The first research and development work in inline inspection of pipelines (ILI) at Middle East region started since 1993. ILI technology along with different types of Intelligent Pig were developed.

In 2016 ZIYA OIL & GAS PIPELINE INSPECTION company (ZOGPI) established in IRAN with the aim of identifying new technologies and cooperating with reputable companies to support and supply Oil and Gas industry with their requirements. Also ZOGPI does pipeline inspection and manufacture polyurethane, cleaning & intelligent pigs in size of 8"- 56".

All departments of ZOGPI have worked in more than 6000 km pipelines inspection by intelligent pigs for 6 years with most of Oil & Gas clients in IRAN such as:

- IOPTC
- NIGTC
- ICOFC
- NISOC
- NIPC
- GOGPC

PRODUCTS
- Polyurethane & cleaning pigs
- Intelligent pigs

SERVICES
- Cleaning pipelines
- Inline inspection by intelligent pigs
- Plug and isolation services
- Integrity management system
- Pigging non-pigable pipelines
- Repair
DEPARTMENTS
- Design & manufacturing
- Operation
- Interpretation
- Integrity management systems
- Repair

PARTNERS
- GPAS: Manufacture intelligent pigs and pipeline inspection
- STATS GROUP: Tecno Plug™ - Process & Pipeline Isolation
- IRM SYSTEM: Integrity management system
- A.HAK INDUSTRIAL SERVICES: Pigging non-pigable pipelines
**Caliper: EGP (Electronic Geometry Pig)**

ZOGPI Caliper pig is a type of intelligent Pigs that is used to measure the internal pipeline geometry. Caliper is equipped with multi-channel mechanical arms and measures the whole 360 degree of the internal dimensions. Caliper can detect geometrical defects such as dents, ovalities, gouges and etc. It is also used to detect defects due to the installed parts or elements on the pipe such as check valves, pig signaler and etc.

**Min. Dimension of measured defects**

<table>
<thead>
<tr>
<th>Defect type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal diameter deviation</td>
<td>±0.6 %D</td>
</tr>
<tr>
<td>Ovality</td>
<td>2 %</td>
</tr>
<tr>
<td>Dent or goffer</td>
<td>3 mm</td>
</tr>
<tr>
<td>Radius of pipeline axis curvature</td>
<td>Rmin 1.5D, Rmax 100D</td>
</tr>
</tbody>
</table>

**Measurement error of defects**

<table>
<thead>
<tr>
<th>Defect type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal diameter deviation</td>
<td>±0.3 %D</td>
</tr>
<tr>
<td>Ovality</td>
<td>2 %</td>
</tr>
<tr>
<td>Dent or goffer</td>
<td>Depth ±2, Length ±20, Width ±40</td>
</tr>
<tr>
<td>Radius of pipeline axis curvature</td>
<td>±10 %R</td>
</tr>
</tbody>
</table>

**GEO PIG: GEO Graphic PIG**

GEO Pig uses INS (Internal Navigation System) technology. These types of smart pigs can detect the change in its spatial position and the rotation around all the three XYZ spaces. Therefore, this type of Smart Pig is capable of spotting its location with geographical coordinates of the beginning and end of the pipeline with higher accuracy (sub meter). The ZOGPI Company’s GeOPig service can be provided as a separate intelligent Pig alone or in combination with other intelligent Pigs.

**Accuracy of parameters of navigational inspection**

<table>
<thead>
<tr>
<th>Error type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>determination of main pipeline centerline: coordinates, its technological elements, m/km</td>
<td>0.5</td>
</tr>
<tr>
<td>root = mean – square of positioning of any main pipeline’s object less than, m</td>
<td>0.5</td>
</tr>
<tr>
<td>determination of elements position on the pipeline centerline, 1/2 from the distance to nearest marker</td>
<td>0.1</td>
</tr>
<tr>
<td>the determination of the curvature angle of centerline of the pipeline sectors, each pipe and on each</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**Error of ZOGPI intelligent pigs in defect location**

