When you need the world's most reliable globe control valve...

Fast! Pronto! IMMEDIATELY!

TRIMTECK®
OPTIMUX®

SAME DAY SHIP

OpGL® Globe Control Valve

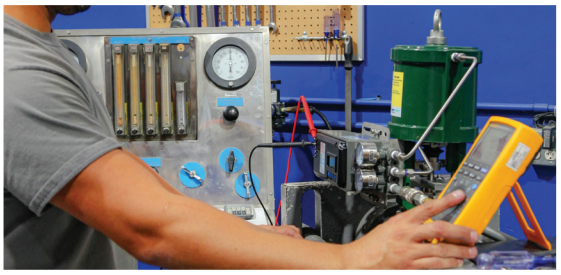
Our manufacturing facility in Coral Springs, Florida now has a dedicated production cell to configure, assemble, test, and ship a range of control valves within hours of receiving a purchase order.

Place an order for a qualifying **General Service OpGL®** before **10:00am Eastern time**, and we will ship ***on the same day!***

— Sudden failure of an existing control valve causing expensive, unplanned downtime?

— Have a valve that's been deemed unrepairable during a planned outage?

TRIMTECK® is here for your OH SHIP! moments!



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TRIMTECK® OPTIMUX®

SAME DAY SHIP

Qualifying General Service OpGL Configurations:

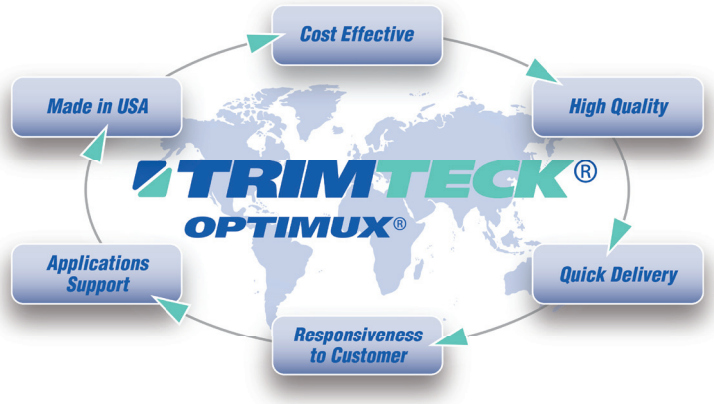
Trimteck's Same Day Ship Program	
▶	Sizes: ½" to 4"
▶	Pressure Classes: CL150 to CL600
▶	End Connections: ISA/ANSI RFF
▶	Body Material: WCB Carbon Steel or CF8M Stainless Steel
▶	Trim Material: 316 SS
▶	Trim Size: All Standard C_V
▶	Flow Characteristic: Linear, Equal Percent, Quick Open
▶	Actuator: OpTK Pneumatic Piston Cylinder
▶	Positioner: HPP Series Digital and/or Pneumatic

Contact your local Trimteck distributor: trimteck.com/find-a-rep

About TRIMTECK®

Trimteck is a NASA VDB-approved, ISO 9001-2015-certified U.S. company (Registration No. 2012-98243) with over thirty years of experience engineering, manufacturing, and marketing high-quality, cost-effective flow, pressure, and temperature control solutions and equipment for critical processes, and our products are currently helping customers safely improve quality, optimize throughput, and reduce emissions and energy costs across an array of industries in more than 42 countries.

We manufacture a comprehensive line of control valves – and variety of actuators, positioners, severe service trims, and other accessories – that our applications engineers and representatives use to solve even the most complex flow control problems quickly and economically.



TRIMTECK LLC Headquarters
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Products in compliance with:
ASME B16.34
ANSI/ISA-75.05.01-2019

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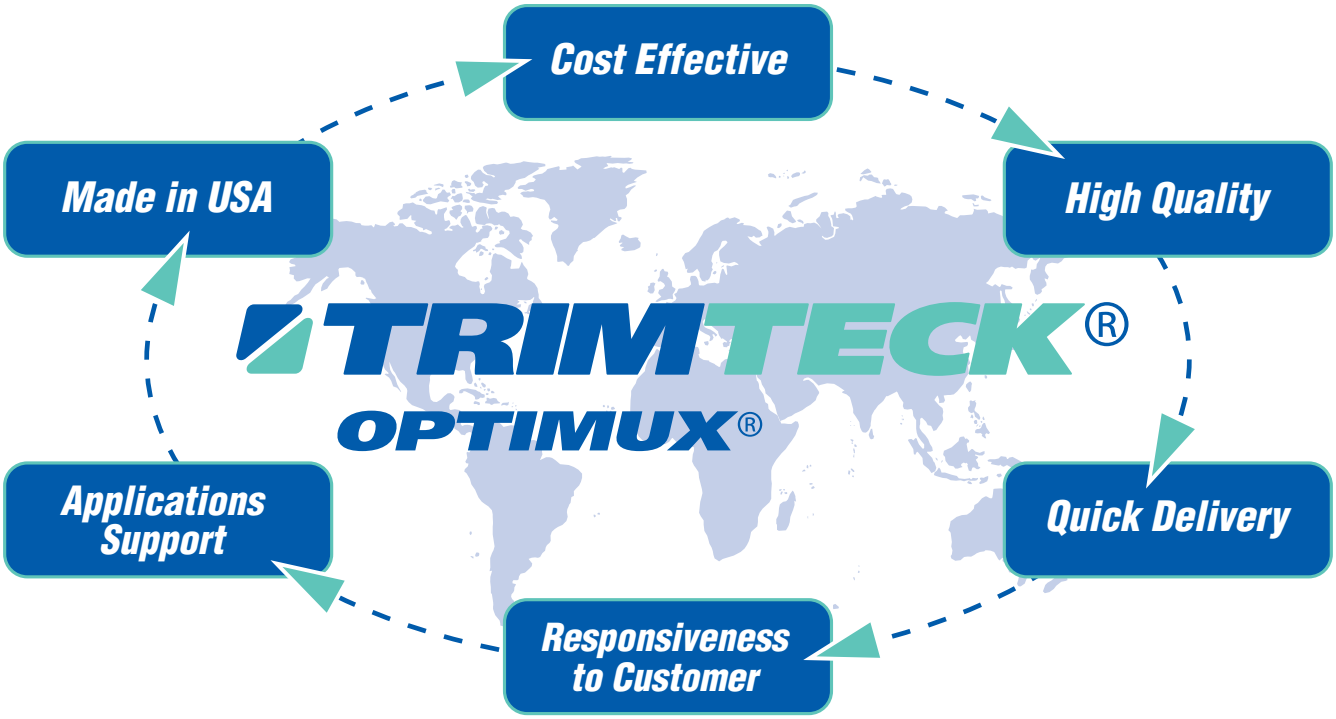
TRIMTECK®
OPTIMUX®

Severe Service
CONTROL VALVE TRIM

When you partner with Trimteck® you can expect:



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.

Introduction to Noise, Cavitation, and Flashing

Cavitation, flashing, and noise in control valves are a concern for plant stakeholders, such as operators, maintenance personnel, and owners, because they can be the source of decreased utility and profitability. Cavitating or noisy valves can cause damage to pipelines and other equipment, increasing the likelihood of unplanned downtime.

Trimteck designs, engineers, and manufactures an array of control valve trims that control cavitation and abate noise in all manner of applications. This document aims to explain the source of cavitation and noise, its effects on various applications and industries, and Trimteck approach to ameliorating or altogether solving such problems.

The basic ***Trimteck*** severe service trim designs described herein are custom-engineered and adapted depending on the unique challenges of the industry and application.

Oil & Gas, Refining, and Petrochemicals

Media

Crude oil, Refined Hydrocarbons, Water, Multi-Phase Fluids, Natural Gas, Corrosive Processed Chemicals

Challenges for Controlling Cavitation & Noise

Particulates in suspension, Process variability, Broad range of valve types and sizes

Power

Media

Steam, Saturated Steam, High Pressure Water

Commonly Problematic Applications

Boiler Feedwater, Recirculation, Anti-Surge, Desuperheating

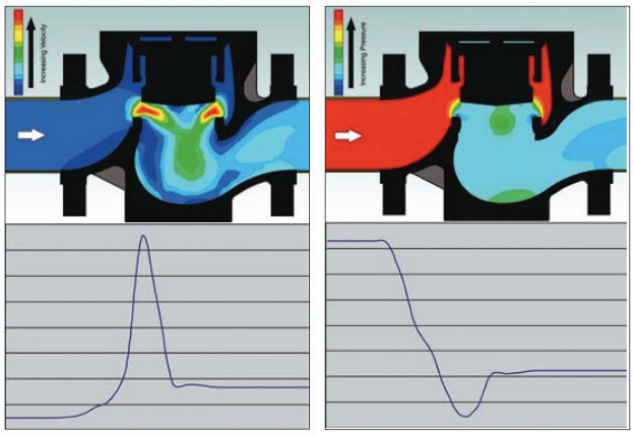
Other Industries

Pulp & Paper, Metals & Mining, Chemical, Food & Beverage, Aerospace & Defense

Cavitation, Flashing, and Noise Explained

Cavitation and flashing in control valves occur only with liquid media, whereas noise can be associated with both liquid and gaseous media. In both cases the principal variables in question are fluid velocity and pressure drop.

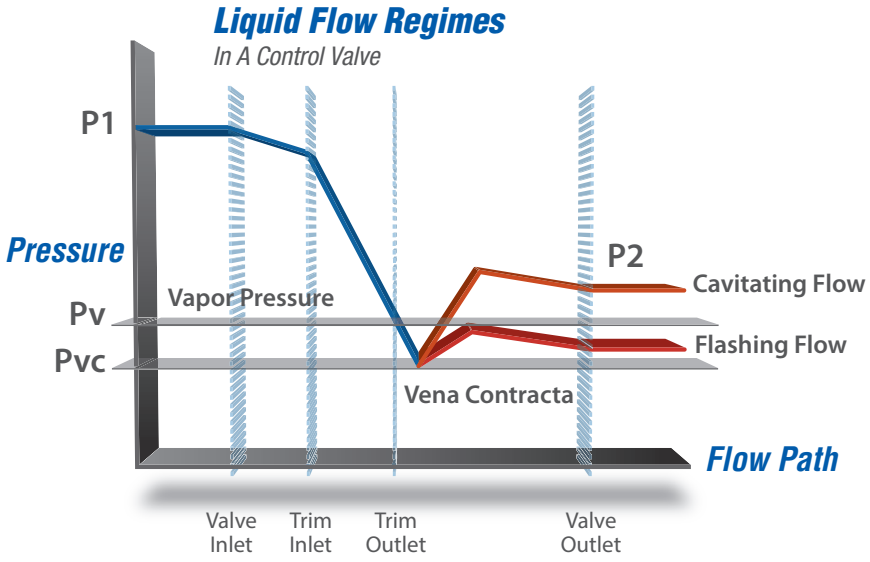
Across a valve, choked flow is a phenomenon that begins to occur at the point at which flow ceases to increase as the pressure differential is increased. That is, there is a maximum flow that can be achieved through any given valve, and beyond this threshold is where choked flow occurs.



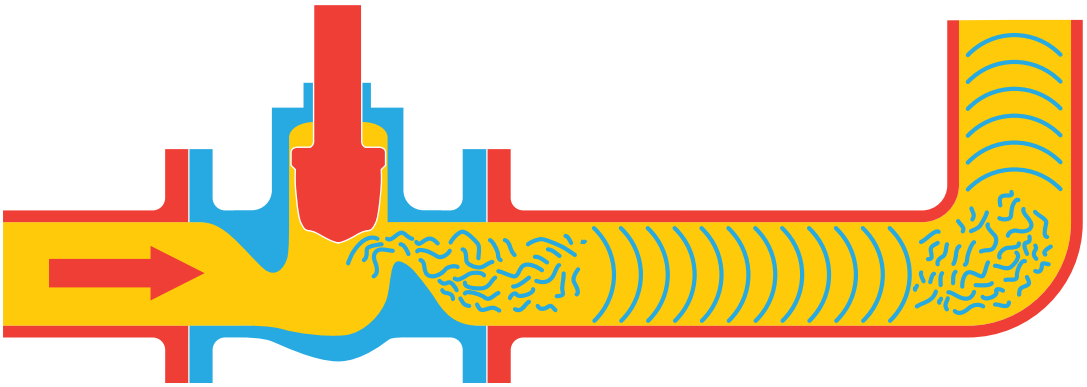
Velocity **Pressure**

Pressure drop occurs through a valve because as velocity increases to its maximum through the flow restriction, pressure decreases to its minimum. As velocity normalizes over distance downstream, pressure recovers as well but not to the level it was at upstream of the restriction. The point at which pressure is at its minimum and velocity is at its maximum is called the vena contracta. In liquids, at this point the local pressure may drop to or below the liquid's vapor pressure, forming vapor cavities, or bubbles in the fluid. The fluid then essentially becomes multi-phase, or a combination of liquid and gaseous, and the density thereof continues to decrease as more vapor cavities are formed. The fluid reaches its minimum density at choked flow

If the liquid pressure downstream of the vena contracta recovers to a point higher than the vapor pressure, the vapor cavities will collapse. This is called cavitation. If the liquid pressure downstream does not recover and remains below the vapor pressure, the vapor cavities do not collapse and cause further damage. This is called flashing.



Both cavitation and flashing tend to cause hydrodynamic noise in a valve, but aerodynamic noise in gas or vapor service is typically what constitutes a noisy problem valve. Aerodynamic noise in valves is caused by fluid turbulence that typically originates within the valve body. First, fluid turbulence, and thus noise, can occur within the valve trim as velocity increases and pressure decreases. Second, it can occur in the region between the valve trim and the body wall as fluid impinges on itself. Lastly, another noise source can be the combination of the turbulence at the valve outlet and the vibration of the downstream pipe.



Throttling across a control valve generates high turbulence.

Factors Affecting Cavitation and Noise

Cavitation and noise do not always cause damage, but when they do they depend largely on the following factors:

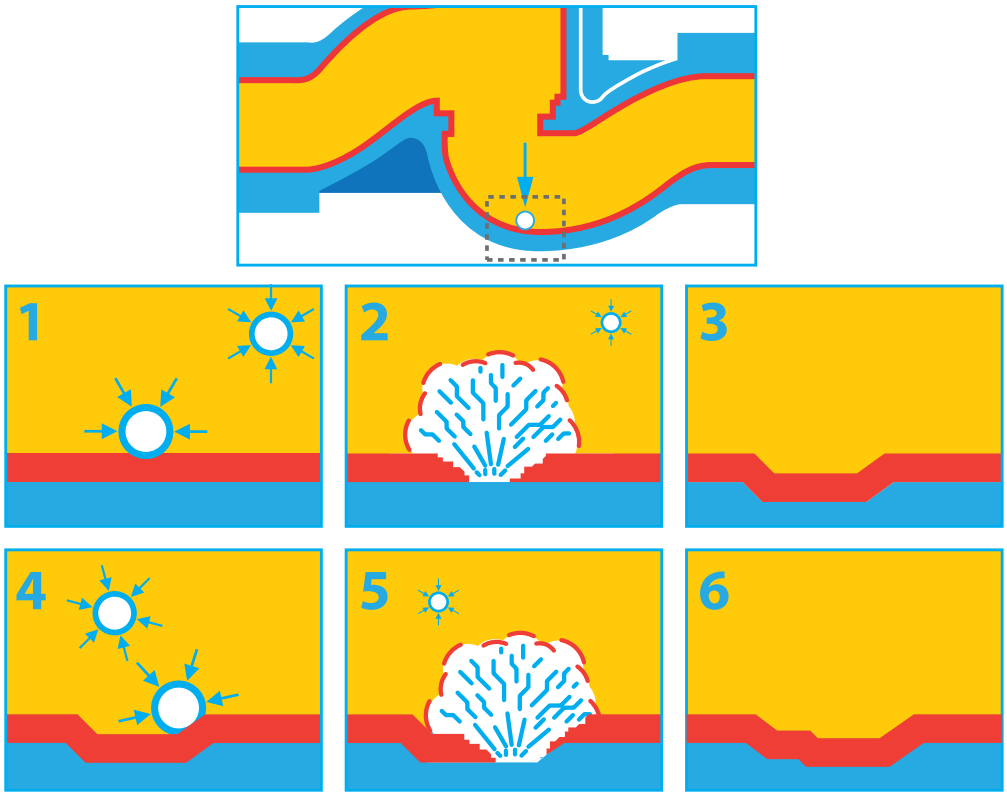
- ***Pressure Drop:*** the higher the pressure the drop, the greater the chance of damage as a result of noise and cavitation.
- ***Time of Exposure:*** the longer cavitation or noise occurs in an area, the more likely it is to result in damage
- ***Materials:*** hardened materials reduce damage and extend the life of the trim and/or valve. For noise, thicker and larger diameter pipelines and valve bodies help in abatement.
- ***Flow Rate:*** both cavitation and noise tend to increase with increasing flow rates.
- ***Valve and Trim Design:*** Trimteck produces anti-cavitation and anti-noise trim to counteract the effects of cavitation and abate noise.
- ***Seat Leakage:*** if leakage occurs through the seat of the valve while it is closed, the fluid escapes from a high-pressure area to a low-pressure area, which can exacerbate cavitation and noise. Trimteck's Optimux® control valves achieve ANSI Class V metal-to-metal seat leakage, which minimizes seat leakage.
- ***Fluid:*** behavior, specific gravity, and viscosity of fluid need to be considered when selecting Trimteck valves and trim.

Cavitation Damage

Cavitation damage is a form of hyper erosion that can destroy both piping and control valves, which can result in unacceptable process failures. The vapor bubbles created as a result of a pressure drop will implode – nucleate, grow, collapse, and rebound – as the vapor turns back to liquid. This implosion inflicts damage in the form of small pits in the metal, which cumulatively begin to wear away seating surfaces or drill holes through pressure vessel walls.

To ensure that valve damage has been caused by cavitation and not corrosion, determining a precise location is important. This is due to the fact that corrosion damage can often look very similar to cavitation damage. However, cavitation damage is almost always located downstream of the seating areas and can sometimes be found further down the line in the piping, whereas corrosion damage tends to form in narrow gaps and crevices.

Control Valve Plug Damaged by Cavitation



Imploding Vapor Bubbles Damage Control Valve Body

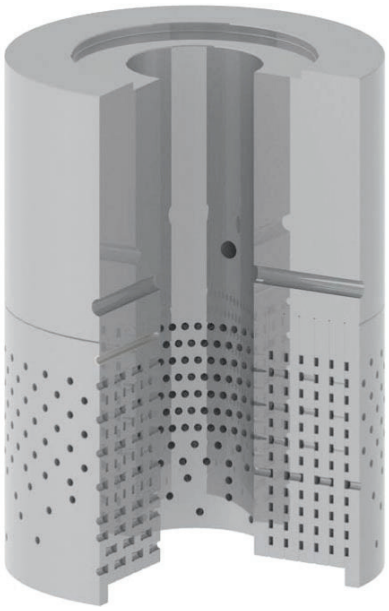
Trimteck's Approach

to Solving Cavitation and Noise-Related Severe Service Problems

Severe service applications vary in degree of severity, so ***Trimteck*** offers its customers appropriate, timely, cost-effective products to enhance performance while driving down operating costs. Our rationale is simple: invest in a reasonably-priced custom-engineered solution and enjoy extended performance combined with a dramatic reduction in operation and maintenance costs caused by failures and untimely shutdowns

When operating conditions in a process loop are fixed, a control valve may be called upon to perform under unavoidable cavitating conditions. Of course, a single anti-cavitation or noise abatement design is not sufficient for the wide variety of applications that exist across a multitude of industries. Therefore, ***Trimteck*** employs a wealth of experience and knowledge of severe services and the effects of valve size, type, trim design, geometry, and materials when designing a solution. We use differing methods and technologies for solving cavitation and noise issues that involve one or more of the following:

- Selection of ***appropriate materials,*** some of which are more resistant to cavitation than others
- Introduction of ***multi-stage pressure-reducing trims,*** which create a torturous path to reduce velocity, pressure, and energy levels
- Utilization of ***low recovery trim packages,*** which break down the mass flow into a multiplicity of small flow streams
- ***Optimization of flow direction*** to take further advantage of the design mechanics



Trimteck Severe Service Trim Cage

Precision CNC machining of ST-2 Trim

Trimteck's Approach

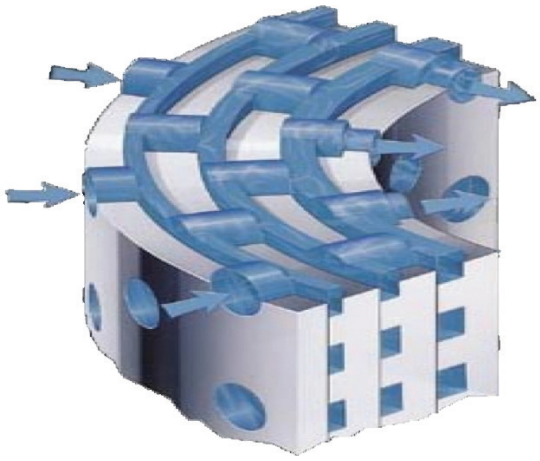
(continued)

In cases of minimal or incipient cavitation, material selection can be a sufficient method of control. Typically, valve body materials are relatively soft. As a general rule, as the chrome and molybdenum content increase, so does the material's resistance to cavitation. High-grade stainless steels, then, are much more resistant to cavitation than carbon steels. However, often times in order to further increase hardness and toughness of materials, ***Trimteck*** uses its proprietary CVD-5B hardening process, which significantly improves the cavitation resistance of stainless and carbon steels. This treatment alone is often sufficient for low pressure cavitation.

When pressures are relatively low and some cavitation control is required, a single stage "mutual impingement" trim that directs streams of cavitation bubbles into each other is often sufficient to reduce the effects of cavitation. This method essentially involves controlling or dissipating the energy of the imploding vapor bubbles by isolating them away from valve or trim surfaces with the use of low recovery trim packages.

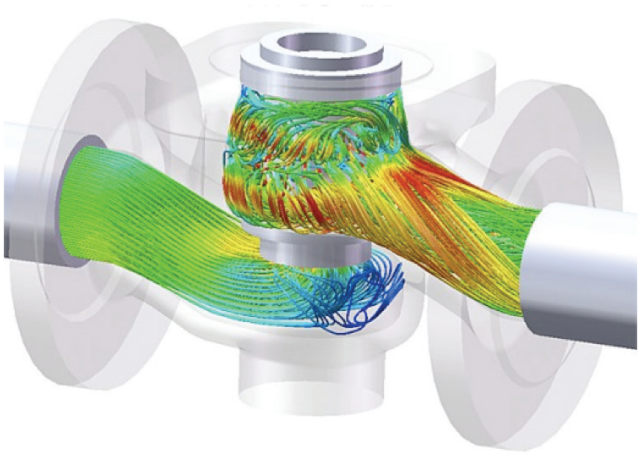
However, in cases of more severe cavitation, the ideal solution to more severe cavitation is to reduce the pressure from inlet to outlet gradually, thus avoiding the pressure drop at the vena contracta altogether. It can be eliminated entirely by not allowing the pressure to fall below the liquid's vapor pressure, which eliminates the formation of bubbles and their subsequent damaging collapse. ***Trimteck*** achieves this with single and multi-stage pressure-reducing trim.

