



EMERSON EXCHANGE 2025

ACCELERATING INNOVATION



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Unlock the secrets to specifying the perfect control valve actuators!

Session ID: 2-1198

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Agenda

The Basics

Why “Safety Margin” might be a bad idea?

The Better Actuator Specification

The Basics

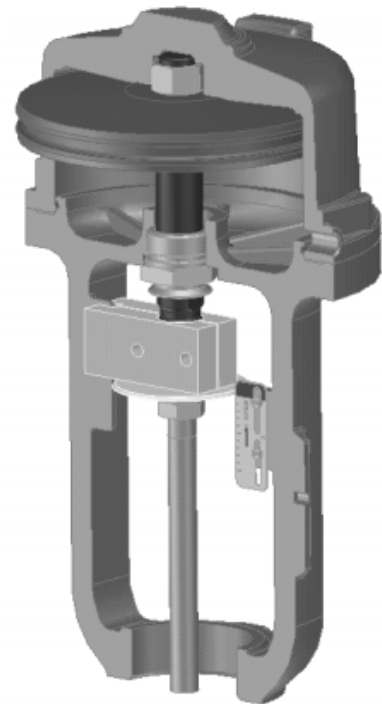
Role of an “Control Valve” actuator

- Position the throttling element accurately
- Offer throttling resolution for fine control
- Provide shutoff by pushing hard on the seat
- Take control valve to a fail-safe position
- On-Off valves don't have any throttling requirements



Types of actuators

Springless Piston



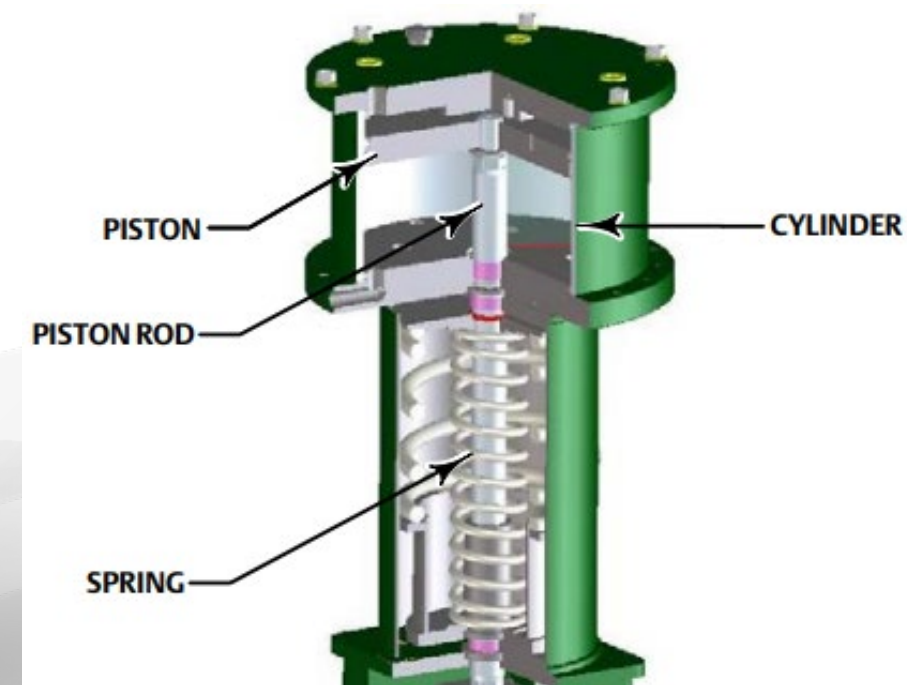
Spring & Diaphragm



Piston Spring-Return (Single Acting)

