Fisher® GX Control Valve

Innovation

Technology

Reliability

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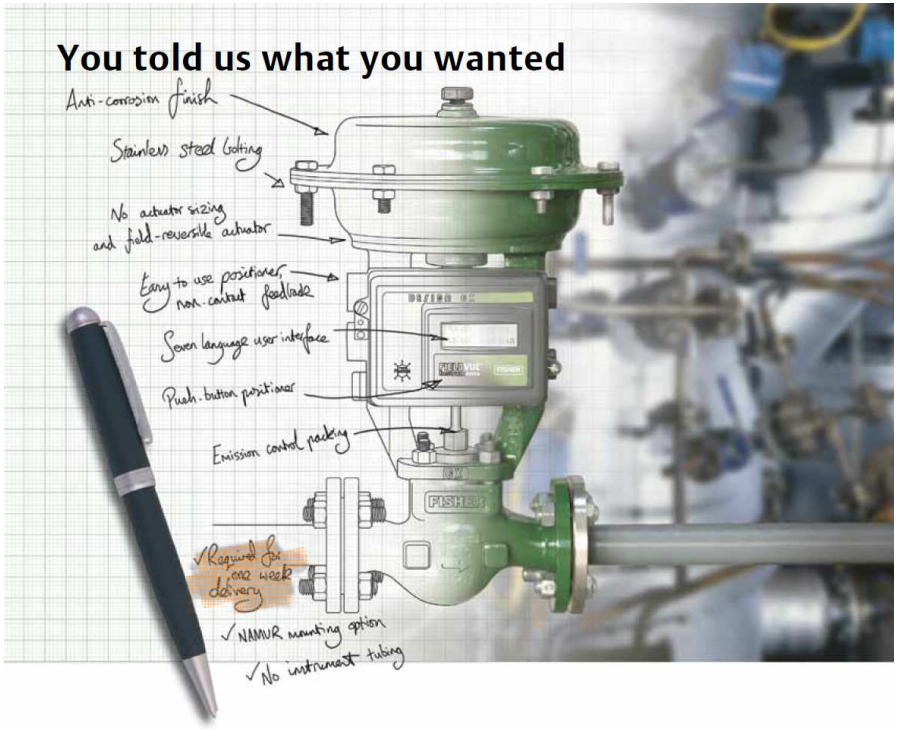
The GX Solution

Overview of the Fisher GX Control Valve

- Design
- Applications
- Product Timeline

Challenges and Solutions

- Actuation
- Severe Service Trim
- High Cycle Qualification
- Interface
- Stem Connection
- Corrosion Protection
- Bellows
- Low-E



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GX Design

Customer Needs

- Simplicity
- Reliability
- Lower cost
- Faster delivery
- Smaller & lighter product
- Simple and reliable purchase transactions

GX: designed to meet customer needs

GX Features

- Customer feedback driven design process
- Reduced parts complexity
- Rugged, compact design that is easy to size and select
  - Actuator selection is automatic
- Testing to over 1 million cycles
- 1-2 week lead times on standard constructions
  - WCC, CF3M, and CW2M

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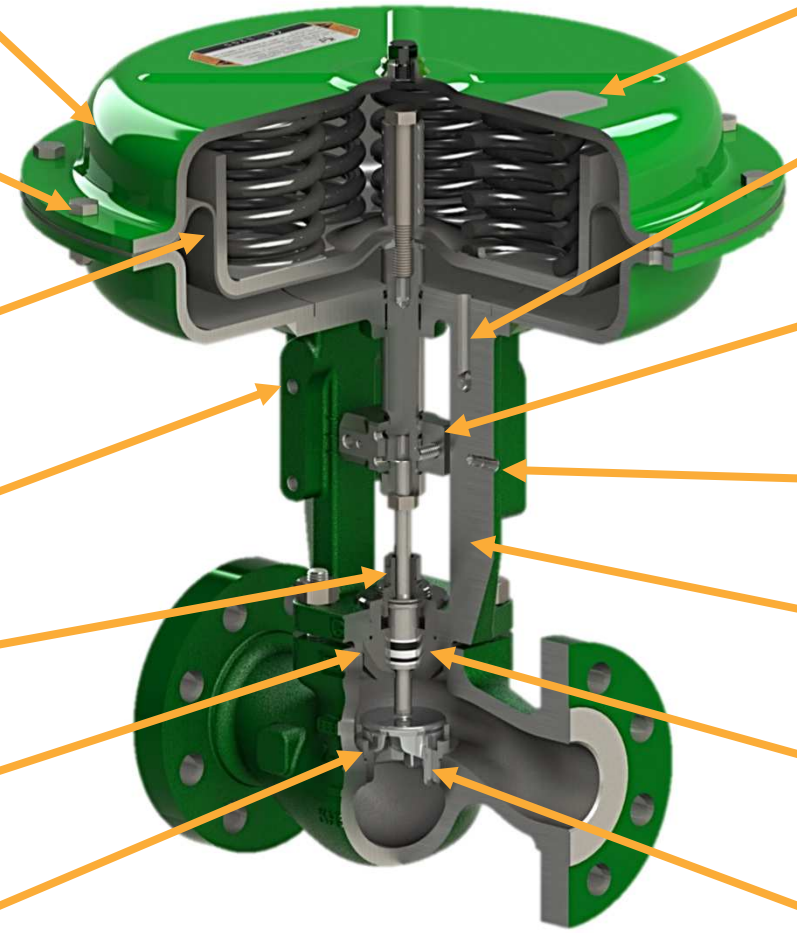
Design Overview



Compact, multi-spring actuator

Stainless steel casing fasteners (standard)

Low temperature capable diaphragm material

Integrated positioner mounting for linkage-less feedback

One-piece threaded packing follower

Clamped bonnet design

Self aligning threaded seat ring with relief on seat

Air distribution channel

Symmetrical integral air passage

Stem connector corrects alignment

NAMUR mounting

LCC steel yoke (SST optional)

ENVIRO-SEAL™ live-loaded packing system (standard)

