СЕКЦІЯ XVI. ЕНЕРГЕТИКА ТА ЕНЕРГЕТИЧНЕ МАШИНОБУДУВАННЯ

INVESTIGATION OF THE STABILITY OF THE CASING OF THE HEAT EXCHANGER OF THE TPG

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The volume of fitting and finishing works performed to ensure the established tolerances on the displacement of the edges of the collar joint joints of the bottoms with lining, is high and makes up 32 ... 66% of the total complexity of assembly work. The assembly of ring connections "bottom-shell" and "bottom-body" is several times lower than the connection "cladding shell". Thus, in the apparatus-building the bottom is the leading basic detail [1].

The assembly of the ring joints of the base parts could be greatly improved in the presence of control and measuring devices, which allow you to quickly and fully obtain information on the geometrical characteristics of the cross sections of parts. But currently available at hardware enterprises, funds do not allow this to be done. Therefore, the problem is the development of an operational method for controlling the geometric characteristics of cross sections of basic parts of the body of devices [2].

Appearance in the process of manufacturing deviation of the shape and size of the cross-sections of the base parts affect the tensely deformed state of the body of apparatus when loaded with internal or external pressure. In the work the methods of recording the influence of deformations of the form on the strength of the cases of apparatus loaded with internal pressure have been developed.

Investigation of the influence of deviations of the shape of the cross-section of the casings on the coefficient of efficiency of the design of the STA.

Heat emission coefficient in inter pipe space of heat exchanger is defined by formula

$$\alpha = J_{tot} \cdot \alpha_i \qquad (1)$$

where, J_{tot} – general efficiency coefficient of apparatus construction; α_i – heat transfer coefficient of perfect bundle at transversal washing.

Efficiency coefficient of construction is calculated by expression:

$$J_{tot} = J_s \cdot J_b \cdot J_l \cdot J_c \cdot J_r \quad (2)$$

where, J_s – coefficient that takes into consideration the placement step of baffles on input and output section of inter pipe space; J_b – coefficient that takes into consideration the bypass diversion between housing and periphery of bundle; J_l – coefficient that takes into consideration diversion between housing and baffle, baffle and pipes; J_c – coefficient that takes into consideration heat emission in the window of segmental baffle; J_r – coefficient that takes into consideration oppositional gradients of temperatures that is arise at laminar stream.

From accuracy of casing manufactory by the shape and external diameter of transversal cross-section is depending correctional coefficients J_l and J_b.

On the basis of analysis of influence of form deviations of transversal cross-section of casing (ovality, angularity and offset of edges in longitudinal sew) on the plane of gaps in inter pipe space of heat exchanger were estimated analytical correlations of coefficients J_l and J_b (fig. 1) from parameters of form deviations.

With the increase of the deviation parameters of the form correction factors, and hence the coefficient of efficiency of the design, decrease. It has been established that the deviations of the shape of the cross-section of the housing allowed in accordance with the NTD may reduce the coefficient of efficiency of the STA design by 6 ... 12%.

