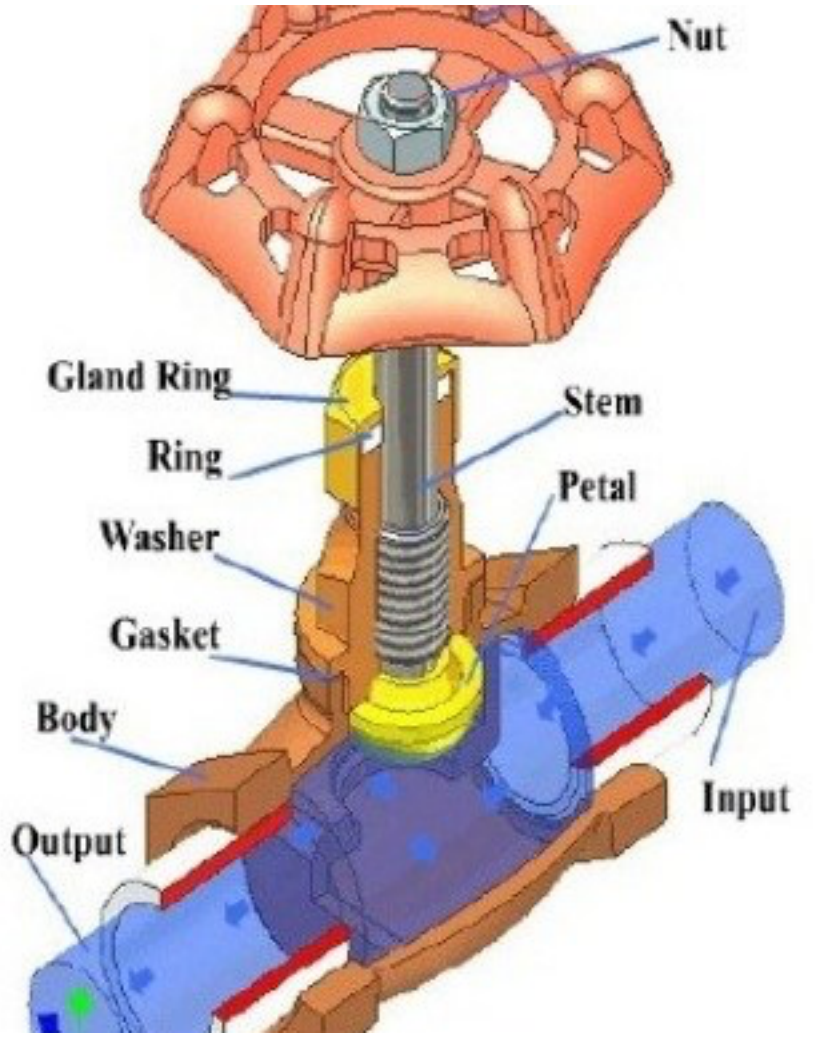
How to choose a control valve? Conditions affecting control valve selection

Sivaranjith



Valves

What is a control valve?

A **control valve** is a final control element used to regulate the flow of liquid through a channel. They can throttle flow over a range of fully open to fully closed. A control valve is installed perpendicular to the flow, a controller can adjust the valve opening at any stage between ON & OFF.

Conditions affecting the valve selection:

The control valve is important in the process operation. Not only are the

specifications of the valve itself important, but it is also necessary to sufficiently consider other matters related to the control valve in order for it to function as required. The following are the main points to keep in mind when specifying a control valve:

1. Process Target:

It is important to understand well the process including the control valve. one should sufficiently understand the start-up and shut-down of the process itself, including proper conduct in an emergency situation.

2. Purpose of use:

The control valve is used for different purposes, Control valves are used to control the level in a tank, there are also valves that control a pressure drop from a high-pressure system to a low-pressure system.

There are control valves that control the cut-off and release of fluids, mix two fluids, separate the flow into two directions, or exchange fluids. Therefore, the most appropriate control valve is chosen after determining the purposes of a particular valve.

3. Response time:

The time taken to respond to the control valve after changing the manipulation signal is the response time of the control valve. The control valve experiences a period of dead time before the plug stem can overcome friction from the packing and begin to move. There is also a period of operating time needed to move the required distance. It is necessary to consider the effect of these factors on the controllability and safety of the entire system. For good control valve, the response time should be less.

4. Specific characteristics of the process:

Determine in advance the presence or absence of self-equilibrium, the range of variation in the required flow rate, the speed of response, etc.

5. Fluid conditions:

The various conditions of the fluid can be obtained from the process data sheet, and these become the basic conditions for the selection of the control valve. The following are the main conditions that will be used:

- Name of fluid
- Components, composition
- Flow rate
- Pressure (at both the inlet and outlet ports of the valve)
- Temperature·
- Viscosity
- Density (specific gravity, molecular weight)
- Vapour pressure
- The degree of superheating (water vapour)

6. Fluidity, special characteristics:

One should determine the presence of possible dangers regarding the nature of the fluid, corrosiveness, or slurry.

7. Rangeability:

In the case where one control valve cannot provide the necessary rangeability, consideration of the use of two or more valves becomes necessary.

8. Valve differential pressure:

The rate of control valve pressure loss in a piping system is a complicated problem. As the rate of the valve's differential pressure decreases relative to the overall pressure loss of the entire system, the installed flow characteristics

shift away from the inherent flow characteristics. Although it is impossible to generalize, a value for PR between 0.3 and 0.5 is usually chosen.

9. Shut-off pressure:

The highest value of the differential pressure at the control valve shut-off time is important data to be used in the choice of the actuator and in ensuring a sufficiently strong design for each part of the control valve.

Designs in which the intake pressure is set equal to the maximum shut-off pressure are numerous, but this method might result in over-specification of the valves. Thus it is necessary to consider actual use conditions when determining the shut-off pressure.

10. Valve-seat leakage:

It should be clearly determined the quantity of seat leakage can be tolerated at time of valve shut-off. It is also necessary to know the frequency with which the valve shut-off condition occurs.

11. Valve operation:

There are mainly two types of operation for control valve:

- **Operation according to the valve input signal:** The opening and closing direction of the valve is adjusted according to whether the input signal to the valve increases or decreases, but the operation is not necessarily the same as the fail-safe operation. When the valve closes as a result of the increased input, this is called direct action. When the valve opens as a result of the increase of the input signal, this is called the reverse action.
- **Fail-safe operation:** The movement of valve operation is in a safe direction of the process in case the input signal and the power supply is lost. The operation is classified as “air failure close,” “open,” or “lock.”

12. Explosion-proofing:

Based on the location where the valve is installed the control valve needed sufficient explosion-proof rating, both the electrical used with the valve should have the explosion proof.

13. Power supply:

Pneumatic power supply to the valve actuation should be sufficient and it is important to provide clean air with water, oil and dust removed in order for parts such as the actuator and positioner to function without failure. At the same time, one must determine the actuative pressure and capacity so as to secure enough actuative power.

14. Piping specifications:

Determine the specifications of the piping in which the control valve is installed. The important specifications include the diameter of the pipe, the piping standards, the quality of the material, the type of connection to the piping, and so on.