<table>
<thead>
<tr>
<th>Defect type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>On distance, % of travelled distance</td>
<td>0.1</td>
</tr>
<tr>
<td>Relative to the nearest girth weld,</td>
<td>0.05 m</td>
</tr>
<tr>
<td>On circumference</td>
<td>3 deg</td>
</tr>
</tbody>
</table>
**PIMKA, MFL: Magnetic Flux leakage**

ZOGPI HR-MFL intelligent Pigs are designed and manufactured based on MFL technology. ZOGPI HR-MFL intelligent Pigs have measurement accuracy of “high resolution” and “Extra high resolution. HR-MFL is capable of detecting the most extensive pipeline defects including: General Corrosion, pitting, circumferential cracks, Gouges, dents, scratches, girth weld anomalies.

**Detection and sizing accuracy for metal loss feature in body**

<table>
<thead>
<tr>
<th>Defect type</th>
<th>the minimum depth for detection in POD 90%</th>
<th>Sizing accuracy in certainty 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>depth</td>
<td>length</td>
</tr>
<tr>
<td>General corrosion</td>
<td>0.05t</td>
<td>±0.1 t</td>
</tr>
<tr>
<td>Pitting corrosion</td>
<td>0.1t</td>
<td>±0.1 t</td>
</tr>
<tr>
<td>Slot</td>
<td>0.2t</td>
<td>±0.2 t</td>
</tr>
<tr>
<td>Axial groove</td>
<td>0.2t</td>
<td>±0.2 t</td>
</tr>
<tr>
<td>Circumferential groove</td>
<td>0.1t</td>
<td>±0.12t</td>
</tr>
</tbody>
</table>

**PITK, TFI: Transverse Flux Inspection**

Zogpi HR-TFI intelligent Pigs have been designed and manufactured based on magnetic flux leakage (MFL) technology with TFI (Transverse Flux Inspection) type. These types of Pigs work by creating circumferential magnetic flux on the pipeline. Therefore, they have a high potential in detecting defects in the longitudinal direction of the pipe such as: SCC, Axial crack longitudinal weld seam defect.

**Detection and sizing accuracy Crack like flaws**

<table>
<thead>
<tr>
<th>Defect type</th>
<th>the minimum depth for detection in POD 90%</th>
<th>Sizing accuracy in certainty 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circumferential crack in annular zone of seamweld [L&gt;60 mm, minimum crack opening 0.1 mm]</td>
<td>0.25t</td>
<td>±0.15 t</td>
</tr>
<tr>
<td>Colony of cracks [L&gt;80 mm, minimum crack opening 0.05 mm]</td>
<td>0.1t</td>
<td>±0.15 t</td>
</tr>
<tr>
<td>Colony of micro cracks [L&gt;10 mm, minimum crack opening 0.01 mm]</td>
<td>The minimum linear sizes of colony that can detect is 100 x 50 mm in 50&lt;POI&lt;70.</td>
<td></td>
</tr>
</tbody>
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**Detection and sizing accuracy Crack like flaws**

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<tr>
<td>Axial crack in annular zone of seamweld [L&gt;60 mm, minimum crack opening 0.1 mm]</td>
<td>0.25t</td>
<td>±0.15 t</td>
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<tr>
<td>Colony of cracks [L&gt;80 mm, minimum crack opening 0.05 mm]</td>
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Design & Manufacturing
Zogpi has design and manufacturing teams in various fields such as: mechanic, electronic, magnet, software for design and manufacture different types of intelligent pigs in IRAN.
All of mechanical and electronic analyses and tests are done in ZOGPI to earn the best results.
ZOGPI is specialized in manufacturing pipeline cleaning pigs and polyurethane which use its products in ZOGPI's intelligent pigs and in all types of cleaning pigs in different sizes. This company also benefits from modern and standard machines with high technology and laboratory equipment in workshop. Proficient engineers and personnel in casting and molding polyurethane have enabled us to provide a wide range of products for utility and intelligent pigs. Zogpi supplies all its and clients polyurethane requirements. This company can produce all polyurethane parts of intelligent pigs and utility pigs in size of 8” to 56”.

