The Dutch implement 'gas roundabout' concept

By John Tiratsoo, *Pipelines International* Editor-in-Chief

The Netherlands' state-owned infrastructure company N.V. Nederlandse Gasunie is currently working on the Dutch Government's ambitious 'gas roundabout' concept, which will see the Netherlands becoming the heart of a major gas hub for northwestern Europe.

Involved is a network of 15,000 km of high-pressure gas pipelines, many up to 48 inches in diameter, in both the Netherlands and Germany. The idea is to combine gas from Dutch and German fields within the Gasunie pipeline network with gas from other international sources including Russia, Norway, the Middle East, Asia, and Africa, and to transport it onward to the United Kingdom, Germany, France, Belgium, and consumers in other European countries.

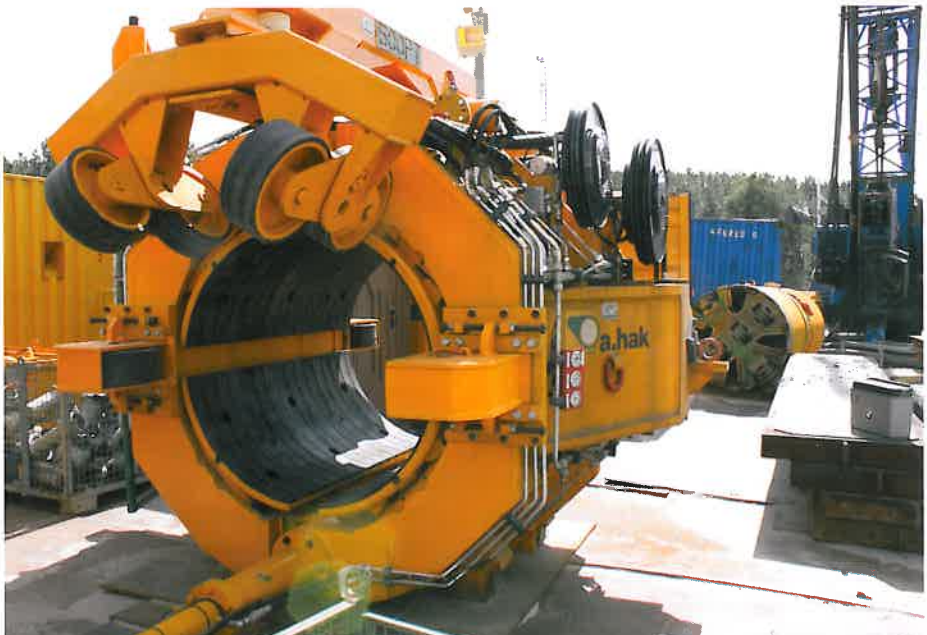
The 'gas roundabout' provides significantly increased transmission capacity, and will accommodate European energy needs for decades to come.
The gas network will also include LNG importation, regasification facilities, which are currently under construction, and the company's giant salt-cavern gas-storage facility at Zuidwending in the north of the Netherlands. The system is capable of transporting up to 125 Bcm/a of gas, and incorporates 18 compressor stations and 14 export stations, as well as a considerable number of other entry points and facilities for blending and pressure regulation.

As an extra complication, the country's giant onshore Slochteren Gas Field produces low-calorific value gas that is used by many of the country's domestic consumers. Imported gas that is used for domestic purposes must therefore have its calorific value lowered to match the indigenous production, and this is done by nitrogen injection.

One of Gasunie's main export routes to the UK is the Balgzand – Bacton Gas Pipeline, which became operational in 2006. Powered by a compressor station in the northwest of the Netherlands, the 235 km, 36 inch diameter pipeline presently supplies 15–18 Bcm/a to the UK. Based on an open season in the market, the capacity of the pipeline is to be expanded.

In 2007 Gasunie commissioned its 110 km, 48 inch diameter East – West Link, which runs from the north of the Netherlands across the Ijsselmeer Lake to Balgzand. As with all major infrastructure construction in the Netherlands, the pipeline had to be designed to have a minimum environmental impact, and to accommodate the unique challenges posed by the Netherlands' high water table, concentrated land use and significant population densities. Along the 110 km route there were 11 major horizontal directional drill (HDD) crossings as well as a 36 km long crossing of the Ijsselmeer

The launch pit for the Hartelkanaal crossing. The pit is being prepared to accept the pipe sealing unit and the tunnelling machine. Visible also is the two-piston pipe-thrusting unit onto which the clamping unit will be fixed.be used to push the pipe into the microtunnel.



The Herrenknecht 500 tonne clamping unit that will be used to push the pipe into the microtunnel.

