PIGGING PRODUCTS & SERVICES ASSOCIATION

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Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Jan Frowijn, ROSEN Group, USA

I hope you are all well and managing to stay warm despite the increased energy prices. Challenges around the world this year have demonstrated the continued importance of our pipeline infrastructure and keeping it working efficiently and safely. The work of the PPSA members and the wider pipeline industry is of great significance and value to a wide variety of users in industries and people in their homes.

As we move to the latter part of the year we turn our attention to the next set of events in our calendar. The Directory of Members and Buyers Guide has been published and sent to our worldwide mailing list. It can be downloaded at https://ppsa-online.com/publications or if you would like to receive a free of charge printed copy please email ppsa@ppsa-online.com.

In September we exhibited at the IPC Conference in Calgary, Canada. It was great to catch up with our members and see people in the pipeline industry again and to tell new people about our Association and the work that our members do.

We are also really looking forward to the PPSA Pipeline Pigging seminar which is taking place in Aberdeen on 16th November. After two years of this event being online we are excited to be meeting up face to face with everyone again. There is a free of charge reception the day before in the exhibition area (4-7.30pm), so come along and join us if you can. It's a great way of meeting pigging experts and finding out about technical advances in the industry. The seminar programme consists of 10 high quality technical presentations made by PPSA members and operators, all experts in their fields. Topics covered include multiple pig launching, pig detection, a rescue pigging operation, pipeline inspections including wireless robotic MFL, bi-directional high resolution, flexible pipeline inspection and navigating difficult underwater installations and decommissioning. Details about the Seminar and how to book a place are at https://ppsa-online.com/seminar.

We will soon be looking for nominations for Directors for our Board of Directors 2023. This year we are looking for people from PPSA member companies in the Western Hemisphere to stand for election. The election will take place in the new year and the result will be announced at our Annual General Meeting in February.

Also save the date for our annual golf tournament which will take place in Houston, USA on Monday 6th February 2023. We will be looking for sponsors and teams to take part. This is a fantastic, informal event that raises money for Young Pipeline Professional Projects.

This will be followed by our Annual General Meeting 2023 and the PPIM Conference and Exhibition.

Stay safe and we hope to see you soon at one of the forthcoming events.

NEW Members

Full

Pipeline Engineering (part of Nylacast Group), UK

Individual

Andy Bain, UK

DEXON Technology brings sub 1 mm crack detection and measurement in-line inspection capabilities to North America

Sub 1 mm crack measurement pipeline inspection launched in North America

In July 2022, **DEXON Technology PLC** (formerly **Dacon Inspection Technologies Co.,Ltd**) completed a long-length crack detection and measurement In-Line Inspection (ILI) run from the USA-Canada border up across southern Canada. A team of specialist inspection engineers was mobilized from Thailand to North America to carry out the inspection. The inspection marks DEXON's expansion into the North American market and another successful inspection run for the newly developed UT (Ultrasonic) CS (Crack Sizing) Hawk ILI System which DEXON released earlier in 2022. The debut of the CS Hawk ILI system in North America follows the debut of DEXON's Furnace ILI System in South America last month.

Levi Porter, Ultrasonic Crack Inspection Specialist for DEXON and project manager for the Hawk ILI system said "The technology is a huge step forward allowing for the calculation of anomaly size through direct measurement rather than indirect comparison. This will allow for greater accuracy in asset integrity calculations, as well as monitoring propagating cracks."

The UT-CS Hawk ILI System achieves ultra-high-resolution inspection data via the use of 768 sensors that collect direct measurements of the physical characteristics of the pipe wall. This resolution allows for the detection and measurement of axial and circumferential cracks smaller than 1mm in depth and as little as 15 mm in length in addition to obtaining corrosion measurements able to detect pinhole corrosion.

Software development has been a key area of focus in the UT-CS Hawk's development. Machine learning and artificial intelligence have been utilized to achieve automated defect sizing and classification, speeding up reporting times, efficiency, and accuracy.

Ensuring data collection and first-run success has been a paramount design task. Double redundancy has been incorporated eliminating single points of failure and increasing run efficacy.

DEXON Technology pipeline inspection engineers performing an initial mechanical assessment after a 72-hour tool endurance test run in one of DEXON's 160m infinity test loops.

