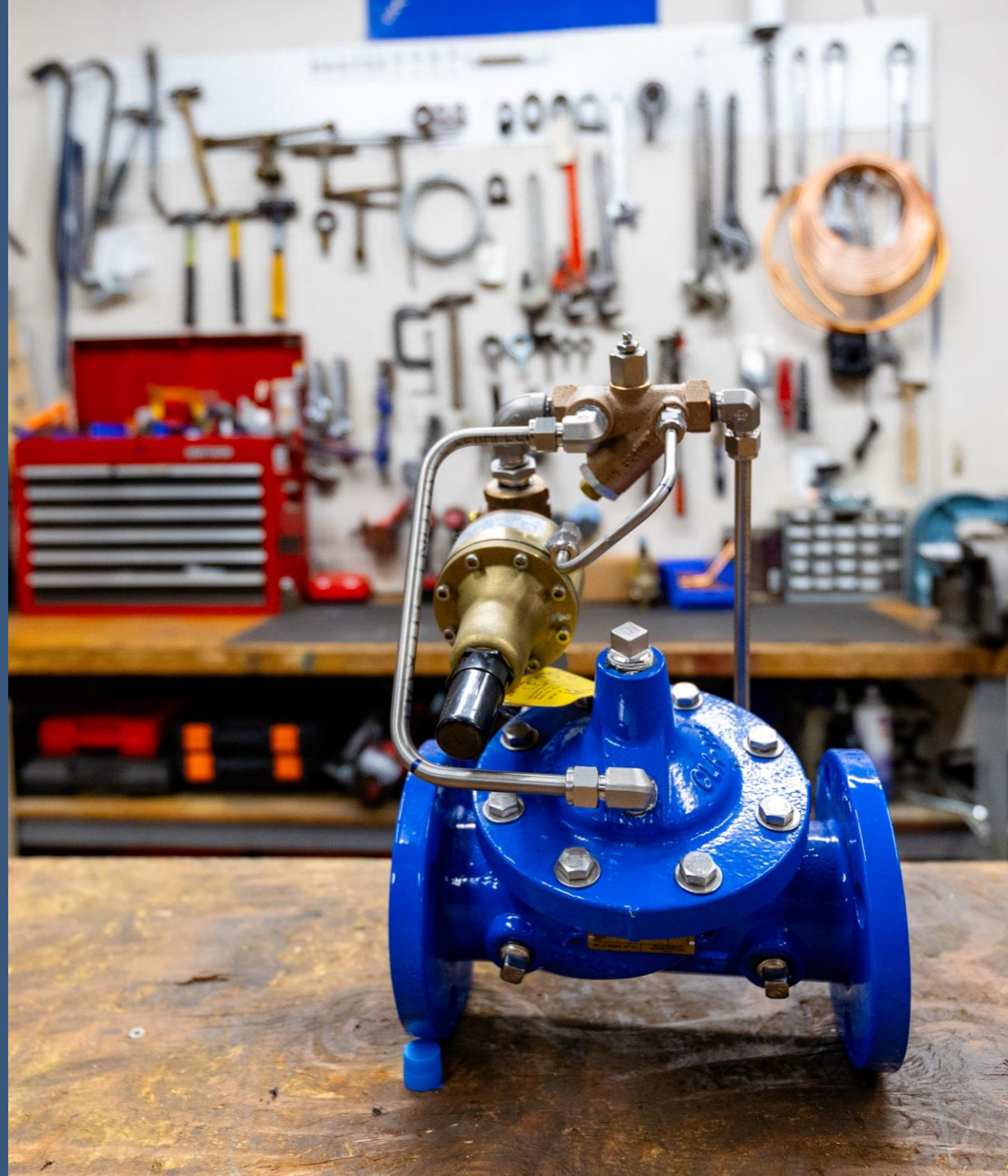
Cimco-GC SYSTEMS

Hands-On With Hydraulic Controls Valves

Part 1: Function



What’s on tap for today:

- Introduction to Cimco-GC Systems and Cla-Val
- Why Control Valves? Hydraulics 101
- Control Valve Main Body
- Intro to Pilot Systems
- Pressure Reducing Valves
- Pressure Relief Valves
- Pressure Sustaining Valves

Don’t be afraid to ask questions!

How do I…?

What is the best way to…?

What does it mean when my valve is…?

How can I improve…?

Can I go the bathroom?

How do I keep my spouse happy??

What is the meaning of life??!!

Cimco-GC SYSTEMS

Puyallup, Washington

40+ years in control valves

Technical support and service

Maintenance, troubleshooting, startups

Pressure reducing valves and stations

Cimco-GC SYSTEMS

CLA-VAL

Cimco-GC PACKAGED SYSTEMS

Copperhead INDUSTRIES

ECHOLOGICS a MUELLER brand

Link-Seal Garlock RANGER II GPT

HYDRO-GUARD a MUELLER brand

MAXADAPTOR ONE&DONE

SAFE-T-COVER

VAL-MATIC

Waterman A MCWANE PLANT & INDUSTRIAL SOLUTION

WELD-ON

Raeann Velasquez

CEO

Carol Wells

Founder (retired)

Rob Velasquez

Cla-Val Design and Quoting

Sarah Sleight

Valmatic Design and Quoting

Teri Todd

Cla-Val Parts and Order Tracking

Beau Swet

Service and Troubleshooting

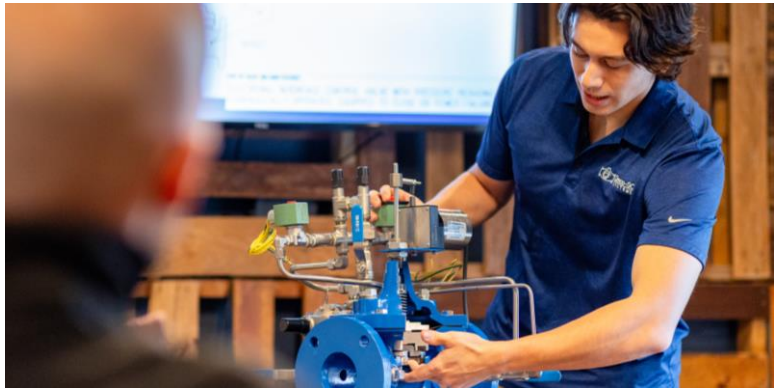
Cimco-GC SYSTEMS

How we support your region

Engineering/Design Support

Troubleshooting

Price and availability



Outside Sales Support

Only factory-authorized Cla-Val Service Team in WA, OR, ID and AK

Inventory: parts, pilot, valve bodies through 8”

Cimco-GC SYSTEMS

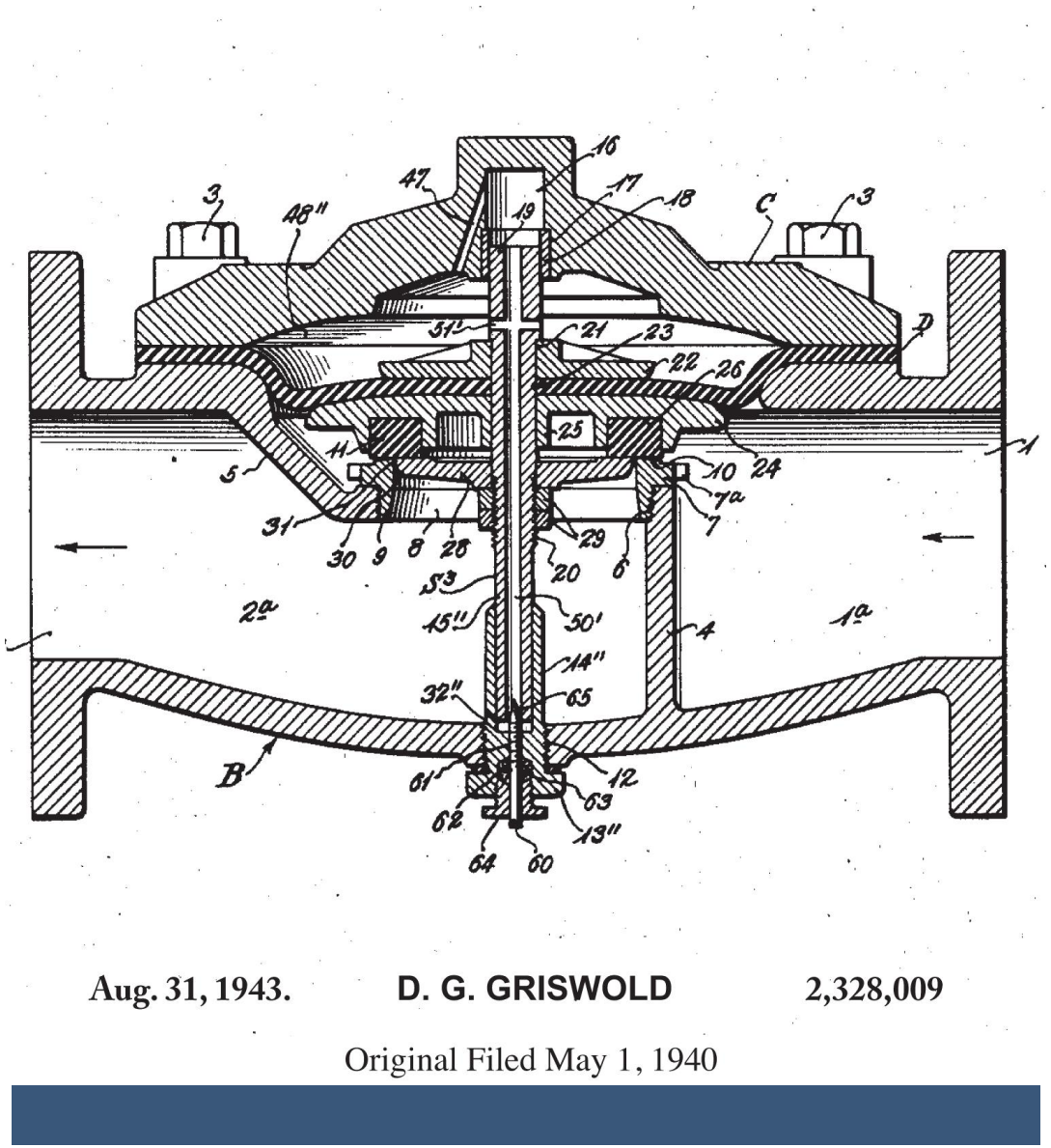
Cla-Val Overview

Global HQ: Costa Mesa, California

cla-val.com

CLA-VAL™

More than 80 years in the making



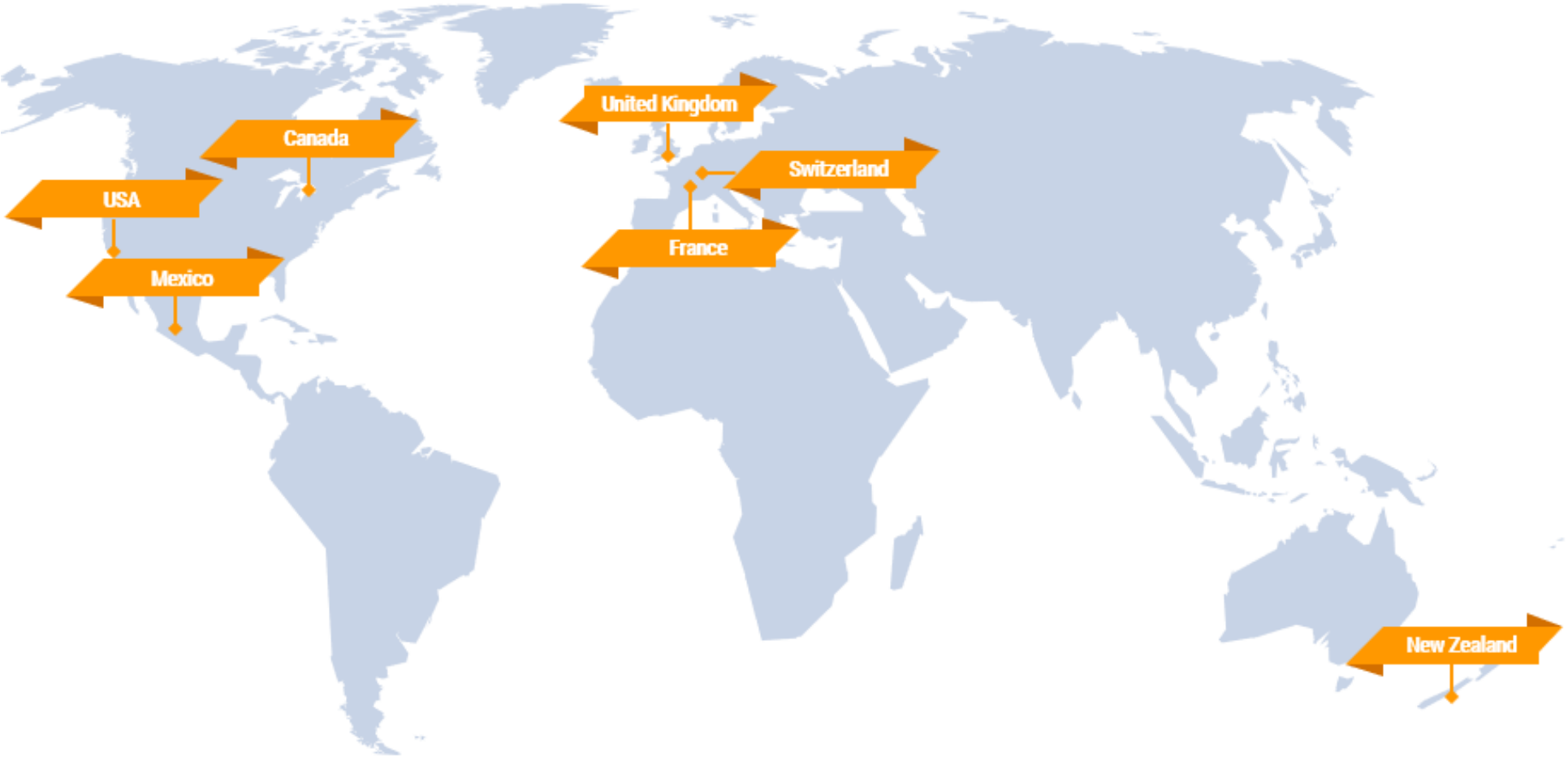
The first of many patented products

- Since 1936, Cla-Val has produced the automatic control valves for a diverse array of industries.
- Established in South Pasadena with just five employees, Cla-Val moved to its present home in Costa Mesa, California in 1954.

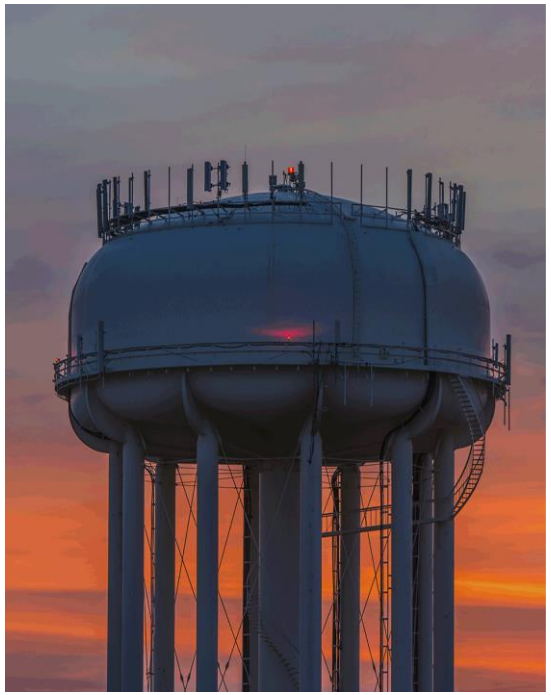
Cla-Val Automatic Control Valves

- Founded by Donald G. Griswold 1936
- Based out of Costa Mesa, CA
- Only control valve manufacturer in the US
- Only one generation of valves (no additional phases, styles, etc.)
- Preferred brand worldwide

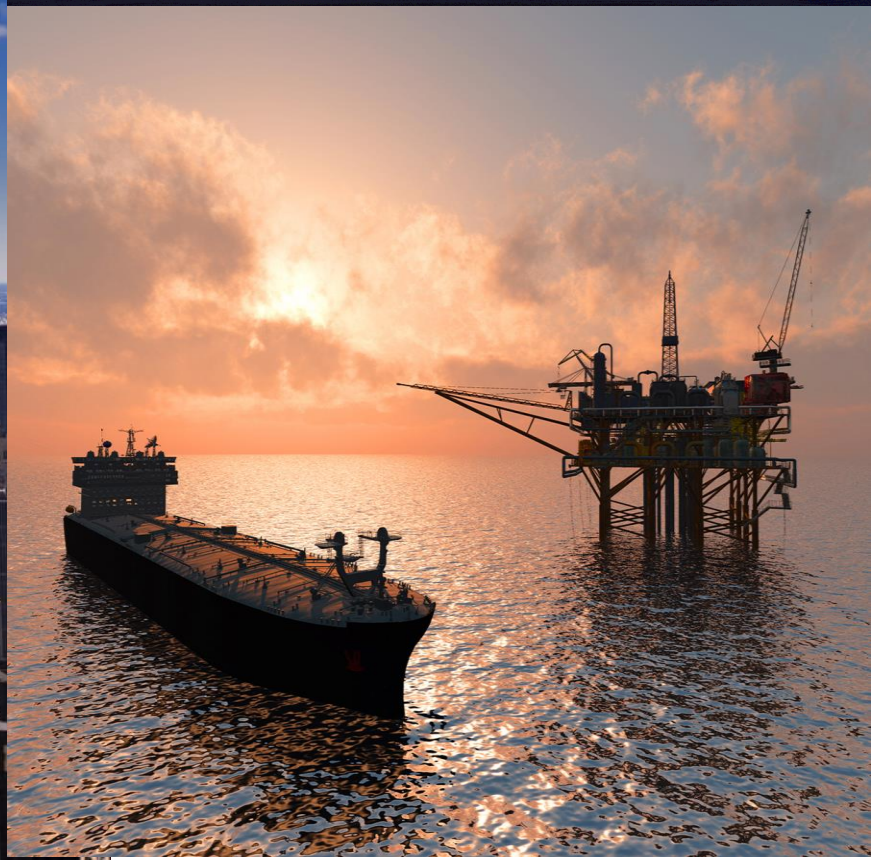
Production locations throughout the world



Not just waterworks…



Fire Protection



Industrial

Mining, Oil, Gas

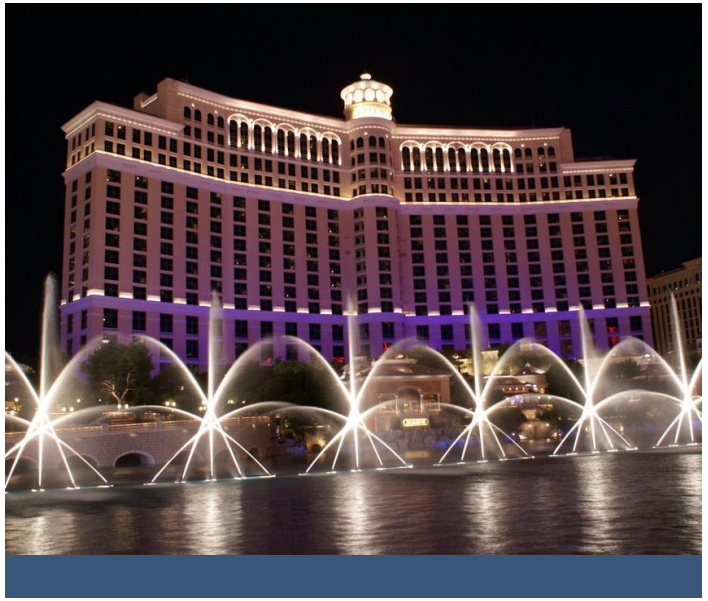
Commercial Fueling

Military-Grade Fueling

Military Applications

Burj Khalifa

Dubai, U.A.E.
(tallest building
in the world)



Bellagio Hotel Fountain

Las Vegas, NV

The White House

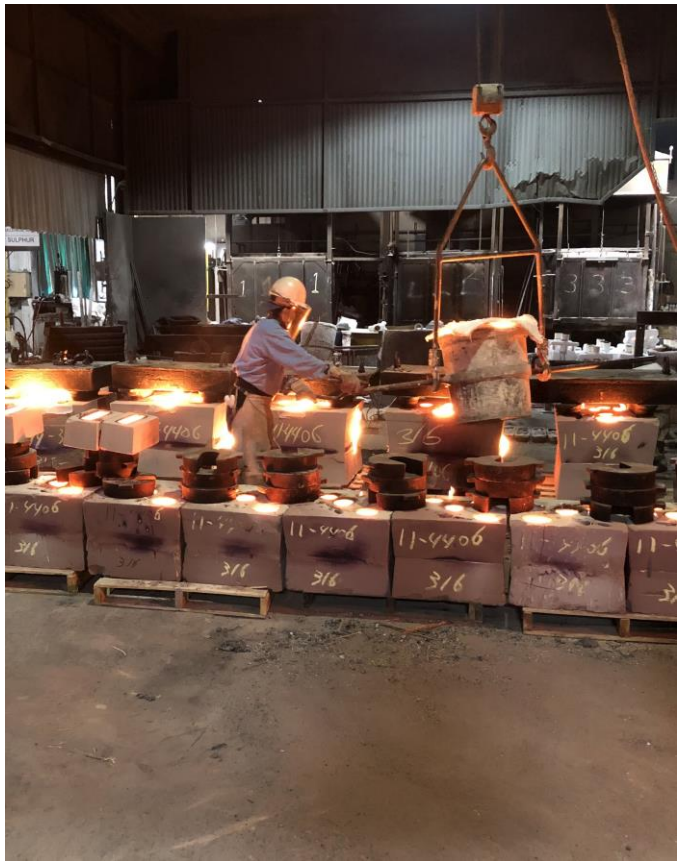
Washington, D.C.

