Bring on the Butterfly

Butterfly Valves

Zone valves. Ball valves. Globe valves. Butterfly valves. These are the control valves used in HVAC today. Whereas zone, ball, and globe valves are used in small valve applications, butterfly valves are often used when water applications call for valves larger than 2" (3.1 cm) or when the flow coefficient (Cv) is greater than 150.

Butterfly valves have several advantages over other types of valves. Size, cost, control, and workable options come into play when seeking tight control and economic solutions.

Size

Butterfly valves are more compact and lighter than comparable globe valves or ball valves. They can be built in standard sizes up to 24" (61 cm) and even bigger in special applications. It is not unheard of to see valves larger than 48" (122 cm).

Cost

Butterfly valves are less expensive than other valves when the valve size is greater than approximately 2.5" (6.4 cm). This is due to fewer parts and simplicity of design.

Control

Butterfly valves offer better control and throttling range over other control valves when the size is bigger than 2.5" (6.4 cm). Bubble-tight close off is standard at very high close-off pressures. Very good control is provided when the valves are sized properly.

Options

All control types are available with or without fail-safe return, and they can be fitted with all the feedback bells and whistles you desire.
The construction material can be selected to fit almost any corrosive liquid or environment.

Sizing for Success

The success of a butterfly valve depends considerably on proper sizing. The method used to size the valve depends on whether you want to size for two-position or modulating control.

Two-Position (On/Off): Transitions can be expensive and difficult to install, especially if there are space limitations or high ceilings; therefore, a line size valve is most often the best choice for two-position control. You can also use the Cv formula to downsize the valve smaller than the feed line. Make sure you configure your control for the full 90° valve stem rotation.

Cv Formula:

$Cv = GPM / \sqrt{\Delta P}$ (psi)
If the SI equivalent (Kv) is known, use
$Cv = Kv/0.86$

Modulating Control: When sizing a butterfly valve for modulating control, use the formula above. This is the same formula used for sizing a globe valve or a ball valve.

First, determine the Cv. Then, select the open valve Cv at 60° stem rotation. All butterfly valves exhibit equal percentage characteristics from 0° to 60° rotation. They exhibit a quick-opening characteristic from 60° to 90°. Configure your control from 0° to a maximum of 60° rotation. This provides the best equal percentage control. Typically, the mechanical consultant gives the differential pressure (**ΔP)** in the specification. For those times when the mechanical consultant is not available, 5 psi is a good **ΔP** for modulating control applications. The gallons per minute (GPM) can be found on the control drawings or the specifications of the equipment being controlled. Applications include heat exchangers, cooling tower bypass, condenser water, chilled water isolation, and hot or chilled water change over.

