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2022 TECHNICAL AWARDS ENTRY FORM

Entry Deadline: Friday 22nd April 2022

Please tick which categories you are entering (entries may be submitted in multiple categories)

- Landbased Pipeline Project Award
- Landbased Pipeline Technology Award
- Utility Pipeline Project Award
- Utility Pipeline Technology Award
- Subsea Pipeline Project Award
- Subsea Pipeline Technology Award
- iICE Award

1. **Brief title of entry:**
FTPS Pipeline Spacers for Dead Insertion of PE Pipe over Weko Seals
FT Pipeline Systems working with Cadent and Rosen

2. **Company name:**

3. **Signed:**
7th April 2022

4. **Date:**
Andy Fraser

5. **Company contact name:**
07899 918791

6. **Telephone:**

7. **Email:** afraser@ftpipelinesystems.co.uk.....

8. **Precis of your entry (50 words):**

The Spacer is an encirclement band with wheeled ramps, for installation onto PE pipe in order for it to be inserted into a cast iron host pipe without the need to remove Weko seals from socket and spigot joints, with the spacers rolling over the seals and brackets holding them in place.

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9. Summary of entry:

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Team Members:

- Andy Fraser (FTPS)**
- Nick Cannon (Cadent)**
- Simon Daniels (ROSEN)**
- Ian Martin (ROSEN)**

Criteria:

- Is well designed, easy to use and of genuine benefit to those planning, constructing, operating or maintaining a gas network.**
- Improves efficiency by saving time and/or reducing cost.**
- Reduces risk and/or contributes to the continued safety of those working in the gas sector, its customers and the general public.**
- Reduces the disruption associated with maintenance and repair activities.**
- Contributes to the decarbonisation of a gas network by reducing the environmental impact of activities.**

The “Spacer” was developed by FTPS for Cadent, with guidance from ROSEN(UK). The Spacer is an encirclement band with wheeled ramps, for installation onto PE pipe in order for it to be inserted into a cast iron host pipe without the need to remove Weko seals from socket and spigot joints, with the spacers rolling over the seals and brackets holding them in place.

Weko seal removal requires specialist operatives to enter the cast iron pipes (24” diameter and above) and remove the seals by hand, which requires the operatives to be in the pipe for extended periods of time. There are significant risks associated with operatives working inside buried pipes, including ground failure and flooding from adjacent water mains. The Spacers mean that this removal step is not required, significantly reducing risk to health.

Excavations require significant planning and in addition to the environmental impacts of these activities, costs for road closures, soil removal, and reinstatement can total up to £60,000 per trench. Weko seal removal normally requires air flow trenches every 100m. By using Spacers, these trenches are no longer required, reducing the overall timescale, disruption to customers and general public, and eliminating this cost from the operation.

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Ancillary Entry Information

(Entry restricted to normal type face and font size on this form plus no more than 3 pages of A4 drawings or photographs)

FTPS PIPELINE SPACERS FOR DEAD INSERTION OF PE PIPE OVER WEKO SEALS

(Additional information)

Background

Historically, cast iron mains were constructed using pipes with socket and spigot joints approximately every 3 metres. Commonly, these joints were packed with yarn which provided the gas tight seal due to moisture in the gas causing it to swell. However, in the 1970s when the gas networks moved to dry natural gas these yarn joints began to dry out and start leaking. One method of repairing these leaks was for operatives to enter the large diameter pipes and install “Weko” seals on the joints, a large rubber gasket stretched over the joint and held in place by two split rings that are tightened against the pipe wall by pushing either a wedge spacer into the split of the rings, or large brackets pushed apart using some stud bars and nuts, see Figure 1 and Figure 2.