Lake itself, which was treated as an offshore construction though in only 5 m water depth. A concrete weight-coated three-layer polyethylene (PE) coating was used for this section of pipe.

The North – South Pipeline project

As part of the 'gas roundabout' project, a further new pipeline being constructed is the 485 km, 48 inch diameter, North – South Pipeline, which is in two sections. The longer one is in the east of the country and runs from Rysum in northern Germany and Oude Statenzijl in the north of the Netherlands, to Schinnen in the south. The shorter section runs from a new compressor station at Wijngaarden in the centre of the country to an export station at Zelzate in the southwest, on the Belgian border.

The North – South Pipeline has two new compressor stations, one in Scheemda in the north and the other in Wijngaarden. In total there are over 60 crossings of all types of existing infrastructure, including roads, railways, canals, and rivers.

Gasunie is among the world's leading experts in pipeline crossings, and will often use HDD as its first choice, even in places where trenching and backfilling might be the norm in other countries. Among the reasons for this are speed (fewer permits have to be obtained) and minimised environmental impact. The company has already carried out some record-breaking results with the technology, and crossings of up to 1.4 km length using 48 inch diameter pipe, and 2.7 km in length using 16 inch diameter pipe, have been satisfactorily achieved.

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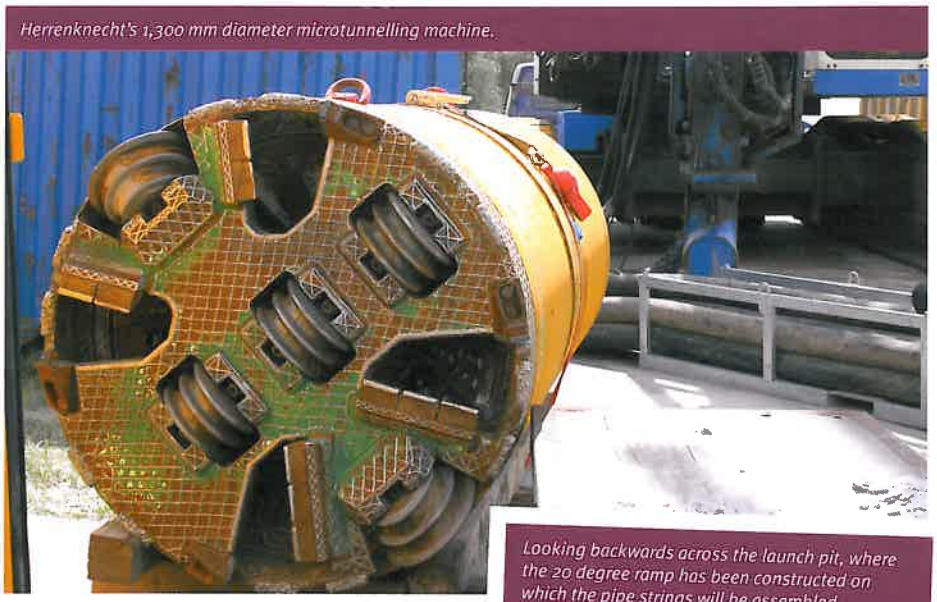
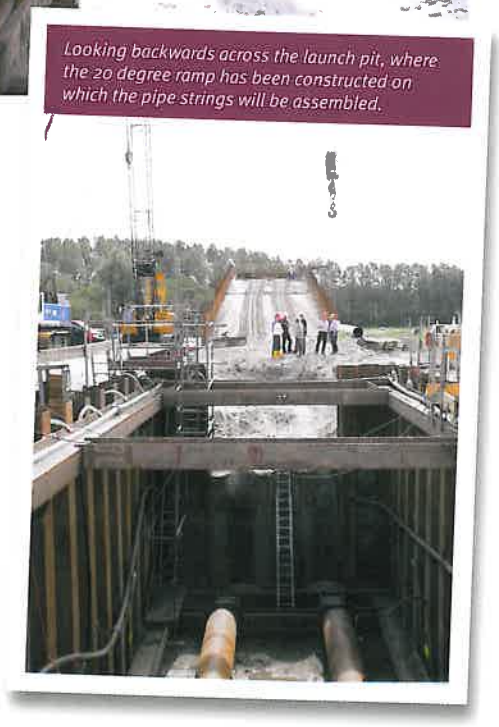
Table 1: Gasunie's field-joint coating choices.