Freedom Tower One

100+ Cla-Val’s Domestic Water System

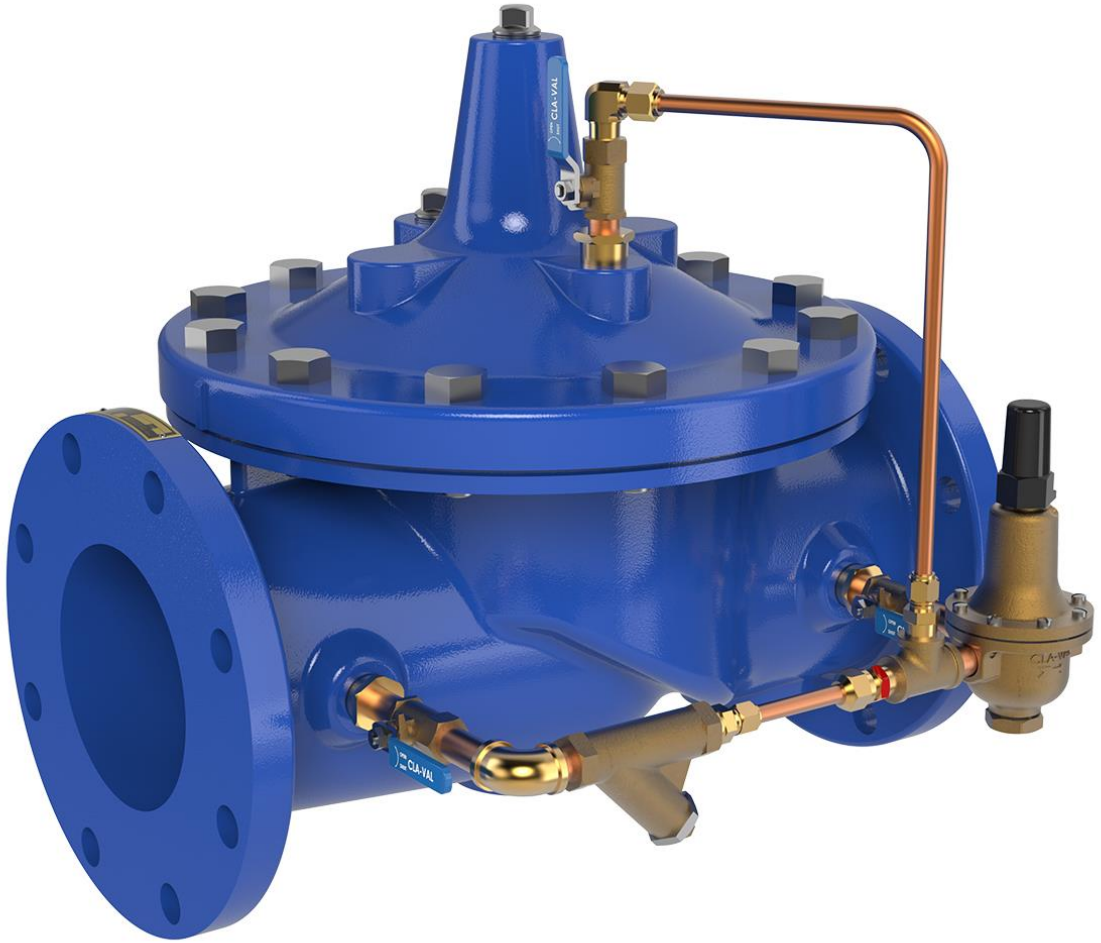
100+ Cla-Val’s Fire Protection System

Cla-Val Factory Tours and Training



Cimco-GC SYSTEMS

Questions?



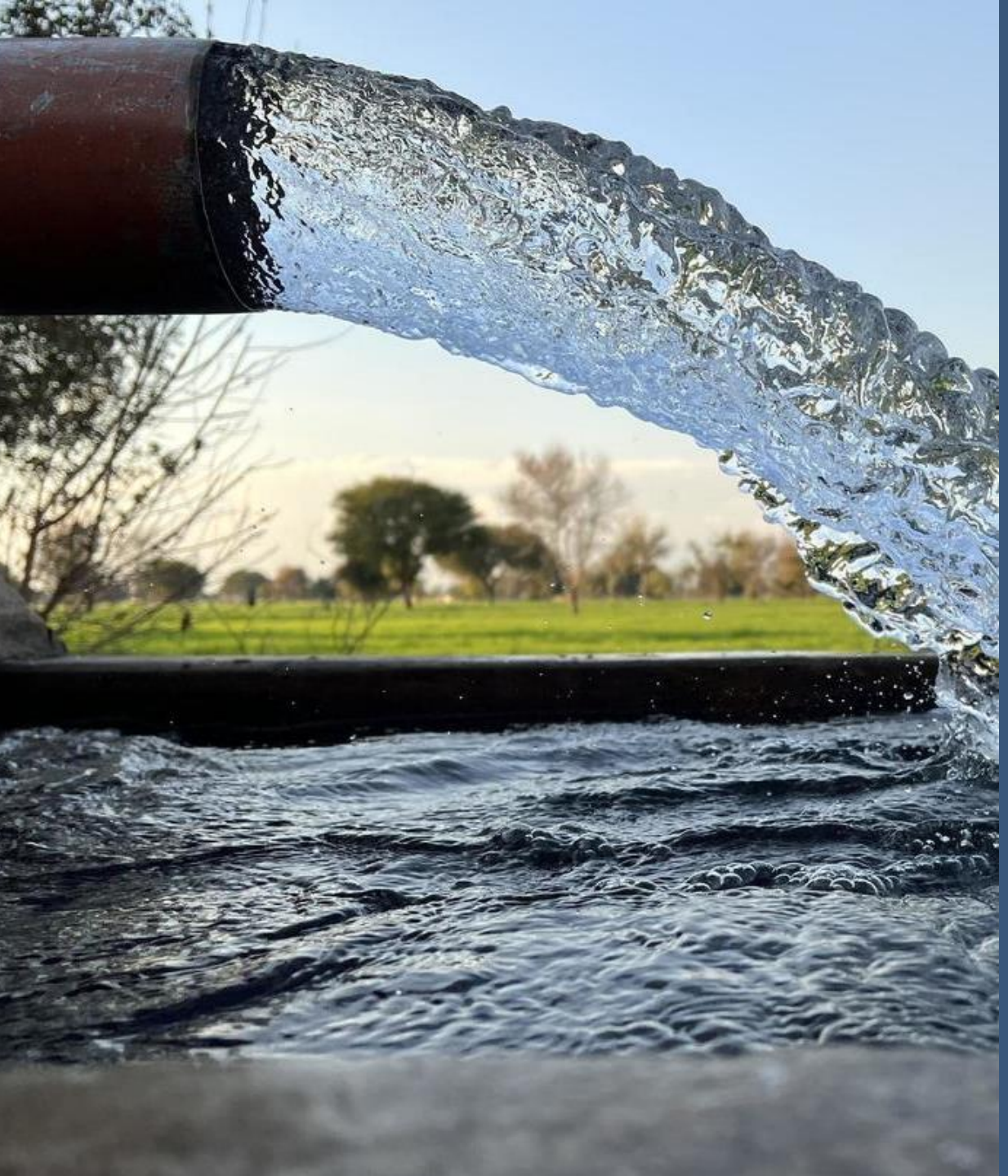
Cimco-GC SYSTEMS

Why Control Valves?

One Big Reason: Elevation

Necessary for many applications throughout the distribution system

- **Pressure Control**
  - Pressure Reducing
  - Pressure Sustaining
  - Pressure Relief
- **Flow Control**
  - Hydraulic Rate-of-Flow
  - Electronic flow control
- **Level Control**
  - Tank/Reservoir Fill
- **Surge Control**
  - Downstream Surge control
  - Surge Anticipators
- **Pump Control Valves**
  - Booster Pump Control
  - Deep Well Pump Control
- **Electronic Control Valves**
  - Programmable Features
  - SCADA Integration
- **Check Valves**



Cimco-GC SYSTEMS

Hydraulics 101

But not too much math.

Hydraulics 101

“The study of fluids at rest and in motion”

The relationships between water volume, velocity, flow, and pressure is critical for water systems.

What we will look at today:

1. Flow
2. Pressure Head
3. Pascal’s Principle
4. Hydraulic Advantages
5. Operating Pressure
6. Relationship Between Flow & Pressure

Hydraulics 101:

1. Flow

Flow

The volume of water displaced per unit time, and is expressed as:

- cubic feet per second,
- gallons per minute
- million gallons per day

Hydraulics 101:

1. Flow

The basic flow equation is :

$$Q = A \times V$$

- **A** = cross-sectional area of the flowing stream of water [ft^2]
- **V** = the velocity of flow (speed at which the water is moving) [ft/s]
- Q = flow

Hydraulics 101:

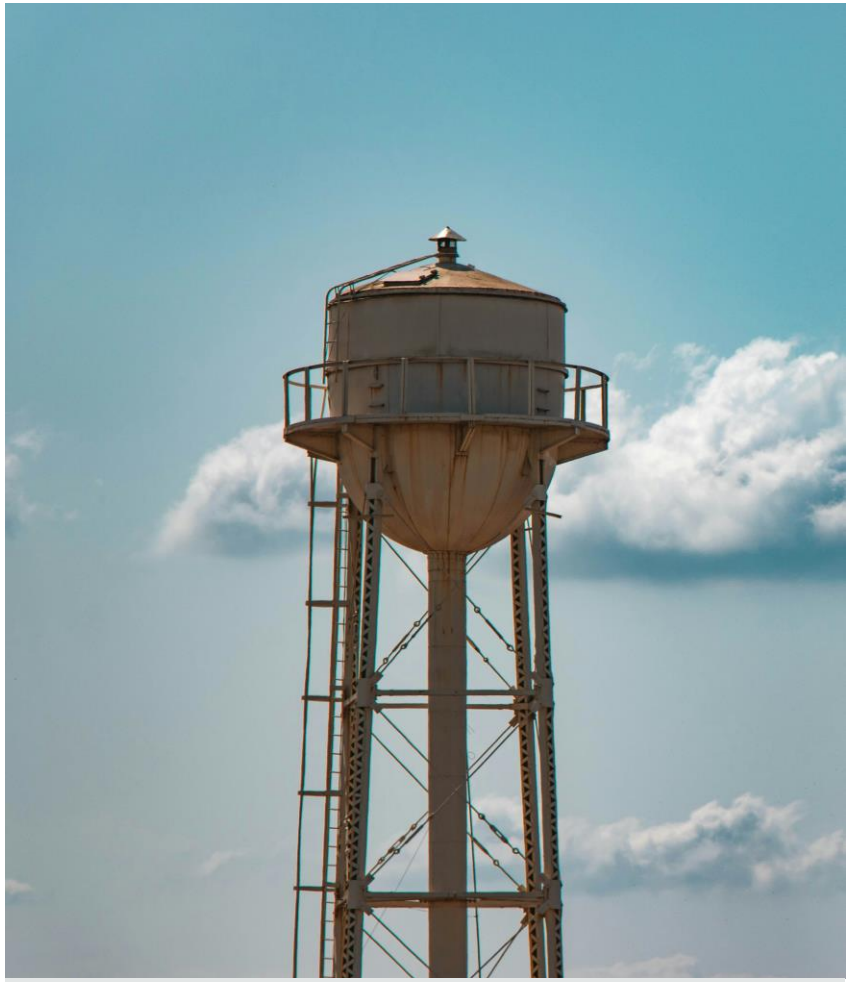
2. Pressure Head

(Also known as *static pressure* or *static head)*

In a tank that is not airtight, the only pressure exerted is by the specific weight of water.

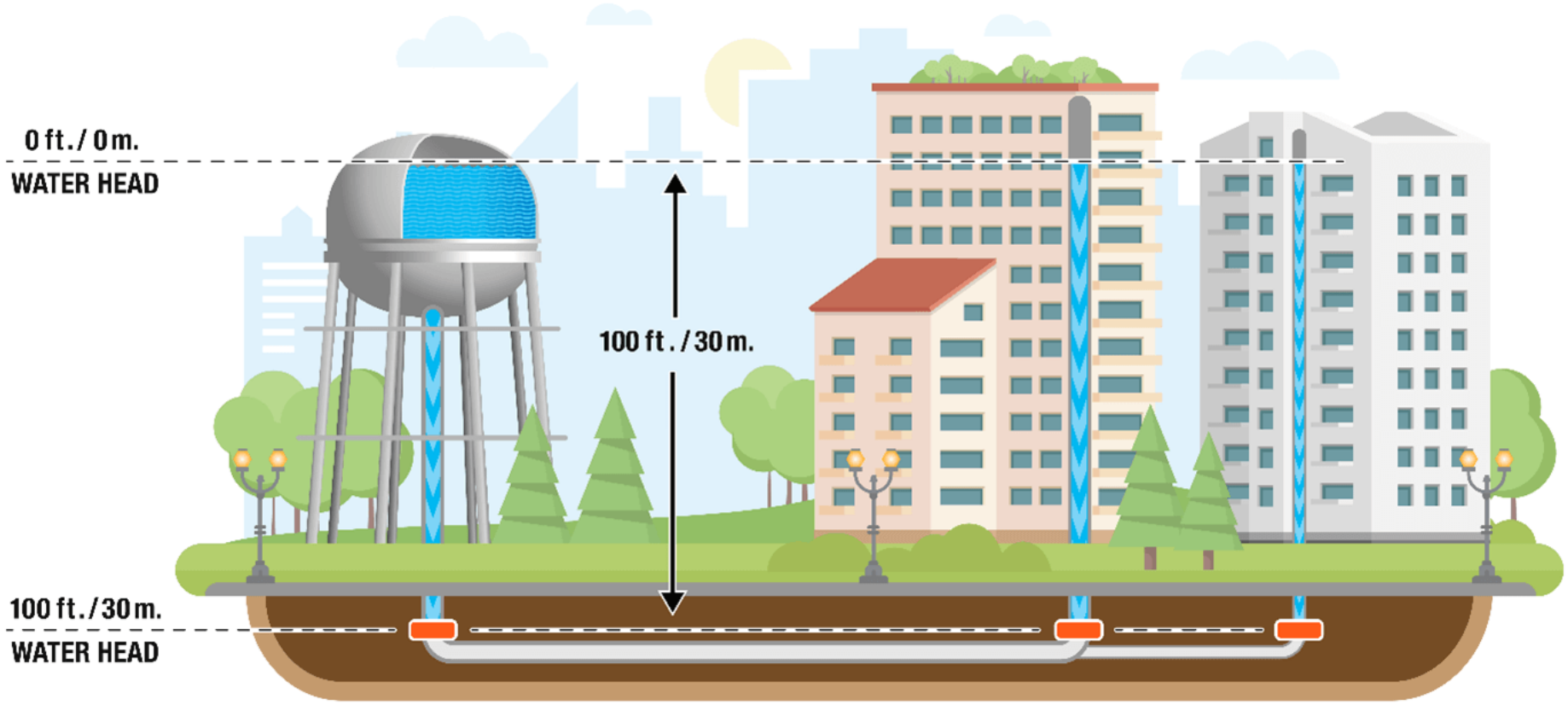
Pressure Head Can be expressed as either:

- **Head** (feet of water or meters of water),
- or **Pressure** – (psi / or bar).



Hydraulics 101:

2. Pressure Head



Hydraulics 101:

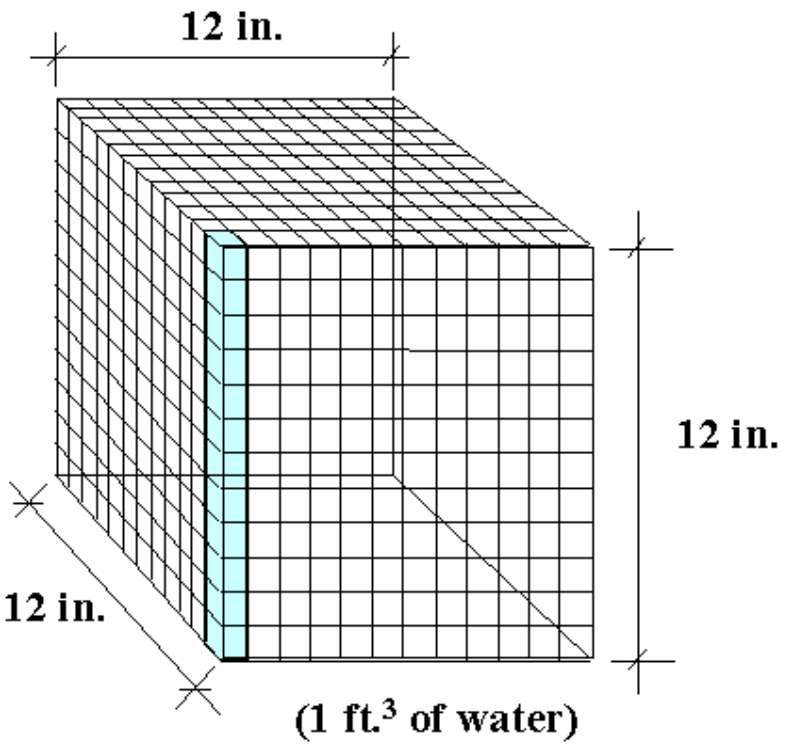
2. Pressure Head

How to Convert Feet of Head to PSI

A cubic foot of water weighs 62.4 pounds.

Therefore, if a column with a 144 square inch base exert a pressure of 62.4 pounds

Then a single square-inch column undergoes:



62.4 pounds/144 square inches = 0.433 pounds per square inch

Hydraulics 101:

2. Pressure Head

1 ft of head = 0.433 psi

&

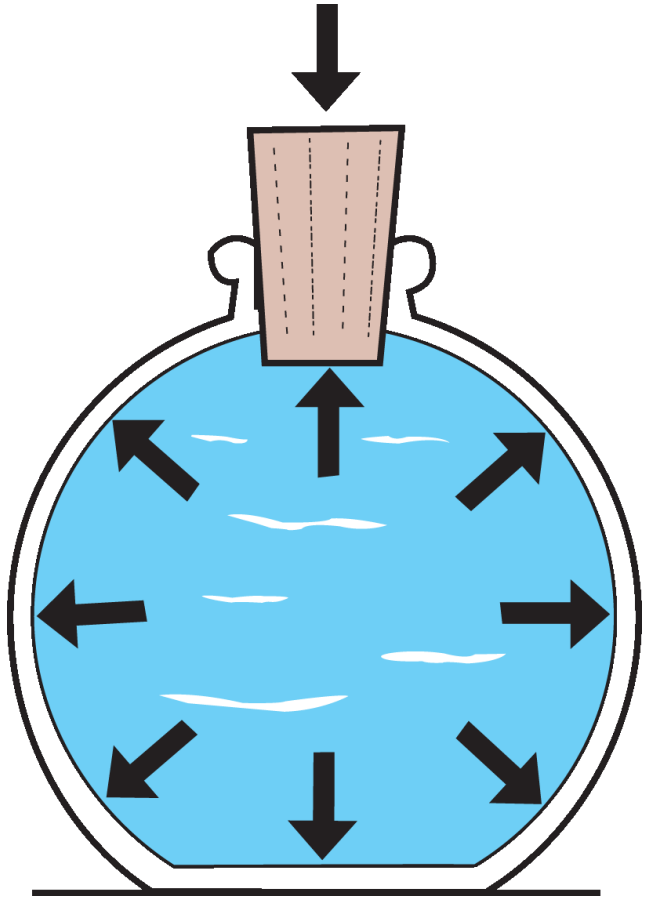
1 PSI = 2.31 ft of head

Hydraulics 101:

3. Pascal’s Principle

Pressure exerted anywhere in a confined fluid is transmitted equally in all directions throughout the fluid.

Pressure is transmitted equally in all directions.

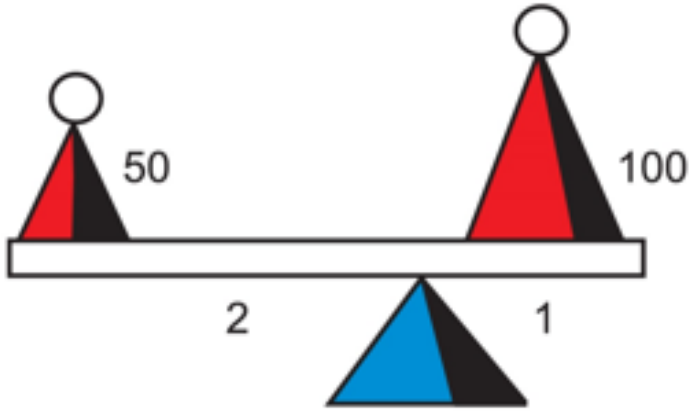


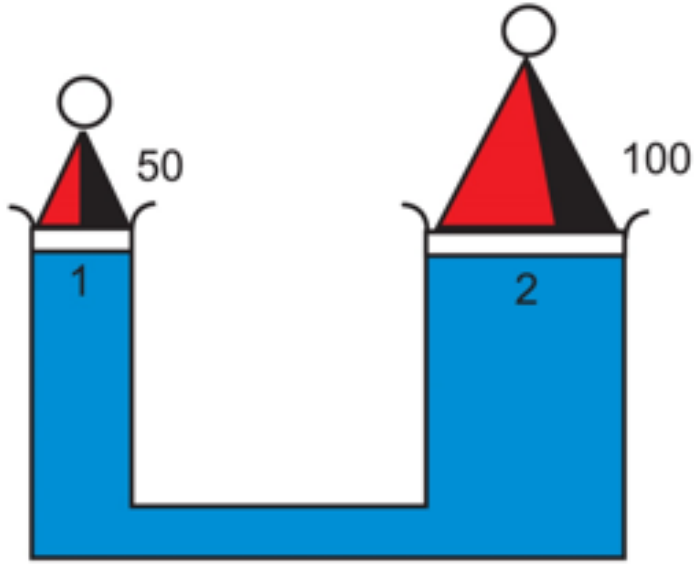
Hydraulics 101:

4. Hydraulic Advantage

Pressure x Area = Force

Change the surface area with the same pressure, you get more force.