**Utility pigs:**
- Foam pig
- Solid cast pig
- Steel mand ral pig
Pipeline Survey by Intelligent Pig

Oil and gas pipelines are the main arteries of the oil and gas industry and are responsible for continuous and safe delivery of our energy needs. Early detection of pipeline defects is very crucial in preventing any kind of leakage and explosion by performing timely maintenance procedures. Smart Pigs are the best and most comprehensive equipment which are used for inspection, defect detection and also identification of the technical specification of the pipeline. For these reasons, they are widely used in oil and gas industry. Smart Pigs are specialized equipment that move with the fluid inside the pipeline and perform a thorough pipeline inspection to identify any defects in the pipeline and also determine technical specification of the pipeline. ZOGPI Company uses Magnetic Flux leakage technology for detection of defects related to Metal loss. Along with this technology, the company has also developed two other technologies of Caliper and Geo to detect geometric defects and geographical locations. ZOGPI Company provides full chain pipeline inspection services using four types of Smart Pigs for all sizes of 8 inches to 56 inches.

- MFL: Magnetic Flux leakage
- TFI: Transverse Flux Inspection
- Caliper: EGP (Electronic Geometry Pig)
- GEO PIG: GEOgraphic PIG
To provide a suitable solution for the inspection of non-piggable pipelines, A.Hak Industrial Services has developed the Piglet® – a highly versatile inspection tool on a mobile platform for use anywhere in the world on short notice.

For maximum flexibility, the system applies a contact-free ultrasonic measuring head that is able to scan the full surface of the pipe wall, whereby high-resolution options can be realized seamlessly.

The ultrasonic system is based on direct ultrasonic measurement with time of flight (TOF) measurement so that absolute wall thickness data can be gathered. This allows a full overview of any wall-thickness reductions that may impact the pipeline's integrity.

Simultaneously, the centralized set-up of the UT-head allows measurement of the pipeline’s geometry, detecting any deformation (like ovalities, dents and buckles) easily. This is critical when third-party damage may be applicable.

To allow the best possible interpretation, the system stores the raw A-scan data of each measurement. This enables a detailed analysis of defects, allowing re-evaluation and preventing errors due to algorithm induced analysis.

The system can be utilized free-swimming as well as tethered, for real-time observation of the inspection and short-term feedback on the results. This means immediate decision-making on-site is possible.

For the inspection of short pipe sections without the need for temporary pigging and pumping equipment, A.Hak Industrial Services has developed a hand-fed, push-pull system which can be applied with minimum downtime and yield results instantly.
**Interpretation**

ZOGPI as the only Iranian company having the full cycle of pigging has interpretation department. After operation, pig records are given interpretation team to prepare reports.

**Duties of interpretation team:**
- Express report
- Verification of express report
- Final report
- Verification of final report
- FFS & FFP
Integrity management system

When a pipeline is run to failure, flow of product becomes increasingly inefficient and the number of unplanned repairs escalates. More unplanned repairs means higher costs, and revenues lost through downtime. In an emergency, simply having kit on standby might sometimes be better than doing nothing, but the kit must be accompanied by a well thoughtout plan. Otherwise the result is serious damage to reputation and bottom line.

We ensure that operators experience the least overall downtime during steady state operations, and they achieve earliest possible re-commissioning during an unplanned repair. We do this by helping them integrate emergency preparedness with their ongoing operations in the most straightforward way possible. As specialists in planning the repair and maintenance of complex pipeline systems we translate plans into action. Whether it is conducting piggability studies, or designing cleaning runs for In-Line Inspection or throughput optimization, our highly experienced marine, pipeline and intervention specialists ensure that plans are inherently practical, whilst adhering to the toughest technical standards. Once preparations are completed, we supervise the contractors – making sure that the probability of error is absolutely minimized.