Port guided trim

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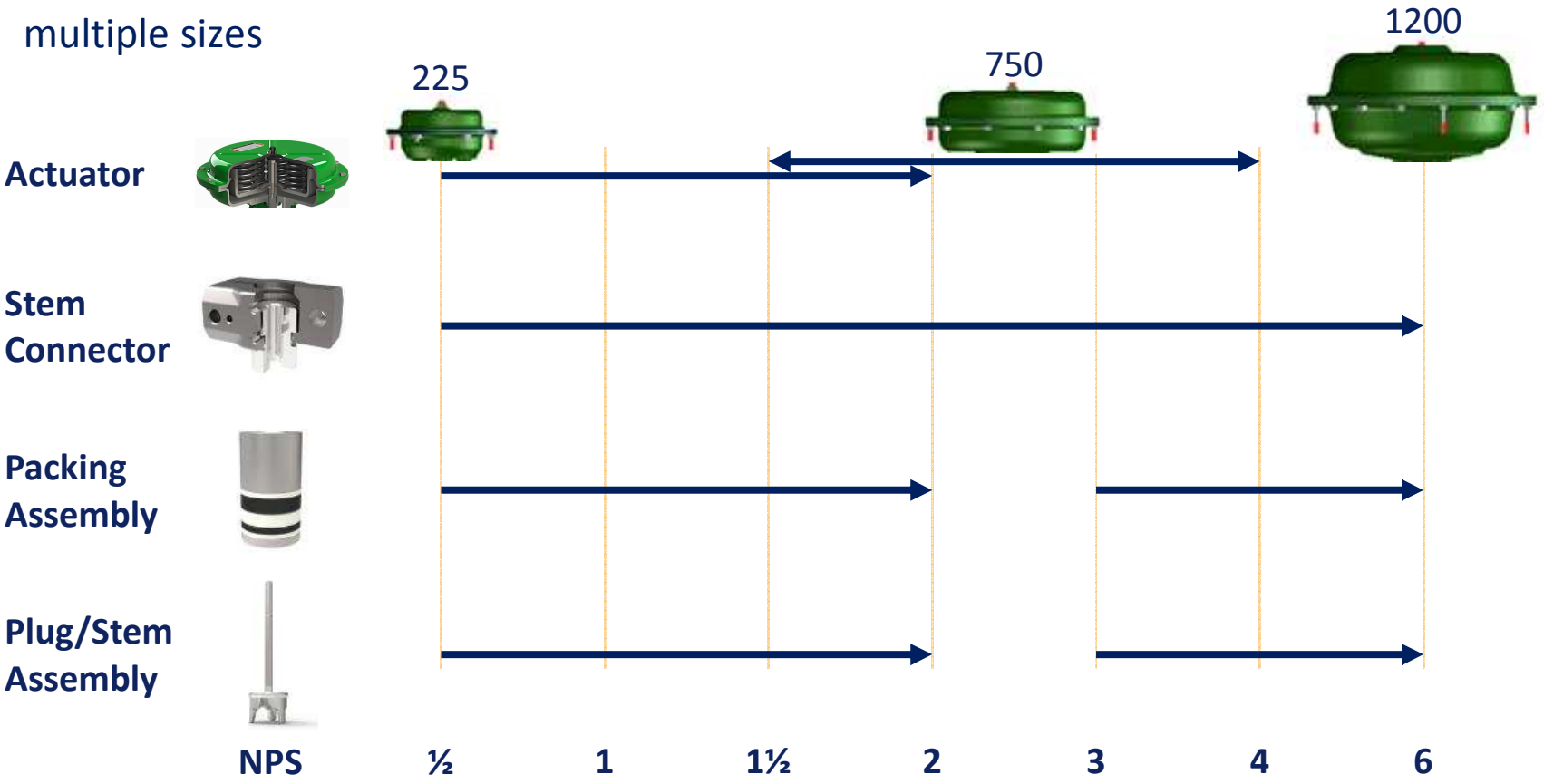
Parts Interchangeability

Reduced spare parts complexity by utilizing common parts across multiple sizes



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Innovation

Delivers Fisher quality & performance:

- External anti-corrosion platform
- Emission control packing
- Superior dynamic performance
- Long cycle life
- State of the art manufacturing

Reduced engineering time:

- No actuator sizing
- Integrated positioner mounting
- On-board limit switch & 4-20mA output

Ease of commissioning:

- Quick & simple local push-button calibration
- Seven language user interface
- AMS™ ValveLink® enabled

Reduced inventory:

- Increased parts commonality
- Fewer parts required

Ease of maintenance:

- Field reversible actuator
- On-line diagnostics
- Smaller, compact, & less weight
- Reduced parts complexity

Increase reliability:

- Utilized state of the art design techniques
- Extensive laboratory verification
- > 1 million cycles, > 800K with Bellows
- > 15,000 units globally
- Complies with multiple world area standards and certifications

Fast & reliable delivery:

- ***1 week or less***

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Application Range & Options

Process coverage

- Body Sizes : NPS ½ – 6 and DN15-150
- End connections: ASME Class 150 & 300, PN10-40 per EN1092-1
- Leakage shutoff : Class IV, V, VI

Standard materials of construction

- WCC – Carbon Steel
- CF3M - Stainless Steel
- CW2M – Hastelloy C

Extended temperature capability

- -325 to 700°F (-196 to 372°C)
- Requires extension bonnet available for WCC and CF3M constructions

Bellows

Alloy materials of construction

- LCC – Carbon Steel
- CN7M – Alloy 20 (N06022 Trim)
- M35-2 - Monel
- CF3 – 304L
- CD3MN – Duplex
- N7M – Hastelloy B2

ENVIRO-SEAL live-loaded packing

- Certified to TA Luft, ISO 15848-1 and FCI 91-1 fugitive emissions standards

NACE materials and trim

- MR0103
- MR0175-2002
- MR0175-2003
- MR0175/ISO15156

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Broad Range of Sizes and Materials For Maximum Application Range

Process pressures: up to 51.7 Bar / 750 psi

- Body sizes : NPS ½ – 6
- End connections: ANSI Class 150 & 300
- Leakage shutoff : Class IV, V, VI

Process temperatures: -20 to 700°F (-29 to 372°C)

MATERIALS OF CONSTRUCTION			
BODY & BONNET	**STEM**	**PLUG**	**SEAT**
Steel 1.0619/WCC	316L Strain Hardened	SA351 CF3M	SA351 CF3M
			316L
			SA351 CF3M/PTFE
		316L	SA351 CF3M
			316L
			SA351 CF3M/PTFE
	Nitronic 50	SA351 CF3M/CoCr-A	SA351 CF3M/CoCr-A
	CW2M	CW2M	CW2M
			CW2M/PTFE
SST 1.4409/CF3M	316L Strain Hardened	SA351 CF3M	SA351 CF3M
			316L
			SA351 CF3M/PTFE
		316L	SA351 CF3M
			316L
			SA351 CF3M/PTFE
	Nitronic 50	SA351 CF3M/CoCr-A	SA351 CF3M/CoCr-A
	CW2M	CW2M	CW2M
			CW2M/PTFE
Hastelloy C CW2M	CW2M	CW2M	CW2M
			CW2M/PTFE

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Product Timeline

GX

Monel

Whisper Trim™ III

PSA

Cryogenic

Travel Stop

NPS 6

Cavitrol™ Trim

2 and 3 Bar Air Supply

Actuator Optimization

3-Way

Electric Actuator Yoke

3-Way High Temperature

Exceeding 1 Million Cycles in PSA Service
With Fisher® GX Control Valves

Control valve shutoff is a major concern because it affects PSA unit efficiency. If valve leakage causes contamination from one PSA bed to another, industrial gas purity can be compromised. Improper selection of globe valves can be the limiting factor in achieving PSA purity and longevity requirements.

Fisher PSA valves have been designed and tested to meet the highest of reliability standards:

Fisher® digital valves must exceed one million cycles to meet Emerson's PSA standard.

Increasing Product Application
Range and robustness

2004 2005 2006 2007 2008 2009 2010 2011 2012

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The GX Actuator

- 3 size actuators: 225, 750, & 1200
- Yoke
  - Integrated yoke – bonnet flange
  - Robust yoke to lower casing weld design
  - Namur yoke mounting
- Diaphragm
  - Multi-spring & diaphragm actuator
  - 3-6 Bar (44-87psig) high pressure diaphragm design
- Wide range of applications
  - Small, compact, lower weight design
  - Field reversible
  - Integral air passage allows for tubeless DVC2000 mounting
- Durability
  - SST fasteners and powder coat paint standard
  - Material: dual certified WCC

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No Actuator Sizing

- Actuator size is determined by port size.
- Actuators are designed for full CL300 inlet rating*

Actuator Determination		
Port Size	**Maximum Pressure Drop**	**Actuator Size**
9.5 mm	51.7 bar/750 psi	225
14 mm	51.7 bar/750 psi	225
22 mm	51.7 bar/750 psi	225
36 mm	51.7 bar/750 psi	750
46 mm	51.7 bar/750 psi	750
70 mm	51.7 bar/750 psi	750
90 mm	51.7 bar/750 psi	750
70 mm	32.5 bar/472 psi	1200
90 mm	19.7 bar/286 psi	1200