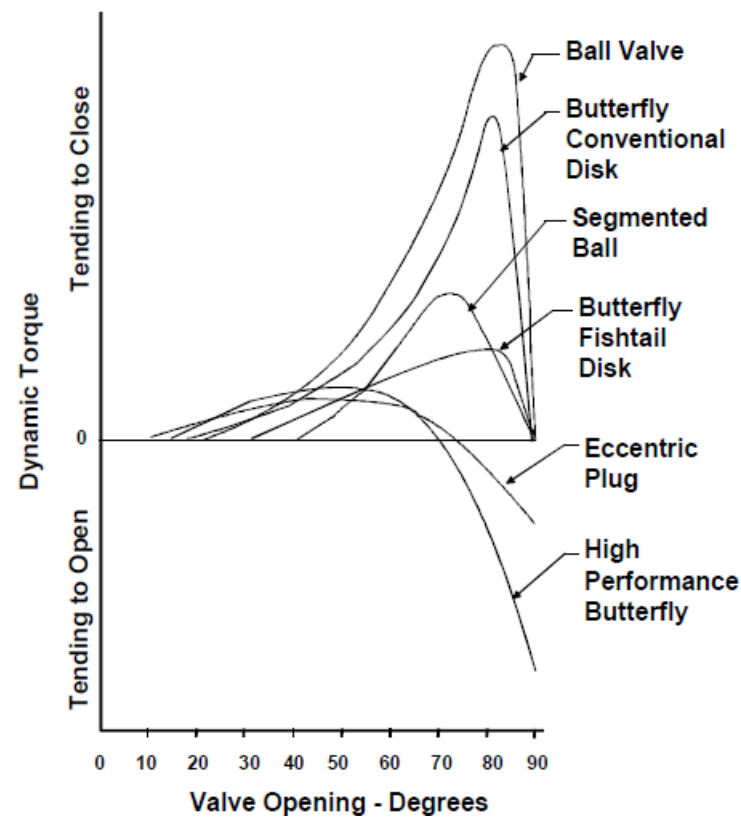


Piston Spring-Return (Double Acting)



Rotary vs. Sliding Stem

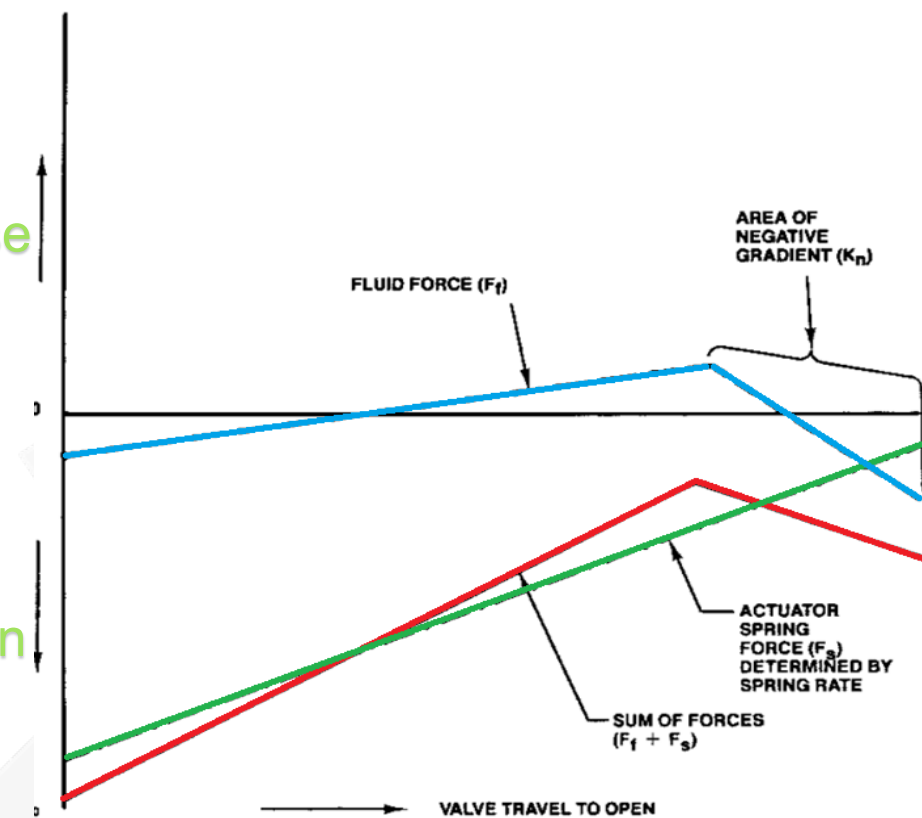
- Position Seated mostly
- High Dynamic forces



