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Document Title

Technical Volume for Intelligent Pigging of High-Pressure Natural Gas Pipelines

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SECTION A: SPECIFICATION AND SCOPE OF WORK

FOR SERVICE OF IN-LINE INSPECTION OF 18", 24", 30" & 36" NATURAL GAS PIPELINES (INTELLIGENT PIGGING)

1. Introduction

Israel Natural Gas Lines (INGL) is planning to perform a program of Intelligent Pigging Inspections of their pipelines. Several of the newer pipeline sections have still to be inspected and this should be viewed as a "Base Line" survey with the intention to repeat within 5 years. The locations and lengths of all pipelines are shown in the table below.

Inspection Forecast	Pressure (BAR)	Flow velocity (m/s)	Diameter (Inch)	Length (km)	Location (Pipeline Segment)
2024	58.1	5.78 - 2.77	18"	59.7	Aroer to Sdom
2024	71.8	2.83	30"	61.47	Reading to Dor
2024	71.8	5.3	30"	34.6	Ashdod to Reading (Offshore)
2024	68.4	5.4	30"	21.15	Ashdod to Sorek
2025	61.3	2.17	18"	1.91	Dovrat to Alon Tavor
2025	69.9	5.4	24"	37.24	Ashdod to Nesher
2025	68.4	3.27 - 7.28	24"	52	Ashkelon to Sorek
2026	73.9	9.01	30"	13.47	Dor to Hagit
2026	63.8	3.8 - 1.52	24"	3	Zafit to Dalia
2026	63.7	5.12	30"	12.43	Hagit to Tel Kashish
2026	13.9	0.06	10"	14.3	Keshet (Sdei Ilan) to Ziporit Ind
2027	63.4	2.8	24"	17.2	Tel Kashish to Kishon
2027	63.7	2.93	18"	1.59	Kishon to Haifa IEC
2028	62	2.03	10"	15.6	Kfar Baruch to Nilit
2028	62.2	0	36"	28.5	Sorek to Kiryat Gat
2028	73	1.94	12"	4.34	Hadera Coastal - Hadera OPC
2030	61.6	2.6	36"	29.93	Tel Kashish to Dovrat
2030	61.9	2.6	36"	22.6	Dovrat to Emek Hayarden
2030	55.6	0	30"	24.79	Ashkelon to Kiryat Gat

(1) Note: the velocity indicated above is the current known and regular gas rate in the line pipe and may change in the future.

This Invitation to Tender provides all technical requirements for the selected Contractors to be able to tender for the works.

Prior to inspection, pipelines are to be inspected to measure any ovality, dents, buckles, bore restrictions, etc. and to confirm the absence of any geometrical anomalies which may interfere with the running of the MFL Inspection Tool.

The pipelines are to be inspected using the Magnetic Flux Leakage (MFL) technique. The pig will pass through the pipeline driven by the natural gas flow in the pipeline. Contractor should also offer the option of using a mapping tool to determine the x,y,z coordinates.

2. References, Abbreviations and Definitions

2.1. References

2.1.1. Pipeline Operator Forum “Specifications and requirements for intelligent pig inspection of pipelines" Version (Latest Revision).

2.1.2. Site Layout drawing for the following valve stations shall be provided to the Contactor when issuing the Commencement Order for respective pipeline segment.

2.2. Abbreviations

ERF	Estimated Repair Factor
ID	Internal Diameter
INGL	Israel Natural Gas Lines
INS	Internal Navigation System
ILI	In-Line-Inspection
MFL	Magnetic Flux Leakage
POD	Probability of Detection
POF	Pipeline Operator Forum
RS	Receiving Station
TBA	To Be Advised
TFI	Transverse Field Inspection
VS	Valve Station

2.3. Definitions

Company	INGL
Contractor	Pipeline Inspection Company
Bidder	Contractor bidding for the works in the Tender

3. Pipe Line Details

Pipeline segments details, such as flow rate (velocity), operational pressure, design temperature, due to information security, shall be shared by the Company with the selected Contractor upon completion of the Tender or when issuing the Commencement Order for respective pipeline segment.

