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PROSPECTS OF GAS OIL PIPELINES RELIABILITY GROWTH BY PIPE STEELS IMPROVEMENT

Pipeline transportation is considered to be one of the most economical means of delivering liquid and gaseous products over long distances with minimal loss of product in the course of delivery to consumers. Modern pipelines are exceptionally long metal structures with a length exceeding thousands of kilometers.

It is known [1] that the destruction of gas pipelines is too dangerous. The area of environmental impact from the site of destruction ranges from several hundred meters to several kilometers. Particular danger during destruction is associated with the possibility of gas contamination of territories and settlements, the formation of an explosive mixture of gas and air, inflammation of transported products, their possible penetration into large bodies of water. It is known [1], for example, that only 1 tonne of spilled oil creates an 18 km^2 oil film on the surface of water bodies. In such cases, the complete restoration of the ecological balance requires the implementation of a whole complex of remediation works, which is associated with high material costs.

The working conditions of the pipe metal in a high-pressure gas pipelines are very specific, sharply different from the operating conditions of the metal in other metal structures, which is caused by the following factors [1-3].

Exploitation of metal pipes of the same pipeline due to its large length is carried out in dramatically different natural and climatic conditions - from sub-zero temperatures in the northern regions of the country to plus in the southern. The same conditions determine a wide range of types and mechanical characteristics of the soils in which the pipeline is laid; possibility of plastic deformation of the pipes when crossing various natural obstacles - water obstacles, swamps, mountains, lakes, etc [4-5].

In underground gas pipelines, the metal works at ground temperature. Fixing of the pipes with a diameter up to 1020 mm with soil is carried out on the area of several tens of meters long. As shown by the results of experimental measurements of elastic axial displacements and stresses taken during the cutting of an emergency underground gas pipeline with a diameter of 425 mm, fixing of the pipes with soil is carried out at a length of 25-50 m. Moving the ends of the pipes at the point of incision reached ≈ 29 mm, and longitudinal stresses a ≈ 200 MPa. In the pipelines with diameters of 1020 mm or more, fixing of the pipeline with soil is not always sufficient; the temperature regime and the magnitude of the longitudinal deformations are largely determined by the conditions of operation of the air cooling apparatus (ACA) and their number. In the case of ACA absence, the temperature of the pipeline may increase along its length, as the soil is no longer able to absorb the heat obtained by gas during compression. Therefore, securing absence of powerful gas pipelines in soils, preventing them from rising or bending in swampy and flooded places is a difficult task that cannot always be reliably solved, so the stability of the pipeline is not always secure.

Depending on climatic conditions, the metal of the pipes is operated in a wide temperature range - from 30 ... 40° C in summer to -15 ... -20° C in winter, and in the northern climatic zones in the areas of the above-ground routing the minimum operating temperature can be much lower. Construction and installation works on pipelines is in some cases are carried out only in winter at temperatures up to -40° C.

During the amortization cycle (more than 30 years), the pipe metal works almost constantly in a two-axis stress state with different, depending on many factors, ratio of stresses in the circular and longitudinal directions. In addition, metal pipelines are subjected to

low-cycle loads, which in some cases can cause stresses that reach a yield strength.

The influence of pipelines scheme stressed state on the plastic properties of the pipes metal is clearly traced by the change in a relative elongation. Thus, when on flat fivefold specimens with a uniaxial tensile elongation is 20-30%, then in the conditions of flat stress state in hydraulic tests before the destruction of full-sized pipes, the plastic elongation of the perimeter reaches only 3-7%, and in high-viscosity plastic pipes of controlled rolling steels - 8-12%.

In metal pipelines, as a rule, the inevitable presence of concentrators - burrs, scratches, oriented along the forming pipe.

Experimental studies have allowed to determine the change of circular deformations of the outer surface from the internal pressure in pipes with different ovalities (in section along the small axis of the oval). In particular, as the ovality decreases due to the increase in internal pressure, the value of deformations in the specified cross section increases the faster the greater the ovality in the initial state.

At a pressure of 1 MPa, local deformations can reach values corresponding to the yield stress, at a more or less low value of the average stresses in the pipe metal. The maximum value of local deformation is about 0.6% at a pressure of 5.5 MPa, then the increase in deformation ends, which corresponds to the moment of acceptance of the cylindrical shape pipe.

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