LOCATION	COATING CHOICES	REMARKS
Fittings	Denso AS 4+	
	STOPAQ	Plus tape or shrink sleeve
General line pipe	Bitumen	If mill-applied coating is bitumen
	Canusa GTS 65	
	Raychem HTLP 60	
	STOPAQ	Plus shrink sleeve or tape
HDD, jacking, thrusting	Canusa GTS PP	
	PP flame spray	Requires much craftsmanship; good results
	PUPP Lining	New process; good results



Herrenknecht's 1,300 mm diameter microtunnelling machine.



Looking backwards across the launch pit, where the 20 degree ramp has been constructed on which the pipe strings will be assembled.

Due to space constraints at the launch end, this crossing is being made by the 'direct-pipe' method in which a 1,300 mm diameter Herrenknecht microtunnelling machine will be used to create the hole.

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Other options for pipeline crossings that Gasunie regularly employ are microtunnelling, pipe jacking, and pipe ramming, each of which has its particular advantages for the different situations in which Gasunie needs to operate. For example, as well as the over 60 HDDs, the North – South Pipeline already incorporates a 4 km long crossing at its northern end that was constructed as a 3 m diameter microtunnel into which the 48 inch pipe was inserted. Once the pipe had been laid and tested, the microtunnel was flooded with a mix of Bentonite drilling mud and cement before being sealed to ensure that the pipe remains protected against corrosion.

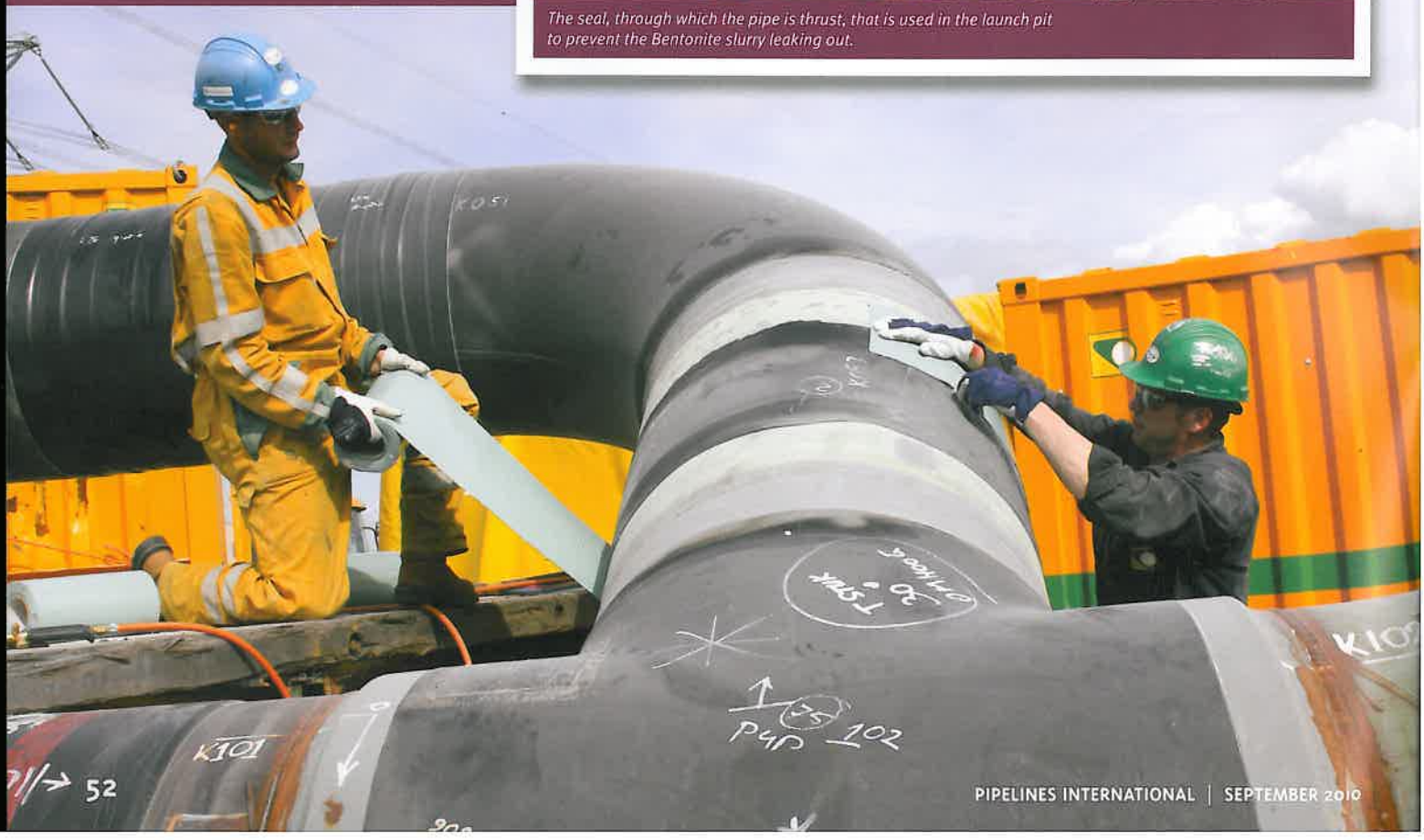
Pipelines International recently visited another of Gasunie's sites on the North – South Pipeline, at the Hartelkanaal crossing near Europoort. Here, the 48 inch diameter, 22.7 mm wall thickness pipe is being installed along a 537 m trajectory under the canal. The maximum depth of the canal is 12.5 m, and the pipe will be a minimum of 15.4 m below this.

