# Basic Training: Control Valves

Elements for Defining, Sizing, and Selecting

Training Module 1

## About Trimteck

**Trimteck is a family-owned American company** with over thirty years of experience in engineering, manufacturing, and marketing flow control solutions and equipment for a variety of industries. Our application engineers and certified representatives are **committed to personalized customer service** and have an extensive line of products and technologies to draw upon when designing and specifying a solution.

With a comprehensive line of **Optimux control valves** – and an array of actuators, positioners, severe service trims, and other accessories – our engineers and representatives **can solve the most complex flow control problems quickly and economically**. Moreover, our organizational focus on implementing highly efficient sourcing, engineering, manufacturing, assembly, and distribution processes enables us to **guarantee world-class quality, competitive pricing, and rapid delivery** to anywhere in the world.

Welcome to **Trimteck**.

# A Comprehensive Portfolio of Control Valves

# Agenda

I. Definition and Classification

II. Valve Selection

III. Sizing Basics

IV. Actuators

V. Positioners

VI. Common Accessories

# What is a Control Valve?

**valve** noun \ˈ valv\

any of numerous mechanical devices by which the flow of liquid, gas, or loose material in bulk may be started, stopped, or regulated by a movable part that opens, shuts, or partially obstructs one or more ports or passageways

**control valve** noun \kənˈtrōl ˈvalv\

a power operated device which modifies the fluid flow rate in a process control system; consists of a valve connected to an actuator mechanism that is capable of changing the position of a flow controlling element in the valve in response to a signal from the controlling system

Source: Merriam-Webster, ISA S75.05

# How do we Classify Valves?

**In order to simplify the selection and specification of a device with such a broad definition, valves are traditionally classified according to one or more of the following factors:**

| 1 By Function | 2 By Application | 3 By Motion |
|---|---|---|
| ▪ On/Off<br>▪ Non-return<br>▪ Throttling<br>▪ Final Control Element | ▪ General Service<br>▪ Special Service<br>▪ Severe Service | ▪ Linear<br>▪ Rotary |

# 1 Classifying Valves according to **Function**

**Sometimes referred to as *block* valves, on/off valves are used to start or stop the flow of the medium through the process**

- Used in applications where media must be diverted, in non-critical mixing, and in safety management systems
- Most are hand-operated, although they can be automated with the addition of an actuator as seen in the photo of an Optimux OpTE herein
- Common On/Off Valves Include**:**
  - Gate
  - Plug
  - Ball
  - Pressure Relief
  - Tank Bottom

## Classifying by Function: Non-Return Valves

**Non-return valves allow fluid to flow in only the desired direction; any flow or pressure in the opposite direction is mechanically restricted from occurring**

- Used to prevent backflow of fluid that could damage equipment or endanger the process
- Particularly useful in protecting a pump in liquid applications or a compressor in gas applications
- Common Non-Return Valves Include:
  - Check

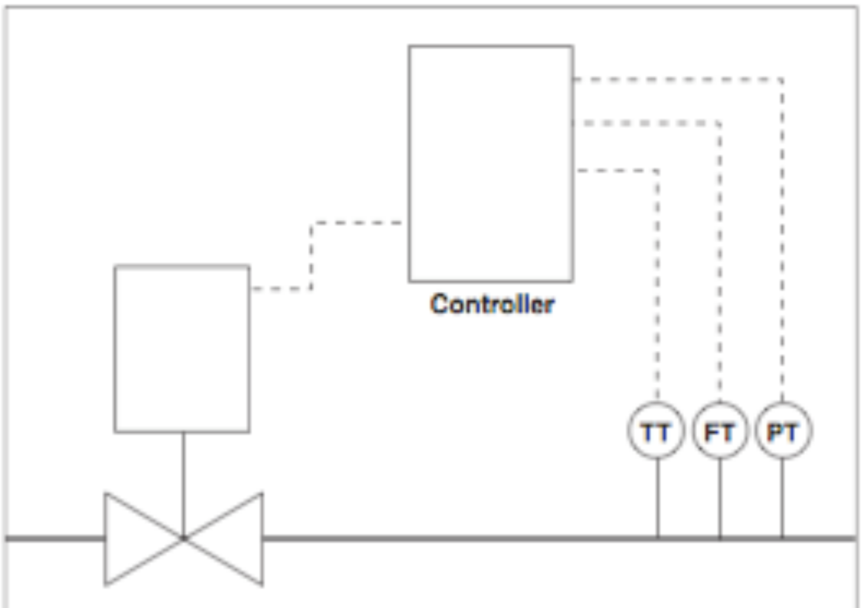
**Note:** Trimteck does not produce or market check valves

**Throttling valves are used to regulate the flow, temperature, or pressure of a service; can move to any position within the stroke, including full-open or full-closed positions**


- Can also act as on/off valves
- Many are hand-operated, but some are equipped with actuators, which provide greater thrust and positioning capability as well as automatic control
- Common Throttling Valves Include:
  - Pressure Regulators
  - Control Valves

**Note:** Trimteck does not currently produce or market pressure regulators

**Final Control Element refers to the high-performance equipment needed to provide the power and accuracy to control the flowing medium to specific service conditions**



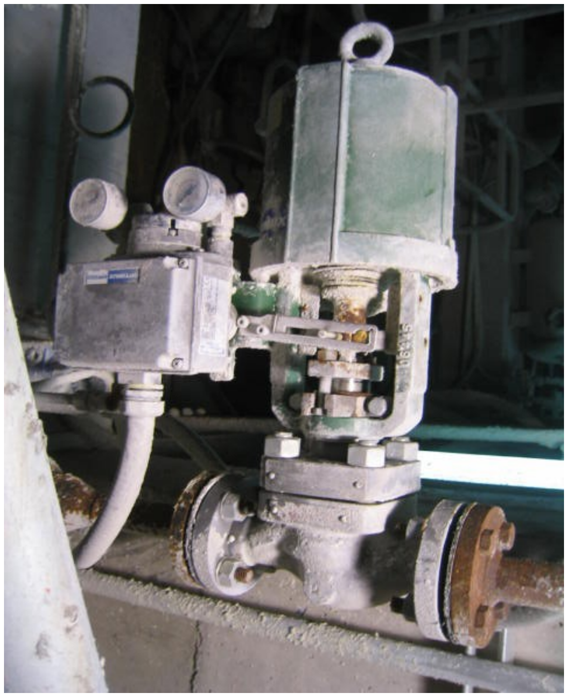

Transmitters:
Flow (FT)
Temperature (TT)
Pressure (PT)

- Part of the control loop, which consists of at least two other elements besides the control valves:
  - Sensing element
  - Controller
- Control valve makes a change automatically, based on a signal from the controller, and the sensor measures and verifies the change
- Control valves are the most common final control element

