

## NTC «NefteGasDiagnostika»

Since 1997



Non-destructive testing and technical diagnostics



## **COMPLEX APPROACH TO PIPELINE SAFETY**

2016г.



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## **MAIN ACTIVITIES**

- Non-destructive control, technical diagnostics, the expertise of industrial safety of oil and gas facilities, including underwater inspection of underpasses;
  - **Geodesy and cartography;** 
    - Maintenance and developing of the field pipeline route;
    - **Engineering services;**
    - **Creating and mounting of monitoring systems of technical condition of**
    - equipment and pipelines at oil and gas facilities;
    - Innovation activity;
    - Creation of technical documents and norms.
    - Underwater technical works, diver's works



# SUPERVISED FACILITIES

- UNDERGROUND PIPELINES
- OFFSHORE PIPELINES
- PIPING
- TANKS
- PRESSURE VESSELS



### TANKS, PRESSURE VESSELS, TECHNOLOGICAL PIPELINES

- Acoustic emission control including detection of leaks in tanks bottoms;
- Ultrasonic thickness measurement, ultrasonic defect detection, testing by penetrates etc.;
- Determination of geometric characteristics and structure elements, horizontal and vertical deviations;
- Full set of calculations including the calculation of corrosion speed, strength, resistance, residual life;
- Expertise of industrial safety.







#### UNDERGROUND and TECHNOLOGICAL PIPELINES

#### -Inspection of insulating coat condition:

Search and pipeline routing in the field with establishing executive trimming;

Locating potentially dangerous sectors and insulation damage points and the points of pipeline metal lifting by electric current;

Inspection of pipeline cathodic protection; Calculation of residual life of the coat.

#### -Inspection of the base metal and weld joints:

Earthmoving works;

Acoustic emission control and locating pipeline metal defects (cracks of weld joints, plastic deformation zones, metal loss, corrosive damages, blue holes);

Metal defect identification: Visual and measurement control, ultrasonic test, color defectoscope, radiography, metal magnetic memory and other NDT methods.

Currently , perhaps, only two types of underwater pipeline inspection is available:

- External survey performed by divers or using ROV
- Intelligent pigging.

Pipeline Inspection carried out from the ship allows to detect scouring of bottom under the pipe, pipe sag, torn anchors and fishing trawls, and possible biases of the pipeline from the design values. Device range is wide enough and include various sonar, multibeam echo sounder, etc.

Using ROV allows to monitor condition of the insulation coating, protective insulating sleeves on welded joints and cathodic protection. Diving survey additionally allows to perform pipe wall thickness measurement or, in some cases, crack detection of pipe









## In-line inspection carried out by intelligent pigs



#### Intellectual magnetic pig - MFL defectoscopes





- Pipe report book
- Determination of pipeline profile and localization of geometric defects
- Localization of base metal defects of wall and weld joints (cracks, corrosion damages, metal loss, pitting, lamination etc.)
- Localization of stress-corrosion damages and rill corrosion (AFD examination with cross magnetization for detection of longitudinal defects)
- □GYRO-examination for defining pipeline in XYZcoordinates

#### Stages of inspection

## Preliminary work

- ✓ Filling questionnaires
- ✓ Checking pig launcher-receiver
- ✓ Equipment mobilization

## □ In-line inspection

- $\checkmark$  Clearing and pipeline calibration
- ✓ Pig tracking
- ✓ Geometry inspection
- ✓ Metal loss inspection
- ✓ Calculations







#### Monitoring of pig launcher-receivers and line pipe

(analysis of stop-gate valve, geometrical dimensions of launcherreceivers, turn radius of a pipeline and tapping 1,5D; 3D)









### Results of pipeline clearing





#### In-line inspection tools for small diameter

#### pipelines

• MFL – magnetic flux leakage

- ULTRASONICK
  - Multi-sensors tool





Single-sensor



 ART - acoustic resonance technology



The base of MFL technology



magnetic flux leakage

### MFL equipment



Defects 13-23. Corrosion

### Ultrasonic single-sensor

technology



### Pipeline wall is inspected using ultrasonic (US) principle

The system contains a horizontally placed transducer within the center body of the pig. The transducer sends it's sound wave forward where it hits a 45° rotating mirror which then directs the sound wave perpendicular on to the pipe wall. From the inner pipe wall the next signal will travel to the outer pipe wall. Every time the signal hits a surface it will bounce back the same way it was sent allowing the computer to calculate the time of travel. This time of travel is then converted to distance which results in a measurement figure.