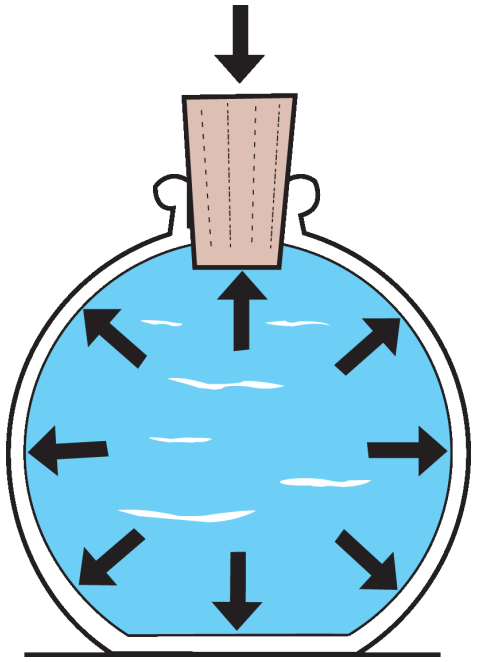


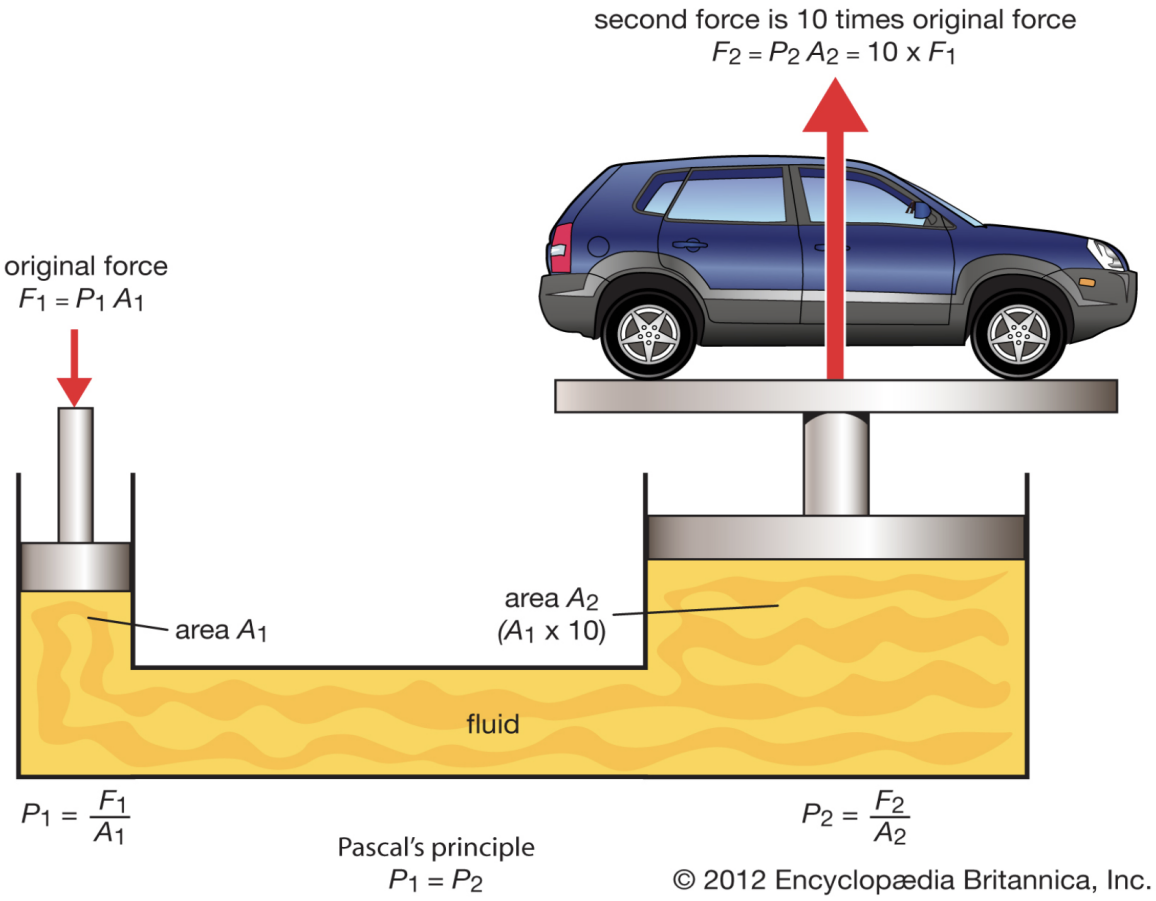
Fluid can be used like levers

Hydraulics 101:

4. Hydraulic Advantage

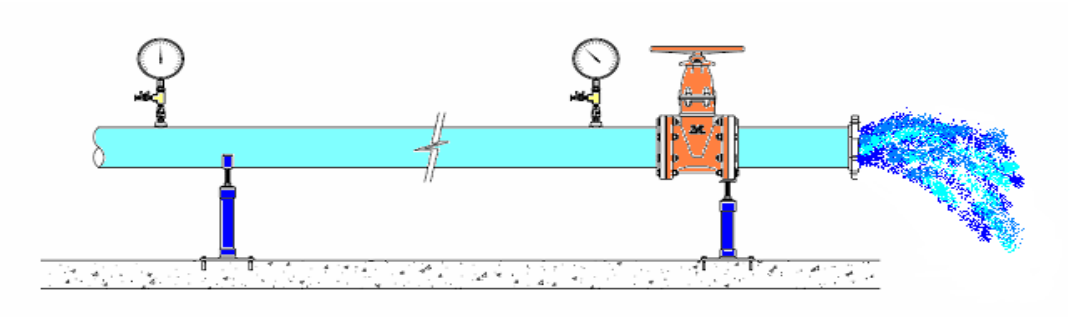
Force = Pressure x Area





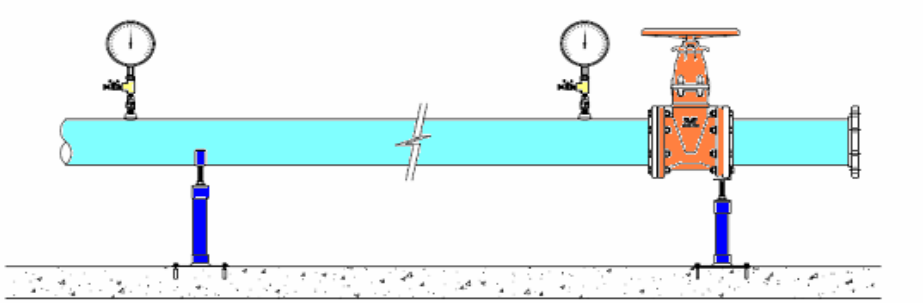
Hydraulics 101:

5. Relationship between pressure and flow



Dynamic Pressure

When fluid is in motion



Static Pressure

When fluid is at rest

Hydraulics 101:

5. Relationship between pressure and flow

When water flows through a pipeline, there will always be pressure drop.

Factors:

- Size of the pipe
- Age of the pipe (roughness of the inside)
- Volume of water is going through the pipe
- Number of fittings or bends are in the pipe
- Length of pipe

Hydraulics 101:

5. Relationship between pressure and flow

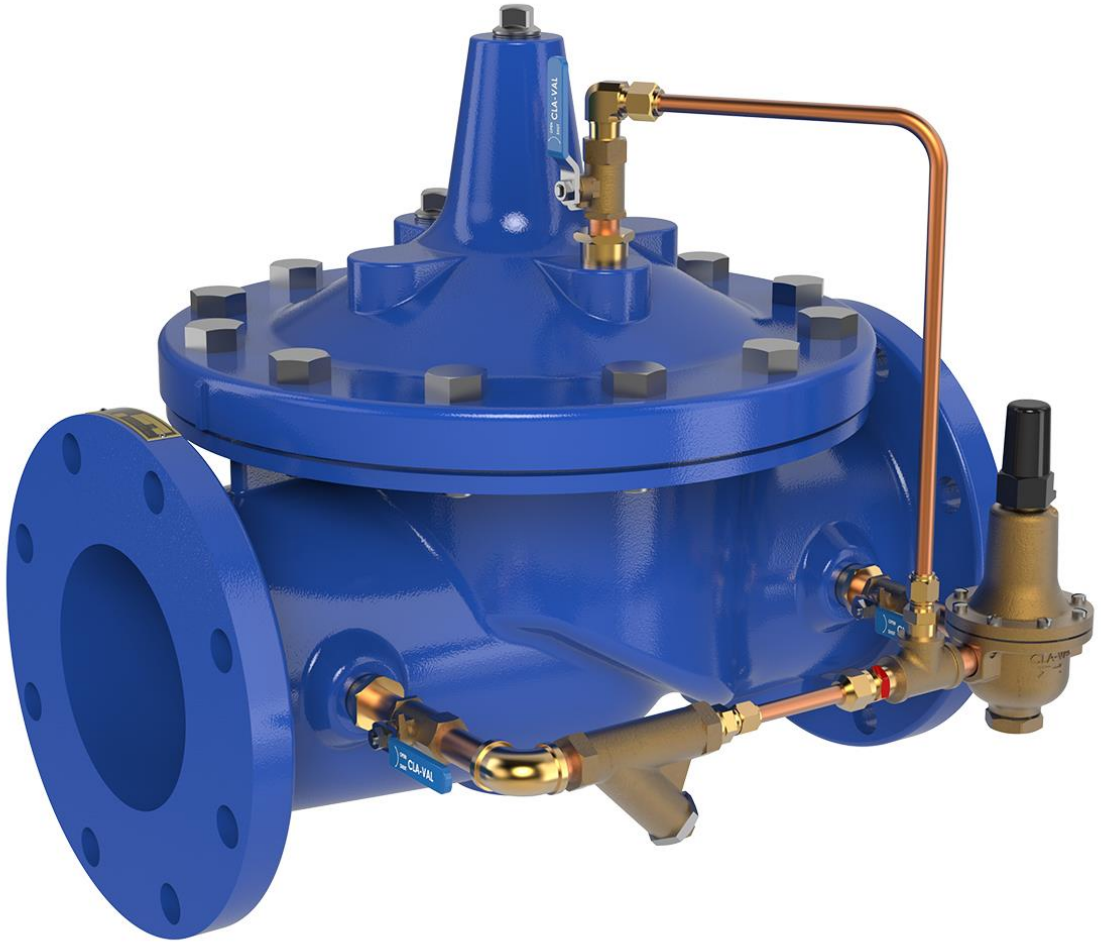
In most water and wastewater systems pumps and gravity are what create flow by introducing energy into the system.

Pressure is the evidence of resistance of the system of pipe and fittings.

Hydraulics 101:

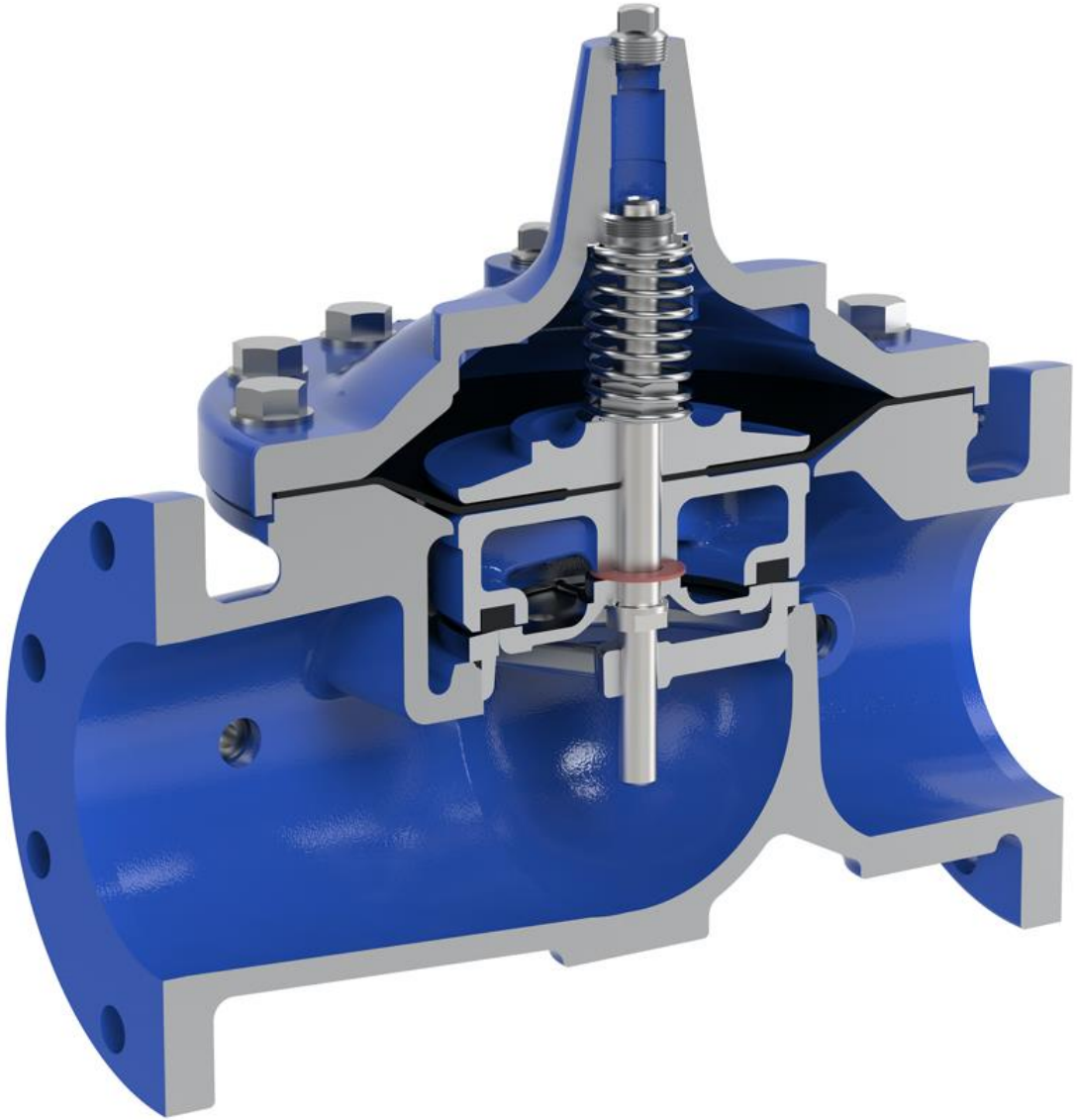
5. Relationship between pressure and flow

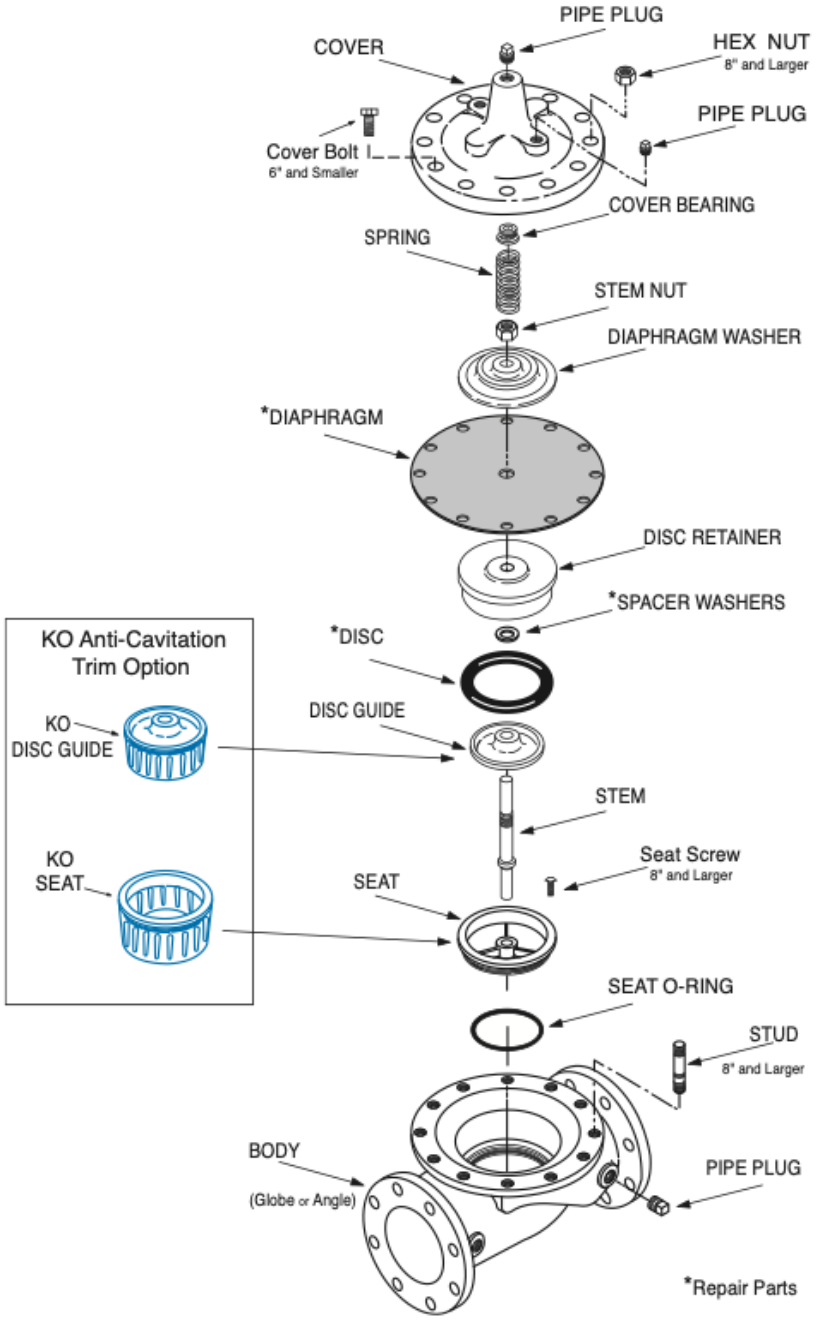
- Control Valves do not directly create pressure or flow.
- Control Valves manipulate pressures and flows in the system



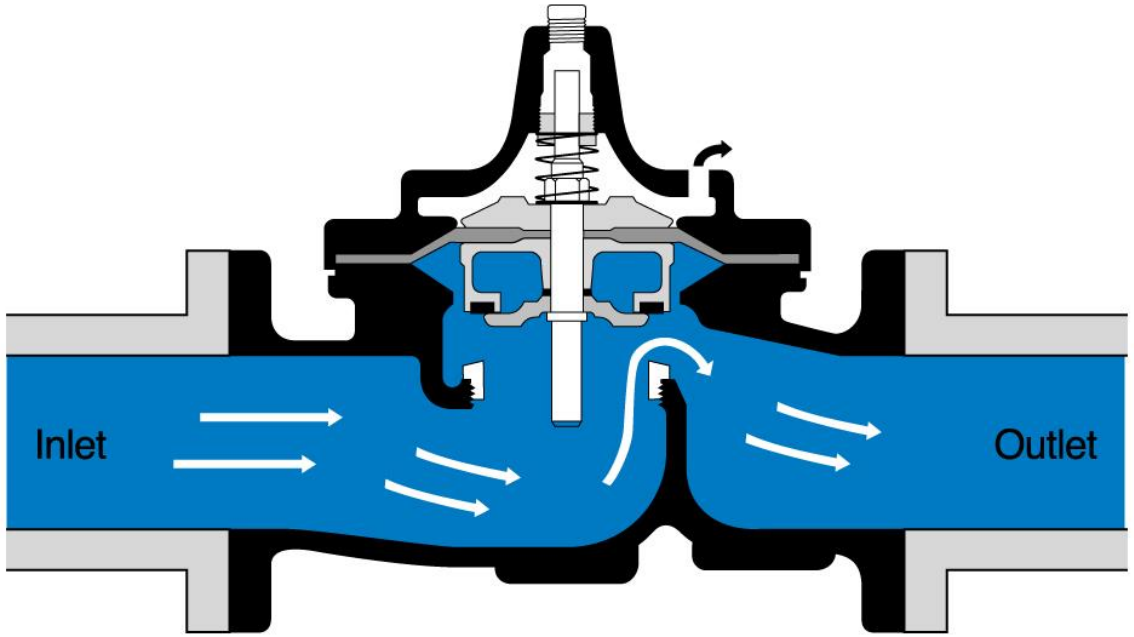
Cimco-GC SYSTEMS

Basic Principles of Control Valves




PIPE PLUG
COVER
HEX NUT
8" and Larger
PIPE PLUG
Cover Bolt
6" and Smaller
COVER BEARING
SPRING
STEM NUT
DIAPHRAGM WASHER
*DIAPHRAGM
DISC RETAINER
*SPACER WASHERS
KO Anti-Cavitation
Trim Option
*DISC
KO
DISC GUIDE
DISC GUIDE
STEM
KO
SEAT
Seat Screw
8" and Larger
SEAT
SEAT O-RING
STUD
8" and Larger
BODY
(Globe or Angle)
PIPE PLUG
*Repair Parts

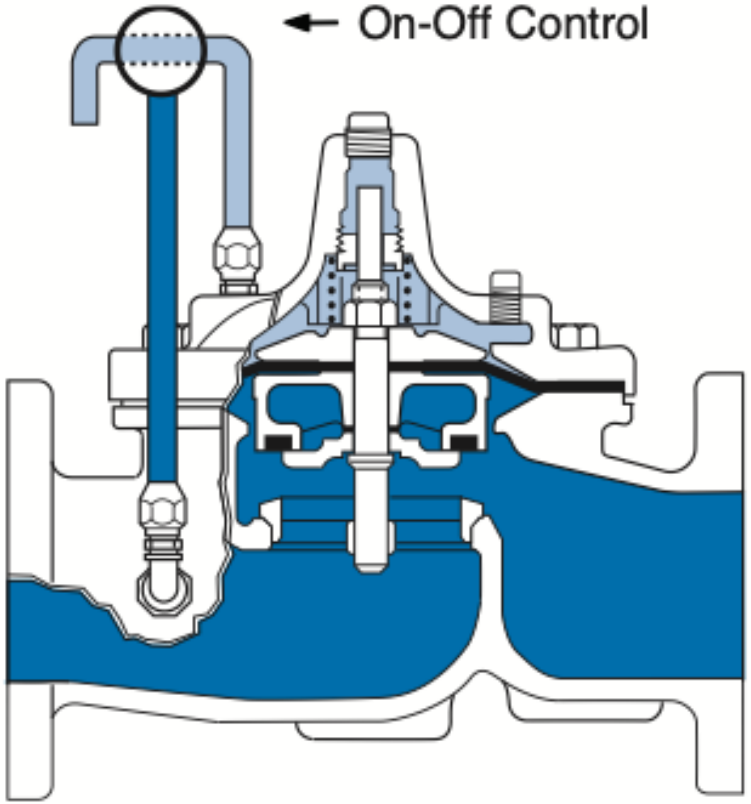
Standard Flow



Up and Over Seat

Principles of Operation

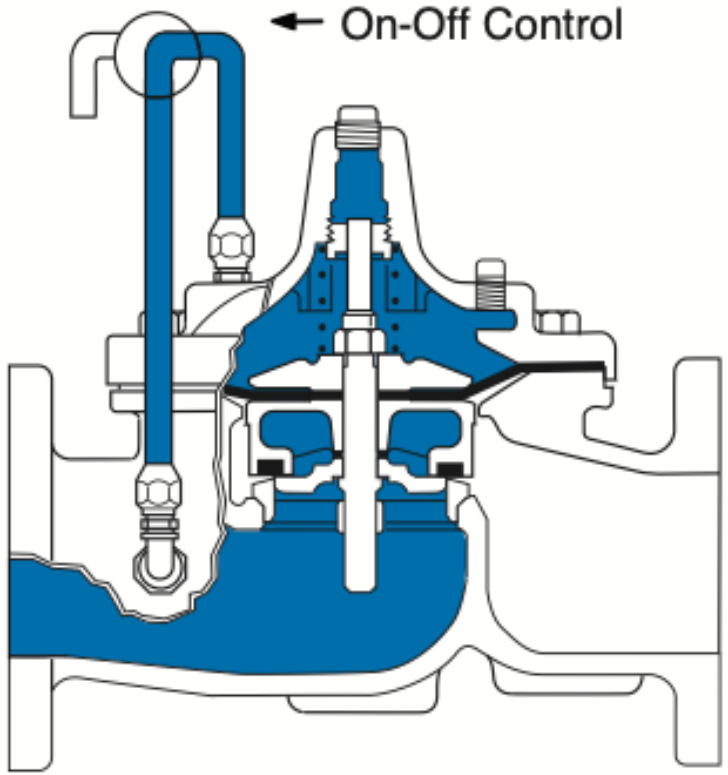
Full Open
When pressure in the cover chamber is relieved to a zone of lower pressure, the line pressure at the valve inlet opens the valve, allowing full flow.



