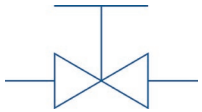
Safe Valve Selection

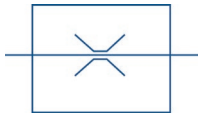
Swagelok

Valve Function

1. On-Off

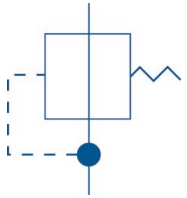


2. Flow control



3. Directional flow

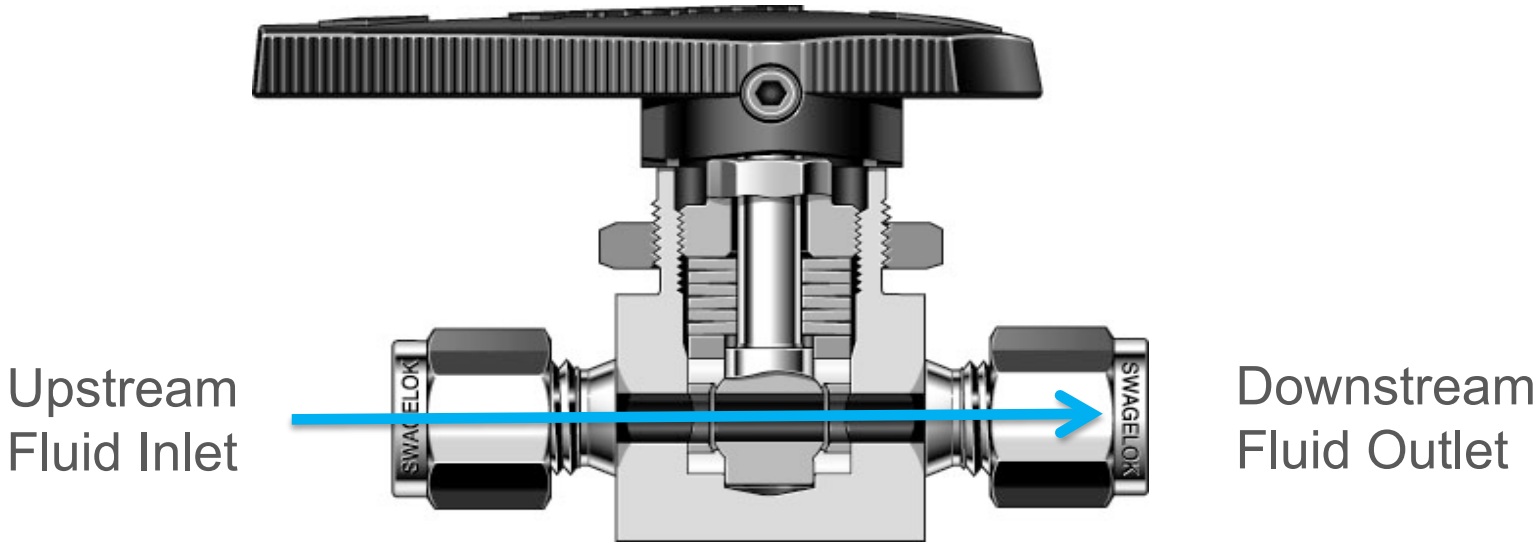
4. Over-pressure protection



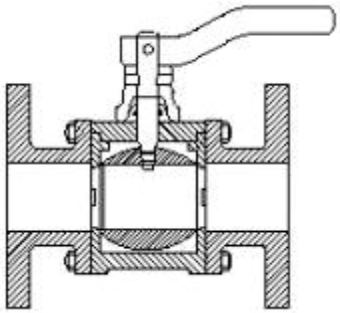
5. Excess-flow protection

Common Terms

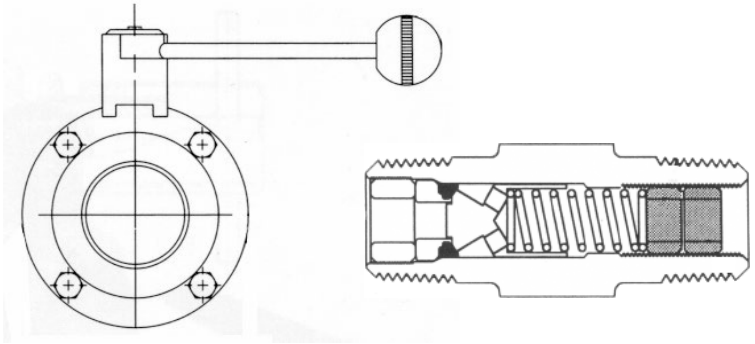
- Flow: to move in a steady or continuous way