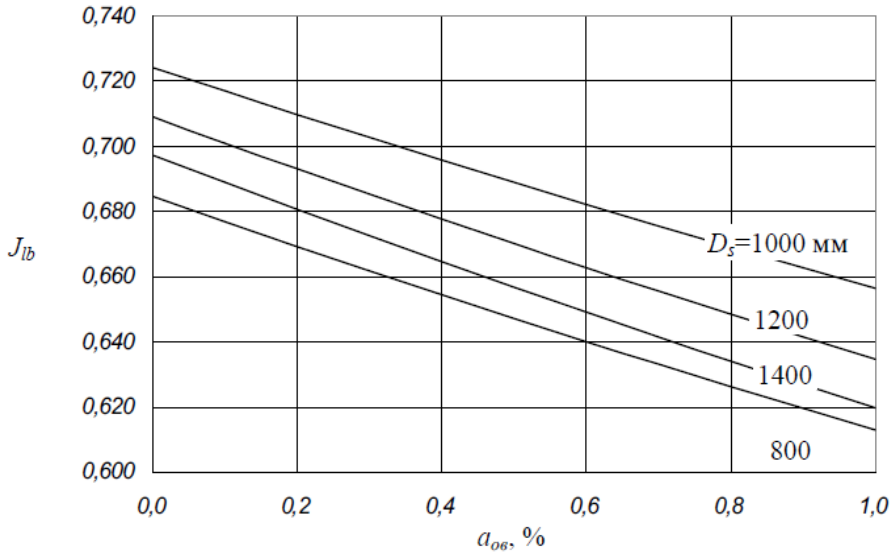

Fig. 1. **Derivative correlation of correctional coefficients J_{lb} from ovality value of casing cross-section**

The influence of deformations of the form on the stress-deformed state of the cases of apparatus loaded with internal pressure was also studied.

One of the most common form deviations in the area of the "shell-elliptical bottom" is the displacement of the edges and the taper of the opening part of the bottom, which arise in the process of manufacturing the apparatus (fig. 2). Offset edges are of technological origin. Its final value is the result of accumulated errors in the entire flow of procurement, form-making and assembly operations.

The study of the effect of the displacement of the edges on the performance of the apparatus is devoted to numerous works of domestic and foreign researchers, in which the negative influence of the displacement of the edges on the tensile state of the ring welded joint has been proved.

At the same time, in literary sources there is not enough data on the tensile state of the annular butt joint "shell-bottom".

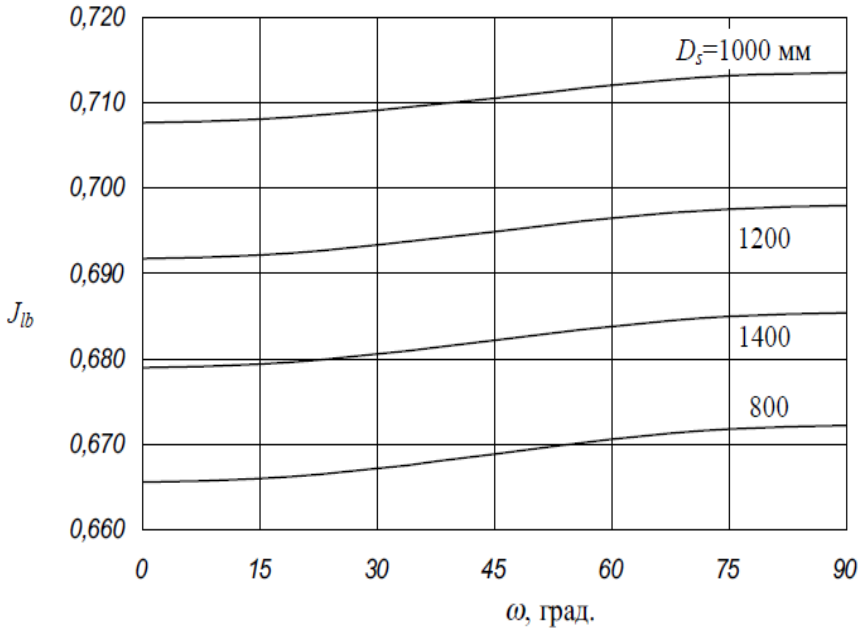

Fig. 2. **Derivative correlation of correctional coefficients J_{lb} from angle of oval's slope of casing cross-section**

References:

1. Cetin, M. (2010). Design and experimental investigation of microchannel heat exchanger [Master's thesis, METU]. http://etd.lib.metu.edu.tr/upload/12611856/index.pdf
2. Zhou, S., Zhang, J., Song, W., & Feng, Z. (2019). Modeling on heat transfer performance of supercritical compressed air in a casing heat exchanger. Energy Procedia, 158, 4611–4616. https://doi.org/10.1016/j.egypro.2019.01.746.