Keeping a pipeline fit for service demands technical expertise and extensive practical experience, and never more so when it is transitioning to a new phase of life. Mistakes onshore can expose communities to unacceptable hazards, while in a subsea context they can reduce a business case to tatters. In either scenario, errors can lead to significant environmental and reputational damage.

Whether it is to meet a specific technical need, or an extra pair of experienced hands is required, we provide engineers and project managers – absolute specialists – for services covering the entire pipeline lifecycle. Our engagement begins during pipelay with non-destructive testing (NDT) and flood-prevention support, and continues all the way through to extension-of-life and decommissioning activities. During operations, we provide owner’s engineering for spool piece design, tie-backs to existing infrastructure, and modification works such as temporary pig traps.

We review and verify pigging and repair procedures, and provide support services for the intervention. Since we have no ambitions for our own implementation capability, we assure our clients that our interests are mutually reinforcing, on each-and-every deployment we undertake.

- Risk assessment and failure mode analysis
- Maintenance and repair strategy development and workplanning
- Emergency Pipeline Repair Systems (EPRS): contingency planning, and unplanned repair procedure development
- Inspection planning and feasibility studies
- NDT feasibility studies, method selection, and procedure development
- Fitness For Purpose analysis, reporting, and mitigating action design
- Corrosion prevention consulting
- Chemical cleaning advisory services
- Pipeline (and tank) integrity management software development and consulting
**Tecno Plug™ - Process & Pipeline Isolation**

STATS comprehensive Tecno Plug™ range provides fail-safe double block and bleed isolation tools for high pressure operations. These dual seal isolation plugs are available for remote, tethered, piggable or manual deployment and operation. The dual seal configuration of the Tecno Plug™ provides an annulus void which can be pressure tested to verify both seals are leak tight before maintenance work is carried out, both seals are leak tested at %110 of the maximum potential isolation pressure. Once the seal integrity has been proved the annulus is then vented to ambient to create a zero energy zone, providing effective double block and bleed isolation. The large section elastomer seals are highly compatible with poor pipe surfaces and are customised to suit corrosion or ovality issues ensuring a leak tight seal even in ageing assets. A through-port is provided for downstream pressure monitoring or pressure application as required.

**Pipeline Isolation Applications**
- Pipeline valve replacement / repair
- Riser replacement / repair
- Pressure testing i.e. leak detection of risers or repaired pipelines
- Mid-line pipeline repair / tie-in
- Platform abandonment and bypass
- Pipeline diversion

The Tecno Plug™ fail-safe design uses differential pressure acting on the tool to energise the locks and seals, this is referred to as self-energisation. When the isolation plug is self-energised the isolation is maintained independent of the control system, it is however backed up by the hydraulic control system which maintains the isolation when the differential pressure is below the self-energisation threshold. Once the Tecno Plug™ is activated the hydraulic circuits are locked in by pilot operated check valves and manual isolation valves (tethercontrolled) or fail-safe solenoid valves (remote controlled). The Taper lock-ring provides twice the required lock contact area giving %100 contingency. In the event that the hydraulic control system is compromised, the tool actuation mechanism will unset when differential pressure is equalised. This feature ensures pipeline integrity is maintained and the Tecno Plug™ is always recoverable upon job completion.
**Tecno Plug™ - Process & Pipeline Isolation**

**Operator Benefits**
- De-commissioning (bleeding down) and re-commissioning (refilling / re-pressurising) of pipelines minimised or eliminated, saving time and reducing costs.
- Production continued during pipeline maintenance or modifications.
- No flaring of gas or displacement of pipeline inventory.
- No emissions of gas / hydrocarbon vapour to atmosphere during blow down.
- No danger of accidentally flooding offshore pipelines during construction.
- No need to dispose of hydrates, chemicals and contaminated water.
- Isolates short sections of pipeline anywhere in the pipeline system.
- Emergency preparedness and operational readiness minimized.