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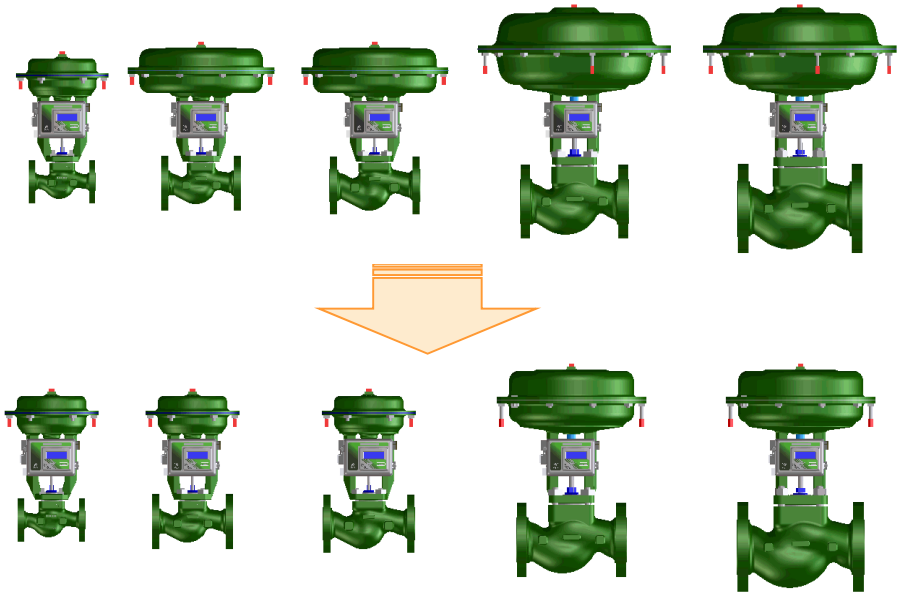
Actuator Optimization

Challenge:

Customers requested smaller envelope and weight on the GX actuators



Solution:

Emerson develops and engineers

- Enhanced the size 750 with extended travel and thrust to cover NPS 3 & 4
  - Reduced height by *14%*
  - Reduced envelope diameter by *24 %*
  - Reduced weight by *35%*
  - Increased parts commonality
- Enhanced the size 225 thrust equivalent to original 750 for NPS 1½ & 2
  - Reduced height by 9%
  - Reduced envelope diameter by 37%
  - Reduced weight by 45%

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Actuator Optimization

Challenge:

Customers requested the GX actuator supply range be expanded to utilize traditional 30 psig (2 bar) plant air supply

Solution:

Emerson engineers expanded the GX supply pressure range utilizing new spring designs and spring arrangements

- 29 psig (2 bar)
- 44 psig (3 bar)
- 58 psig (4 bar) up to 87 psig (6 bar)
- Permits usage of traditional I/P instruments like the 3582

All GX spring designs are tested to 1,000,000+ cycles to support PSA and other high cycle applications

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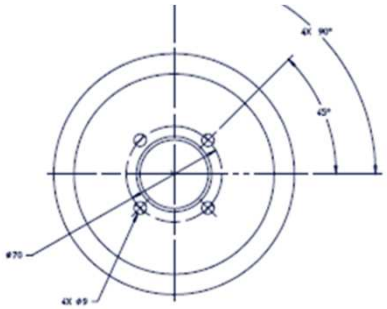
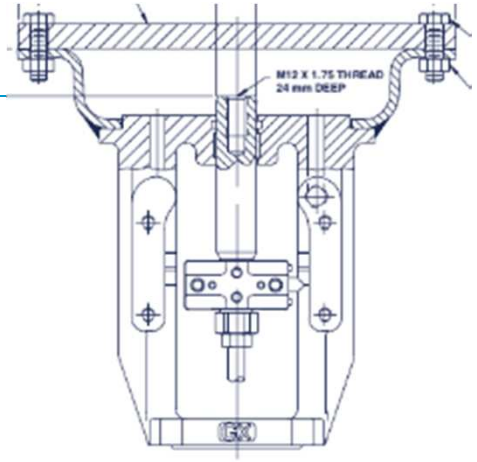
GX and Electric Actuation





Challenge:

- Mounting electric actuators on GX control valves required custom solutions by the end user or Emerson Local Business Partner
- Extended lead times
- Increased cost and complexity

Solution:

Emerson engineers designed a yoke compatible with an industry standard mounting pad and bolting

- ISO 5210 F7 mounting dimension
- Permits mounting any manufacturer that complies with ISO 5210 Flange type F7
- Emerson provides GX yoke, actuator rod adaptor, spacer, and necessary bolting

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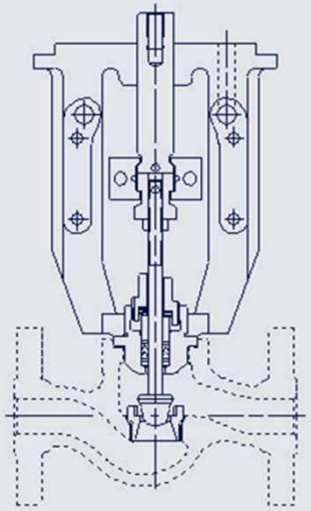
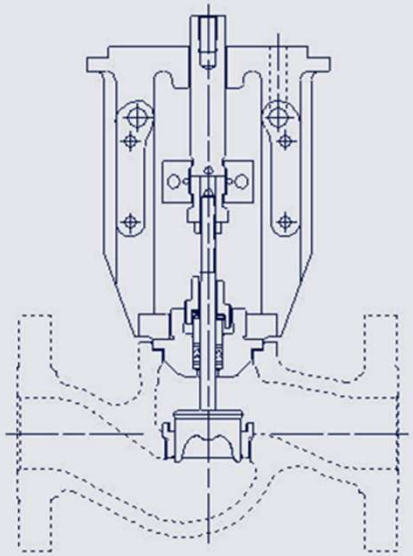
Trim Architecture

