PROSPECTS FOR THE DEVELOPMENT OF TRUNK DIAGNOSTICS

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Annotation: *The article provides a brief analysis of the formation and current status of the main gas pipeline diagnostics. The development of local defect detectors and the scope of their application in industry are shown, examples of the creation of external defect detection scanners for use in capital repairs are given. Data on standard and problematic sections of gas pipelines are provided in terms of the use of in-line fault detection. Depending on the diameter of the gas pipeline and the working pressure, the range of typical fault detection tools is indicated. The problems encountered in the use of modern in-line facilities in gas pipelines, including technical, economic and organizational aspects, are listed.*

Keywords. *Trunk pipe, diagnostics, defect, external defect, stress-deformation, EMAT*

In addition to the detection of in-line faults, the use of ground-based systems for contactless diagnostics is proposed, which allows the detection of spatial condition of pipes, insulation defects, current and magnetization parameters. The capabilities of such tools are demonstrated in terms of efficiency, diagnostic coverage of the entire gas pipeline and year-round performance, which increases the accuracy of the research and allows a rapid assessment of the reliability of the gas pipeline. area to the consumer. It was noted that the use of surface systems for the diagnosis of gas pipelines allows to inspect any sections of main and process gas pipelines at relatively low prices. The scope of their use in the implementation of relevant research and development work can be expanded, including the assessment of stress-strain state.

The concept of development of diagnostic work has been developed, the main purpose of which is to quickly obtain information on the technical condition of the entire gas pipeline, and on this basis to increase efficiency and reduce the cost of capital repairs. Approaches to gas pipeline diagnostics are proposed, including the principle of establishing priority criteria for online inspection of each gas pipeline, automated data processing, diagnostics and repair work online.

Trunk Pipe Diagnostics (MQ) is an integral part of maintenance and repair (TXK and T). However, the organization of diagnostic work in the domestic gas transmission system (GUT) has fundamental features compared to European gas pipelines due to its significant length and performance in areas with severe natural-climatic conditions. From a technological point of view, it should be noted that GUT operates in a single hydraulic mode, a large number of transit gas pipelines of large length (diameter 3-420 thousand km from the Far North to the central part) Features of gas pipeline design solutions it is necessary to highlight unequal sections, sharply curved rods, direct connections, as well as a significant number of gas pipeline networks (about 36 thousand km). , including a single line. All of these factors necessitated the development of the concept of MQ diagnostics and technical solutions for its implementation, taking into account the unity of requirements for the reliability and safe operation of GUT.

The concept of diagnostics and its formation as a system is defined in the industrial program "Integrated system of diagnostics and technical inspection of main gas pipelines in Russia" developed in 1994 on the basis of practical domestic and foreign experience, analysis of research work. ITI and field research. The implementation of the program has allowed the transition from a separate variety of diagnostic work to a complex inspection in the industry, as shown in the diagram in the figure. one.

During the implementation of the program of diagnostic work, new topics were identified on the effectiveness of diagnostics, assessment of the performance of gas pipelines in the presence of defects and determining the service life of gas pipelines. These tasks were mainly implemented in the network program "Diagnostic repair and reliability of main gas pipelines, gas production and processing facilities."

Currently, the fleet of defect detectors includes third-generation devices that use magnetic and ultrasonic principles, including the detection of stress-corrosion cracks. One such device has a magnetic defect detector with a longitudinal magnetization diameter of 1420 mm. Scanners for external faults have also been developed to allow for pipeline diagnostics during major overhauls of gas pipeline sections (Figure 3).

A fleet of modern fault detection devices capable of inspecting standard sections is used to diagnose gas pipelines. However, in-line flaw detection (ITD) capabilities are limited, and the main difficulties in its application are related to the analysis of problem areas (Figure 4).