**Key Features Tecno Plug™**
- Size range: 3”– 56”. Pressure range: up to 350 Bar / 5075 psi.
- Available as 3D or 5D compliant.
- Robust compact design, enables Tecno Plug™ to be set in short sections of pipeline. In many instances production can be continued during pipeline maintenance or modifications activities.
- Twin compression elastomer seals are highly effective even in pipelines with corrosion & ovality issues.
- High integrity isolation, taper lock-ring provides twice the required lock contact area (%100 contingency).
- Annulus bleed between seals allows pressure to be vented to ambient creating a zero energy zone providing effective double block & bleed isolation.
- Fail-safe design feature: lock & seals energised by differential pressure, referred to as self-energisation.
- Self-energisation feature maintains safe isolation while differential pressure exists across the plug.
- Hydraulic system override releases the plug setting mechanism when pressure is equalised.
- Both seals fully energised by pressure (rubber pressure 1.4 - 1.1 times greater than pipeline pressure).
- Reverse pressure can be applied across the isolation.
- Outboard pressure monitoring options.

**Key Features Remote Tecno Plug™**
- Size range: 12”– 42”.
- Standard remote control module housing rated for 200 Bar / 2900 psi external pressure.
- The remote control module provides a robust system for safety critical activities and has undertaken a rigorous validation programme with ATEX rating to Ex P2 II 3 GT3.
- The external communication system is housed in an ATEX rated enclosure EE xd IIB T5.
- Through-wall communication is achieved using an extremely low frequency (ELF) radio control system for reliable tracking and accurate positioning.
- Subsea communication via acoustic link (3000m depth rating).
- Remote Tecno Plug™ does not use lithium batteries negating the need for emergency response procedures for the transportation / use of extremely hazardous materials.
Mechanical Tie-In Clamp

Mechanical Tie-In Clamps allow the connection of new branch pipework to existing infrastructure without the requirement for welding. Tie-In Clamps are routinely used to provide a flanged off-take to enable hot or cold tapping into an existing pipe with no interruption to production. The clamps can also be utilised as an access point for double block and bleed BISEP™ line isolation. The clamps feature a dual seal arrangement which provides an annulus cavity to fully verify seal integrity prior to hot tapping. Compression flanges mechanically actuate the seals and drive taper locks which grip the pipe, providing axial restraint. The clamp components are compatible with a wide range of fluid types and flow conditions and are designed for ease of installation with minimal disruption to the pipework or system to which they are fitted. STATS can provide a full turnkey service including clamp installation and hot tapping. STATS can provide a completion plug to provide permanent isolation to the branch off-take and enable the removal of the slab valve allowing a blind flange to be fitted to the tie-in clamp.

Key Features

- Size range: standard pipe sizes 6"–56"
- Full range of reducing branch sizes available
- Branch angle to suit application
- Pressure range: up to ASME #900
- Can be utilised for hot tapping or line isolation
- Dual seal design with annulus test facility
- Structural locks / grout injection to suit application
- No hot work required
Other services

Demagnetizer
ZOOGPI Company recommends using PDM1 machine in order to neutralize the magnetic field created by Pigging. This device measures the magnetic field at the welding location and creates an equal and opposite magnetic field in order to neutralize the residual magnetic field.

Ultrasonic Thickness Gage
ZOOGPI for verification of reports and calibration uses high resolution ultrasonic devices for evaluation of pipes and welds.

DGPS
ZOOGPI to improve quality of reports uses DGPS technique for Registration of geographical coordinates of all pipeline installations and magnet markers.

Pig Location & Tracking System
offered in several configurations, CDI's CD42 pipeline pig location and tracking system is the most sophisticated, accurate, and simplest to use in the world. the rugged design has proven itself time and again with over ten years of sales and rentals for customers.
ZOGPI
Ziya oil & gas pipeline inspection

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