Stem guided



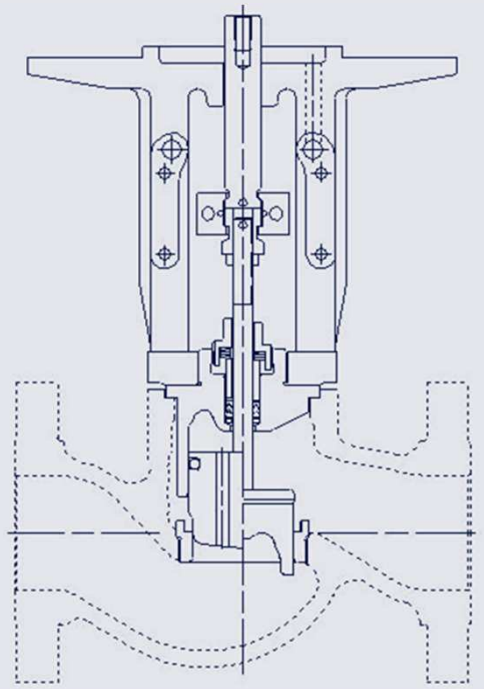
NPS ½ - 1

Port guided



NPS 1½ – 4

Balanced and unbalanced trim



NPS 3 & 4

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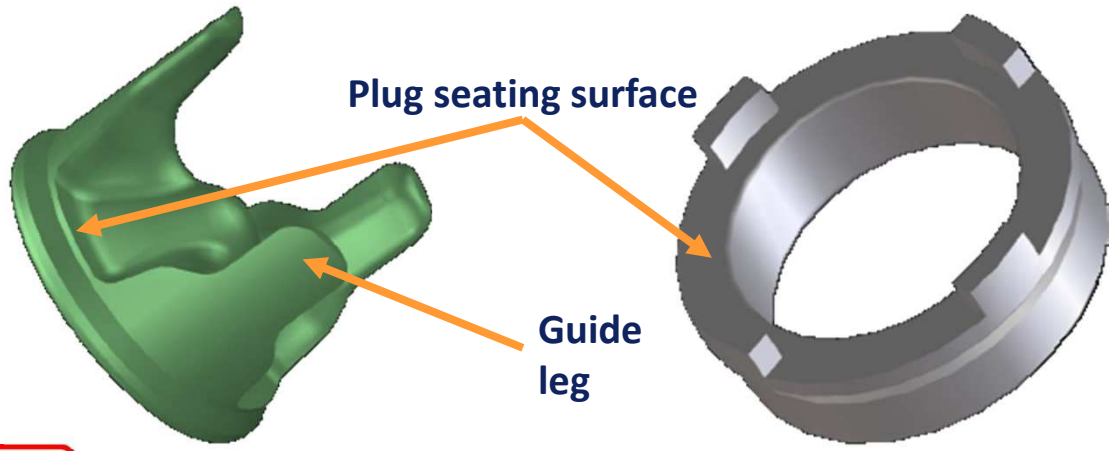
Port Guided Trim Design

Challenge:

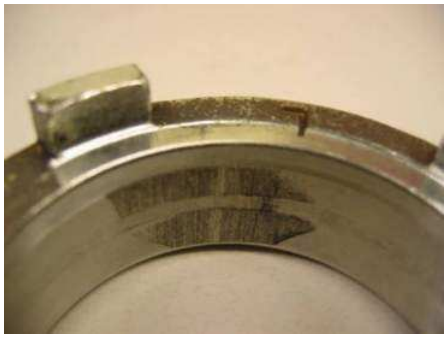
Significant trim wear in early life

Solution:

- Equal capacity at less travel enables compact size.
- Smaller stem required produces less friction
- Lateral stability reduces vibration.



*Relief in seat ring manages wear**



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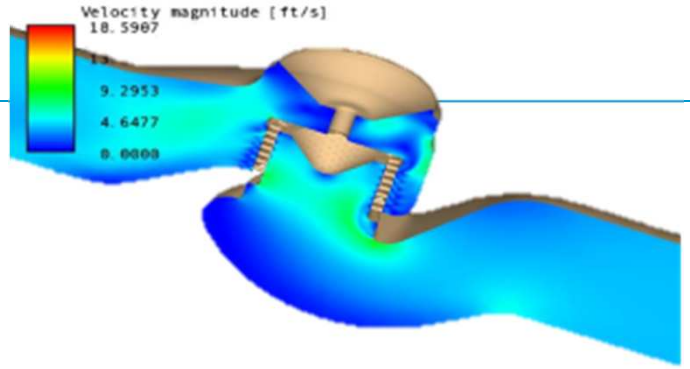
* Greater than 20,000 cycles with 20lb. side stem load. Unlikely to be duplicated in service. Still met Class IV shut off.

Severe Service Trim



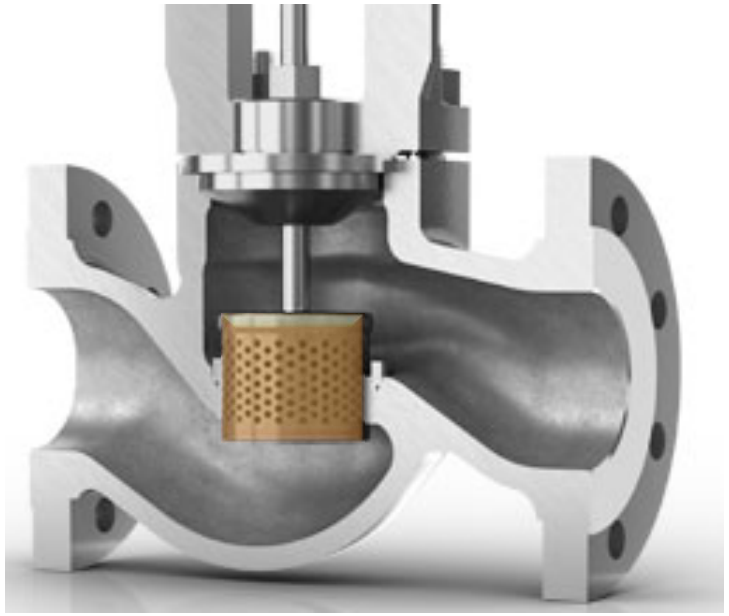
Challenge:

Flow generated aerodynamic valve noise

Solution:

Whisper III noise abatement trim

- NPS 3, 4 and 6
- Utilizes Whisper III drilled hole technology
  - 3” and 4” port-guided plug
  - 6” drilled hole cage
- Whisper III Level A1 up to 0.6 ΔP/P1 shifts acoustic energy to a higher frequency range
- Up to 18 dBA noise reduction



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Severe Service Trim

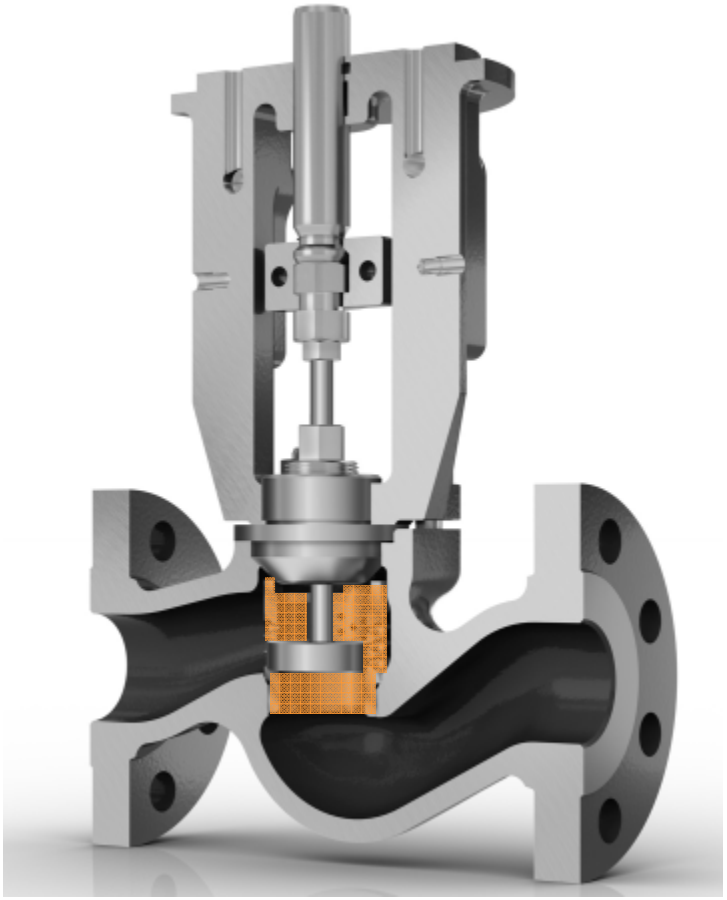
Challenge:

Cavitating process conditions damage valve and trim components

Solution:

Cavitrol III 1 stage trim

- NPS 1, 1½ and 2
- Utilizes proprietary Cavitrol III drilled hole shape and spacing to stage the pressure drop across the cage and isolate cavitation to prevent valve damage
- Capable of 400 psi pressure drop
- Class V shutoff standard