Common Valve Types

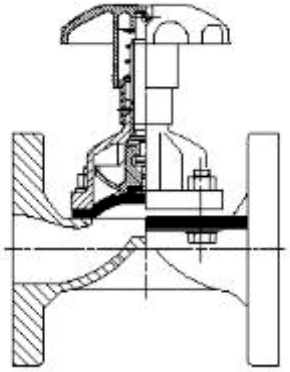


Ball Valve

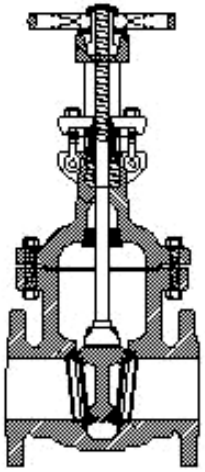


Butterfly Valve

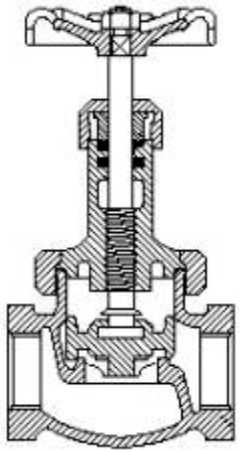
Check Valve



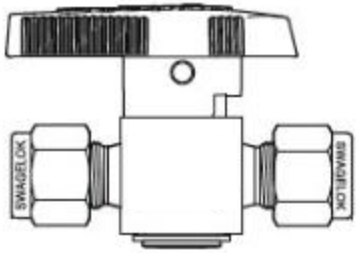
Diaphragm Valve



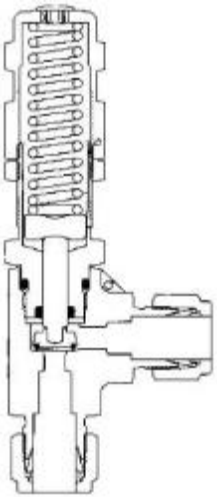
Gate Valve



Globe Valve

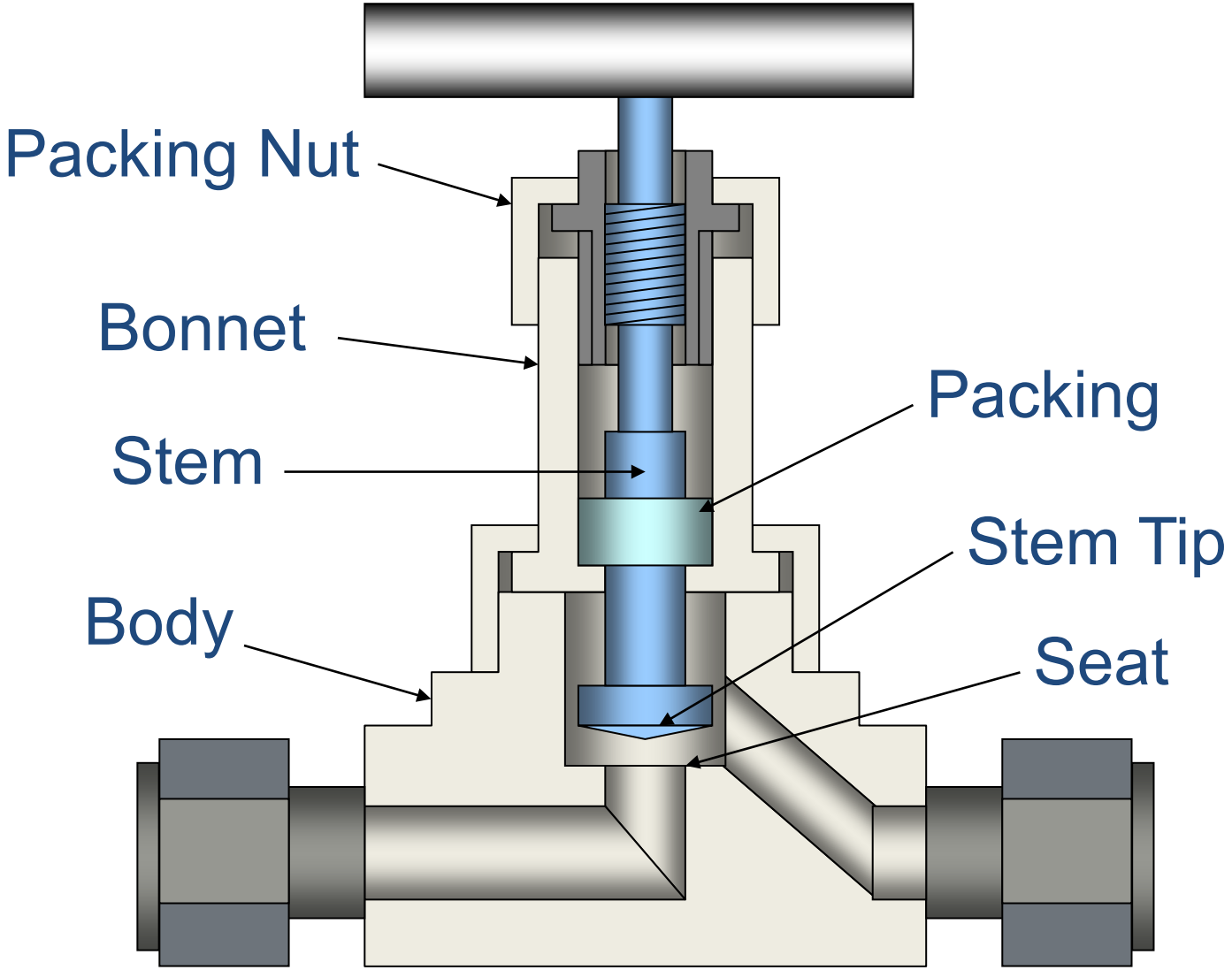


Plug Valve



Relief Valve and Safety

Construction - Material

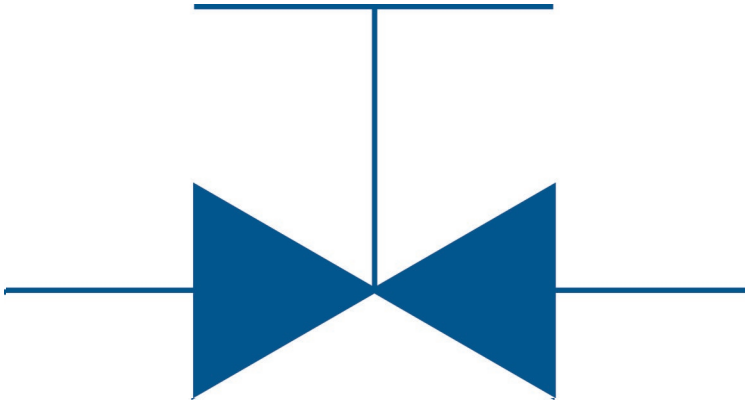


Flow Coefficient (C_v)

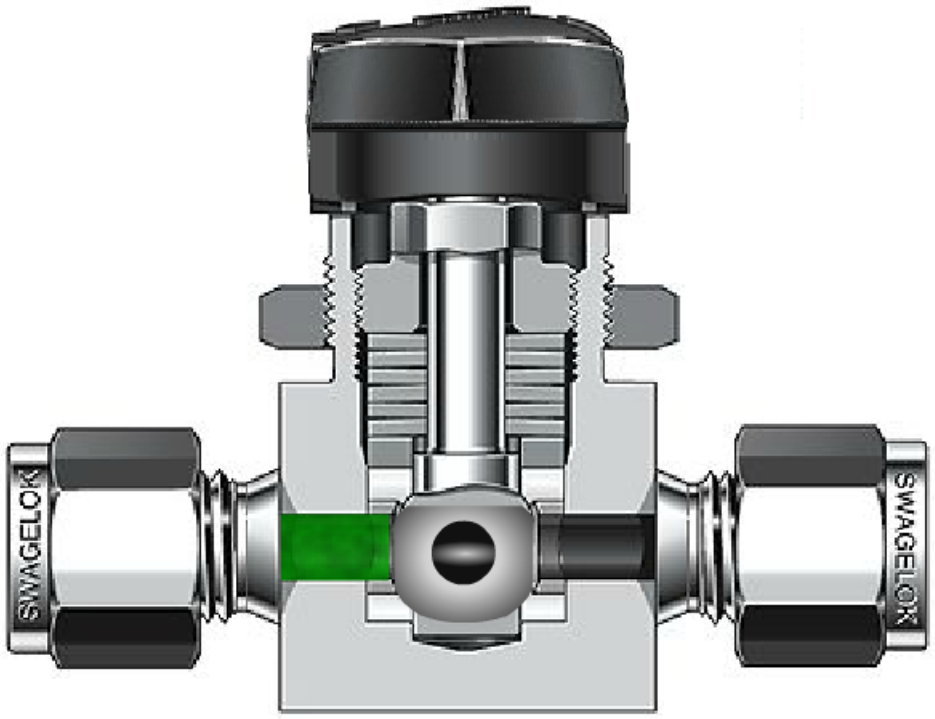
- Valves permit flow based primarily on factors including diameter of end connection and the valve's flow path.
- To help you understand a valve's ability to allow flow, manufacturers provide a flow coefficient, or C_v, for their valves. This will help you select the right valve for your fluid system.
- A higher C_v means a higher flow rate. Depending upon the valve type and application, you may see a C_v near 0.
- The definition of C_v is the # of gallons of water that will flow through the valve with a 1 PSI pressure differential when the valve is open.

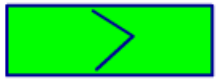
Valve Function
On-Off

- Purpose
  - Stop fluid flow
  - Re-start fluid flow
- Types
  - Ball
  - Diaphragm
  - Gate
  - Plug
  - Other