# 2 Classifying Valves according to **Service**

# Classifying by Application: General Service

**General service valves are those designed for the majority of commonplace applications with lower pressure ratings**



Optimux OpGL globe control valve in general service at a pulp plant in Chile

- Lower ANSI Class: 150 - 600
- Moderate Temperature: -50 – 650°F
- Noncorrosive fluids
- Minimal Pressure Drops
  - No cavitation
  - No flashing
- Carbon or Stainless Steel
- Interchangeable and common to a wide variety of applications

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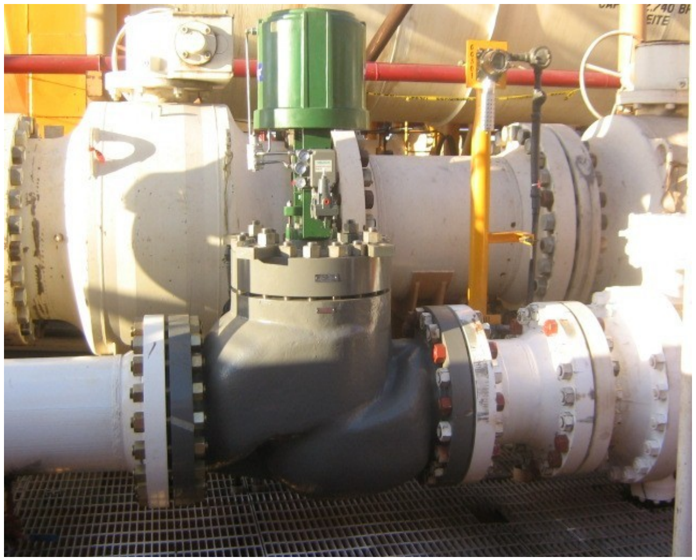
**Special service valves are custom-engineered and designed for a single application outside normal process applications**


Optimux OpGL globe control valve designed to withstand high temperatures and corrosion at a tereftalic acid plant in Mexico

- High pressures
- Demanding temperatures
- Corrosive fluids
- Minimal to Moderate Pressure Drops
    - Mild cavitation
    - No flashing
- Special materials
- Unique applications

## Classifying by Application: Severe Service

**Severe service valves are fitted with special features to handle extreme applications, such as high pressure drops that result in severe cavitation, flashing, choking, or high noise levels**



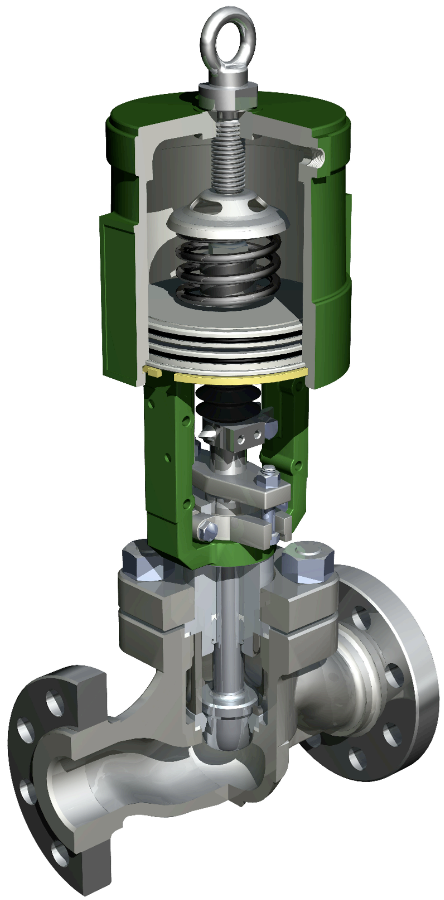
Optimux OpGL globe control valve fitted with a multi-stage trim designed to withstand high pressure drop with oil, gas, saltwater and sand media

- High pressures
- Extreme temperatures
- Corrosive fluids
- Severe Pressure Drops
  - Cavitation
  - Flashing
  - Choking
  - Noise
- Custom-engineered trims aimed to prevent or reduce effects of service
- Unique applications

# 3 Classifying Valves according to **Motion**

# Classifying by Motion: Linear

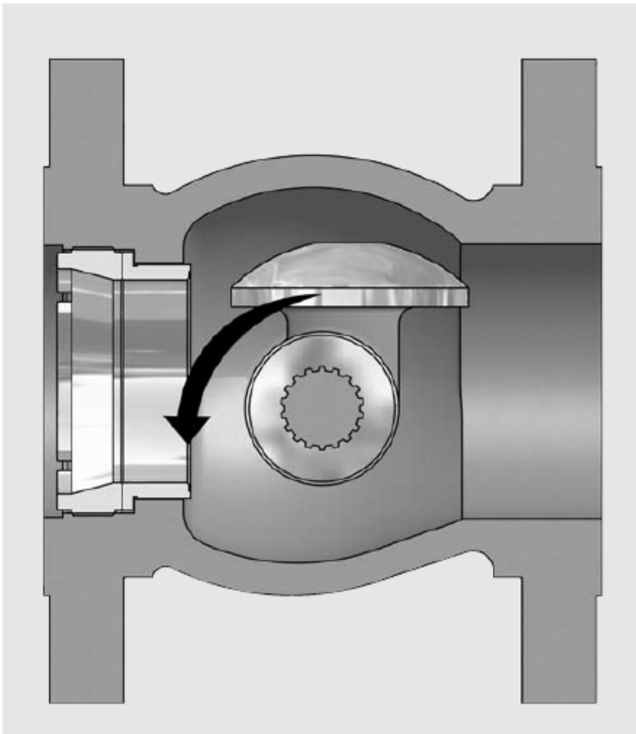
**Linear valves have a sliding-stem that pushes a closure element – any internal device that is used to open, close, or regulate the flow – into an open or closed position**



Optimux OpGL linear globe control valve

- Simple design
- Easy maintenance
- Versatility in:
  - Sizes
  - Pressure classes
  - Design options
- Common linear valve styles:
  - Gate
  - Globe
  - Pinch
  - Diaphragm
  - Split-body
  - Three-way
  - Angle

**Rotary valves use a closure element that rotates – through a quarter-turn or 45° range – to open or block the flow**



Cross-section view of an eccentric rotary plug valve

- Larger port compared to linear valves of similar size
- Weigh less than linear size-for-size
- Limited in applications with pressure drops
- Prone to cavitation and flashing
- Often less costly

# Agenda

The measurement commonly applied to valves is the *valve coefficient* ($C_V$) - also referred to as the *flow coefficient* - which is used to determine the valve size that will best allow the valve to pass the required flow rate while providing control of the process fluid