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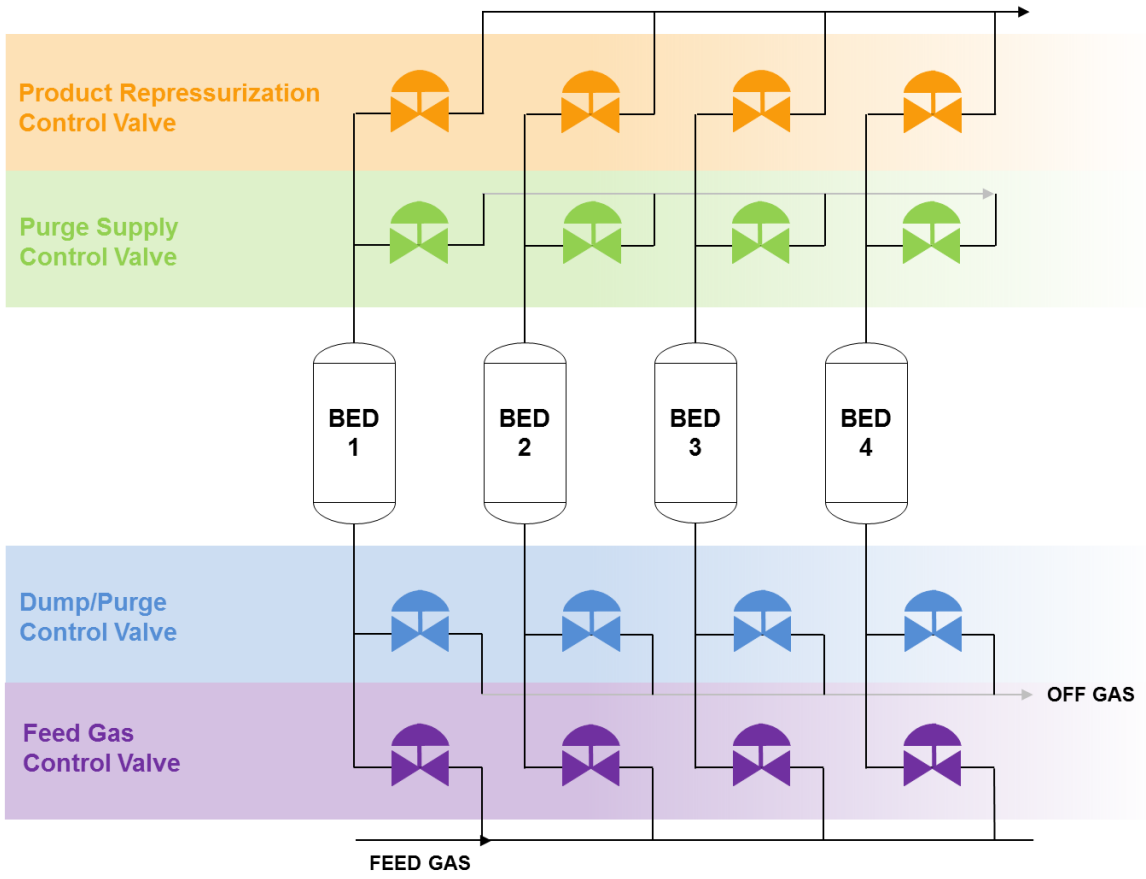
PSA High-Cycle Qualification

Challenge:

Pressure Swing Adsorption (PSA) demands high cycles and tight, bi-directional shutoff

Solution:

Emerson engineers validated the high-cycle capabilities of the GX through rigorous testing utilizing a PSA test skid designed to replicate actual PSA process conditions



PSA applications need to run upwards of 1,000,000 cycle between maintenance cycles

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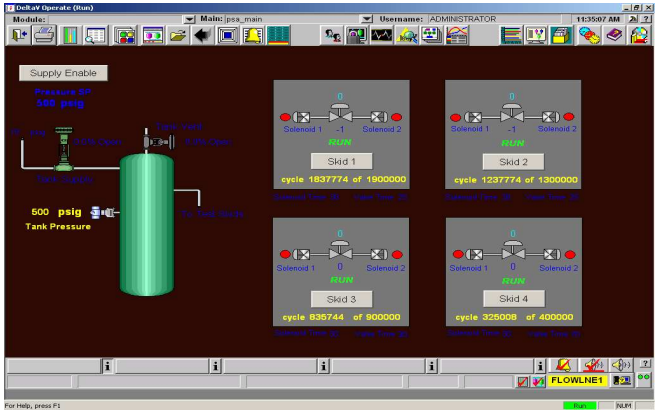
PSA High-Cycle Qualification

Solution (continued):

Test specifications and process developed based on a leading licensor's test requirements

- Test program
  - 350 psig test pressure
  - 100% travel
  - Stroking speed: 1.5 – 2 seconds
  - Leakage measurement
    - 50 psid and 450 psid helium seat leak tests every 5,000 cycles to 100,000 cycles
    - 50 psid and 350 psid seat leak tests every 100,000 cycles thereafter
    - Seat leakage check in both flow directions
- Control valve assemblies not adjusted nor any maintenance performed



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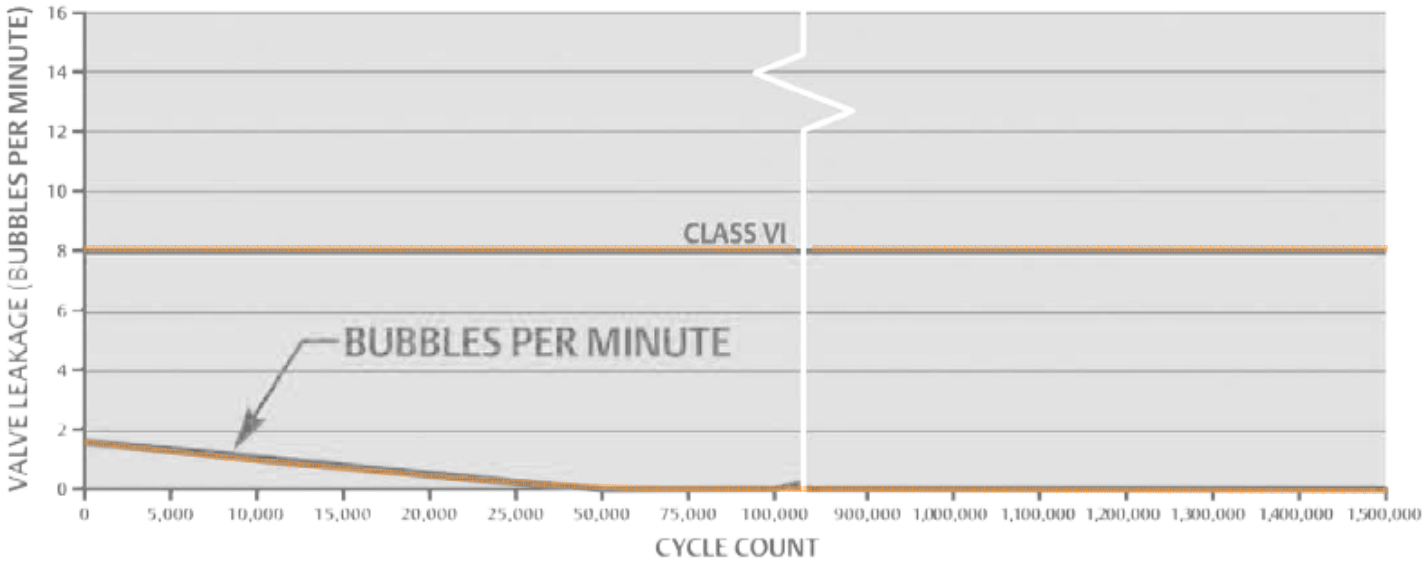
PSA High-Cycle Qualification