The DEXON Hawk ILI System prior to launch in North America.

NDT Global release 2021 independently assessed KPI

NDT Global are delighted to announce 2021 independently assessed key performance indicators. At NDT Global we continue to set new standards in diagnostic inspection, data analysis and integrity assessment. One way in which we measure the effectiveness of our operations is to perform annual independently verified Key Performance Indicators (KPI) for On-Time Reporting (OTR) and First Run Success Rate (FRSR).

The KPI "First Run Success Rate" reflects the number of successful runs, related to the total number of first inspection runs for a defined period of one calendar year.

'Our exemplary First Run Success Rate is attributable to the close collaboration and partnership we have with our clients and our commitment to holding ourselves accountable to the highest standards. We recognize the importance of first run success and are proud of another great result in 2021.' commented Nathan Leslie, VP - Products and Marketing.

The KPI "On-Time Reporting" reflects the number of inspection and evaluation reports which are issued to NDT Global customers within the contractually agreed delivery time, related to the total number of issued reports.

Vice President, Data Services, Garrett Fitzsimons commented, "Our record of delivering quality data on-time over the last number of years demonstrates our ongoing commitment to our clients. This commitment gives the confidence needed to effectively plan integrity programs."

The results of the independent assessment performed by DNV are as follows:
KPI First Run Success Rate: 95%
KPI On-Time Reporting: 98%

Continuous improvement, customer focus, trust and partnership are the pillars of our success.

NDT Global awarded health and safety transformation award

NDT Global, are delighted to announce we have been awarded the **British Safety Council's International Award** (ISA) in the category "Health and Safety Transformation". This award recognizes our transition from a "Zero Harm" to a "Beyond Zero Harm" strategy, with increasing focus on areas such as employee mental health and well-being.

Niall Walsh, Vice President HSEQ commented, 'Our new approach has significantly increased focus on this area, and we continue working to raise awareness of the risks, preventative measures, and resources in place to support mental health and well-being in the workplace. This includes the introduction of mental health first aid training, communication of employee assistance programs (EAP); awareness presentations with staff; health and fitness activities and incorporating mental health topics into meeting safety moments. We are very proud and thankful to all our employees who work hard every day to ensure we reach the highest safety, health, and well-being standards in our industry.'

At NDT Global, our aim is to drive further improvements, so we continually deliver positive outcomes for our people, our customers, and the environment.

A ROSEN Group case study: Tethered robotic inspection solution

A pipeline service company that operates a pipeline and related pump facilities and terminal has regularly carried out conventional ILI on the mainline, but some of the facility lines had been deemed “unpiggable” and required innovative inspection solutions.

A few months back the operator approached **ROSEN** with the opportunity to inspect the relief piping at the terminal with a tethered robotic solution. A robotic tethered inspection tool was proposed, including a UT wall thickness scanner with 480 PE transducers, covering the complete circumferential of the pipeline with a high resolution. A weld scanner would be included for an internal ToFD inspection to locate and size any crack like indications. In addition to this, a camera would be mounted in the front of the propulsion unit.

Due to pipeline installations, it was not possible to inspect the entire line with only one launch. A previous inspection by another vendor required seven entry points, and this concept was adopted and adapted. Once the tool train was designed at ROSEN Norway in Bergen, friction calculations were carried out and it was concluded that only four loadings would be required with this tool.

A site visit verified all information gathered by the client. Upon completion, the final proposal was issued and ROSEN received a PO for not only the inspection, but also a similar inspection at a pump station during the same mobilization.

After the tool design was completed, and all parts required completing the tool train created, the tool assembly commenced and the complete tool train was ready for testing.

Test loop, Bergen

During the first days on site, tool validation tests were carried out. With help from the data evaluation team in Houston, results were delivered within 48-hours.

At the first inspection run, wall thickness and ToFD data was collected during both directions of the bi-directional run and live data and video was monitored topside. After each shift, data was uploaded to the evaluation team and any anomalies above 40% of the wall thickness were reported within a few days.

Once the first inspection was completed, the equipment was moved to the next location and the above procedure was repeated. After completion, several locations of interest were reported and the team continued the journey towards the pump station.

