"PREVENTION OF EMERGENCY EVENTS IN PRESSURIZED PIPES DESIGNED FOR WATER CONSERVATION WITH AIR AND SURGE DAMPERS (CASE STUDY OF THE SARAY PUMP STATION IN THE KASHKADARYA REGION)"

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Abstract: This paper examines the issues of water conservation and ensuring the safety of pressurized pipes at the Saray Pump Station in the Kashkadarya region. The effectiveness of preventing emergency events and protecting the pipes from high pressure using special surge dampers and air intake systems is analyzed. The study focuses on how water-saving technologies affect the protection of pipes and the operation of surge dampers during emergency situations. Economic aspects, such as energy conservation and optimal use of resources, are also considered in the work.

Keywords: Water conservation, pressurized pipes, air intake system, surge dampers, emergency, safety, Kashkadarya region, Saray pump station.

Introduction

The efficient and safe use of water resources is closely linked to the development of modern technologies and infrastructure. In particular, ensuring effective management of water conservation and distribution is of great importance. The pressurized pipe system plays a key role in the processes of water transmission and distribution. However, accidents that occur in these systems, depending on their construction and operation, can pose a threat to human life and property safety. This research, conducted at the Saray Pump Station in the Kashkadarya region, analyzes the safe operation of pressurized pipes and the effectiveness of air intake and surge damper systems. The increase in pressure or surge oscillations in the pipe system can severely affect its operation, increasing the likelihood of major accidents. Furthermore, reducing energy consumption by conserving water resources is another critical task.

Main Section

The pressurized pipe system is a widely used infrastructure for the transmission of water and other liquids, and it is essential to control pressure for its effective operation. To ensure water conservation and the continuous, safe operation of the

designed pressurized pipes, several technological methods have been implemented. Pressure changes, hydraulic surges, and other issues in the pipe system can lead to system failures and emergency events.

In normal operation, an increase in pressure, strong surges, and the rapid rupture of pipes can occur. To prevent such accidents, the use of surge dampers and air intake systems enhances the reliability of the system. Hydraulic surges typically arise during the start-up or shut-off of pumps, which can result in sharp pressure changes and cause ruptures in the pipes. Surge dampers mitigate these processes and ensure stable operation of the pipe system.

Surge dampers are devices designed to reduce hydraulic surges and ensure safe operation of the system. Their effective operation helps maintain continuous operation of the system by reducing the impact of rapid pressure changes and fluid flow. Surge dampers and air intake systems are particularly important for protecting pressurized pipes in the Saray Pump Station, preventing damage from excessive pressure.

Surge Dampers and Their Function

Surge dampers are devices designed to mitigate hydraulic surges and ensure the safe operation of pressurized pipe systems. Hydraulic surges typically occur during the start-up or shutdown of pumps. In these cases, sharp pressure changes can lead to ruptures in pipes. Surge dampers help to alleviate these processes and stabilize the operation of the pipe system. At the Saray Pump Station, surge dampers are critical for preventing hydraulic surges and protecting the pipes from harmful pressures. Their efficient functioning ensures the uninterrupted operation of the system.

Air Intake Systems and Their Importance

Air intake systems play a crucial role in preventing the mixing of air and liquid and preventing pressure increases in water transmission systems. The purpose of air intake systems is to trap air bubbles in the system and prevent sudden pressure changes. In water pipe systems, air intake systems help prevent the buildup of excessive pressure, thereby reducing hydraulic surges.

At the Saray Pump Station, the air intake system works in conjunction with the surge dampers. Their integrated operation protects the system from hydraulic surges and reduces the pressure variations in the pipes. These systems also contribute to energy savings and ensure the efficient operation of the system.

Automatic Control Systems and Safety

The use of automatic control systems is crucial for ensuring safety in pressurized pipe systems. These systems allow for real-time monitoring of pressure and other parameters. The automatic systems installed at the Saray Pump Station monitor pressure changes in the pipe system and prevent emergency risks.

Dangerous situations, such as increased pressure or hydraulic surges, are detected by automatic systems and are quickly mitigated using surge dampers and air intake systems. The efficient functioning of these systems plays a critical role in ensuring the continuous operation of the pipe system and preventing emergencies.

Environmental and Economic Benefits

Water-saving technologies not only ensure safety but also have economic and ecological benefits. Through water conservation, energy consumption can be reduced, system performance optimized, and natural resources preserved. The implementation of such technologies in water supply systems helps to prevent wasteful use of water resources, reduce energy consumption, and protect the natural environment.

By using surge dampers and air intake systems at the Saray Pump Station, energy efficiency is improved, the safety of the pipe system is ensured, and the economic benefits of resource conservation are increased. The ecological impact of this process contributes to the conservation of natural resources and environmental protection.

Conclusion

The issues of water conservation and ensuring the safe operation of pressurized pipe systems are of great importance in increasing the efficiency of modern water supply and hydraulic systems. Hydraulic surges, pressure changes, and the flow velocity of liquids can significantly affect the operation, safety, and long-term efficiency of a system. Therefore, it is necessary to maintain a balance between components such as pipe diameter, fluid velocity, surge dampers, and air intake systems when designing the system.

The research conducted at the Saray Pump Station shows that using surge dampers and air intake systems minimizes hydraulic surges and stabilizes pressure. These systems play an essential role not only in ensuring safety but also in improving energy efficiency and conserving natural resources. Automatic control systems enable real-time monitoring of system parameters and help prevent accidents and dangerous situations, ensuring the continuous operation of the system.

Moreover, water conservation technologies also provide significant economic and environmental benefits. Effective water resource management, reduced energy consumption, and environmental protection are achieved. The results of the research demonstrate the possibility of implementing similar technologies at pump stations in other regions.

Overall, the integration of pressurized pipe systems, surge dampers, air intake systems, and automatic control systems ensures the effective, safe, and long-term operation of water supply and hydraulic systems. The development and widespread application of these technologies contribute significantly to global water conservation and the improvement of hydraulic system safety.

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