Principles of Operation

Tight Closing

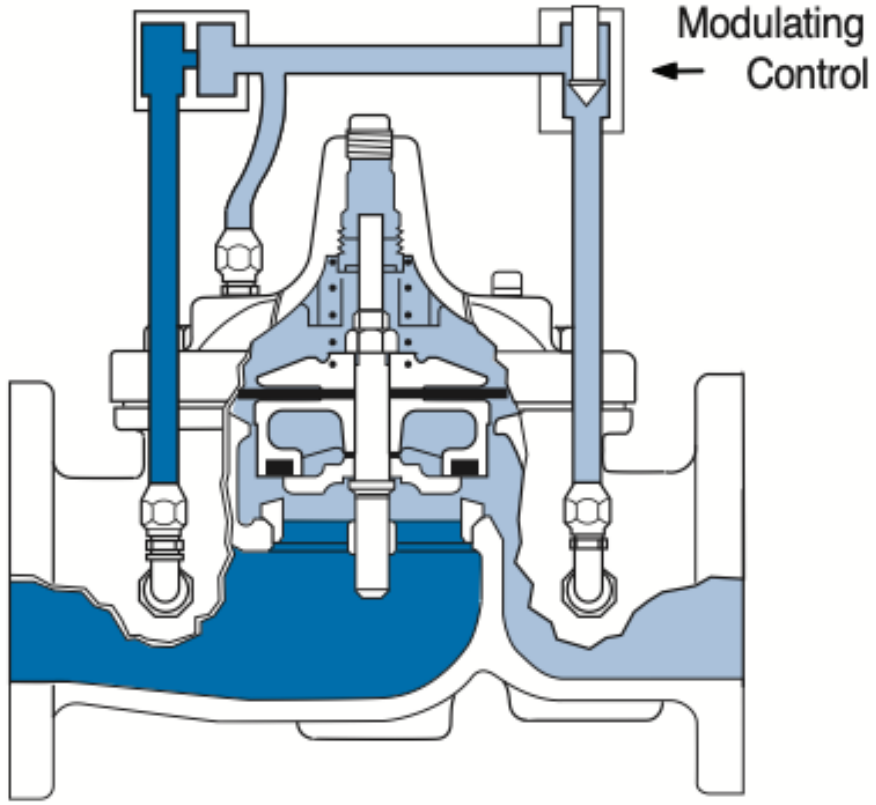
When Pressure from the valve inlet is applied to the cover chamber, the valve closes drip tight.



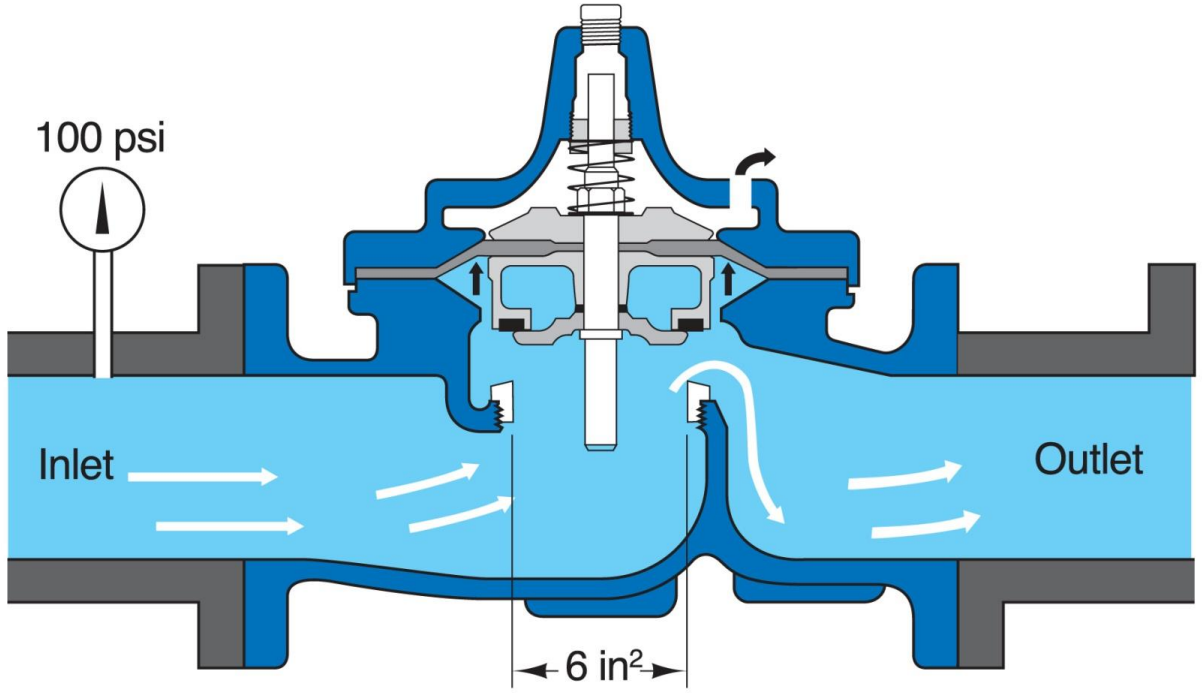
Principles of Operation

Modulation

The valve holds any intermediate position when operating pressures are equal above and below the diaphragm.



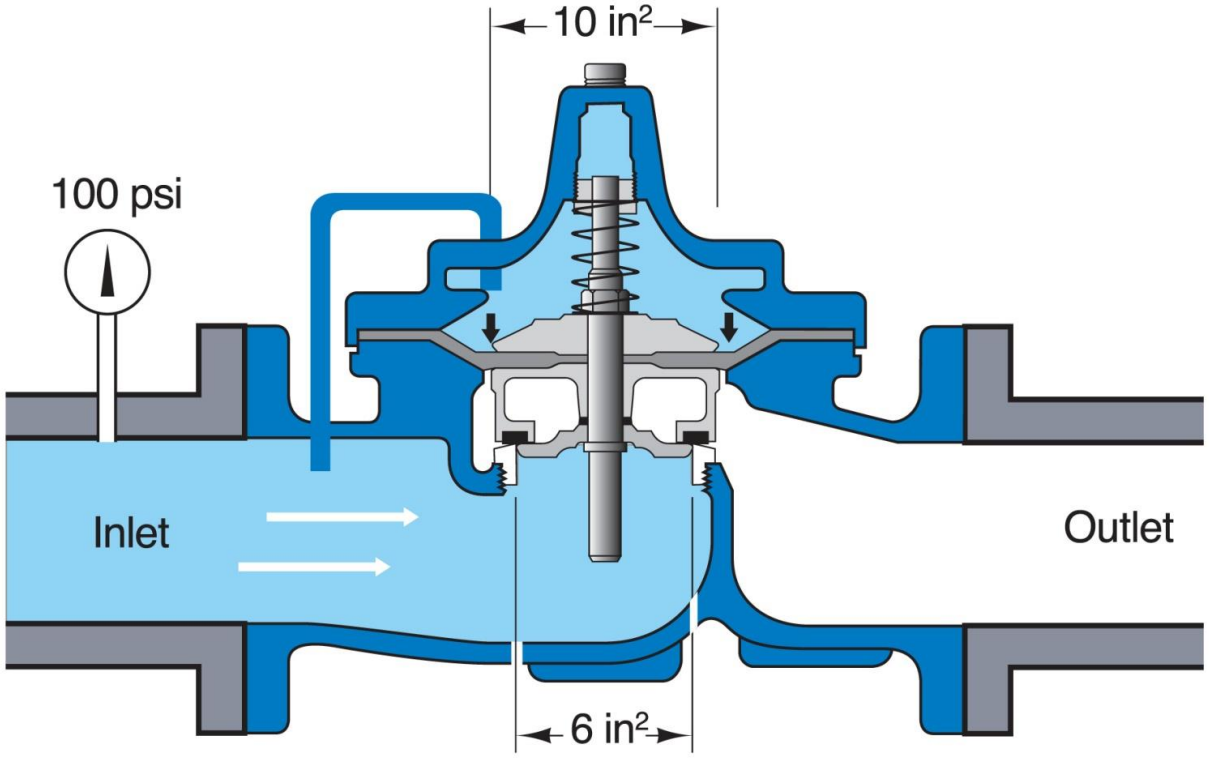
Line Pressure to Open – Opening Force



100psi.x 6 = 600lbs.

(opening force)

Line Pressure to Close – Closing Force



Closing Force 100 x 10 = 1000 lbs.
Opening Force 100 x 6 = 600 lbs.
Difference = 400 lbs.

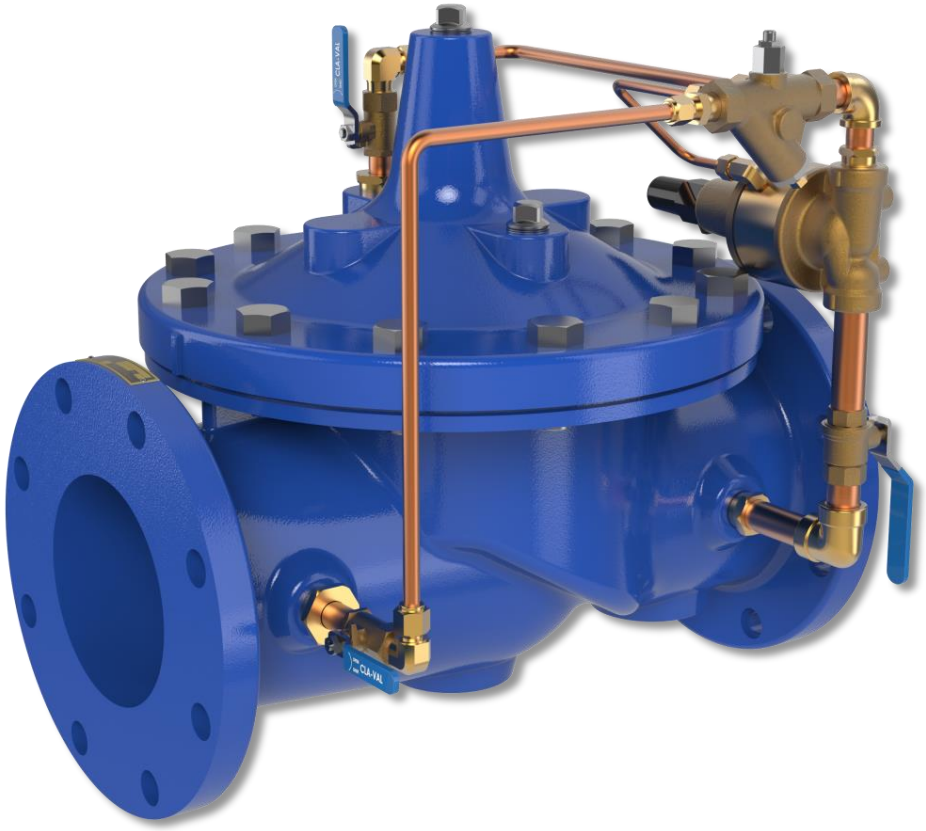
Cla-Val 100-01 Hytrol Main Valve X101 Valve Position Indicator

Hammer this in!

- Water **on** the cover valve goes **closed**
- Water **off** the cover valve goes **open**
- Remembering this will help when you have to troubleshoot

Cimco-GC SYSTEMS

Control Valve Main Body



Complete Valve Installed

Hytrol Model 100-01

Hydraulic Control = Hytrol

Used in 75-80% of all applications

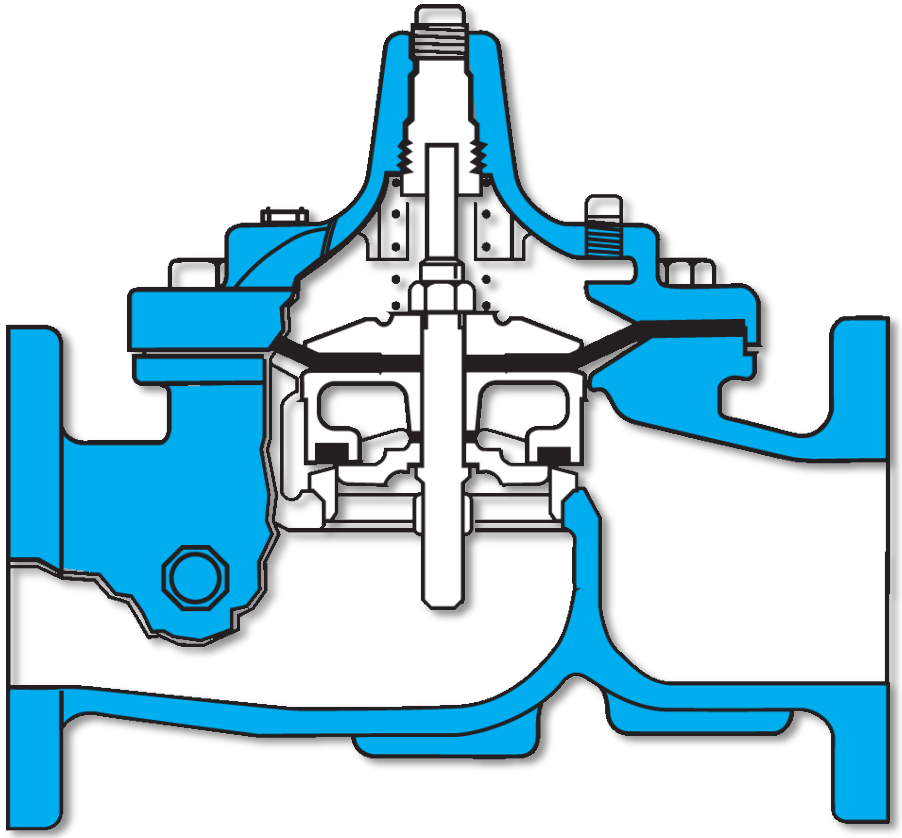
Powertrol Model 100-02

Power + Control = Powertrol

Used in pump control applications

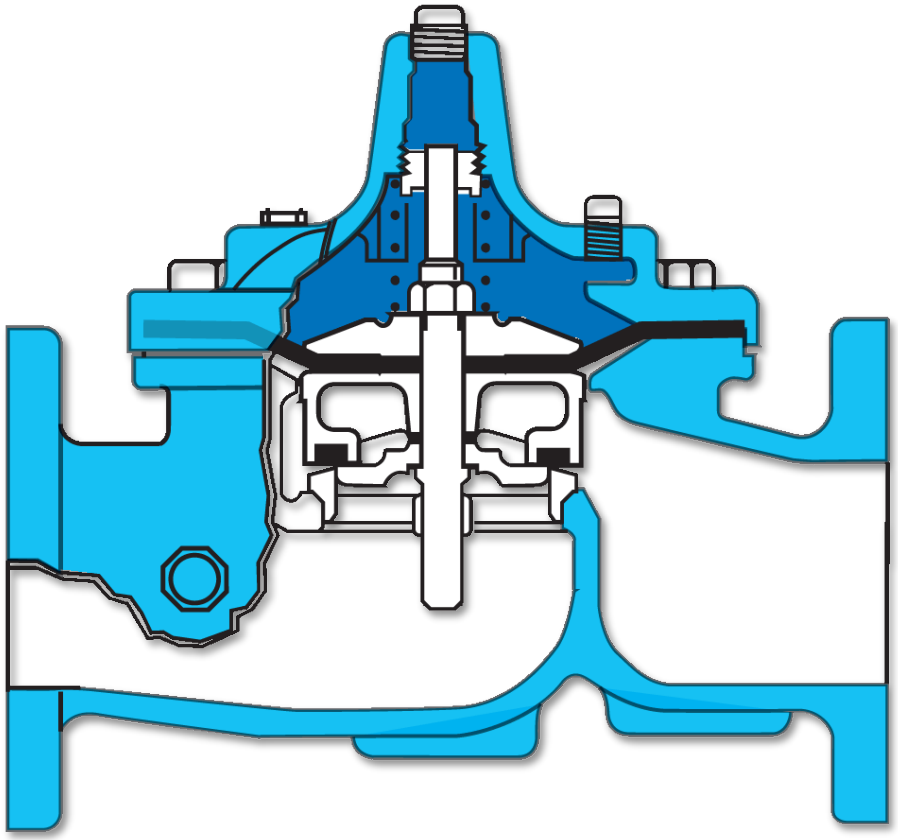
Four Basic Design Ideas

1. **Modified Globe Design**



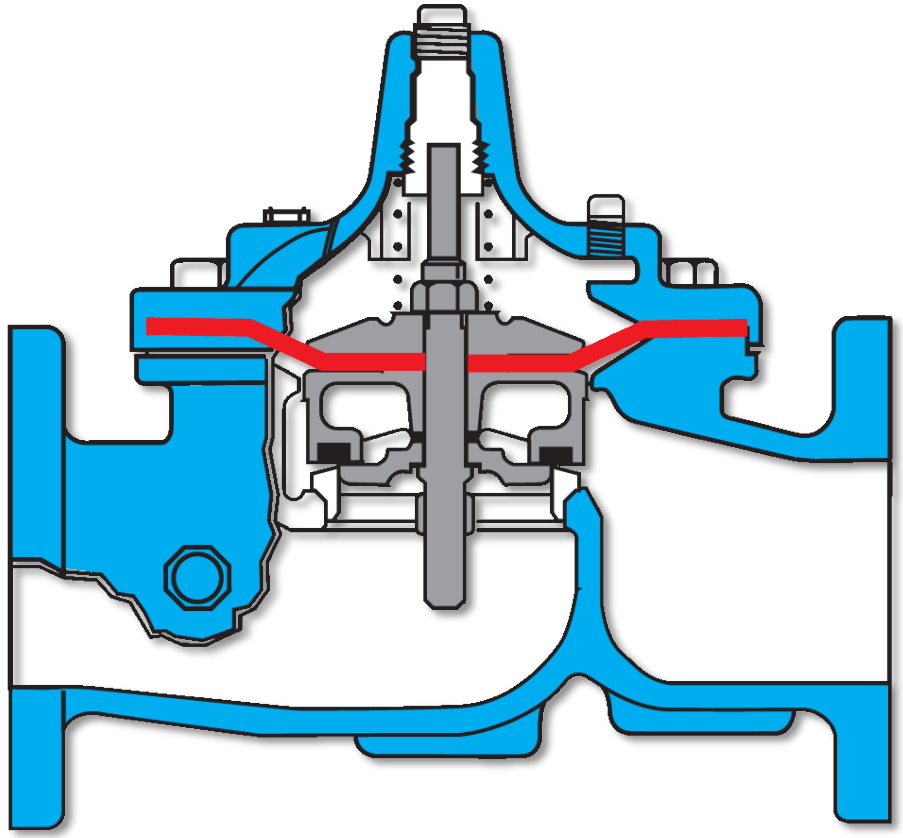
Four Basic Design Ideas

1. Modified Globe Design
2. **Hydraulically Operated**



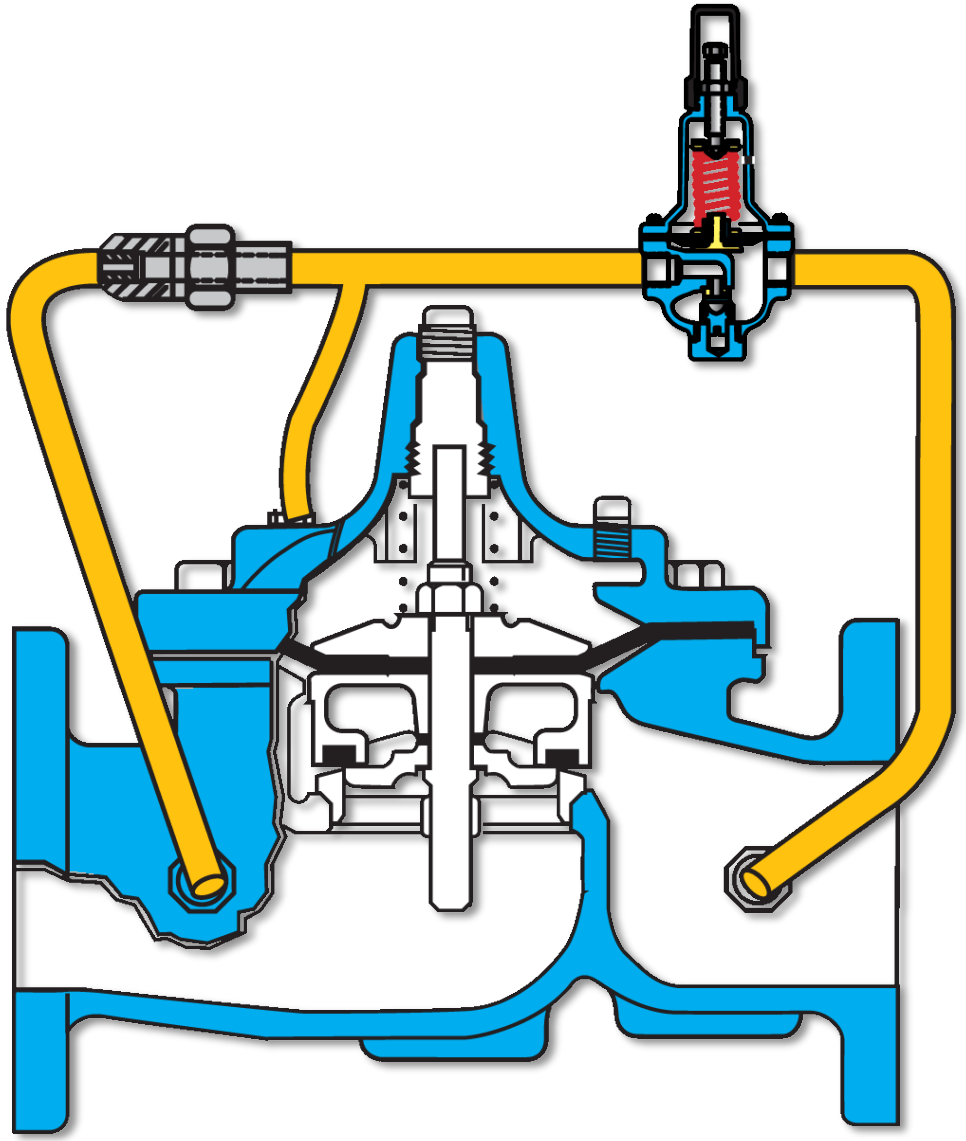
Four Basic Design Ideas

1. Modified Globe Design
2. Hydraulically Operated
3. **Diaphragm Actuated**



Four Basic Design Ideas

1. Modified Globe Design
2. Hydraulically Operated
3. Diaphragm Actuated
4. **Pilot Controlled**



Smallest: 3/8-inch valves

36-inch valves

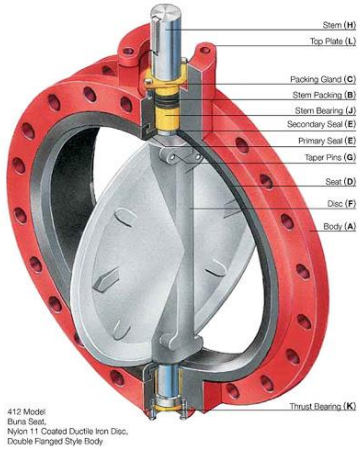
40-inch valves

48-inch valves… and even larger!

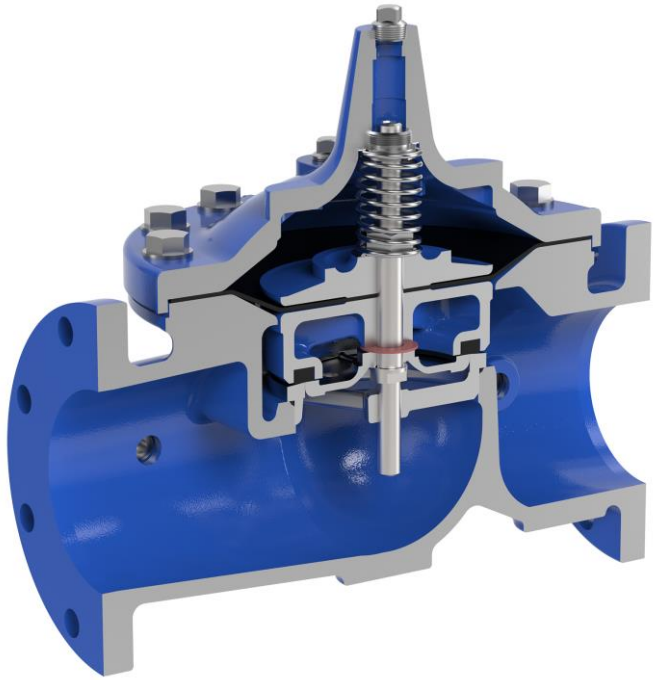
Why Control Valves?