There, the access point would be a removed spool in the middle and one bi-directional inspection would be carried out in each direction.

After six days at the pump station, both inspection runs were completed. Final reports have been issued to the operator.

Tool inserted and flanged off

ROSEN Group in Malaysia has secured 5 years contract for pan Malaysia in-line inspection

ROSEN Group, a global supplier of leading technology for pipeline integrity management has won three (3) packages for the 5 years Pan Malaysia for Pipeline In-Line Inspection Services for **PETRONAS Group of Companies and Petroleum Arrangement Contractor (PACs) (Pan Malaysia ILI)** contract.

The contract includes ROSEN Group in Malaysia via **H. Rosen Engineering Sdn Bhd** with approximately 200 pipelines for inspection in the 5 years with diameters ranging from 4 to 48 inches. The contract covers nationwide and cross-country pipelines with Thailand and Singapore.

"As a locally based company, we have the edge of having superior resources– from facilities to manpower, we are capable of providing the best services at any time. Our state-of-the-art technologies and service level deployed efficiently worldwide make it equally accessible to all Pan Malaysia ILI contract user," said Nija Amri Jemari, Director of Business Execution for ROSEN Group in Malaysia.

Business Execution Manager, Mazlan Md. Ramly added, "ROSEN always be a good partner with PETRONAS and all PACs supporting their pipeline integrity management system. With our experience working together for almost 30 years, I believed we can achieve the objective of Pan Malaysia ILI, to ensure such assets continue to be operated safely under current and future demands."

This contract will be utilizing Magnetic Flux Leakages (MFL) and Ultrasonic (UT) as the main technology for the inspection. Nevertheless, it can be extended to other technology depending on the needs and case to case basis.

ROSEN Kuala Lumpur is the headquarters for ROSEN Asia Pacific with a success record of completing inspection project over 100,000 km of pipeline in most countries in the region.

Tecno Plug successfully deployed in Australia

STATS Group provided pipeline isolation services on an offshore platform to allow the safe replacement of a launcher valve, in the Bass Strait, off the coast of Australia.

The project was challenging due to the change in diameter in the export pipeline, from 24" reducing down to 20" at the isolation location and required innovative thinking to provide an efficient and safe solution.

The vertical pipeline featured a launcher, 24" valve and production tee which then reduced to 20" and included a 20" valve that needed to be isolated and replaced. The dual diameter piping presented a challenge to engineer a piggable isolation plug to negotiation the change in internal diameter. To overcome this issue STATS proposed the use of a remotely operated Tecno Plug that would be deployed to the isolation location on rigid stem bars, rather than being pigged through the pipeline. This deployment method allowed the Remote Tecno Plug to be lowered in a controlled manner and precisely positioned in the short straight section of pipe after the 20" valve before a bend. This avoided the need to pig the isolation tool which can present challenges in dual diameter pipelines.

The Remote Tecno Plug provided a fully proved, double block and monitor isolation of the gas pipeline and ensured that only a small section of pipework was required to be vented and purged while the valve replacement activities took place. This provided the operator with considerable time and cost savings while ensuring the safety of the worksite. The use of the remotely operated Tecno Plug ensured communication to the plug was maintained throughout the project and while the valve replacement activities took place.

To enable the Remote Tecno Plug to be deployed from the launcher to the set location with stem bars, STATS provided a 24" isolation plug to act as an isolation barrier of the launcher, as the launcher door would not be able to be used during the isolation activities due to the stem bars. The 24" Door Plug provides the same dual seal double block and bleed isolation as a Tecno Plug but has a port through the centre of the plug to allow the stem bar to be fed through the pipeline while the Door Plug provides isolation of the launcher, which during operations had the potential to be 118 bar.

As part of the project, STATS conducted a client witnessed Factory Acceptance Test (FAT) at their operational base in Abu Dhabi, UAE on both the Remote Tecno Plug and Door Plug. A full scale test fixture was created to replicate the exact pipeline configuration onsite. The FAT was conducted using STATS live remote monitoring system, which offers a unique opportunity for the client team to witness the FAT without the need to attend their facilities in person. This system was particularly beneficial to the client who was based in Australia, due to travel restrictions in place due to the COVID pandemic.