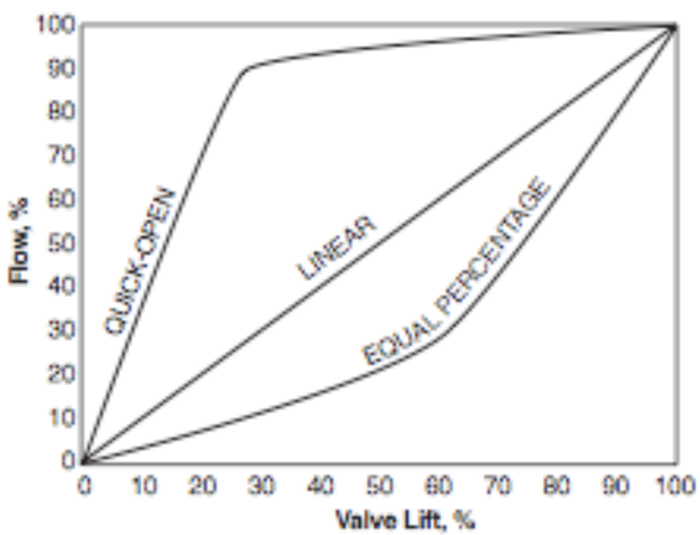
One $C_V$ is defined as one U.S. gallon (3.78 liters) of 60°F (16°C) water that flows through an opening during 1 minute with a 1- psi (0.1-bar) pressure drop

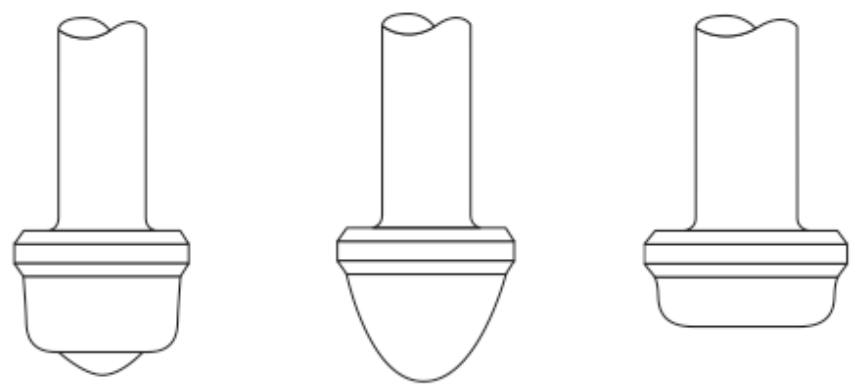
$$C_v = F\sqrt{\frac{SG}{\Delta P}}$$

$C_V$ = Flow coefficient
F = Flow rate (US GPM).
SG = Specific Gravity fluid (Water = 1).
$\Delta P$ = Pressure drop (psi).

Each valve has a *flow characteristic*, which describes the relationship between the valve coefficient ($C_V$) and the valve stroke – as a valve opens, the flow characteristic—which is inherent to the design of the selected valve—allows a certain amount of flow through the valve at a particular percentage of the stroke, which allows the valve to control the flow in a predictable manner

The three most common types of flow characteristics are *equal percentage*, *linear*, and *quick-open*



Equal Percentage

Linear

Quick Open

Two rules of thumb for choosing the right flow characteristic:

1. If most of the pressure drop is taken through the valve and the upstream pressure is constant, a linear characteristic will provide better control

2. If the piping and downstream equipment cause significant resistance to the system, equal percentage will provide better control

| Control Valve Pressure Drop | Recommended Inherent Flow Characteristic |
|---|---|
| Constant ΔP | Linear |
| Decreasing ΔP with increasing load: ΔP at maximum load >20% of minimum load ΔP | Linear |
| Decreasing ΔP with increasing load: ΔP at maximum load <20% of minimum load ΔP | Equal Percentage |
| Increasing ΔP with increasing load: ΔP at maximum load <200% of minimum load ΔP | Linear |
| Increasing ΔP with increasing load: ΔP at maximum load >200% of minimum load ΔP | Quick Open |

**Rangeability is the ratio of maximum to minimum flow that can be acted upon by a control valve after receiving a signal from a controller**

**High rangeability allows a valve to control flow from large to small flows**

**Rangeability is affected by three factors:**

1. **Valve geometry –** inherent rangeability due to the design of the body and the regulating element

2. **Seat leakage –** excessive seat leakage can cause instability as the valve lifts off of the seat

3. **Actuator –** diaphragm actuators are seldom accurate at less than 5% of the valve opening, whereas piston-cylinder actuators can provide control within 1% of valve lift due to the presence of air in two chambers

# Shutoff Requirements

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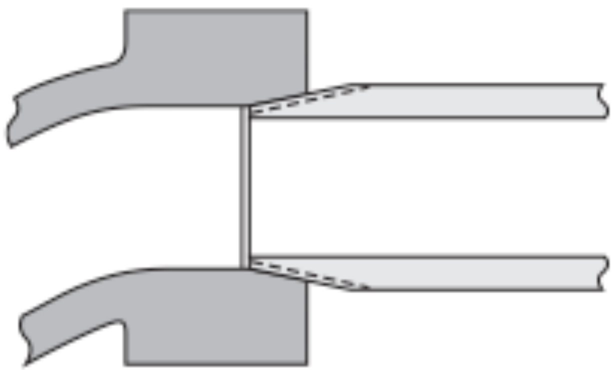
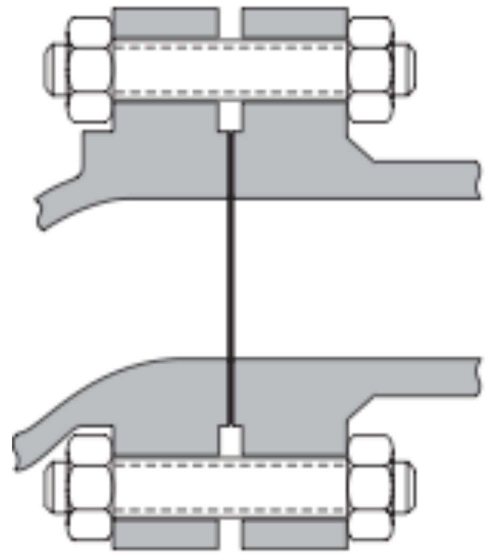
## Industry standards regarding the amount of permissible leakage of the process fluid through a valve's seat or seal – most applicable to throttling valves

| Leakage Class Designation | Maximum Allowable Leakage | Test Medium | Test Pressure | Test Procedure |
|---|---|---|---|---|
| Class I | N/A | N/A | N/A | No Test |
| Class II | 0.5% of rated capacity | Air or water at 50 - 125° F(10 - 52°C) | Lower of 45 - 60 psig or maximum operating differential | Lower of 45 - 60 psig or maximum operating differential |
| Class III | 0.1% of rated capacity | As above | As above | As above |
| Class IV | 0.01% of rated capacity | As above | As above | As above |
| Class V | 0.0005 ml per minute of water per inch of port diameter per psi differential | Water at 50 to125°F (10 to 52°C) | Maximum service pressure drop across valve plug not to exceed ANSI body rating | Maximum service pressure drop across valve plug not to exceed ANSI body rating |
| Class VI | Not to exceed Class VI standard per port diameter | Air or nitrogen at 50 to 125° F (10 to 52°C) | 50 psig or max rated differential pressure across valve plug whichever is lower | Actuator should be adjusted to operating conditions specified with full normal closing thrust applied to valve plug seal |