4. Inspection tool requirements

Inspection Tools shall conform as a minimum to the requirements of this Specification and the requirements refer to the Recommended Practice of the Pipeline Operator Forum (POF) "Specifications and requirements for intelligent pig inspection of pipelines" (Latest Revision).

Note: The Recommended Practice of the POF shall apply at all times (rather than the Standard Practice of the POF).

4.1. Gauge Pig

A gauging pig shall be used to confirm geometrical integrity and the gauge plate shall be:

4.1.1. sized to meet the required internal dimensions of the 18”-X52 pipe, 24” - X70 pipe, 30” - X70 and 36” – X60 pipe.

4.1.2. be made of 6mm aluminium.

4.1.3. have a 45°chamfer on the leading edge.

4.1.4. be slotted at (a minimum of) 45° intervals.

4.1.5. Not greater than 90% of the minimum ID.

4.2. Calliper Tool

Contractor shall propose an additional method to a gauging pig for confirming that the pipeline is not affected by ovality, dents, buckles and bore restrictions etc. This should take the form of a calliper tool with the following attributes:

4.2.1. 100% circumferential coverage and 100% POD.

4.2.2. minimal ID changes - from 2mm.

4.2.3. minimal dent measurement - from 1% of ID.

4.2.4. Mechanical Measuring System.

4.2.5. On-board Energy Supply (high capacity batteries): to provide electrical energy for independent operation.

4.2.6. Data Processing and Recording System: which ensures that all information received from the individual measuring devices during an inspection run are continuously recorded, digitised, compressed and stored in a suitable mass storage unit.

4.2.7. Odometer System: to measure and record distance travelled. This shall include a backup system in case of failure.

4.2.8. Locator System, to locate the position of the pig at all times:

4.2.9. Drive System: to enable the tool to be propelled through the line by the medium flow (natural gas).

4.3. MFL Tool

Contractor shall propose options for both single and multi-channel systems.

The MFL Tool shall constitute a system including the following attributes:

4.3.1. On-board Energy Supply (high capacity batteries): to provide electrical energy for independent operation.

4.3.2. Magnetising System: capable of sufficiently magnetising the pipe wall under investigation.

4.3.3. Sensor System: to enable discrimination between internal and external defects.

4.3.4. Data Processing and Recording System: which ensures that all information received from the individual measuring devices during an inspection run are continuously recorded, digitised, compressed and stored in a suitable mass storage unit.

4.3.5. Odometer System: to measure and record distance travelled. This shall include a backup system in case of failure.

4.3.6. Pendulum System to record Tool Rotation: to accurately locate the circumferential position of any feature in the pipeline.

4.3.7. Control (Master) System: that is programmed prior to the survey(s) and controls the overall system during the run(s). It should also produce information regarding the correct functioning of the tool's electronic systems during the inspection run(s).

4.3.8. Locator System, to locate the position of the pig at all times:

4.3.9. Drive System: to enable the tool to be propelled through the line by the medium flow (natural gas).

4.3.10. Wall thickness range: 9.5 mm – 19.05 mm.

4.3.11. Speed range: 0.70 – 4.0 m/s.

4.3.12. Minimum bend radius: 3D.

4.3.13. Contractor shall state the accuracy/deviation for time/distance.

4.3.14. **Minimum requirements for MFL intelligent tool to satisfy**

Standardisation (definitions, abbreviations, geometrical parameters and interaction rules, metal-loss feature typing, ERF and resolution of measurement parameters), tool specifications (in metric units) and reporting requirements shall be according to Pipeline Operator Forum (POF) "Specifications and requirements for intelligent pig inspection of pipelines" (Latest Revision).

4.4. Transmitter Battery

All pigging types shall include transmitter battery lifetime of at least 5 days as a minimum requirement.