Considerations When Sizing Butterfly Valves

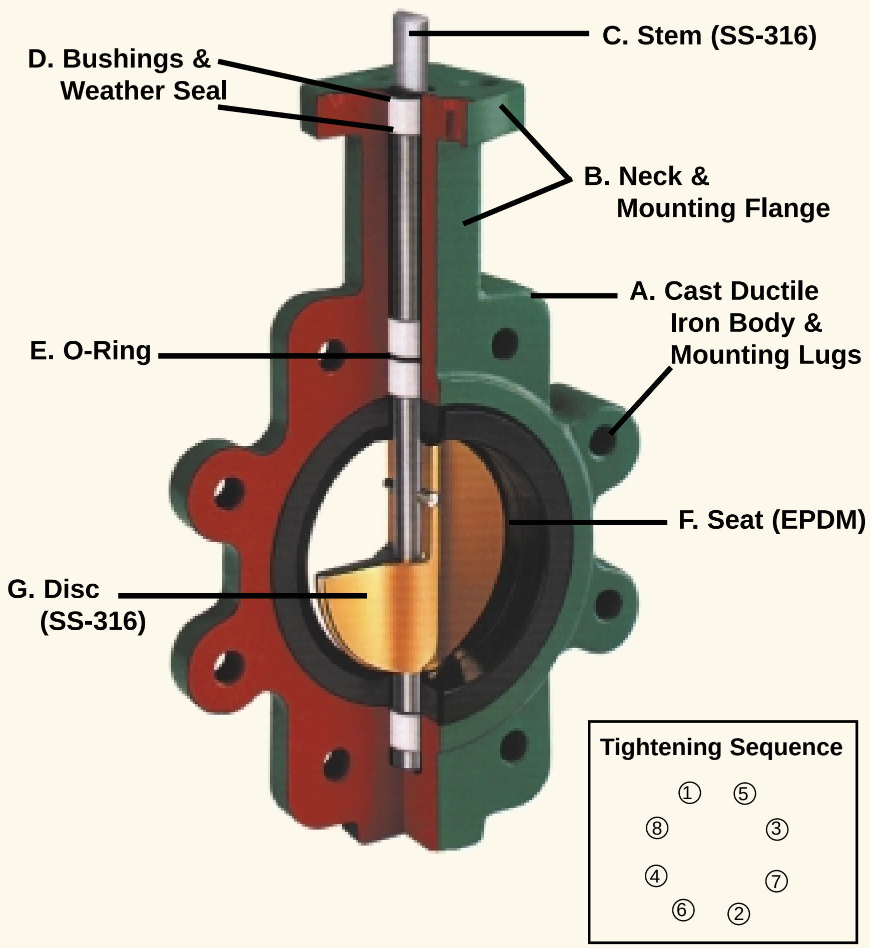
The advantages are great, but there are a few issues that should be considered when selecting butterfly valves. For instance, water hammering can be a problem if the valve is closed too fast, and as with any down-sized control valve, cavitation can also cause trouble.

Cavitation: If a valve is sized too small for the flow, the velocity increases, pressure decreases, and bubbles form in the water. As the bubbles burst, the resulting high pressure explosions damage and ultimately destroy the inside of the pipe wall. This should be a concern if your valve is two or more sizes smaller than the feed line.

Close off: Butterfly valves have inherently high close-off ratings. Close-off pressure is the calculation of the pump head pressure plus any high-rise building head pressure (.433psi/ft or 9.8 kPa/m) which could affect the actuator used on the valve. The valve body pressure rating should also be a consideration in very tall buildings.

technical

Kele Butterfly Valve



Water hammering: Water hammering is caused by high velocity water that is closed off quickly. The inertia causes a backpressure wave, which propagates in the pipe between the closed valve and the pump. If the valve is closed slowly (longer than ten seconds) then the pressure wave is reduced to an acceptable amount.

Butterfly Valve Construction

The components of a standard butterfly valve are surprisingly simple and, when the valve is properly sized, exceedingly efficient.

A. Cast Ductile Iron Body & Mounting Lugs - Ductile iron is much stronger than cast iron bodies and is used to house the disc and mount the valve to the pipe.

B. Neck & Mounting Flange - Part of the cast body of the valve, the neck contains the valve stem housing and the actuator mounting flange.

C. Stem - The stem is the drive shaft between the actuator and the disc. Stainless steel is the recommended material for extended life.

D. Bushings & Weather Seal - The stem is aligned with bushings and weather seals to prevent side loading problems and outside contamination of the stem and neck.

E. O-Ring - The O-Ring is an added feature to provide further protection from stem leakage.

F. Seat - The seat is the seal between the disc and the valve body. Most seats are Ethylene Propylene Diene Monomer (EPDM) and have superior abrasion resistance, temperature range, chemical resistance, and elasticity. No other gaskets are needed since the seat extends around the valve face to make contact with the mating pipe flange.

G. Disc - The disc closes the valve to fluid or low-pressure steam. Discs are made of many materials, including aluminum bronze, ductile iron, and stainless steel. 316 Stainless steel is the most versatile due to its durability and resistance to most chemicals found in HVAC systems.

by Eric Karl