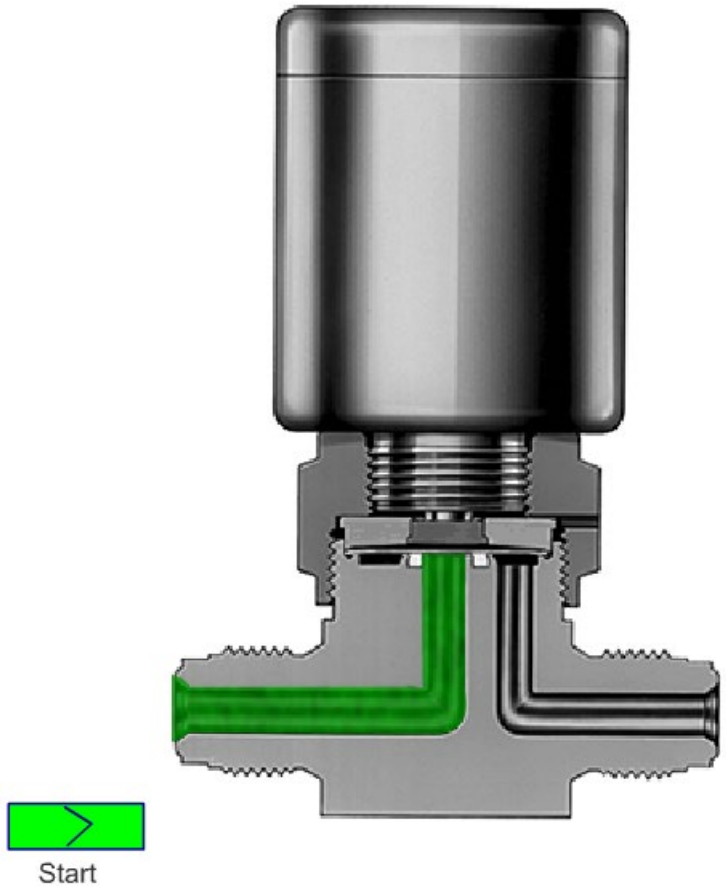
On-Off: Ball



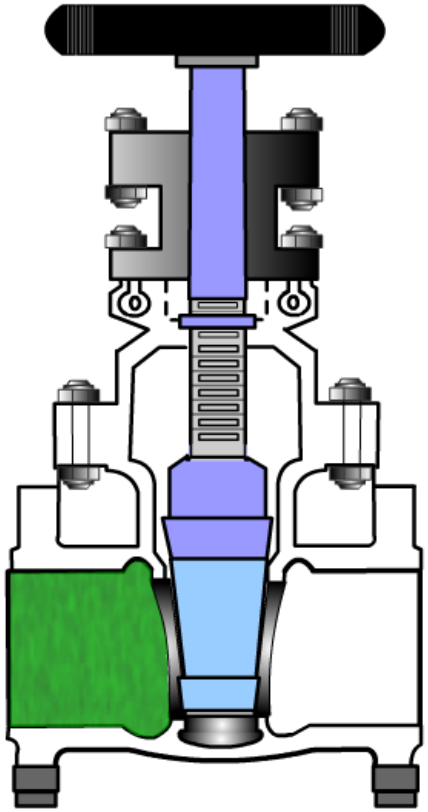


Start

On-Off: Diaphragm

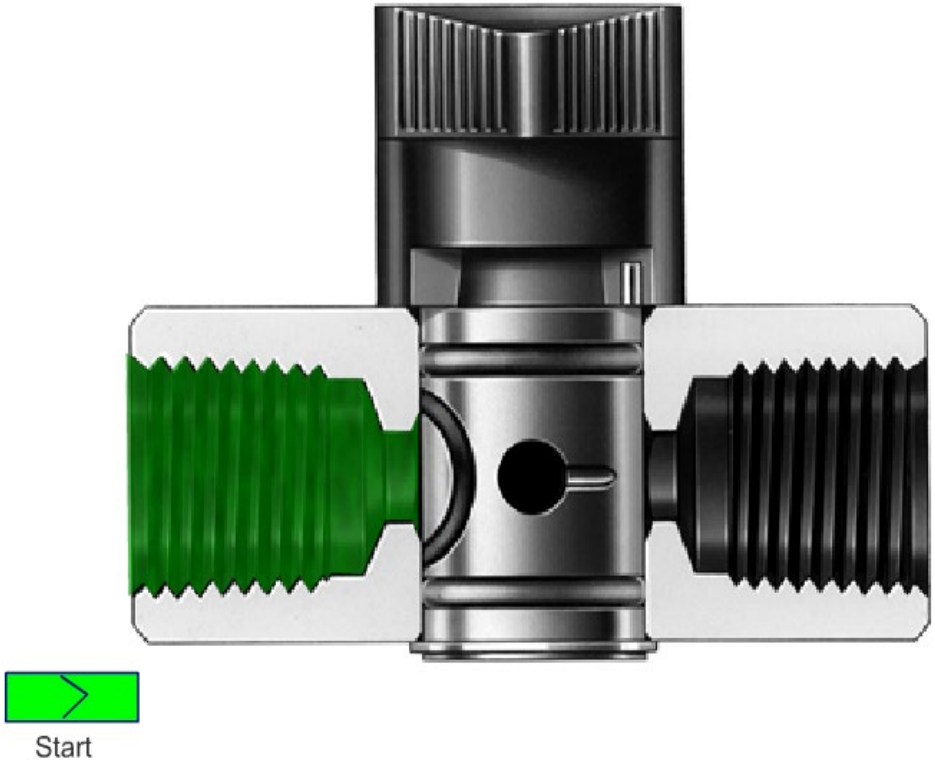


On-Off: Gate



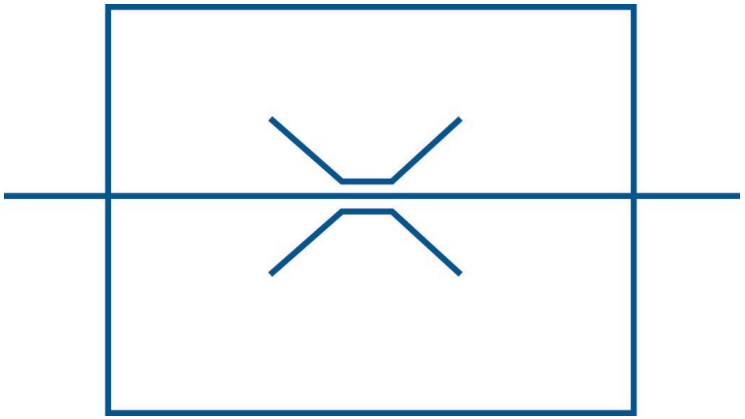
Start

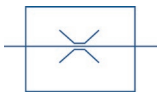
On-Off: Plug



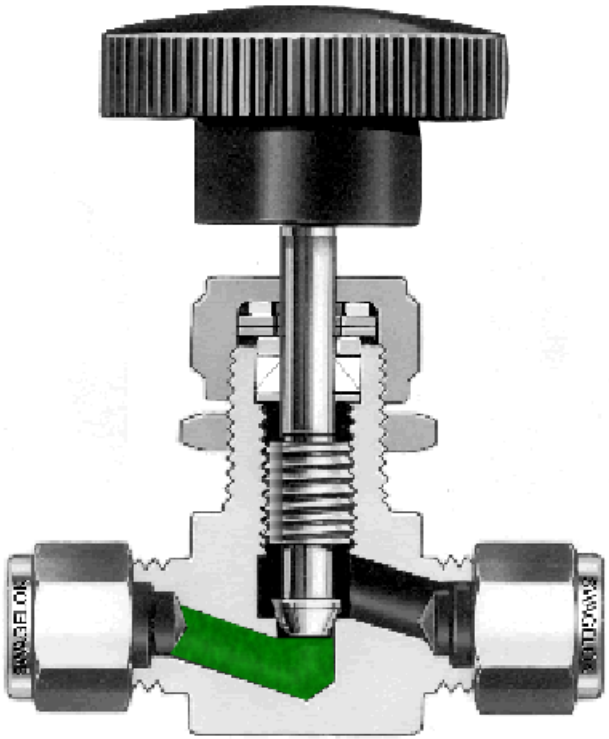
Valve Function
Flow Control

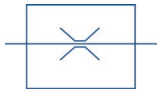
- Purpose
  - Regulate flow
- Types
  - Needle
    - Regulating
    - Fine metering

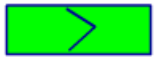




Flow Control: Regulating

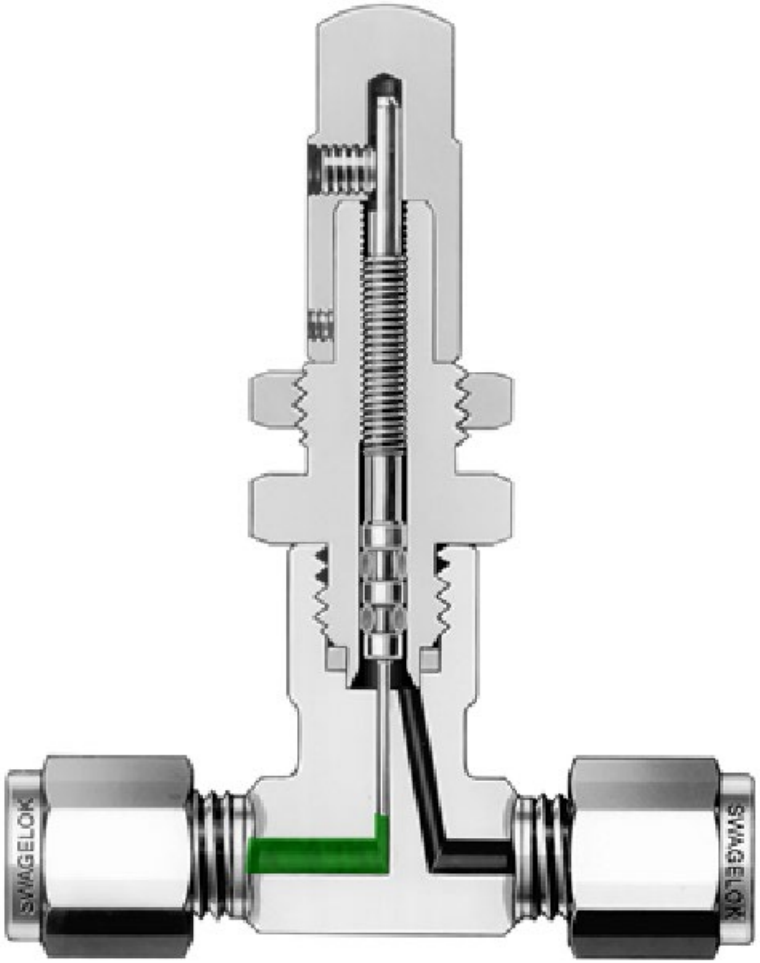


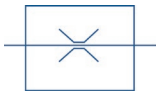


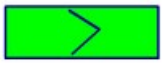


Start

Flow Control: Fine Metering



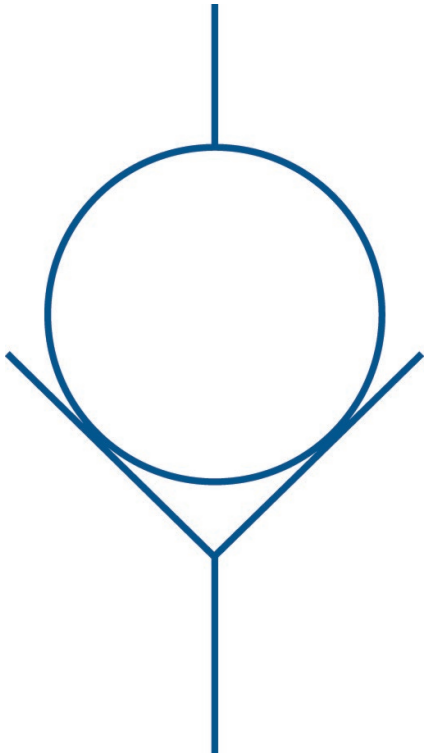


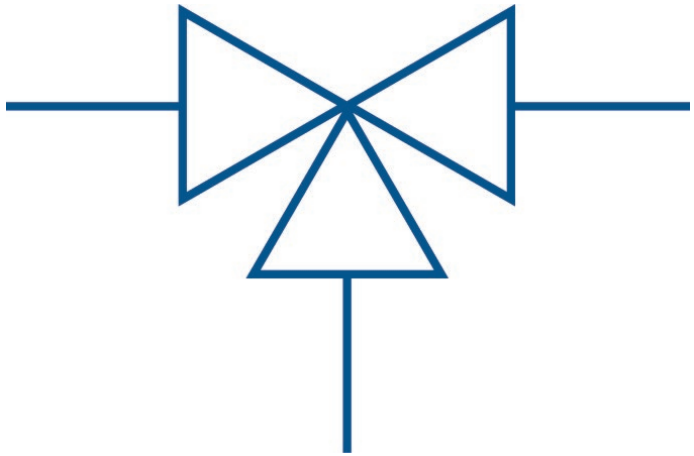


Start

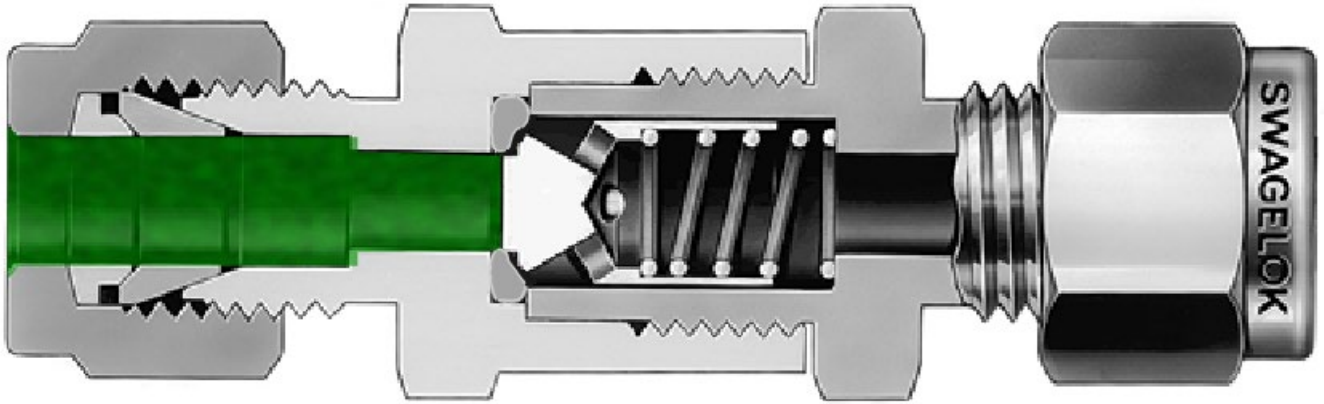
Valve Function
Directional Flow

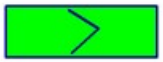
- Purpose
  - Ensure fluid flow in one direction only
- Types
  - Check
  - Multi-port ball