5. Scope of Work

5.1. Execution Standard

All Scope of Work by the Contractor shall apply the Recommended Practice of the Pipeline Operator Forum (POF) "Specifications and requirements for intelligent pig inspection of pipelines" (Latest Version).

Note: The Recommended Practice of the POF shall apply at all times (rather than the Standard Practice of the POF).

5.2. Company Supply

5.2.1. Company will prepare the gas pipeline for launching and receiving the pig pursuant to the Contractor's instructions.

5.2.2. Company will provide an area for the Contractor to install his supplied roofed workshop for personnel along with a connection to 220V. Contractor will supply details.

5.2.3. Company’s Gas Supplier will have to ensure appropriate speed and pressure in the pipeline during the surveys in accordance with the Contractor`s requirements.

5.2.4. Company will supply As Built Data from both pipelines as well any available survey data.

5.2.5. Company will be responsible for installing and dismantling the launcher and receiver trap.

5.3. Contractor Supply

5.3.1. The total inspection program will consist of:

5.3.1.1. Project Management and Site Visit.

5.3.1.2. Preparation of Procedures and Plans (see Clause 5.4.2.3 below).

5.3.1.3. Tool Preparation, calibration and testing.

5.3.1.4. Mobilisation of Equipment and Personnel to Israel (incl. Customs Clearance).

5.3.1.5. Pipe Line survey involving:

a) **Cleaning and gauging the pipelines to be inspected**:
Contractor shall propose the options to use standard BIDI cleaning pigs or special BIDI cleaning pigs with brushes, magnets and tracer pinger. The Cleaning Procedure shall be agreed with Company.

b) **Gauge Plate and/or Caliper survey** of each line in order to ensure that the passage is free for the MFL Tool. In case the gauge plate arrives, damaged further investigation is mandatory in order to locate the restriction and measure its exact value.

c) **Metal Loss Survey using the MFL Tool**
The lines will each be inspected in one tool run.
INGL shall ensure that the pipeline conditions meet the MFL tool specifications, as requested by the Contractor and agreed by the Company, with regard to velocity and pressure prevailing during the inspection.

5.3.2. Contractor shall also include options for a TFI (Transverse Field Inspection) Tool and x,y,z mapping using an INS (Internal Navigation System) Mapping Tool.

5.3.3. Demobilisation of Personnel and Equipment

5.3.4. Data Evaluation reports and Final Report

5.3.5. Comparison of the date evaluated to each line pipe to the new data evaluation executed by the Contractor.

5.3.6. Presentation of Report, including comparison of former and new data evaluation, in Israel.

5.3.7. All information, data, procedure, reports, emails etc. provided by the Contractor in connection with the services shall be provided in English to the Company.

5.4. Summery

5.4.1. Contractor will include provision of (at least) the following activities and services in his proposal.

5.4.2. All activities shall be executed by the Contractor, separately for **each** commencing work order (each pigging activity) as integral part of his quotation, without additional consideration by the Company.

5.4.2.1. Site visit

5.4.2.2. Project Management

5.4.2.3. Preparation of procedures and plans that shall include:

a) Operational procedures, including the following independent documents:

1) Pigging run procedure.

2) Contingency plan (including possible stuck pig or equipment).

3) hydraulic Dynamic Simulation of the pipeline segment (including Hydraulic test report to confirm the operation success).

b) Calculation of pigging speed and pig travel time requirements for each loop.

c) Determination of pipeline preparation requirements.

d) Calibration of the pigging tools.

e) Specifications and Operational Manual for the pigging tool run(s).

f) Pigging Survey Schedule making efficient use of facilities.

g) Evaluation procedures.

h) Proposed reporting format (see clause 6 below).

i) Preparation of a schedule detailing quantity of proposed runs.

j) perform dynamic simulations of the pigging

5.4.2.4. All procedures, plans and reports required to the pigging operation shall be provided by the Contractor to the Company's review and comments.