- Thrust Seated
- Minimal Dynamic forces
 - Except for localized areas of high gradients

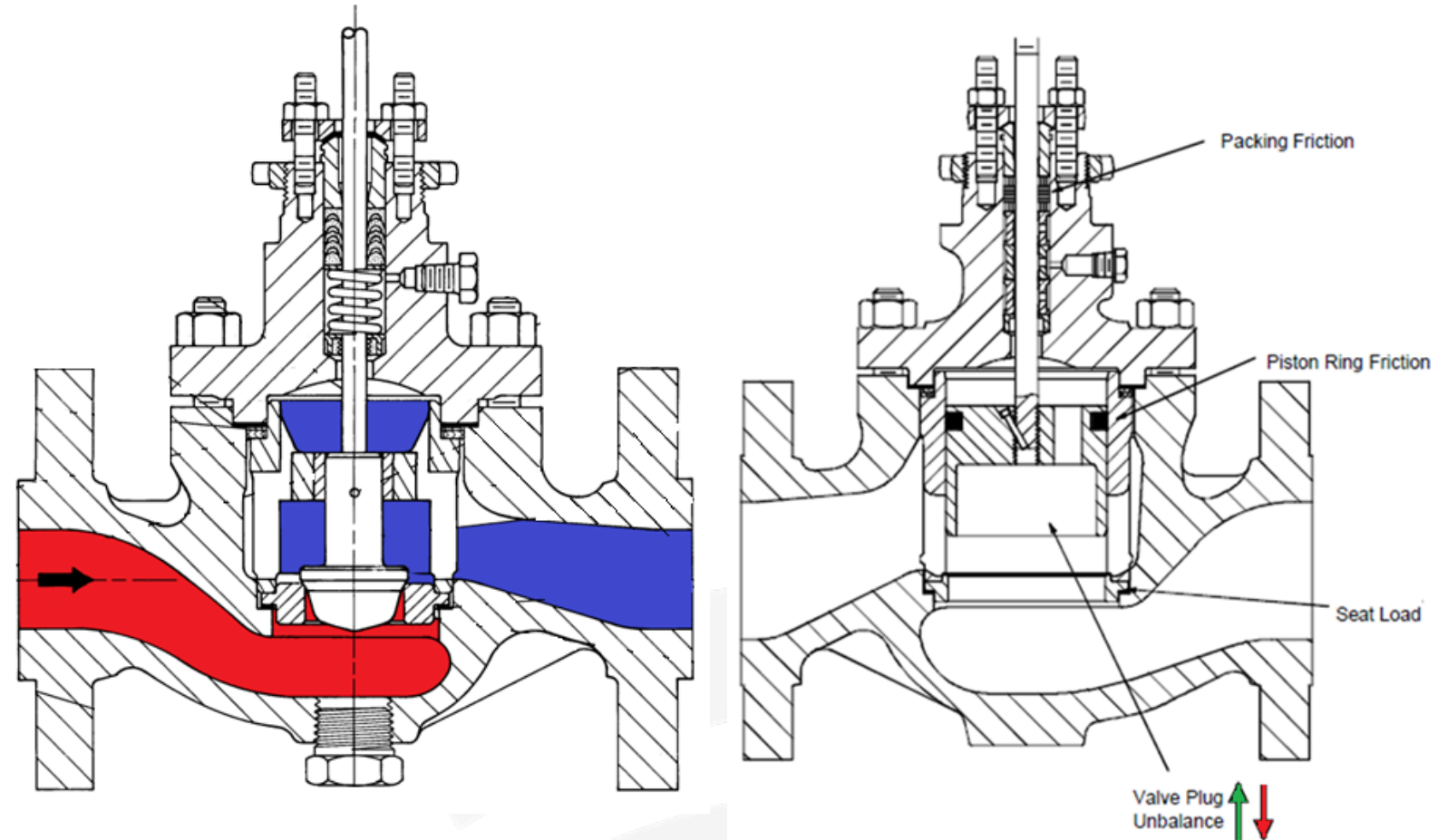
Flow tends to close

Flow tends to open



What goes into Required Thrust Calculations?