Directional Flow: Check



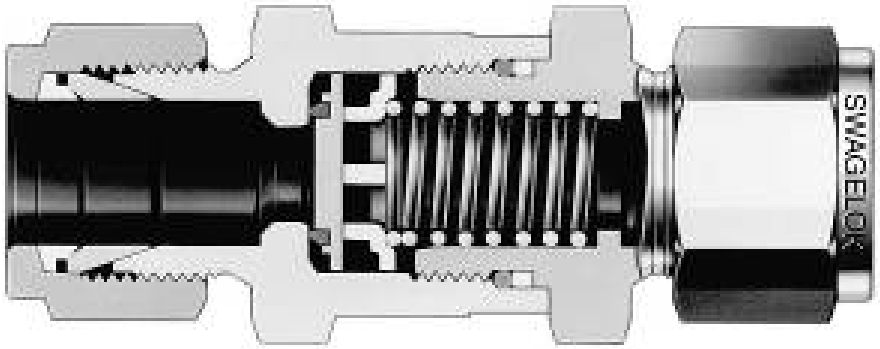


Understanding Crack and Reseal

Nominal Cracking Pressure: The **average** pressure differential required to open the check valve

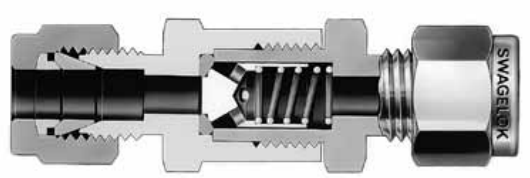
Cracking Pressure Range: The maximum (and minimum) **upstream** pressure required to open

Reseal Pressure: The maximum **downstream** or **upstream** pressure required to create a seal

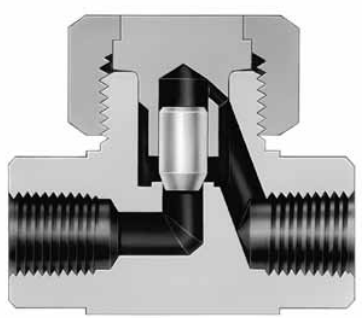


Design Considerations

- Operation
  - Spring check (A)
  - Lift check (B)
  - Swing check

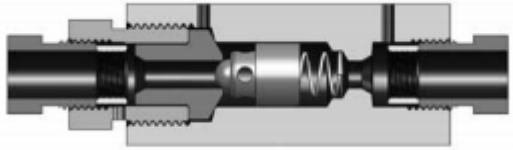


A

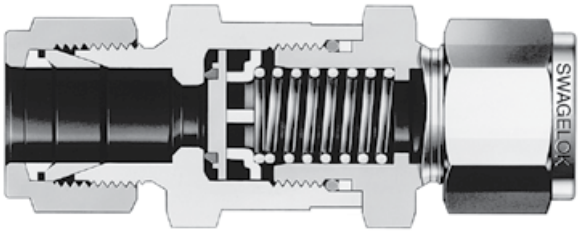


B

- Closure type
  - Ball (C)
  - Poppet (D)

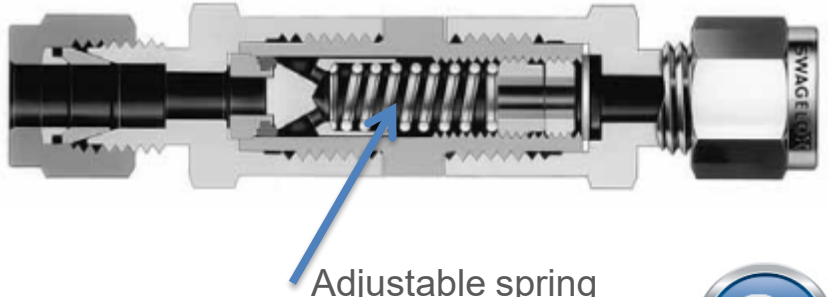


C

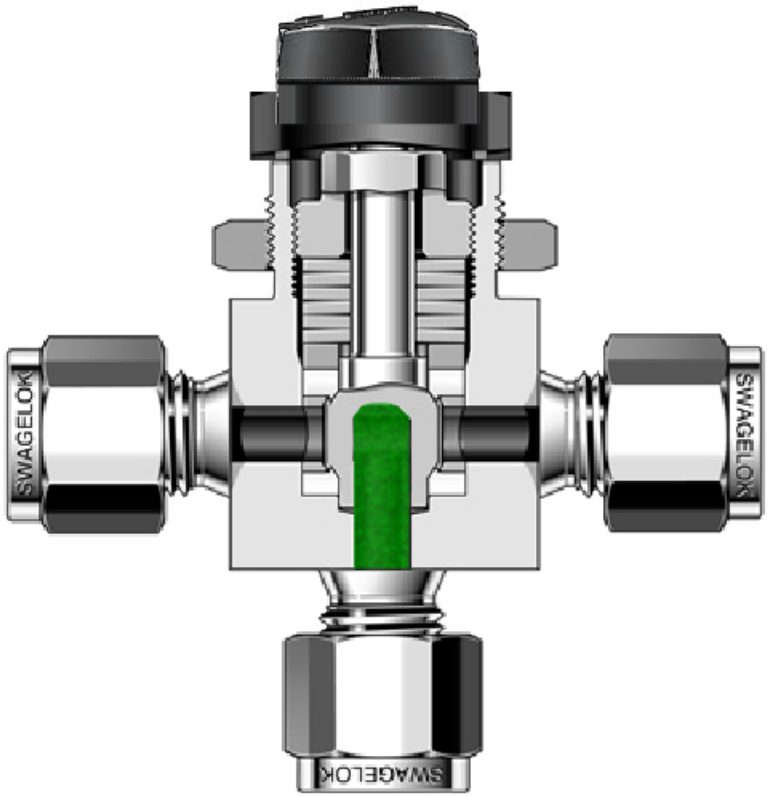


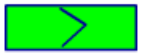
D

- Adjustability
  - Some check valves will come preset from the factory. Select a style that permits adjustments if your system will require fine tuning.



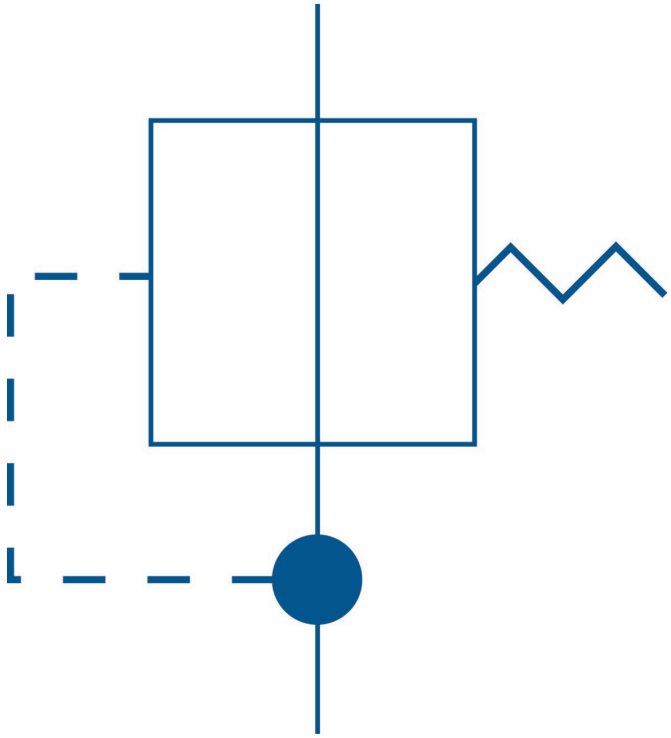
Directional Flow: Multi-Port Ball

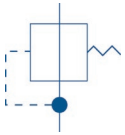




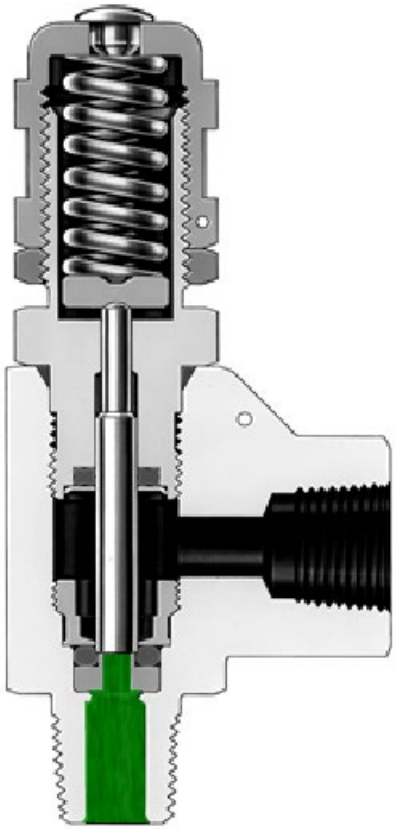
Valve Function
Overpressure Protection

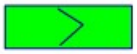
- Purpose
  - Relieve system pressure
- Types
  - Relief
    - Proportional
    - Safety



