FIGHTING WATER HAMMER IN THE PRESSURIZED ADDUCTION WORKS OF HYDROTECHNICAL SYSTEMS

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Abstract

This paper presents an experimentally proven mathematical model of determining theoretically the functional characteristics of an overpressure safety valve of open type, with a spring. These were implemented in a computer program that simulates the water hammer in a gravitational adduction, to quantitatively determine the suppressing effect of the valve. For the qualitative and/or quantitative effect of the water hammer, the elasticity of the fluid and of the pipe wall must be taken into consideration. Although the duration of the phenomena, $T_{LB} = t_f - t_0$, is usually relatively small, the study of the water hammer is of paramount importance since, in the absence of constructive solutions and/or adequate usage measures, dangerous overpressures and/or under-pressures may occur, leading to the loss of resistance and/or stability of the hydraulic system with serious economic and safety consequences. The goal of this study is to determine the sections and the moments in which dangerous pressures occur, as well as to find technical solutions to fight water hammers. As far as the values of the parameters are concerned (that is the pressures) and their time variation, respectively the manifestation of the water hammer phenomena, these are specific to each concrete hydraulic plant and, in fact, *we cannot make significant general assessments*. Some apparently insignificant particularities of the general design may be the cause of serious distinctions in the manifestation of the water hammer phenomena. Analytical formulae, graphic-analytical methods and numerical methods can be used to determine the dangerous pressure values.

Keywords: water hammer, safety valve, mathematical modeling, numerical simulation, overpressure suppression.