Following the FAT, the equipment and personnel were mobilised to the platform to carry out the isolation and allow the valve to be replaced during a planned shutdown. To allow the Tecno Plug to be installed into the launcher the valves were closed and the launcher was vented and purged. Final pre-deployment checks were conducted on the isolation plugs and the launcher door was opened. The Door Plug and Remote Tecno Plug were then lifted together and lowered into the launcher until the Remote Tecno Plug engaged in the reducer and the Door Plug was positioned in the end of the launcher. The Door Plug was then hydraulically activated to energise the locks and dual seals. The seals were each tested independently to confirm leak-tight isolation and the launcher was repressurised and a leak-tested was conducted.

Remote Tecno Plug Isolation

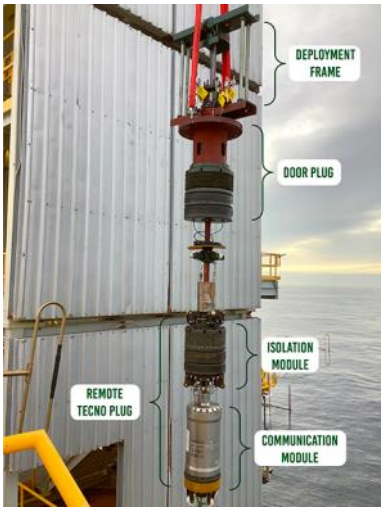
Prior to deploying the Remote Tecno Plug a deployment frame was positioned at the end of the launcher, this allowed each section of stem bar to be assembled and hydraulically deployed into the pressurised pipeline, through the Door Plug.

Communication with the Remote Tecno Plug was maintained using an extremely low frequency (ELF) inductive system while the plug was deployed through the pipeline and once positioned at the set location. At location, the isolation plug was hydraulically set to activate the locks and dual seals. The dual seals were then independently tested with full pipeline pressure in the correct direction to confirm leak-tight isolation and allow the pipeline to be bled down to ambient from the platform launcher to the rear of the Remote Tecno Plug. The annulus between the plug seals was then vented to ambient to create a zero-energy zone. Following an isolation stability hold period the 'Isolation Certificate' was issued. The stem bar was then hydraulically disconnected from the rear of the Remote Tecno Plug and recovered back to the launcher.

With the isolation in place and the double block and monitor isolation verified and constantly monitored, the valve replacement activities were safely completed. Once the new valve had been installed, the stem bars were redeployed and re-attached to the rear of the Tecno Plug. A wheel bracket mounted to the stem bar ensured the stem bar remained centralised ensuring reconnection to the Remote Tecno Plug. With connection made and confirmed, the launcher pressure was raised to 60 bar to carry out a reinstatement pressure test of the newly installed valve while the isolation remained undisturbed. Once the leak test was successfully completed the pipeline pressure was equalised and the Remote Tecno Plug was unset and recovered to the launcher. The launcher valves were closed allowing the launcher to be vented and purged and the Remote Tecno Plug and Door Plug were removed from the pipeline completing the project.

Gareth Campbell, Regional Manager for Asia Pacific, said: "This is a significant milestone for STATS marking our first deployment of the Remote Tecno Plug in Australia. This workscope is now one of many safety critical pipeline isolation projects completed for this client in the region, following projects utilising our tethered Tecno Plug and patented BISEP.

"The Tecno Plug offers a high level of safety while providing a cost-effective solution for the operator, this successful isolation prevented the operator from depressurising and purging the entire gas pipeline required to ensure the pipeline was hydrocarbon-free prior to maintenance activities."



Remote Tecno Plug Isolation

iNPIPE PRODUCTS™ new Aberdeen Service Centre

iNPIPE PRODUCTS™ is pleased to announce the opening of its Aberdeen Service Centre, headed up by Barry Ritchie, General Manager.

The Aberdeen facilities allows iNPIPE PRODUCTS™ to respond to the customer needs in the centre of the UK's oil & gas exploration and production, the 'energy capital of Europe'.