To assess the condition of the protective coating of the pipes, you should pay attention to the electromagnetic-acoustic technology (EMAT) defect detection devices provided at the bottom and the detection of high-precision defects to determine the geometry of the pipes. Subsequent calculation of stress-strain state (SSS) developed by ROSEN Group (Germany). These defect detectors expand the scope of VTD, but significantly increase the cost of diagnostic tests. The same company has also developed recommendations for selecting the type of fault detectors for diagnosing pipes of different diameters and operating pressures, as shown in the figure.

A separate component of the diagnostics is electrometry aimed at assessing the state of electrochemical protection of soil corrosion activity and predicting the risk of corrosion of individual plots. It should be noted the diversity of electrometric methods, including alternating and direct current, resistance, and electrochemical methods. Gazprom also monitors the condition of pipelines, route sections, analyzes possible erosion processes, examines gas pipelines in a helicopter using laser and thermal imaging systems for trench erosion, leak detection, video recording and analysis. conducts geotechnical diagnostic work to make. condition of protected areas and minimum safe distances [2].

Thus, from a technical point of view, the industry has developed a complex diagnostic system for main gas pipelines, which allows monitoring the status of the GTS.

At the same time, the concept of developing diagnostic work based on the analysis and analysis of trunk pipelines should be considered in terms of increasing reliability and efficiency. In-line diagnostics has the following main limitations as a basis for testing:

About 40% of the gas pipelines (problem areas) used are not covered by VTD (Figure 4), and about 36,000 km of gas pipelines cannot be inspected by VTD methods;

the standard VTD range is limited by a pressure range of not less than 2 MPa, diameters and wall thickness (Fig. 5);

the use of improved VTDs, such as EMAT, involves costly measures (2-3 times more expensive than standard VTDs).

From an organizational perspective, the rapid link between diagnostics and repair planning is not sufficiently apparent. In practice, according to the results of diagnostics, priority areas for repair are selected, and there are shortcomings in the implementation of diagnostic work for a year or more, which significantly reduces their effectiveness.

Based on the diagnostic work, individual potentially hazardous areas are identified, but the assessment of the reliability of the gas pipeline in general - from the field to the consumer is not carried out.

Inspection of technical condition in transit gas pipelines or gas pipeline corridors is carried out by different executors using different technical means, which leads to errors both in connection of defects to the place of measurement and in their risk assessment.

Experience shows that the formation and evaluation of results (technical report) on the gas pipeline in general takes a long time, and this fact does not allow to get a true picture of the technical situation for the current year and makes planning difficult.

At present, from a technical and economic point of view, in-line diagnostics has reached its limit. In this regard, prospective diagnostic work using underground facilities, in addition to VTD, should be considered.

The concept of diagnostic work development is aimed at improving the level of diagnostics, its planning and reducing the cost of carrying out inspections and overhauls. The main goal of the concept - from the field to the consumer - is to provide knowledge about the reliability of each gas pipeline and to quickly provide information on the technical condition of gas pipelines to plan repairs.

To implement the concept, a new approach to diagnostic work should be applied, in particular:

implementation of work planning based on the principle of inspection of gas pipelines as a whole during one season using high-speed surface complexes and using standard VTD (if possible);

to determine the area and operation of underground facilities and VTD for concrete gas pipelines and to compile a register of diagnostic work under the GTS;

providing a fast link between diagnostics and repair planning based on automated data processing this season;

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formation of priority criteria

based on the justification of diagnostic and repair work

and the planning of these works should be based on the principle of efficiency (online) and complex analysis.

The implementation of the above work will allow to cover all main and technological gas pipelines, gas pipeline networks and various problem areas with diagnostics, which, in turn, will improve the management system of technical condition and integrity of gas pipelines. GTS.

Thus, the development of a new concept of diagnostic work on gas pipelines will allow the formation of a rapid and economical system of monitoring the technical condition, with the main focus on assessing the reliability and safety of transit gas pipelines and corridors in general. - from the field to the consumer. At the same time, an effective basis for real-time repairs will be created, which will ultimately create conditions for optimizing gas transportation methods.

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