- Drip-Tight Shut Design
- No Packing Glands – Water cannot leak at handle
- No Breakaway Friction – Control valves don’t stick
- No External Linkages – No external motors for operation
- Self Lubricating – Internals are all in water
- Lowest Operating Friction Possible – Opening & closing forces are balanced

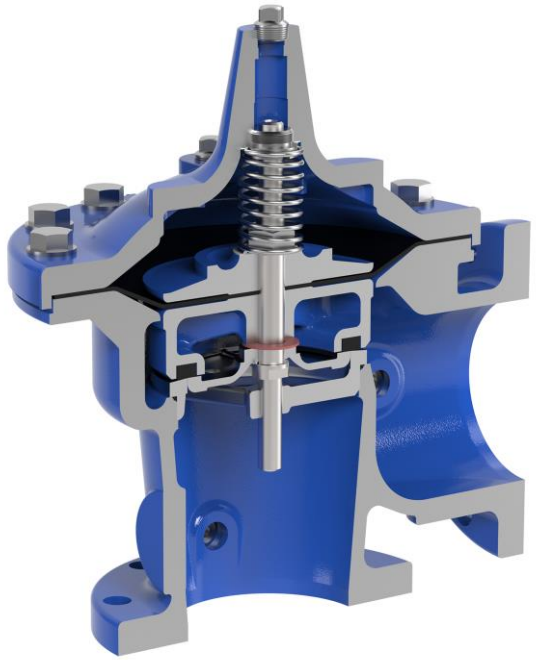
VS.



Globe and Angle Pattern

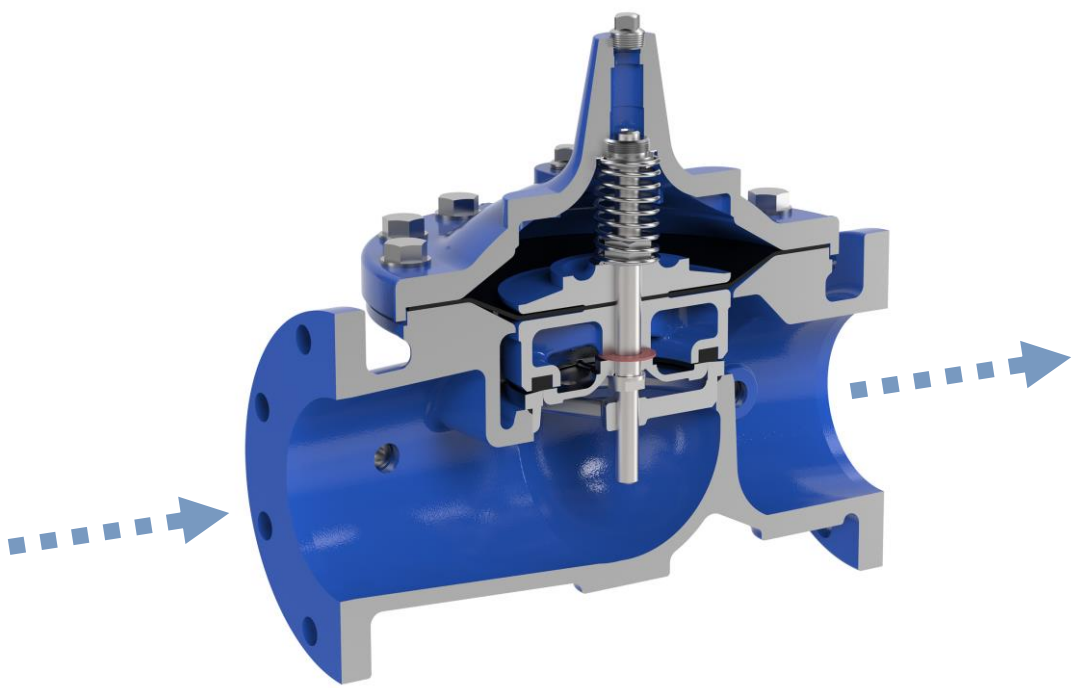


Globe

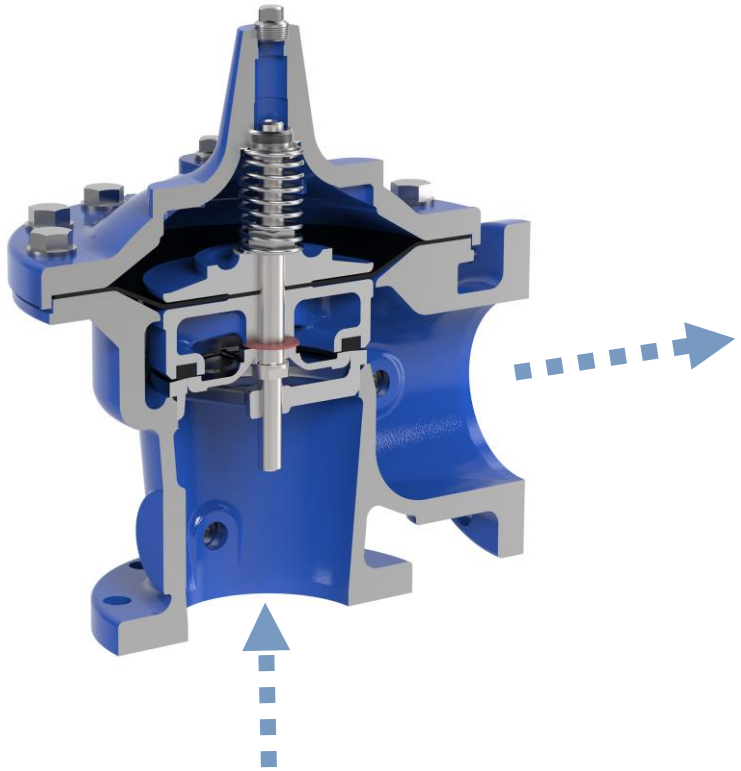


Angle:

Globe and Angle Pattern



Globe



Angle:

Angle Pattern

Sideways Installation Issues

Rough on the Internals

- Stem & Bearings Wear Out
- Increased Replacement Costs

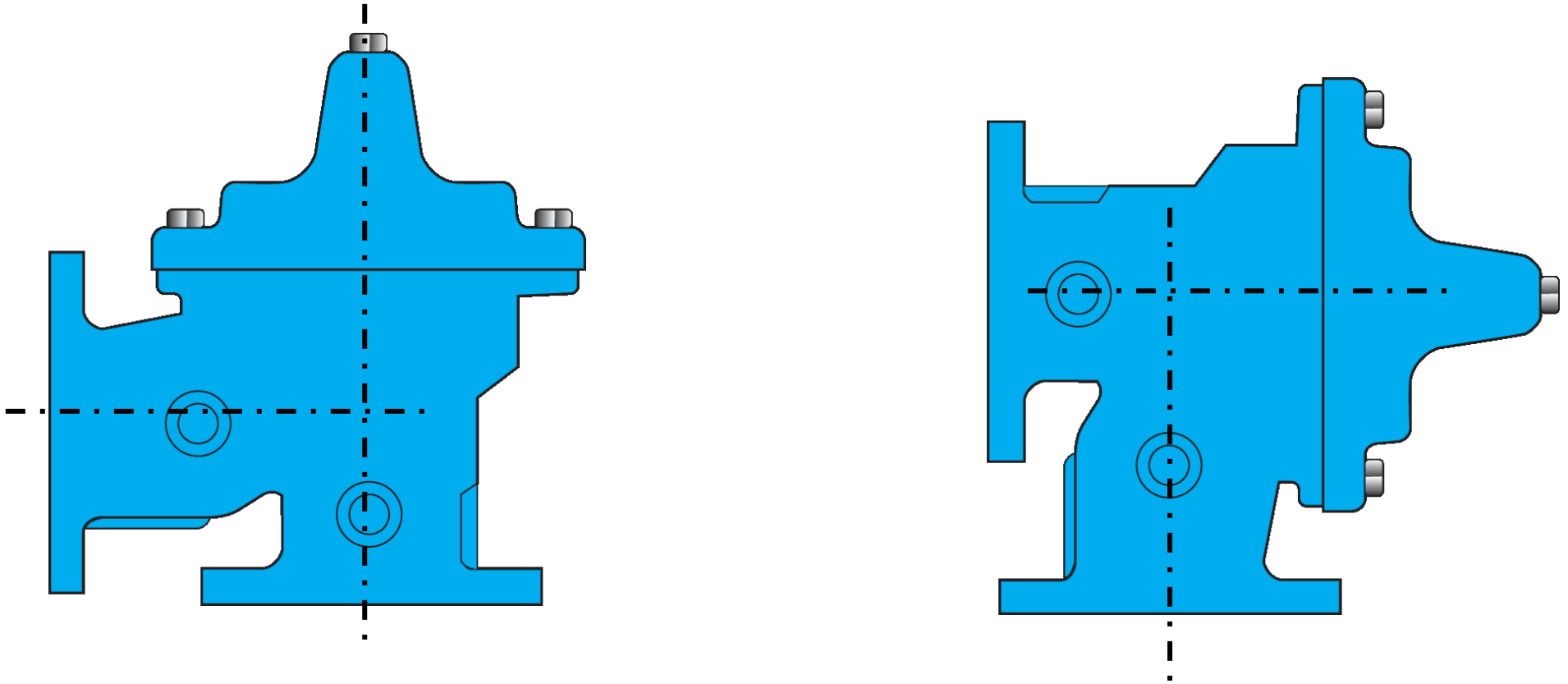
Hard to Bleed the Air

- Bleeding air is critical for setting valve
- Air will naturally rise to system high-point

Tough Job to Service

- Risk damaging internals when removing

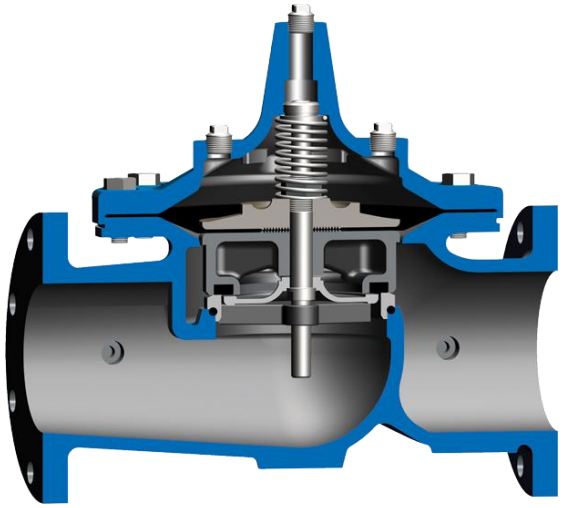
Installation Tip



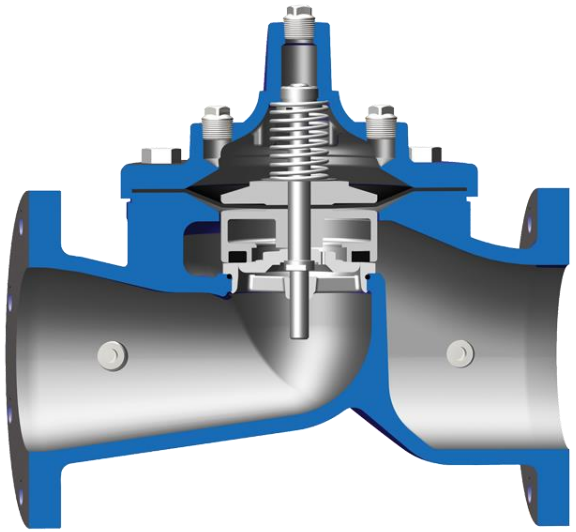
Unequal length to centerline

Full and Reduced Port

- Seat size is one size smaller than flange
- Why?
  - Control valves are sized for flow, not for pipeline size
  - Cavitation

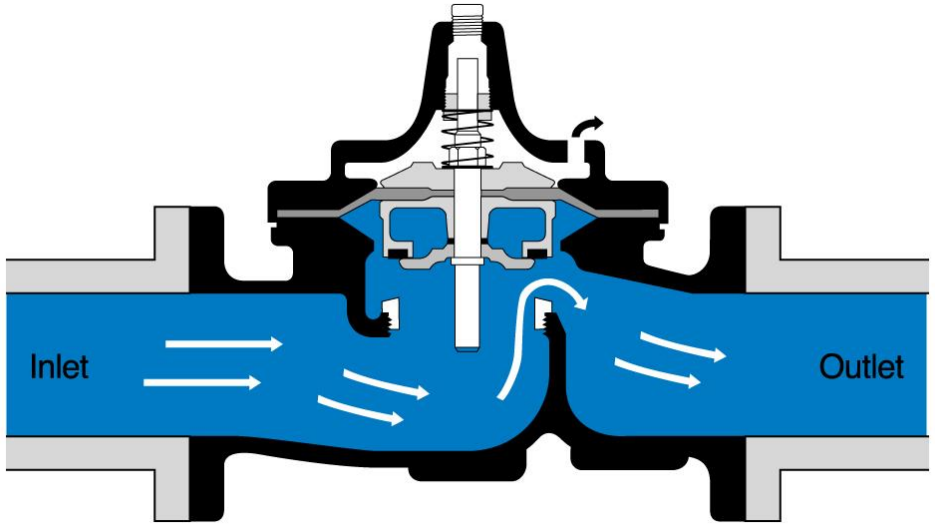


100-01

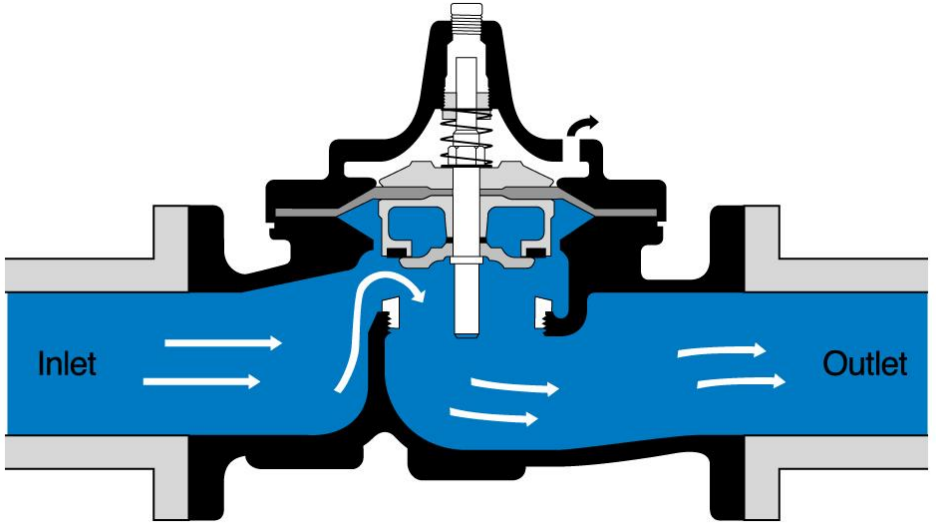


100-20

Two Directional Flow



Standard Flow Up and Over Seat



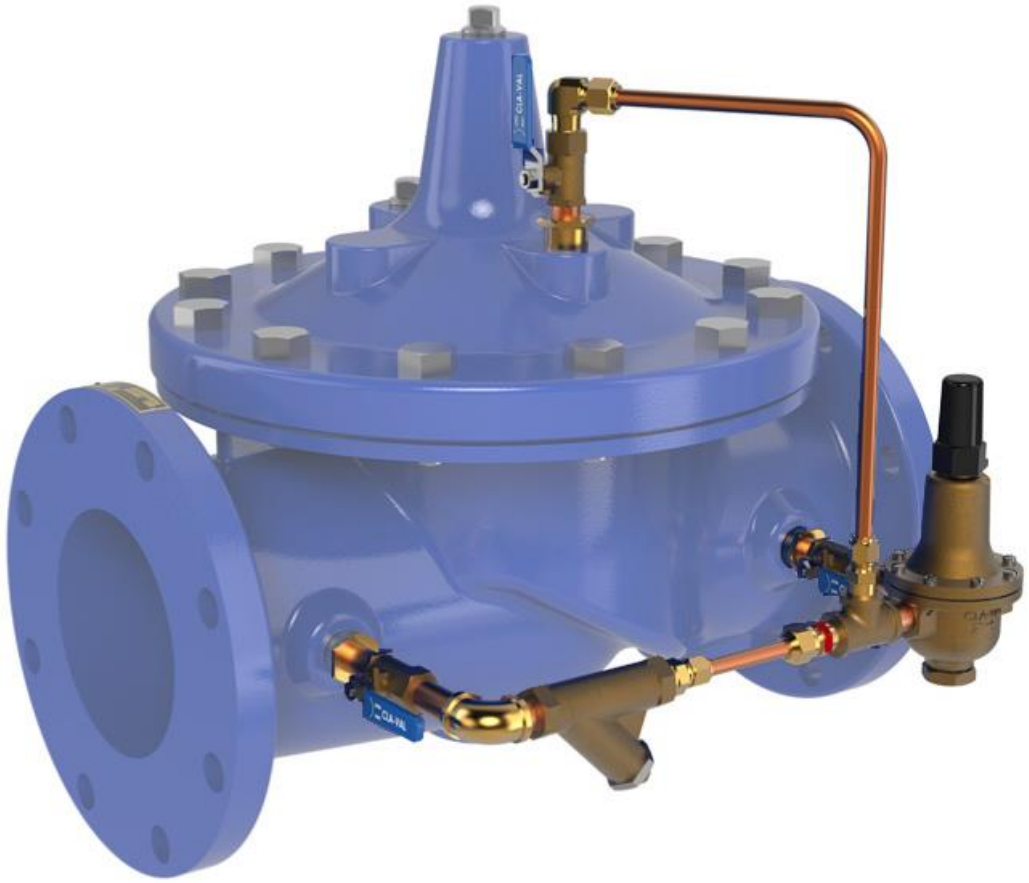
Reverse Flow Over Seat and Down
(acceptable only under specific conditions)

Two-Directional Flow

If you take away nothing else...

- Water **on** the cover valve goes **closed**
- Water **off** the cover valve goes **open**

Remembering this will help you understand pilot systems and help when you have to troubleshoot

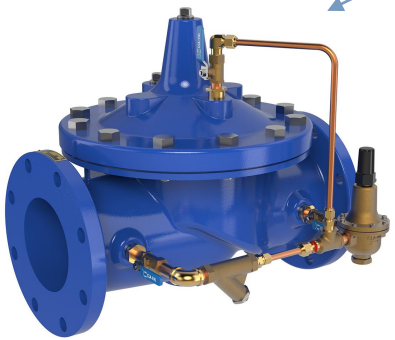


Cimco-GC SYSTEMS

Intro to Pilot Systems

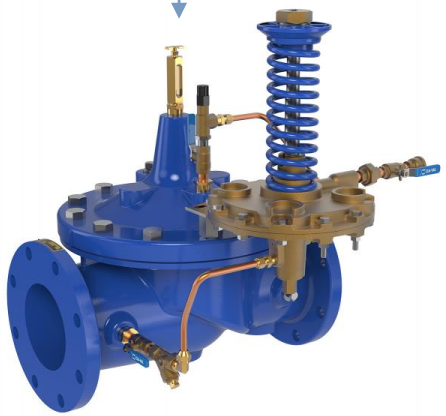
Pilot Systems Provide Functionality for a Valve

Base Valve
(No Function)



Pressure Reducing

Pressure Relief



Level Control

Flow Control

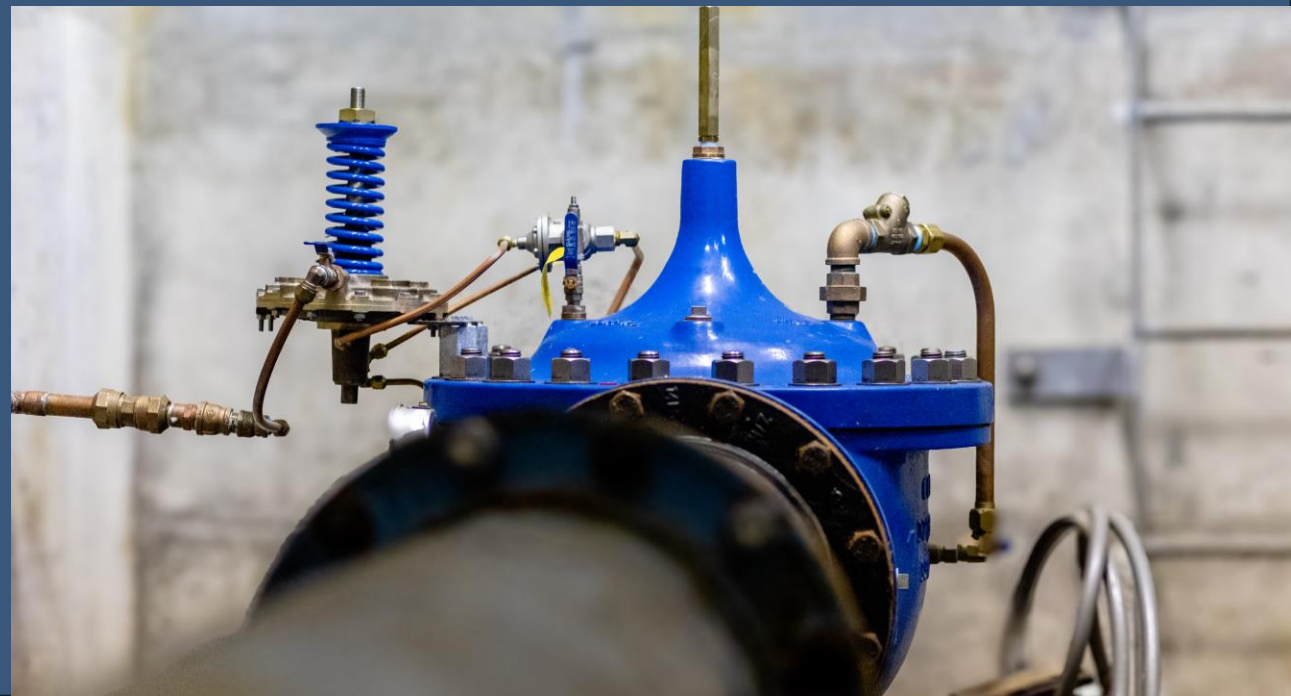
Electronic Interface

Pilot Controls

Move water on and off the cover of the valve

Common Features

- Mechanical pilots
  - CRD, CRL, CRA, CDS6A, etc.
- Solenoid controls
- Tubing and fittings
  - Copper tubing and brass fittings standard
  - *We highly recommend Stainless Steel tubing and fittings due to new low-lead copper and brass*
- Strainers, speed controls, sensors, check valves, ball valves, auxiliary Hytrols, etc.