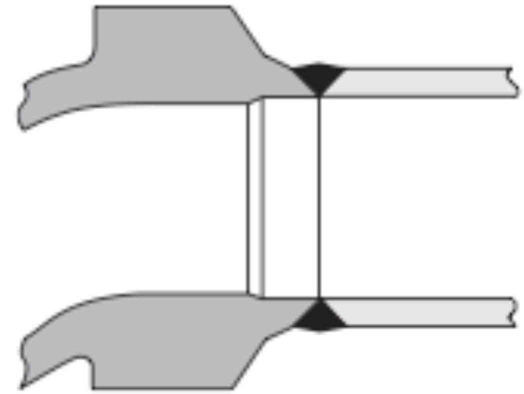
There are various end connections to allow a valve to be fitted to the system's piping, and in ideal circumstances, the valve's end connections and materials will match those of the system



Threaded



Flanged

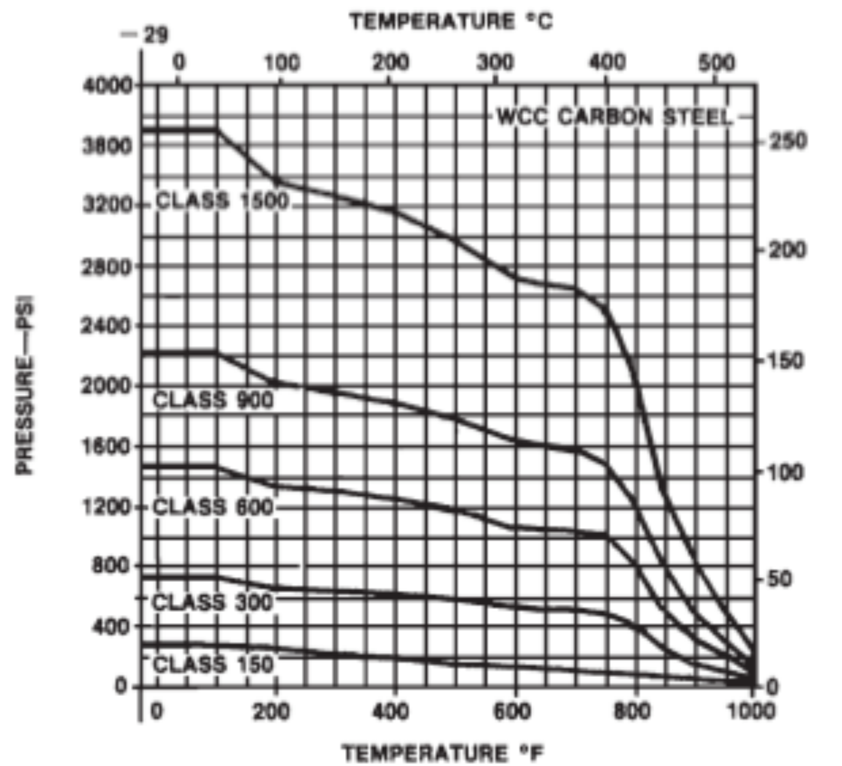


Welded

A valve is designed to handle a range of pressures up to a certain limit, called the valve's *pressure rating* – the higher the rating, the thicker the walls of the valve vessel to prevent rupture

Temperature effects: the higher the process temperature, the less pressure can be handled by the body subassembly

Standard Classes: 150, 300, 600, 900, 1500, 2500, 4500




Sources: ANSI B16.34, Emerson Process Management

## Face-to-Face

**The dimension between one pipe mating surface of the valve to the surface on the opposite end is called the *face-to-face dimension* This physical dimension is always determined by the surface-to-surface measurement regardless of the type of end connection (threaded, flanged, or welded)**

| Standard | Valve Type | Pressure Rating |
|---|---|---|
| ANSI/ISA S75.03 | Globe valves | 150 – 600 (valve is interchangeable between Class 150, 300, and 600 |
| ANSI/ISA S75.04 | Flanged globe valves | 125, 150, 250, 300, 600 |
| ANSI/ISA S75.04 | Flangeless globe valves | 150, 300, 600 |
| ANSI/ISA S75.08 | Flanged clamp or pinch valves | All classes |
| ANSI/ISA S75.12 | Socketweld and threaded end globe valves | 150, 300, 600, 900, 1500, 2500 |
| ANSI/ISA S75.14 | Buttweld globe valves | 4500 |
| ANSI/ISA S75.15 | Buttweld globe valves | 150, 300, 600, 900, 1500, 2500 |
| ANSI/ISA B16.10 | Iron (ferrous), gate, plug, globe valves | All classes |
| BS 2080 | Steel valves used in the petroleum, petrochemical, and associated industries | All classes |
| MSS SP-67 | Butterfly valves | All classes |
| MSS SP-88 | Diaphragm valves | All classes |
| MSS SP-42 | Stainless steel valves | All classes |

# Body Materials

Common practice dictates that the end-user specify the body material, especially with special or severe service valves

General service valves are specified with commonly found materials to match the pipe material

### Standard Materials

- Carbon Steel
- Stainless Steel
- Chrome-moly

### Special Alloys

- Hastelloy B and C
- Titanium
- Monel
- Bronze

### A Word on Investment Casting …

Control valve bodies are either cast, forged, or machined from bar stock, with standard sand casting as the most commonplace method

Trimteck elects to use an **advanced investment casting** method as its standard for control valve bodies between .5" and 4"

Investment casting **offers the following benefits**:

- Consistent and repetitive close tolerances
- Superior integrity and no porosity
- Fatigue performance equal to that of forgings
- Minimal need for machining

