The working parameters in the packing tests were within the permissible limits. This was also confirmed in the tests of the packing units of series-produced pumps (Table 2) which are under operation now.

The following conclusions can be drawn from the foregoing. The basic design elements of the packing with a self-regulated gap for high operational parameters have been experimentally investigated and developed. The results obtained confirmed the suitability of the packing design for cooling pumps. The working parameters of the packings meet the demands made on them and ensure the reliability required for operation in APS.

LITERATURE CITED


STRESS—STRAIN STATE IN A HIGH-PRESSURE ELECTROMAGNETIC VALVE

B. V. Karmugin, A. N. Beskov, D. A. Mendelson, and A. S. Kudinov

UDC 539.319
621.646.223-837

Ignorance of stress distribution patterns in the different elements of high-pressure armatures frequently results in an unjustified safety factor at some places and the development of dangerous strains at others.

The authors studied stress distribution in an electromagnetic valve with \( D_n = 6 \text{ mm} \) and \( p_{\text{work}} = 36 \text{ MPa} \) (Fig. 1). To reduce the size and weight, the valve body was threaded to the electromagnet body and welded to the annular bulge to ensure airtightness. This feature hampers the design of the threaded-welded joint because of indefinite load distribution.

The object under study is complex in design with high gradients of stress zones. The design of such a complex spatial system is difficult. Even the use of well-developed numerical methods of discrete analysis does not yield satisfactory results because of difficulties in calculations involving the threaded component.

The stress—strain state in an electromagnetic valve was studied by a polarization-optical method and by holographic interferometry together with the numerical potential method [1, 2]. The model for polarization-optical study was made of optically sensitive material ED-16M on scale 2:1 ensuring total geometric similarity. The selection of the model scale was dictated by convenience of preparing the components and the reliability of the measurements of optical effects.

The stress pattern in the zones of the threaded component and welded joint was distorted because of stress concentrations in the frozen model, and thus optical anisotropy could not be measured. Therefore, simultaneous with investigations on models, experiments were carried out in an actual design using holographic interferometry. A scheme with a reference beam and speckle photography were used [3]. The valve was loaded to an internal test pressure of \( p_{\text{test}} = 49 \text{ MPa} \) and the first exposure made. Then, the load was removed and the second exposure made. An LG-38 laser was used as a source of coherent radiations. The interferograms were recorded on photographic plates. The interference patterns of zones corresponding to the actual surface deformations recorded on the plates (Fig. 2) were interpreted, and the resultant displacement vector components were used as boundary conditions in the numerical calculation of stress—strain state of the electromagnetic valve by the potential method using a computer. For calculating the mechanical characteristics of the welded joint, the characteristics of the constructional metal were regarded as identical.

Translated from Khimicheskoe i Neftyanoe Mashinostroenie, No. 6, pp. 7-9, June, 1982.
The interpretation and study of interference patterns helped establish that the pressure of the working medium caused intense deformations of the entire welded zone. Particularly large displacements (up to 170 μm axial and up to 140 μm radial) of section A of the annular bulge under the welding were noticed (Fig. 3).

A qualitative analysis of the sections of the photoelastic model in the polariscope field and interference pictures on holograms showed that the pattern of stress distribution on the underside of electromagnet body was close to axisymmetric. Calculations showed that the axial stresses $\sigma_z$ are maximum in this zone. At an internal pressure of 49 MPa, these stresses go up to 147 MPa in the inner corners of the upper portion of electromagnet body because of stress concentration. An analysis of the stress state established that the flat spots under the key (sections 9-11) influenced the stress state only in the midportion of the electromagnet body by introducing asymmetry of stress distribution.

The maximum stress state was noticed in the zone of vertical section $O-H_1$, running through the flat spots under the key (see Fig. 3). Normal stresses $\sigma_\theta$ and $\sigma_z$ prevailed here and attained the maxima in sections 9 and 10. In this zone when the internal pressure of the working medium was a maximum, the annular stresses $\sigma_\theta$ amounted to 255-260 MPa and axial stresses $\sigma_z$ amounted to 176-178 MPa. Stresses $\sigma_\theta$ and $\sigma_z$ changed little along the rest of vertical sections $O-H_2$, $O-H_3$, and $O-H_4$ in the electromagnet body and ranged 25-40 and 45-60% of maximum stresses in section $O-H_1$.

Nearly axisymmetric stress distribution was noticed in the valve body. The maximum tensile stresses $\sigma_\theta$ in this zone did not exceed 149 MPa on the inner contour. Maximum tensile stresses $\sigma_z$ arose due to stress concentration from the...