assessment curve is dependent on the calculation method of Psafe (ASME B31.G, Modified B31.G, RSTRENG, SHELL92, or DNV), in addition to other parameters such as the MAOP, the pipe diameter, the pipe wall thickness and the pipe material specifications.



* maximum length depending on diameter

EXTENDED LIFESPAN

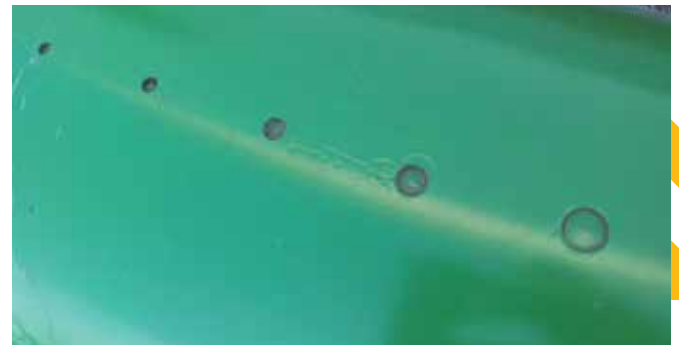
Although installations and systems might have been designed for a certain lifespan, it is worthwhile to study the feasibility of extending the operational life of systems. Increased regulations require such systems to be fully accounted for regarding their integrity.

As a tankfarm reached its designed end-of-life age, A.Hak Industrial Services was challenged to provide insight into the integrity of the underground connecting pipelines which were 24", 28" and 30" in diameter – without shutting down the tankfarm's operations.

Since the connecting pipeworks were never designed to allow pigging, a non-piggable approach was selected to allow the pipelines to be inspected and, consequently, re-certified.

Together with the client, an integral plan was developed, combining hydrostatic testing, mechanical cleaning, in-line ultrasonic inspection and defect validation, to be performed periodically so that corrosion growth could be monitored.

The result was a package that assured governing bodies of the integrity of the system and allowed the tankfarm to remain operational for the years to come, all with minimum impact on its ongoing operations.



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