

## EXPERIMENTAL STUDIES OF THE INFLUENCE OF HYDRODYNAMICALLY ACTIVE ADDITIVES ON THE OPERATION OF A SCREW COMPRESSOR

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### ABSTRACT

Experimental study of the 79VKG-25/5 screw compressor was carried out in compressor mode on industrial oil with the addition of Polyisobutylene (PIB) at the following solution concentrations: 0.2%, 0.4%, and 0.6%. The productivity of a screw compressor practically remains constant in the range of changes in PIB concentrations from 0 to 0.2% and decreases on average by 10%. The decrease in performance is due to an increase in internal gas flows in the screw compressor. From the presented dependences it follows that in the entire range, the introduction of PIB additives does not lead to a significant increase in the air temperature at the outlet of the screw compressor and, consequently, in the pressure in the working cavity of the compressor. Therefore, the main reason for the increase in leakage and a decrease in productivity, apparently, is the deterioration of the sealing properties of the working fluid in the gaps between the housing and the rotors. The results of experimental studies are presented in the form of graphical dependences of the consumed power, volumetric productivity and isothermal efficiency of the 7VKG-25/5 screw compressor on the degree of pressure increase and polyisobutylene concentrations - in the range for the working fluid flow rates V(M1) 100 l/min and V(M2) 140 l/min.

**Keywords:** Screw compressor, Centrifugal pump, Polymer additives, Polyisobutylene, Hydrodynamic losses, Fluid flow rate.

### INTRODUCTION

Experimental study of the 79VKG-25/5 screw compressor was carried out in compressor mode on industrial oil with the addition of Polyisobutylene (PIB) at the following solution concentrations: 0.2%, 0.4%, and 0.6%. At working fluid temperatures of ~45°C, at a suction air temperature of 20+27°C, at a suction pressure  $P_{BC}=1.04 \text{ kg/cm}^2$  and an oil consumption  $V_M=100$  and 140 l/min.

Before testing PIB solutions, the characteristics were taken on industrial oil, conventionally, the concentration of the solution  $K=0$  is considered.

The influence of polymer additives on the characteristics of a screw compressor was determined by comparing the characteristics when operating on industrial oil and oil solutions with the addition of PIB.

### MATERIALS AND METHODS

#### Experimental technique and results of processing

Based on these measurements, the following parameters were calculated:

##### 1. Compressor suction pressure

a) When measured with a vacuum meter  $P_{BC} = P\delta \cdot K - 0.01 \text{ n/kg/cm}^2$ ,

Where  $P\delta$  - barometric pressure; n is the number of divisions of the vacuum meter;  $K=0.00136 \text{ kgf/sms/mm Hg}$  - conversion factor.

b) When measuring with a U-shaped tube filled with dibutyl phtolate  $P_{BC}=0.0769 \Delta h_{-1}/\text{mm Hg}$ , where  $\Delta h_{-1}$  is the liquid drop in the U-tube, 0.0769 is a conversion factor.



Fig. 2. Dependence of the power of the 79VKG-25/5 screw compressor on the degree of pressure increase of the working fluid at a flow rate of 100 l/min. Note: Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$

Fig. 3. Dependence of the isometric efficiency of the 79VKG-25/5 screw compressor on the degree of pressure increase at a working fluid flow rate of 100 l / min. Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$

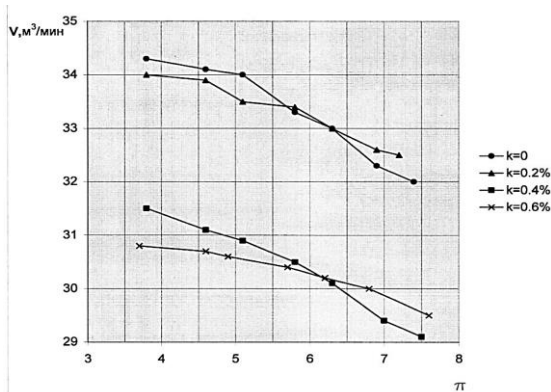


Fig. 4. Dependence of the volumetric performance of the 79VKG-25/5 screw compressor on the degree of pressure increase at a working fluid flow rate of 140 l/min. Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$

Fig. 5. Dependence of the power of the 79VKG-25/5 screw compressor on the degree of pressure increase of the working fluid at a flow rate of 140 l/min. Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$

Fig. 6. Dependence of the isometric efficiency of the 79VKG-25/5 screw compressor on the degree of pressure increase at a working fluid flow rate of 140 l/min. Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$

Fig. 7. Dependence of the compressor outlet temperature on the discharge pressure for the working fluid flow rates of 100 l/min and 140 l/min. Note: (↔)  $k=0$ ; (↔)  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$ ; (↔)  $k=0$ ; ( )  $k=0.2\%$ ; ( )  $k=0.4\%$ ; ( )  $k=0.6\%$