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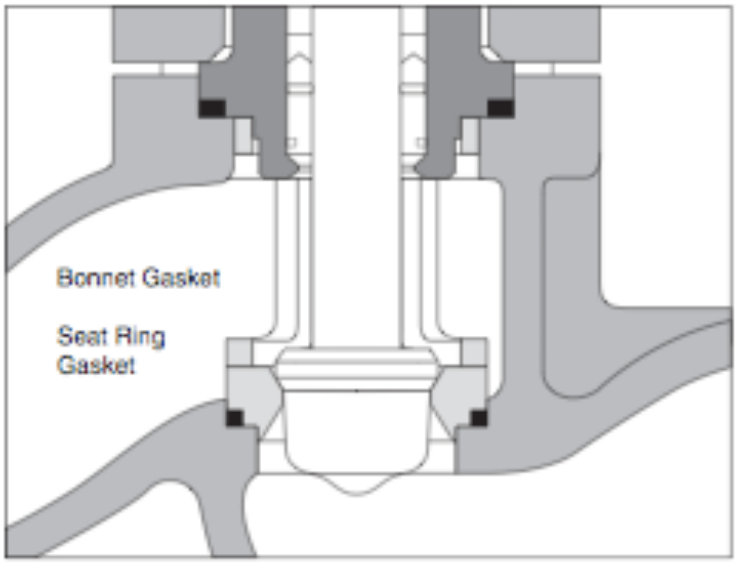
**Valve parts – body, bonnet, bonnet bolting, plug, ball, disk, wedge, and/or drainage plug – exposed to pressure, process fluid, corrosion, and other effects of the service are required by regulation to be manufactured from approved metals**

**In applications requiring elevated material hardness levels and resistance to corrosion and abrasion, Trimteck has pioneered the use of CVD-5B**

**Trim Material Characteristics**

| Trim Material | Hardness Rockwell C | Impact Strength | Corrosion Resistance | Maximum Temp. Recomm. | | Erosion Resistance | Abrasion Resistance |
|---|---|---|---|---|---|---|---|
| | | | | ºF | ºC | | |
| 316 Stainless steel | 8 | Excellent | Excellent | 600 | 315 | Fair | Fair |
| nº 6 Stellite | 44 | Excellent | Excellent | 1500 | 815 | Good | Good |
| 416 Stainless steel | 40 | Good | Fair | 800 | 426 | Good | Good |
| 17 - 4 PH H 900 | 44 | Good | Good to Excellent | 800 | 426 | Good | Good |
| 440 C Stainless steel | 55-60 | Fair | Fair | 800 | 426 | Excellent | Excellent |
| K Monel | 32 | Good | Good to Excellent | 600 | 315 | Fair to Good | Good |
| Tungsten Carbide | 72 | Fair | Good on bases Poor on acids | 1200 | 648 | Excellent | Excellent |
| CVD-5B | 72 | Excellent | Good | 1200 | 648 | Excellent | Excellent |

**A *gasket* is a malleable material, which can be either soft or hard, that is inserted between two parts to prevent leakage between that joint**




**Common Gasket Materials and Types**

| Type | Gasket Material | Max Temp (°F/°C) | Min Temp (°F/°C) | Max Pressure (psi/bars) |
|---|---|---|---|---|
| Flat | Virgin PTFE | 350/175 | -200/-130 | 6000 – 1000 psi<br>415 – 70 bar |
| Flat | Reinforced PTFE | 450/230 | -200/-130 | 6000 – 500 pis<br>415 – 35 bar |
| Flat | CTFE | 200/95 | -423/-250 | 6000 – 500 psi<br>415 – 35 bar |
| Flat | FEP | 400/205 | -423/-250 | 6000 – 500 psi<br>415 – 35 bar |
| Spiral-wound | AFG | 1500/815 | -20/-30 | 6250 psi<br>430 bar |
| Spiral-wound | 316SS/ PTFE | 350/176 | -200/-130 | 6000 – 500 psi<br>415 – 35 bar |
| Spiral-wound | 316/ Graphite | 1500/815 | -423/-250 | 6250 psi<br>430 bar |
| Hollow O-ring | Inconel X-750 | 1500/815 | -20/-30 | 15000 psi<br>1035 bar |

# Agenda

Valve sizing is based on the standard thermodynamic laws of fluid flow, and is affected by the function of the valve plus the type and severity of the service

Control valves require a systematic method of determining the required flow, as well as the size of the valve body, the body style, and materials that can accommodate (or tolerate) the process conditions, the correct pressure rating, and the proper installed flow characteristic

**Required Conditions**

- Upstream Pressure
- Maximum and Minimum Temperatures
- Process Fluid
- Maximum, Average, and Minimum Flow Rates
- Vapor Pressure
- Pipeline Size, Schedule, and Material
- Maximum, Average, and Minimum Pressure Drop
- Specific Gravity of the Fluid
- Critical Pressure

# Valve Sizing – Electronic Data Sheet on Trimteck.com

**Please tell us what you know about the application, and be sure to attach any additional documentation or drawings below.**

**Valve Type:** Unknown

**Quantity:**

| | Up | Down |
|---|---|---|
| **Pipe Size:** | | |
| **Pipe Schedule:** | | |

**Allowed Noise:** **Add'l Attenuation:** **Type:**

**Process Fluid:**

**Critical Pressure:** psi (a)

| | Unit | Condition 1 | Condition 2 | Condition 3 | Condition 4 |
|---|---|---|---|---|---|
| **Temperature:** | °C | | | | |
| **Inlet Pressure:** | psi (a) | | | | |
| **Outlet Pressure:** | psi (a) | | | | |
| **Liquid Flow Rate:** | Cv | | | | |
| **Gas Flow Rate** | Cv | | | | |
| **Viscosity: cP** | | | | | |
| **Vapor Pressure:** | psi (a) | | | | |
| **SG-MW:** | SG | | | | |

**Max Shutoff:** psi (a) **Shutoff Class:** Class IV

**Avail. Air Supply:** psi

**Fail Position:** Open **Valve Function:** Throttling

**Additional documentation for this valve:** If you have written specifications, or any other support documentation that you would like to include that are not on this form, browse your hard drive and attach your file below.

