CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES

https://cajmtcs.centralasianstudies.org

Volume: 03 Issue: 12 | Dec 2022 **ISSN: 2660-5309**

HYDRAULIC IMPACT IN HYDRO SYSTEMS AND ITS CAUSES

O'tbosarov Shuhratjon Rustamjon ugli

Institute, Republic of Uzbekistan, E-mail: Sh.utbosarov@ferpi.uz

Xusanov Nurmuhammad

Teacher, Fergana polytechnic institute. Republic of Uzbekistan, E-mail: N.xusanov@ferpi.uz

Abstract

Hydraulic impact is a negative character of inertial forces in pipes, a change in speed and pressure as a result of local resistance in a space filled with liquid.

The causes of hydraulic shocks in pumping stations can be the starting and stopping of the pumping station, the gradual closing of the shut-off and control fittings, the release of air packs, hydraulic processes, etc..

ARTICLEINFO

Article history:

Received 16 Oct 2022

Revised form 15 Nov 2022

Accepted 17 Dec 2022

Ключевые слова: *hydraulic impact, pump, pipe, pressure, pumping station, speed, flow.*

---***---

Introduction. We will consider the most common types of them. Placing a device on an open valve in the outlet pipe of the pump is mainly a violation of the technological process, which can only be explained by the failure of a part of the pumping station equipment.

At the same time, the pressure increase in the initial section of the pipeline at pumping stations with a high lift height is limited by the pressure classification of the pump, as an example of the analysis of the transition process through the graph (Fig. 1).

In this case, the traditional assumptions developed for quality analysis are used: the pump is considered to be a link without inertia, it is considered that the hydraulic resistance of the pipe is concentrated at one point and does not depend on the flow acceleration.

There are other options for the development of the process, but in any case, the above conditions remain valid. Shutting down a pumping unit is the most common cause of dangerous pressure fluctuations.

According to the rules of technical use of pumping devices, the closing of the primary valves at the outlet should be controlled when stopping the pumps, but they cannot be controlled all the time, for example, by turning off the power supply from the motor or suddenly in case of disturbances in the process in which the liquid is being consumed can be deleted.

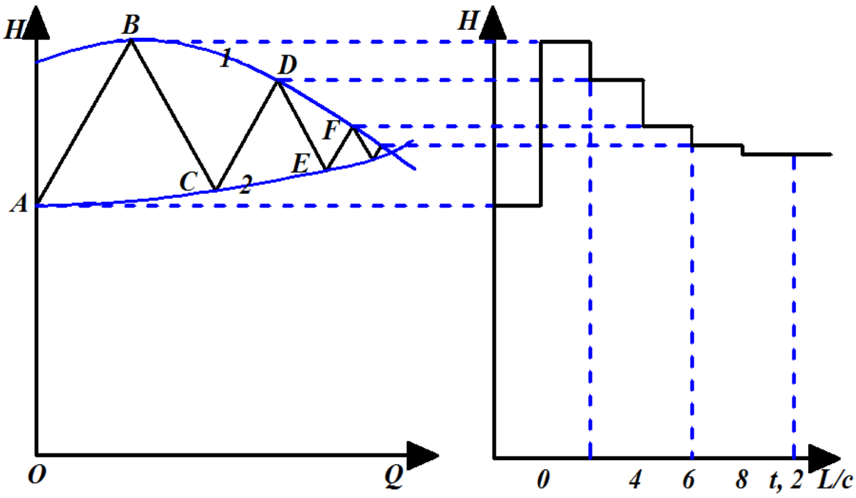

Figure 1. Graphical analysis of the transition process when starting the pump:

H – pressure; Q – fluid consumption; L – pipe length; t – time; c - shock wave propagation speed; 1 – pressure description of the pump; 2 - network consumption description; AB, BC, CD, DE, EF - wave classification of the pipe.

Hydraulic impact corresponds to a significant pressure amplitude at the same time and can be dangerous (Fig. 2).

