Abstract

Study of flow behavior in tubes -under pressure tubes- has a great importance for the construction and better operation of hydraulic Installations. If you allow the air to enter in such a single-phase water transferring tubes, a different kind of flow emerges that called two-phase flow. This type of flow is generally very different from the single-phase flow of water and depending on the hydrodynamic characteristics of the flow, the geometry of the pipe or physical properties of the lubricating composition of the fluids within the tube are present in the form of flow regimes with different patterns. Generally, entry of air into the water and formation of two-phase flow is desirable, because it prevents from formation of negative pressure. But with the production of undesirable sudden pressure (hummer impact) can lead to serious problems and damages to challenge the system and its usefulness. Lack of information and inadequate experimental and theoretical research in the field of two-phase flow have led to the design of hydraulic structures are most often based on previous experience or guesswork to be done in this area. Mathematical and numerical models for this type of water transferring lines have not been studied. Also, there are limitations on the use of physical models, such as high cost, large number of experiments, space requirements, etc. In the present study, the feasibility of the pipeline design was carried out with numerical simulations in FLUENT software and using sensitivity analysis, in both single and two-phase flow. In the meantime, priority of each flow in process of pipeline design was studied and the values of parameters involved in the design - Static head of height and dynamic heads of the pressure and speed - were compared with their values in operating conditions. Within these and after designate the most important parameters of the two-phase flows, its effect on the pressure changes (compared to single-phase mode) were determined by the type and quantity. In this model, initially for the percentage of the liquid and gas phase composition, the value of 5.89 was obtained. Though, the final rate of 5% was recorded for that from the nearest outlet pressure results compared with the observed data and was used for calibration. Numerical simulations have been carried out on the basis of the above considerations and finally between results of single-phase flow simulation and observed data emerged more discrepancy in comparison with the two-phase flow simulation and them. All of this means that despite the complexity of two phase flow of water and air, design of transferring lines based on two-phase flow by applying appropriate proportion of air and water is possible. Moreover, the results are the depreciation pressure drop and consequently less energy than single-phase flow.

Keywords: Two-phase flow, Pipelines, Water transferring, Two-phase flow patterns.

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