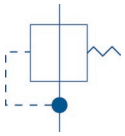


Overpressure Protection: Proportional Relief

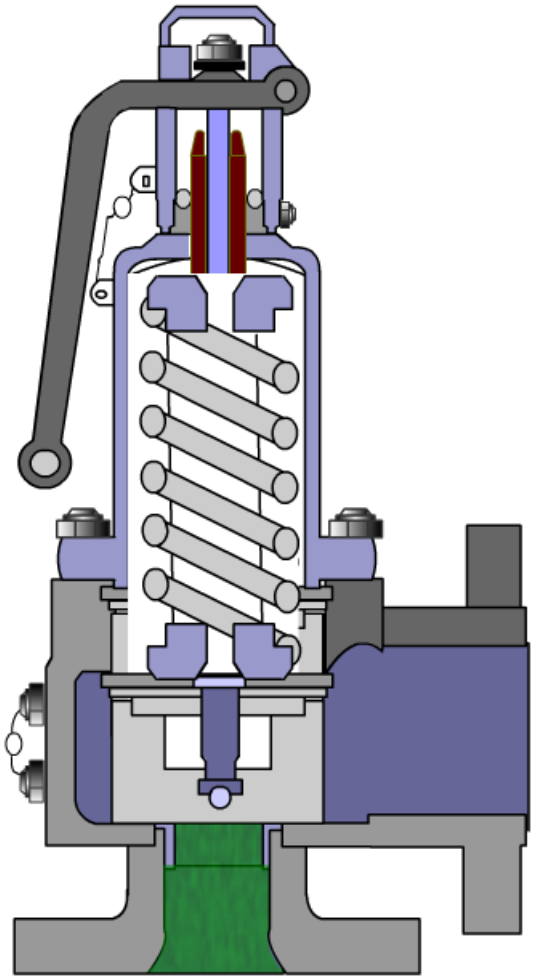


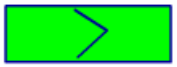


Crack

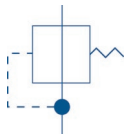


Overpressure Protection: Safety Relief





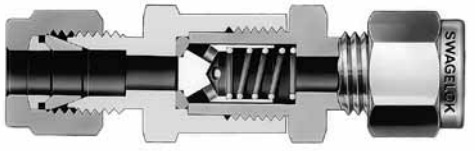
Start

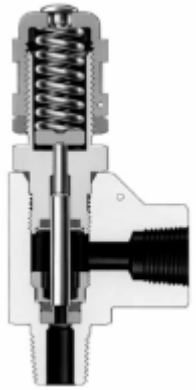


Check Valves vs. Relief Valves

Check Valves

- Designed to stay **open**
- Close quickly to prevent flow in opposite direction
- Crack at low enough pressures to open a system



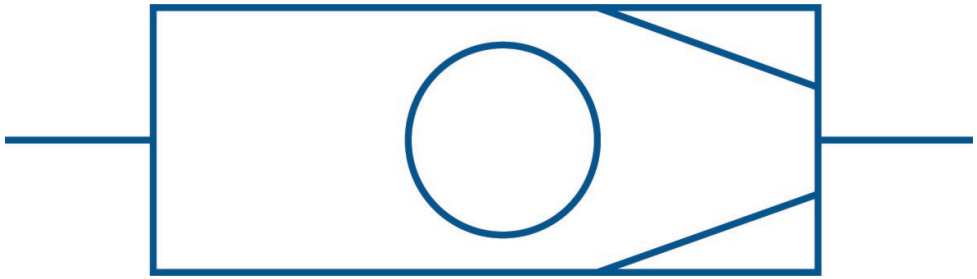


Relief Valves

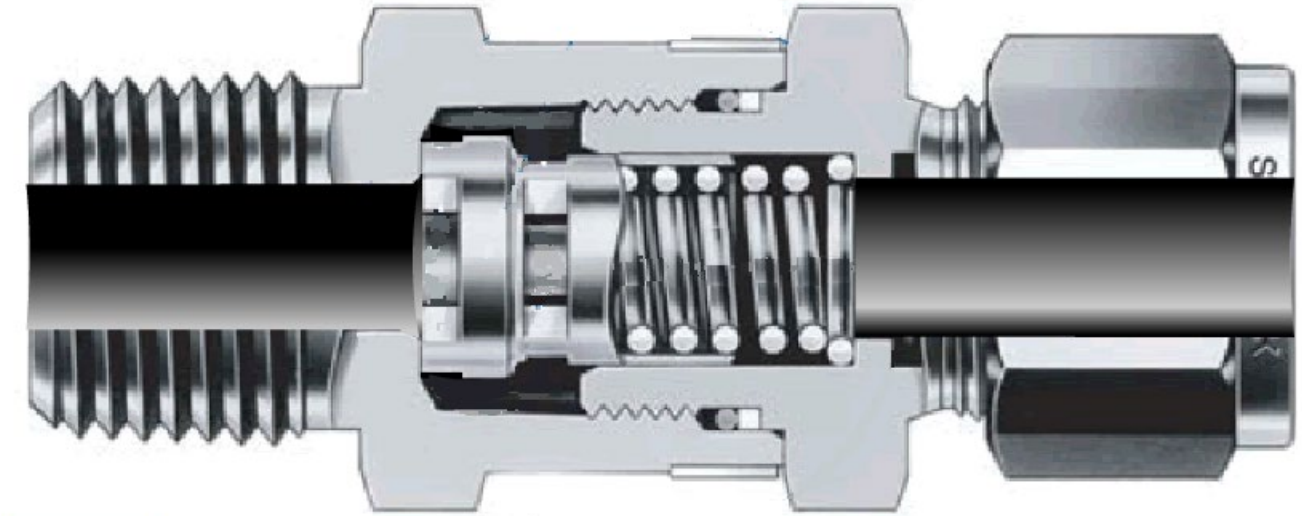
- Designed to typically be **closed** and open at a certain set pressure
- Most close once pressure drops as the product is bled

Valve Function
Excess Flow Protection

- Purpose:
  - Contains uncontrolled release of system media
- Types
  - Excess flow