Figure 1: Weko Seals and brackets at Cast Iron Pipe Joints (Left: Wedge Spacer, Right: Large Brackets)

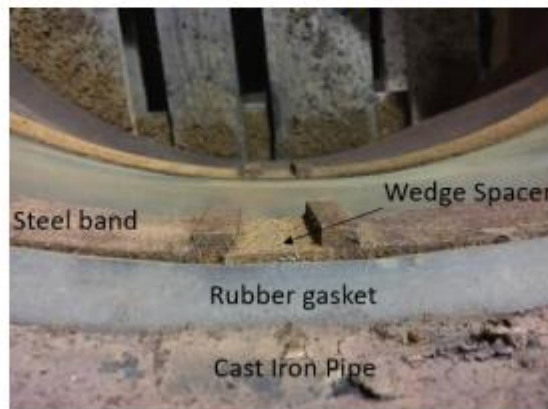


Figure 2: Weko Seal Components

These older cast iron mains are gradually being replaced with PE pipe, and one method of replacement is dead insertion, which is the process of fusing a PE pipe together above ground and pushing the pipe string into a larger diameter cast iron host pipe.

This process of mains insertion of large diameter PE pipe (500 mm and above) inside cast iron pipelines (24" and above) requires specialist operatives to enter the cast iron pipes and remove the seals by hand, and can require the operatives to be in the pipe for extended periods of time. There are significant risks associated with operatives working inside the buried pipes, including ground failure and water flooding from adjacent water mains.

An additional considerations during the Weko seal removal process is the need for air flow trenches approximately every 100 metres in order for the operatives to work safely. Every trench has significant planning and costs associated with them, such as road closures, excavation, spoil removal, and reinstatement. These factors can cause disruption to stakeholders and customers, and have significant environmental costs as well as monetary costs. Depending on location, it is estimated that each trench can cost up to £60,000.

In order to avoid the requirement of having operatives enter the pipe, FTPS have developed a pipeline spacer (Spacer) design, in the form of a wheeled clamp, that is clamped around the PE pipe at specified intervals during the insertion process. The pipeline spacers enable the PE pipe to be "rolled" over the

Weko seals during insertion, thus eliminating the need to remove them; and the associated requirement for man entry into the cast iron pipe, and the associated risk to health. Pipeline spacers also reduce the overall job timescale, disruption to customers and general public, and eliminate certain trench costs from the operation. The design of the spacers and the specified interval are designed to provide in excess of the 50-year design life of the asset.

Approach

FTPS provide pipeline supports and spacers to many different industries for different applications, however, as this was a new application for PE pipe in the gas industry it was required that this industry innovation would need to be reviewed, tested, and field trialled prior to being introduced as business as usual.

The Spacer is made up of two half-shell clamps that are bolted together, with a number of rollers and ramps around the circumference. The roller is intended to reduce the pushing forces required when inserting the pipe over the seals, and the ramp is designed to protect the roller in the event of direct contact with the seal brackets, see Figure 3.