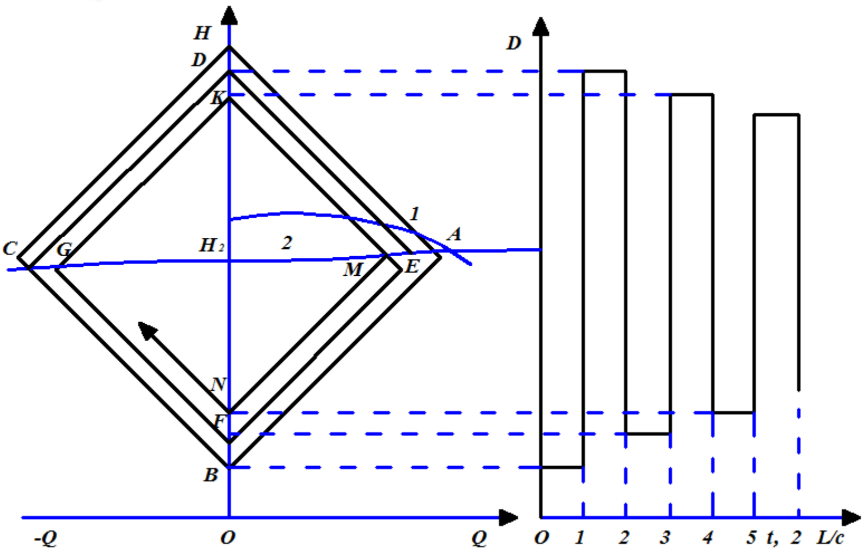

Figure 2. Graphical analysis of pressure fluctuations in the initial section of the pressure pipe when the pumping device is suddenly turned off:

H - pressure; Q – fluid consumption; L – pipe length; t – time; c - shock wave propagation speed; 1 – pressure description of the pump; 2 - network consumption description; AB, BC, CD, DE, EF, FG, GK, KM - wave description of the pipe.

In pressure pipelines, rapid closing (opening) of the valve at a sufficiently high pressure is observed before (in the direction of flow) and after the valves, a sharp increase in pressure is observed. The need to quickly close the valves or to reduce the current consumption depends on the functional nature of the hydraulic system.

Material and methods. As a result of slow closing of the valves, the delay in stopping the flow in the sections of the water supply pipes causes the pipes to bend excessively and, as a result, they burst.

Graphical and analytical analysis of hydraulic hammering shows its danger with partial or complete closure of the shut-off valve (Fig. 3). Pipe resistance is not taken into account, and during sudden closing (opening) of the closing device, it is considered less than the hydraulic impact phase.

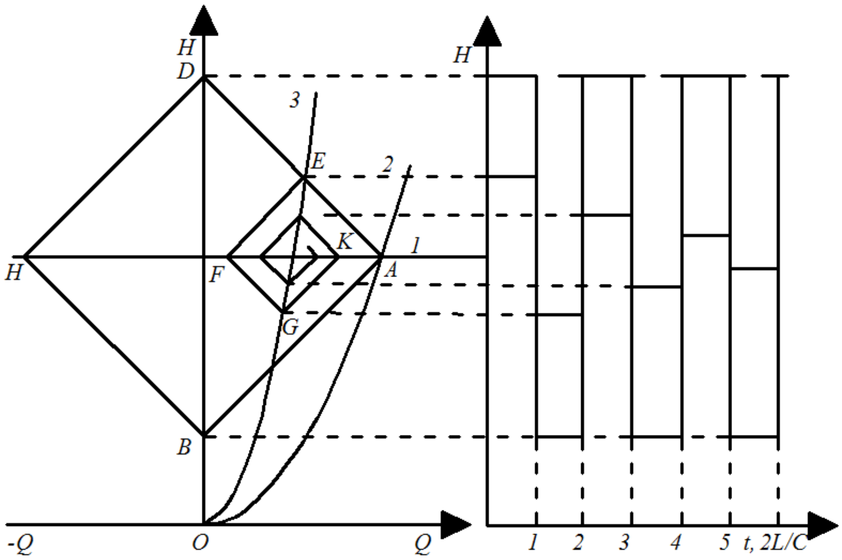

Figure 3. Graphical calculation of the hydraulic blow in complete and partial closing of the closing device:

1 - description of the reservoir; 2 - consumption description of an open tap; 3 - consumption description of partially open faucet; AB, BC, CD, DE, EF, FG, GK, KM - wave description of the pipe

In the closed position of the valve, the release of the air plug from the pipe through the suction cup is similar to the partially closed position of the valve. The exact amount of pressure increase depends on the performance of the system and can reach dangerous levels.

The effect of hydraulic hammering is as follows:

- First of all, they can cause direct damage to pipes, closing fittings, fastening elements of pump equipment.
- It can cause damage to auxiliary equipment, loss of pressure.
- In some cases, hydraulic hammering can stop the work process of the entire enterprise.

Non-hermeticity of pipes, failure of closing fittings often occurs in household heat supply systems, which also depends on their relative deterioration (Fig. 4-5).

Figure 4. Breakage of a cast iron pipe as a result of hydraulic hammering

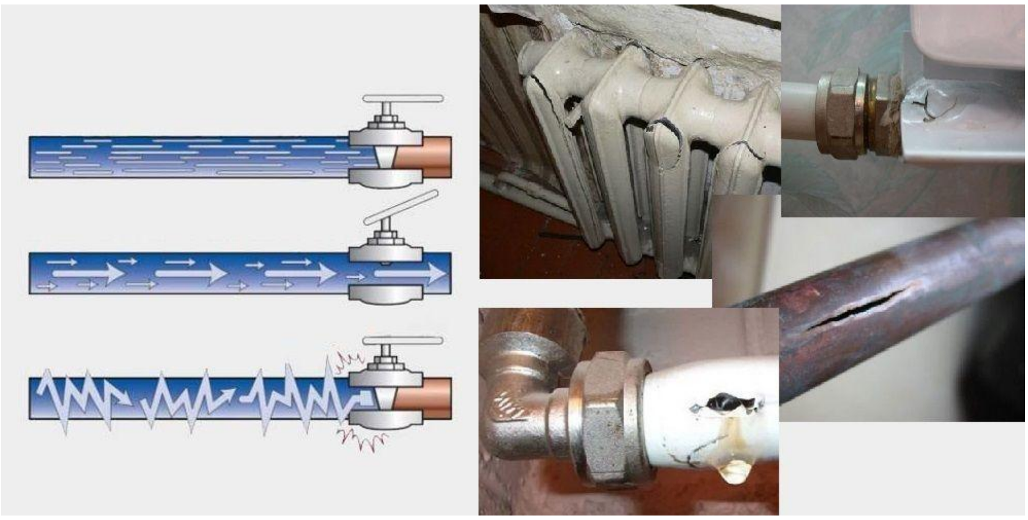

Figure 5. Failure of the gearbox as a result of hydraulic hammering.

Conclusion

Almost all water supply systems face the problem of hydraulic hammer. In pressure pipelines, rapid closing (opening) of the valve at a sufficiently high pressure is observed before (in the direction of flow) and after the valves, a sharp increase in pressure is observed. The need to quickly close the valves or to reduce the current consumption depends on the functional nature of the hydraulic system. The physical model of the hydraulic hammer phenomenon is a complex issue, and it is necessary to use the method of similarity of physical processes in the modeling process.

Reliable, shock-resistant devices have been developed to prevent and protect against hydraulic shocks, and a set of shock-resistant complexes for large-diameter water pipes has been developed. This complex also includes air valves to admit air or water in places where the flow may be interrupted, check valves in corner sections to separate the flow, and devices designed to flow water in the opposite direction after the pump is turned off takes.