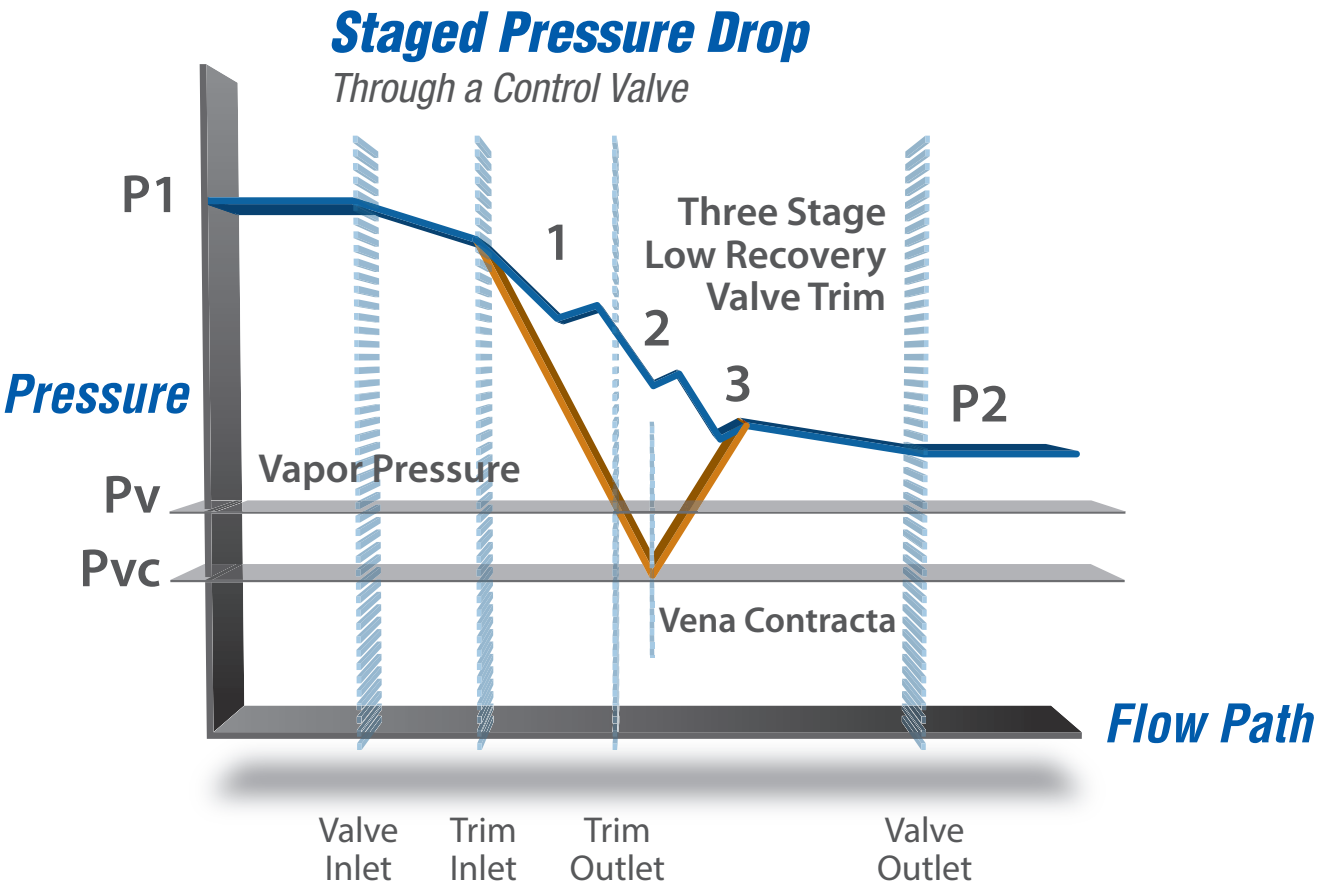
To learn more about CVD-5B, see page 16.



Trimteck ST-2 Four Stage Pressure Reducing Trim

Similarly, for noisy applications, the focus of the solution to the unwanted noise originating in the valve is through use low-recovery trim packages that break up the flow into smaller flows, as well as multi-stage pressure reducing cylinders.





Sigma σ: The Cavitation Index

In the past there have been a variety of indices used to correlate performance data to improve design of process equipment. The most widely-accepted and precise cavitation index used to quantify cavitation in control valves is Sigma (σ). Simply put, Sigma is the ratio of the potential for resisting formation of vapor cavities to the potential for causing formation of vapor cavities.

Sigma is defined below:

$$\sigma = \frac{(P1-PV)}{(P1-P2)}$$

Where:

P1 = Upstream pressure (psia)

P2 = Downstream pressure (psia)

PV = Vapor pressure of the liquid at flowing temperature

Acceptable operating Sigmas for eliminating or reducing cavitation and its associated damage have been established over time through laboratory and field tests.

The typical ***Optimux® OpGL*** globe valve's operating conditions fall into the following categories:

σ ≥ 2.0	No cavitation
1.7 < σ < 2.0	Hardened trim provides sufficient protection
1.5 < σ < 1.7	Some cavitation, single-stage trim may work
1.0 < σ < 1.5	Potential for severe cavitation, multi-stage pressure drop trim required
σ < 1.0	Flashing

Of course, additional factors need to be considered when sizing a valve and selecting trim for an actual application. In doing so, the various calculated and tested Sigmas can be compared to the above general categories to show how they are used.

We also note that the type of valve used in a given application does make a difference in the possible level of resistance to cavitation. The table below lays out some sigma limits for various types of ***Trimteck*** control valves.

Common Valve Recovery Coefficients

Valve/Trim Type	Flow Direction	Trim Size	F_L	Fi	σ choked*	σ incipient* damage
OpDX High Performance Butterfly	90° Open	Full	0.56	0.49	3.17	4.16
OpVEE V-Notch Ball	90° Open	Full	0.60	0.54	2.78	3.43
OpGL Globe	Over	Full	0.85	0.76	1.38	1.73
	Under	All	0.90	0.81	1.23	1.52
ST-1 Single-Stage	Over Seat	All	0.92	0.85	1.18	1.20
ST-2 Multi-Stage	Over Seat	All	~1.0**	***	**	1.20-1.001

** Pressure and size scale factors not included in these calculations*

*** Choking will not occur if properly applied*

**** Does not apply to valves with ST-2 multi-stage trim*

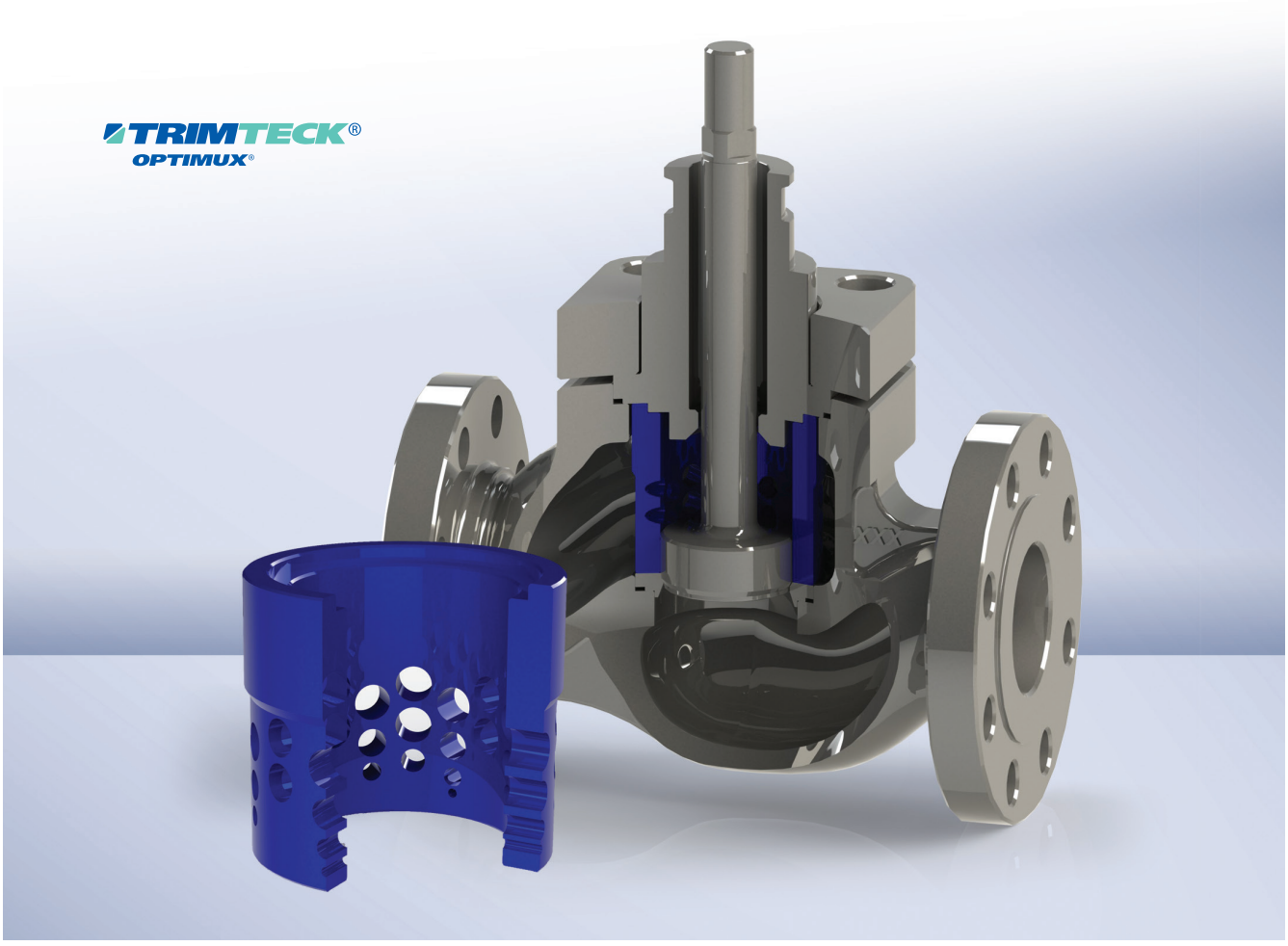
Trimteck® ST-1

Single Stage Anti-Cavitation Trim

ST-1 trim is a cost-effective single-stage trim that minimizes cavitation damage to valve and piping by diverting the location and controlling the concentration of imploding vapor bubbles to an area away from metal parts. The ST-1 trim works with diametrically opposed drilled, stepped holes that force vapor jets to impinge on each other in a column at the center of the cage rather than erode the valve body or trim.

As with all other *Trimteck-Optimux®* control valves and products, ST-1 trim is designed with maintenance, reliability, performance, and high interchangeability of parts in mind.

Type	ST-1 Single Stage Trim for Mild Cavitation
Base Valve	Optimux OpGL Globe or Angle Body
Size Range	1” to 24”
CV Range	1.5 to 1,000
Flow Direction	Flow Over
Pressure Stages	1
Features	• Tolerates Sigma as low as 1.2 • Can be characterized • Cost-effective



Trimteck® ST-2

Multi-Stage Anti-Cavitation Trim

ST-2 Multi-Stage trim not only eliminates cavitation damage, but it often prevents cavitation from occurring altogether. By reducing pressure through a series of restrictive channels and expansion areas, it prevents vapor bubbles from forming and minimizes hydrodynamic noise. The ST-2 Multi-Stage cartridge consists of concentric cylinders of drilled holes and grooved channels; the expansion and contraction of the fluid from channels through holes and back into channels create a series of pressure drops that eliminate cavitation in most applications, and reduces cavitation damage others.

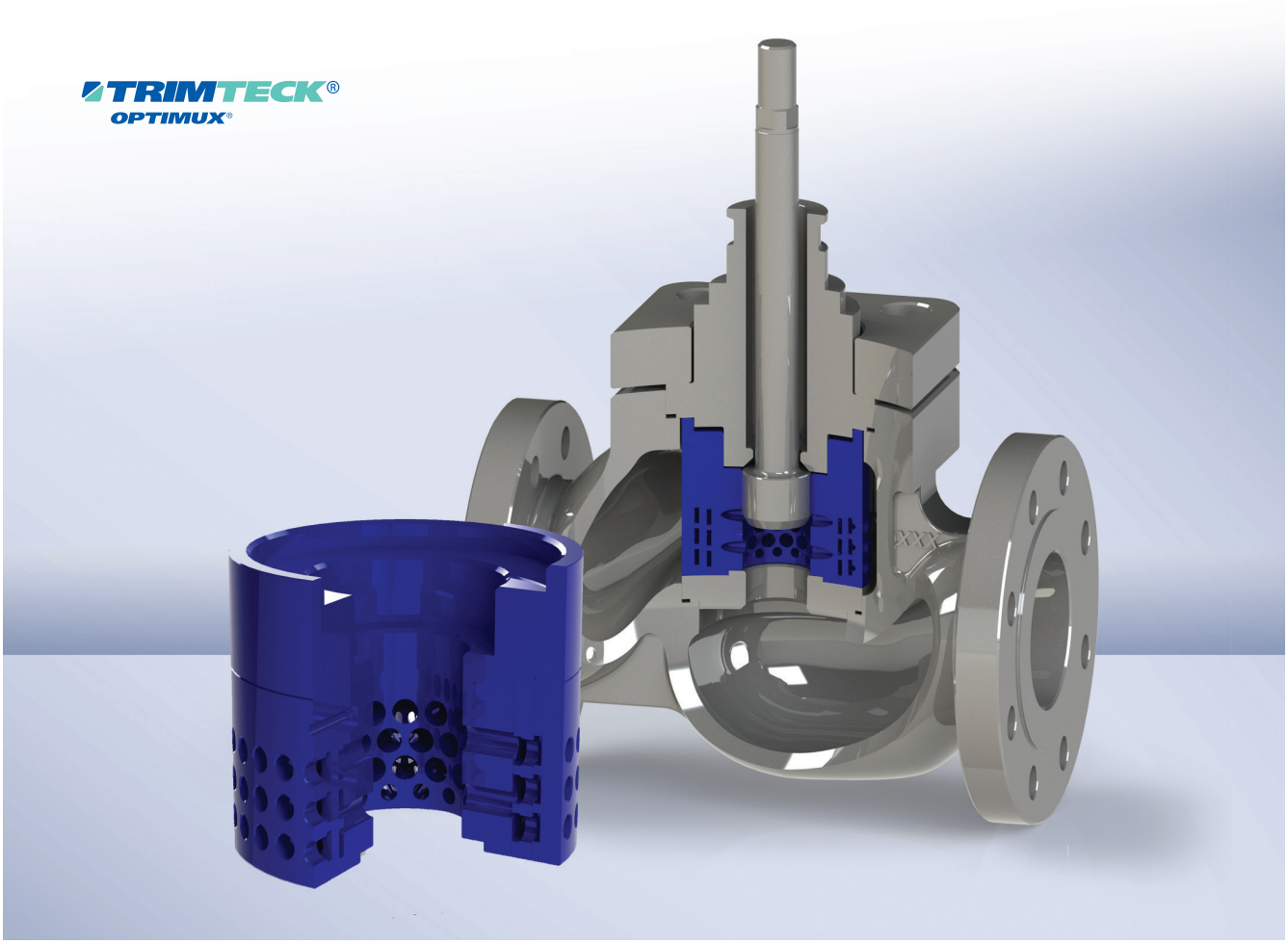
Type	ST-2 Multi Stage Trim for Cavitation
Base Valve	Optimux OpGL Globe or Angle Body
Size Range	1” to 32”
CV Range	6 to 720
Flow Direction	Flow Over
Pressure Stages	2 to 6
Features	• Tolerates Sigma as low as 1.001 • Eliminates mild to moderate cavitation • Controls effects of heavy cavitation • Custom-engineered for optimization and characterization of flow according to application requirements – including dirty service

Trimteck® ST-3

Noise Attenuation Trim

ST-3 Noise Attenuation trim works to reduce control valve noise in a broad spectrum of gas applications. ST-3 trim has two variants: the first is a one or two-stage design that reduces noise levels up to 15 dBA, the second is a multi-stage design for more extreme noise reduction up to 30 dBA. ST-3 works by controlling both pressure and velocity of the gas through the valve, thereby reducing turbulence, which is the culprit of all aerodynamic control valve noise. Multi-stage ST-3 reduces pressure with a concentric cylinder design similar to the ST-2 anti cavitation trim.

Type	ST-3 Noise Attenuation Trim
Base Valve	Optimux OpGL Globe or Angle Body
Size Range	1” to 32”
CV Range	1 to 3220
Flow Direction	Flow Under
Pressure Stages	1 to 6
Features	• Effective attenuation of up to 30 dBA of noise • 1 or 2 stage cartridges fit a standard OpGL without modification



Trimteck® Downstream Devices for Noise Attenuation
ST-3D and ST-3P

When ST-3 or ST-4 in-valve noise attenuation trim is insufficient to reduce noise to acceptable levels, Trimteck offers economical downstream devices for additional attenuation: ST-3D Diffusers and ST-3P Diffuser Plates, both capable of noise reductions of up to 25dBA. For more extreme reductions, Trimteck also offers in-line silencers with the capacity to reduce noise levels by more than 30dBA.

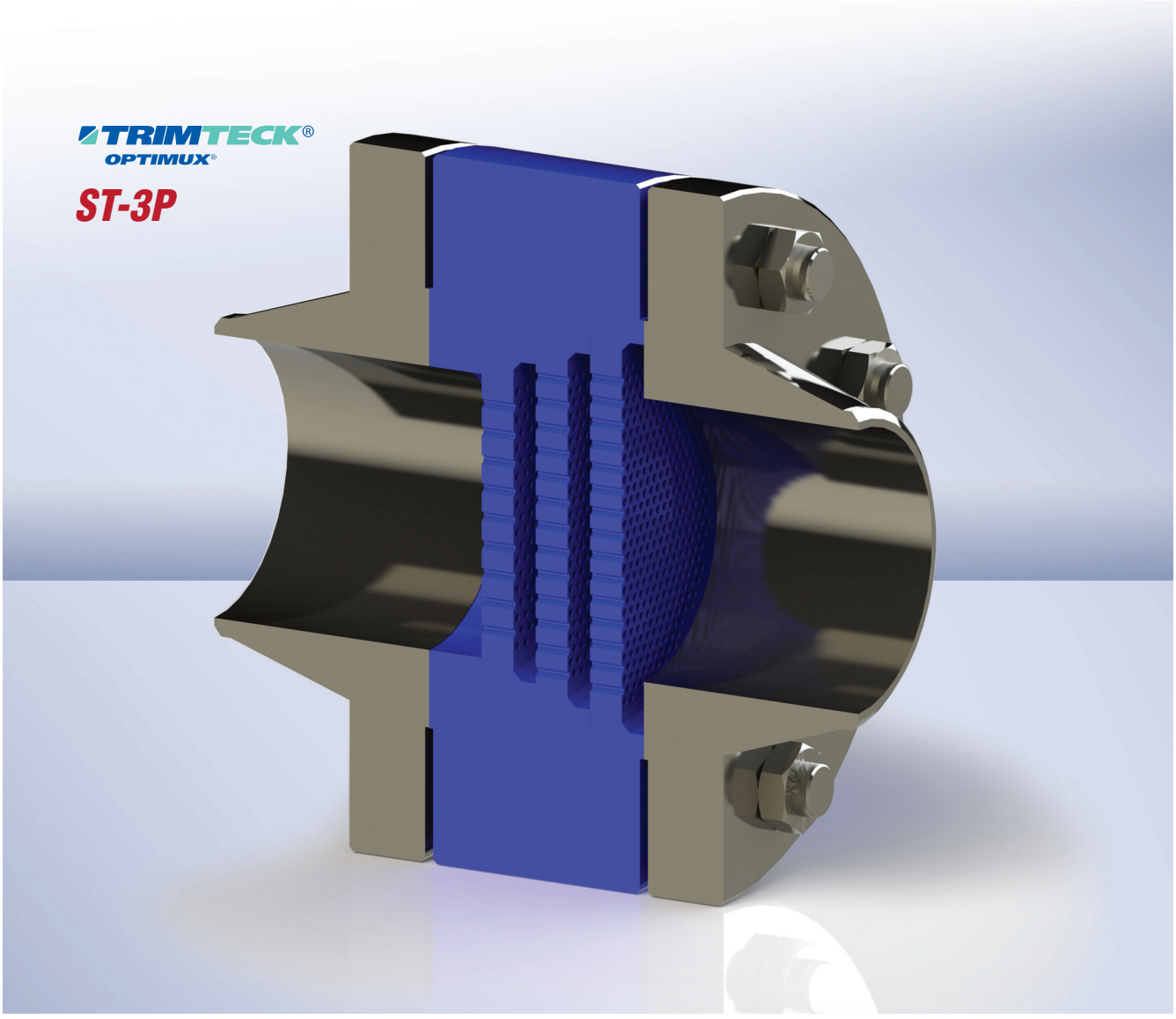
Type	ST-3D Diffuser
Style	Wafer, Outlet Head, Open Shell
Size Range	1” to 42”
ANSI Rating	150, 300, 600, 900, 1500, 2500
Flow Direction	One Way
Pressure Stages	1
Features	• Length and Number of holes are custom-designed for specific applications • Commonly manufactured from carbon and stainless steels, but available in a variety of other materials

Downstream Devices for Noise Attenuation (continued)

Any of these solutions can be used in series with Trimteck's Optimux OpGL Globe Control Valves fitted with ST-3 or ST-4 noise abatement trims to cost-effectively reduce noise levels and provide backpressure in many applications.

ST-3D Diffuser in 316SS

Type	ST-3P Plate
Style	Wafer, Flanged
Size Range	2" to 32"
ANSI Rating	150, 300, 600, 900, 1500, 2500
Flow Direction	One Way
Pressure Stages	1-4
Features	• Stages minimize turbulence and absorb pressure drop • Commonly manufactured from carbon and stainless steels, but available in a variety of other materials



Trimteck® ST-4

Stacked Disc Anti-Cavitation & Noise Abatement Trim

ST-4 Stacked Disc trim is a powerful solution designed to tackle the most severe pressure drops while reducing sound levels and eliminating the effects of cavitation. It can be used in liquid, gas, or multi-phase service. The ST-4 design consists of individual discs machined with progressively deeper concentric grooves machined and stacked to create a compact cylinder. The cylinder is then clamped into the body cavity of an OpGL globe valve and doubles as a seat retainer. Flow in this case is under the plug and as the fluid travels from the interior of the cylinder through the jagged grooves it is forced to make a series of 45o dives and ascents. Simultaneously the space between the grooves grows as you move from the center of the cylinder outward, allowing for expansion and thus reducing pressure in stages.

Type	ST-4 Stacked Disc Trim
Base Valve	Optimux OpGL Globe or Angle Body
Size Range	1.5” to 38”
CV Range	4 to 4000
Flow Direction	Flow Under
Pressure Stages	2 to 10
Features	• Tolerates Sigma as low as 1.001 • Eliminates cavitation • Tolerant of dirty services • Noise attenuation up to 30 dBA • Custom-engineered for optimization and characterization of flow according to application requirements

Trimteck® ST-5

Venturi Seat Ring for Flashing Service

No matter how many pressure stages are introduced into a valve, in flashing service the pressure drop will result in the liquid flashing from liquid form to a gaseous form – carrying with it erosive water droplets at high velocity.

Therefore, if flashing is present in a service, then the damaging effects must be controlled by displacing the erosion to non-critical components in the system. One way to do this is with a CVD-5B hardened ST-5 Venturi Seat.