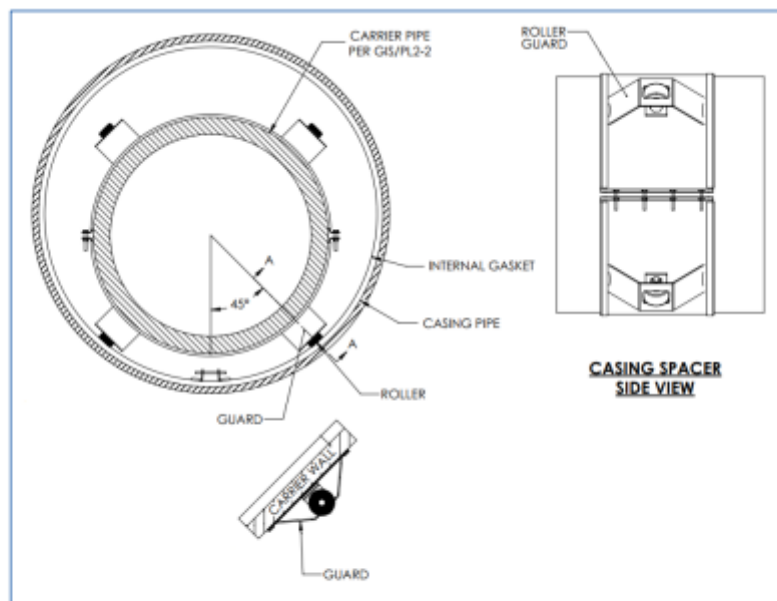


Figure 3: PE Pipeline Spacer Design

The initial design was for inserting 630 mm diameter PE pipe into a 36" (914.4 mm) diameter cast iron host. The design was reviewed by ROSEN to ensure that it complied with relevant requirements, and testing records were inspected to ensure that the spacers were fit for purpose and would withstand any forces that could be seen during the insertion operation. Following the design review, the ramp was reinforced with an additional gusset to allow for multiple impact strikes with the brackets, ensuring the ramp remained intact and safe, see Figure 4.



Figure 4: Spacer ramp and reinforcement gusset

An element for the design review was to consider any risks of damage caused to the PE pipe during the insertion operation and during the life of the PE asset. This included ensuring that the design provided enough clearance for the PE pipe to be inserted without the risk of the pipe being damaged by any Weko seal brackets within the main. For the inserted pipe, damage can occur during the insertion operation as the pipe is pushed over the Weko seal brackets, and also over the years as the PE material creeps and sags between spacers. While considering the spacer interval specified by the manufacturer and the short and long term material properties of PE pipe, the deflection of the PE pipe between spacers was reviewed to ensure that the pipe would not sag onto any brackets over the life of the asset. The materials of the spacer were also reviewed to ensure that over the life of the PE pipe the spacer would not degrade/corrode in such a way that the pipe would come into contact with the Weko seal brackets and create a local stress raiser within the pipe wall. Figure 5 shows the final stainless steel Pipeline Spacer design installed on 630 mm PE pipe, with the ramp and reinforcement gusset.



Figure 5: Final Pipeline Spacer Design installed on 630 mm PE pipe

Following the complete design review, modification of the ramps, and acceptance for the design by Cadent, the Spacers were used in two field trials within Belgravia, London, see Figure 6 and Figure 7. These trials demonstrated that the design was suitable, and allowed the PE pipe to be inserted over the Weko seals without damaging the pipe. It was no longer necessary to have specialist operatives entering the pipe to remove the Weko seals from the host pipe, eliminating a stage of the dead mains insertion operation that can have safety implications.



Figure 6: Spacers installed during Field Trial 1



Figure 7: Spacers installed during Field Trial 2

Conclusions

Working closely with Cadent and ROSEN, FTPS have developed and brought to market a new range of stainless steel pipeline spacers for use during dead insertion operations. The design was reviewed, tested, and subsequently updated to ensure that the design is easy to use, quick to install, robust, and will not cause any potential issues for the design life of the PE pipeline asset.

This new approach to dead mains insertion eliminates the requirement for man-entry into pipelines (above 24" diameter) in order to remove the Weko seals installed at every joint, significantly reducing the hazards to health during replacement activities. The use of the Spacers will also reduce the number of excavations required, lowering the financial costs and environmental impact of these replacement activities, and also reducing the disruption to the general public due to fewer road closures. Following the successful field trials of the 630mm spacer for 36" host pipe, a full range of spacers are in development for different size combinations, with the aim to eliminate the requirement for Weko seal removal for all dead insertion operations across the network.



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- Subsea Pipeline Technology Award
- IICE Award

1. Brief title of entry: Replacement of 36" gas main cast iron pipe through the heart of London
2. Company name: Collaboration of Murray Utilities and Innovex Technologies Limited.....
3. Signed: Rosalind MacGregor.....
4. Date: 1st April 2022.....
5. Company contact name: Christy and Jerry Murray of MUT and Rosalind MacGregor (Innovex).....
6. Telephone: 07450 260471
7. Email: Rosalind@innovex-tech.co.uk.....

8. **Precis of your entry (50 words):**

How a 36" gas main, built in the 1940s, 20ft underground in the absolute heart of London, is being replaced, pulling on years of experience, technology, grit and understanding of the pipeline industry to implement.

