

Crossing the Alps in a Pipeline – Unfavourable Conditions for an Intelligent PIG

By René Landstorfer

Well-engineered technology is necessary to cross mountains of 2,000 m and more with a leak detection PIG in a pipeline. A challenge that must not be underestimated and has been solved by Gottsberg Leak Detection in close collaboration with the operator Transalpine Pipeline.

In a way, pipelines are like the lifelines of modern society. Almost all aspects of life are dependent on fossil fuels in one way or another and in order to guarantee crude oil delivery, for example, the product must be distributed via pipeline networks.

There are several options for ensuring the security of these transit routes. One such option – one that is almost indispensable – is the use of leak-detecting PIGs (= Pipeline Inspection Gauge). Online systems, for example, which make calculations based on model processes and external measurements of the operating parameters along the pipeline, offer good opportunities for continual monitoring but have the disadvantage that they cannot capture small, subtle leaks of the magnitude of a few litres per hour and that, when it comes to the detection of larger defects, they have difficulty locating the defects in question. As described already, we are ultimately speaking here of a mathematical model process where, unlike the use of PIGs, one arrives at precisely measured values at all points along the pipeline.

In contrast, PIGs can save the actual parameters for each relevant point in the pipeline network, thereby allowing more accurate statements to be made about the leak-tightness of the pipelines. Gottsberg Leak Detection from Germany has developed a particularly precise system for this purpose. This

company has created a leak detector based on ultrasound technology, which takes records in the pipeline which are then analysed later by the operators. And it is here that one of the company's best innovations becomes clear: namely, the fact that the devices are so easy to use. For example, analysis by the largely automated system is so simple that the operators can have it carried out by their own staff, which means that most leak-detecting PIGs sold by GLD can be used as often as needed and – unlike other pigging services – are inexpensive to install as well. It is, one could say, the PIG for all seasons, which basically only has to stop its inspections to charge its batteries and to read out the data it has collected. In addition, thanks to its approval for Ex zone 0 from the TÜV Nord standards organisation – something which is unique among intelligent PIGs – the device can be used without restricting operations in the pipeline in the least. One other advantage of the leak identification system is the way it reliably avoids false alarms. These are eliminated by the fact that noises and, especially, their origins can be appropriated through an exact frequency analysis. So, unlike before, any harmonics from a noise typically found in the frequency range of a leak will not be classed as potentially dangerous. Instead, the new multi-channel technology can accurately determine the causes of these harmonics and thereby determine their origin.

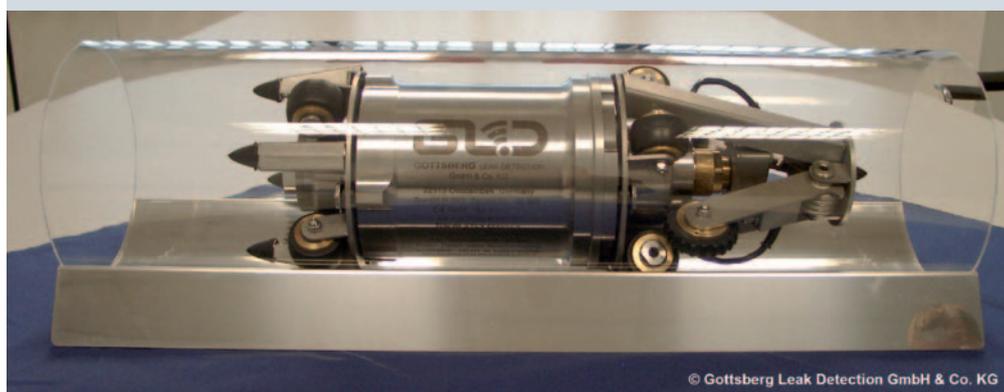


FIGURE 1:
GLD202 with
the chassis
GLD303-200
for a 8" Pipeline

PIPELINES IN DIFFICULT TERRAIN

On flat land, pipeline operators will not be confronted with any major problems, either during the construction phase or during operation. If, however, the pipeline passes through difficult terrain like mountains and valleys, the operator will face new challenges.

These challenges begin during the construction phase, when questions like „Should the pipeline go over the top of the mountain or perhaps even through a tunnel, so that we will not have to overcome big altitude differences?“ or “How much energy will be required to traverse a mountain or entire mountain ranges?“ arise.

It is not only upward slopes that give planners headaches; descents, where the medium being carried in the pipeline can accelerate in speed to the point where it is almost in free-fall, must be borne in mind too.

All these considerations are not only of immense importance during the construction phase; they must also be remembered during operation and, especially, when it comes to maintenance.

What better way to encounter all these challenges than with an Alpine crossing!

And so Gottsberg Leak Detection has, in collaboration with the operating company TAL (Transalpine Pipeline), recently commissioned a new generation of leak-detecting PIGs, the aim of which is to defy these odds.

From the oil port in the Italian city of Trieste, the pipeline crosses the Alps to supply refineries in Germany and Austria. Over the course of the pipeline's trajectory, altitude differences of several hundred metres at a time, rising to over 2,000 m total, must be overcome.

Furthermore, there are several sections where the pipeline faces such steep descents that both the medium being transported and the PIG found in the pipeline are almost in free-fall. It is precisely in these areas that the durability of the PIG and of the carrier is naturally of huge importance, which meant that new structures were required at very different locations. The carrier had to be fitted with braces, while the odometer devices were also changed in order to achieve reliable measurement of the distance already covered and the speed.

Not only that, the measurement data and records taken also had to be reliably delivered under these challenging conditions, so as to allow the operators assess the leak-tightness and other parameters. Uncontrollable speeds along with huge pressure variations make it difficult to calculate reliable values and presented the developers with issues that they had never faced before. For example, the sensitivity of the hydrophones was raised to allow enough data to be received even under unfavourable conditions and thereby allow an accurate assessment of the pipeline's leak-tightness to be made.

In order to ensure that the anticipated forces would not damage the devices and that the devices would, in turn, not damage the pipeline, test runs were carried out first using dummies and not until many modifications (developed in close collaboration with the operators) had been made could regular operation of the PIGs finally commence.

By now, the PIGs have made many investigative journeys between Trieste and Ingolstadt, helping to ensure even more secure operation of the transalpine oil pipeline. One of these journeys, representing a complete traversal of the Alps, takes around five days. During this time, the PIG must process huge amounts of data. Because this must all be done in such a small casing, the engineers at Gottsberg Leak Detection have managed, via a compression rate of around 1:300, to shrink the amount of data collected, which means that, for a 200-hour run, a low-energy, error-resistant 1GB memory card is sufficient. Despite this, no relevant information or measurement data is lost and any leaks present in the pipeline can be detected with the greatest accuracy.

Photo: © GOTTSBERG Leak Detection GmbH & Co. KG



FIGURE 2: GLD303-1000 chassis for the Alpine crossing in a 40" Pipeline

Photo: © GOTTSBERG Leak Detection GmbH & Co. KG



FIGURE 3: Engineers at the Gottsberg testing facility

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