The fully equipped workshop provides pipeline pigging and isolation solutions to its customers inclusive of engineering, maintenance and services expertise. The workshop caters for pig fleet management, pig trials, refurbishments, spares and pig washing whilst stocking an extensive range of hire tools for pipeline testing, isolation, pig tracking and pig location to complement the services offered.

iNPIPE PRODUCTS™ new Aberdeen Service Centre

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A successful MFL+TFI+Crack+Stress inspection by IP Pipeline Technology

In early July, 2022, **IP Pipeline Technology** has successfully performed an inspection for a natural gas line. A multifunction detector was used to complete the MFL+TFI+Crack+Stress inspection. The outer diameter of the tested pipeline is 610mm, the wall thickness 10mm, and the length 46.3km.

Figure 1 The multifunction detector

Traditional MFL detectors can only achieve axial excitation, incapable of detecting defects parallel to the pipe. However, the multifunction detector we used carried a circumferential excitation unit, which can help identify and quantify defects in all directions of the pipeline, including general corrosion, pitting, bulk metal loss, mechanical damages, internal defects, weld anomalies, gouge and oil-stolen orifices. And pipeline features like casing, patches, valves and tees can also be detected.

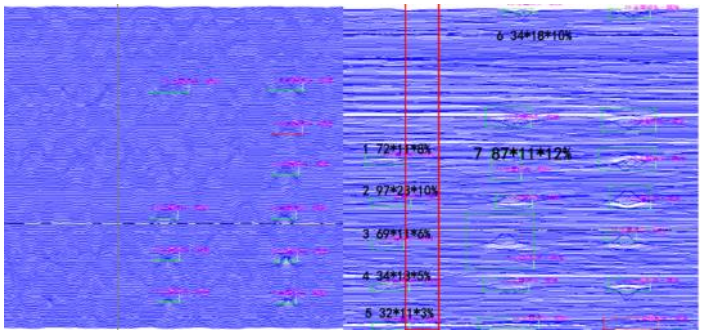


Figure 2 Pull through test of the detector

Figure 3 Launching/receiving the multifunction detector

Carried by the detector, balanced field electromagnetic probes can detect axial cracks and circumferential cracks in pipeline, in the meantime, with low field magnetic flux leakage technology, the stress concentration zone in pipeline can be detected and effectively assessed to avoid sudden accidents caused by stress damage.

The raw data of this inspection is complete and effective, checked and accepted by the Client. “By running the multifunctional detector, we conducted MFL+TFI detection, crack detection and stress detection for the pipeline. This not only reduces risk to pipeline operation from multiple inspection, but also saves costs for the client”, said Fred Lee, the GM of IP Pipeline Technology.

STATS Group pick up Energy Industry Council Award

STATS Group has been recognised for its commitment to a sustainable future in the **Energy Industry Council (EIC) Awards**.

The EIC is a leading 900-member trade association covering the global supply chain in oil and gas, power, nuclear and renewables industries.

Pipeline technology specialist STATS collected the Sustainability Award at a ceremony attended by EIC members, government representatives and project decision makers.

Stuart Broadley, EIC’s chief executive officer, said: “At these times, when energy supplies are tight and prices are high, the energy industry’s supply chain is doing its best to keep our lights on and our economies running.

“Our members are acutely aware of the urgent need to ensure a sustainable supply of affordable energy with as little environmental impact as possible. It’s a herculean task given the current geopolitical and economic challenges, but everyone is working hard.”

In the EIC’s Survive and Thrive insights report, Aberdeenshire-based STATS were said to “demonstrate innovative capabilities in helping organisations to save emissions while providing significant carbon price savings in the process”.

The report said STATS recognised the need to properly evaluate where the company lay on the sustainability spectrum and how it could further shift the dial in order to reduce its own footprint, while also supporting the net-zero endeavours of clients.

Global pipeline community to meet again in Berlin in May 2023

ptc 2022 Exhibition (©2022 Sabri Hasso/Eitep)

After two years of online **Pipeline Technology Conference (ptc**) and a hybrid event, ptc 2023 will once again focus entirely on face-to-face networking. From 8-11 May 2023, participants from all over the world will again travel to Berlin for the Pipeline Technology Conference and exhibition. About two-thirds of ptc visitors come from abroad. Delegations from 70 different pipeline operators were registered for the last ptc.

In addition to the traditional topics of safety, inspection, leak detection, construction and maintenance, next year's focus will again be on hydrogen, CO2 transport and methane emissions. Against the backdrop of the current geopolitical situation, political discussions and in-depth exchanges with operators from Europe, Asia and Africa will be addressed in the keynote lectures and discussion panels.

