

Frequently Asked Questions ILI – PIT

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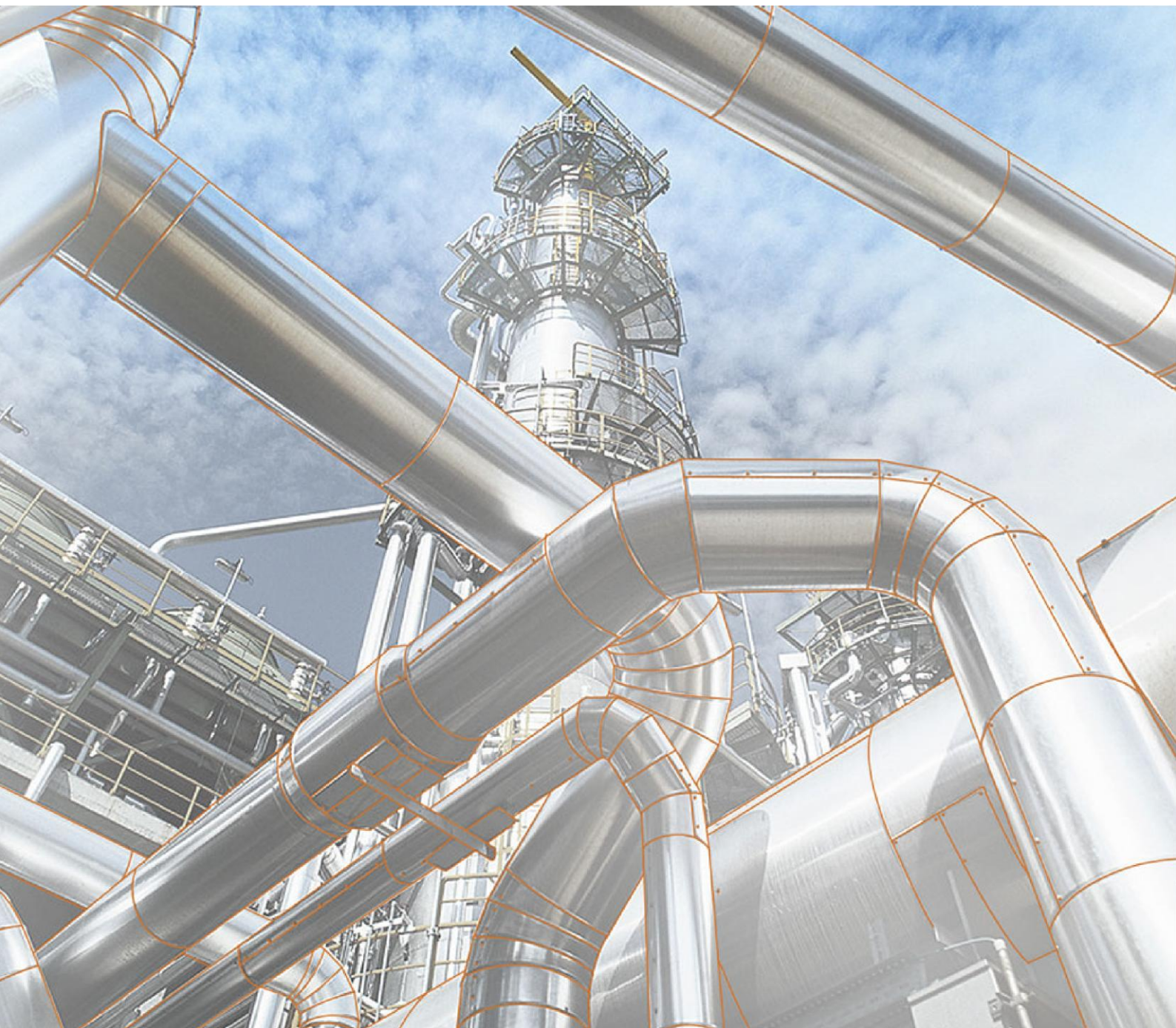


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1 Measurement

Q1.1 What measurement principle does the tool use?

The system employs advanced straight beam ultrasonic technology in a non-contact immersion configuration. The transducers are positioned at an optimized stand-off distance from the pipe wall, typically between 25 mm and 45 mm for smaller diameter pipes and approximately 90 mm for larger pipelines.

During inspection, the probe array rotates around the pipeline, collecting measurements across the entire circumference. This rotating configuration provides significantly higher measurement resolution than conventional fixed probe systems. The increased resolution enables reliable detection and accurate sizing of even very small defects, including pinholes, ensuring comprehensive inspection coverage.

Q1.2 What is the accuracy of the measurement?

Measurement accuracy depends on the transducer frequency. A standard 2.5 MHz setup delivers a theoretical accuracy of 0.2 mm, and a practical inspection accuracy of approximately 0.3 mm. Detailed values are provided in the tool specification sheets.

Q1.3 What is the measurement resolution?