Murray Utilities had to think strategically to overcome consistent obstacles, part of this involved working with Innovex Technologies to create the perfect piece of kit – The 800 mm pipepusher to push the very large PE pipe through the old monster pipe below Buckingham Palace, Downing Street and other high profile historical landmarks with minimum disruption and on target. (Project is still active)


Rosalind MacGregor (Apr 5, 2022 14:52 GMT+0)



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9. Summary of entry:

Opening with the years of experience surrounding Murray Utilities and what particular considerations must be given when tackling a mammoth high profile job like this, the document takes you back to the 1940s to when the pipe was first put in place and how MUL follow the original footsteps of these pipe installers, using any surviving maps and documents to help them.

Using these surviving materials it then highlights how modern changes and adaptations to the environment can completely overshadow and negate them, calling on the right experience, the ability to multitask and plan, the use of powerful equipment which can be used to complete sections of the extensive underground pipeline.

The use of the Innovex pipepusher and how it lifts, aligns and inserts the PE pipe by attaching it to the excavator arm and hence taking away the manual handling and injury risks associated with pipe insertion is detailed in a real life exciting way by use of quotes in a story like format.

Murray Utilities is proud of outperforming expectations on this job and explains that this is crucial while working in London city. Mixed with humor, feeling and drive, the document explains about soil types and how it effects their work, it spells out the safety of using the Innovex Pipe pusher and how both Murray Utilities and Innovex worked together to design and then Innovex to make the bespoke 800mm pusher (with shims that reduce diameter to grip the pipe tightly and push depending on whether it's an 800mm or 600mm) to push the new PE pipe inside the old pipe overcoming obstacles at every point.

Referring to themselves as the 'Pipe Whisperers' MUL could not love their work more and this is clear from the document. Attention to detail and always thinking about the next steps, right down to walking the route several times before breaking ground is essential. Innovex is with them every push of the way, ready to respond to any technical issues.

Nothing stops Murray Utilities and Innovex and this strong B2B relationship shines through and depicts the dynamic way of working to complete sections of the old underground pipe in one of the world's busiest and high profile cities. Without each of these companies working closely together, leveraging experience and listening carefully to requirements the sections of this job would not be completed safely and on time with major implications to the gas network, the city of London, the general public, the employees of contractors, tourism, congestion and overall time of disruption.

Ancillary Entry Information





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"The Pipe Whisperers"

It would be difficult to find someone more qualified and experienced in the pipe pushing industry than John (Jerry) Murray, one of the owners of Murray Utilities Limited.

Having moved to London when he was 17, he has watched and been part of the pipeline industry for years and has seen many changes, progressions in technology, use and deployment of resources and incredible advancements. Jerry and his brother Christy, are trusted, experienced and respected professionals in this hardworking industry and bring with them an unquantifiable wealth of knowledge gained through the years.

"I actually never stop thinking about a job, where is the best place to dig a hole? What is the soil like? Is it sand? Is it gravel? Where's the sewer and fibre optic cables?" says Jerry. 'Every single obstacle must be considered and understood. It's not just a case of picking a spot, digging a hole, and pushing in a cable. Maps, cameras and mostly experience and understanding of the area are deciding factors. Together with this, I need the best machine and the best pipe pusher that can do the job with minimum disruption'.

Right now Murray Utilities Ltd are working on a section from Belgrave Square to Buckingham Palace and will soon move to Downing Street 'area in a few months time. This is a monster of a job which is home to a whopping 36inch cast iron original pipe carrying gas servicing the absolute heart of London. It was likely laid in the 40s or 50s with teams of men using hundreds of man hours and creating constant upheaval and congestion. Jerry and the team are, to put it very simply, pushing a new plastic polyethylene pipe inside the old gas mains pipe and its extensive network of deep underground piping. There are different sizes of pipes and this very old network of pipes has many quirky twists and turns, and will take years to complete. This new polyethylene pipe is between 630mm and 800mm wide and to do this the team are using the Innovex 800 mm pipe pusher.

