Q&A

32Q2: I want to know the pump design considerations and parameters? *(U.G, Rwanda)*

> I need to use a pump for distribution in rural area within an existing water network. The proposed suction reservoir site is of 1697m elevation, and the delivery reservoir site is of 1829m elevation.

A: Many pumps are used in water supply facilities, such as raw water intake pumps, pumps used for water treatment in water purification plants, water transmission pumps that send water from water purification plant to water distribution reservoir, and water distribution pumps that distribute water from water distribution reservoir to customers.
In the design of the pump, it is necessary to select an appropriate pump according to its purpose and application of the pump, which satisfies the water demand and pressure. Also, it is important to be able to operate safely and stably.
In this question, I explain the point to keep in mind in the design of a water transmission pump, because you will plan to install a pump to send water from a distribution reservoir to another distribution reservoir.

1. Plan of pump facilities

We will determine the number of pumps, discharge volume, head, motor output and pump rotation speed to satisfy the planned water volume and required water pressure. We need to select pumps of the most suitable capacity commensurate with current and future water demands.
In addition, depending on the situation of the conduit such as a long watering distance, it is necessary to consider the water hammer pressure. And as a countermeasure, it may be necessary to install a surge tank, etc. to a pipeline.

2. Capacity and number of the pump

Transmission pump requires the capacity and number to operate with constant flow in the point where the pump efficiency is high.
However, if constant flow operation is difficult due to the lack of the capacity of the water distribution reservoir, you set the capacity and the number of pumps that can respond to the hourly change of water demand. The number of pumps is decided in consideration of planed quantity of water (maximum, minimum, average). Furthermore, it is desirable to install a standby pump in consideration of failure or repair.

3. Pump specifications

Total head of the water pump is calculated by summing actual pump head[*1] and head loss[*2].

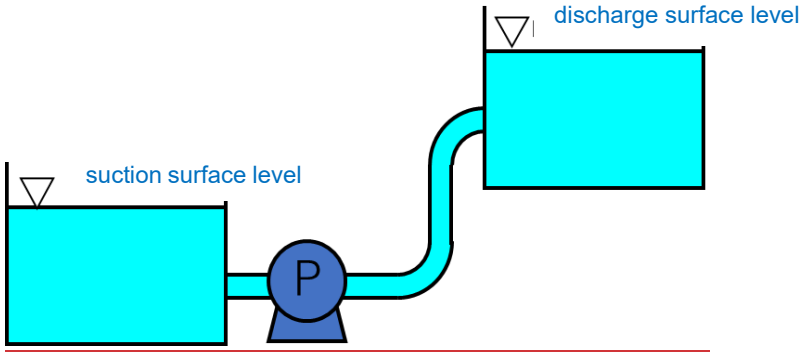
*1 Actual pump head: Height between a suction surface level and a discharge surface level

*2 Head loss: Potential energy due to the frictional resistance of the piping system

Please note that the suction surface level shall be set the low-water level (L.W.L.), and the discharge surface level shall be set the high-water level (H.W.L.). In addition, please note that the head loss shall calculate to the actual situation appropriately.

If total head is set lower than that actual condition, you cannot not satisfy water demand. If total head is set higher than that actual condition, you operate the pump with low efficiency, and possible to cause the occurrence of cavitation.

The pump discharge flow rate is decided by plan quantity of water and pump number.



4. Pump efficient operation

It is necessary to design an appropriate control system regarding a motor for a pump. Electricity costs at a pumping station occupy big ratio in an operational expense of water utility. Therefore, it is necessary to examine saving energy such as the adoption of a high efficiency pump and an effective control system. Please note that if you don't install an energy-saving equipment and system, it is difficult to achieve energy saving until a time of renewal.

In the design of a pump, various studies are required as mentioned above. It is important to ask an expert for detailed examination as needed after studying the site situation.

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