ABSTRACT

The doctoral dissertation concerns the methods of estimating operational reliability of building security systems.

It contains an original review of actual cases of failure mechanisms in modules and devices forming electronic security systems (ESS) along with their detailed analysis aimed at determining the factors affecting the unserviceability, technical scope of damage and potential consequences affecting the stability of maintaining an appropriate level of security of goods under their supervision. In selected cases, verification tests were also carried out to indicate the degree of degradation of electronic components.

Based on the provisions and procedures contained in the document of the Armed Forces Support Inspectorate: *Wymagania eksploatacyjno-techniczne dla XIX grupy SpW – Systemy i urządzenia specjalistyczne do ochrony obiektów* of May 8, 2020, the model of the ESS operation process operating in a military facility was mapped, which was presented in the form of the Chapman–Kolmogorov equation system. An original model of the operation process was proposed, taking into account the author's modifications aimed at its rationalization. It is also presented in the form of an analogous system of equations. Both models were solved and a computer exemplification was carried out for each of them, simultaneously assessing the legitimacy of the proposed changes.

The dissertation contains a detailed description of the author's destructive operational tests of miniature fuse-links with the same key technical parameters, performed in order to record the average breaking time of the circuit t_w of all the products taken into account. It consisted of: characteristics of the subject of the study and the interesting physical quantity, presentation of the assumptions that the experimental stand was supposed to meet, characteristics of the experimental attachment, description of the methodology and the course of the process of recording the characteristics of the current efficiency of the test module (preparatory part), setup of the stand, the results of the main stage and their quantitative and qualitative as well as economic analysis. Based on the results of proprietary experimental research, mathematical models of time-current characteristics of all products were developed. A non-linear regression was used with a power function as a regression model requiring only three parameters to faithfully reproduce the aforementioned characteristics. The measure of model fit to empirical data was carried out using the MAPE coefficient. The concept of the protective potential of DC circuits, which is an additional criterion for classifying miniature fuse-links as a tool for assessing the suitability of selected products in the ESS

application, was presented, and its possibilities were illustrated on the example of the obtained results. The concept of the damage intensity correction factor was also introduced, which enables the rationalization of the damage intensity factor estimated by the expert method when the results of practical operational tests are available, taking into account the impact of the selected damage factor.

Keywords: electronic security systems, building security systems, modelling, reliability, operation process, rescue subsystems.