Choose File no file selected

**Additional Requirements:**

Submit Request

# Agenda

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# Actuators – Introduction

**With most valves, some mechanical device or external system must be devised to open or close the valve, or to change the position of the valve if it is to be used in throttling service**

**Automatic control of valves requires an actuator, which is defined as any device mounted on a valve that, in response to a signal, automatically moves the valve to the required position using an outside power source**

**Pneumatic Actuators**

- Diaphragm
- Piston-Cylinder
- Rack and Pinion
- Rack and Gear
- Scotch Yoke

**Non-pneumatic Actuators**

- Electromechanical
- Electro Hydraulic
- Hydraulic

# Diaphragm Actuator

## Advantages

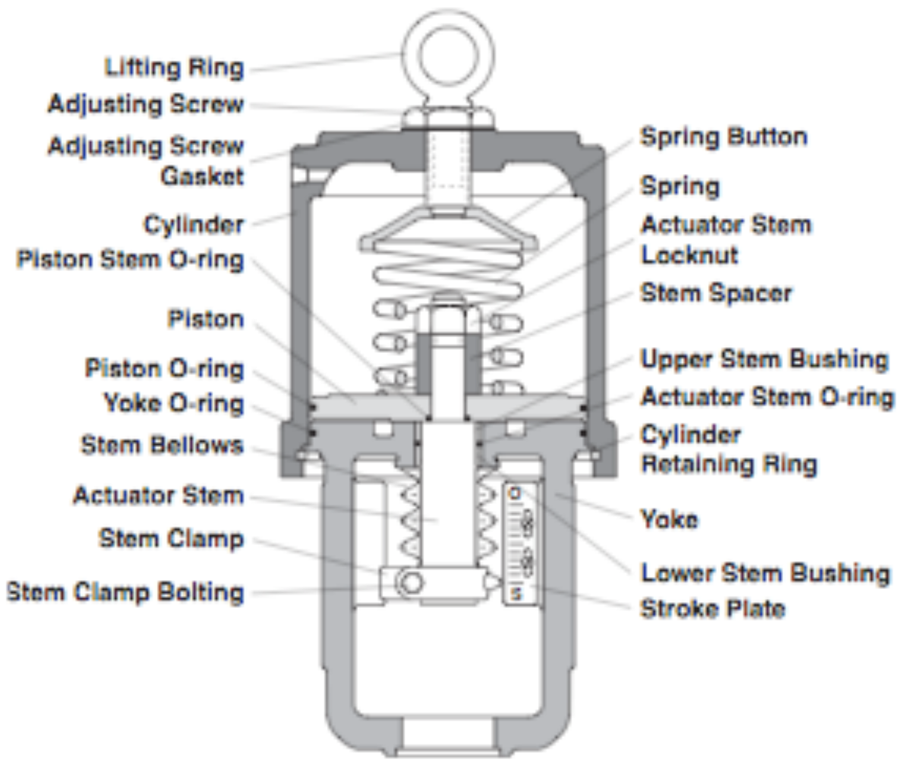
- Relatively inexpensive to produce
- Suited to low-pressure ranges where limited thrust is adequate
- Quick response
- Simple design

## Disadvantages

- Height and weight
- Limited stroke
- Low thrust
- Pressure limitations on diaphragm
- Do not provide exceptional stiffness
- Not enough power to prevent “bathtub stopper effect”
- Not field-reversible, laborious maintenance

**Note:** Trimteck does not manufacture or market diaphragm actuators

# Piston-Cylinder Actuator (OpTK)




## Advantages

- Higher thrust capability
- Compact and lightweight
- Faster stroking speed
- Longer stroke
- Greater stiffness prevents "bathtub stopper effect"
- Better performance than diaphragm actuators, with virtually no hysteresis, highly accurate signal response, and excellent linearity
- Field-reversible

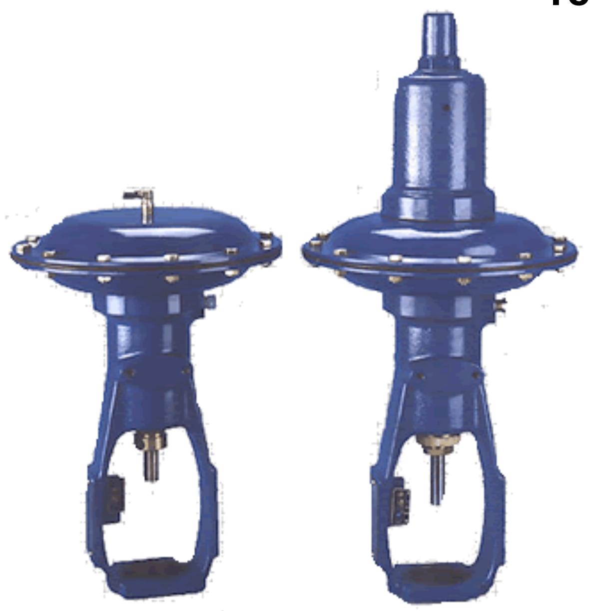
## Disadvantages

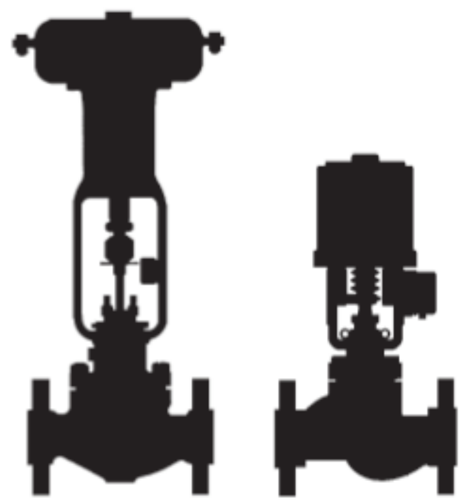
- Some breakout torque required
- Positioner adds to cost and complexity

# Diaphragm vs. Piston Cylinder Thrust Comparison

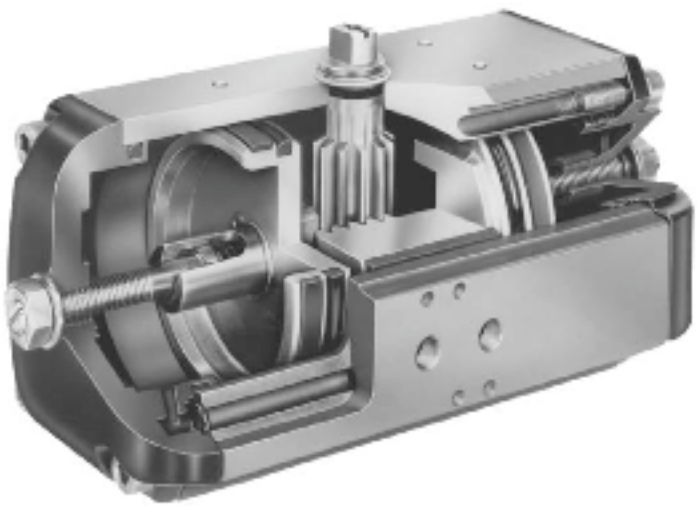
| Diaphragm | Piston Cylinder |
|---|---|
| 60 inches$^2$ | 25 inches$^2$ |
| 30 psi Air Supply | 80 psi Air Supply |
| 750 lbs of thrust | 2000 lbs of thrust |