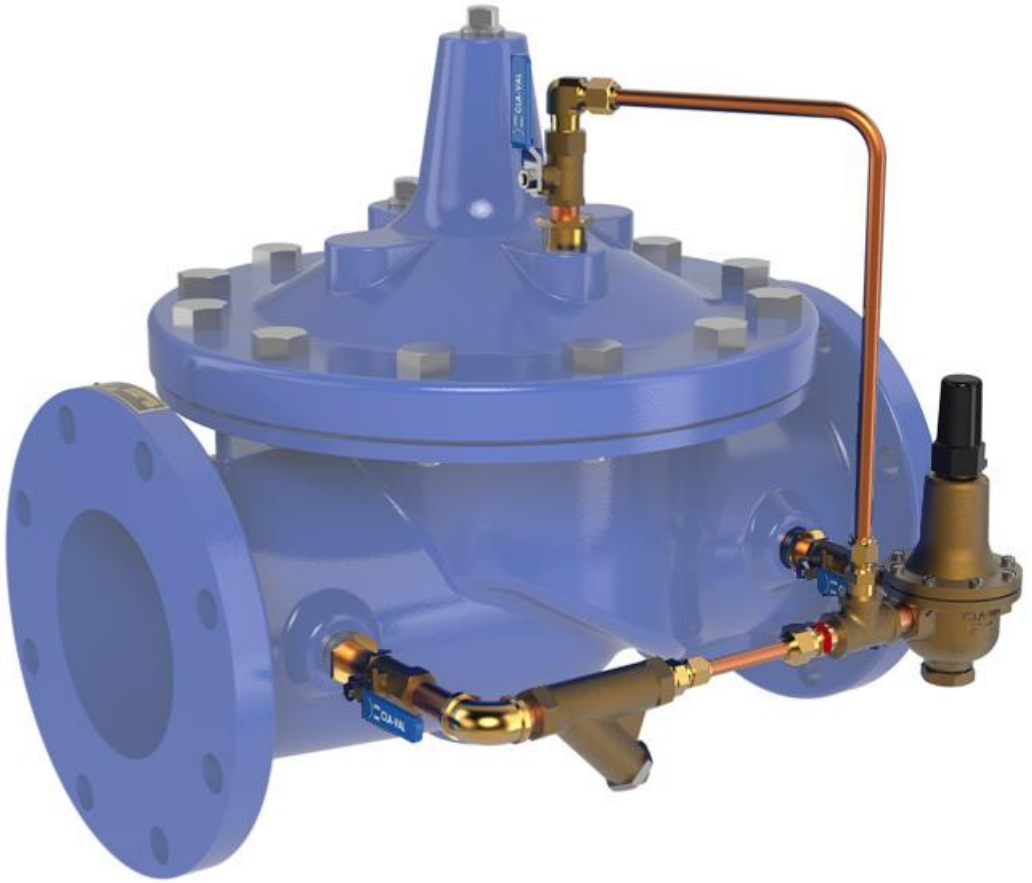


Intro To Pilot Systems

How many different pilot control configurations or combinations?

33,000!

Remember – one valve can do multiple jobs



One Valve, Multiple Jobs

Example

Four Solenoid controls

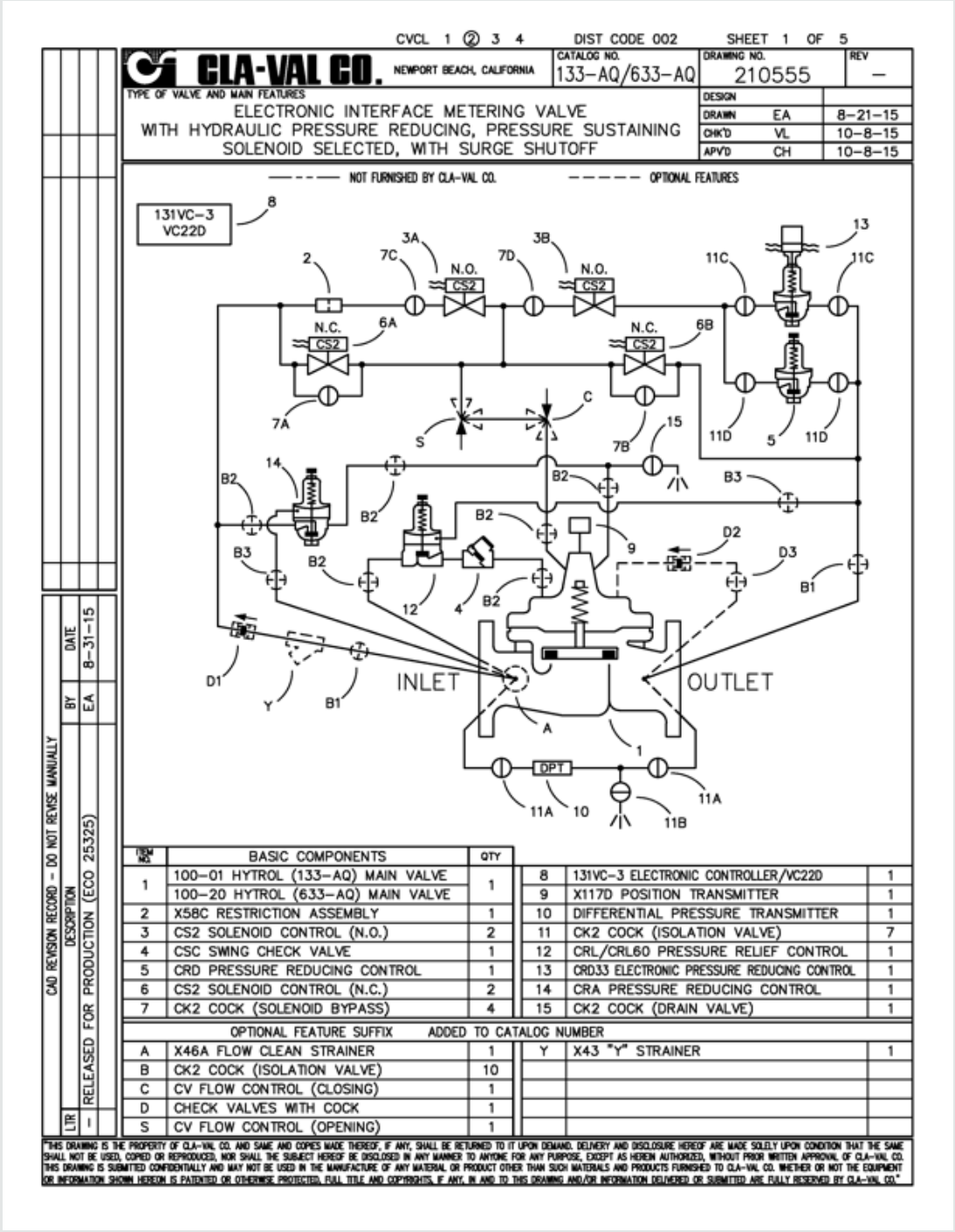
- Electronic interface control
- Solenoid selection control

Four Mechanical Pilots

- Electronic pressure reducing pilot
- Backup pressure reducing pilot
- Pressure Sustaining Pilot
- Surge shut-off pilot

Many Complementary features

- Strainer, fixed restriction, speed controls, check valves, ball valves, pressure transducers, etc



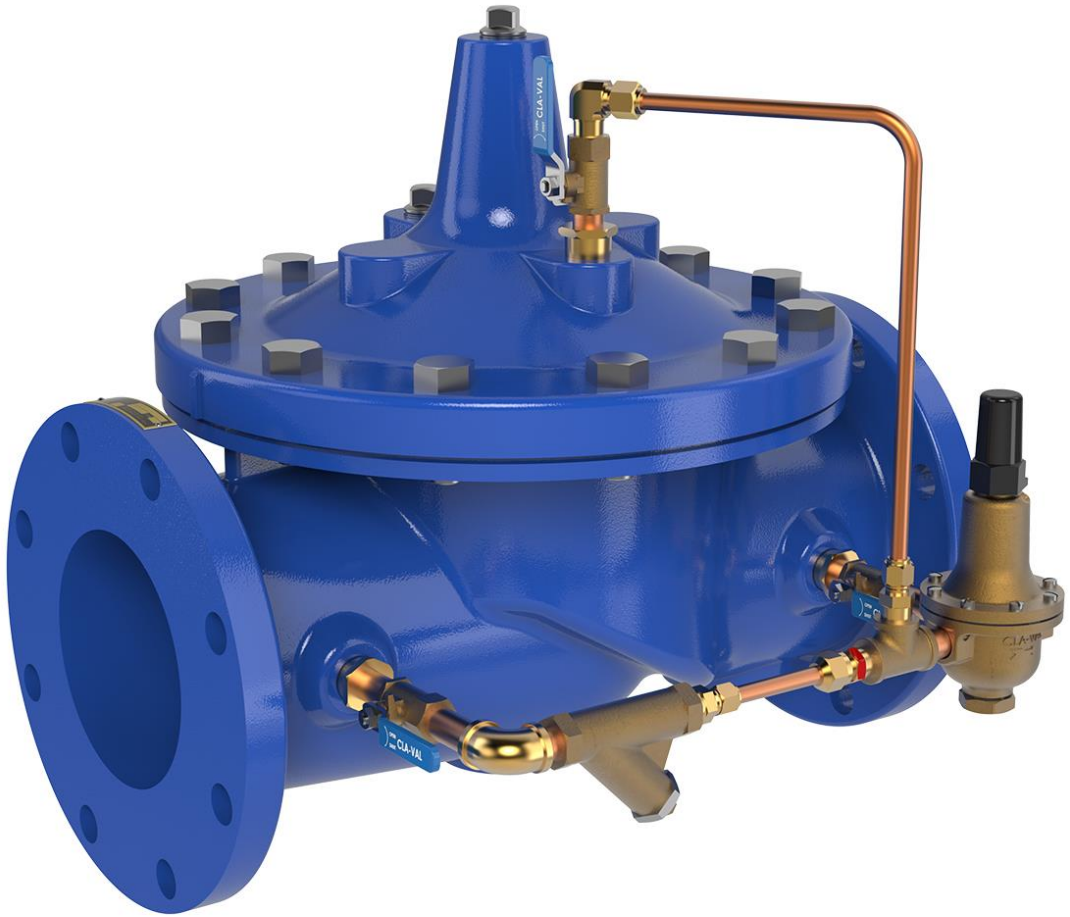
Pilot Systems Divided into Two Groups

Modulating

1. Pressure Reducing
2. Pressure Sustaining/Relief
3. Rate of Flow
4. Electronic

Non-Modulating

1. Pump Control
2. Solenoid Operated
3. Level Control

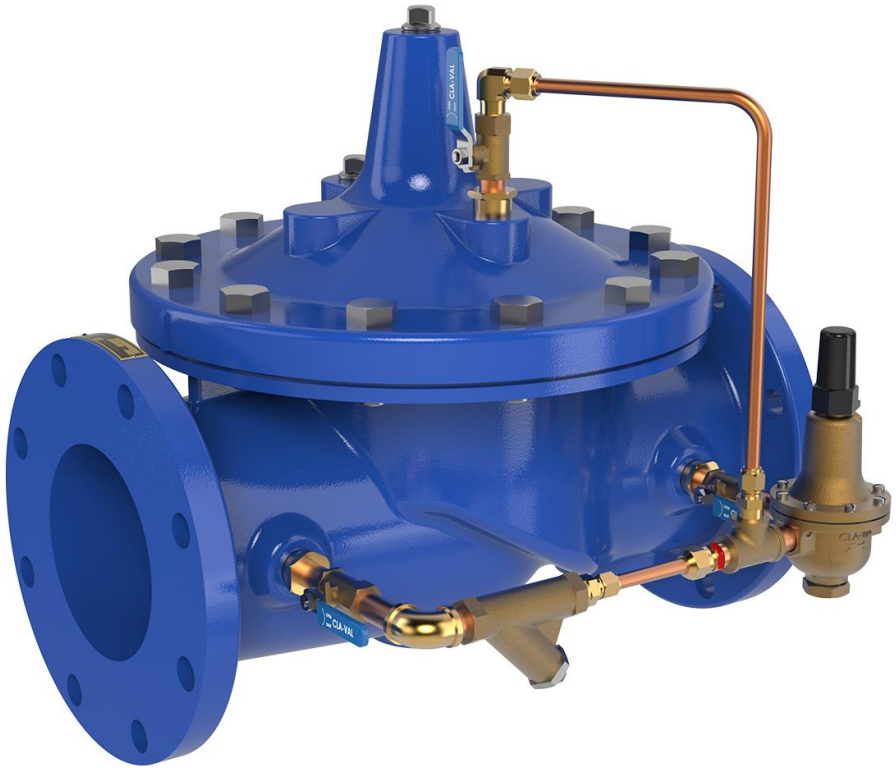


Cimco-GC SYSTEMS

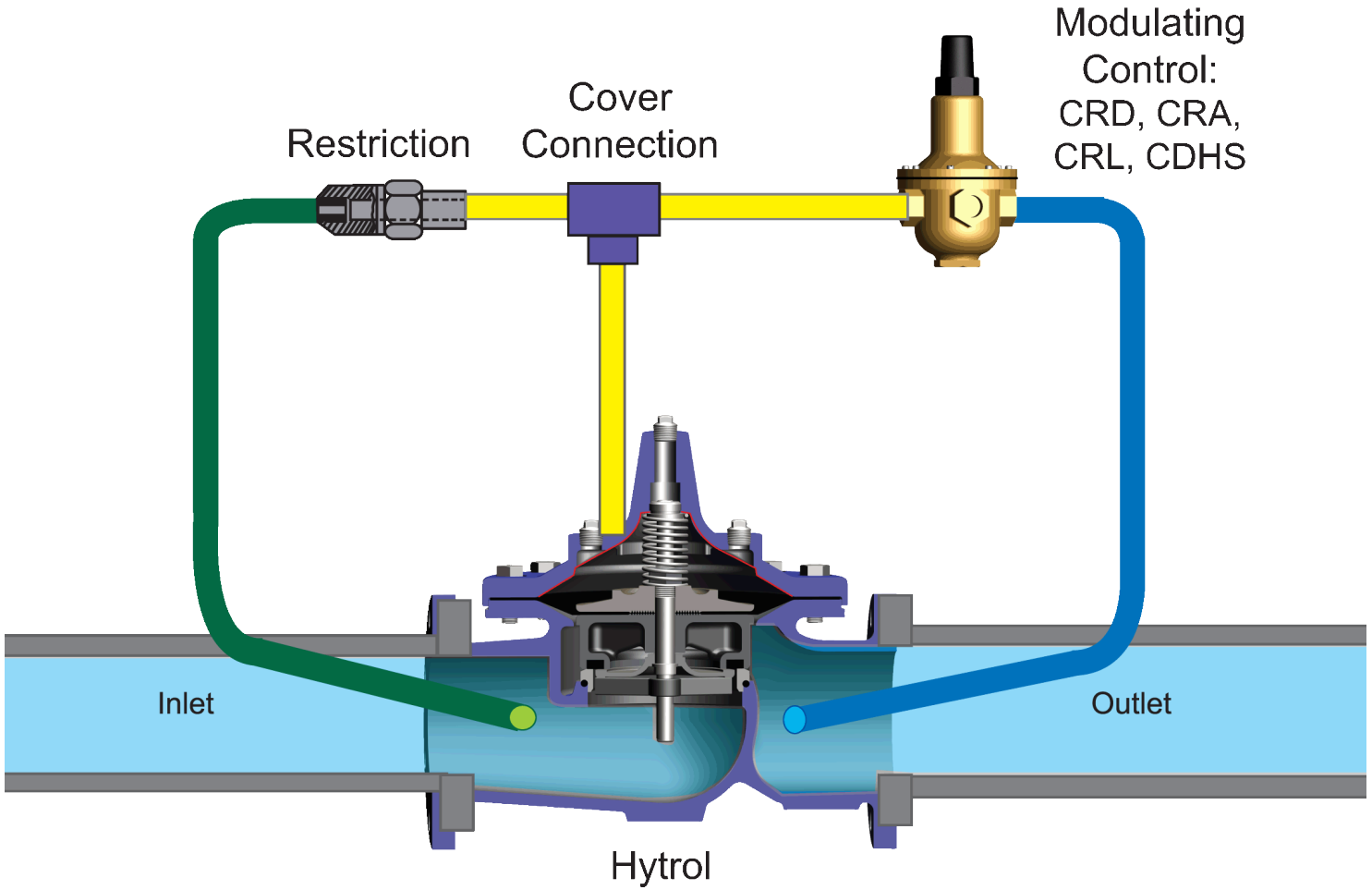
Pressure Reducing Valves

Pressure Reducing Valves

Maintain a constant downstream pressure regardless of inlet pressure or changes in flow rate



All modulating, hydraulic control valves will have…



Examples

- 16” Pressure Reducing valve on a 24” irrigation pipeline Beau Started-up

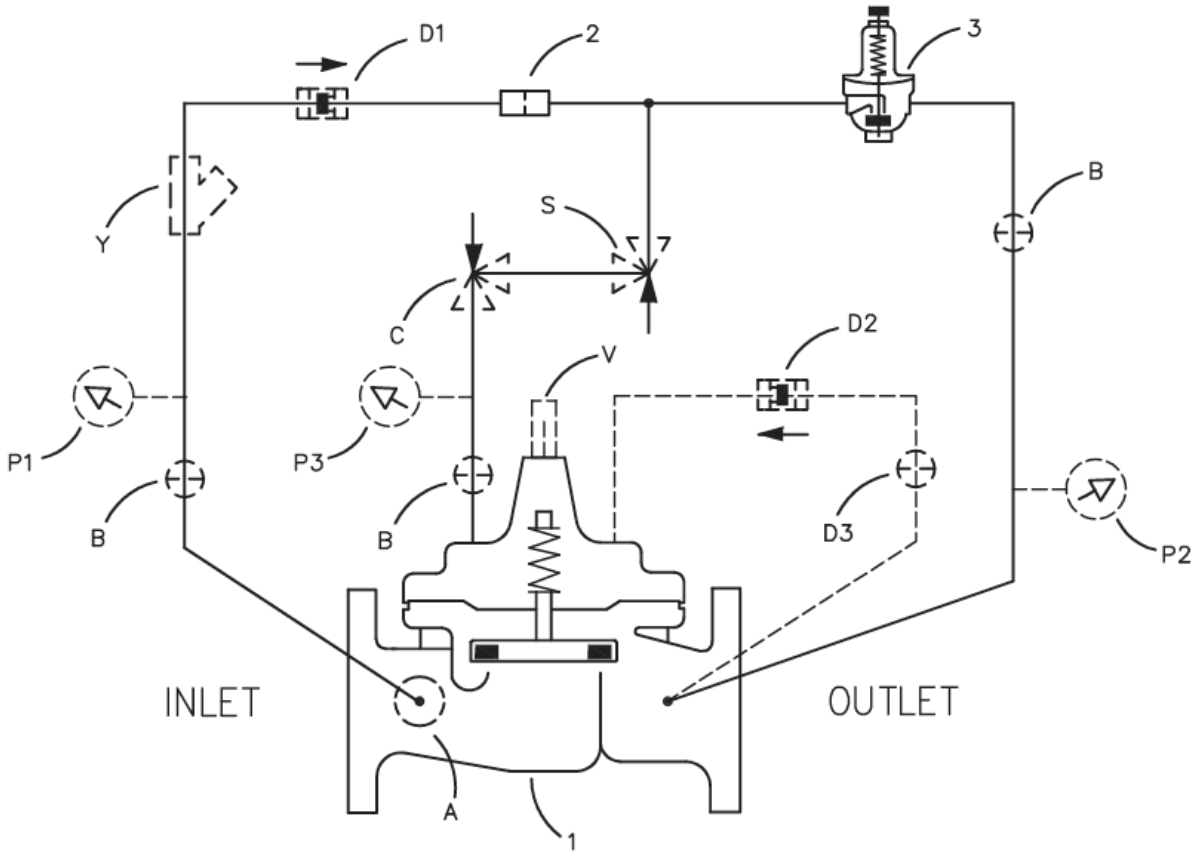
Examples

- Pressure Reducing Station with a 6” and a 1 ½” Pressure Reducing Valves

90-01 Components

Most Common Pressure Reducing Valve

- Always Included:
  - 100-01 Hytrol Main Valve
  - X58C Restriction Fitting
  - CRD Pressure Reducing Pilot
  - Either an X46A Flow Clean or a X43 “Y” Strainer
- May also Include:
  - Ball valves, Speed controls, X101 valve position indicator, check feature, etc.