Digging deep for this job is all part of a day's work for MUL. It is 23ft deep to be precise, under the ground, in the centre of the capital. It's enough to strike fear into any one's heart, but not Murray Utilities.

Before the team break the ground, Jerry and his brother Christy will walk the route a good few times. They will take themselves back 70 years and imagine how the men in those days placed the original piping. Looking for twists in the road, examining manholes, inspecting angles where the road turns (because the pipes follow the flow of the road), checking for any modern day obstructions that may have been built on top of it, and generally using their years of experience and expertise to anticipate any obstacles they could come up against. Together with this above ground view, they may have some old maps that the men of the 40s put together when laying the original pipe. Jerry explained that these original craftsmen would cycle around London drawing highly detailed maps of every turn and twist of the pipe. They created pipe to pipe drawings and precise measurements would be calculated and recorded. Sadly, many of these maps have been lost so a lot of the time MUL must call on their skill set to make sure they get it right. Once the ground is broken and a point of entry determined, a robotic camera can be used to help but its experience that counts mostly, especially when the pipes are deep underground.

'It's easy to draw on paper where a shaft should be dug or a pipe should be laid, after all, paper doesn't refuse ink' says Christy, 'But when you stand above ground and consider the many factors, it more than likely will not be possible to use the paper schematic, I say, let's get to the site and see what is actually possible'.

The Murray brothers have to be straight to the point because when they are dealing with gas pipes of any size, whether it is a 32mm or an 800mm the same respect must be given. After all, any mistakes are serious, can complicate and lengthen jobs and most importantly are highly dangerous.

This is where the Innovex pipe pusher really comes into its own. This powerful attachment performs consistently in this sometimes unpredictable environment putting pressure on the polyethylene pipe and pushing it through – even around 20 degree corners. Every day, there are different obstacles but the Innovex pipe pusher always stands up to the job.


Murray Utilities Limited (MUL) (MUL 1, 2022 24-02 0877-1)



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'Traditionally with a job like this, winches would need to be used to lift and lay the pipe if you couldn't find a way through. Now, with the new pipe pushing technology it's just a case of upping the pressure, but the trick is, knowing when the pressure is too much and knowing when to relax it'. This is down to experience' says Jerry.

Some days Jerry can push a pipe, using the Innovex pusher a phenomenal 200 metres. Using the camera inside the mains and having a visual on top of ground to give the angles and twists in the road really helps. If you come up against an obstruction, you may need to dig another 'pushing hole' but they try to keep excavations to the absolute minimum.

'The Innovex pipe pusher can push the new polyethylene pipe around a bend or 2, especially the 22 degree ones, so it saves on multiple excavations' says Jerry, a natural mathematician and physicist.

Old fashioned experience can't be overlooked, 'you still have to dig a hole, you still have to climb down and find the mains and you have to do it safely in the right spot'.

In the next couple of weeks MUL will be digging in the grounds of Buckingham Palace. With them they will have an appointed archaeologist although jokingly Jerry says 'if he finds anything he's keeping it!' Kidding aside, no two days are the same. Working in Hyde Park was a treat for the company where they were entrusted with the keys to the very gate designed by Prince Philip, The Queen Elizabeth Gate. The company showed total respect for the park and pushed to have the work done quicker than the allocated time frame. Beating this time frame could not have been achieved without the use of the Innovex pipe pusher.

The Innovex pipe pusher does two jobs, it can be used to push pipe (what the tin says, according to Jerry), or it can be used to pick the pipe up and load it on to the welding rig, instead of using slings. This is much safer and more cost effective because instead of using 3 men, one man sitting in a machine can move it and place it where it needs to be.

'The Innovex pipe pusher is continuously robust and useful. It's the Rolls Royce version of pipe pushers made in the UK from high quality steel and it gets you to where you need to have your pipe' says Jerry.