**Conclusion: A far larger diaphragm actuator would be needed to provide the same thrust requirement as the piston cylinder actuator.**





# Rack and Pinion Actuator (OpRPA)



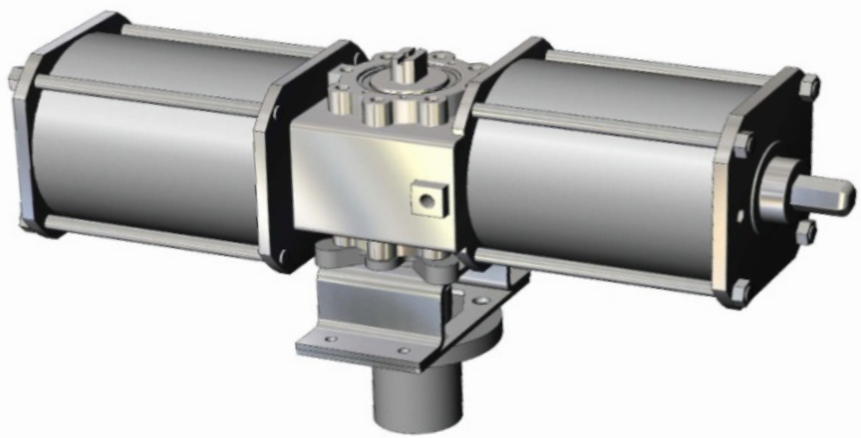
## Advantages

- Suitable for both on/off and modulating control applications
- Durability and long cycle life
- Cost effective
- Versatility of casing materials
- Field-reversible

## Misconceptions

- Only for on/off service
  - Meets requirements for modulating control valves
- Mechanical backlash
  - Lash between racks and pinion is minimal, and shaft to control element has no lash; clamping device ensures no play between actuator pinion and valve shaft

# Rack and Gear Actuator (OpRGA)



## Advantages

- Offset pistons eliminate internal cantilever loads
- Low friction
- Exceptional throttling control capability
- Rugged
- Field reversible
- High cycle-life
- Stainless steel standard
- High temperature
- Low pressure options
- High speed option
- Easy installation and maintenance

# Heavy Duty Scotch Yoke Actuator (OpSY)

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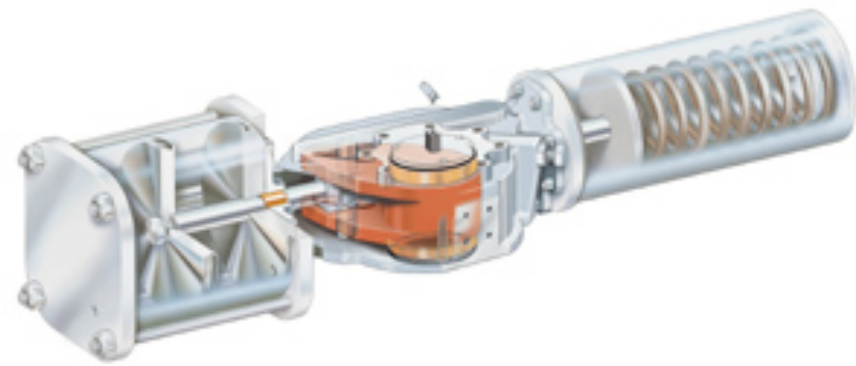
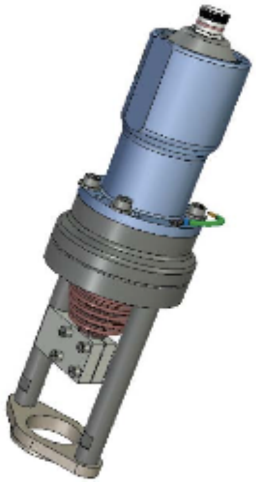
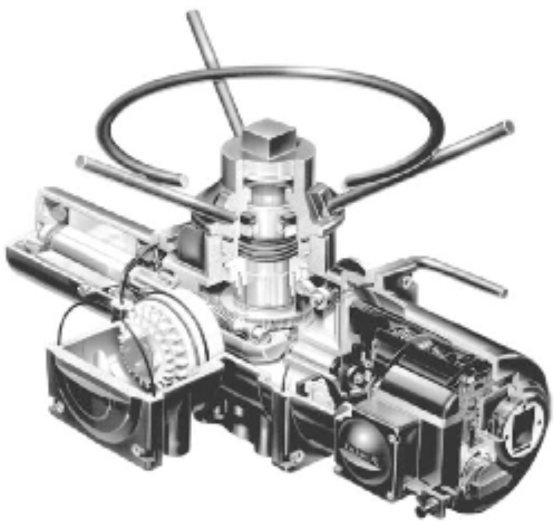


## Advantages

- Ideal for heavy-duty applications, particularly for ESD
- Excellent option for large valves with high breakout torque requirements
- Simple and infrequent maintenance requirements
- Known to achieve 1M cycles
- Pressure ranges from 40psi to 2500psi
- Torque from 1000in-lbs to 17,000in-lbs

# Electromechanical (OpEM)





## Advantages

- High degree of stability
- Constant thrust
- Extraordinary stiffness
- Fails in place upon loss of electric power
- Great solution for remote, solar-powered applications

## Disadvantages

- Higher cost than pneumatic actuators
- Complexity
- Not recommended for flammable atmospheres
- Slower speeds
- Generate heat

# Hydraulic and Electrohydraulic

## Advantages

- Exceptionally stiff due to incompressibility of liquids
- Used in valves with low rangeability
- Fast stroking speeds
- Ideal for safety management systems

## Disadvantages

- Expensive
- Large and bulky
- Complex
- Require specialized engineering

# Actuator Performance Terminology

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***Dead band*** – the maximum amount of input that is required to create a reversal in the movement of the actuator stem

***Frequency response*** – a response to a system or device to a constant-amplitude sinusoidal input signal

***Hysteresis*** – a common term used to describe the amount of position error that occurs when the same position is approached from opposite directions

***Independent linearity*** – the maximum amount that an actuator stem will deviate from a true straight linear line

***Maximum flow capacity*** – the volume of air pressure that can flow into an actuator during a particular time period measured in SCFM

***Open-loop gain*** – the ratio of the imbalance that occurs when an instrument signal change is made and the actuator stem is locked up

***Repeatability*** – similar to hysteresis, although it records the maximum variation of position when the same position is approached from the same direction

***Resolution*** – the smallest change possible in a valve-stem position

***Response level*** – the maximum amount of input change required to create a change in valve-stem position (in one direction only)