Besides the current topics and news on development and application in the conference, the exhibition is gaining more and more importance. Next year, the entire Hall 2 with 4,600 sqm will be occupied for the first time. Additional alternative space in the transition area between conference and exhibition will be used for special events. Already about 30% of the space has been sold.

A special focus will again be devoted to the area of promoting young talent. Apart from the active participation of pipeline students in the execution of the event, there will again be a joint booth of the international Young Pipeline Professional organizations and, for the first time, a separate award ceremony for students and young professionals.

With an extensive evening program and various networking events, next year's ptc will again offer a wide range of opportunities to exchange ideas with old acquaintances and new contacts from the global ptc community.

The call for papers for the conference is open until 30 September 2022.

First and only SSWC classifier improves integrity decision-making and operational safety

Knowing which pipeline anomalies to address first is a continuing challenge for operators. Integrity is non-negotiable but being able to emphasize safe operation while also properly allocating financial resources and avoiding unnecessary intervention isn't always easy. Having thorough and accurate inspection data can help, though.

With the release of the industry's first performance specification for classifying selective seam weld corrosion (SSWC), global pipeline solutions provider **T.D. Williamson (TDW)** is providing the information operators need for better decision-making and repair prioritization — especially for those operators whose networks include pre-1970s pipelines that are more susceptible to SSWC. Currently, more than half of all hydrocarbon pipelines in the U.S. are of that vintage, meaning the cumulative risk of SSWC can add up quickly.

The SSWC classifier is made possible utilizing data from technologies on the TDW multiple dataset (MDS) platform. It's also the latest example of field proven TDW innovation designed to improve pipeline safety and performance. Matthew Romney, senior product manager – MDS & EMAT, at the TDW Global Center of Excellence, Salt Lake City, Utah, said operators have already leveraged the classifier on more than 75 inspections and 700 unique SSWC calls.

A Preferential, Time-Dependent Threat
SSWC occurs in the long seam of welded pipe and often presents as a deep, V-shaped groove filled with corrosion products. It is considered "preferential" because the corrosion is more aggressive in the seam weld than in the base pipe material surrounding it. SSWC is also time-dependent, meaning it becomes more of a threat the longer it remains in place.

For decades, traditional axial magnetic flux leakage (MFL) — the most frequently deployed method for detecting volumetric corrosion in pipelines— has been under-performing identification, characterization and sizing of SSWC.

According to Romney, that's because SSWC features are axially oriented, meaning the SSWC groove runs parallel to the axial MFL magnetic field.

"As a result, the MFL tool often under-calls the corrosion depth and fails to identify coincidence with the long seam at all," he said.

To improve detection and characterization of the SSWC anomaly, TDW combines conventional MFL with SpirALL® MFL (SMFL) technologies. The SMFL technology creates a spiral or transverse magnetic field that provides 100% coverage of the pipe wall and can detect axial planar or crack-like defects MFL misses. What's more, SMFL is able to identify the long seam, including the electric resistance welded (ERW) and electric flash welded (EFW) seams where SSWC often appears.

While being able to identify SSWC with greater accuracy helps operators meet corporate integrity standards, that's hardly the only benefit. It also aids in compliance.

"While regional regulation may currently require certain actions, the validated specification allows operators to defend their decisions to regulators and to optimize utilization of sometimes limited maintenance budgets by mitigating more serious pipeline threats first," Romney said.

TDW is grateful to the operators who provided the valuable in-ditch non-destructive evaluation results required to validate the classifier.

Baker Hughes acquires Quest Integrity to deliver expanded asset inspection solutions

Baker Hughes has announced an agreement to acquire **Quest Integrity**, a subsidiary of Team, Inc and a global leader in the development and delivery of technology-enabled asset inspection and reliability management solutions across the pipeline, refining, petrochemical and power generation sectors. This complements Baker Hughes' existing asset integrity offerings and will support customers with the delivery of actionable insights on a broader range of industrial infrastructure.