Type	ST-5 Venturi Seat
Base Valve	Optimux OpGL Angle Body
Size Range	1” to 42”
Cv Range	1.5 to 4000
Flow Direction	Flow Over
Pressure Stages	1
Features	• For Sigmas under 1.0 • Displaces flashing downstream • Tolerant of dirty services • Economical and easily replaceable

Trimteck® CVD-5B

Metal Hardening Process

Trimteck is at the forefront of applying innovations in material science to extend the life of its process control equipment. First used in the aerospace industry to harden rocket nozzles on the space shuttle, CVD-5B is a chemical vapor diffusion process using boron wherein a hard wear-resistant metal mesh is fused into the surface of a wide variety of ferrous and non-ferrous materials.

Unlike coatings, during the CVD-5B process, superheated boron atoms are diffused deep into a host surface to form a metal boride layer that permeates evenly up to .015". Trimteck has harnessed and perfected this advanced technology to, in many cases, effectively extend the life of our valves more than 10 fold.

- **Economical alternative to Tungsten Carbide**
- **Corrosion resistant**
- **Lends extended life to severe service trims**
- **Resists temperatures of up to 1200° F**
- **Reduces coefficient of friction**
- **Not a ceramic, will not crack under duress**

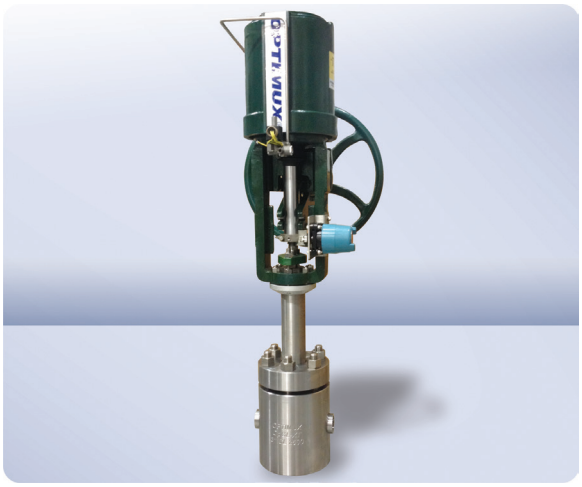
CVD-5B significantly extends the life of Severe Service Trim

Trim Material	Hardness Rockwell C	Impact Strength	Corrosion Resistance	Max Temperature		Erosion Resistance	Abrasion Resistance
				°F	°C		
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**

In addition to CVD-5B, Trimteck provides other common metal hardening processes:

- Tungsten Carbide
- Stellite
- Nickel
- Hard Chrome
- Titanium
- Zirconium

2” CL150 Optimux OpGL ST1 in CF8M



3” CL2500 Optimux Fabricated OpGL-XT ST2 for Cavitating Liquid Service

12” CL600 Optimux OpGL ST3 in WCB for Natural Gas Service

When ordering anti cavitation trim, please specify:

Application Information

1. Process Liquid: state particle size and type of impurities, if any.
2. Specific gravity
3. Temperature and vapor pressure of fluid
4. Critial pressure
5. Rage of flowing inlet pressures
6. Pressure drops
   a. Range of flowing pressure drops
   b. Maximum at shutoff
7. Flow rates
   a. Minimum controlled flow
   b. Normal flow
   c. Maximum flow
8. Required CV
9. Line size and schedule

Severe Service

The information and specifications contained herein are accurate, however they are intended for informational purposes only and should not be used to specify or size process control equipment without the assistance of an experienced Trimteck representative.

Moreover, Trimteck-Optimux products are continuously improved upon and upgraded, therefore information in this document is subject to change without notice.

Trimteck uses the ISA Recommended Practice for evaluating control valve cavitation (ISA-RP75.23-1995) as its basis for calculating potential for cavitation in process control equipment.

Consult your Trimteck representative for specific instructions on installation, operation, troubleshooting, or maintenance of the products depicted in this document.

For more information, visit our website at www.trimteck.com

Cat. Severe Service Trims Rev.01 ENG-06/01/22

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TRIMTECK®
OPTIMUX®

OpVEE™ V-Notch Control Valve

TECHNICAL BROCHURE

OpVEE™
Introduction

Trimteck's **OpVEE** Control Valve is the highest performance V-Notch Ball Valve on the market today. Its advanced design features have taken into account the requirements and recommendations of process control engineers and plant personnel from across varying industries: Pulp & Paper, Chemical, Oil & Gas, Power Generation, and others. Its signature v-notch ball with an equal percent flow characterization delivers an astounding 300 to 1 turndown.

Trimteck's design engineers have combined unique features such as an oversized post bearing system, and a large packing box with a robust bolted flange and stem blowout prevention. Special care has been given to the mechanical connection between shaft and ball, which is splined using precise EDM techniques for maximum grip to avoid any lost motion or dead band.

The **OpVEE** valve body is casted as a single piece, using investment casting technology, which assures an integral metallurgy, zero porosity, accurate mechanical tolerances, and perfect alignment of all moving parts.

For flexibility in actuation alternatives, the tops of our shafts have been designed according to standard ISO mounting patterns so as to facilitate the use of a large variety of rotary actuators, including Trimteck's own models (OpTK-R Piston-Cylinder, OpRPA Rack & Pinion, OpSY Scotch Yokes, etc.), as well as other manufacturers' models.

To summarize: the Trimteck-Optimux **OpVEE** is a state-of-the-art v-notch ball control valve that provides affordable, precise process control to users in a multitude of demanding industries.

Figure 1: OpVEE V-Notch Control Valve

OpVEE™
Control Valve

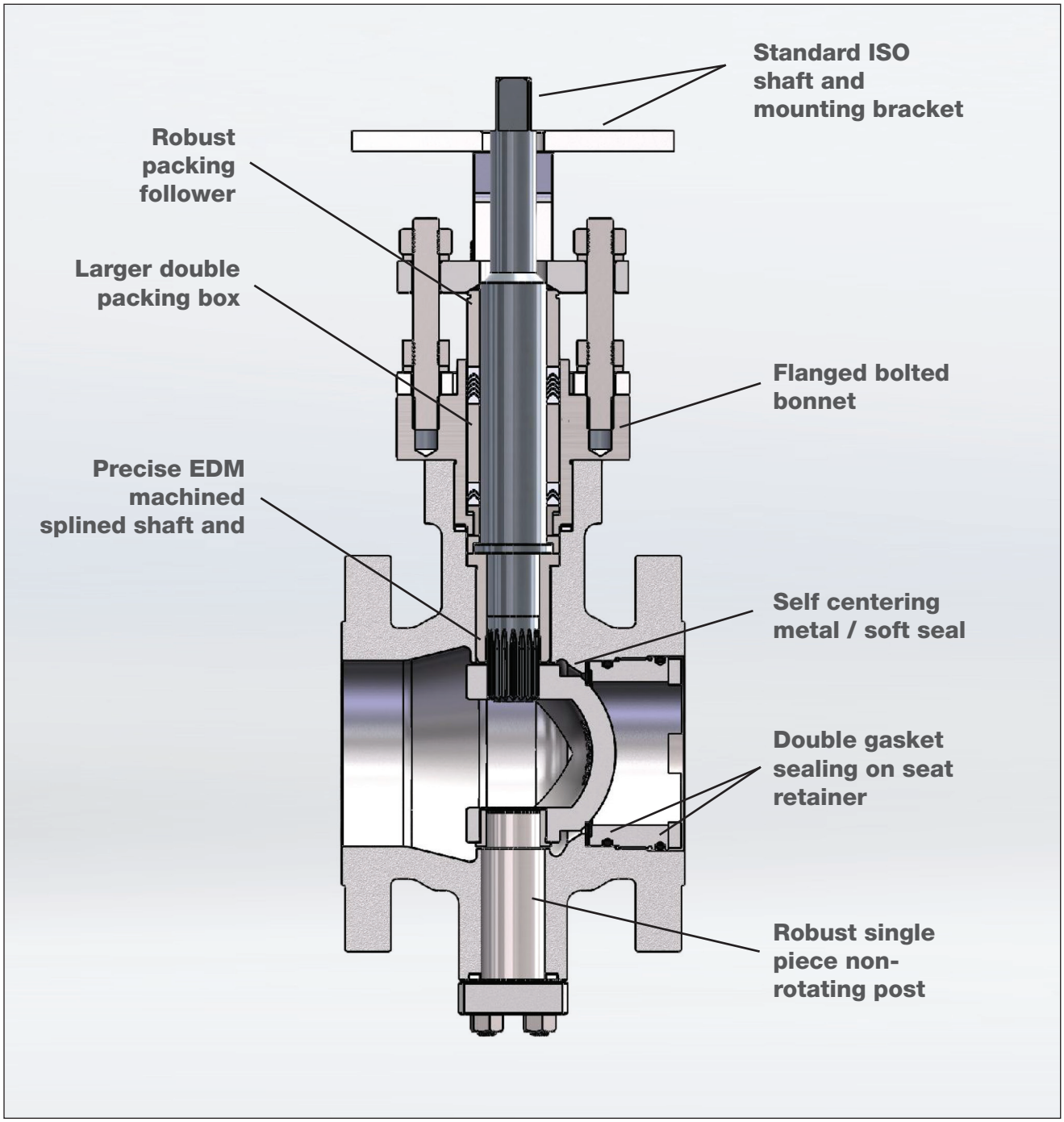


Figure 2: OpVEE Differentiated Features

OpVEE™
Seat Rings

Soft Seal Rings

The soft seal ring standard design for the OpVEE utilizes a 316 stainless steel Inconel ring in conjunction with PEEK or PTSE. This design provides for a quick and easy soft seal replacement in case of failure allowing for an easy removal or cutting operations. In some applications such as those for alloy bodies, back-up rings cannot be used due to occasional harsh problems on the ball, specially if it is surface-plated or hardened. In those cases a soft seal ring design can be used instead where metal back-up ring is not permitted such as for alloy bodies. This sealing design also permits a bi-directional flow as well as applications such as oxygen or corrosive media where 316 stainless steel or 625 Inconel is not compatible with the process flow media or ball material.

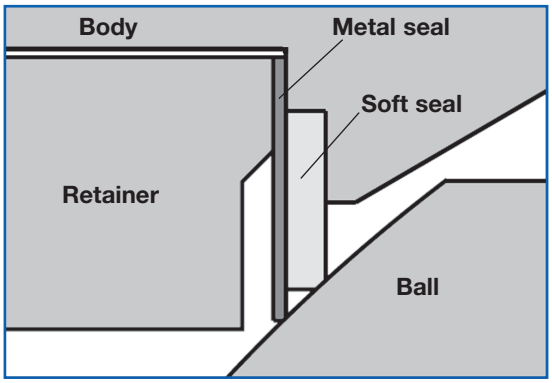


Figure 3: Dual Ring

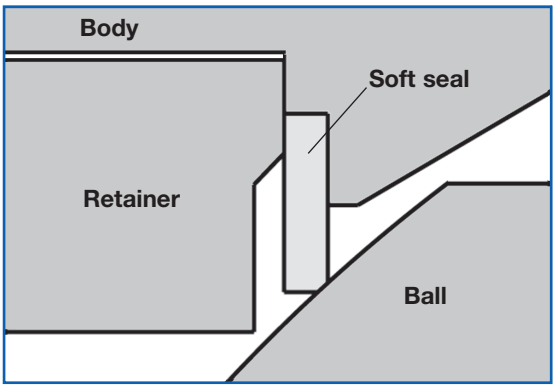


Figure 4: Soft Seal

Bi-directional Seal Rings

The metal seal design for the OpVEE utilizes the pressure drop across the ring to energize the seal to bubble-tight shutoff in either flow direction. As pressure enters the cavity with the shaft downstream, the flexible seal deflects into the ball, causing it to seal tighter against the ball. As pressure enters the cavity with the shaft upstream, the back-up ring locks the seal ring against the ball, causing it to increase sealing between the ring and the ball itself.

The ANSI Class IV shutoff can be achieved by utilizing a metal seal and ANSI Class VI shutoff by utilizing a soft seal. As pressure drop increases, OpVEE uses that pressure to achieve a tighter shutoff.

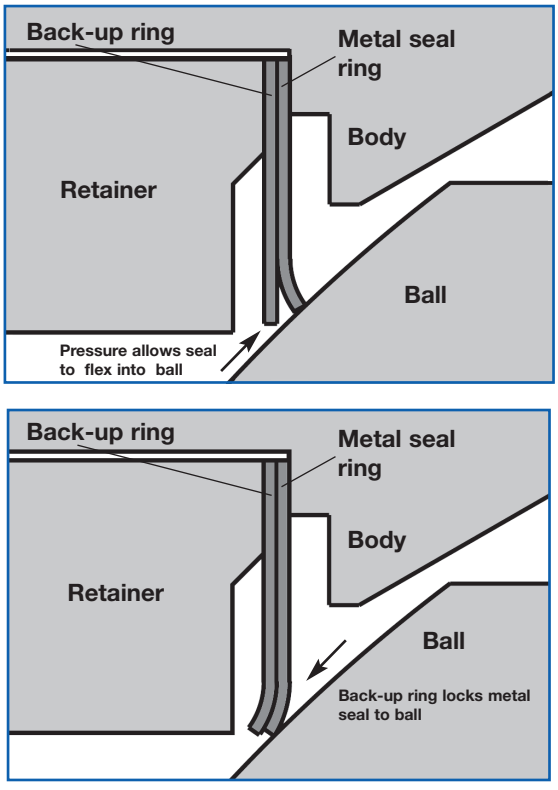


Figure 5: Bi-Directional Seal Rings

OpVEE™
Features and Advantages

OpVEE incorporates the following characteristics for ruggedness and high performance

One piece body

- High performance ensured regardless of flange
- Seat tightness not altered by piping forces, as in two-piece bodies
- One leak path eliminated

Segmented V-notch ball

- Clogging reduced
- "V" shaped ball characterization exceeds 300 to 1 rangeability
- Shearing action in fibrous media

Bi-directional assisted type shutoff seal

- Metal seal provides greater than ANSI Class IV shutoff
- Soft seal achieves tight ANSI Class VI shutoff

Self-centering seal

- Seal installation improved and simplified
- Shutoff further improved

No-shim seal

- Servicing and installation problems reduced

Thick-walled retainer

- Extends service life of valve in abrasive or corrosive media

Integral flange standard

- Bolt length reduced, avoiding leakage in event of fire

Interchangeability

- Actuators fully interchangeable with our OpDX High Performance Butterfly Valve and OpEXL Eccentric Rotary Plug Valve actuators
- OpVEE bonnets, shafts and posts are interchangeable with those of our OpEXL eccentric plug control valve which improves asset management and lower operational costs at industrial plants

Seal replaceable without removing ball and shaft

- Maintenance is fast and easy

Shaft serviceable from outboard end of valve

- The need for actuator removal to replace ball and shaft is eliminated
- Shaft protected from blowout

Full, uninterrupted gasket surface

- Gasket alignment problems reduced
- Wider range of gasketing possible, including spiralwound

Piston cylinder actuator

- High-thrust for a high performance throttling
- Actuator air pressures allowable up to 150 psi (10.3 Bar)

Splined shaft

- Using EDM machining, extra stiffness and resolution provided with no lost motion or dead band

Available in variety of materials

- Materials include carbon steel, 316 stainless steel and other alloys

Each OpVEE feature contributes to a product measurably superior to other Vee Ball valves, as illustrated by the following pages which contain additional information and specifications.

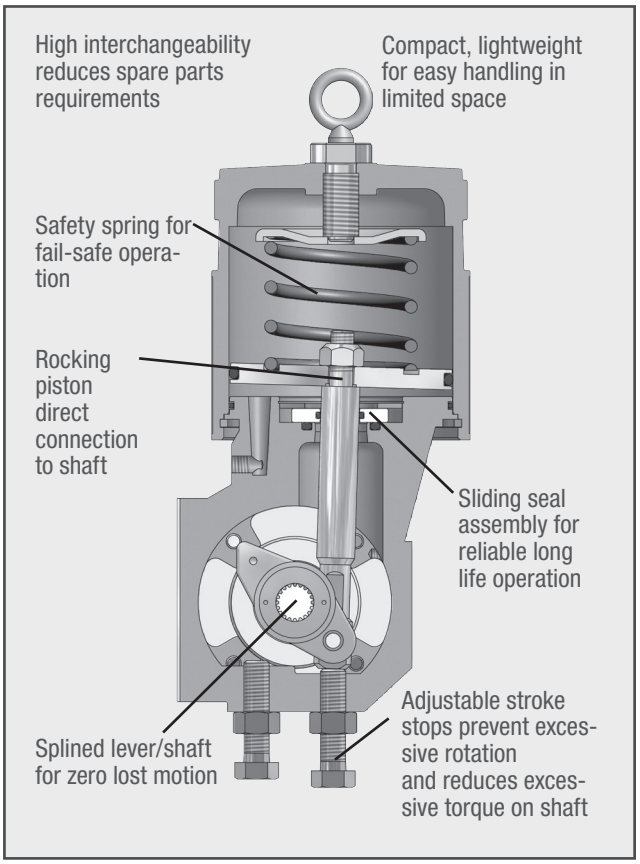
OpTK
OpTK-R Piston Actuator

RA Piston

Optimux's OpTK-R Piston-Cylinder-Rotary-Actuators obtain maximum performance and resolution of our OpVEE V-Notch Ball Control Valves. The Optimux OpTK-R piston cylinder rotary actuators with fail-safe spring combine high torques with pneumatic stiffness which together deliver excellent throttling characteristics. The OpTK-R compared to regular spring-diaphragm actuators, are lightweight, compact, efficient and in general, they take a smaller foot-print for installation in pipelines, they are simply, one of the best choices in actuation systems for rotary control valves.

The OpTK-R piston cylinder actuators are offered as a standard for all of our Rotary valves.

The Optimux OpTK-R piston cylinder actuator was designed to work with supply pressures of up to 150 psi (10.3 bar), which significantly increases torque capacity. The OpTK-R performance and reliability in the field has no par, as it has proven life service above one million cycles.



The pneumatic stiffness achieved by the Series RA assures excellent throttling and control characteristics specially in near closing control positions.

Table I: Rotary Actuator Specifications

Type	Double-acting piston and cylinder with fail-safe spring
Sizes	25, 50
Action	Air-to-open Air-to-close Last position Field reversible
Operating Pressure	Max 150 psig Max 10,3 bars
Stroking Speed	≤ 1 second
***Temperature Range**	-40˚ to 350˚F (-40˚ to 175˚ C)
Auxiliary Handwheels	Declutchable side-mounted handwheel Lever-gear operated handwheel Lever operator
Positioners	Digital HPP-3000 Digital HPP-3500

Table II: Construction Materials

Yoke	Ductile Iron
Transfer Case	Anodized Aluminum
Splined Lever Arm	Nickel-plated Ductile Iron
Stern	UNS S 41600 Stainless Steel
Bearings	Filament wound fiberglass with Teflon liner
Sliding Seal	Delrin, aluminum
Retaining Ring	Cadmium plated steel
Piston	Anodized Aluminum
Cylinder	Anodized Aluminum
O-Ring*	Buna-N (standard)
Actuator Spring	Coated steel (rust proof)
Spring Button	Cadmium-plated steel

* Ambient temperatures higher than 180˚ F (82˚ C) require Viton O-rings. Ambient temperatures below -40˚ F (-40˚C) require fluorosilicone O-rings.

OpTK
Rotary Actuators, Features and Characteristics

RPA Rack and Pinion Actuators

Optimux's Series RPA represent an excellent alternative to our RA Piston-Cylinder Series for rotary valves applications. As with the RA Series the RPA actuators are compact, allow for field reversibility, provide adequate torque for most standard applications and are easy to maintain. RPA actuators are designed for extremely long cycle life when utilized in normal loading applications. The RPA actuators will take service temperatures of -10º to 275º F (-23º to 135º C).

The Series RPA actuators are also offered for all our rotary valves: Series DX and Series VB.

Table III: Double Acting Torque Values (in. Lbs)

PSI	40	60	80	100	120
RPA052	263	395	526	658	789
RPA148	740	1,109	1,479	1,849	2,219
RPA222	1,109	1,664	2,218	2,773	3,327
RPA470	2,071	3,106	4,142	5,177	6,123
RPA900	4,550	6,825	9,100	11,375	13,650

*Other model numbers and torque options are also available

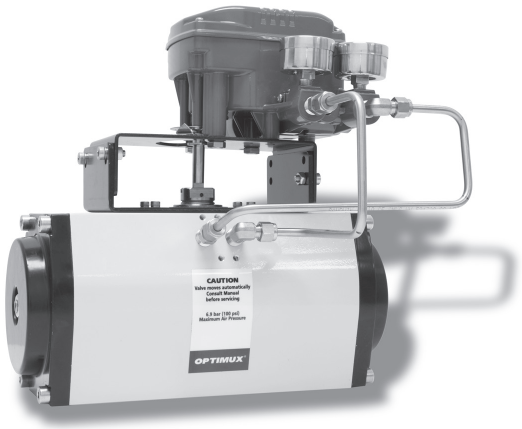


Figure 6: RPA Rack and Pinion Actuator

Optimux® HPP4000 Smart Valve Positioners

Our new HPP4000 brings to the market all the field proven attributes of our former HPP3000 plus all the additional features our users have requested for the past few years: LCD Display, 4-20mA feedback signal, HART® communication protocol and Auxiliary Limit Switches, all of these within our legendary and well proven robust enclosure capable of sustaining the most rigorous industrial plant conditions.

But this is not all, the HPP4000 was designed to accurately position your control valve and to operate it efficiently at the lowest possible air consumption (LPM) bellow 3 LPM @ 100 psi.

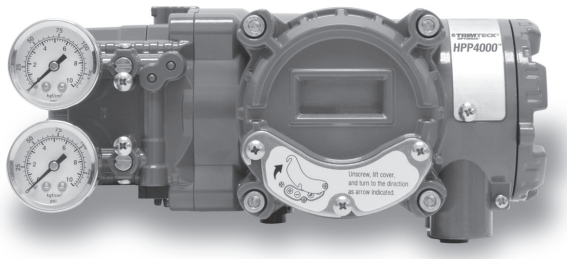


Figure 7: HPP4000 Digital Series

Optimux® HPP4500 Smart Valve Positioners

Our new HPP4500 microprocessor equipped, current-topneumatic digital positioner is a reliable, accurate and robust positioner which offers as a standard many features and technical characteristics traditionally offered as options by other digital positioner's manufacturers.

The HPP4500 offers as a standard, Hart® communication, 4-20mA Feedback Signal and a LCD display.

Figure 8: HPP4500 Digital Series

OpVEE™
Packings

The **OpVEE** rotary valve is built with a large packing box which gives a longer service life to the packing assembly. The **OpVEE** Packing box design allows for the use of a large number of packing system options, and fully complies with the most demanding fugitive emission control regulations in modern industrial processes.

Standard Packing

The **OpVEE** standard packing set is composed by PTFE "V" rings, Figures 8A and 8B. The PTFE "V" rings are the most used packing system since their introduction, providing exceptional tight sealing. They provide a very low friction coefficient, good mechanical resistance and excellent resistance to corrosion. The PTFE "V" rings are the most common application choice for gasketing material.

The PTFE "V" rings are used within temperature ranges of - 150º to 450°F (-101 to 232° C). High Temperature Packing The **OpVEE** formed packing rings, Figures 9A and 9B, is an alternative choice whenever the operating temperature exceeds that determined for the use of PTFE "V" rings. The materials employed in the formed packing rings of the **OpVEE** are braided PTFE for use in temperatures up to 500°F (260°C) and Grafoil for use in temperatures up to 752°F (400°C). The Grafoil formed packing rings are an excellent choice whenever packing is subjected to high operating temperatures, however it should be noted that the demand of high forces required to achieve a tight sealing results in a significant friction increase forces as the valve plug turns.