Solution (continued):

- Test Program Results
  - Class VI was maintained through 1,000,000 cycles and beyond
  - GX's installed on a PSA skid at customer site and continue to operate successfully to date



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Reliability: Optimized Low-Stress Actuator Casing Design

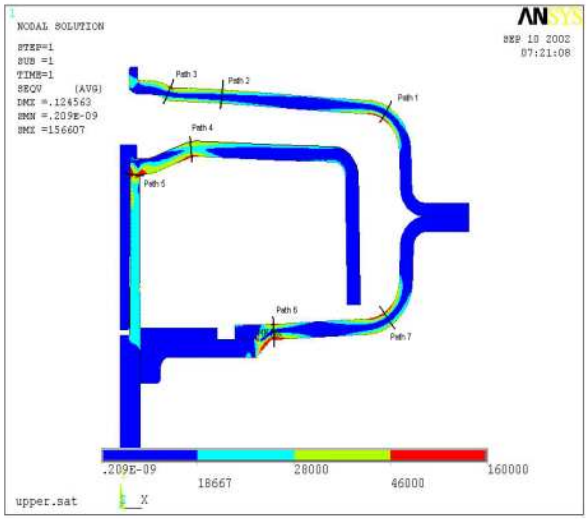
Challenge:

High stresses seen on actuator casing

Solution:

Design revised

- High-stress regions eliminated
- Lab verification



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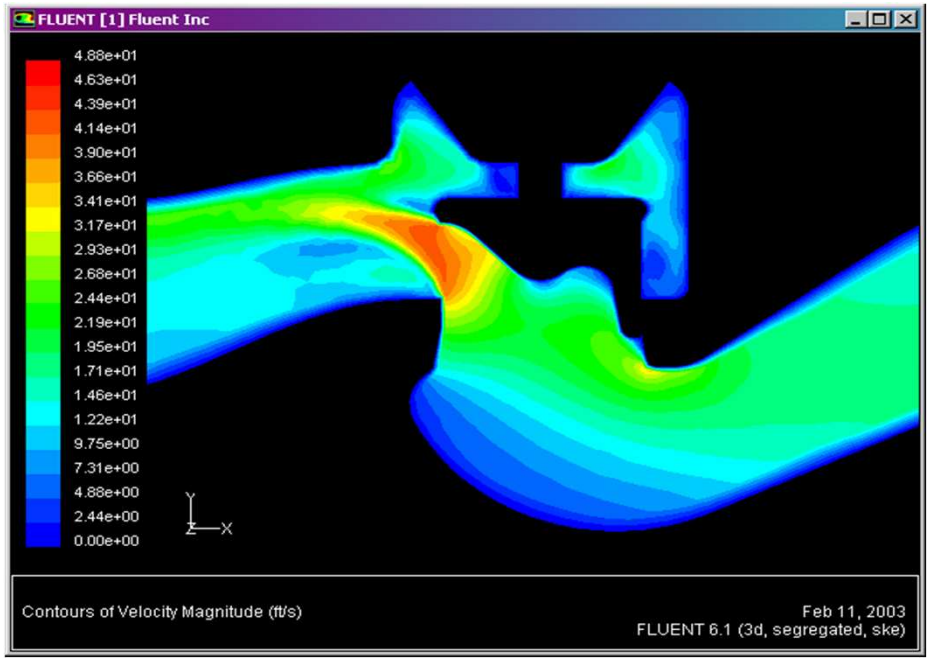
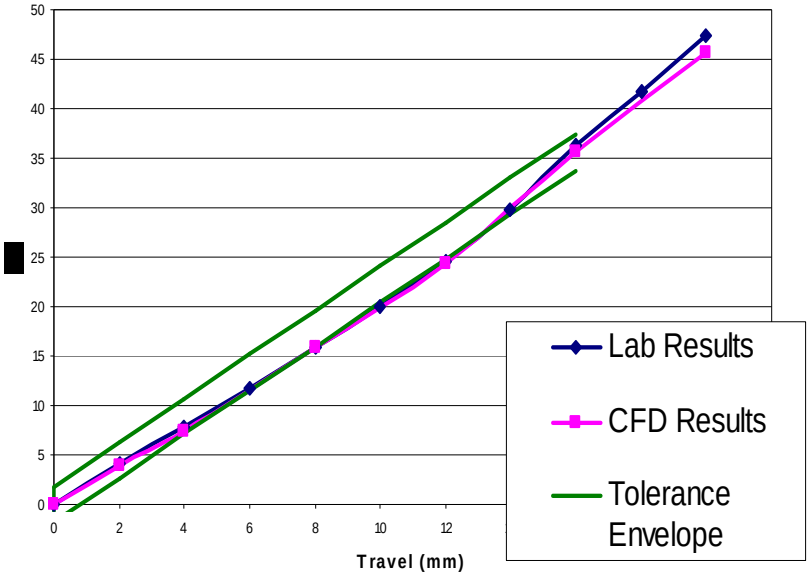
Reliability: Computational Fluid Dynamics (CFD)

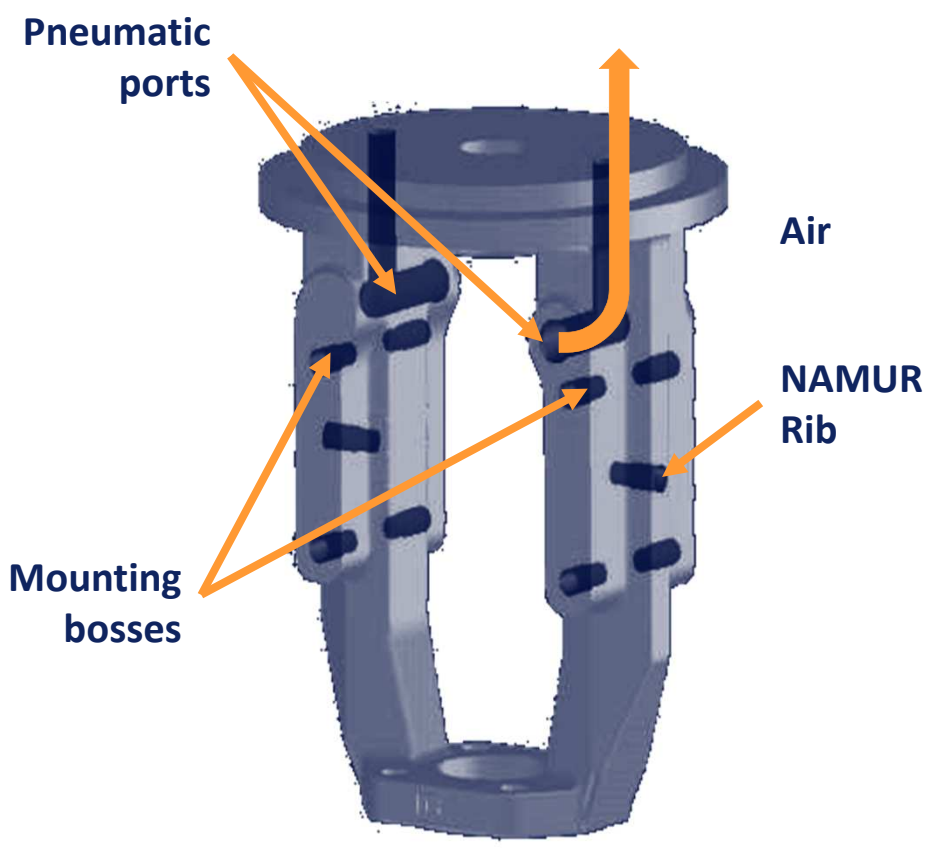
- Flow capacities and characteristics
- Cavitation analysis
- Fluid forces
- Flow field analysis