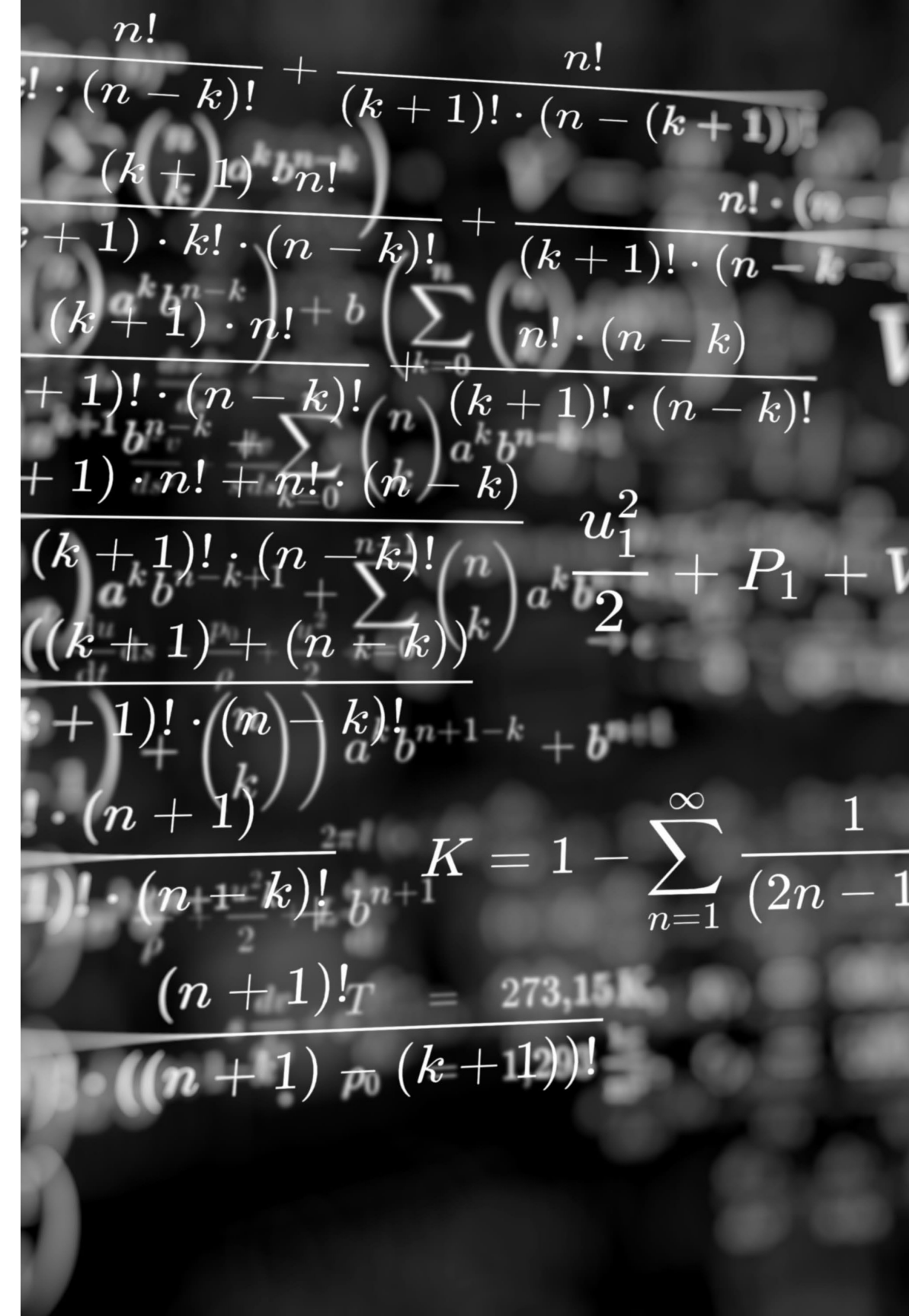
- Unbalance Forces
- Friction
 - Packing
 - Sealing
- Seat Load to achieve shutoff
 - Higher for tighter leakage classes
 - ANSI/FCI Class II to VI



- Valve Thrust Up (to open) = Friction (+/- Unbalance forces)
- Valve Thrust Down (to close) = Friction + Seat Load (+/- Unbalance forces)

What does a Safety Margin get you?