Special Packing

The PT type packing set, Figure 10A, is composed by a set of "V" type rings under compression by an assembly of disc springs that result in a "live-loading" effect. This system achieves a sealing level of below 500 ppm. The PT type packing combines the superior virgin PTFE "V" rings quality with the PTFE "V" rings combined with carbon filament wound. The PTG type packing, Fig. 10B, is composed of an advanced packing set that is capable of keeping a sealing rate very below 500 ppm (at a 10 ppm step rate). The PTG packing set is composed by the combination of PTFE "V" rings with carbon filament wound and Kalrez® "V" rings, an advanced material that provides a superior performance to the packing set. For temperatures higher than 450°F (232°C) the PTG XT packing set is employed. This type of packing utilizes Zymax® rings instead the PTFE/carbon rings.

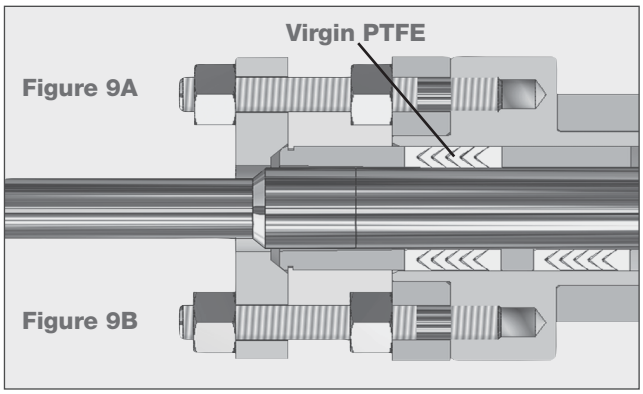


Figure 9A: Standard Packing: "V" rings
Figure 9B: Double Packing: "V" rings

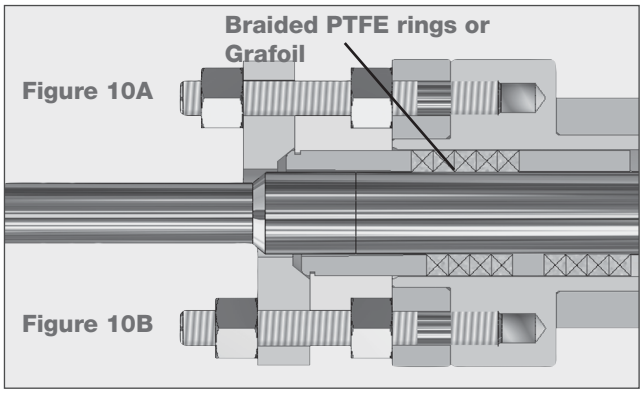


Figure 10A: Packing: Formed Rings
Figure 10B: Double Packing: Formed Rings

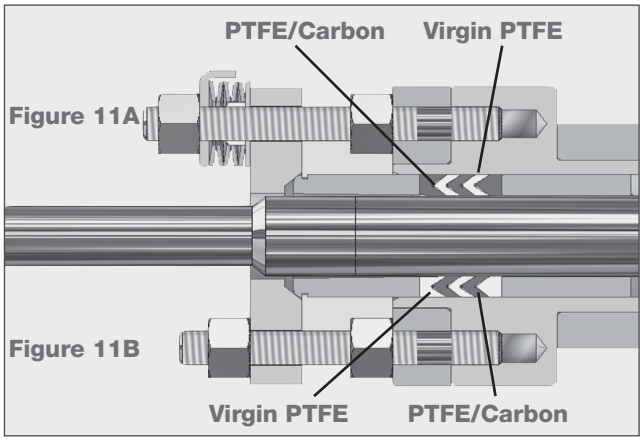


Figure 11A: PT Packing Set
Figure 11B: PTG Packing Set

OpVEE™
Specifications

Table IV: Packing: Temperature Limitations(°F/ °C)

Packing material	Standard body (1)		Extended body (1)		Cryogenic extended	
	°F	°C	°F	°C	°F	°C
Teflon TFE	-20 to 450	-28 to 232	-150 to 600 (2)	-101 to 315 (2)	-420	-251
Braided PTFE (3)	-20 to 500	-28 to 260	-150 to 650	-101 to 343	-420	-251
Glass-filled Teflon PTFE	-20 to 500	-28 to 260	-150 to 650	-101 to 343	-420	-251
Asbestos-free with Inconel AFPI (4)	-20 to 750	-28 to 398	-20 to 1200	-28 to 649	N/R	N/R
Grafoil (5)	-20 to 750	-28 to 398	-20 to 1500	-28 to 815	N/R	N/R
PTG	-20 to 450	-28 to 232	-150 to 600	-101 to 315	-420	-251
PT	-20 to 450	-28 to 232	-20 to 600	-28 to 315	-250	-156
PTXT	-20 to 550	-28 to 289	-20 to 700	-28 to 371	-250	-156

(1) The ANSI B16.34 Standard determines the pressure/temperature limitations for the valve body materials
Consult Optimux engineering dept. for additional information
(2) When adequate material for body and extension are used
(3) 8 to 12 inch ANSI Class 150-600, 3-12 inch Class 900-1500 can be used up to 850°F (455°C)
(4 Asbestos-free, high temperature packing
(5) Do not use Grafoil in temperatures above 800°F (427°C) in oxiding medium such as oxygen or air

Table V: Bearings

Bearing	Temperature		Description
	°F	°C	
MBT	-50 a 425	-45 a 218	316 Stainless steel with Teflon liner
Ultimet	-50 a 600	-45 a 315	Cobalt - Chrome - Nickel - Molybdenium - Tungsten
Stellite	-50 a 600	-45 a 315	No. 6 Stellite

Table VI: Seats Configuration

Seat	Configuration	Shaft Position	Seal leakage ANSI Class	Materials	Maximum Temperature	
					°F	°C
Metal seat	One metal seal	Upstream	IV	316 s. steel	300	150
				Monel	400	204
				Inconel	600	315
Dual seat	One metal seal One soft seal	Downstream	VI	PTFE Metal	350	177
Soft seat	One soft seal	Downstream	VI	PTFE	350	177
				PEEK	500	260
Bi-directional Metal seat	Two metal seals	Upstream Downstream	IV	316 s. steel	300	150
				Inconel	600	315
Flow ring	No seal	Upstream Downstream	II*	N/F	600	315

* Flow rings are used in control applications. With the valve totally closed an approximate Class II shutoff can be obtained.

OpVEE™
Specifications: △P/Temperature

Table VII: Maximum Allowable Differential Pressures (psi) versus Temperature: SHAFTS

Temperature		Shaft Material: 17-4 PH								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	850/675	1200/675	760/410	2550/1060	920/380	1515/875	850/515	745/440	705/690
425	218	915/740	1330/750	850/460	2770/1180	1080/415	1670/980	895/550	835/490	770/755
400	204	925/750	1350/760	865/470	2800/1200	1085/450	1675/985	945/585	840/495	775/760
300	149	925/800	1430/805	920/500	2940/1275	1175/485	1750/1040	980/610	890/525	815/785
200	93	925/850	1510/850	980/530	3085/1350	1265/525	1840/1100	1030/650	940/555	850/835
70	21	925/900	1585/890	1040/560	3245/3585	1370/565	1935/1165	1090/700	1000/590	900/880
-50	-45	925/900	1585/890	1040/560	3245/3585	1370/565	1935/1165	1090/700	1000/590	900/880

Temperature		Shaft Material: Nitronic								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	740/475	960/540	580/315	1725/690	470/195	1100/580	620/335	490/290	510/500
425	218	800/515	1025/575	625/340	1890/755	555/225	1180/635	655/365	535/315	545/530
400	204	805/520	1035/580	635/345	1915/765	560/230	1185/640	660/370	540/320	550/535
300	149	880/775	1125/630	705/385	2080/830	755/265	1260/690	700/400	585/350	585/570
200	93	950/625	1225/685	775/420	2260/900	725/300	1340/750	755/430	630/375	620/605
70	21	1025/675	1325/745	850/460	2575/1030	880/365	1480/850	830/500	725/420	685/670
-50	-45	1025/675	1325/745	850/460	2575/1030	880/365	1480/850	830/500	725/420	685/670

Temperature		Shaft Material: Inconel								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	1290/855	1280/1000	1170/635	3085/1350	1265/525	1840/1100	1040/650	940/555	850/835
425	218	1315/875	1790/1040	1225/665	3140/1375	1300/535	1865/1115	1055/665	955/565	865/845
400	204	1320/880	1860/1045	1235/670	3145/1380	1305/540	1870/1120	1060/670	960/570	870/850
300	149	1330/890	1880/1055	1250/675	3165/1390	1320/545	1880/1130	1065/675	965/570	875/855
200	93	1340/900	1900/1070	1265/685	3185/1400	1330/550	1900/1140	1070/680	970/570	880/860
70	21	1355/905	1925/1085	1285/695	2345/1435	1370/565	1930/1160	1090/700	1000/590	895/880
-50	-45	1355/905	1925/1085	1285/695	2345/1435	1370/565	1930/1160	1090/700	1000/590	895/880

Temperature		Shaft Material: Monel								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	830/500	825/585	755/370	1990/795	600/245	1220/665	680/380	565/330	565/550
425	218	850/515	1160/610	795/390	2040/810	620/255	1240/675	690/685	575/325	570/555
400	204	855/520	1205/615	800/395	2045/815	625/260	1245/680	700/390	580/340	575/560
300	149	870/530	1235/630	820/400	2080/830	645/270	1260/690	710/400	590/345	580/570
200	93	890/545	1265/645	840/415	2125/850	665/275	1280/700	720/410	600/355	590/580
70	21	915/560	1300/670	870/430	2230/890	715/295	1320/740	740/430	870/630	615/600
-50	-45	915/560	1300/670	870/430	2230/890	715/295	1320/740	740/430	870/630	615/600

(1) Determine the operating temperature
(2) Select the shaft material according to △P (psi) required
(3) The numbers at left are for shaft upstream; the number at right for shaft downstream
(4) Check medium compatibility with shaft material
(5) Shafts in Monel are not recommended for non-lubricating fluids operation

OpVEE™
Specifications: △P/Temperature

Table VIII: Maximum Allowable Differential Pressures (psi) versus Temperature: SEAL RINGS

Temperature		Seat Material: TFE								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315									
425	218									
400	204									
300	149	400/400	400/400	400/400	350/470	275/360	260/350	270/350	265/230	275/165
200	93	600/600	600/600	500/550	350/480	280/360	265/355	275/355	270/230	280/170
70	21	925/925	616/702	500/550	350/480	280/370	270/360	280/360	275/235	280/170
-50	-45	925/925	616/702	500/550	350/480	280/370	270/360	280/360	275/235	280/170

Temperature		Seat Material: 316 stainless steel								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	996/1566	536/613	448/488	318/426	252/323	236/315	244/315	240/206	246/149
425	218	1080/1702	583/665	485/530	342/461	270/350	253/340	264/341	259/221	265/159
400	204	1090/1712	588/670	490/534	346/446	274/353	258/345	268/345	262/225	270/163
300	149	1105/1736	546/680	495/542	351/473	278/368	261/350	272/350	266/228	274/165
200	93	1120/1761	604/690	504/549	356/480	282/364	264/355	276/355	270/232	278/168
70	21	1140/1794	616/702	512/559	364/489	288/370	270/362	280/361	276/236	282/171
-50	-45	1140/1794	616/702	512/559	364/489	288/370	270/362	280/361	276/236	282/171

Temperature		Seat Material: Inconel								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315	1390/2185	750/856	624/681	442/595	350/451	328/440	342/440	334/287	344/205
425	218	1440/2270	777/890	650/709	460/619	362/367	340/455	352/455	346/296	354/215
400	204	1450/2282	782/894	652/712	462/622	366/471	344/460	356/459	350/300	358/218
300	149	1500/2363	810/926	675/737	479/644	379/488	356/476	369/475	362/311	371/225
200	93	1550/2445	838/958	698/763	496/666	392/505	368/493	382/492	374/322	384/233
70	21	1700/2600	894/1021	746/814	528/711	418/538	392/526	408/525	400/343	410/249
-50	-45	1700/2600	894/1021	746/814	528/711	418/538	692/526	408/525	400/343	410/249

(1) Select seat material and find the value of DP (psi) required
(2) Numbers at left are for shaft upstream; number at right for shaft downstream
(3) Check for medium compatibility with seat material

Table IX: Maximum Allowable Differential Pressures (psi) versus Temperature:BEARINGS

Temperature		Bearings Material: MBT								
		Valve Size (inch)								
˚F	˚C	1	1 1/2	2	3	4	6	8	10	12
600	315									
425	218	350	350	350	350	350	350	350	350	350
400	204	375	375	375	375	375	375	375	375	375
300	149	490	490	490	490	490	490	490	490	490
200	93	600	600	600	600	600	600	600	600	600
70	21	740	740	740	740	740	740	740	740	740
-50	-45	925	925	925	925	925	925	925	925	925

Table X: Maximum Allowable Differential Pressures (psi) versus Temperature:BEARINGS (cont.)

Temperature		Bearings Material: Ultimet								
		Valve Size (inch)								
°F	°C	1	1 1/2	2	3	4	6	8	10	12
600	315	750	750	750	750	750	750	750	750	750
425	218	925	925	925	925	925	925	925	925	925
400	204	925	925	925	925	925	925	925	925	925
300	149	925	925	925	925	925	925	925	925	925
200	93	925	925	925	925	925	925	925	925	925
70	21	925	925	925	925	925	925	925	925	925
-50	-45	925	925	925	925	925	925	925	925	925

Temperature		Bearings Material: Stellite								
		Valve Size (inch)								
°F	°C	1	1 1/2	2	3	4	6	8	10	12
600	315	850	850	850	850	850	850	850	850	850
425	218	925	925	925	925	925	925	925	925	925
400	204	925	925	925	925	925	925	925	925	925
300	149	925	925	925	925	925	925	925	925	925
200	93	925	925	925	925	925	925	925	925	925
70	21	925	925	925	925	925	925	925	925	925
-50	-45	925	925	925	925	925	925	925	925	925

(1) Select bearings material
(2) Check for medium compatibility with bearings material
(3) Ultimet bearings with shafts in Monel are not recommended for non-lubricating medium operations

Table XI: Material Selection

Part	Material
Body	Carbon steel; 316, 316L, 304, 304L, Monel, Hastelloy C, Hastelloy B/B-2, Titanium
Ball	317, 316, 316L, 304, 304L stainless steel, Hard chrome plating, stellite, Hastelloy C, Hastelloy B/B-2, Monel, Alloy 20, Titanium
Shaft / pins	17-4 pH, Nitronic 50, Nitronic 50/Stellite, Hastelloy C, Hastelloy B/B-2, K-Monel, Alloy 20, Titanium
Bearings	MBT, Stellite, Ultimet.
Metal seal	316 stainless steel, Inconel
Soft seal	Glass-filled Teflon, PEEK, TEFZEL.
Packing	TFE V-rings, AFPI, Glass-filled Teflon/TFE, Grafoil, PTG, PT, PTXT
Back-up ring	316, 316L, 304, 304L stainless steel, hard-chrome plating, Stellited 316 stainless steel, stellited 316L stainless steel, Monel,Hastelloy C, Hastelloy B/B-2, Alloy 20, Titanium
Bearings seal	Viton, Graphite "O"-rings.
Yoke bolting	Carbon steel, stainless steel

OpVEE™
Specifications

Table XII:
Estimated Weight for Shipping
(With Standard actuator and positioner)

Valve size (inch)	Flangeless body		Body end flanges	
	pounds	kg	pounds	kg
1	41	19	47	22
1 1/2	45	21	55	25
2	47	22	59	27
3	61	28	80	36
4	80	36	111	50
6	146	66	197	89
8	186	84	266	121
10	278	126	400	181
12	496	225	653	296
16	908	412	1259	571

The OpVEE seat configurations are defined according to the shaft position. See Table VI to determine both type of seat and shaft position.

Table XIII:
End Connections

Valve size (inch)	ANSI Class	Connection type
1	150 - 600	Flangeless
		Integral Flanges
1 1/2	150 - 600	Flangeless
		Integral Flanges
2	150	Flangeless
		Integral Flanges
	300 - 600	Flangeless
		Integral Flanges
3	150 - 600	Flangeless
		Separable flanges
		Integral Flanges
4	150 - 600	Flangeless
		Separable flanges
		Integral Flanges
6	150 - 600	Flangeless
		Integral Flanges
8	150 - 600	Flangeless
		Integral Flanges
10	150 - 600	Flangeless
		Integral Flanges
12	150 - 600	Flangeless
		Integral Flanges
16	150 - 600	Integral Flanges

* For OpVEE size 2 inch ANSI Class 300-600 all flange holes are screwed.

Table XIV: Valve/Actuator Compatibility

Actuator Size	Spring type	Valve size (inch)									
		1	1 1/2	2	3	4	6	8	10	12	16
25	Standard										
	Heavy-duty										
50	Standard										
	Heavy-duty										
100	Standard										
	Heavy-duty										
200	Standard										
	Heavy-duty										

Table XV: Additional Specifications

Characteristics: equal-percentage, Linear (defined by the positioner)
Ball rotation: Counterclockwise to open, as seen form actuator side

OpVEE™

Specifications: Flow Coefficients – C_V

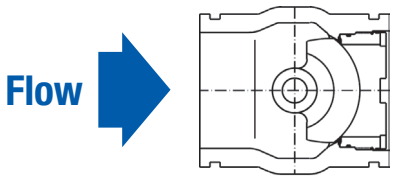


Table XVI : Shaft UPSTREAM

Size (inch)	C_V versus Percent opening									
	100	90	80	70	60	50	40	30	20	10
1	25	21	15.8	11.6	8	5.2	3	1.38	0.47	0.08
1 1/2	51	44	33	23	16.2	10.3	5.9	2.8	0.81	0.11
2	107	84	59	41	27	18.1	10.8	5.2	1.76	0.16
3	272	233	174	124	81	54	31	14.4	4.3	0.40
4	444	372	278	186	121	72	37	16	7	1
6	836	757	599	437	303	196	122	66	26	4
8	1370	1198	928	674	466	308	184	94	37	5.2
10	3320	2580	2170	1680	1190	806	570	320	195	83
12	4150	3220	2700	2090	1490	1010	646	400	243	104
16	7150	5580	4676	3700	2580	1808	1140	700	440	185

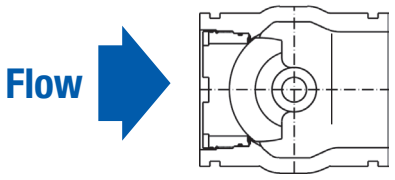


Table XVII : Shaft DOWNSTREAM

Size (inch)	C_V versus Percent opening									
	100	90	80	70	60	50	40	30	20	10
1	24	17.1	12.8	9.4	6.7	4.4	2.6	1.38	0.42	0.03
1 1/2	50	37	26	19.3	13.6	8.6	4.9	2.3	0.58	0.08
2	104	71	50	36	26	17.4	10.7	5.5	1.89	0.14
3	275	205	142	103	74	50	31	16.2	5.8	0.52
4	445	314	219	154	105	66	36	20	8	1
6	844	628	439	321	241	166	106	59	23	3.6
8	1338	955	710	532	384	265	170	95	42	5.7
10	3180	2340	1750	1290	960	705	486	314	195	83
12	4150	3060	2280	1680	1250	920	633	409	254	108
16	7150	5350	4060	2950	2210	1604	1110	708	438	190

OpVEE™
Dimensions

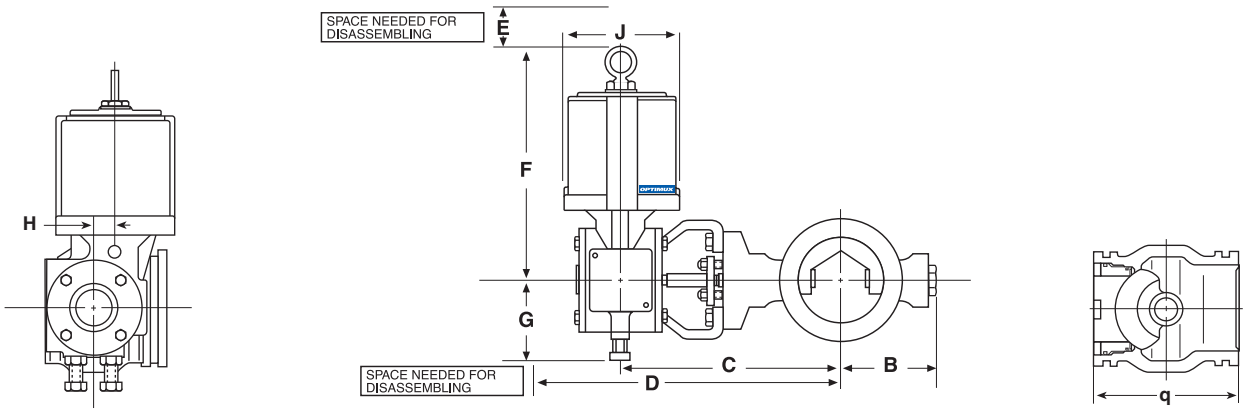


Table XVIII : OpVEE Dimensions

Valve size (inch)	Actuator size	Shaft diameter inch	A		B		C		D		E		F		G		H		J	
			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
1	25	11.2	4.00	101.6	3.3	85	10.6	269	21.2	538	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
1 1/2	25	15.9	4.50	114.3	3.9	99	11.1	282	21.7	551	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
2	25	15.9	4.94	125.5	4.3	109	11.4	290	22.0	559	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
3	25	19.1	6.50	165.1	5.0	127	12.5	318	23.1	587	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
	50	19.1	6.50	165.1	5.0	127	12.5	318	23.3	592	7.5	191	18.3	465	5.8	147	2.0	51	9.1	231
4	25	19.1	7.62	193.5	5.5	140	13.7	348	24.3	617	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
	50	19.1	7.62	193.5	5.5	140	13.7	348	24.5	622	7.5	191	18.3	465	5.8	147	2.0	51	9.1	231
6	25	22.7	9.00	228.6	7.9	201	15.9	404	26.5	673	5.3	135	13.3	338	4.5	114	1.1	28	6.5	165
	50	22.7	9.00	228.6	7.9	201	15.9	404	26.7	678	7.5	191	18.3	465	5.8	147	2.0	51	9.1	231
	100	22.7	9.00	228.6	7.9	201	15.9	404	30.2	767	8.5	216	22.9	582	7.5	191	2.4	61	12.5	318
8	50	22.7	9.52	244.3	8.7	221	16.7	424	33.5	851	7.5	191	18.3	465	5.8	147	2.0	51	9.1	231
	100	22.7	9.62	244.3	8.7	221	16.7	424	37.0	940	8.5	216	22.9	582	7.5	191	2.4	61	12.5	318
10	50	28.6	11.70	297.2	11.0	279	17.7	450	28.5	724	7.5	191	18.3	465	5.8	147	2.0	51	9.1	231
	100	28.6	11.70	297.2	11.0	279	17.7	450	32.0	813	8.5	216	22.9	582	7.5	191	2.4	61	12.5	318
	200	28.6	11.70	297.2	11.0	279	17.7	450	34.5	876	9.0	229	23.4	594	7.5	191	2.4	61	17.5	445
12	100	38.1	13.30	337.8	12.0	305	17.7	450	32.0	813	8.5	216	22.9	582	7.5	191	2.4	61	12.5	318
	200	38.1	13.30	337.8	12.0	305	17.7	450	34.5	876	9.0	229	23.4	594	7.5	191	2.4	61	17.5	445
16	100	44.5	15.80	400.0	16.6	422	26.1	663	42.0	1067	8.5	216	22.9	582	7.5	191	2.4	61	12.5	318
	200	44.5	15.80	400.0	16.6	422	26.1	663	44.5	1130	9.0	229	24.3	594	7.5	191	2.4	61	17.5	445

TRIMTECK®
OPTIMUX®

OpVEE

The information and specifications described in this brochure are considered accurate, however, they are intended for information purpose only and should not be considered as certified information.