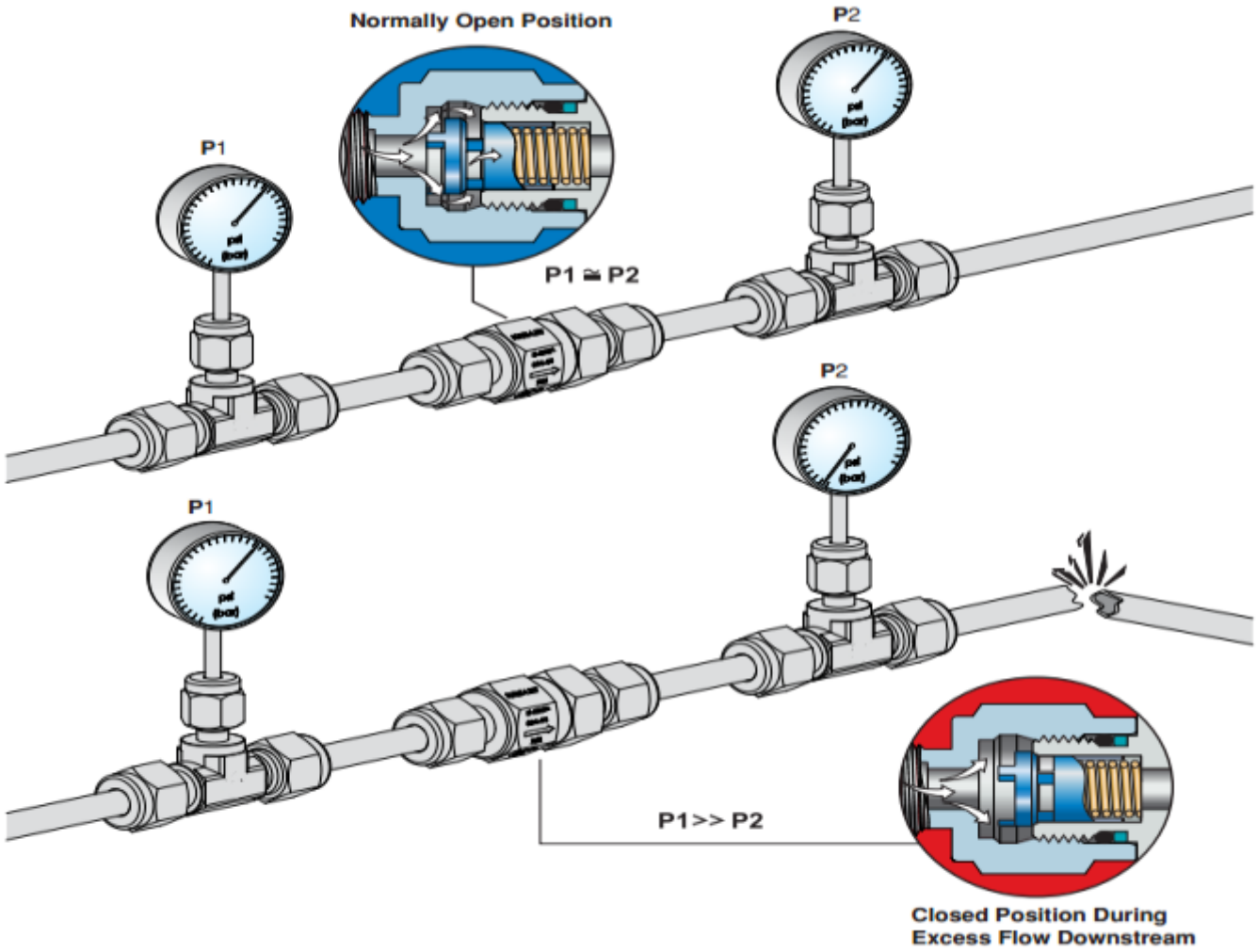


Excess Flow Protection:
Excess Flow Valve



Start

Excess Flow Protection Valve Summary

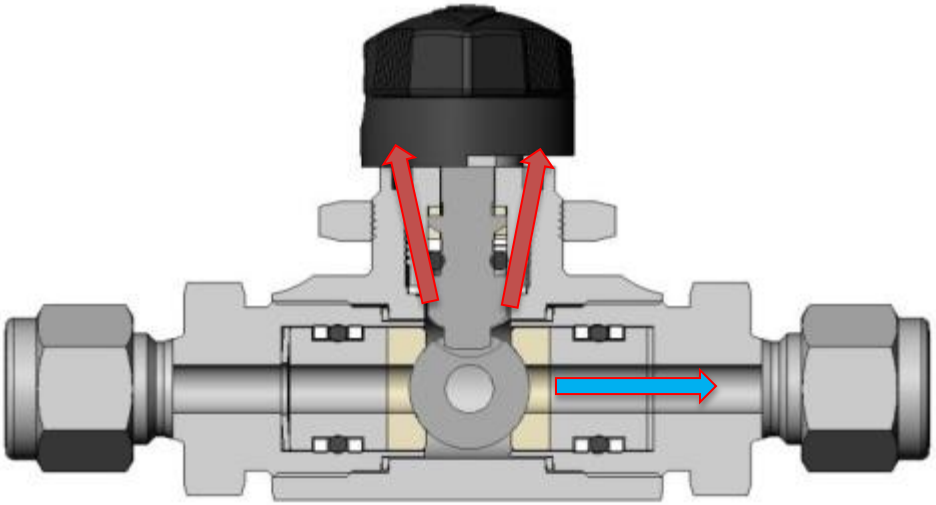


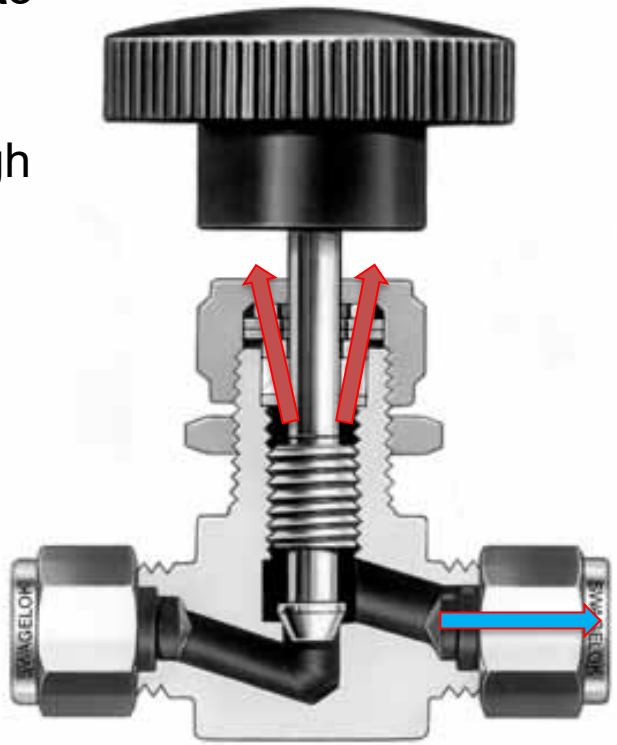
Valve Leakage

Valves can leak in one of two locations:

Seat: leak is contained inside the valve, but fluid passes through the seal and the valve is unable to stop the flow

Shell: fluid leaks outside of the valve into the atmosphere (an outboard leak). Could be through the stem or body of the valve.

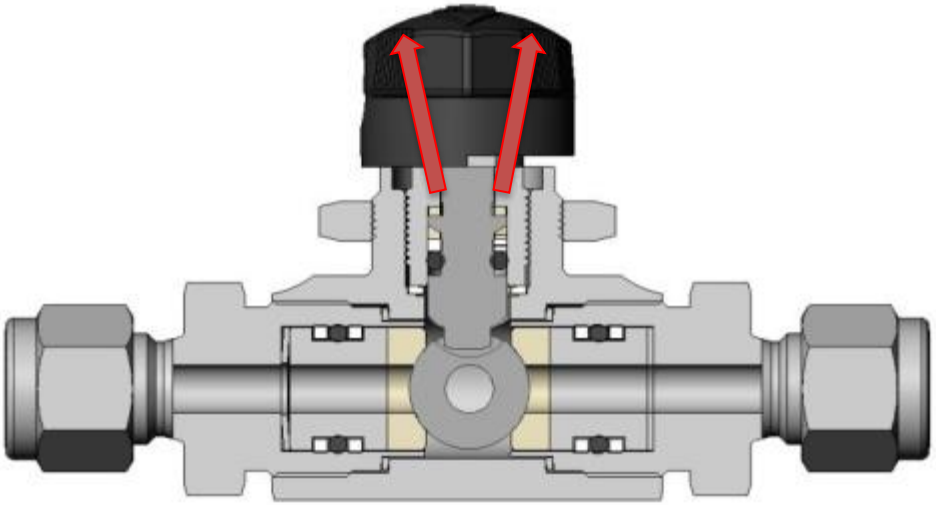


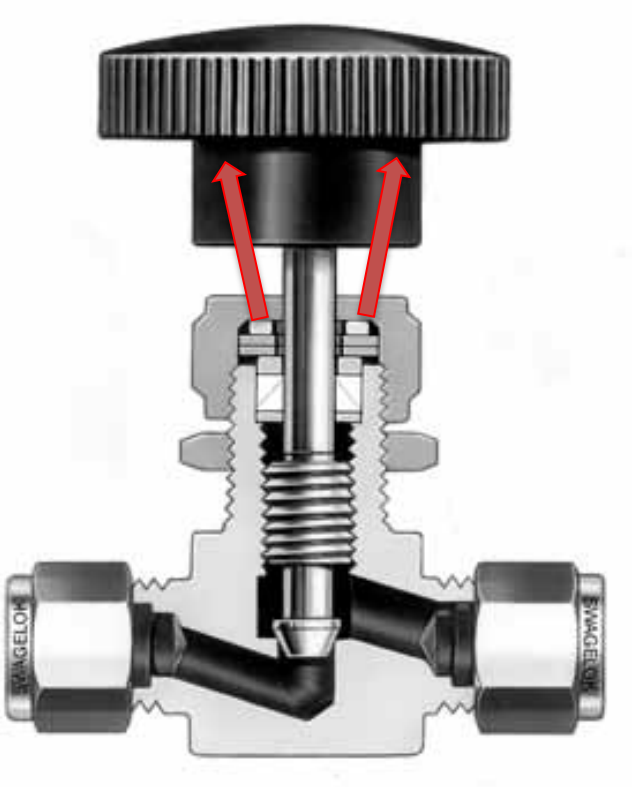


Seal Considerations

When selecting a valve, consider:

- Ability to adjust a valve in the field
- Ability for the valve to self-adjust to wear and temperature





Valve Maintenance & Troubleshooting

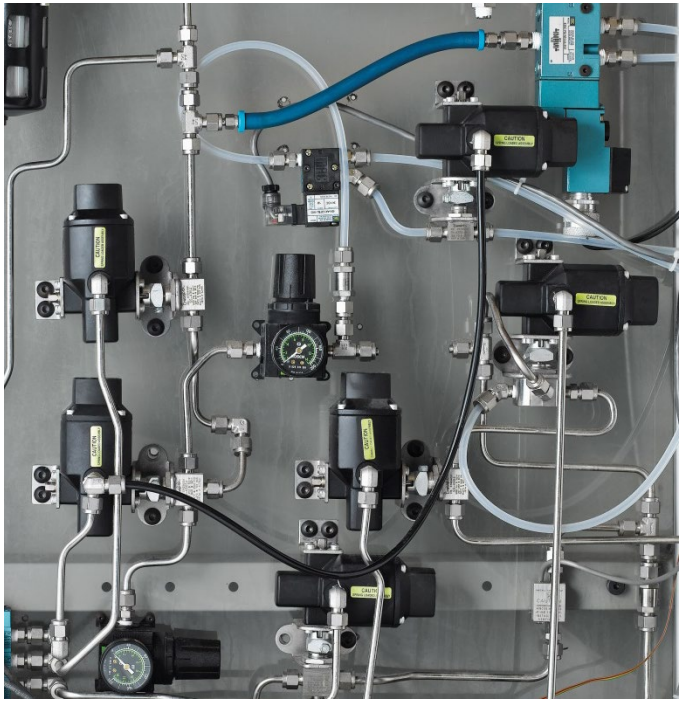
- Test
  - Verify valve operation
- Inspect
  - Examine components
    - Seats
    - O-rings
    - Stem tips
- Maintain
  - Replace components based on test/inspection results
- Overhaul
  - Replace all internal wear components
- Replace
  - Remove current valve
  - Install new valve

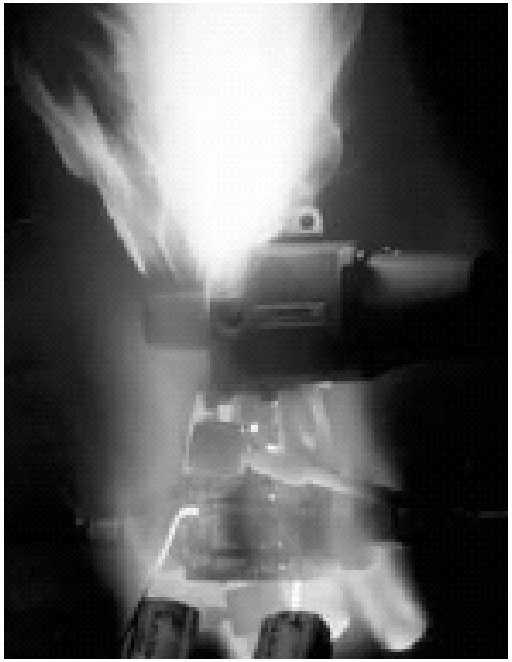
Selection Process

- What do you want the valve to do?
  - On-Off
  - Flow control
  - Directional flow
  - Over-pressure protection
  - Excess-flow protection
- What are your applications and system parameters?
- How should the valve be constructed?
- What actuation method is required?
- Does it meet code or specification?
- How will the valve be installed and maintained?