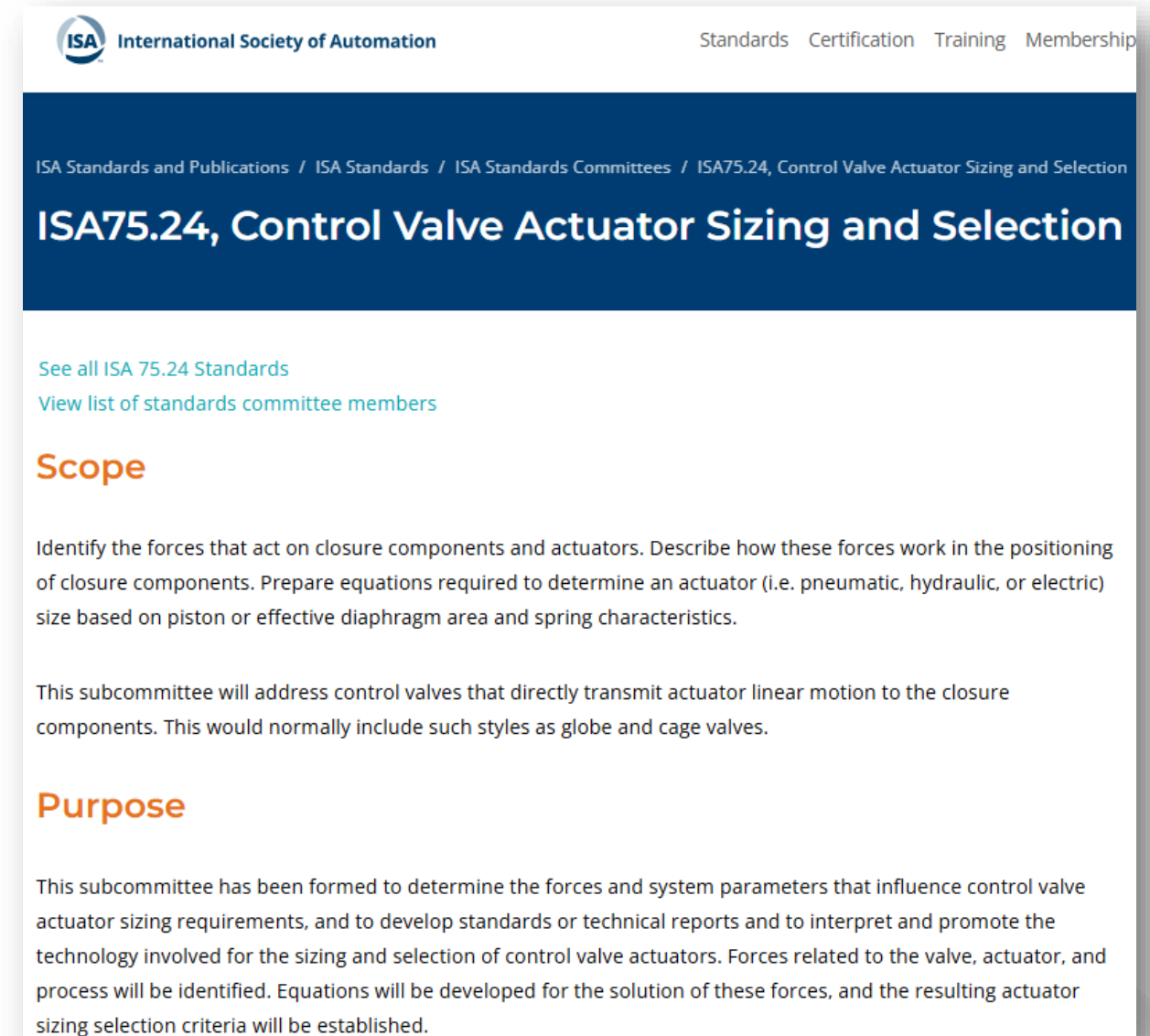
- Available actuator thrust > Required Valve Thrust
- Generally, **more closing thrust!**
 - An actuator capable of pushing harder on the seat
 - This is more commonly needed in the On/Off valve market



Why “safety margin” might be a bad idea?