Resolution is defined during project preparation based on inspection requirements and detection probability. Typical values range from 1 mm to 3 mm. Measurements are designed with overlap to ensure 100 percent coverage.

Q1.4 Can the tool inspect gas lines?

Direct inspection of gas filled pipelines is not possible with ultrasonic technology. However, gas pipelines and risers can be inspected after being partially or fully filled with a suitable liquid medium.

Q1.5 Is wax a problem for the measurement?

The Pipeline Inspection Tool is a crawler tool in contrary to regular intelligent pigs, which use disks for propulsion. As only the wheels of this vehicle are in contact with the pipeline surface the collection of wax and debris on the tool is minimal and does not influence the manoeuvrability in the line. Additionally, for the ultrasonic measuring system a wax layer of up to 1 mm is not a problem.

Q1.6 What is the circumferential inspection coverage of these tools?

Circumferential coverage of all the Inline Inspection Tools is 100%. See also Q1.3

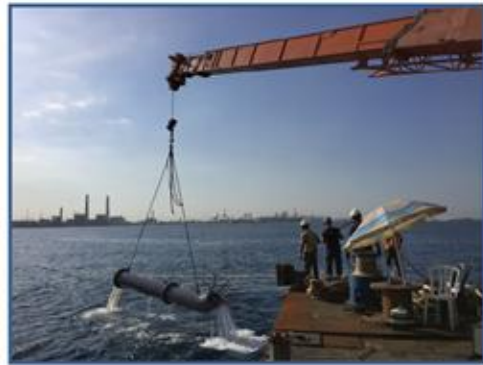
2 Launching

Q2.1 How is the tool launched?

The PIT system needs open access to the pipeline therefore the pipeline must be off-line, depressurised and opened. Usually a launch-tray is used to keep the pipeline full of liquid and allows the tool to easily drive into the pipeline. The liquid is required as it is the ultrasonic couplant to the pipe wall and therefore essential to perform the ultrasonic inspection.

Several other options available depending on the pipeline and situation.

Such as special launching trays for sub-sea launching or vertical launching in space constrained situations. The best launching option with the least impact will be determined by our engineers and proposed to the client.



Q2.2 What is the length of the spool-piece to give sufficient space for the launch-tray?

The standard launch-tray has a length of approximately 5.5 meter hence a spool piece with a length of 6 m is sufficient. However, several different launching options are available depending on the situation. The best launching option with the least impact will be determined by our engineers and proposed to the client.

Q2.3 Can the tool be launched under an angle or even vertically?

Yes, the inspection tool can also be launched under an angle or even vertically launching is not a problem.



3 Typical PIT Pipelines

Q3.1 Which customer Assets are typical PIT applications?

Typical application for unpiggable tools is for pipelines that may have some of the following:

- ✓ Loading and Unloading Pipeline
- ✓ Jetty/Marine Export or Import Dock lines
- ✓ Buried piping
- ✓ District Heating
- ✓ Gathering, Transmission, distribution pipelines
- ✓ Cased River, Road or Railroad Crossings
- ✓ Cavern piping
- ✓ Pipe-rack piping
- ✓ Branch connections
- ✓ Through-wall facility penetrations
- ✓ Thermal pipelines (glass houses)
- ✓ Empty - or partly filled pipelines
- ✓ Storage piping



Q3.2 What is difficult in pipelines?

The size, diameter, of the pipeline can be restrictive to crawler tools. To expand the inspection options for pipeline operators to know all physical characteristics that pose challenges to internal inspections:

- ✓ Multi diameter
- ✓ Short radius or heavy wall bends
- ✓ Fabricated ("mitre") bends
- ✓ Thick and thin wall pipe

- ✓ Repair sections
- ✓ Over- or under-sized valves
- ✓ Wax, scaling or other pipeline operator challenges
- ✓ Product

Q3.3 What are special bends and connection?

Examples of challenging bends/connections:

- ✓ Back-to-Back bends
- ✓ Y-connection
- ✓ Short radius and thin wall bends
- ✓ Unbarred tees
- ✓ Fabricated ("mitre") bends
- ✓ Full bore off takes

Q3.4 Why are older pipelines difficult to inspect?

Other restrictions on pipelines are related to how the pipeline was constructed, especially in older, longer pipes. Some of the restrictions are listed below:

- ✓ Cased road, rail, or river crossings
- ✓ Bore restrictions
- ✓ Steep and vertical sections
- ✓ Installations such as plug valves, dead ends, offtakes
- ✓ Exotic materials
- ✓ Coating or insulated, liners
- ✓ Unknown repairs
- ✓ Expansion sections
- ✓ Pipeline drawings not available anymore

4 Tool capabilities

Q4.1 What bend radius can the tool pass?