Considered that Optimux products are continuously improved and upgraded, specifications, dimensions, and information described herein are subject to change without notice.

For further information or verification, consult your Optimux representative. Specific instructions for the installation, operation, troubleshooting and maintenance of the OpVEE control valves are contained on the OpVEE Maintenance bulletin.

For more information, visit our website at www.trimteck.com

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ISO 9001
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TRIMTECK®
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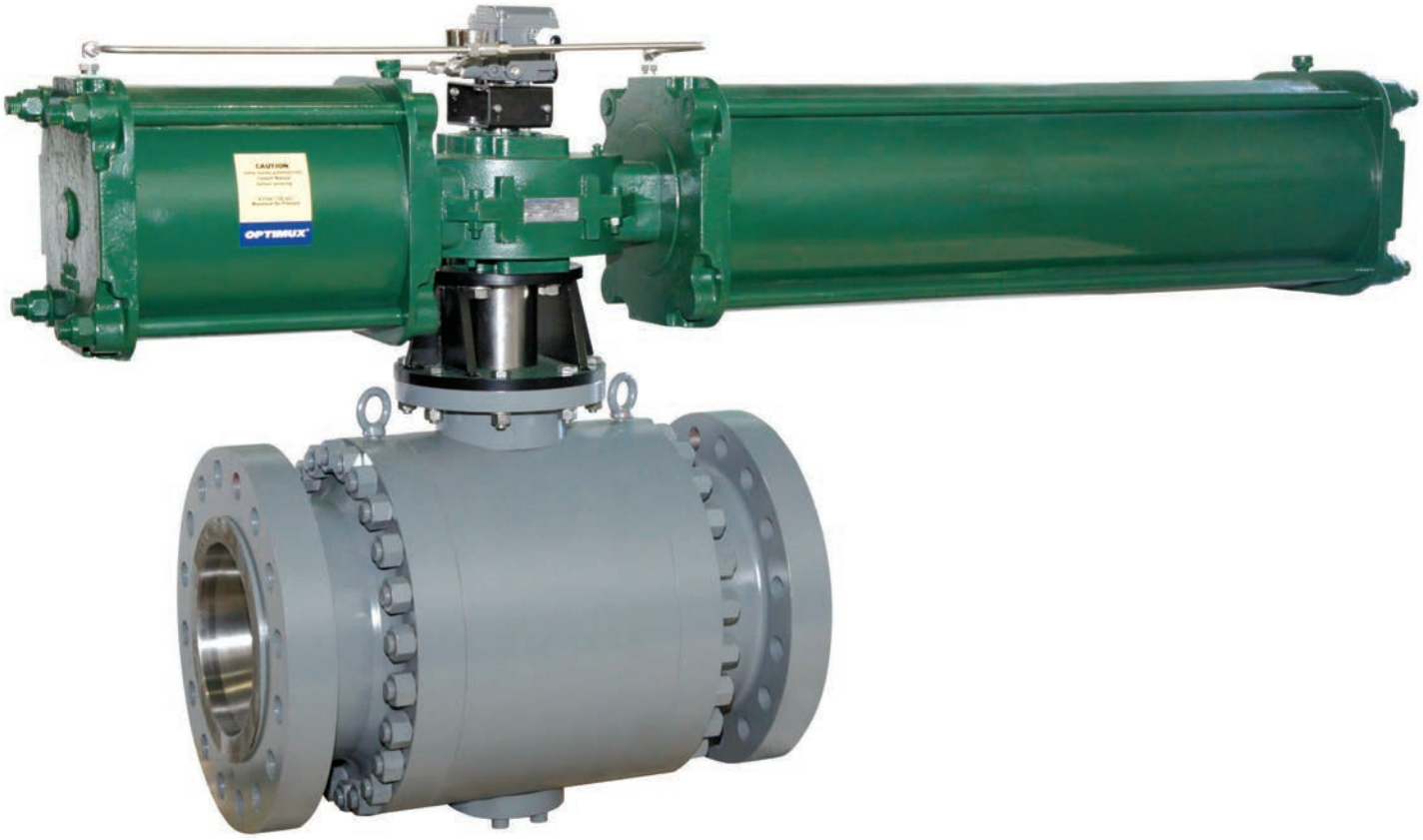
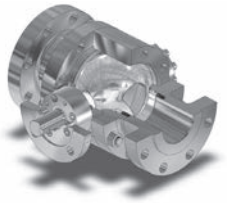
OpTB™ Trunnion Ball Valve
POB™ Process Optimizer Ball

TECHNICAL BROCHURE





OpTB™
Trunnion Ball Valve

INTRODUCTION

The Optimux **OpTB** Trunnion Ball Valve brings the legendary and well proven robustness and dependability of the trunnion ball design to process control applications, no longer limited to a full port option, but now being offered with our new **Process Optimizer Ball POB™** which delivers excellent flow characteristics and high flow coefficients **(Fig. 1)**.

Our new **OpTB** with its efficient **POB™** design, delivers excellent rangeability and accurate control for pressure Classes 150 to 1500 while maintaining critical features such as fire-safe and metal-to-metal tight shutoff. The **OpTB** raises the bar to new levels not yet reached by traditional V-Notch ball valve manufacturers, typically limited to 600 pressure class.

The **OpTB** has been designed with flexibility in mind, the full bore ball **(Fig. 2)** is totally compatible and interchangeable with the new **POB™ (Fig. 2)** within the same size and class valve, and with no additional valve components or special tooling required.

All these features make the **OpTB** an exceptional process control valve ideally suited for industrial services which require solutions for challenging abrasive, corrosive fluids, high temperatures and pressures.

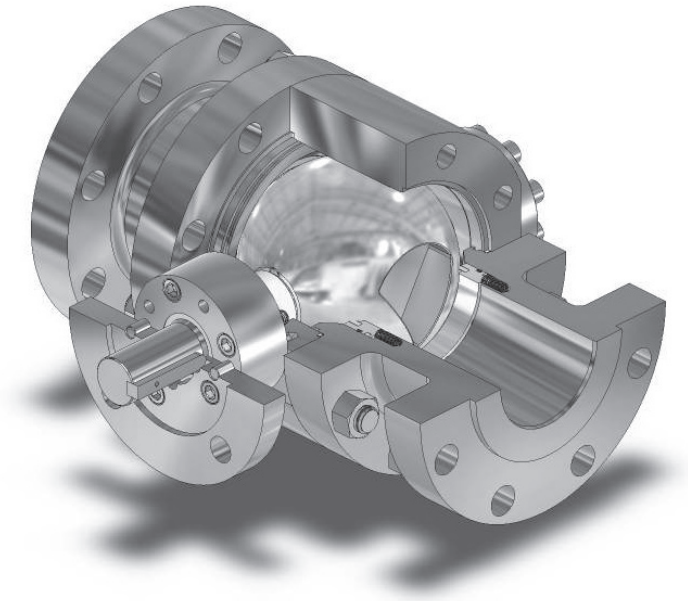


Figure 1
OpTB POB™ Process Optimizer Ball

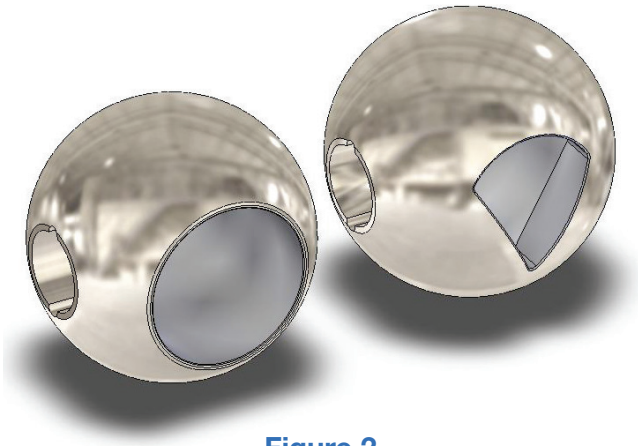


Figure 2
Full Bore & POB™ Balls

When the POB™ is used please refer to the flow coefficient Cv information shown in **Table 1** for proper selection

OpTB™
Trunnion Ball Valve

OS2T™ Optimizer Severe Service Trim

Our **OpTB** is also well equipped to withstand and manage the undesired effects of noise and cavitation in liquid fluids.

The **OS2T™** trim **(Fig. 3)**, has been designed to reduce up to 25 dB of noise, as well as to eliminate the destructive effects of cavitation.

The unique design of the **OS2T™** drives the process fluid through a tortuous path consisting of a series of orifices and back channels which remove kinetic energy and lower fluid pressure,

There are several application-specific **OS2T™** trims available to handle any given fluid dynamics condition. Our application engineers will carefully evaluate your process data as to be able to choose the optimal solution.

The **OS2T™** trims have been designed to work inside the core of the **Control Optimizer Ball COP™** itself, so that the fluid characterization, as well as the noise, and cavitation abatement occurs simultaneously within the core of the ball, and not delayed upstream or downstream, where these undesired effects can damage the valve internal components.

Noise or cavitation baffles inserted upstream or downstream off valve bodies or on pipelines have been used extensively in the past, however they have proven to be less effective, especially when handling flow conditions exhibiting high noise, and cavitation.

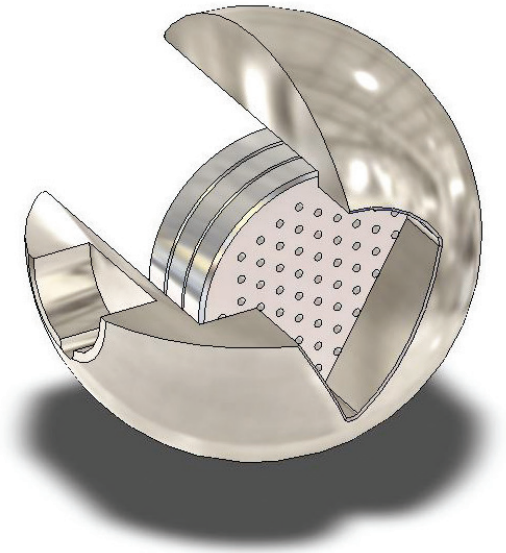
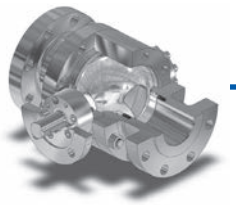


Figure 3
OpTB OS2T™
Optimizer Severe Service Trim

Typical industry applications include compressor surge control taking advantage of the high rangeability and capacity of the **OpTB™**. High pressures and temperatures associated with steam production from geo-thermal wells mixed with sand are comfortable controlled with the **POB™** specially when hardened with **CVD-5B™**. Feed gas regulation applications such as gas-to-flare are ideally suited for the **OpTB™** because of it's exceptional tight shutoff characteristics.

In general, the **OpTB™** will be one of the best choices for challenging process control applications such a multiphase fluids and light to medium slurries like those found in oil sands, mining and pulp and paper fluids.



OpTB™

Features and Advantages

- ***Rugged well proven three-piece trunnion design***
- ***Conforms to API 6D Standard***
- ***Fire-Safe tested to API 607***
- ***Lower operating torques for smooth operation while reducing actuator cost***
- ***Ball mechanical tolerances 0.0009" and 4 RMS mirror finish***
- ***Meets NACE MR01.75 Standards for sour applications***
- ***POB™ alternative offers precise flow characterization for accurate control, pressure class 150 to 1500***
- ***The POB™ design allows the control of fluids with a rangeability superior to 300:1***
- ***Our standard Full Bore Ball and the POB™ are fully interchangeable within same size and class body without any additional components***
- ***Spring loaded seat rings for positive sealing***
- ***Designed for a broad spectrum of on-off, or control application in the Oil & Gas, Chemical, Petrochemical, Geo-Thermal Power Generation, and a large variety of industrial slurries under high pressures and temperatures.***
- ***Noise abatement and anti-cavitation severe service OS2T™ trims available***

Technical Specifications		
Design Reference	**API**	**ASME**
Design Standard	API 6D	ASME B16.34
Flange Ends		ASME B 16.47 ASME B 16.5
Buttweld Ends		ASME B 16.25
Test & Inspection	API 6D API 598	
Fire-safe	API 607	

OpTB™
Trunnion Ball Valve

POB™ Flow Coefficients Cvs										
Cv versus Percent Opening										
Size Inch	100	90	80	70	60	50	40	30	20	10
2	112	89	62	44	29	19	12	9	2	0.17
3	285	244	182	130	85	57	32.5	15.1	4.5	0.4
4	470	394	294	200	127	76	40	17.2	7.5	1.4
5	525	418	384	316	283	159	86	54.8	19.3	2.3
6	894	809	641	467	324	209	130	70.3	27.8	4.3
8	1,479	1,281	993	721	498	335	196.8	101.5	40.2	5.5
10	3,524	2,786	2,300	1,764	1,261	870	615.6	345.6	204.7	87.5
12	4,482	3,413	2,835	2,257	1,609	1,090	697.6	432.5	257.6	113.4
14	5,123	4,753	4,288	2,985	2,125	1,324	983.3	572.2	389.5	154.3
16	7,597	5,914	5,050	3,885	2,786	1,880	1,231	763.3	475.2	199.6
18	9,116	7,392	6,565	4,856	3,621	2,256	1,538	954.5	594.8	259.5
20	10,939	8,870	8,206	6,312	4,526	2,933	1,845	1,240	773.2	324.3
24	14,220	10,644	10,011	7,748	5,748	3,813	2,195	1,587	966.5	395.64

Table 1

OpTB™ Full Port Flow Coefficients Cvs			
Cvs Shown at 90° Opening			
Size Inch	CL150	CL300	CL600
2	500	430	370
3	1,360	1,100	1,020
4	2,500	2,000	1,850
6	5,300	5,250	4,400
8	10,750	10,100	8,450
10	17,500	16,820	14,250
12	26,750	25,950	22,550
14	31,850	30,900	28,500
16	44,000	42,600	38,150
18	58,000	55,870	51,150
20	75,500	72,500	68,500
22	91,770	86,850	80,150
24	113,400	109,340	98,860

Table 2

Cvs information for CL900 and CL1500 available on request.
CVs Values for reduced bore available on request.

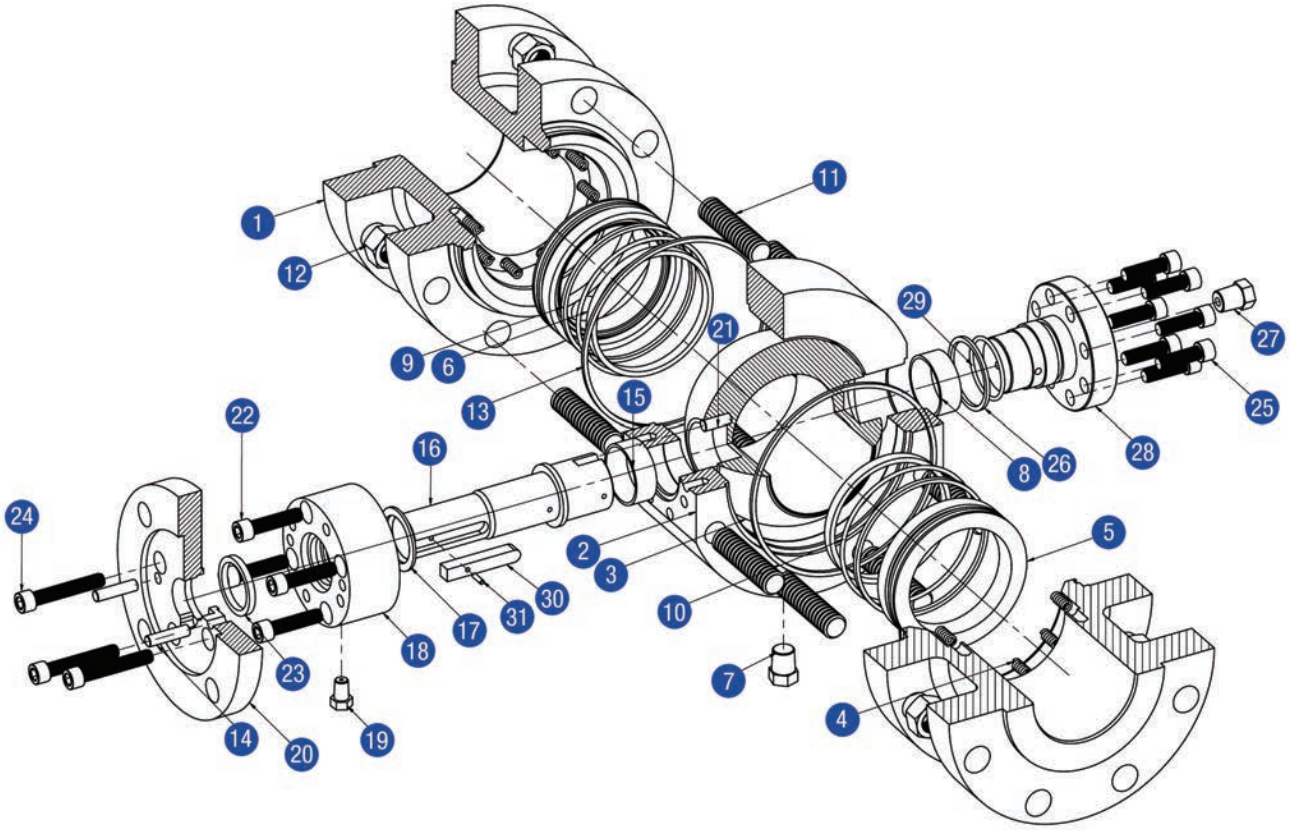


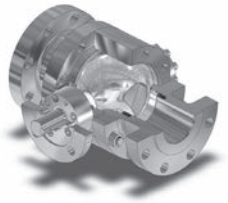
Figure 4: Exploded View of Body Sub-Assembly

OpTB™
Trunnion Ball Valve

Materials List			
Item	**Description**	**Carbon Steel/NACE**	**Stainless Steel**
1	Flange	ASTM A105	ASTM A182-F316
2	Body	ASTM A105	ASTM A182-F316
3	Ball	ASTM A105/ENP-CVD-5B	ASTM A182-F316/ CVD-5B
4	Seat Spring	Inconel X-750	Inconel X-750
5	Seat Ring	ASTM A105/ENP-CVD-5B	ASTM A182-F316/CVD-5B
6	Seat Insert	25% Glass Filled PTFE	25% Glass Filled PTFE
7	Plug Drain	316 SS	316 SS
8	Bearing	316SS/PTFE/MoS2	316SS/PTFE/MoS2
9	Firesafe Seal Gasket	316SS/Graphite	316SS/Graphite
10	O-ring	NBR	NBR
11	Body Stud	ASTM A193-B7	ASTM A193-B8
12	Body Nut	ASTM A194-2H	ASTM A194-8
13	Seal Gasket	316SS/Graphite	316SS/Graphite
14	Gland Pin	Carbon Steel	316 SS
15	Bearing	316SS/PTFE/MoS2	316SS/PTFE/MoS2
16	Stem	ASTM A105/ENP	ASTM A182-F316
17	Stem Gasket	316SS/Graphite	316SS/Graphite
18	Packing Box	ASTM A105	ASTM A182-F316
19	Stem Injection	Assembly	Assembly
20	Top Flange	ASTM A105	ASTM A182-F316
21	Pin	316 SS	316 SS
22	Packing Box Screw	Carbon Steel	316 SS
23	Packing	316SS/Graphite	316SS/Graphite
24	Flange Screw	Carbon Steel	316 SS
25	Trunnion Plate Screw	Carbon Steel	316 SS
26	Trunnion Gasket	316SS/Graphite	316SS/Graphite
27	Bleed Valve	Assembly	Assembly
28	Trunnion Plate	ASTM A216-WCB/ENP	ASTM A351-CF8M
29	O-Ring	NBR	NBR
30	Key	Carbon Steel	316 SS
31	Key Pin	Carbon Steel	316 SS

Table 3

Notes: 1. All NACE materials comply with MR01.75.99
2. Alternative materials are also available for all of the components listed



OpTB Design Operating Torque					
Stem Torque Ft. Lbs					
Size Inch	CL150	CL300	CL600	CL900	CL1500
2	36	64	108	152	241
3	44	81	140	199	318
4	111	197	338	479	761
6	232	398	669	940	1,483
8	751	1,183	1,886	2,589	3,999
10	798	1,349	2,244	3,139	4,936
12	1,149	1,918	3,169	4,419	6,929
14	1,786	3,128	5,312	7,495	11,876
16	2,224	3,944	6,741	9,538	15,152
18	3,370	5,878	9,955	14,032	22,215
20	4,433	7,795	13,264	18,732	29,706
22	5,113	8,953	15,199	21,444	33,978
24	7,163	12,713	21,741	30,769	48,886
26	8,812	15,000	25,064	35,128	
28	10,702	18,487	31,145	43,810	
30	13,264	23,324	39,685	56,047	
32	15,742	27,681	47,099	66,516	
34	18,702	31,719	52,891	74,062	
36	24,465	41,545	69,325	97,105	
40	31,646	53,795	89,818		
42	37,431	63,730	106,503		
48	49,362	84,028	140,409		

Table 4

Notes: 1. Torques shown on this table are used as a guide for actuator selection. A safety factor of 1.3 - 1.5 times is recommended for actuator sizing.
2. Torques may change according to different mediums and trim materials

OpTB™
Trunnion Ball Valve

Manual Actuators

For on/off applications, and in addition to a broad selection of automatic actuators, the OpTB can be fitted with hand levers or worm gear actuators with hand wheel.