Selection Process System Parameters

- Pressure
- Temperature
- Media
- Flow
- Environment

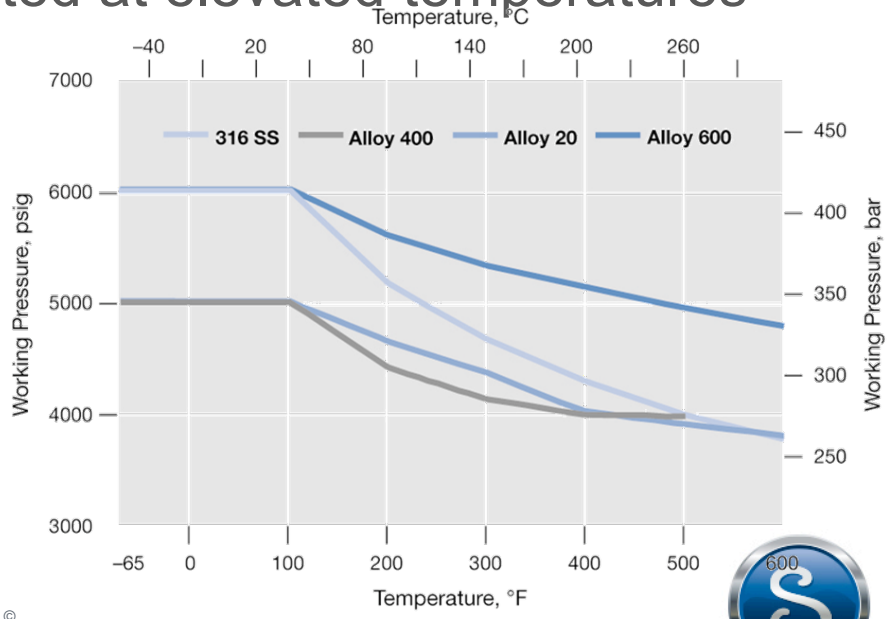




System Parameters

- Pressure and Temperature
  - Select a valve that is within the pressure and temperature rating
  - Caution: A valve rated to 6000 psig (413 bar) at ambient temperature may be de-rated at elevated temperatures

ASME Class	2500			
Material Group	2.2	3.4	3.1	3.5
Material Name	316 SS	Alloy 400	Alloy 20	Alloy 600
Temperature, °F (°C)	Working Pressure, psig (bar)			
–65 (–53) to 100 (37)	6000 (413)	5000 (344)	5000 (344)	6000 (413)
200 (93)	5160 (355)	4400 (303)	4640 (319)	5600 (385)
250 (121)	4910 (338)	4260 (293)	4500 (310)	5460 (376)
300 (148)	4660 (321)	4120 (283)	4360 (300)	5320 (366)
350 (176)	4470 (307)	4050 (279)	4185 (288)	5220 (359)
400 (204)	4280 (294)	3980 (274)	4010 (276)	5120 (352)
450 (232)	4130 (284)	3970 (273)	3955 (272)	5030 (346)
500 (260)	3980 (274)	3960 (272)	3900 (268)	4940 (340)
600 (315)	3760 (259)	—	3790 (261)	4780 (329)



Materials of Construction

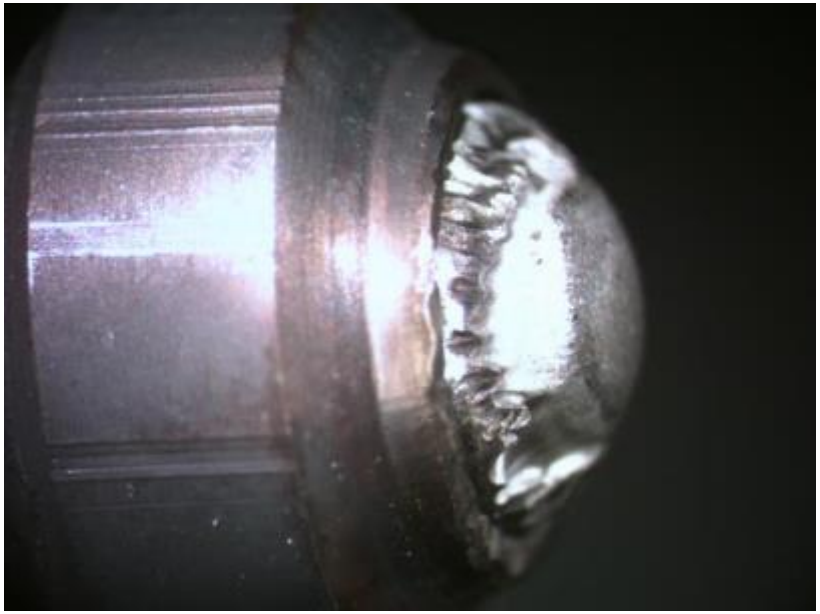
Valve Body: Typically, valve bodies are made of metal or plastic. Examples of common body materials include:	**Internal component:** Seats and seals are typically made of softer materials. Examples of common material types include:
▪ Stainless steel ▪ Brass ▪ Bronze ▪ Chrome ▪ Titanium ▪ PVC ▪ CPVC ▪ PFA-lined	▪ Reinforced Teflon (RTFE) ▪ Kel F (PCTFE) ▪ Nylon ▪ PEEK ▪ Virgin Teflon (TFE) ▪ Graphoil ▪ Viton