Taking a closer look into the thrust calcs

- Thrust Calculations are Internal
 - Based on valve design, testing
 - There is no international standard
 - Hard for external verification of accuracy
 - Primary reason customers enforce a safety margin
- Most actuators are sized against full design pressure



ISA International Society of Automation Standards Certification Training Membership

ISA Standards and Publications / ISA Standards / ISA Standards Committees / ISA75.24, Control Valve Actuator Sizing and Selection

ISA75.24, Control Valve Actuator Sizing and Selection

[See all ISA 75.24 Standards](#)
[View list of standards committee members](#)

Scope

Identify the forces that act on closure components and actuators. Describe how these forces work in the positioning of closure components. Prepare equations required to determine an actuator (i.e. pneumatic, hydraulic, or electric) size based on piston or effective diaphragm area and spring characteristics.

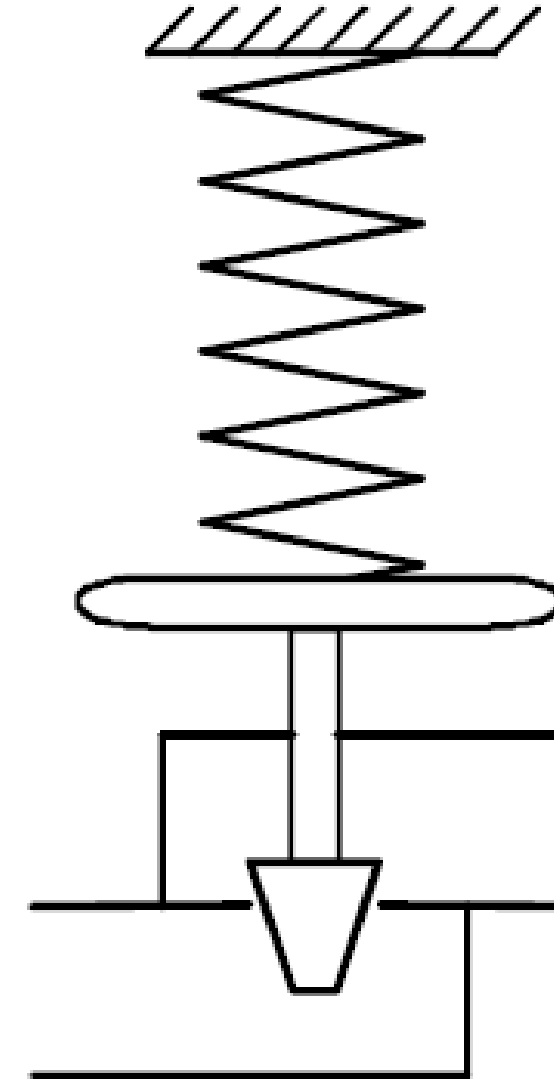
This subcommittee will address control valves that directly transmit actuator linear motion to the closure components. This would normally include such styles as globe and cage valves.

Purpose

This subcommittee has been formed to determine the forces and system parameters that influence control valve actuator sizing requirements, and to develop standards or technical reports and to interpret and promote the technology involved for the sizing and selection of control valve actuators. Forces related to the valve, actuator, and process will be identified. Equations will be developed for the solution of these forces, and the resulting actuator sizing selection criteria will be established.