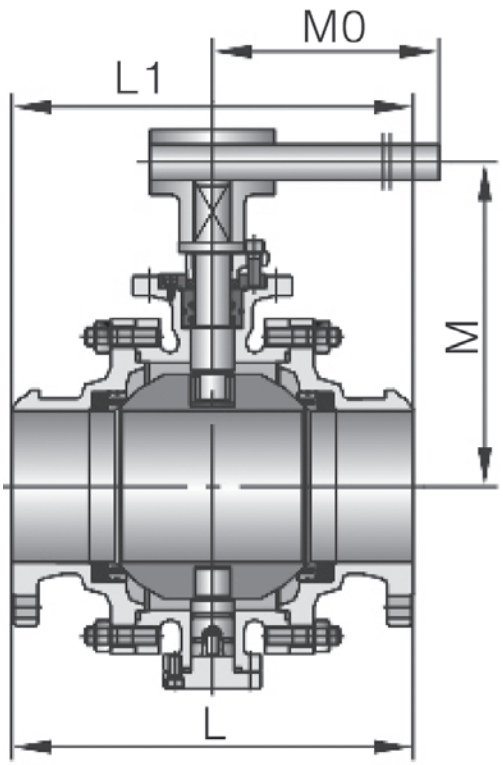


Figure 5
Hand Operated

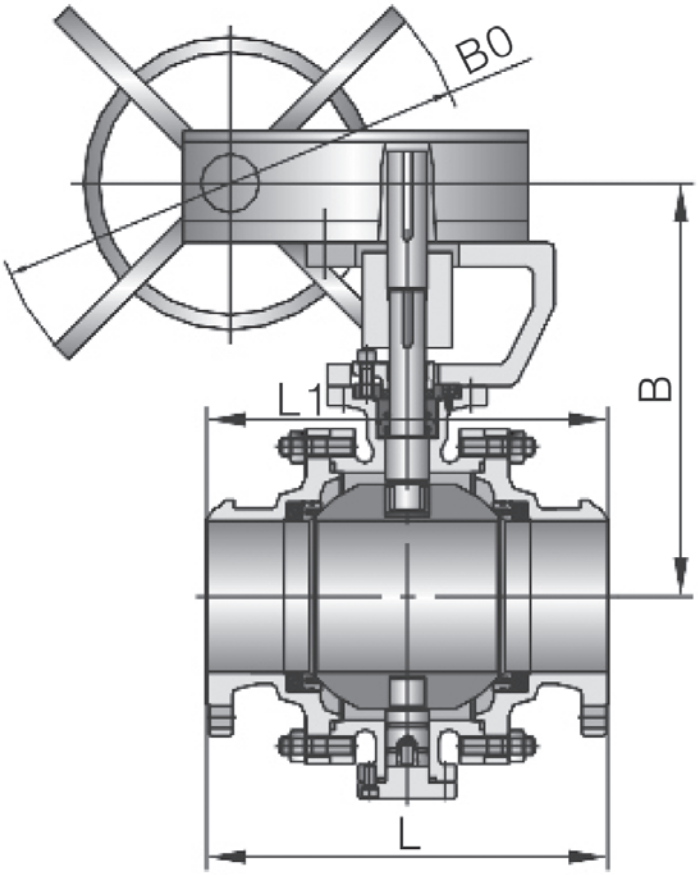
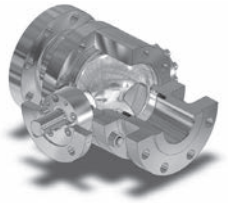


Figure 6
Worm Gear Actuator



Cast & Forged Steel Trunnion Ball Valve
Valve Weight & Dimensions – Class 150

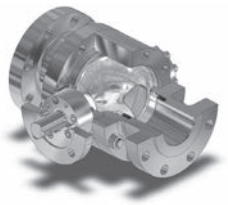
	Flange	Butt Weld	Hand operated		Worm Gear Act.		Weight Lbs
Size Inch	L	Li	M	Mo	B	Bo	Flanged
2	7.0	8.5	4.7	9.0	-	-	66
3	8.0	11.0	6.0	15.7	-	-	132
4	9.0	12.0	7.0	25.6	-	-	202
5	14.0	15.0	11.8	41.3	-	-	325
6	15.5	18.0	13.0	41.3	-	-	418
8	18.0	20.5	-	-	15.7	23.6	759
10	21.0	22.0	-	-	19.5	23.6	1,089
12	24.0	25.0	-	-	22.8	31.5	1,551
14	27.0	30.0	-	-	26.6	31.5	1,889
16	30.0	33.0	-	-	26.4	31.5	2,244
18	34.0	36.0	-	-	27.5	31.5	3,168
20	36.0	39.0	-	-	33.0	31.5	4,219
24	42.0	45.0	-	-	41.3	31.5	6,166
28	49.0	53.0	-	-	43.3	31.5	8,899
32	54.0	60.0	-	-	45.3	31.5	12,078
36	60.0	68.0	-	-	48.4	31.5	16,753
40	67.8	76.0	-	-	52.0	31.5	22,596

Table 5

OpTB™
Trunnion Ball Valve

Cast & Forged Steel Trunnion Ball Valve Valve Weight & Dimensions – Class 300							
	Flange	Butt Weld	Hand Operated		Worm Gear Act.		Weight Lbs
Size Inch	L	Li	M	Mo	B	Bo	Flanged
2	8.5	8.5	4.2	9.0	-	-	68
3	11.1	11.0	6.0	15.7	-	-	152
4	12.0	12.0	7.0	25.6	-	-	244
5	15.0	15.0	12.0	41.3	-	-	386
6	15.8	15.9	13.0	41.3	-	-	464
8	19.8	20.5	-	-	15.7	23.6	827
10	22.4	22.0	-	-	19.5	23.6	1,188
12	25.5	25.0	-	-	22.8	31.5	1,678
14	33.0.	30.0	-	-	24.6	31.5	1,980
16	33.0	33.0	-	-	26.4	31.5	2,860
18	36.0	36.0	-	-	27.5	31.5	3,773
20	39.0	39.0	-	-	33.0	31.5	4,598
24	45.0	45.0	-	-	41.3	31.5	6,358
28	53.0	60.0	-	-	43.3	31.5	10,065
32	60.0	60.0	-	-	45.3	31.5	13,728
36	68.0	68.0	-	-	48.4	31.5	18,557
40	82.0	82.0	-	-	52.0	31.5	24,640

Table 6



Cast & Forged Steel Trunnion Ball Valve
Valve Weight & Dimensions – Class 600

	Flange	Butt Weld	Hand Operated		Worm Gear Act.		Weight Lbs
Size Inch	L	Li	M	Mo	B	Bo	Flanged
2	11.5	11.5	4.3	25.6	-	-	99
3	14.0	14.0	7.8	25.6	-	-	176
4	17.0	17.0	-	-	9.2	23.6	330
6	22.0	22.0	-	-	11.8	31.5	545
8	26.0	26.0	-	-	14.8	31.5	963
10	31.0	31.0	-	-	17.5	31.5	1,375
12	33.0	33.0	-	-	20.3	31.5	1,542
14	35.0	35.0	-	-	21.6	31.5	2,706
16	39.0	39.0	-	-	24.2	31.5	3,377
18	43.0	43.0	-	-	29.5	31.5	4,697
20	47.0	47.0	-	-	31.9	31.5	5,808
24	55.0	55.0	-	-	41.3	31.5	8,712
28	61.0	61.0	-	-	46.4	31.5	13,332
32	70.0	70.0	-	-	49.2	31.5	17,215
36	82.0	82.0	-	-	51.7	31.5	23,430
40	92.0	92.0	-	-	56.0	31.5	32,340

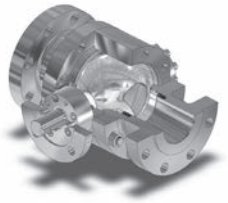
Table 7

OpTB™
Trunnion Ball Valve

Cast & Forged Steel Trunnion Ball Valve
Valve Weight & Dimensions – Class 900

	Flange	Butt Weld	Hand Operated		Worm Gear Act.		Weight Lbs
Size Inch	L	Li	M	Mo	B	Bo	Flanged
2	14.5	14.5	8.6	25.6	-	-	114
3	15.0	15.0	10.2	25.6	-	-	191
4	18.0	18.0	-	-	11.8	23.6	352
6	24.0	24.0	-	-	14.4	31.5	847
8	29.0	29.0	-	-	15.5	31.5	1,120
10	33.0	33.0	-	-	19.9	31.5	1,804
12	38.0	38.0	-	-	22.6	31.5	2,475
14	40.5	40.5	-	-	26.5	31.5	3,542
16	44.5	44.5	-	-	30.1	31.5	4,422
18	48.0	48.0	-	-	34.3	31.5	6,182
20	52.0	52.0	-	-	35.2	31.5	7,612
24	61.0	61.0	-	-	37.8	31.5	12,093
28	70.0	67.0	-	-	47.6	31.5	22,444
32	80.7	70.0	-	-	50.8	39.4	26,622

Table 8



Cast & Forged Steel Trunnion Ball Valve
Valve Weight & Dimensions – Class 1500

	Flange	Butt Weld	Hand Operated		Worm Gear Act.		Weight Lbs
Size Inch	L	Li	M	Mo	B	Bo	Flanged
2	14.5	14.5	8.7	25.6	8.7	23.6	132
3	18.5	18.5	10.3	25.6	10.3	23.6	253
4	21.5	21.5	-	-	11.8	23.6	427
6	27.7	27.7	-	-	14.4	31.5	1,276
8	32.7	32.7	-	-	18.7	31.5	1,654
10	39.0	39.0	-	-	22.8	31.5	2,626
12	44.5	44.5	-	-	27.5	31.5	4,774
14	49.5	49.5	-	-	30.0	31.5	4,950
16	54.5	55.3	-	-	32.8	31.5	6,072

Table 9

OpTB™
Rotary Actuators, Features and Characteristics

RPA Rack and Pinion Actuators
Optimux's Series RPA actuators are compact, allow for field reversibility, provide adequate torque for most standard applications and are easy to maintain. RPA actuators are designed for extremely long cycle life when utilized in normal loading applications. The RPA actuators will take service temperatures of -10° to 275° F (-23° to 135° C).

Double Acting Torque Values (in. Lbs)					
PSI	**40**	**60**	**80**	**100**	**120**
RPA052	263	395	526	658	789
RPA148	740	1,109	1,479	1,849	2,219
RPA222	1,109	1,664	2,218	2,773	3,327
RPA470	2,071	3,106	4,142	5,177	6,213
RPA900	4,550	6,825	9,100	11,375	13,650

Table 10

* Other model numbers and torque options are also available

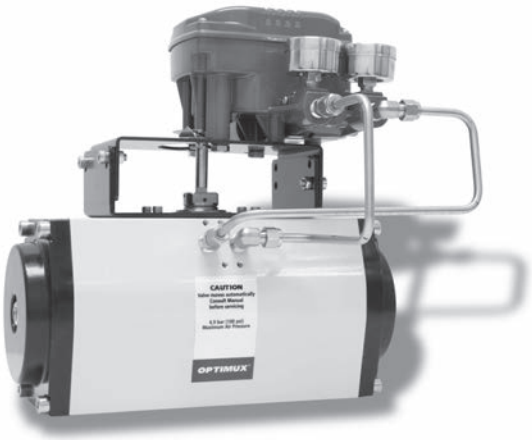


Figure 7: RPA Rack and Pinion Actuator

Optimux® HPP4000 Smart Valve Positioners
Our new HPP4000 brings to the market all the field proven attributes of our former HPP3000 plus all the additional features our users have requested for the past few years: LCD Display, 4-20mA feedback signal, HART® communication protocol and Auxiliary Limit Switches, all of these within our legendary and well proven robust enclosure capable of sustaining the most rigorous industrial plant conditions.

But this is not all, the HPP4000 was designed to accurately position your control valve and to operate it efficiently at the lowest possible air consumption (LPM) bellow 3 LPM @ 100 psi.

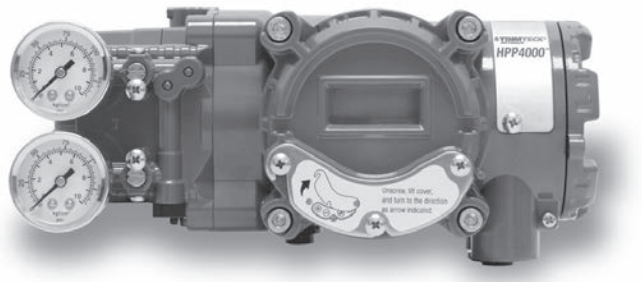


Figure 8: HPP4000 Digital Series

Optimux® HPP4500 Smart Valve Positioners
Our new HPP4500 microprocessor equipped, current-to-pneumatic digital positioner is a reliable, accurate and robust positioner which offers as a standard many features and technical characteristics traditionally offered as options by other digital positioner's manufacturers.

The HPP4500 offers as a standard, Hart® communication, 4-20mA Feedback Signal and a LCD display.

Figure 9: HPP4500 Digital Series

TRIMTECK®
OPTIMUX®

OpTB™
Trunnion Ball Valve

The information and specifications described in this brochure are considered accurate, however they are intended for information purpose only and should not be considered as certified information.

Considering that Optimux products are continuously improved and upgraded, specifications, dimensions, and information described herein are subject to change without notice.

For further information or verification, consult your Optimux representative. Specific instructions for the installation, operation, troubleshooting and maintenance of the OpTB control valves are contained on the OpTB Maintenance Bulletin.

For more information, visit our website at www.trimteck.com

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TRIMTECK®
OPTIMUX®

XL SERIES

OpEXL™ Eccentric Plug Rotary Control Valve

TECHNICAL BROCHURE

OpEXL™ Control Valve
Introduction

Rotary control valves have become one of the best control valves' choices in the market, mostly due to their capacity to handle large flows, superior rangeability, compact sizes and their shaft sealing design, all these characteristics provide a wide range of process solutions for most of control valves' industrial plant applications.

The **OpEXL** eccentric plug rotary control valve has been designed as a simple but yet robust, lightweight, and more economically-built alternative to our well known Exc Series, eccentric plug rotary valve design.

Our **OpEXL** was designed to comfortably handle differential pressures of up to 725 psi (50 bar), temperature ranges from -150º F to 752º F (-100º C to 400º C), in sizes from 1" to 4", and body class ANSI 150-300 or DIN PN 16-40.

The **OpEXL** eccentric plug provides an excellent rangeability 160:1, which is significantly higher than that of globe valves; 50:1 or 20:1 displayed in most butterfly valves. Several reduced trim sizes are also available for each valve size. These trim reductions offer a wider range of Cv values for every body size selection which enhances optimal sizing alternatives during the engineering application and selection process.

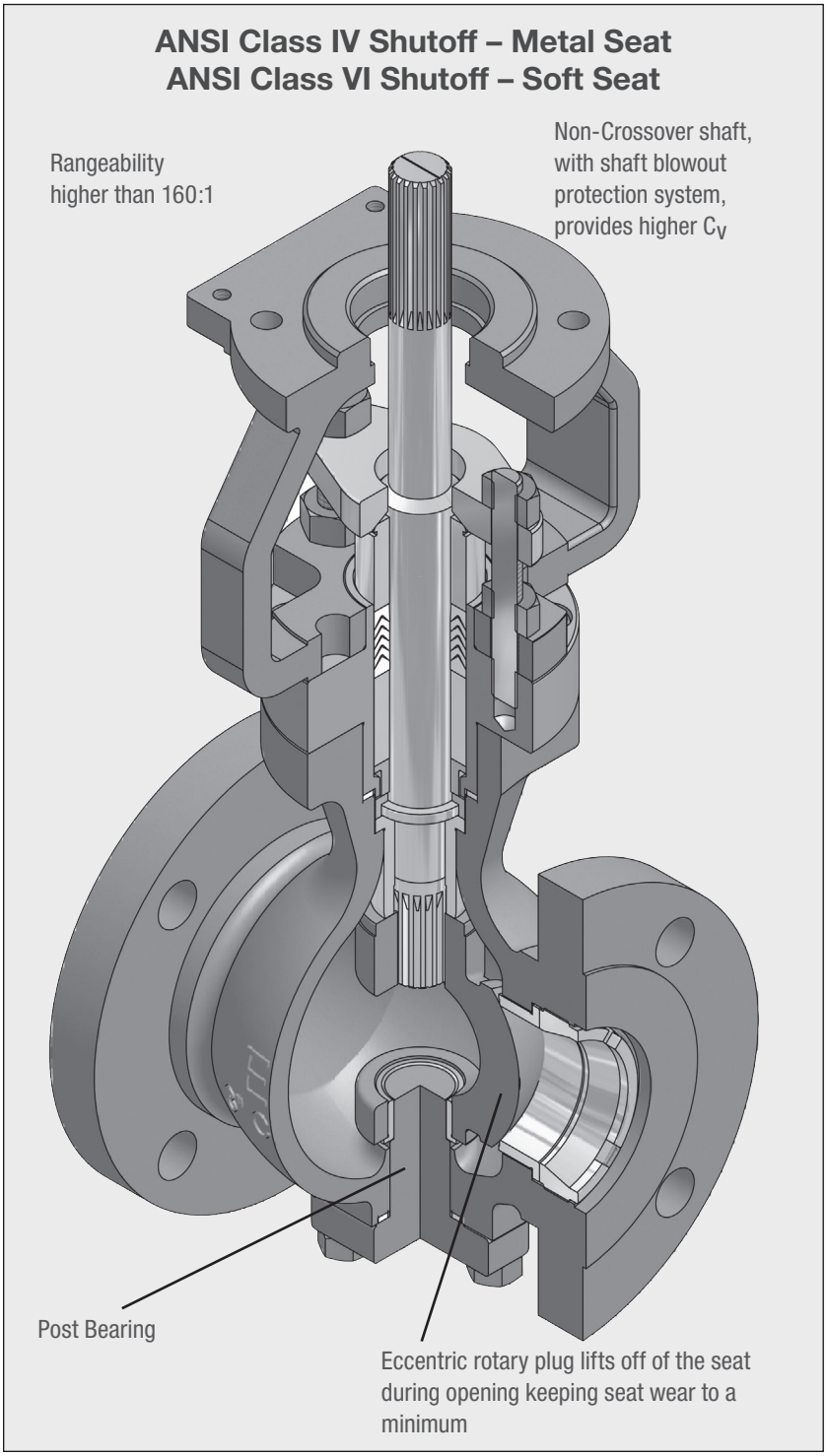

Figure 1: OpEXL Eccentric Plug Rotary Control Valve

OpEXL™
Construction/Seating

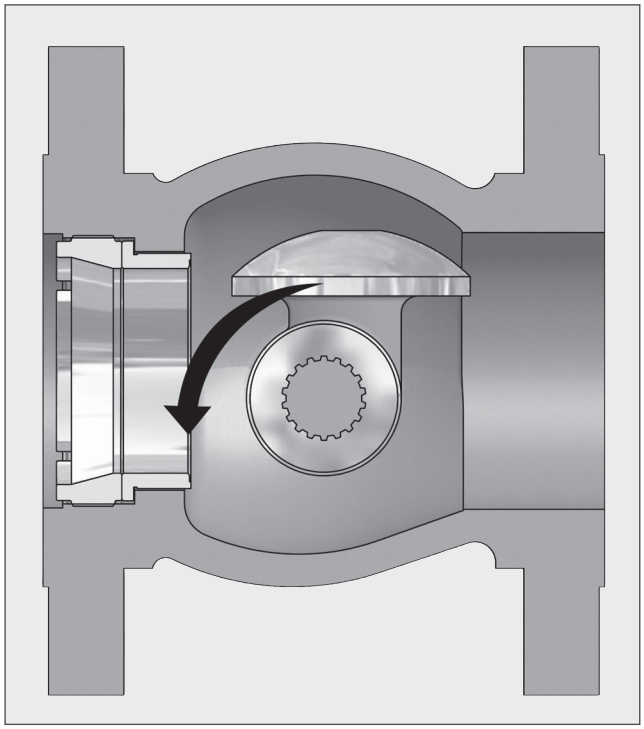

Figure 2: Valve Open

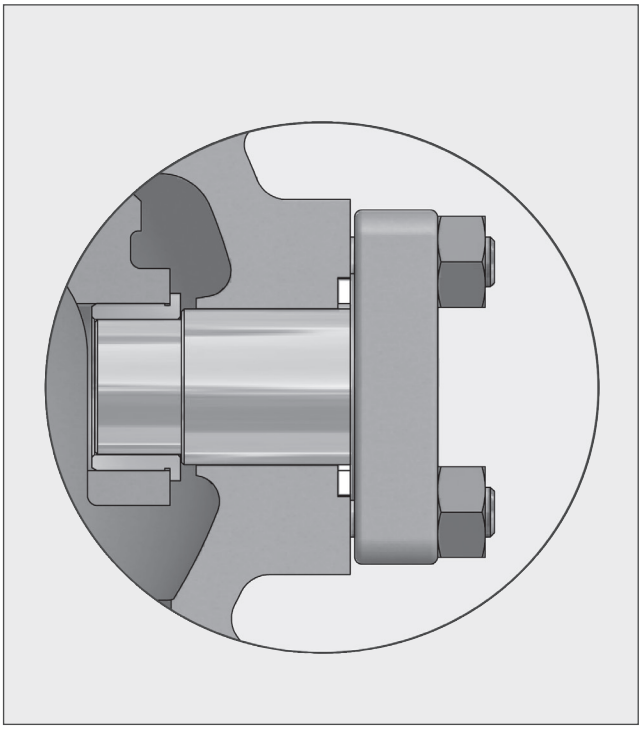

Figure 3: Post Bearing

Design Characteristics

Designed with a rugged and well sized non-cross-over shaft, higher flow capacities can be achieved for every valve size. This superior quality design characteristic eliminates potential damage caused by corrosive and/or heavy slurry processes.

In most conventional rotary control valves the shaft crosses over the valve stream line therefore causing a significant reduction in flow capacity and additionally causing unnecessary wear of the shaft. The **OpEXL** valve configuration assures a higher Cv capacity. While in the open position the streamlined fluid flow is not affected since the plug is kept totally retracted and away from the natural flow of the medium.

When the plug moves to the closed position, and due to its double-eccentricity configuration, the plug slides easily into its seat in such an angle that eliminates any direct metal-to-metal contact with its seat. This unique design characteristic contributes to drastic reductions of seat wear, therefore, less maintenance and service requirements.

As the valve opens and the eccentric plug slides smoothly off the seat, the possibility for the water-hammer effect to occur is greatly reduced, this is mainly due to the "zero breakout torque" characteristics provided by the **OpEXL** eccentric plug. This "zero-breakout torque" feature also allows for the selection and usage of smaller actuators which translates into less initial costs and life-time-maintenance costs.

Our valve design engineers have combined in one valve excellent features such as a large dimensioned post bearing system (Fig. 3), and a well sized shaft and plug made in hardened 17-4Ph as a standard, which together provide excellent tight shutoff characteristics as well as increased life expectancy of the inner parts of this assembly.

The **OpEXL** displays a large size packing box which complies to EPA* requirements and a shaft system that complies with ANSI B 16.34 standards, built in such a way as to prevent shaft blowout when the valve is still under pressure. Reduced trim sizes 70%, and 40% are offered to obtain a wide range of flow capacity.

*EPA = U. S. Environmental Protection Agency

RA Piston

Optimux's Series RA Piston-Cylinder-Rotary-Actuators are an excellent actuation choice to obtain maximum performance of our **OpEXL** eccentric plug control valves. The Optimux Series RA piston cylinder rotary actuators with fail-safe spring combine high torques with pneumatic stiffness which together deliver excellent throttling characteristics. The Series RA compared to regular spring-diaphragm actuators, are lightweight, compact, efficient and in general, they take a smaller foot-print for installation in pipelines, they are simply, one of the best choices in actuation systems for rotary control valves.

The Series RA piston cylinder actuators are offered as a standard for all of our Rotary valves: Series VB, and Series Dx.

The Optimux Series RA piston cylinder actuator was designed to work with supply pressures of up to 150 psi (10.3 bars), which significantly increases torque capacity. The Series RA performance and reliability in the field has no par, as it has proven life service above one million cycles.