5.4.2.5. The Contractor shall bear the sole responsibility to such procedure, plans and reports.

5.4.2.6. For the good order, the Company's reference to such procedures and reports shall in no way be interpreted as assuming **any type** of responsibility by the Company to the pigging activity.

The Company's shall be responsible to the accuracy of the data and information provided to the Contactor.

5.4.3. Time Schedule for preparing the procedures

5.4.3.1. The launching and receiving procedures and plans will be sent to INGL 45 days after signing the contract. Company will respond in 14 days with comments, if any. The final document shall be discussed with INGL, in Tel Aviv, the planned mobilisation of equipment and personnel.

5.4.3.2. At the completion of those discussions the Contractor will give a presentation including:

a) A summary of the agreed Operational procedures.
b) General layout of the project
c) Technical presentation of the Inspection tools that he intends to use in the project.
d) Agreed time schedule.
e) Example results of a final report done by the Contractor (see Clause 6.5.6 below)

5.4.3.3. Before commencing the works, the Contractor will be in Israel to coordinate the implementation of the agreed Operational procedures and to visit the sites to ensure correct preparation of the launching and receiving facilities.

a) Supply of all equipment, tools and launch/receive trays.
b) Supply of suitably qualified personnel (see Clause 5.5 below).
c) Mobilisation of personnel and equipment to the involved sites.
d) Set up of Equipment at INGL base camp.
e) All local taxes, duties, and fees in relation to the survey.
f) Customs clearance of equipment and customs fees.
g) Local work permits, licences, etc. (if required).
h) All transportation of crew and equipment to and from mobilization point and during survey.
i) Coordination with local companies and labour if required.
j) A suitable covered workshop area with 220V electric power supply.
k) Office space for computer equipment and data checking.
l) Technician(s) qualified to use the designated equipment.
m) Preparation of the pipeline and launcher/receiver for survey activities and any required modifications.
n) Sufficient pipeline cleaning prior to the intelligent tool run.

o) Suitable lifting gear for the equipment at mobilization point and during the on-site work period;

p) Cleaning of all pigging equipment – including providing the cleaning equipment for cleaning of tools.

5.4.3.4. Shall be carried out via INGL.

a) Loading, retrieving the tools from launcher/receiver at the launch and retrieving sites.

b) Preliminary data check on site.

c) Provision of reports to INGL containing detailed past survey results (if available).

5.4.3.5. For further requirements refer to Contract.

5.4.3.6. Contractor is invited to offer any suggestions on technical or logistical matters that may assist in improving the inspection program.

5.5. Qualification of Personnel and Contractor

Contractor shall supply proof of experience with details of similar projects worked on for the team leader, field personnel and those responsible for evaluation, analysis and assessment of the Data for the final report. In respect of Data Protection this information will be treated confidentially and only held over the period of tender review.

Contractor shall also submit details of his Quality Management and HSE Systems.

5.6. Tool box Meetings

Before the commencing of any run a detailed briefing concerning operations scheduled for that day will be given by the Contractor. All relevant INGL and Contractor personal shall attend in that the briefing.

6. Data Evaluation and Final Report

6.1. Data Evaluation

The total information collated by the MFL Tool shall be stored after every inspection run. Contractor shall have available a sufficiently powerful computer system to be able to evaluate this data using automatic search programmes and to carry out individual analysis of the data.

6.2. On Site Data Check

Immediately after every inspection run the data shall be downloaded and checked for quality and completeness. This data check must be carried out at the inspection base prior to any tool preparation for a subsequent run or demobilisation.

Contractor shall issue a report to INGL to demonstrate a successful run of the inspection tool in the pipeline. This will be done as soon as practical after the tool has been received and the raw data downloaded.

6.3. Back-Up Data

Contractor shall have the facility to immediately make back-ups of any data and these must be transported separately to the Contractor's main premises to avoid any loss of information.