Flexible Interface

- Simple instrument replacement
  - Integral instrument mounting
  - No external tubing/fittings
  - NAMUR instrument mounting
- Multiple convenient mounting bosses
- No pinch points



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Improved Stem Connection

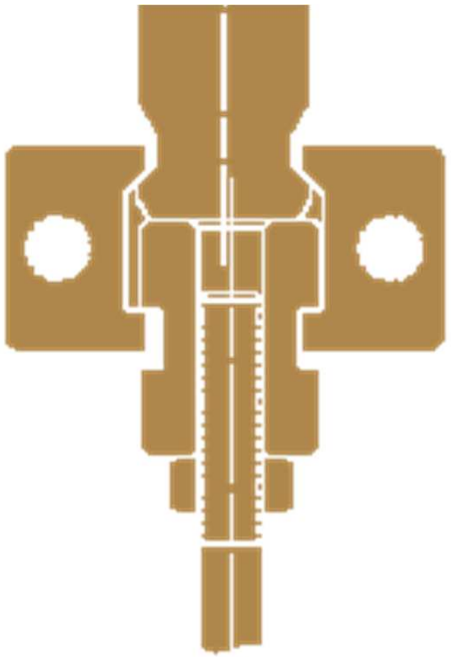
Challenge:

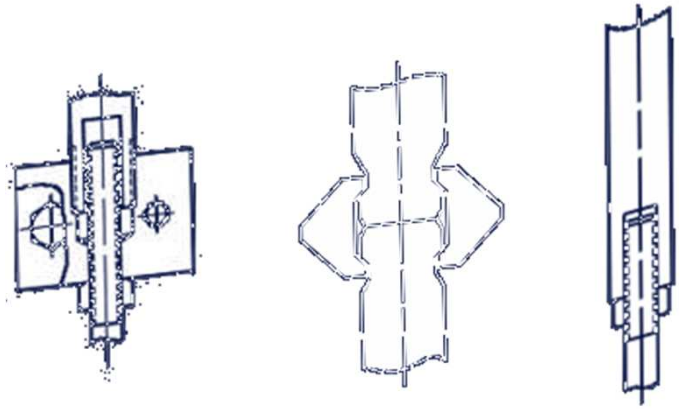
Conventional designs draw into axial alignment

Solution:

Allow for misalignment

- Eliminates axial load on packing
- Improves stem seal
- Increases packing life





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Corrosion Protection

Challenge:

Corrosive process environments

Solution:

- Powder paint standard
- Stainless Steel casing fasteners
- Proprietary coatings on high strength steel fasteners meet 500 hour ASTM salt spray tests

Advantage:

- Environmental protection ensures survival in aggressive environments
- Improved reliability and service life

Standard Zinc Plated

HCF Coated

Powder-coated actuator casing with HCF coated cap screws after 500 hours of salt spray

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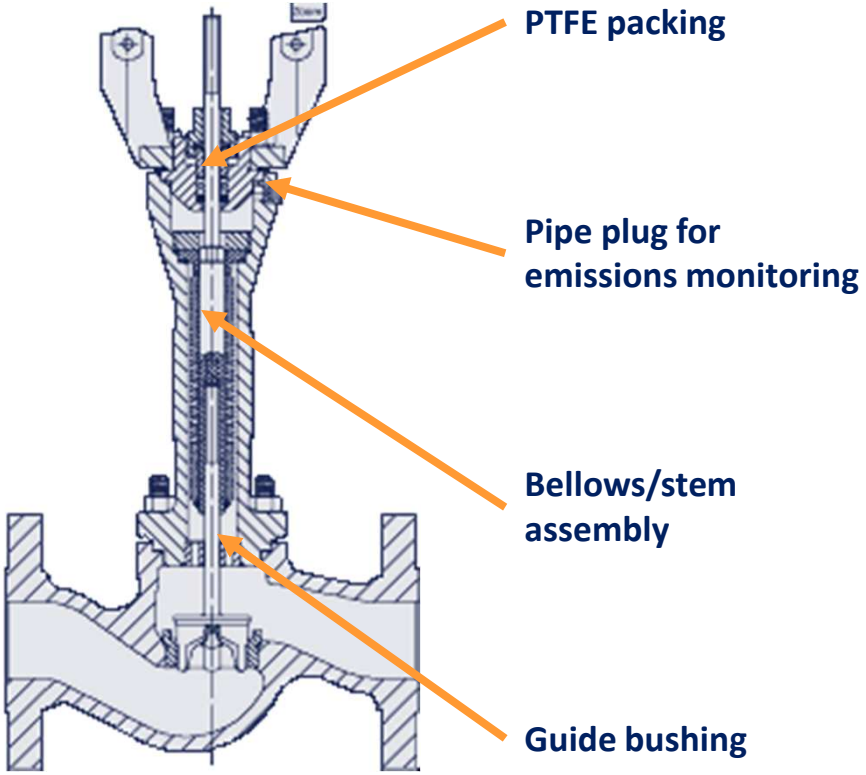
Bellows Bonnet Offering

Construction:

- Bellows material
  - 316L SST
  - Hastelloy C
- Operating conditions
  - ANSI class 300 rating
  - Up to 450 F (232 C)
  - 100 000 cycles life for bellows full stroke and full pressure at 51.7 Bar/750 Psi



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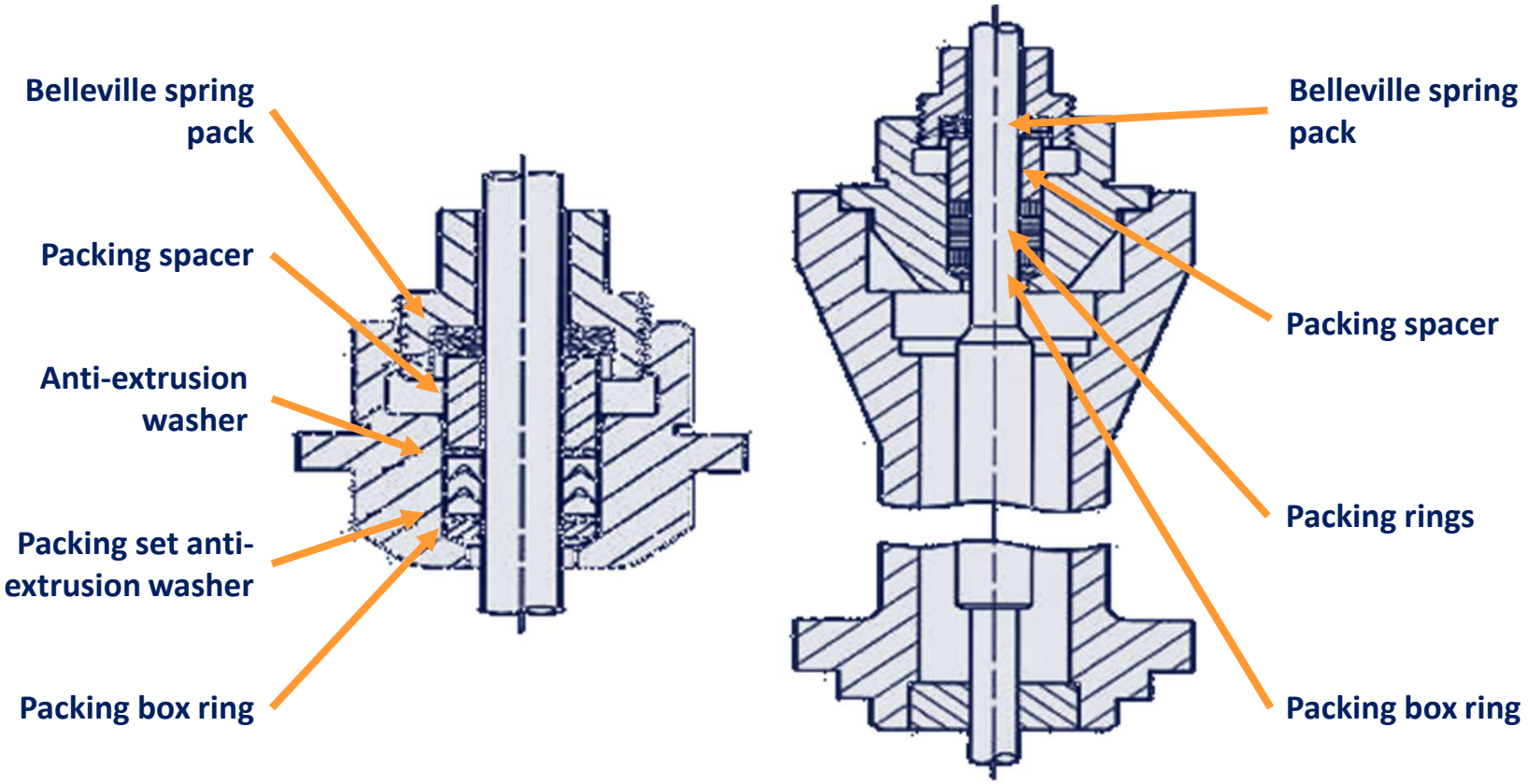
ENVIRO-SEAL Packing