Risks of Oversizing

- Larger actuator than needed
 - Valve Stem buckling
 - Larger stem might be needed
 - Stronger material might be needed
 - Valve Seat overload
 - Strong material
 - Change in seat angle/design
- }}}} \$\$\$
- Issues become amplified in High Pressure applications
 - E.g. A 7-stage anti-cavitation operating in 8000 psig application



More Thrust does not mean better control

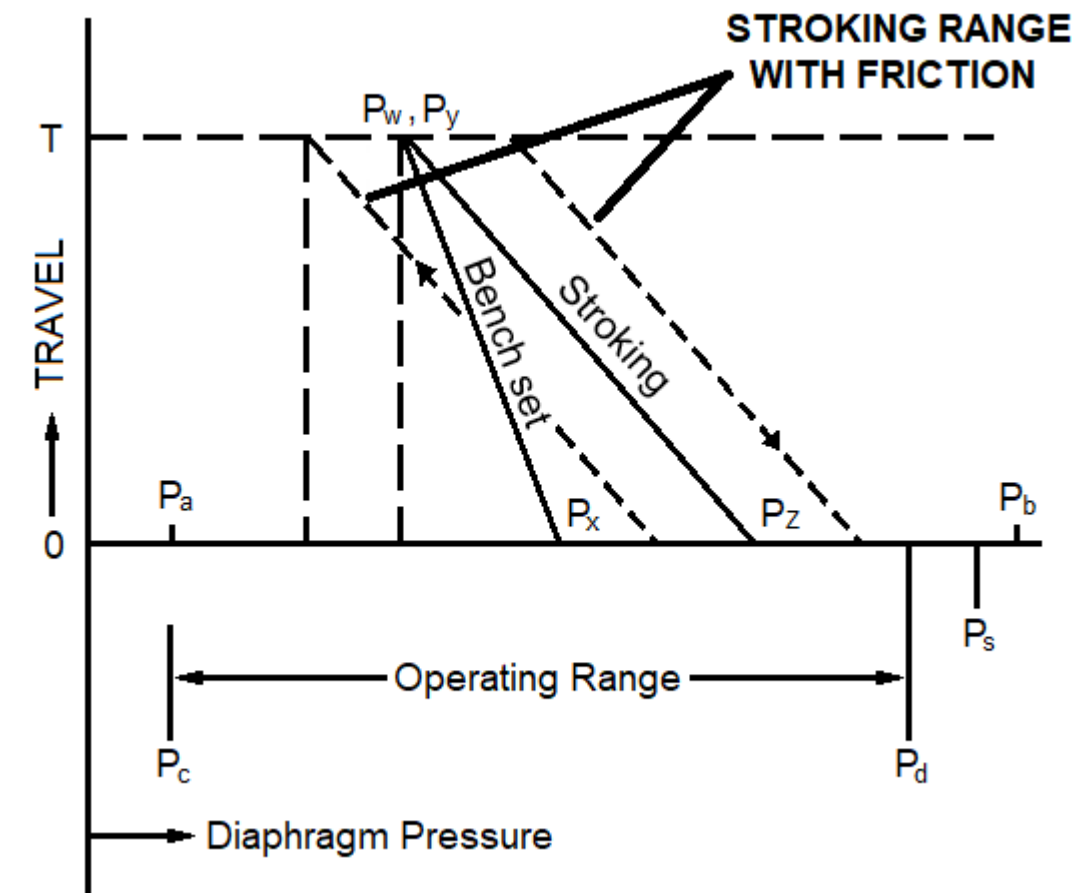
- In the example shown below, a vendor chose to meet the safety margin requirement using a weaker spring
- This has allowed them to use a smaller actuator
- The shortened benchset might translate to poor throttling resolution and control

Piston Area	Spring Rate	Spring Preload	Actuator Closing Thrust	Actuator Opening Thrust	Benchset	Psi/inch of travel
700 in ² (30in)	2450 lbf/in	12600 lbs	13800 lbf	4700 lbf	20 to 48 psig	3.5
520 in ² (26in)	600 lbf/in	18700 lbs	19000 lbf	4300 lbf	37 to 46 psig	1.15

The Better Actuator Specification

The Better Actuator Specification

- Avoid blanket oversizing requirements
- Specify realistic Shutoff Pressure drops
- Identify applications that might need oversizing
 - Applications with sticky fluid, scaling, fouling or uncertainty in process conditions
- Does this valve need tight shutoff?
- Class V water seat leak test
 - Tested in the factory at **service pressure drops**. Very accurate representation of real-world performance
- Specify a wide Stroking Range requirement
 - 25% of supply pressure or 10 psig minimum
- Application specific dynamic performance specifications





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Thank You