Baker Hughes' asset integrity solutions include pipeline inspection services that detect, characterize, locate and size anomalies in the wall of a pipeline that might potentially compromise its integrity. Quest Integrity's technology will expand this capability to support "difficult-to-inspect" pipelines where the construction or operation of the line does not allow for conventional inline inspection methods to yield reliable results.

The acquisition includes Quest Integrity's Invista™ and Furnace Tube Inspection (FTIS) technology. Invista™ enables new inspection capability that extends across pipelines, marine loading lines, petrochemical, chemical, refining, power, utility and other industrial segments and facilities, such as airports. FTIS technology applies the same principles to enable the inspection of heater coils, a critical component in furnaces, detecting issues with corrosion and deformation for customers in the petrochemical and refining industries. Quest Integrity also brings significant engineering expertise, with a focus on conducting critical assessments to deliver actionable insights and verify asset integrity across a diverse range of industrial assets such as pipelines, pressure vessels, tanks, and turbine blades.

"The acquisition of Quest Integrity marks another step in Baker Hughes' commitment to help customers ensure their asset infrastructure is safe and reliable and demonstrates how we continue to invest for growth in this area," said Rami Qasem, executive vice president of Digital Solutions at Baker Hughes.

Earlier this year, Baker Hughes acquired **Qi2 Elements**, a designer and manufacturer of advanced robotic sensor systems that inspect, assess and monitor the integrity of critical energy infrastructure. Along with pipeline inspection, Baker Hughes' asset integrity expertise includes a range of industrial inspection and non-destructive testing (NDT) solutions. The acquisition is expected to close in the fourth quarter of 2022 and will be integrated into the Process & Pipeline Services product line within Baker Hughes' Digital Solutions segment.

3X Engineering reinforces 3 valves suffering from internal corrosion

Overview
The objective of the repair, carried out in October 2021 by **3X ENGINEERING (3X)** and its local distributor **WISKOTS** was to reinforce 3 valves with ball geometry suffering from internal corrosion. To restore valve integrity and prevent further deterioration, it was decided to repair the defected areas using REINFORCEKiT® 4D. The valves are on an onshore oil pipeline in the Kingdom of Saudi Arabia, with a design pressure from 105 to 180psi and a design temperature of 76.7°C

Scope of work
According to **ASME** PCC-2 standard and 3X calculations, it was decided to apply REINFORCEKiT® 4D using R3X150+ resin (specifically dedicated to internal and external corrosion at high temperature). From 6 to 8 layers of composite were determined to reinforce the valves.

Surface preparation was completed with grit blasting to get a good surface cleanliness roughness (superior to 60µm Rz) and ensure a good bonding between the steel and the composite. Hygrometric conditions were checked and approved and the prepared areas were cleaned with acetone.

The composite repairs were then completed following below stages (application procedure is the same for the 3 valves to be reinforced).

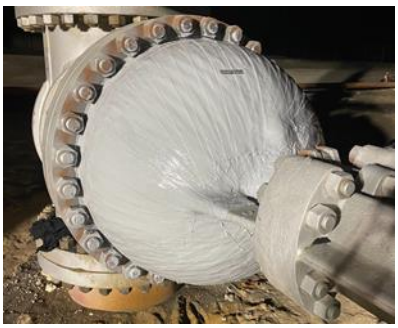
1/ F3XCOMB filler application on the defected areas to avoid sharp angles and reshape the valve before reinforcement.
2/ F3XS1 filler application to impregnate the surface and ensure good wetting and perfect impregnation of Kevlar® tape on the corroded areas.
3/ Composite covering using 300mm width Kevlar® tape impregnated with F3XS1filler (1 layer) on internal corrosion areas.
4/ Composite reinforcement using 100mm width Kevlar® tape impregnated withR3X150+ resin (for high temperature). The overlap is made by "L" patches on the complete circumference of the valves (depending on the valve and the level of corrosion, between 6 and 8 layers were applied).
5/ Finishing stage with id plate installation for traceability.

Results
Hardness measurements validated the good curing of the applied products and concluded the good completion of the valve reinforcements. The design life for these reinforcements is 20 years. This job was quite complicated because of the specific valve geometry but was perfectly performed and will enable the system to operate efficiently and safely.

Valve to be reinforced

Hygrometric conditions checking after surface preparation


Filler application


Reinforcement completed + ID plate


Overview of final result