#### Ultrasonic single-sensor

tool



Resolving capacity of NGD in-line equipment: 2,5x5,5mm and 2,5x2,5mm (longitudinal and crosscut direction); Scanning frequency of sensors - 2000 Hz

Possibility of 1,5D radius turn; Possibility of double diameter pipeline inspection, from 0,75 to 1,0 D; Active regulation speed system (stream speed up to 10 m/sec);

Onboard gyroscope for XYZ-cartography of pipelines in DGPS coordinate system reduces significantly efforts while defects detecting (accuracy of coordinates determination on site +/- 1,0 meters);

#### Soft ware for working with data bases on results of in-

#### pipeline inspection



#### Typical certificate of a certain

Client LUKOIL UKHTA Contract Number 4-7000-10275 Date December 27, 2005 Revision Number 0 ROSEN Project No. 4-7000-10275 Inspection Type CDP / EGP

#### 12" YUZHNO-IRAEL

Preliminary Report Individually Sentenced Feature Report (ISFR) Weld and Feature Location Sheet Inspection Technologies www.Roseninspection.net defeat



#### Feature Location



#### Feature Information

log dist.: 31114.76 m t: 8.00 mm o'clock: 06:45 event: Lamination-extending to surface internal: YES depth: 59.% length: 349 mm width: 244 mm cluster: - comment: PR # 5

# Analyses of location of defects on the pipe scan



## Analyses of pipelines defects allocation on pipe`s

#### length

(external/internal, cracks, metal losses, pitting, etc.)





#### Display of board gyroscope data



GYRO inspection measures and displays 3D coordinates of a pipeline that enables precise image of its trace and profile, dimensioned pipeline location as well.

Board gyroscopic inert gage block measures changes of angular rate and line speed along X, Y, Z - direction, as cylinder piston moving in a pipeline. GYRO-inspection enables to calculate coordinates of ring seams and anomalies, determine radius of pipeline curve and discover



- Strength analyses and discarded wall thickness
- Classification of revealed defects by types;
- Calculation of allowable operating pressure;
- Calculation of corrosion ratio for each defect;
- Calculation of residual life for each defect revealed;
- Ranking of defects on hazard rate and repair priority;
- Ranking of pipeline's area on actual technical condition and rate of wear;
- Analyses of a situation and peculiarities of defects allocation by type and pipeline length;
- Recommendations on repair and conditions of further operation (operational pressure, electrochemical protection settings, inhibition)







#### Special ART technology for inspection of water supply pipelines is utmost solution for city pipes network

- ART provides for savings on rehabilitation costs of up to 70 % from ART inspections;
- ART delivers complete and reliable information on the condition of the network;
- ART prioritises pipes according to urgency and type of repair;
- ART provides recommendations on costeffective and risk reducing actions.



#### The base of ART-Technology

ACOUSTIC RESPONSE OF PIPE WALL



Acoustic Resonance Technology is a low frequency, ultra-wideband inspection technology, which enables very accurate thickness measurements to be made. ART has developed advanced algorithms to perform analysis on very large amounts of data.

- Developed by Det Norske Veritas since ~1990;
- Wide bandwidth, low frequency ultrasonic pulse;
- Half-wave resonance detects thickness;
- Robust to corrosion and sediments;
- Does not require direct contact;
- Detects external and internal corrosion.

#### ART In-line inspection tools



Technical Capabilities	
Pipe sizes scanned	From 300-600mm
Accuracy	±0,25 mm
Speed	750 m in 2hrs 40 m

#### Inspection Truck for mobile team

Inspections are carried out by using a truck which has the following equipment on it:

- 1. Mobile laboratory;
- 2. PipeScanner;
- 3. Propulsion unit;
- 4. Winch;
- 5. Mobile Entry Unit;
- 6. Control station and video of in-line pipe inspection;
- 7. IT systems for the collection of data and initial analysis.







#### Entry Units

The Company has two different types of entry units, depending on client needs.