The bend radius that can be passed strongly depends on the pipeline diameter and the tool that is used. All crawlers are specially designed to deal with 1.5D bends. In special conditions 3D is preferred. There is a difference in passing capabilities between bends in the horizontal and vertical plane. Also mitre bends, dents or other obstructions in the pipeline can be passed but this sometimes requires special precautions to protect the cable inside the bends. To establish the inspect ability of a line it is important to know all features that exist in the line.

Q4.2 Is there a limitation on the number of bends that can be passed?

Yes, each bend generates friction on the cable, and this will limit ultimately the distance that can be travelled by the tool. Under normal circumstances the total bend radius that can be passed is at least 360 degrees (e.g. 4 times 90 degrees). Whether the tool will travel further strongly depends on the liquid inside the pipeline and the internal surface condition.

Q5.2 Can a pig launcher be used?

Yes, opening the launcher door and introducing the tool at this point into the pipeline is a possible launching scenario.

Q5.3 What kind of pig receiving station is necessary?

As this inspection tool is connected to an umbilical cable, this is an inspection tool is launched and received at the same location. This means that no facilities are required other than at the point of launching.



Q5.4 Is cleaning necessary?

See also Q1.5. The requirements for the inside surface condition of the pipeline are not as high as for an inspection with a “free swimming intelligent pig”. Under normal conditions flushing with a liquid velocity more than 1.5 m/sec will be enough to get the pipeline sufficiently clean for a reliable ultrasonic inspection.

Q5.5 Must the pipeline be empty during the inspection?

Since the system uses ultrasonics to perform the measurement a liquid that can act as a couplant is required in the pipeline. This can be a (light) crude oil, (sea) water, diesel, or other safe liquid. Care should be taken that the line only contains one product, and no gas or other product is trapped at high or low points in the line.

Q5.6 What pumping capacity is required for this tool?

As these self-propelled crawler type tools, no pressure or flow is required to inspect the pipeline. This means that there is no need for liquid pumping, liquid handling, or liquid storage during the inspection.

6 Reporting

Q6.1 When can we expect any result of the inspection?

The Pipeline Inspection Tool is equipped with a cable containing fibre optical wires for data transmission, hence during the inspection the inspection data is transmitted to the top-side equipment for storage and result presentation. This means that during the inspection the measurement is monitored, and the condition of the pipeline is visible in real-time.

During and after the forward run, areas of interest are identified and inspected with optimised settings during the reverse run. This means that severe indications can be communicated directly to the client.

Before leaving the site, an operations report will be made. This report includes a data quality assessment and a preliminary report of the most severe defects.

Q6.2 What kind of information will be in the final report?

Our reports are fully compliant with the industry standard POF-100 norm which is developed by the Pipeline operator's forum.

It contains for example. Sizing information of internal and external corrosion, lamination, ovalities, welds, bends, dents and (remaining) wall thickness all with clock position, distance from starting point, distance from previous weld, length and width of these features is available. Also, the Maximum allowable Operating pressure and the burst pressure of each defect is calculated according to the B31G standard. Several graphical presentations will be used to show the features detected in the pipeline in a comprehensible manner.

Additional analysis and reporting can be performed on request. Such as a corrosion growth analysis or a Fit-For-Service report.

Q6.3 Can a pipeline integrity report be made based on the results of this tool?

Yes, a Fit-For-Service integrity report can be made based on the result of the inspection. [Company] has also specialised departments for asset integrity management and is capable to provide this type of additional services.

7 General

Q7.1 What are the major advantages of a system like this?

Only access on one side of the pipeline is required to perform the inspection. No liquid handling or diver support is required. The safety aspect of this system is a big benefit because the tool is connected to a special reinforced cable, and it can therefore always be retrieved. The measuring principle used is ultrasonics that means that the results are quantitative and available in real-time.

Q7.2 In what type of pipelines can this system be used?

In principle the system can be used in any pipeline when the line can be filled with a liquid.

Q7.3 Can the tool get stuck?

The speed of the tool is very low (up to 500 m/hr) and the weight is only 500 kg hence when it hits something in the pipeline the impact of such a collision is very low so the risk of the tool getting stuck is minimal.

Q7.4 What if the tool gets stuck?

When the tool gets stuck switching it in reverse is sufficient to retrieve the tool. When due to a power failure the tool breaks down all systems switch-off and the clutch and pressure arm disengages allowing for an easy retrieval by means of the cable winch.

Q7.5 What kind of tools are available?

The self-propelled PIT crawler system is available from 6" to 60". These systems can cover 1m up to 30km of pipeline. The even smaller PIT can deal with diameters of 4" to 8" and covers distances of 1 m up to 1000 m. [Company] also deploys other systems like the cavern tools which are designed for the inspection of caverns and risers.

All systems use the same ultrasonic technology.

Q7.6 Can I use the pipeline while the pipeline is inspected with this PIT system?

No. During the inspection the pipeline is open hence no liquid flow is possible.

Q7.7 What is the weight of the inspection tool?

The weight of the PIT inspection vehicle is approximately 500 kg. The smaller PIT system has a weight of approximately 200 kg.