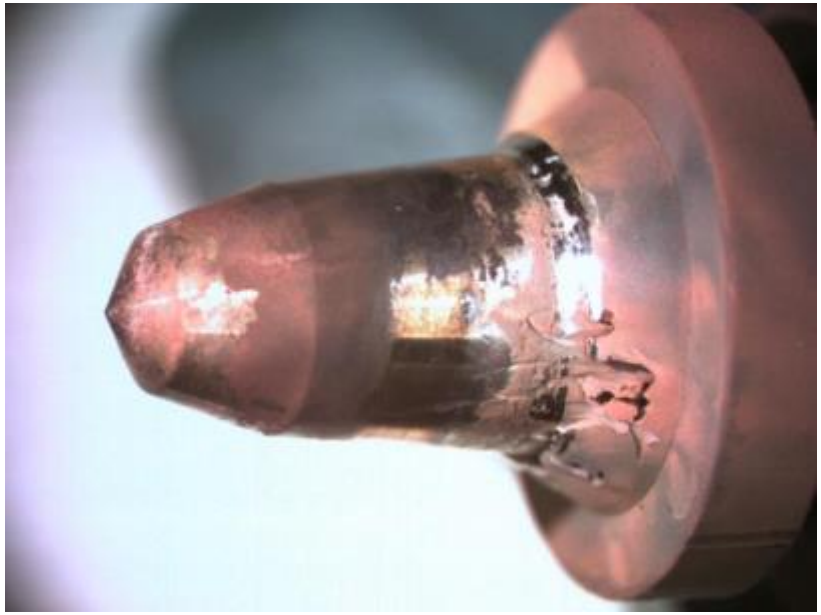
Wire Draw Stem Tip

Seat Wire Draw

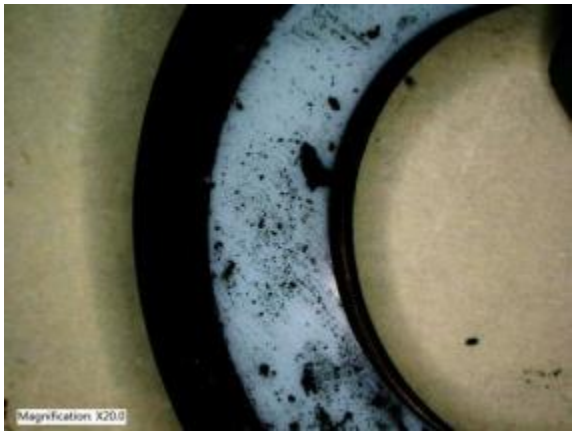
Erosion

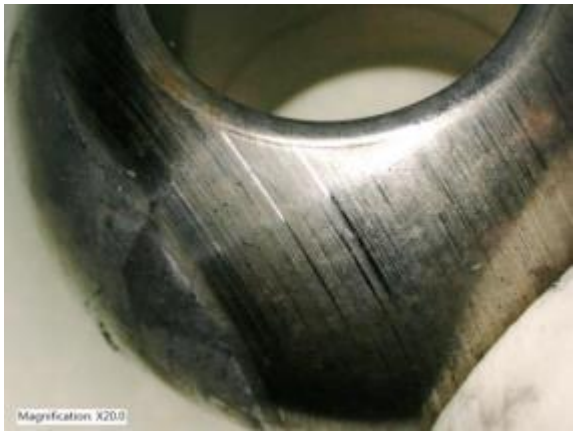
Erosion

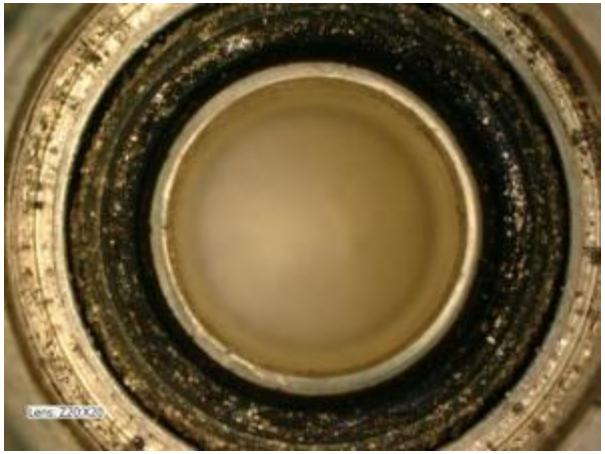




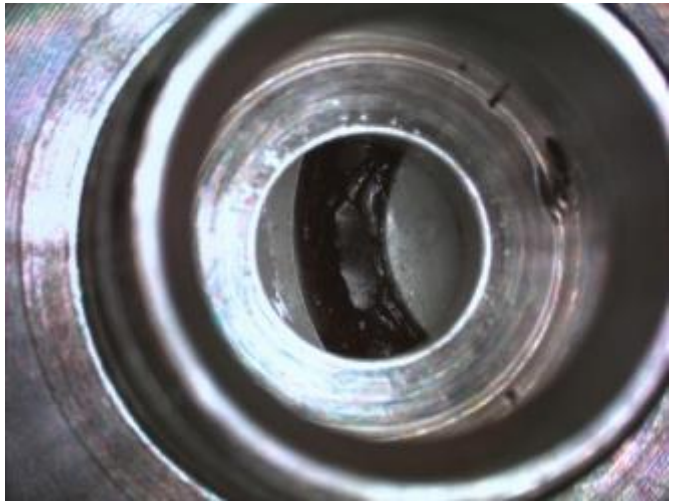
System Contamination



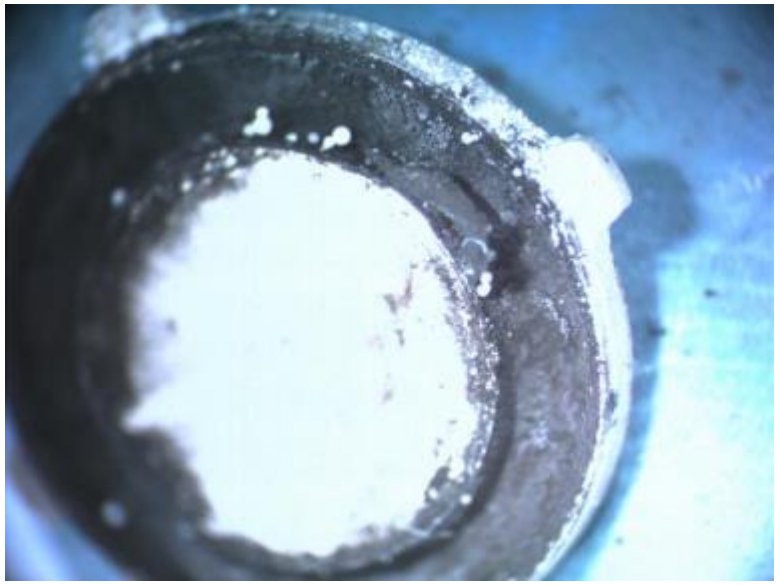




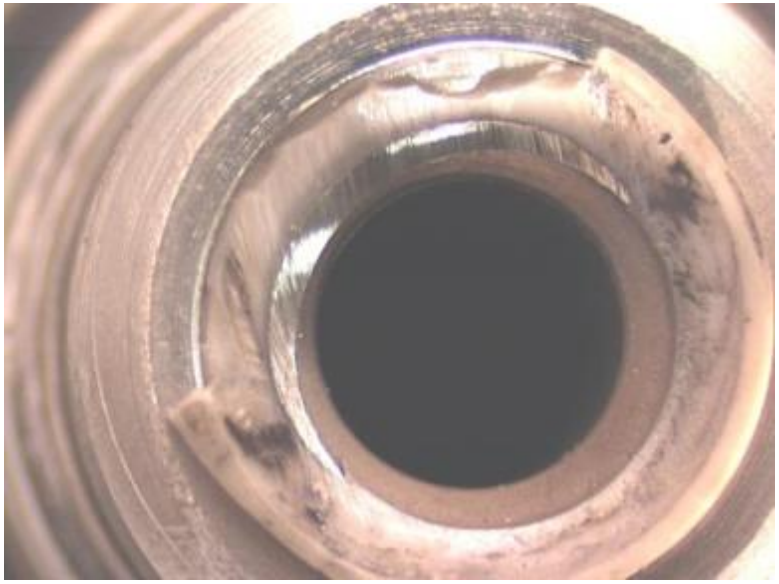
Throttling (Partial Actuation)

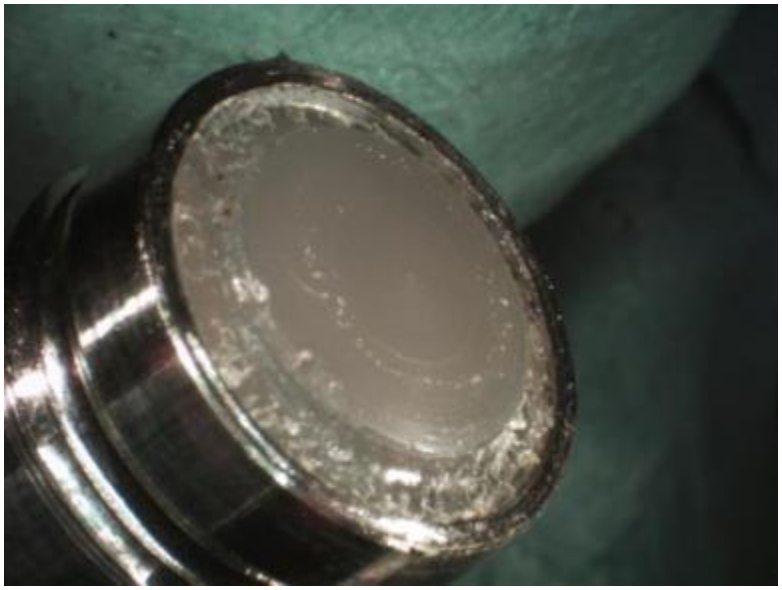


Incompatibility with System Media



Wear





Filters

- Filters help remove particulate from your fluid or gas system. Depending upon its size and molecular structure, particles can cause serious damage to valve seats, contaminate your process fluid causing poor samples, and reduce overall flow through your system.

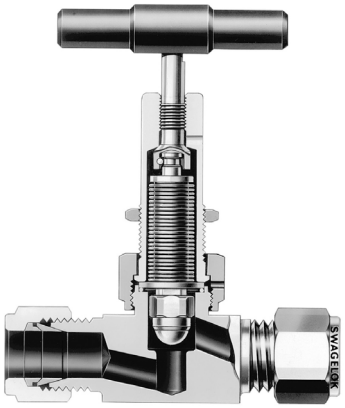
- Filters come in many varieties and sizes based on your need.
  - Can be cleanable
  - Can be replaceable

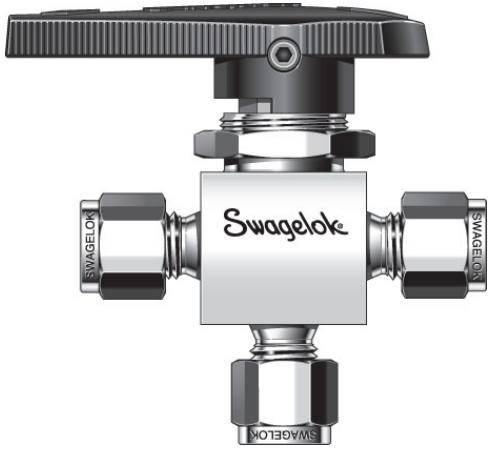
Why Have a Filter

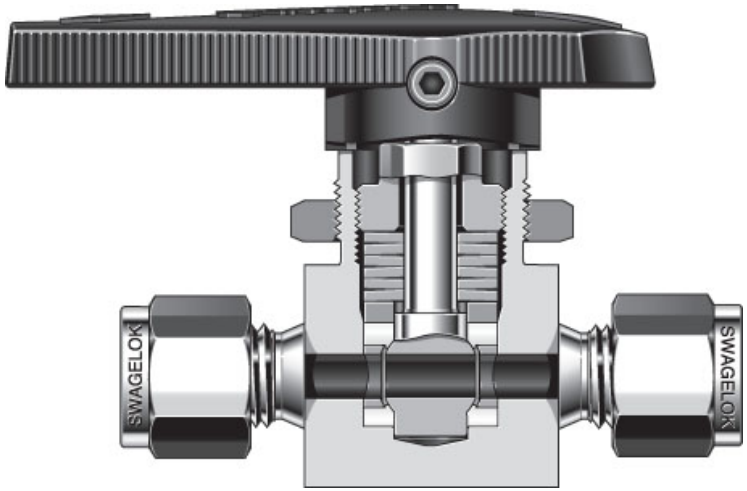
Why Filters Are Important

Construction: Configuration / Pattern

- Straight
- Angle
- Cross
- Globe
- Multi-port







Construction – End Connections

- Swagelok® tube fitting
- Pipe threads
- Pipe flange
- Zero-clearance
- Weld

Join Us for Our Next Tech Talk

- Hose Routing and Installation
- Wednesday, January 20th