REFERENCES

1. Mo'minov, O. A., & O'tbosarov Sh, R. TYPE OF HEATING RADIATORS, PRINCIPLES OF OPERATION AND THEORETICAL ANALYSIS OF THEIR TECHNICAL AND ECONOMIC CHARACTERISTICS.
2. O'tbosarov, S., & Xusanov, N. (2022). ASSEMBLY OF STRUCTURES AND WATER DIVIDERS. *Science and innovation*, *1*(A7), 780-784.
3. Mo'minov, O. A., Abdukarimov, B. A., & O'tbosarov, S. R. (2021). Improving support for the process of the thermal convection process by installing reflective panels in existing radiators in places and theoretical analysis. In *Наука и инновации в строительстве* (pp. 47-50).
4. Аббасов, Ё. (2020). Роль солнечных воздухонагревателей в теплоэнергетической отрасли и перспективы их развития в Республике Узбекистан. *Общество и инновации*, *1*(1), 1-13.
5. Abbasov, E. S. (2004). Calculation of the turbulized boundary layer in diffusor-confusor solar receivers. *Applied Solar Energy*, *40*(1), 92-94.
6. Mamatisaev, G., & Muulayev, I. (2022). ECOLOGICAL AND TECHNOLOGICAL PROBLEMS IN WATER COLLECTION FACILITIES. *Science and innovation*, *1*(A7), 767-772.
7. Mullaev, I. (2022). ҚУЁШ-ҲАВО ИСИТИШ ҚУРИЛМАСИНИНГ САМАРАДОРЛИГИНИ ОШИРИШ. *Science and innovation*, *1*(A7), 756-761.

8. Madaliev, M. E. U., Maksudov, R. I., Mullaev, I. I., Abdullaev, B. K., & Haidarov, A. R. (2021). Investigation of the Influence of the Computational Grid for Turbulent Flow. *Middle European Scientific Bulletin*, *18*, 111-118.
9. Azizovich, N. I. (2022). On The Accuracy of the Finite Element Method on the Example of Problems about Natural Oscillations. *European Multidisciplinary Journal of Modern Science*, 116-124.
10. Nasirov, I. (2022). АКТУАЛЬНОСТЬ ПРИМЕНЕНИЯ МЕТОДОВ МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ И МЕТОДОВ КОНЕЧНЫХ ЭЛЕМЕНТОВ В СТРОИТЕЛЬСТВЕ. *Science and innovation*, *1*(A7), 711-716.
11. Nosirov, A. A., & Nasirov, I. A. (2022). Simulation of Spatial Own of Vibrations of Axisymmetric Structures. *European Multidisciplinary Journal of Modern Science*, 107-115.
12. Akramovna, U. N., & Ismoilovich, M. R. (2021). Flow Around a Plate at Nonzero Cavitation Numbers. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *2*(12), 142-146.
13. Muminov, O., & Maksudov, R. (2022). HIDROTECHNICS PREVENT VIBRATIONS THAT OCCUR IN CONSTRUCTIONS. *Science and innovation*, *1*(A7), 762-766.
14. Abdullayev, B. X., & Rahmankulov, S. A. (2021). Modeling Aeration in High Pressure Hydraulic Circulation. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *2*(12), 127-136.
15. Abdullayev, B. X., & Rahmankulov, S. A. (2021). Movement of Variable Flow Flux Along the Path in a Closed Inclined Pipeline. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *2*(12), 120-126.
16. Xamdamaliyevich, S. A., & Rahmankulov, S. A. (2021, July). Investigation of heat transfer processes of solar water, air contact collector. In *E-Conference Globe* (pp. 161-165).
17. Husanov, N., & Abdukhalilova, S. (2022). HEAT EXCHANGE PROCESSES IN A SHELL-AND-TUBE HEAT EXCHANGER. *Science and innovation*, *1*(A7), 721-725.
18. Madaliev, E. U., & qizi Abdukhalilova, S. B. (2022). Repair of Water Networks. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *3*(5), 389-394.
19. qizi Abdukhalilova, S. B. (2021). Simplified Calculation of the Number of Bimetallic Radiator Sections. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *2*(12), 232-237.
20. Madraximov, M. M., Nurmuxammad, X., & Abdulkhaev, Z. E. (2021, November). Hydraulic Calculation Of Jet Pump Performance Improvement. In *International Conference On Multidisciplinary Research And Innovative Technologies* (Vol. 2, pp. 20-24).
21. Maqsudov, R. I., & qizi Abdukhalilova, S. B. (2021). Improving Support for the Process of the Thermal Convection Process by Installing. *Middle European Scientific Bulletin*, *18*, 56-59.
22. Abbasov, Y. S., & ugli Usmonov, M. A. (2022). Design of an Effective Heating System for Residential and Public Buildings. *CENTRAL ASIAN JOURNAL OF THEORETICAL & APPLIED SCIENCES*, *3*(5), 341-346.
23. Ismailov, M., & Xolmatov, I. (2022). КАНАЛИЗАЦИЯ ТАРМОҚЛАРИНИ ЛОЙИХАЛАШНИНГ АПТИМАЛ УСУЛЛАРИ. *Science and innovation*, *1*(A7), 744-749.
24. Рашидов, Ю. К., Орзиматов, Ж. Т., & Исмоилов, М. М. (2019). Воздушные солнечные коллекторы: перспективы применения в условиях Узбекистана. *ББК 20.1 я43 Э 40*.
25. Ismailov, M., & Xolmatov, I. (2022). OPTIMAL METHODS FOR DESIGNING SEWER NETWORKS. *Science and Innovation*, *1*(7), 744-749.
26. Ибрагимова, З. К. К., Хамдамова, Н. С. К., Умуркулов, Ш. Х. У., & Сабиров, Д. Р. У. (2022). ПОДГОТОВКА ПИТЬЕВОЙ ВОДЫ ИЗ МАЛОМОЩНЫХ ПОВЕРХНОСТНЫХ

