STUDY OF METHODS AND SKILL EXPERIENCE OF DIAGNOSTICS OF THE MAIN HEATING NETWORK STATE DIAGNOSTICS USING A ROBOTIZED DIAGNOSTIC COMPLEX

Moscow, Russia
14-17 April, 2020

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At the same time, taking into account the achieved level of technology integration and production digitalization, it is necessary to popularize diagnostic methods as an integral part of the integrated management intelligent system, including both technological processes and their interaction with the socio-economic society side.
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Kazan is the capital of Tatarstan Republic

STUDY OF METHODS AND SKILL EXPERIENCE OF DIAGNOSTICS OF THE MAIN HEATING NETWORK STATE DIAGNOSTICS USING A ROBOTIZED DIAGNOSTIC COMPLEX
Reconstruction and replacement of 15-20 linear kilometers of trunk heating networks or an average of 2-3% of the total length is carried out annually. This volume is not enough.
Operating organizations use a set of diagnostic devices and instruments, but promising high-tech technologies are especially relevant, which can reduce the time required to complete work and save resources. But they are not able to give 100% representation of the actual pipeline state.
The Russian market presents various existing models of in-line diagnostic systems. Consider two robotic diagnostic systems with a sufficient level of testing in heating networks.

The software and hardware complex based on RDK was developed by specialists of St. Petersburg State University and LLC “Devays Engineering” for in-line diagnostics based on the calculation-analytical method for assessing defects using an empirical approach to collecting and processing information using a high-frequency magnetic sensor, combining different physical measurement methods.

RDK LLC "Engineering Engineering" and St. Petersburg State University
The diagnostic module uses the following control methods: visual, magnetic method with circulating magnetization and ultrasonic method. The magnetic method with circulating magnetization consists in passing an alternating current through the pipeline walls, which forms an alternating magnetic field. A magnetic field passing through the pipe wall is deformed in the defect zone. The magnetic field gradient is fixed by the sensitive elements of the electromagnetic sensor.
The example of a robotic diagnostic complex implementation is the JSC “Diaconte” company development in conjunction with the St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO).
JSC "Tatenergo" together with LLC "IC Energoprogress" in November 2019 in the Kazan city heating networks began full-scale testing of a robotic diagnostic complex for in-line diagnostics (VTD) of heating networks pipelines with the involvement a wide range of specialists.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>RDK 1</th>
<th>RDK 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of the pipeline, mm</td>
<td>500-1000</td>
<td>500-1200</td>
</tr>
<tr>
<td>Inspection Range, m</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>Deposition Thickness, mm</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Wall thickness, mm</td>
<td>5-14</td>
<td>5-14</td>
</tr>
<tr>
<td>Error of measurement of wall thickness, mm</td>
<td>+0,1</td>
<td>+0,3</td>
</tr>
<tr>
<td>Ultrasonic sensor</td>
<td>да</td>
<td>нет</td>
</tr>
</tbody>
</table>

Comparison of complexes LLC “Engineering Engineering” and JSC “Diaconte
A further step towards the construction a system for managing the resource of heating networks pipelines is a complex based on the initial assessment of the actual technical condition (primary diagnosis) and current and retrospective data of the technical condition monitoring system.
CONCLUSION

1) In summary, it should be noted that today the existing methods of in-line diagnostics are not able to give 100% idea of the pipeline actual state and its working life.

2) It is necessary to carry out a diagnostic measures complex using a number of non-destructive testing (infrared diagnostics, acoustic and correlation diagnostics, etc.).

3) The reliability of in-line diagnostics existing methods is at a level of 75 - 80%, which is 1.5-2 times higher than the reliability of other non-destructive testing methods that provide information about the pipeline metal condition. In this regard, it is necessary to continue work on improving of the methods used for in-line diagnostics, to modernize equipment, reduce costs, and increase the diagnostic volume.

The involvement of a wide range of specialists in these issues, both directly involved in energy systems engineering, and those responsible for the operation and equipment repair, as well as young specialists and scientists through their participation in the implementation of promising advanced technological complexes, is one of the most effective ways of technologie developing.
Thank you for attention!

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