



Analysis of crack initiation in the press frame and innovation of the frame to ensure its further operation

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ABSTRACT

The paper describes numerical and experimental analysis of the causes of press frame failure with the aim to propose an optimal variant of its strengthening in order to guarantee safe operation of the press in its original working regime. The analysis of stress states in the frame during the operation was performed using the finite element method. Experimental analysis was focused on determination of residual stresses in the locations of failures.

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1. Introduction

Supporting structures of the technological equipment in mechanical engineering are exposed to intensive influence of force during their operation. The increase in productivity and the volume of production leads to the increased loading of the carrying elements. It results in increasing stress levels in the carrying elements, especially in the locations of their concentration. These effects decrease the time of safe operation of the technological equipment (its lifetime) and in some cases they initiate damage. Numerical and experimental methods [12–15] are most suitable for the stress and strain analysis of such carrying structures. These methods allow both prediction of the residual lifetime of supporting structures (on the basis of the known loading history) and identification of the causes of possible failures.

After approximately 10 years of operation of the press (Fig. 1a) used for cutting and forming side panels of washing machines, there were detected transversal cracks in the vertical columns of the press frame (Fig. 1b). They reached 30–40% of their cross-sections. The press with maximum projected force of a ram 3500 kN was equipped with an automatic limiter of the maximum loading force.

With respect to operational conditions it was necessary to operationally analyze the causes of crack initiation in the columns of the press frame and on the basis of such analysis to propose measures to be taken to ensure its further failure-free operation. The aim of this paper is to present the results obtained in the solution of this problem.

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