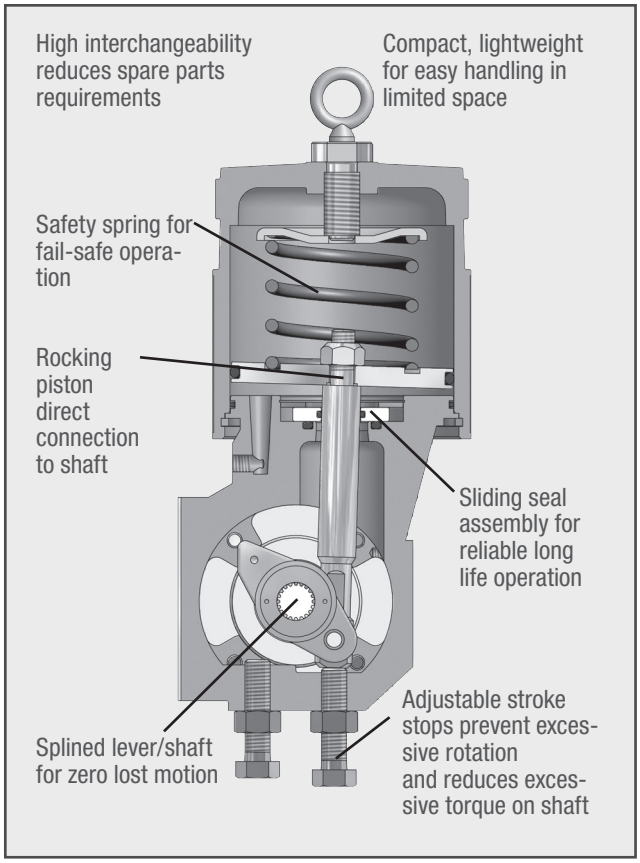

Figure 4: RA Rotary Actuator

The pneumatic stiffness achieved by the Series RA assures excellent throttling and control characteristics specially in near closing control positions.

Table I: Rotary Actuator Specifications

Type	Double-acting piston and cylinder with fail-safe spring
Sizes	25, 50
Action	Air-to-open Air-to-close Last position Field reversible
Operating Pressure	Max 150 psig Max 10,3 bars
Stroking Speed	≤ 1 second
***Temperature Range**	-40˚ to 350˚F (-40˚ to 175˚ C)
Auxiliary Handwheels	Declutchable side-mounted handwheel Lever-gear operated handwheel Lever operator
Positioners	Digital HPP-3000 Digital HPP-3500

Table II: Construction Materials

Yoke	Ductile Iron
Transfer Case	Anodized Aluminum
Splined Lever Arm	Nickel-plated Ductile Iron
Stern	UNS S 41600 Stainless Steel
Bearings	Filament wound fiberglass with Teflon liner
Sliding Seal	Delrin, aluminum
Retaining Ring	Cadmium plated steel
Piston	Anodized Aluminum
Cylinder	Anodized Aluminum
O-Ring*	Buna-N (standard)
Actuator Spring	Coated steel (rust proof)
Spring Button	Cadmium-plated steel

* Ambient temperatures higher than 180˚ F (82˚ C) require Viton O-rings. Ambient temperatures below -40˚ F (-40˚C) require fluorosilicone O-rings.

OpEXL™
Rotary Actuators, Features and Characteristics

RPA Rack and Pinion Actuators

Optimux's Series RPA represent an excellent alternative to our RA Piston-Cylinder Series for rotary valves applications. As with the RA Series the RPA actuators are compact, allow for field reversibility, provide adequate torque for most standard applications and are easy to maintain. RPA actuators are designed for extremely long cycle life when utilized in normal loading applications. The RPA actuators will take service temperatures of -10º to 275º F (-23º to 135º C).

The Series RPA actuators are also offered for all our rotary valves: Series DX and Series VB.

Table III: Double Acting Torque Values (in. Lbs)

PSI	40	60	80	100	120
RPA052	263	395	526	658	789
RPA148	740	1,109	1,479	1,849	2,219
RPA222	1,109	1,664	2,218	2,773	3,327
RPA470	2,071	3,106	4,142	5,177	6,123
RPA900	4,550	6,825	9,100	11,375	13,650

*Other model numbers and torque options are also available

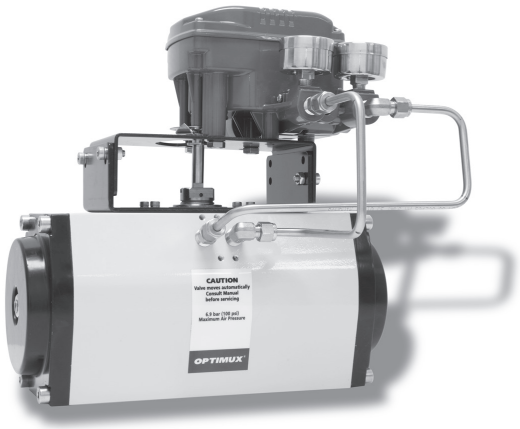

Figure 11: RPA Rack and Pinion Actuator

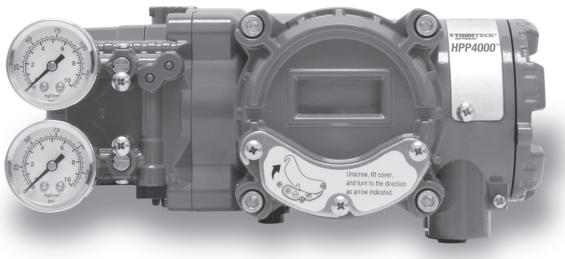

Figure 12: HPP4000 Digital Series

Optimux® HPP4000 Smart Valve Positioners

Our new HPP4000 brings to the market all the field proven attributes of our former HPP3000 plus all the additional features our users have requested for the past few years: LCD Display, 4-20mA feedback signal, HART® communication protocol and Auxiliary Limit Switches, all of these within our legendary and well proven robust enclosure capable of sustaining the most rigorous industrial plant conditions.

But this is not all, the HPP4000 was designed to accurately position your control valve and to operate it efficiently at the lowest possible air consumption (LPM) bellow 3 LPM @ 100 psi.

Optimux® HPP4500 Smart Valve Positioners

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The HPP4500 offers as a standard, Hart® communication, 4-20mA Feedback Signal and a LCD display.

Figure 13: HPP4500 Digital Series

OpEXL™
Construction Materials

Built For High Performance

Manufactured with a rugged oversized shaft and post bearing, the **OpEXL** rotary control valve prevents damages that may occur on its own shaft.

The rotary plug is manufactured in its standard configuration with 17-4 PH heat hardened stainless steel, however the inner parts assembly can be also constructed in solid Alloy #6 type steel, providing for an excellent tight shutoff and enhancing its use in a wide range of applications such as in flashing conditions, corrosive services, mild cavitation, and steam services as well.

The non-crossover shaft design, a characteristic of the **OpEXL** eccentric plug rotary control valve pervents the line from clogging, assuring an uninterrupted flow passage. When the valve is in the open position, the flow is not diverted to the seat or seat retainer, delivering excellent performance even after several years of operation.

The connection between the plug and the shaft is achieved via a tight and precise splined connection, eliminating the use of keys and/or taper pins which are prone to corrosion and/or wear due to vibration. The rugged, rigid and heavy-duty seat design is excellent for applications where the valve is subjected to high pressure drops.

The typical maintenance cycle of the **OpEXL** exceeds the period of five years and the service life expectation exceeds a period of twenty years.

Table IV: Body Specifications

Size (inches)	1; 1.5; 2; 3; 4 DN 25; 40; 50; 80; 100
End Connection	Flanged RF
Finish	125-250 Rc standard
Rating Class	ANSI Class 150-300 DN PN 16-40
Face-to-Face Dimension	ISA S75.04
Seat Area	Full 100% Reduced 70% Reduced 40%
Leakage Class	ANSI Class IV – metal seat ANSI Class VI – soft seat
Operating Temperature	- 150˚ F to 752˚ F (-100˚ C to 400˚ C)

After a detailed analysis of the **OpEXL** control valve under the reliability viewpoint, other considerations should be added to its performance such as: it can provide a flow capacity of up to 70% higher when compared to the eccentric plug rotary valves of other manufacturers. The **OpEXL** can be installed in processes handling paper pulp concentration of up to 3% due to its non-crossover shaft design. The valve design permits the valve to withstand a pressure drop of up to 725 psi (50 bars) in the closed position. It also allows the valve to be installed with shaft upstream or downstream. Reduced trim areas of 70% and 40%. Leakage class ANSI Class IV with metal seat and Class VI with soft seat. Shaft blowout protecting system eliminates the risk of personal injury caused by fluid pressure, fires and process interruptions do to accidents. Plug rotation of 90 degrees with the use of a high performance double-acting rotary cylinder piston fail-safe spring actuator.

Table V: Flow Direction

Installation	Flow	Application
Standard	Shaft downstream flow into the convex plug face	No cavitation Clean fluid
Reversed	Shaft upstream flow into the outward plug face	Fluid with entrained particles, cavitation or flushing

Table VI: Packing Temperature Limitations

Type of Material	Temperature	
	˚F	˚C
“V”-rings – PTFE	-150 to 450	-101 to 232
Braided PTFE	-20 to 500	-28 to 260
Grafoil	-20 to 752	-28 to 400
PT	-20 to 450	-28 to 232
PTG	-20 to 450	-28 to 232
PTG XT	-20 to 550	-28 to 288

*Pressure class versus body material limitations must not be exceeded

Table VII: Standard Construction Materials Carbon Steel Sub-assembly

Part	Material Classification	Specifications		
		ASTM Code (AMS No.)	UNS Code	Hardness Rc
Body	Carbon steel – Cast	A 216 WCB	J 03002	
Plug	17-4PH – Cast	A 747, Gr CB7-Cu-1	J 92180	35-38 C
	Alloy #6 – Cast	AMS 5387	R 30006	40-42 C
Shaft	17-4 PH – Bar	A 564 Gr 630	S 17400	35 C
Post	17-4 PH – Cast	A 747 Gr CB7-Cu-1	J 92180	35-38 C
Bearings (shaft/plug)	440C – Bar	A 276	S 44004	55-60 C
Seat Retainer	316 – Cast	A 351 Gr CF8M	J92900	
Metal Seat	316 – Bar	A 479 Gr 316	S 31600	
	420 – Cast	A 743 Gr CA40	J 91160	38-45
	Alloy #6 – Cast	AMS 5387	R 30006	40-42 C
Soft Seat	316 – Bar / PTFE	A 479 Gr 316	S 31600	
Thrust Bearing	316 – Bar / 440 Bar	A 479 Gr 316 / A 276	S 31600 / S 44004	55-60 C
Gland Flange	316 – Cast	A 351 Gr CF8M	J 92900	
Packing Follower	316 – Bar	A 479 Gr 316	S 31600	
Packing Spacer	316 – Bar	A 479 Gr 316	S 31600	

Table VIII: Standard Construction Material Stainless Steel Sub-assembly

Part	Material Classification	Specifications		
		ASTM Code (AMS No.)	UNS Code	Hardness Rc
Body	316 – Cast	A 351 Gr CF8M	J 92900	
Plug	17-4PH – Cast	A 747, Gr CB7-Cu-1	J 92180	35-38 C
	Alloy #6 – Cast	AMS 5387	R 30006	40-42 C
Shaft	17-4 PH – Bar	A 564 Gr 630	S 17400	35 C
Post	17-4 PH – Cast	A 747 Gr CB7-Cu-1	J 92180	35-38 C
Bearings (shaft/plug)	Duplex – Cast	A 890 4A	J 92205	15-25
Seat Retainer	316 – Cast	A 351 Gr CF8M	J92900	
Metal Seat	316 – Bar / CVD-5B	A 479 Gr 316	S 31600	72 C
	Alloy #6 / CVD-5B	AMS 5387	R 30006	40-42 C / 72 C
Soft Seat	316 – Bar / PTFE	A 479 Gr 316	S 31600	
Thrust Bearing	316 – Bar / Duplex 2205	A 479 Gr 316 / A 890	S 31600 / J 92205	16 / 15-25
Gland Flange	316 – Cast	A 351 Gr CF8M	J 92900	
Packing Follower	316 – Bar	A 479 Gr 316	S 31600	
Packing Spacer	316 – Bar	A 479 Gr 316	S 31600	

OpEXL™
Body Materials

Table IX: Body Pressure and Temperature Limitations (ANSI 16.34)

Material	End Connections	Pressure		Temperature	
		PSI	Bar	˚F	˚C
ASTM A-216 Gr. WCB Carbon Steel	ANSI 150#	285	19,7	-20 to 100	-29 to 38
		260	17,3	200	93
		250	17,2	300	149
		245	16,9	400	204
		230	15,9	500	260
		210	14,5	600	316
		205	14,1	650	343
		195	13,4	750	399
	ANSI 300#	725	50,0	-20 to 100	-29 to 38
		675	46,5	200	93
		655	45,2	300	149
		635	43,8	400	204
		600	41,4	500	260
		545	37,6	600	316
		535	36,9	650	343
		505	34,8	750	399
ASTM A-351 Gr. CF8M Stainless Steel	ANSI 150#	275	19,0	-20 to 100	-29 to 38
		205	14,1	200	93
		185	12,8	300	149
		175	12,1	400	204
		170	11,7	500	260
		165	11,4	600	316
		160	11,0	750	399
	ANSI 300#	725	50,0	-20 to 100	-29 to 38
		535	36,9	200	93
		485	33,4	300	149
		455	31,4	400	204
		450	31,0	500	260
		435	3,0	600	316
		430	29,7	650	343
		420	29,0	700	371
		410	28,3	750	399

Table X: Maximum Pressure Drop*

Nominal Valve Size		Shaft Diameter		Seat Diameter (Full Area Trim)		Maximum Pressure Drop* 90 Degrees Rotation (Bidirectional FLow)	
inches	DIN	inch	mm	inch	mm	PSI	Bar
1	DN 25	0.44	11	.70	17,98	725	50
1.5	DN 40	0.62	16	1.1	27,98	725	50
2	DN 50	0.62	16	1.36	34,75	725	50
3	DN 80	0.90	23	2.35	59,92	725	50
4	DN 100	0.90	23	3.03	76,95	725	50

*The maximum allowable pressure drop is based upon shaft mechanical resistance, however, it is limited to the pressure class. Standard limitations according to the pressure class should not be exceeded.

OpEXL™
Packings

The **OpEXL** rotary valve is built with a large packing box which gives a longer service life to the packing assembly. The **OpEXL** Packing box design allows for the use of a large number of packing system options, and fully complies with the most demanding fugitive emission control regulations in modern industrial processes.

Standard Packing

The **OpEXL** standard packing set is composed by PTFE "V" rings, Figures 8A and 8B. The PTFE "V" rings are the most used packing system since their introduction, providing exceptional tight sealing. They provide a very low friction coefficient, good mechanical resistance and excellent resistance to corrosion. The PTFE "V" rings are the most common application choice for gasketing material.

The PTFE "V" rings are used within temperature ranges of - 150º to 450°F (-101 to 232° C). High Temperature Packing The **OpEXL** formed packing rings, Figures 9A and 9B, is an alternative choice whenever the operating temperature exceeds that determined for the use of PTFE "V" rings. The materials employed in the formed packing rings of the **OpEXL** are braided PTFE for use in temperatures up to 500°F (260°C) and Grafoil for use in temperatures up to 752°F (400°C). The Grafoil formed packing rings are an excellent choice whenever packing is subjected to high operating temperatures, however it should be noted that the demand of high forces required to achieve a tight sealing results in a significant friction increase forces as the valve plug turns.

Special Packing

The PT type packing set, Figure 10A, is composed by a set of "V" type rings under compression by an assembly of disc springs that result in a "live-loading" effect. This system achieves a sealing level of below 500 ppm. The PT type packing combines the superior virgin PTFE "V" rings quality with the PTFE "V" rings combined with carbon filament wound. The PTG type packing, Fig. 10B, is composed of an advanced packing set that is capable of keeping a sealing rate very below 500 ppm (at a 10 ppm step rate). The PTG packing set is composed by the combination of PTFE "V" rings with carbon filament wound and Kalrez® "V" rings, an advanced material that provides a superior performance to the packing set. For temperatures higher than 450°F (232°C) the PTG XT packing set is employed. This type of packing utilizes Zymax® rings instead the PTFE/carbon rings.

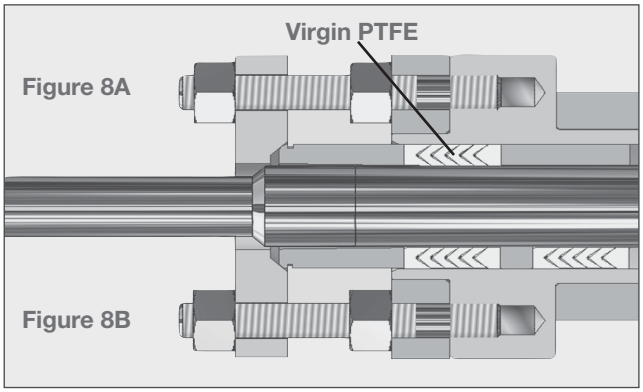


Figure 8A: Standard Packing: "V" rings
Figure 8B: Double Packing: "V" rings

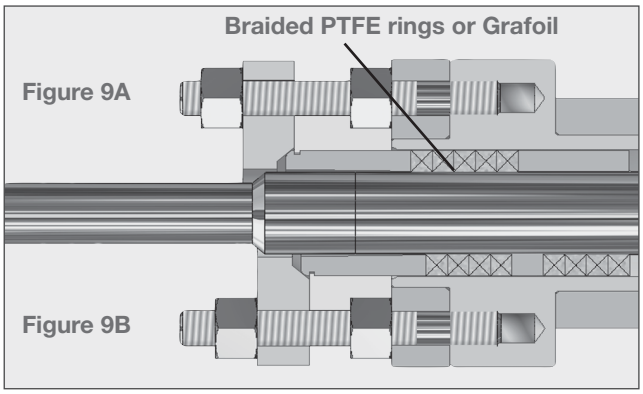


Figure 9A: Packing: Formed Rings
Figure 9B: Double Packing: Formed Rings

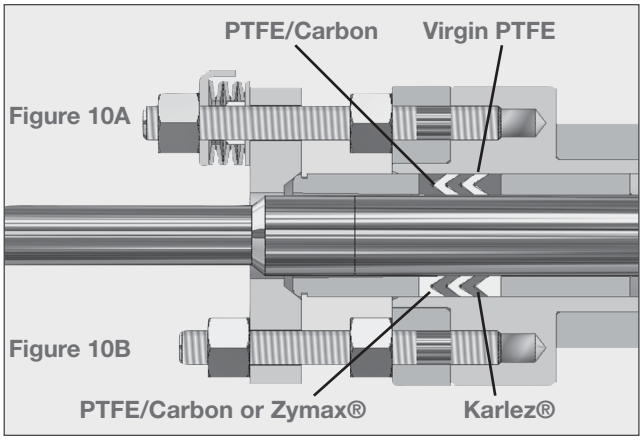


Figure 10A: PT Packing Set
Figure 10B: PTG Packing Set

Table XI: Maximum Allowable Pressure
Actuator versus Supply Pressure (PSI/Bar)

Valve Nominal Size (Inches)	Air Supply Pressure		Actuator Size (Trim Area)											
			25						50					
			100%		70%		40%		100%		70%		40%	
	PSI	Bar	PSI	Bar	PSI	Bar	PSI	Bar	PSI	Bar	PSI	Bar	PSI	Bar
1	40	2,7	725	50,0	725	50,0	725	50,0						
	60	4,1	725	50,0	725	50,0	725	50,0						
	80	5,5	725	50,0	725	50,0	725	50,0						
	100	6,9	725	50,0	725	50,0	725	50,0						
	150	10,3	725	50,0	725	50,0	725	50,0						
1.5 & 2	40	2,7	725	50,0	725	50,0	725	50,0						
	60	4,1	725	50,0	725	50,0	725	50,0						
	80	5,5	725	50,0	725	50,0	725	50,0						
	100	6,9	725	50,0	725	50,0	725	50,0						
	150	10,3	725	50,0	725	50,0	725	50,0						
3	40	2,7	350	24,1	500	34,5	690	47,6	685	47,2	725	50,0	725	50,0
	60	4,1	500	34,5	650	44,8	725	50,0	725	50,0	725	50,0	725	50,0
	80	5,5	620	42,7	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0
	100	6,9	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0
	150	10,3	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0
4	40	2,7	210	14,5	295	20,3	410	28,3	400	27,6	580	40,0	725	50,0
	60	4,1	300	20,7	415	28,6	580	40,0	580	40,0	725	50,0	725	50,0
	80	5,5	375	25,8	530	36,5	725	50,0	725	50,0	725	50,0	725	50,0
	100	6,9	445	30,7	625	43,1	725	50,0	725	50,0	725	50,0	725	50,0
	150	10,3	530	36,5	725	50,0	725	50,0	725	50,0	725	50,0	725	50,0

Note: The pressure limitations should be limited to the body and flanges pressure class.

Table XII: Seat Maximum Pressure Drop

Type of Seat Process	Process Medium	Open Position		Closed Position	
		PSI	Bar	PSI	Bar
Metal Seal	Liquids, Vapors	363	24,7	725	50,0
Metal Seal	Gases	725	49,3	725	50,0
Soft Seal	Liquids, Vapors	145	9,8	725	50,0
Soft Seal	Gases	290	19,7	725	50,0

Note: Pressure limitations should be limited to body and flange pressure classes.

Table XIII: Yoke Gasket/Post Bearing Maximum Pressure/Temperature

Gasket Material	Pressure		Temperature	
	PSI	Bar	PSI	Bar
PTFE	725	50	350	186
316 SS/ Grafoil	725	50	752	400

Table XIV: Trim Material

Body Sub-Assembly Carbon Steel

Plug	Seat	Bearings	Shaft	Post Bearing
17-4 PH	316 Stainless Steel	440C Stainless steel	17-4 PH	17-4 PH
17-4 PH	420 Stainless Steel	440C Stainless steel	17-4 PH	17-4 PH
Alloy #6	Alloy #6	440C Stainless steel	17-4 PH	17-4 PH

Body Sub-Assembly Carbon Steel – NACE

Plug	Seat	Bearings	Shaft	Post Bearing
Alloy #6	316 Stainless Steel	Duplex 2205	A 453 Gr 660	A 453 Gr 660
Alloy #6	Alloy #6	Duplex 2205	A 453 Gr 660	A 453 Gr 660

Body Sub-Assembly Stainless Steel

Plug	Seat	Bearings	Shaft	Post Bearing
17-4 PH	316 Stainless Steel	Duplex 2205	17-4 PH	17-4 PH
Alloy #6	Alloy #6	Duplex 2205	17-4 PH	17-4 PH

Body Sub-Assembly Stainless Steel – NACE

Plug	Seat	Bearings	Shaft	Post Bearing
Alloy #6	316 Stainless Steel	Duplex 2205	A 453 Gr 660	A 453 Gr 660
Alloy #6	Alloy #6	Duplex 2205	A 453 Gr 660	A 453 Gr 660

Table XV: Recommended Application

Fluid	Plug	Seat	Bearings	Flow Direction
Industrial Air and Liquids*	17-4 PH	AISI 316	440C; Duplex 2205	Shaft downstream
Liquid Hidrocarbon	17-4 PH	AISI 316	440C; Duplex 2205	Shaft downstream
	Alloy #6	Alloy #6	440C; Duplex 2205	Shaft downstream
Clean Gases	17-4 PH	AISI 316	440C; Duplex 2205	Shaft downstream
Clean Liquids	17-4 PH	AISI 316	440C; Duplex 2205	Shaft upstream
Clean Liquids w/Cavitation or Flashing	Alloy #6	Alloy #6	440C; Duplex 2205	Shaft upstream
Liquids not clean, Slurry or Abrasive	Alloy #6	Alloy #6	440C; Duplex 2205	Shaft upstream
Liquids not clean, w/Cavitation or Flashing	Alloy #6	Alloy #6	440C; Duplex 2205	Shaft upstream
Non-corrosive Chemical Products	17-4 PH	AISI 316	440C	Shaft downstream
Corrosive Chemical Products	Alloy #6	AISI 316	Duplex 2205	Shaft downstream
	Alloy #6	Alloy #6	Duplex 2205	Shaft upstream
Water Stream – 150 PSI	17-4 PH	AISI 420	440C	Shaft downstream
Water Stream – 300 PSI	Alloy #6	Alloy #6	440C	Shaft downstream

* Except O_2

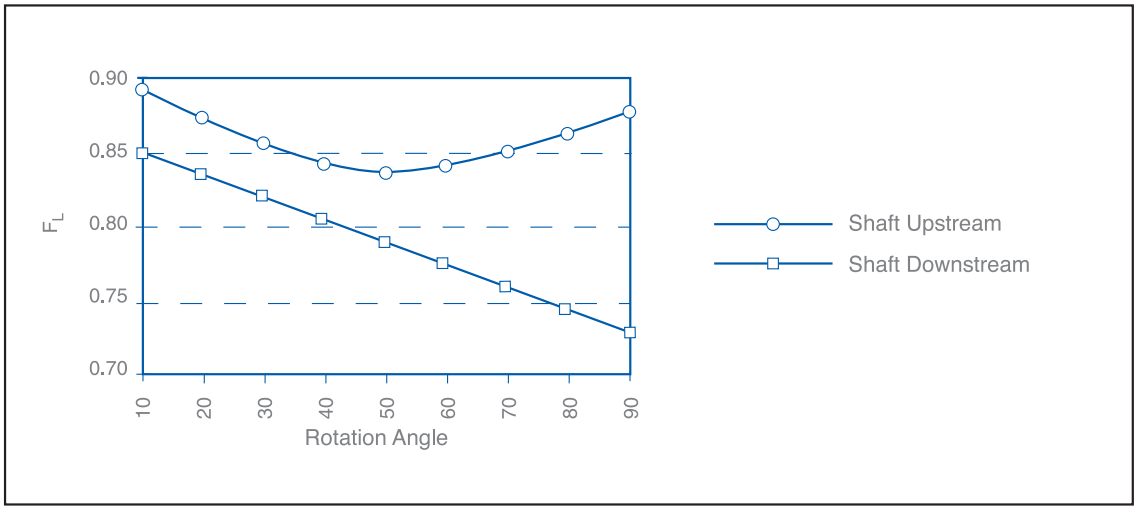


Figure 11: Pressure Recovery Factor, FL: OpEXL Eccentric Plug Rotary Control Valve

Piping Size Effect on Valve C_V Coeficient

The nominal Cv values indicated on the Tables XVI and XVII are considered for a line size valve installation, where inlet/outlet pipe and valve sizes are the same. When the valve is concentrically installed in pipelines with higher nominal sizes, the Cv coeficient is affected and should be multiplied by the "PCF" factor in Table XV.