ВОДОИСТОЧНИКОВ. *Central Asian Research Journal for Interdisciplinary Studies (CARJIS)*, *2*(Special Issue 4), 77-83.

27. Usmonova, N. A. (2021). Structural Characteristics of the Cavern at a Fine Bubbled Stage of Cavitation. *Middle European Scientific Bulletin*, *18*, 95-101.
28. Usmanova, N., & Abdukhalilova, S. (2022). SHELL-AND-TUBE HEAT EXCHANGER DESIGN WITH INCREASED TURBULENCE OF THE HEATED LIQUID FLOW. *Science and innovation*, *1*(A7), 726-731.
29. Madaliyev, E., Makhsitalayev, B., & Rustamova, K. (2022). IMPROVEMENT OF SEWAGE FLATS. *Science and innovation*, *1*(A7), 796-801.
30. Madaliyev, E., & Maksitaliyev, B. (2022). A NEW WAY OF GETTING ELECTRICITY. *Science and innovation*, *1*(A7), 790-795.
31. Koraboevich, U. M., & Ilhomidinovich, M. G. (2021, June). Calculation of the free vibrations of the boxed structure of large-panel buildings. In *" ONLINE-CONFERENCES" PLATFORM* (pp. 170-173).
32. Muminov, O. (2022). TYPES OF CAVITATION, CAUSING VIBRATION IN ENGINEERING AND WATER SUPPLY SYSTEMS. *Science and innovation*, *1*(A7), 732-737.
33. Abbasov, Y., & Usmonov, M. (2022). CALCULATION OF THEIR POWER AND HEATING SURFACE IN IMPROVING THE EFFICIENCY OF AIR HEATING SYSTEMS. *Science and innovation*, *1*(A7), 738-743.
34. Abobakirovich, Abdukarimov Bekzod, Abbosov Yorqin Sodikovich, and Mullayev Ikromjon Isroiljon Ogli. "Optimization of operating parameters of flat solar air heaters." *Вестник науки и образования* 19-2 (73) (2019): 6-9.
35. Abbasov, E. S. (2004). Heat exchange intensification in solar heat collectors of solar air heaters. *Applied solar energy*, *39*(4), 20-23.