6.4. Evaluation and Analysis of Data

6.4.1. Evaluation of the data will be carried out at Contractor's base creating:

6.4.1.1. Pipe tally: listing the individual pipe joints/girth welds.

6.4.1.2. Features List: listing all features detected during the inspection run.

6.4.2. This information will then be further analysed to determine the feature dimensions and to classify these features in:

6.4.2.1. Metal loss: internal, external

6.4.2.2. Dents.

6.4.2.3. Installations.

6.4.2.4. Other features such as sleeves, cathodic protection joints, tees, etc.

6.5. Requirements for the Final Report

6.5.1. The Contractor shall provide the Final Report to the Company in English and issued in both hard copy (one original and two copies) and digital form (USB) and shall contain at least the following information:

6.5.1.1. Introduction

6.5.1.2. tool operational data

6.5.1.3. survey operation

6.5.1.4. pipe tally

6.5.1.5. list of features

6.5.1.6. summary and statistical data

6.5.1.7. fully assessed feature sheets

6.5.1.8. defect assessment method

6.5.1.9. Comparison of the date evaluated to each line pipe to the new data evaluation executed by the Contractor.

6.5.2. All of the above information has to be in accordance with POF "Specifications and requirements for intelligent pig inspection of pipelines" (Latest Version).

6.5.3. Fully assessed feature sheets shall be provided as a minimum for 15 most serious metal loss indications. Priorities for selection of these are:

6.5.3.1. all metal-loss deeper than 80% wall thickness.

6.5.3.2. all metal-loss with ERF>1.

6.5.3.3. In the Final Report, assessment shall be according to ASME B31G.

6.5.4. Software requirements

6.5.4.1. Minimum required options, all of which have to be included in the price:

a) graphical view of all recorded data (so called "raw data")

b) capability of navigating, scaling, filtering, sorting, listing, reporting and statistical presenting of data

c) calculation of ERF and "calculating pressure" according to all three cases of RSTRENG methods: RSTRENG Effective Area, RSTRENG 0,85 dL and original ASME B31G

d) WINDOWS 7 and WINOWS 10 compatible

e) Contractor's software with all recorded data has to be installed and supplied on laptops as well.

f) Contractor shall issue a report to INGL to demonstrate a successful run of the inspection tool in the pipeline. This will be done as soon as practical after the tool has been received and the raw data downloaded.

g) Contractor shall include together with his bid documentation, a Demo Version of his reporting software (referring to the hydraulic dynamic simulation) complying with all of Company's requests.

6.5.5. Provision of a detailed Final Report of the results of the inspection program.

The Final Report will be submitted in within 90 days after completion of field work depending on the condition of the pipeline.

Details include feature identification and location (Enhanced Dig Sheets). Documentation includes colour prints. Usually, the most severe defects as defined by prior agreement with INGL will be selected for detailed documentation. INGL can make special selections from the completed features list.

6.5.6. Contractor shall, with his bid, provide samples of the reports he will submit to INGL on completion of the inspection runs.

6.6. Re-Runs.

In the event that the Company determines that a Run was unsuccessful, then the Contractor shall be obligated to perform a Re-Run, in accordance with the following:

6.6.1. If the RE-RUN is required due to the deficiencies, faults or failure of any of the inspection tools or failure of the Contractor to fulfil any of its obligations, all costs of the repeated RE-RUN shall be borne solely by the Contractor.

6.6.2. If the RE-RUN is required due bad conditions in the pipelines, resulting in inadequate DATA; and/or bad conditions in the pipelines causing damages to any of the inspection tools, and only in the event that the Company is solely responsible for such conditions prevailing in the pipelines, then the Company shall pay the Contractor.

6.7. Drawing of General Locations

Drawing of General Locations due to information security, shall be shared by the Company with the selected Contractor upon completion of the Tender or when issuing the Commencement Order for respective pipeline segment.

7. Revision Record

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R1	13/10/2012	Issued for Approval	BG			SZ	13/10/12
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