Standard bonnet with PTFE packing set

Extension bonnet with graphite ULF packing set

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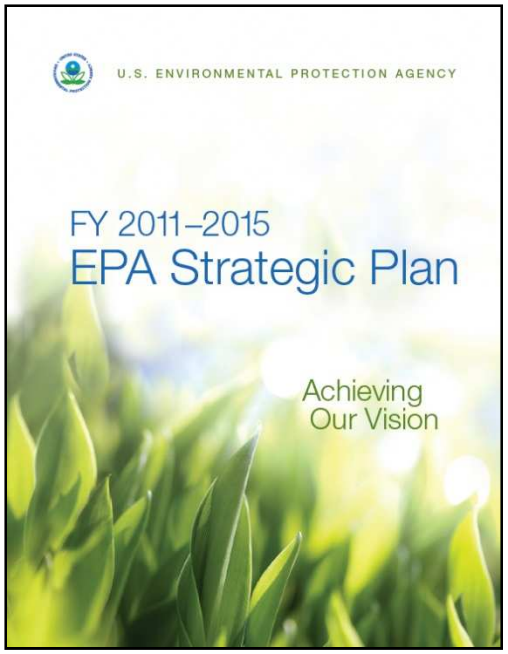
Low-E

- Increased focus from the Environmental Protection Agency (EPA) on LDAR compliance increases necessity for low leaking packing technology
- Recent enforcement of 1990 Clean Air Act (CAA)
  - LDAR reporting
  - Focus on refining and petrochemical facilities
- Companies found not in compliance are subject to consent decrees
  - Fines
  - Enhanced LDAR Program (ELP)
- Enforcement expected to expand to more customers



"EPA will take effective actions to reduce air pollution for the largest sources."

"Pursue vigorous civil and criminal enforcement…"

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Fugitive Emissions Certification

Challenge:

- Increased EPA focus on Leak Detection and Repair (LDAR) compliance
- Companies found not in compliance are subject to consent decrees
  - Fines
  - Enhanced LDAR Program
    - 100ppm requirement
    - 5 yr. warranty

Solution:

- Fisher ENVIRO-SEAL™ packing (standard)

Advantage:

- Compliance
  - Internal and 3rd party testing to fugitive emissions standards
  - 100ppm sealing capability
- Reduced maintenance
- Extended monitoring schedule
- Improved control valve performance

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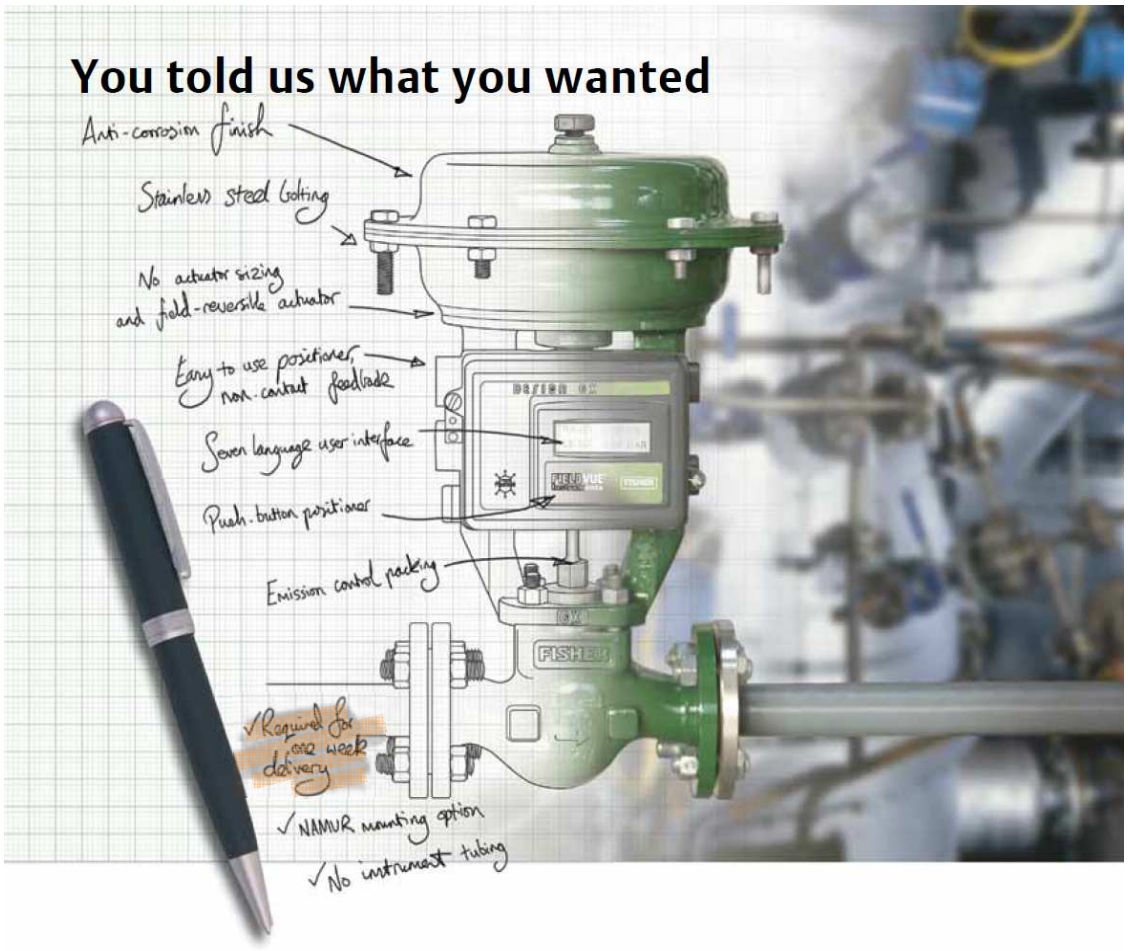
Summary



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Where to Get More Information

- www.emersonprocess.com
- Fisher GX brochure
- High-Cycle Applications brochure
- Your Emerson Local Business Partner

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