BASIC COMPONENTS
1 100-01 Hytrol (Main Valve)
2 X58C Restriction Fitting
3 CRD Pressure Reducing Control

OPTIONAL FEATURES
A X46A Flow Clean Strainer
B CK2 (Isolation Valve)
C CV Flow Control (Closing)
D Check Valves with (Isolation valve)
P X141 Pressure Gauge
S CV Flow Control (Opening)
V X101 Valve Position Indicator
Y X43 “Y” Strainer

90-01 Operation

- Modulates all day based on system demand to maintain set point
- Utilizes CRD Component to sense pressure change
- Drop in Downstream Pressure, Valve Opens
- Rise in Downstream Pressure, Valve Closes
- +/- 1psi accurate
- Reacts quickly to change
- Needs at least 10psi Differential Pressure for control

CRD Pressure Reducing Pilot Control

C = Control

R D = Reduce

CRD

CRD Pressure Reducing Pilot Control

- Normally open
- Closes on pressure rise
- Senses outlet pressure
- 3/8” connection | 1/4” orifice
- Design/repair parts have not changes since the 1950’s

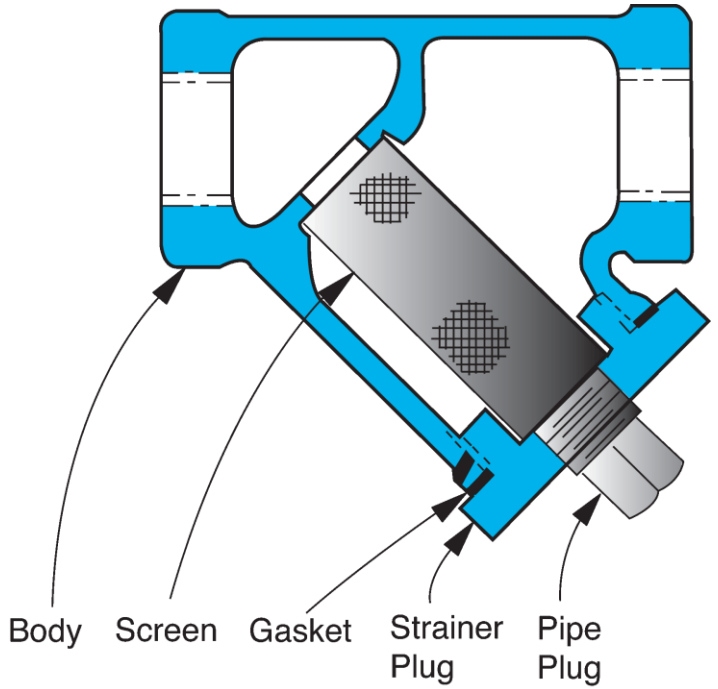
CRD

X58 Restrictors

- Small orifice stained **BLUE** – 3/32″
- Large orifice stained **RED** – 1/8″

Strainers

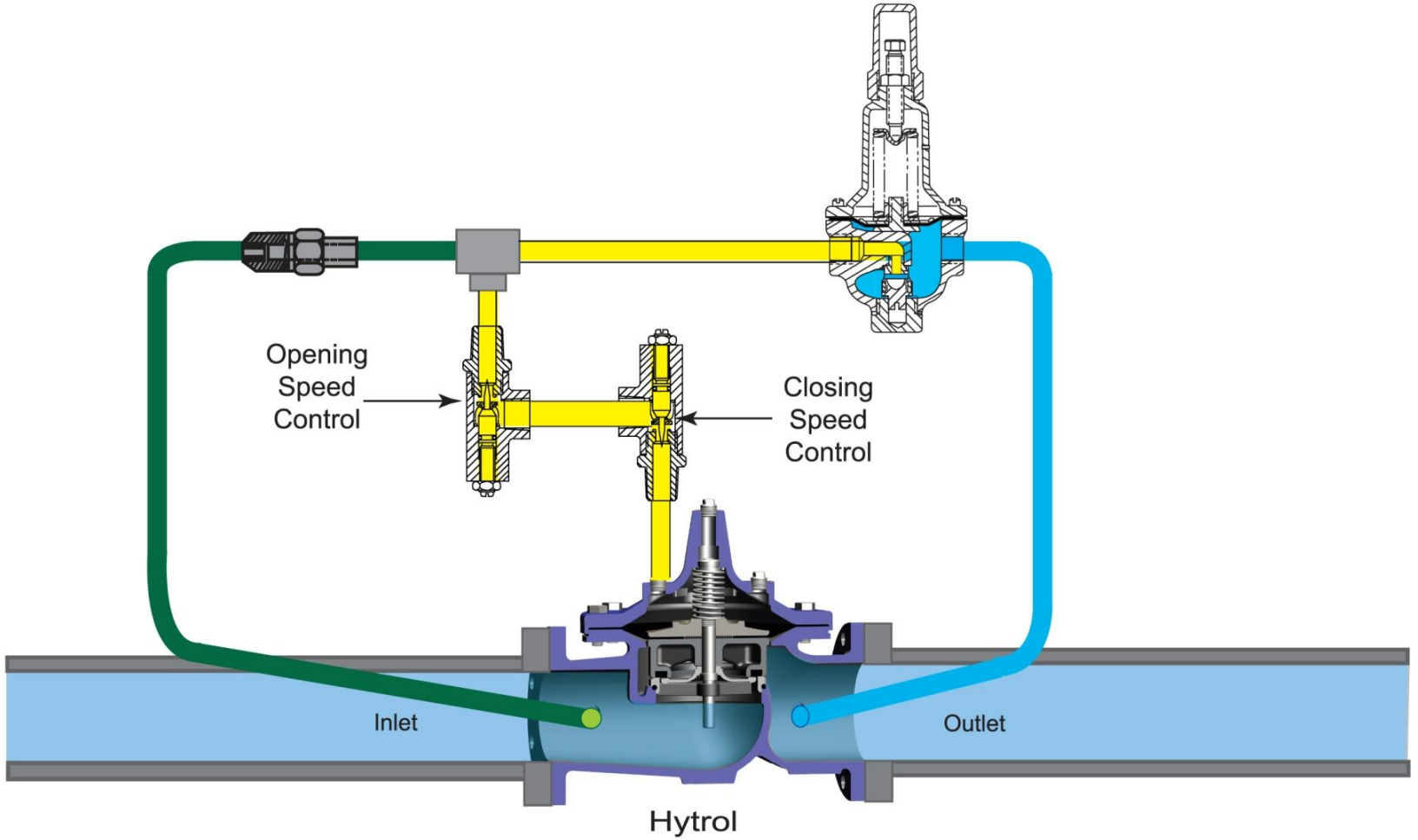
X46 Flow Clean Strainer



X43 Strainer

Cla-Val 90-01 Pressure Reducing Valve

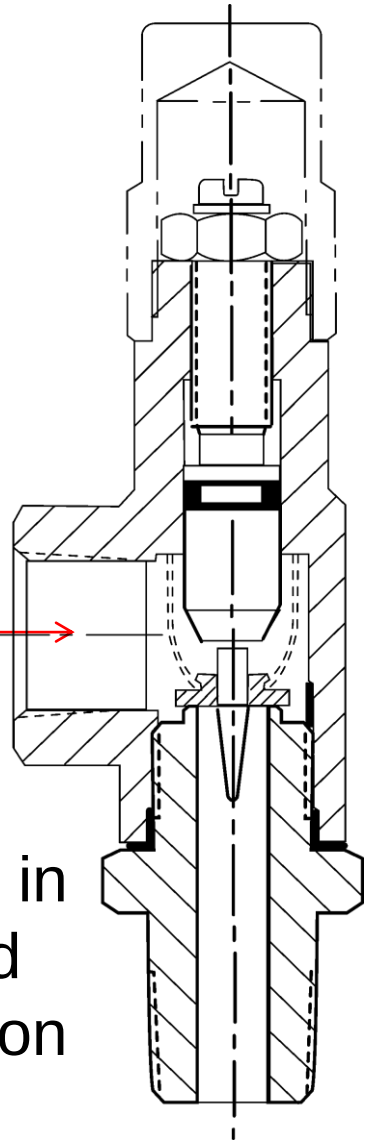
Opening & Closing Speed Controls



Speed Controls

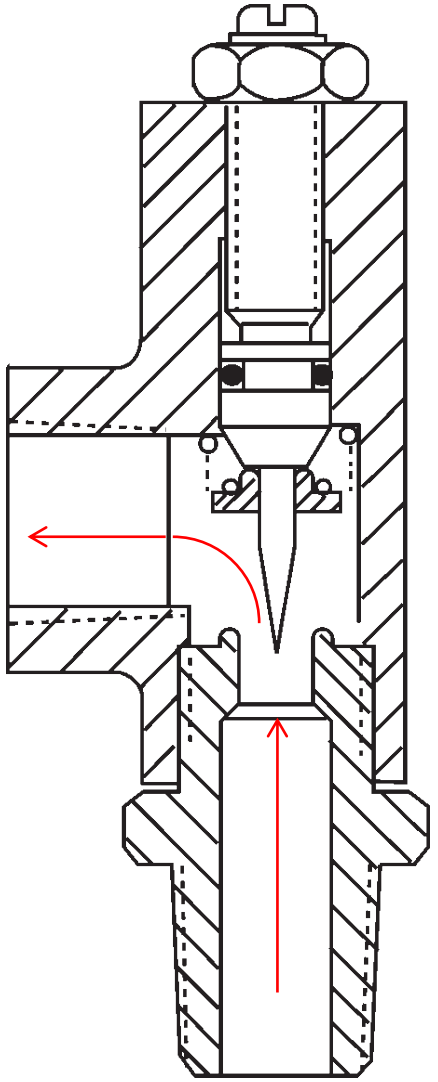
- Slows down the valve going opened and closed by restricting flow
    - Preventing water hammer
- Opening or Closing (or both)
- PRV Start Point – Screw in all the way, back out 3 turns
- Relief Set Point – Screw in all the way, back out ½” turn
- Servicing – Clean the Disc and Needle

CV Speed Controls



Restricted Flow

CV Control in Restricted Flow Position

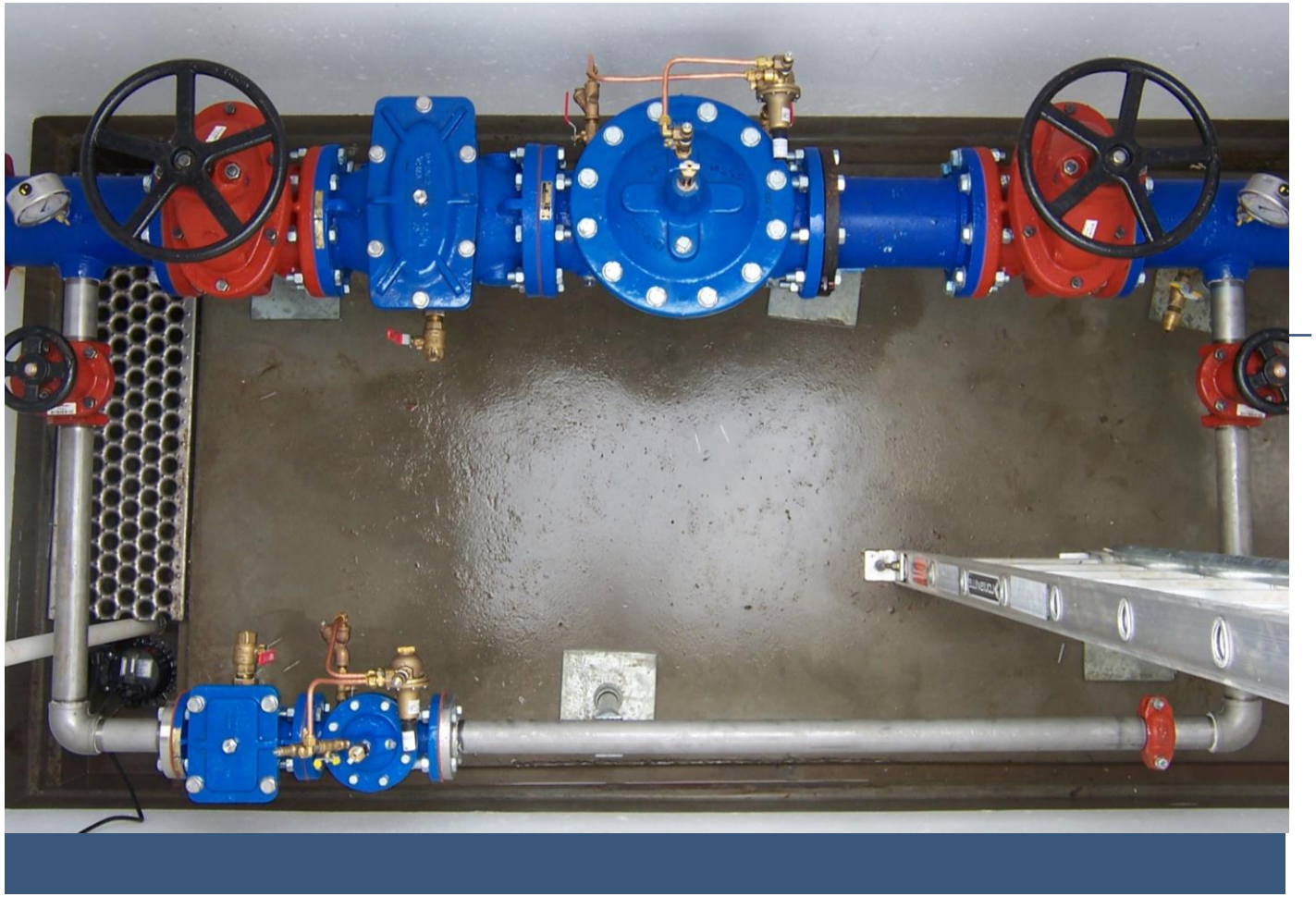


CV Control in Free Flow Position

Free Flow

Cimco-GC SYSTEMS

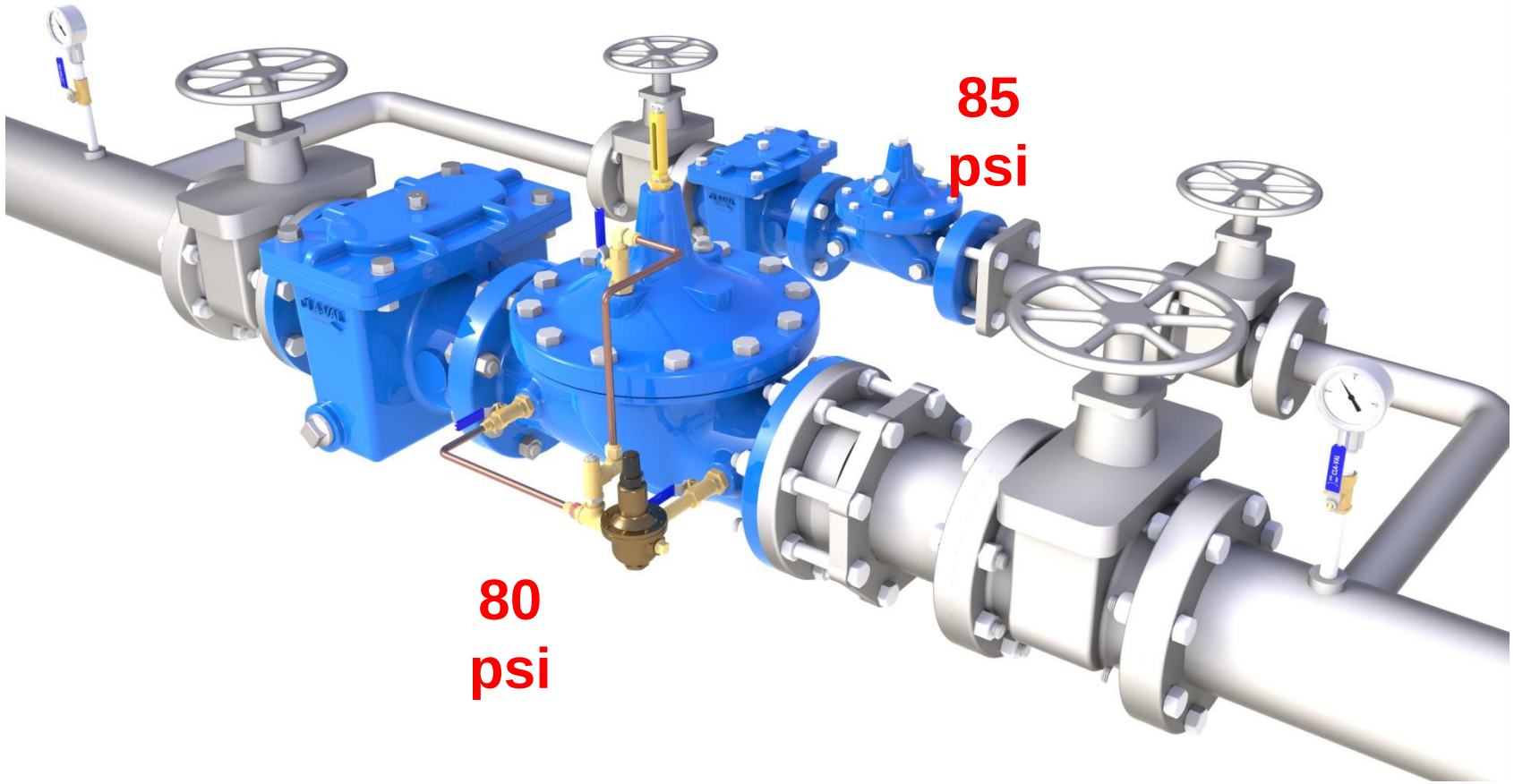
Pressure Reducing Station Design



Pressure Reducing Station with Bypass

Coordinating Pressure Reducing Valves

140 psi



85 psi

80 psi

85 psi

Bypass Advantages

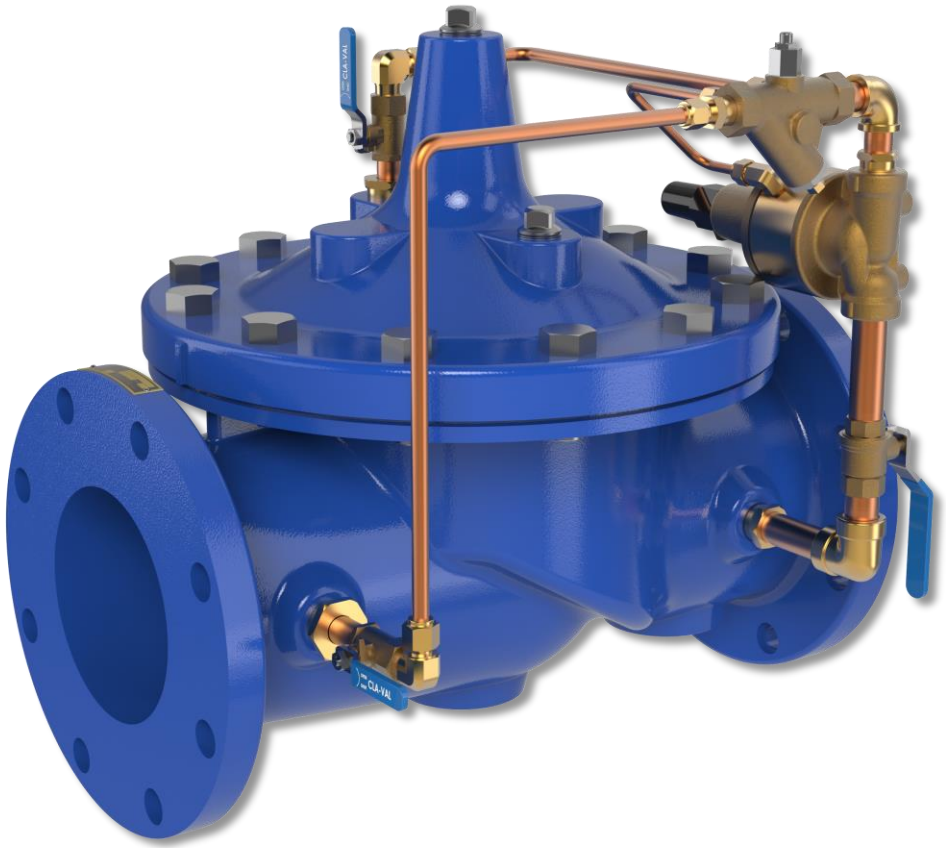
- Individual valves are sized for low and high demand to function in their respective ranges
- No downtime when servicing
- Isolate one for maintenance and flow through the other
- Built in redundancy

Cimco-GC SYSTEMS

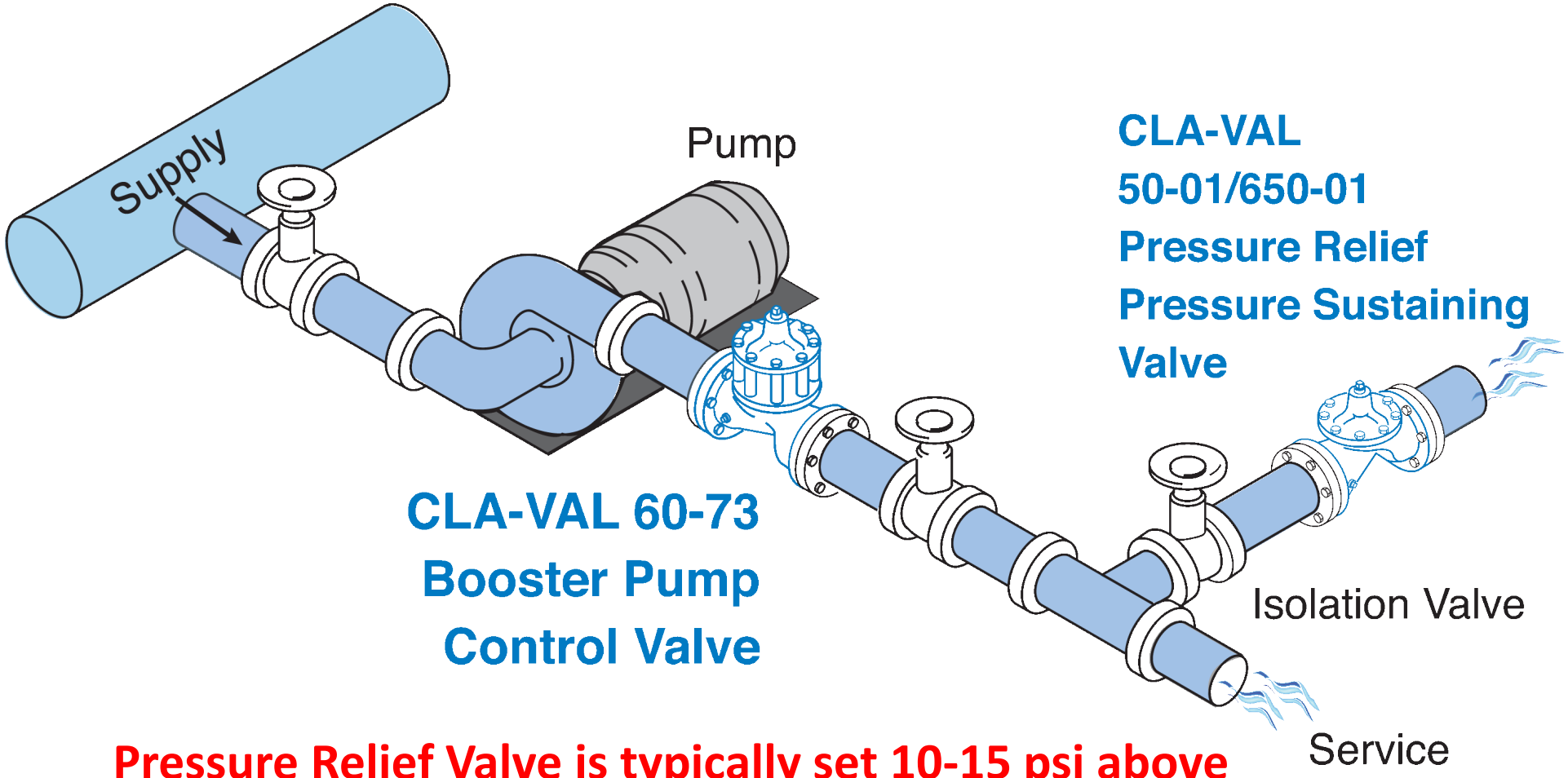
Pressure Relief Valves

Pressure Relief Valves

Maintain a maximum upstream pressure regardless of outlet pressure or changes in flow rate