#### **Removable Entry Unit**

**Stationary Entry Unit** 







#### Removable Entry Unit

Complete modernisation of the removable entry mechanism:

- Better cable control;
- More ability to keep up pressure in pipeline;
- Allows hermetic sealing.





#### **Planning & preparation**

Verify suitability of site: visit site, study maps, ship BEP/hatch.

#### Site preparation

Excavate pipe, installation Entry units/hatch. Same day or day before.

#### Inspection

#### **Post-inspection work**

Repair pipe cut, close ditch. Same day or next.

#### Analysis

Starts next day (+1), 2-15 work days. Depending on complexity.

#### **Report delivery**

Max 15 days after inspection.

#### Results



#### Report



Pipe sections numeration

#### The Main Technological Advantages

- Accurate data. ART with its 360 degree continuous inspection supports information gathering on remaining thickness of the pipe wall.
- Detection of internal and external corrosion.
- Low cost of preparations scanning capacity up to 1500 m from one entry point.
- Scans pipelines with internal rust nodules without any prior cleaning.
- There is no necessity for water to be purged from the pipe during or before an ordinary inspection.



# Pipeline repairs using composite reinforcing sleeves following ILI results









# Smart Lock

# Composite reinforcing sleeve for main and field pipelines



# The best Dollar can buy!

## Smart Lock sleeve design and technical Parameters



The operating principle of the sleeve consists in compensating the inner pressure in the pipeline by exerting the contact pressure due to the considerable tightening of the brads. This allows assembling the sleeve with guaranteed quality at the working pressure unlike the sleeves installed without prior creating the pressure.





#### hermetic liner



#### external anomalies

welded seam

internal anomalies

## Composite reinforcing sleeves to repair 4"to 80" pipelines







configurations of sleeves are manufactured:

Smart Lock - for external and internal defects repair with up to 100% metal loss;
 Smart Lock-A - for emergency repair of penetration defects.







Opening of internal defect, 80% pipe wall thickness deep happened at 182 bar pressure, which means repair done using **Smart Lock** sleeves provides for strengthening sufficient to compensate for internal pressure even without filling the defect cavity with repair compound.

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ПРОДУКЦИЯ Усиливающая композиционная муфта	12 Mar 19
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Тел./факс: (495) 268-77-24 / (495) 268-88-63	
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Руководитель органа	The second case with the second s
М.П.Ф. Эксперт Инания	Р.Ш.Абайдулина

**Smart Lock** sleeves is certified as per ISO 9001.

# **Smart Lock** passed industrial safety expert review.

Repair method using these reinforcing sleeves **Smart Lock** is included in permanent repair methods.

Smart Lock service life is 50 years.



- **Smart Lock** is operable at temperatures from 60 C° to 200C°
- It is possible to manufacture sleeves operable at temperatures up to 400 C°
- Smart Lock provides for operation of repaired pipeline segment without maintenance and repair for at least 50 years.



Smart Lock key feature is un-stressing of pipeline wall defective area metal
Smart Lock is significantly lighter then similar metal structures
530 mm diameter Smart Lock with bolts and insert weighs no more than 30 kg
Allows installation without pipeline depressurizing with guaranteed quality



Among all types of repair sleeves existing today it is only **Smart Lock** easy to install, repair is performed quickly and small scope of earth works is required. **Smart Lock** installation time is 15 to 20 min. Possible to operate the pipe even if internal

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#### УСТРОЙСТВО РЕМОНТА ТРУБОПРОВОДА

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Руководитель Федеральной службы по интеллектуальной 🛱 собственности, патентам и товарным знакам

Б.П. Симонов

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![](_page_50_Picture_0.jpeg)

Smart Lock is successfully used to repair underground offshore pipelines. Applied adhesive polymerizes at up to 100% humidity level and pipe wall temperature down to minus 7 degrees. Sleeve material is not corrosive, metal parts are made of stainless steel, after repair process pockets and holes are filled with a special compound and the sleeve becomes a solid fiberglass reinforced by embedded stainless steel.

Smort Look A configuration allows repairing amorganow through

Baltic Sea, Depth – 28 meters Repair time – 18 minutes

![](_page_52_Picture_0.jpeg)

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