Jerry and Christy Murray travelled to see Rosalind from Innovex and discussed the challenging job they faced, what would work and trialed and tested the Innovex pipe pusher to the max, it stood up to the job with ease. They could not compromise on quality since some of the pipeline work would be running under Trafalgar Square, Winston Churchill's bunker, Covent Garden as well as other major London landmarks and attractions.

'Rosalind listened to their input and went away and done her thing, she has a genuine interest in making our life easy' said Jerry 'Her experience and understanding work perfectly, like glue, to pull it all together designing the perfect pipe pusher'.

Shims go inside the original 800mm pipe pusher and reduce it down to the 630 outside diameter to allow movement to and from different sized pipes.

Jerry laughs, 'if it's big and round, we'll put it in the ground!'

He likes to have fun doing his pipe pushing and if the men are happy and everything is getting done, he has no complaints. However, although it can be fun, strict attention to detail is always at the forefront of his mind.

Jerry went on to explain that the action of the Innovex pipe pusher could be reversed to pull back if an obstruction was met, something not possible with other insertion methods. He stated that the Innovex pusher gives the best possible grip and release system across the market, even in the toughest conditions and that it can push 12 metres every 51 seconds.

'You also need to know your soils', states Jerry. 'Whatever you do under the ground effects how you use the equipment and how quickly the job will move forward'.

Understanding the geology is very important when digging shafts to climb down. There are several types of ground to be considered. 'There can be running sand. You could dig a metre today, come back in the morning and it's completely filled in. We also have the London blue clay which is the best to tunnel through. Gravel, well, that's a complete nightmare, it's unsteady and can be dangerous. As for chalk and flint mixture, this is brutal and can throw the head of the machine off if you hit the flint. Sometimes it can just be


Rosalind (April 9, 2022 10:02 GMT+1)



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ordinary clay and earth, but you need to know the areas. It gives a clear insight into how you are going to build the shaft and how quick you are going to progress'.

Right now the Innovex Pipe Pusher is being used by MUL in an area of gravel. Due to the fact gravel can be dangerous, the men need a wider shaft but taking the right time to dig and carefully considering the approach to be used is absolutely essential. Under the ground of London is a lot of crushed brick from the blitz and this can be unsteady.

As well as working hard re-installing the new gas mains pipe, Jerry likes to be a celebrity spot. He's seen David Beckham, Tom Jones, some celebrity chefs and Prince William in his Audi. Jerry is a bit of a celebrity himself, but he likes to keep low key in case he's spotted by the paparazzi pushing in his pipes. Always the joker, he did have sincere words to say about Innovex and Rosalind.

'Rosalind is such a great asset to the industry and has really worked with us to make our job so much easier. I can't endorse her or the Innovex product enough. She cares about her customers, she acts when we need something and she most certainly listens. Rosalind is always out meeting contractors, not just sitting in the office. Her products are genuinely the best and have been an absolute asset to us – we could not do what we are doing without the Innovex pipe pusher – she provided us with a solution to insert, align and lift simply by attaching the pipe pusher to the excavator's arm. What more could we ask for?'

This team of 'Pipe Whisperers' from Murray Utilities really know that renewing all these old pipes is a challenge and are now even considering the next stretch of the pipe and the fact that Buckingham Palace has protected trees and route systems. They will follow the line of the host main and explained that due to the continual push using the pipe pusher, there will be little to no visible movement of the mains which virtually eliminates the chance of damage to it. They know it will be a massive logistical challenge working out where to start from and where to finish, navigating preservation orders and according to Jerry, the Queen keeping an eye from the balcony, but nothing is insurmountable for these guys with the right experience and the right equipment and we at Innovex are very proud to be part of this mammoth job through the centre of London. Whether it be running a line under the Thames, past the front door of Harrods, through the grounds of Buckingham Palace or even past Downing Street, Murray Utilities are an experienced pair of hands with the continued and strong support of Innovex Technologies.


Reviewed by: Jerry (April 9, 2022 18:02 GMT+0)