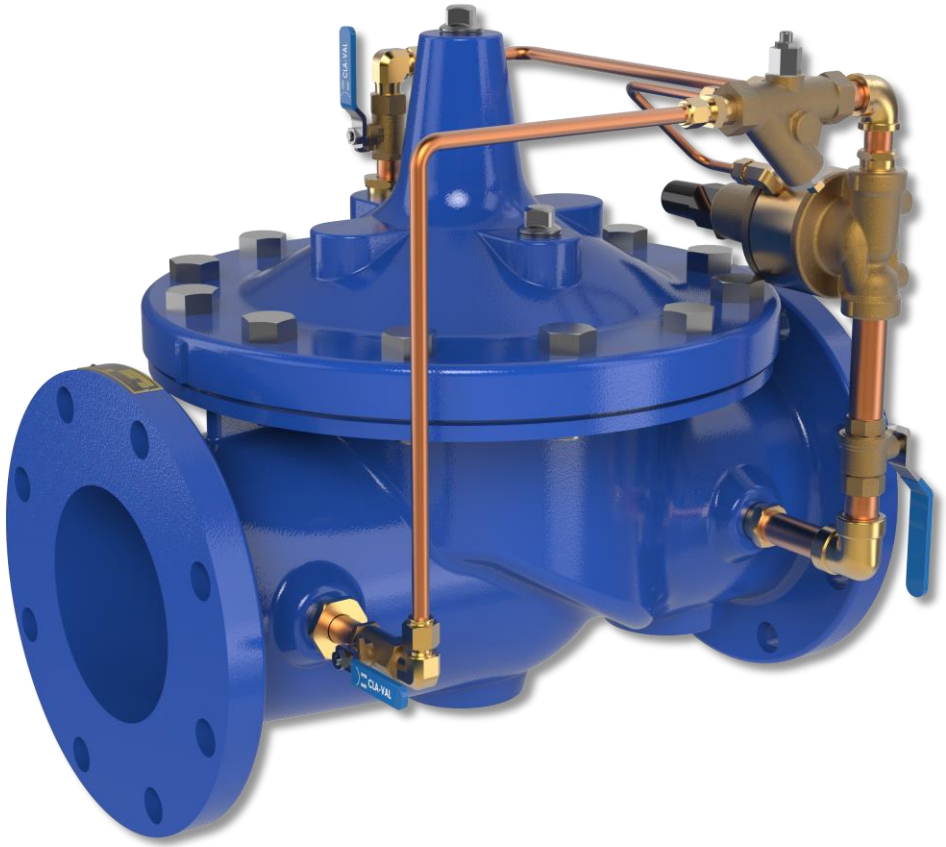
Typical Pressure Relief Application



Pressure Relief Valve is typically set 10-15 psi above normal pressure

Main Components

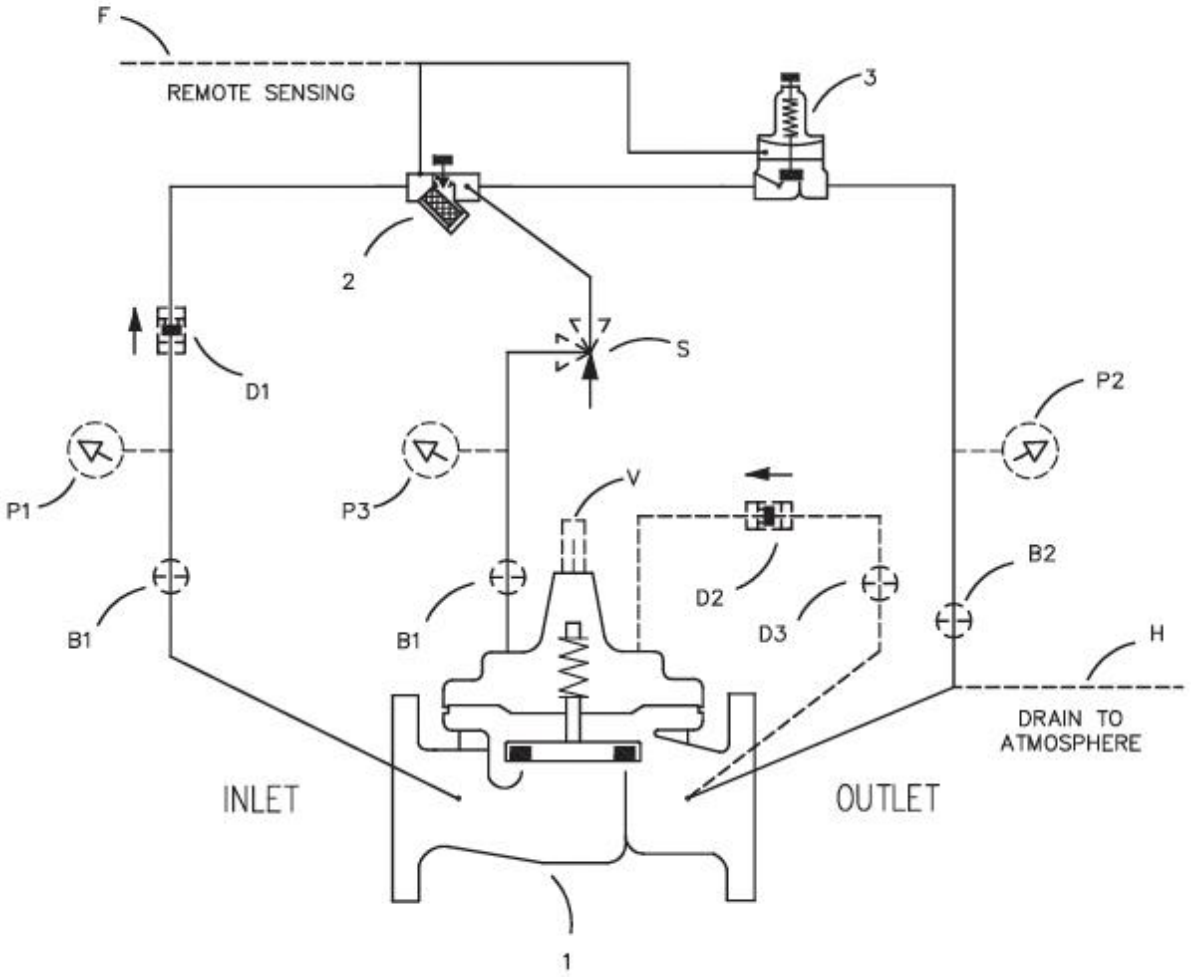
Model 50-01



50-01 Components

Most Common Pressure Relief Valve

- Always Included:
  - 100-01 Hytrol Main Valve
  - X42N-2 Strainer Needle Valve
  - CRL Pressure Relief Control
- May also Include:
  - Ball valves, Speed controls, X101 valve position indicator, check feature, etc.



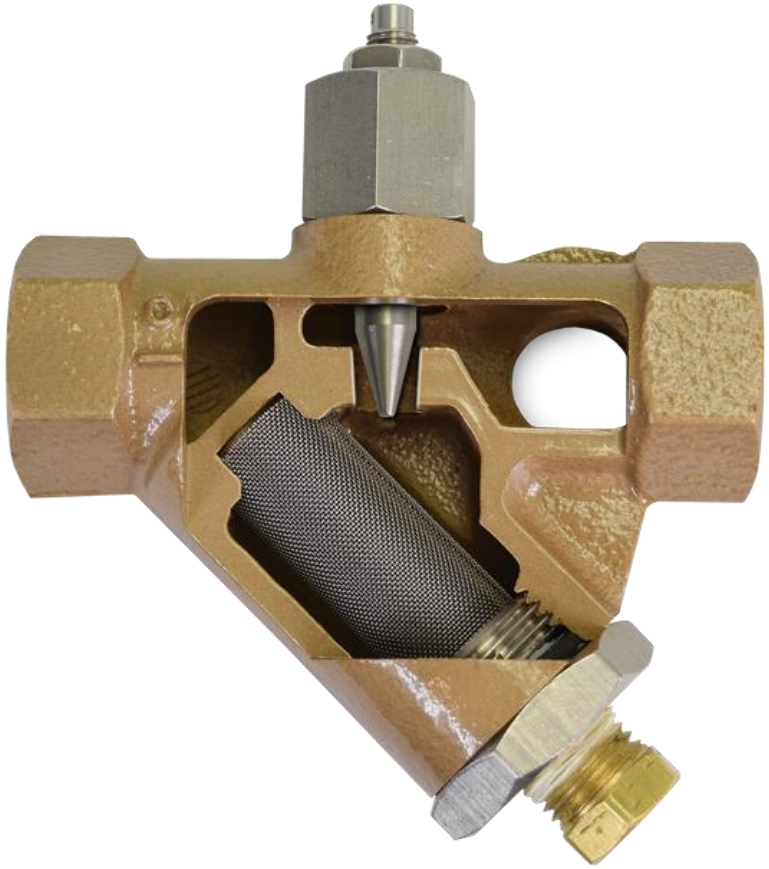
BASIC COMPONENTS
1 100-01 Hytrol (Main Valve)
2 X42N-2 Strainer Needle Valve
3 CRL-60 Pressure Relief Control

OPTIONAL FEATURES
B CK2 (Isolation Valves)
D Check Valves with Isolation valve
F Remote Sensing
H Drain to Atmosphere
P X141 Pressure Gauge
S CV Flow Control (Opening)
V X101 Valve Position Indicator

50-01 Operation

- Opens rapidly when inlet pressure rises above set point, and then closes slowly when system pressure drops below set point
- Utilizes CRL Component to sense upstream pressure changes
- Rise in Upstream Pressure, Valve Opens
- Drop in Upstream Pressure, Valve Closes
- +/- 1psi accurate
- Needs at least 10psi Differential Pressure for control

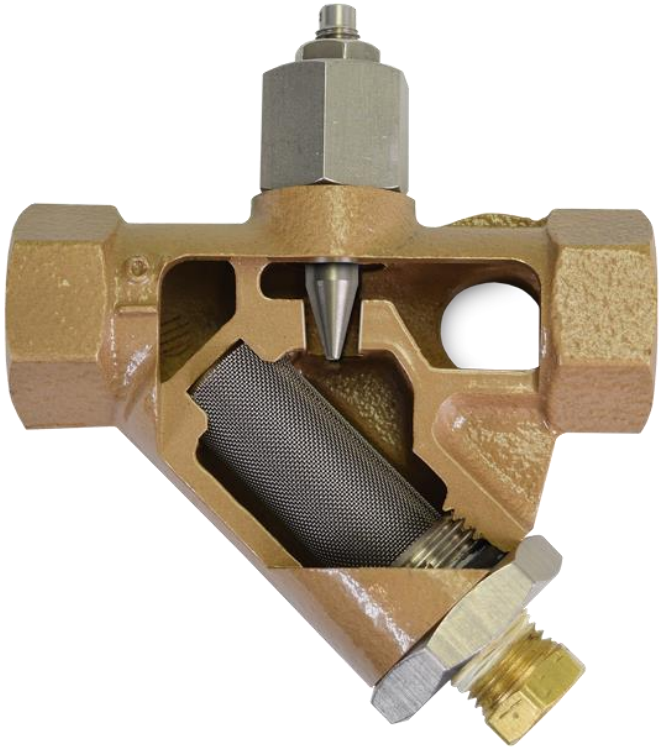
X42N-2 Strainer Needle Valve



X42N-2 Adjustment

Pressure	Turns out from seat
• Under 80psi	1/2
• Over 80psi	1/4

Does Not Come Preset



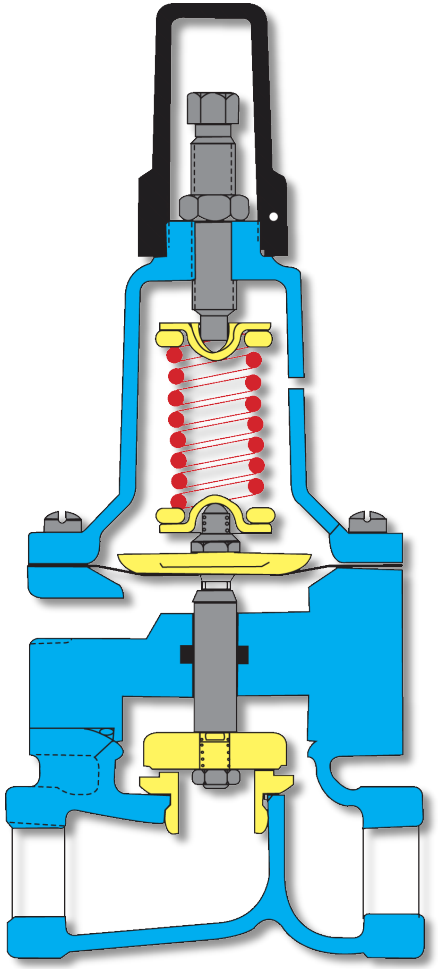
CRL/CRL-60 Pressure Relief Pilot Control

- **C** = Control
- **R L** = Relief

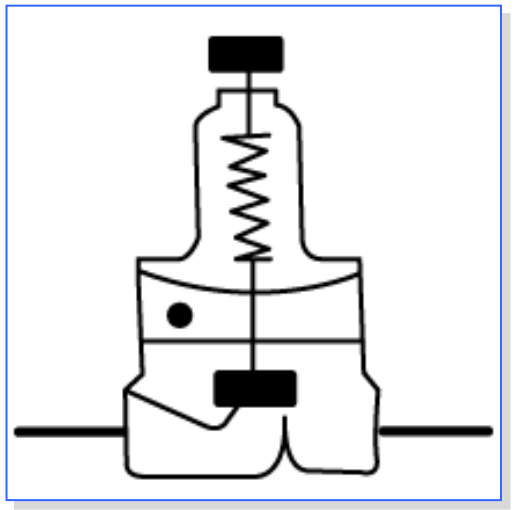
CRL

CRL-60

CRL Pressure Relief Pilot Control



- Normally closed
- Opens on pressure rise
- Senses inlet pressure remotely
- 11/16” Seat



Cla-Val 50-01 Pressure Relief Valve

Installation: 6-Inch 50-01

Cimco-GC SYSTEMS

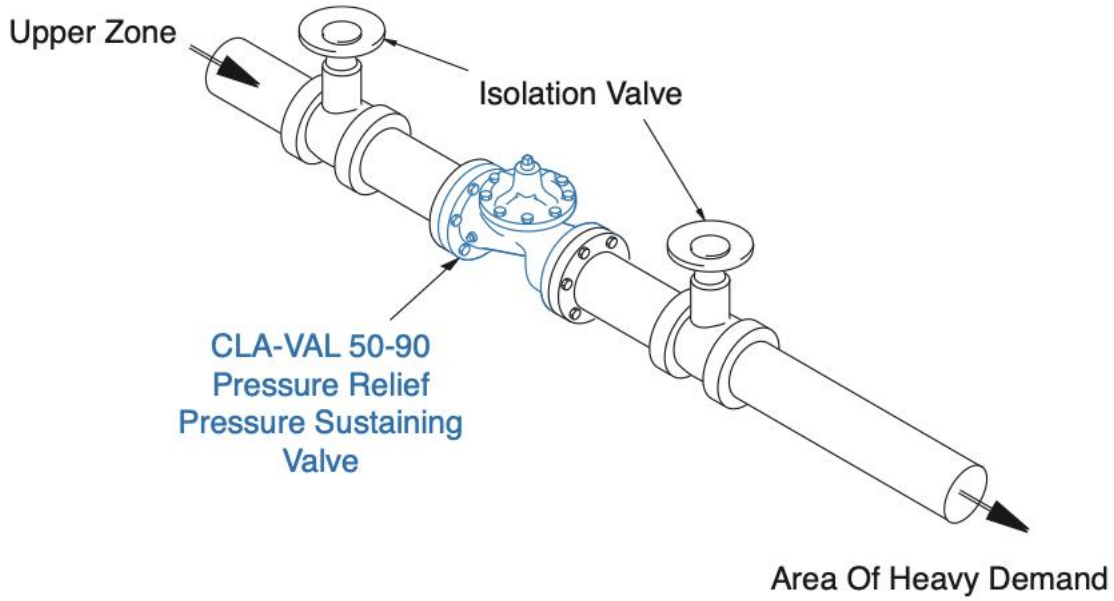
Pressure Sustaining Valves

Pressure Relief Valves

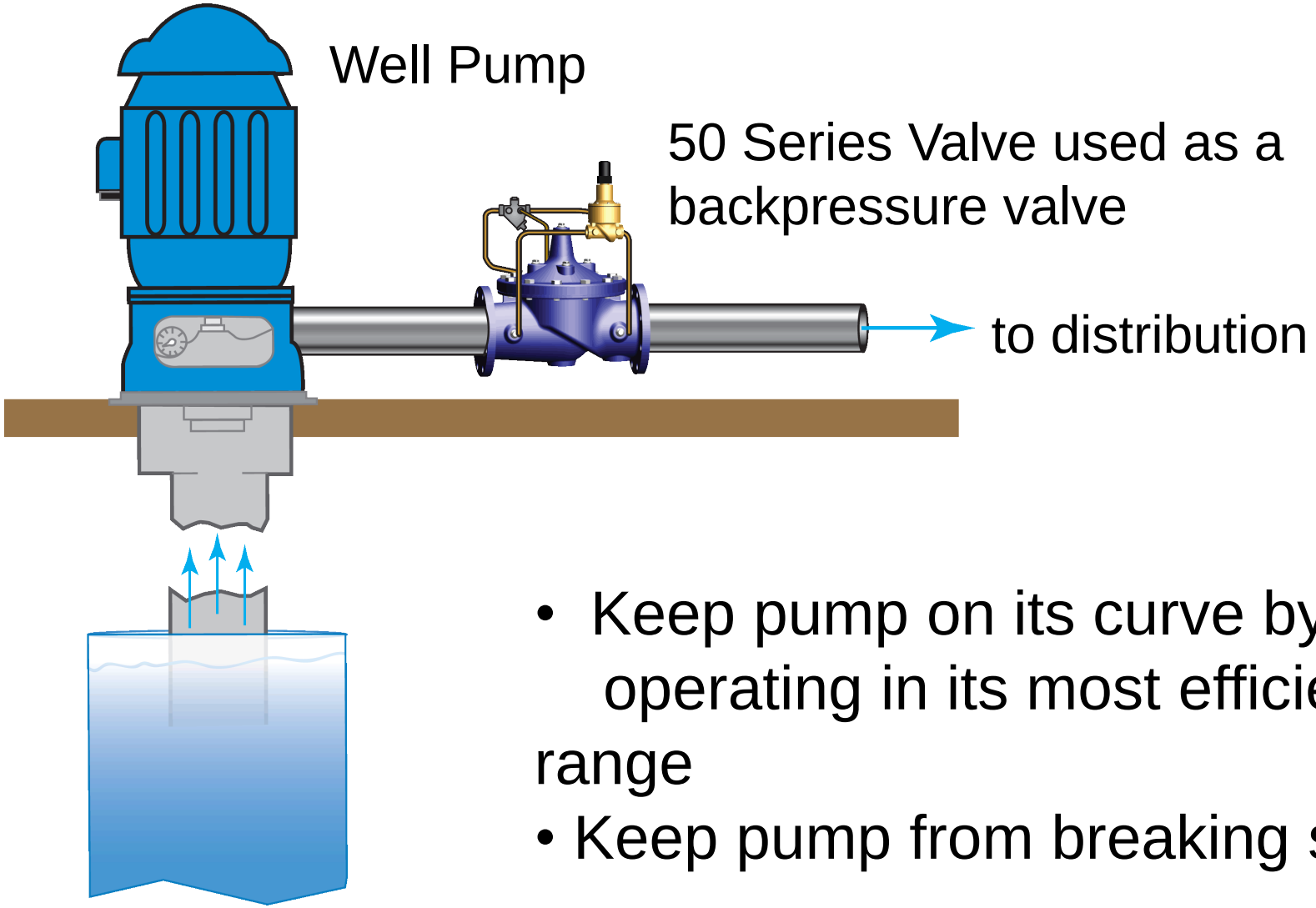
Maintain a minimum upstream pressure regardless of outlet pressure and changes in flow rates

Typical Installation

When heavy demand could potentially drop pressure upstream too low, a pressure sustaining valve can work to maintain a minimum upstream pressure while allowing flow as possible.



Back Pressure Sustaining Application



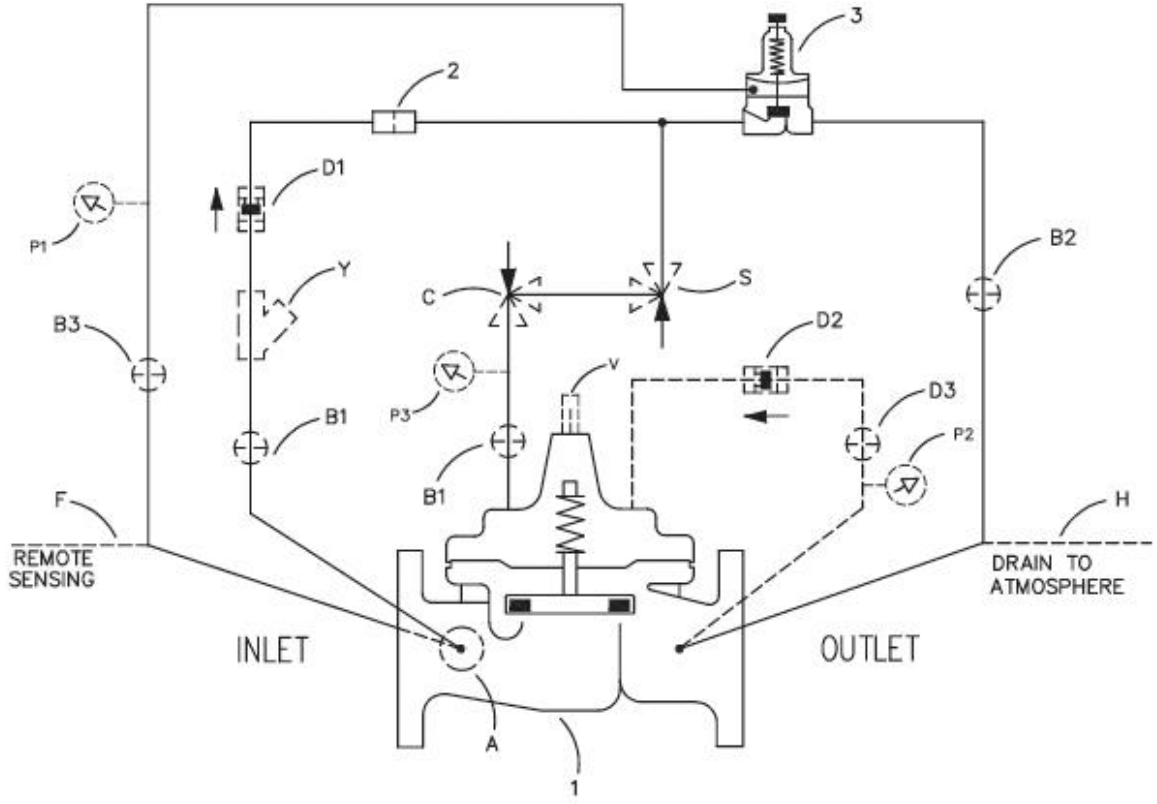
- Keep pump on its curve by operating in its most efficient flow range
- Keep pump from breaking suction

50-90 Components

Most Common Pressure Sustaining Valve

- Always Included:
  - 100-01 Hytrol Main Valve
  - X58C Restriction Fitting
  - CRL5A Pressure Relief Control
  - Either X46A or X43Y Strainer

- May also Include:
  - Ball valves, Speed controls, X101 valve position indicator, check feature, etc.



BASIC COMPONENTS
1 100-01 Hytrol (Main Valve)
2 X58C Restriction Assembly
3 CRL5A Pressure Relief Control

OPTIONAL FEATURES
A X46A Flow Clean Strainer
B CK2 (Isolation Valves)
C CV Flow Control (Closing)
D Check Valves with Isolation valve
F Remote Sensing
H Drain to Atmosphere
S CV Flow Control (Opening)
Y X43 "Y" Strainer

50-90 Operation

- Modulates to maintain upstream pressure. When upstream pressure exceeds set point the valve fully opens.
- Utilizes CRL5A Component to sense upstream pressure changes
- Rise in Upstream Pressure, Valve Opens
- Drop in Upstream Pressure, Valve Closes
- +/- 1psi accurate
- Needs at least 10psi Differential Pressure for control

Cimco-GC SYSTEMS

Questions?

Thank You

Stick around for round two!