***Steady-state air consumption*** – applies to actuators with positioners in which the positioner consumes a certain amount of air pressure to maintain a required position

***Stiffness*** – the ability to hold a position despite process forces

***Stroking speed*** – the amount of time, in seconds, that an actuator requires to move from the fully retracted to the fully extended position

***Supply-pressure effect*** – the change of the actuator stem's position for a 10-psi (0.7-bar) pressure change in the supply

# Agenda

I. Definition and Classification

II. Valve Selection

III. Sizing Basics

IV. Actuators

V. Positioners

VI. Common Accessories

A *positioner* is a device attached to an actuator that receives an electronic or pneumatic signal from a controller and compares that signal to the actuator's position

If the signal and the actuator position differ, the positioner sends the necessary power—usually through compressed air—to move the actuator until the correct position is reached

**Pneumatic Positioners**

Receive and convert pneumatic signal

3 to 15 psi

6 to 30 psi

**Digital Positioners**

Receive and convert electronic signal

4 to 20 mA

10 to 50 mA

# Pneumatic Positioner


Optimux HPP2500 Pneumatic Positioner

## Technical Specifications

| | | |
|---|---|---|
| Type | Pneumatic | Electropneumatic |
| Input Signal | 3 to 15 psi | 4 to 20 mA |
| Supply Pressure | 30 to 150 psi | |
| Hysteresis | 1.0% F.S. | |
| Repeatability | 0.5% F.S. | |
| Max Flow Capacity | 11 SCFM @ 60 psi | |
| Air Consumption | 0.25 SCFM @ 60 psi | 0.31 SCFM @ 60 psi |
| Pneumatic Connections | ¼-18 NPT female connection | |

- **Characterized cam operation**
- **Easy adjustment and calibration**
- **Built-in dampers and gauge ports**
- **Corrosion-resistant**

# Intrinsically Safe Smart Digital Positioner

TRIMTECK® OPTIMUX™


Optimux HPP4500 Digital Positioner

### Technical Specifications

| | |
|---|---|
| Type | Digital |
| Input Signal | 4 to 20 mA |
| Minimum Current Signal | 3.8 mA |
| Output Characteristics | Linear, Equal Percentage, Quick Open, configurable to 16 points |
| Power requirements | 8.5 V |
| Max Impedance | 500Ω/20 mA Dc |
| Enclosure | NEMA 4X, IEC IP66 |
| Safety Certification | Intrinsically Safe Ex ia IIC T6/T5 |
| Digital Communication | HART® |
| Digital Display | LCD |
| Weight | 3.3 lbs (1.5 kg) |

- **Auto Setup**
- **Flexibility in installation**
- **High reliability**
- **One model for multiple characterizations**

# Explosion Proof Smart Digital Positioner

TRIMTECK® OPTIMUX™

Optimux HPP4000 Digital Positioner

## Technical Specifications

| | |
|---|---|
| Type | Digital |
| Input Signal | 4 to 20 mA |
| Feedback Signal | 4 to 20 mA |
| Output Characteristics | Linear, Equal Percentage, Quick Open, configurable to 16 points |
| Max Impedance | 500Ω/20 mA Dc |
| Enclosure | NEMA 4X, IEC IP66 |
| Safety Certification | Explosion Proof Ex d IIC T6 |
| Digital Communication | HART® |
| Digital Display | LCD |
| Air Consumption | Below 2LPM @ 20 psi, 3 LPM @ 100 psi |
| Auxiliary Switches | Dual limit switches |
| Repeatability | +/- 0.3% F.S. |

- **Auto Calibration**
- **Variable orifices minimize hunting**
- **Corrosion resistant**
- **One model for multiple characterizations**

# Agenda

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## Common Accessories – Introduction

**Some special actuation systems or actuators require fast stroking speeds, signal conversions from one medium to another, position transmissions, etc.**

**In these applications, accessories are included with the actuator to help perform these functions**

**Ideally, accessories are mounted directly onto the valve to ensure that the user is aware of the location of the device**

**Common Accessories**

- Air Filter/Regulator
- Solenoid
- Limit Switch
- Safety Relief Valve
- Proximity Switch
- Speed Control Valve
- Position Transmitter
- Transducer
- Flow Booster

# Air Filter/Regulator

The Air Filter/Regulator is designed to screen the power supply medium of impurities that may contaminate an actuation system, positioner, or other accessory, as well as to regulate or limit the air supply to the actuator

Mounted between the source of power supply and the actuator or positioner

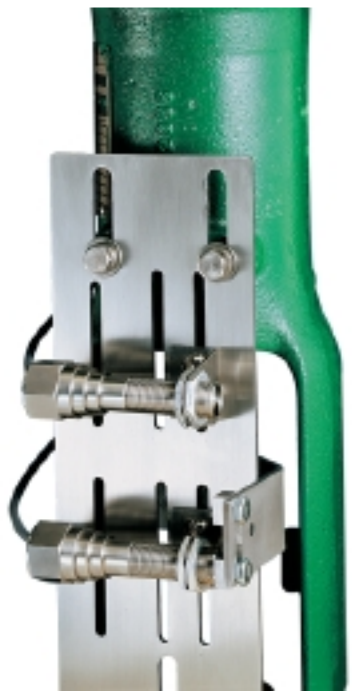
# Limit Switch

When an electrical signal must be sent indicating an open, closed, or midstroke position of an actuator or valve, an electrical switching device—called a *limit switch*—is used

Limit switches are normally used to sound alarms or operate signal lights, electric relays, or small solenoid valves

When a mechanical connection between the limit switch and the stem or shaft is not desirable, a proximity switch is used.

A *proximity switch* is a limit switch that uses a magnetic sensor instead of a mechanical arm



A *position transmitter* is a device that provides a continuous signal indicating the position of the valve or actuator

Allows for signal indication, monitoring actuator performance, logging data, or controlling associated instrumentation or equipment

*Flow boosters* are used to increase the stroking speed of larger pneumatic actuators

Because of their increased volumes, large actuators have difficulty making fast and immediate stokes


## Solenoid

A *solenoid* is an electrical control device that receives an electrical signal (usually a 4- to 20-mA) and, in response, channels air supply directly to the actuator

*Safety relief valves* are designed to open to atmosphere when a particular pressure is exceeded

When volume tanks are used or if high-pressure actuators must be used to handle the service conditions, some local codes require the installation of safety relief valves on these high-pressure vessels as protection against overpressurization

*Speed control valves* are used to limit the stroking speed of an actuator by restricting the amount of air flow to or from the actuator

These small valves can be mounted between the tubing and the actuator and are available in sizes that match common tubing sizes

**Thank you for your attention, for more information please visit us at trimteck.com**