Due to space constraints at the launch end, this crossing is being made by the 'direct-pipe' method in which a 1,300 mm diameter Herrenknecht microtunnelling machine will be used to create the hole, with the pipe connected to the machine and being pushed in behind it as it travels along its path. The Hartelkanaal crossing

Such crossings cannot be easily excavated for subsequent repairs and therefore coatings, particularly, field-joint coatings, need to have the highest possible integrity.

Above: Gasuine's Co-ordinator for Corrosion Prevention, Arie Dam (right), and Frits Doddema of STOPAQ. Below: STOPAQ's material being used on one of the field joints.

The seal, through which the pipe is thrust, that is used in the launch pit to prevent the Bentonite slurry leaking out.



will be the third time that Gasunie has used this technique, which also relies upon a high-capacity thruster to push the pipe in behind the tunnelling machine. The thruster clamps directly to the pipe's externally-coated surface, and pushes it in through a high-capacity seal that retains the Bentonite drilling mud, used both to ensure the hole does not collapse and to export the cuttings slurry. In this case contractor A.Hak Drillcon BV will use a 500 tonne Herrenknecht thruster, anchored in the start chamber.

The microtunnelling machine will be launched at an angle of 20 degrees below the horizontal, and a ramp at this angle has been constructed to support the three 54 m long pipe strings as they are pushed into the hole by the thruster. The strings will be retained on the ramp by a clamp, so that their self-weight does not drag them out of alignment. Each string will be welded, inspected, and field-joint coated on the ramp. The drilling and installation will take an expected 10 days, at a speed of around 200 mm per minute, and is due to be completed by the end of October.

Despite the process used for such crossings, whether HDD, pipe jacking, or pipe ramming, it is imperative that the pipe coating is strong enough to resist the forces being employed and the abrasion of the subsoil strata. Such crossings cannot be easily excavated for subsequent repairs and therefore coatings, particularly, field-joint coatings, need to have the highest possible integrity.

As there are no industry standards for crossing coatings, Gasunie has specified its own. For general linepipe, PE mill coating is specified to various thicknesses depending on the pipe diameter and location. For pipe used for HDD and other types of crossings, polypropylene with a thickness of up to 6 mm for pipe over 20 inches in diameter, and a thickness of up to 4.5 mm for smaller diameter pipe. For field-joint coatings, Gasunie offers its contractors a choice, using the alternatives given in Table 1. These are based on testing Gasunie has done with a water-filled 18 m, 36 inch diameter pipe weighing 17.5 tonnes, which was dragged along a 1,000 m test track. The abrasion resistance and adhesion performance of different coating options were evaluated, and form the basis of the company's current coating philosophy for underground crossings.

Ensuring integrity

In common with all engineering achievements in the Netherlands, Gasunie takes great efforts to ensure that its pipelines are designed and constructed with the maximum of integrity. The company will carefully evaluate the systems and products it and its contractors use, to ensure that they are the best possible systems for the conditions that its pipelines will operate in. The company is also willing to support alternative solutions which may be able to provide greater benefits for both long-term integrity assurance and environmental protection. Among these are its use of STOPAQ coatings for railway crossings and linepipe applications, and PUPP Lining for field-joint coatings.

Although Gasunie no longer has its own specific research department, it works closely with Kema, who acquired Gasunie's Engineering and Technology department in 2009. Gasunie thus has unrivalled access to the new gas consultancy, engineering services, and research and development facilities which form the foundation of the strategic collaboration between it and Kema.

The tie-in pipe being assembled above ground. The field joints for the tee are protected with the STOPAQ system.

A.Hak's equipment at the worksite.

Pipelines International thanks Arie Dam, Co-ordinator Corrosion Prevention, and his colleagues at Gasunie, along with Frits Doddema of STOPAQ and Cees Rombouts of RKT International, for their assistance in preparing this article.