Table XVI: Cv Correction Factor

Trim Area %	Piping Correction Factor, PCF - d/D*						
	0.4	.05	.06	0.7	.08	.09	1
100			0.91	0.94	0.97	0.99	1
70	0.93	0.94	0.96	0.97	0.98	0.99	1
40	0.98	0.98	0.99	0.99	0.99	0.99	1

* d = Nominal Valve Size
D = Larger Piping Size

OpEXL™

Flow Coefficient: C_V

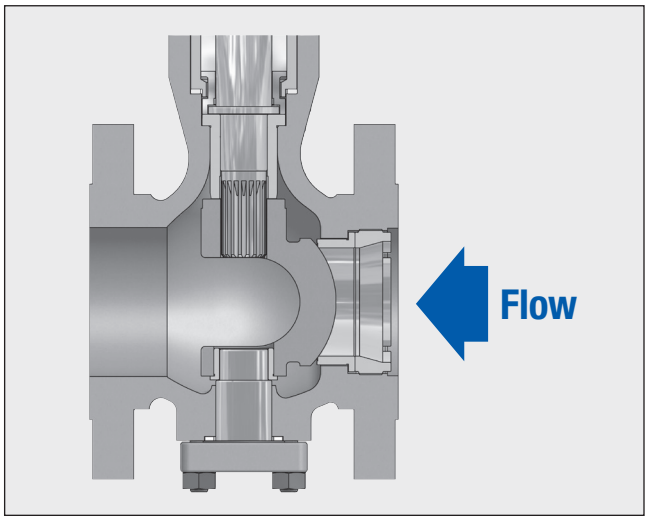


Figure 12: Shaft Downstream

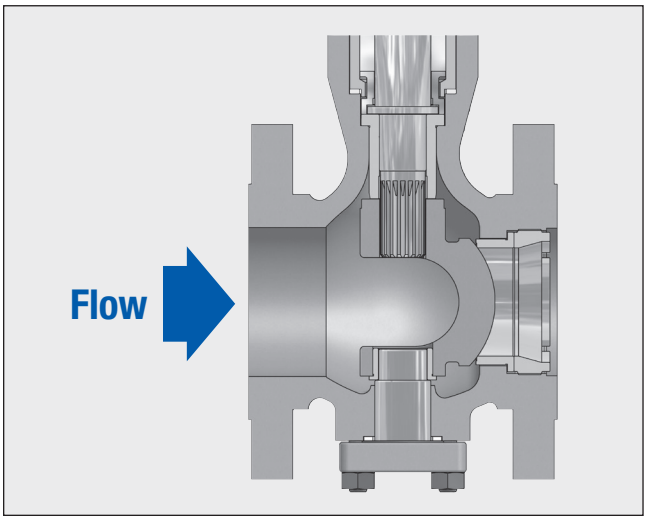


Figure 13: Shaft Upstream

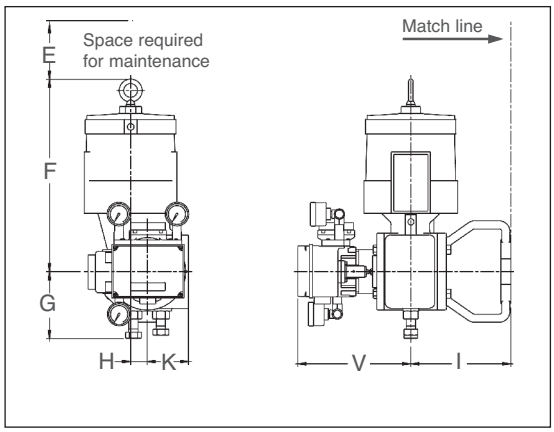
Table XVII: Maximum Flow Capacity (C_V) - Shaft Downstream

Trim Area %	Opening Angle	Valve Nominal Size (Inch)									
		1		1.5		2		3		4	
		Metal	Soft	Metal	Soft	Metal	Soft	Metal	Soft	Metal	Soft
100	90	18	10	47	39	80	17	245	245	408	408
	80	17.7	9.8	44	37	78	69	224	224	380	380
	70	17.4	9.7	40	33	64	57	186	186	309	309
	60	15.9	8.8	34	28	53	47	150	150	245	245
	50	13.3	7.4	29	24	43	38	126	126	207	207
	40	10.4	5.8	22	18	35	31	99	99	162	162
	30	7.6	4.2	16	13	26	23	73	73	118	118
	20	4.2	2.4	9.2	7.6	15	13	41	41	66	66
	10	2.1	1.2	4.5	3.7	5	4	21	21	33	33
70	90	13	7	33	33	53	53	182	182	269	269
40	90	7	6	19	19	32	32	104	104	170	170

Table XVIII: Maximum Flow Capacity (C_V) - Shaft Upstream

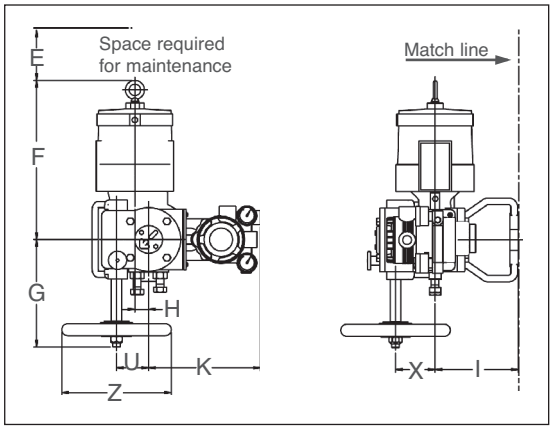
Trim Area %	Opening Angle	Valve Nominal Size (Inch)									
		1		1.5		2		3		4	
		Metal	Soft	Metal	Soft	Metal	Soft	Metal	Soft	Metal	Soft
100	90	21	12	50	40	78	69	218	218	305	305
	80	20.6	11.8	48	38	74	65	198	198	295	295
	70	19.5	11.1	44	35	66	58	170	170	263	263
	60	17.7	10.1	40	32	55	49	142	142	225	225
	50	15.7	9.0	33	26	45	40	115	115	183	183
	40	12.5	7.1	26	21	36	23	92	92	146	146
	30	9.1	5.2	19	15	26	17	67	67	106	106
	20	5.4	3.1	11.5	9.2	15	13	40	40	63	63
	10	2.0	1.1	4.2	3.4	4.7	4.2	15	15	23	23
70	90	15	8	35	35	55	55	167	167	223	223
40	90	8	6	20	20	31	31	68	68	150	150

OpEXL™
Actuator Sub-Assembly Dimensions



Actuator Size	Dimensions (inches / mm)													
	E		F		G		H		I		K		V	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
25	6.0	152	13.1	334	4.6	116	1.1	29	6.8	174	2.9	74	7.7	196
25 EF	9.3	236	17.4	441	4.6	116	1.1	29	6.8	174	2.9	74	7.7	196
50	8.0	203	18.1	461	5.6	144	2.0	51	6.8	174	3.8	96	7.7	196
50 EF	9.8	249	24.0	609	5.6	144	2.0	51	6.8	174	3.8	96	7.7	196

Fig. 14: RA Series Actuator with HPP3500 Positioner



Actuator Size	Dimensions (inches / mm)															
	F		G		H		I		K		U		X		Z	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
25	13.1	334	8.9	226	1.1	29	6.8	174	9.2	233	2.6	67	3.3	83	9.0	228
25 EF	17.4	441	8.9	226	1.1	29	6.8	174	9.2	233	2.6	67	3.3	83	9.0	228
50	18.1	461	9.4	238	2.0	51	6.8	174	10.1	256	3.4	86	3.3	83	12.0	305
50 EF	24.0	609	9.4	238	2.0	51	6.8	174	10.1	256	3.4	86	3.3	83	12.0	305

Fig. 15: RA Series Actuator w/ Handwheel & HPP3000 Positioner

OpEXL™
Body Sub-Assembly Dimensions

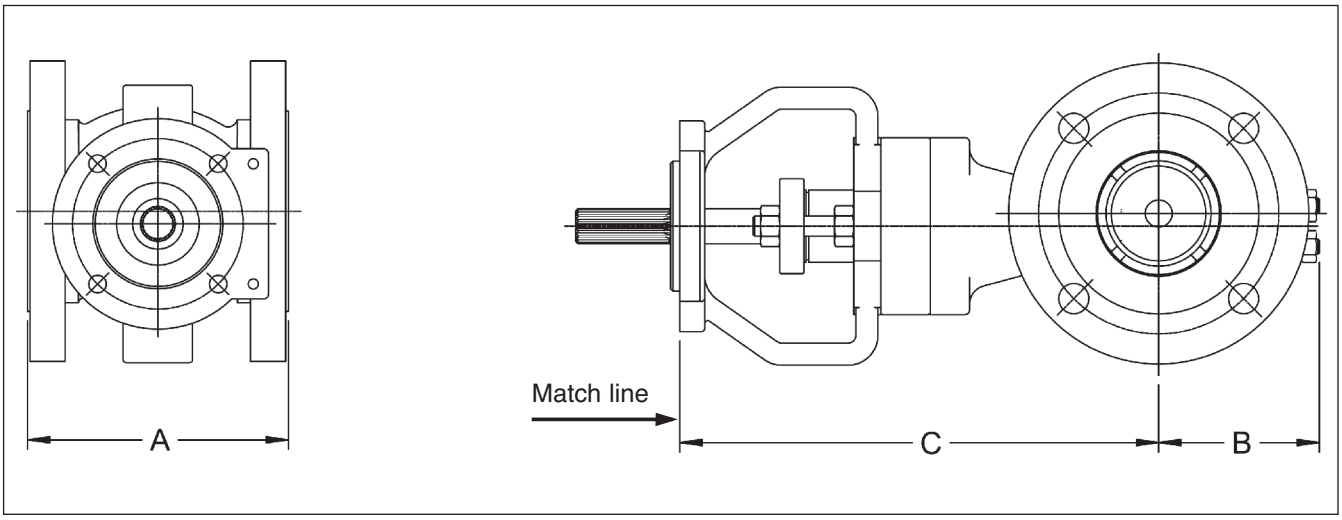


Fig. 16: OpEXL Body Sub-Assembly

Dimensions			Valve Size (Inches)				
			1	1.5	2	3	4
A	150	in.	4.0	4.5	4.9	6.5	7.6
		mm	102	114	124	165	194
	300	in.	4.0	4.5	4.9	6.5	7.6
		mm	102	114	124	165	194
B	150	in.	2.7	2.8	2.9	4.0	4.2
		mm	69	71	74	102	107
	300	in.	2.7	2.8	2.9	4.0	4.2
		mm	69	71	74	102	107
C	150	in.	8.7	9.8	9.8	12.0	12.2
		mm	222	248	250	304	309
	300	in.	8.7	9.8	9.8	12.0	12.2
		mm	222	248	250	304	309

TRIMTECK®
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OpEXL™

The information and specifications described in this brochure are considered accurate, however, they are intended for information purpose only and should not be considered as certified information.

Considered that Optimux products are continuously improved and upgraded, specifications, dimensions, and information described herein are subject to change without notice.

For further information or verification, consult your Optimux representative. Specific instructions for the installation, operation, troubleshooting and maintenance of the OpEXL control valves are contained on the OpEXL Maintenance bulletin. OpEXL Manual. Teflon, Kalrez and Zymax are trade marks of E. I. DuPont Company.

Manual. Teflon, Kalrez and Zymax are trade marks of E. I. DuPont Company.

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Product Instruction Manual

OpVEE
V-Notch Ball Valve

TABLE OF CONTENTS

SAFETY INFORMATION

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in **death or serious injury.**

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, could result in **minor or moderate injury and/or property damage.**

Note: Indicates a potential situation, which, if not avoided, may result in an *undesired result or state.*

INTRODUCTION

Scope of Manual

This instruction manual includes installation, maintenance, and parts information for the Optimux™ OpVee control valve. Refer to separate manuals for information regarding installation, operation, and maintenance of additional features such as actuators, positioners, special accessories, fail-safe systems, etc. Only qualified persons should install, operate, and maintain an Optimux OpVee valve. Any questions about these instructions should be directed to your Optimux sales office or sales representative before proceeding.

This publication does not contain information on Optimux positioners. Refer to the appropriate manual for information on positioner installation, operation, maintenance, and calibration.

WARNING: Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.

Note: Selecting the proper fastener material is the responsibility of the customer. Typically, the supplier does not know what the valve service conditions or environment may be. Optimux's standard bolting material is B7/2H. Grade 660 bolting material is standard with stainless steel or NACE valves. The customer therefore must consider the material's resistance to stress corrosion cracking in addition to general corrosion. As with any mechanical equipment, periodic inspection and maintenance is required. For more information about fastener materials, contact your local Optimux representative or factory.

Unpacking

1. While unpacking the valve, check the packing list against the materials received. Lists describing the valve and accessories are included in each shipping container.
2. When lifting the valve from the shipping container, position lifting straps to avoid damage to tubing and mounted accessories. Valves up through 8-inch may be lifted by the actuator lifting ring. On larger valves, lift the valve using lifting straps or hook through the yoke legs and outer end of the body.

> ⚠ **WARNING: When lifting a valve/actuator assembly with lifting straps, be aware the center of gravity may be above the lifting point. Therefore, support must be given to prevent the valve/ actuator from rotating.**

3. In the event of shipping damage, contact your shipper immediately.
4. Should any problem arise, contact your Optimux representative.

INSTALLATION

1. Before installing the valve, clean the line of dirt, scale, welding chips, and other foreign material. Clean the gasket surfaces thoroughly to ensure leak-proof joints.
2. Install the valve in line. Check flow direction to be sure valve is installed correctly. Be certain flanges are aligned correctly. Correct alignment of flanges is important to prevent possible future leakage.

> ⚠ **WARNING: Keep hands, hair, clothing, etc. away from the rotating ball and the seal when operating the valve.**

3. If the valve is supplied with an actuator and positioner, connect the air supply and instrument signal lines. Two connections are marked for the air supply and for the instrument signal. Most Optimux actuators are suitable for 80 to 150 PSI air supply. An air regulator is not required unless the supply pressure exceeds the maximum allowable actuator PSI (indicated on cylinder). An air filter is recommended unless the supply air is unusually clean and dry. All connections must be free of leaks.

> ⚠ **CAUTION: On valves equipped with air filters, the air filter bowl must point down; otherwise, the air filter will not perform properly.**

4. Apply the recommended torque values to the line flange bolting for proper sealing (see Table I).

Quick-Check

Prior to startup, check the control valve by following these steps:

1. Check for full stroke by making the appropriate instrument signal change. Observe the position indicator plate mounted on the actuator transfer case. The indicator plate should change position in a smooth, rotary fashion.

> ⚠ **CAUTION: The Optimux valve shaft is not designed to take full torque load of the actuator. If the ball were to seize and full torque continued, the shaft could twist and/or shear.**

2. Check all air connections for leaks. Tighten or replace any leaky lines.
3. Evenly tighten the packing nuts to slightly over finger-tight.

⚠ CAUTION: Do not over-tighten packing nuts. This can cause excessive packing wear and high shaft friction, which may impede shaft rotation. After the valve has been in operation for a short time, check the packing nuts to make sure they are properly torqued (readjust if necessary). If packing box leaking occurs, tighten the packing nuts only enough to stop leakage.

4. To observe the valve failure mode in case of air failure, position the valve to mid-stroke and shut off the air supply to the actuator or disconnect the instrument signal to the positioner. Observe the actuator indicator plate, it should move to either fail-open or closed position. If incorrect, refer to the "Actuator Action Reversal" section in the appropriate Actuator Instruction Manual.

MAINTENANCE

At least once every six months, check for proper operation by following the preventive maintenance steps outlined below. These steps can be performed while the valve is in line and, in some cases, without interrupting service. If an internal problem is suspected with the valve, refer to the "Assembly and Disassembly" section.

1. Look for signs of gasket leakage through the body and line flanges. Tighten flange bolting if necessary. (See Table I for specifications.)
2. Note if any corrosive fumes or process drippings are damaging the valve.
3. Clean valve and paint areas of severe oxidation.
4. Check packing box bolting for proper tightness. Packing nuts should be tightened as necessary to prevent stem leakage.

Valve Size (inches)	ANSI Class Rating	Bolt** Length (inches)	Torque* (ft. lbs.)	
			Low Strength	Intermediate Strength
1	150	2.5	23	61
	300	3.0	46	122
	600	3.5	46	122
1 1/2	150	2.75	23	61
	300	3.5	82	218
	600	4.25	82	218
2	150	3.25	46	122
	300	3.5	46	122
	600	4.25	46	122
3	150	3.5	46	122
	300	4.25	82	218
	600	5.0	82	218
4	150	3.5	46	122
	300	4.5	82	218
	600	5.75	132	353
6	150	4.0	82	218
	300	4.75	82	218
	600	6.75	199	531
8	150	4.25	82	218
	300	5.5	132	353
	600	7.5	296	789
10	150	4.5	132	353
	300	6.25	199	531
	600	8.5	420	1119
12	150	4.75	132	353
	300	6.75	296	789
	600	8.75	420	1119

Table I: Flange Bolting Specifications

*Torque values are recommended for low and intermediate strength bolting per ANSI B16.5 ¶5.3.2. Higher torques may be used with high strength bolting (ANSI B16.5 ¶5.3.1). In all cases the user must verify the selected bolting's ability to seat the joint under expected operating condition. Long thru-bolted joints generally require higher strength bolting and torque values than shorter flanged bolting depending on operating conditions.

**Lengths are based on ANSI B16.5 stud bolts and raised face ends.

⚠ CAUTION: Do not over-tighten packing. This can cause excessive packing wear and high shaft friction, which may retard shaft rotation.

5. If the valve is supplied with a lubricator, check lubricant supply and add lubricant if necessary.

6. If possible, stroke valve and check for smooth, full-stroke operation by observing the position indicator plate mounted on the transfer case. Unsteady movement of the plate could indicate an internal valve problem.
7. If a positioner is included, check its calibration by observing the gauges and the actuator position indicator plate. Make sure the positioner is calibrated to the correct range.
8. If an actuator is attached, refer to the appropriate maintenance instructions for preventive maintenance on it. If possible, remove the air supply and observe the actuator stroke plate for correct fail-safe action.
9. Be sure that all valve accessories, brackets and bolting are securely fastened.
10. Clean any dirt or other foreign material from the exposed portion of the valve shaft.
11. If an air filter is supplied, check and replace cartridge if necessary.

Valve Removal From Line

If an internal problem is suspected with the valve and disassembly is required, remove the valve from the line by proceeding as follows:

> ⚠ **WARNING: Depressurize line to atmospheric pressure, drain all process fluids and decontaminate the valve (if caustic or hazardous materials are present).**

1. Attach a hoist or some means to support the valve.
2. Remove line bolting. Do not attempt to pry line flanges apart by pushing or pulling on the valve or actuator.
3. Slide the valve carefully from the line. To avoid damage to the gasket surfaces, do not twist the valve.
4. After the valve is completely removed from the line, slowly relieve air pressure from the actuator.

Actuator Removal

Three to twelve inch Optimux valves are designed to be disassembled without removing the Optimux actuator, however, removing the actuator is recommended. Refer to the appropriate actuator installation, operation, maintenance instructions, and proceed as follows:

1. Support the actuator assembly before disconnecting it from the body assembly.
2. Loosen the actuator adjusting screw to release the spring compression.
3. On Optimux actuators with a clamped lever-arm design, remove the actuator transfer case cover bolts, carefully pry or slide the cover plate from the transfer case, then loosen the linkage bolt.
4. Remove the bolts connecting the yoke to the body subassembly.
5. Slide the entire actuator assembly off the shaft. On Optimux actuators with a clamped lever-arm design, it may be necessary to wedge the splined lever arm apart to loosen it from the shaft splines.

ASSEMBLY AND DISASSEMBLY

Body Disassembly

It is not necessary to remove the actuator from the body assembly to disassemble 3 to 12-inch bodies, however, it is recommended. On valves with the clamped lever-arm design it is necessary to loosen the valve shaft from the actuator prior to body disassembly. Refer to Figures 1, 2 and 5 and proceed as follows:

1. Remove the seal retainer and seals.

   Screw-in style – This requires loosening the retainer by turning it counterclockwise and removing it from the body. (A special cross-wrench tool may be ordered from

the factory. See Table IV.) Remove the metal seals. Remove the soft seal if applicable.

Lock-ring style – Some valve designs have a retaining ring held in with set screws. To remove it, loosen the set screws in the lock ring, then remove the retaining ring, lock ring and finally the seal retainer. If the lock ring set screws will not loosen, the retaining ring can be forced out using a flat-headed screwdriver and pliers. Remove the seals.

2. Remove the gland flange by removing both packing nuts. It is not necessary to remove the studs.
3. **On rotating post designs:** Drive both the shaft and post pins into the center of the shaft and post until the outward end of the pin clears the ball. Be careful to not damage the shaft or post. The pins can then be punched out of the shaft and post when they are removed from the valve. Carefully remove the shaft plug and O-ring and finally the rotating post. (Inserting a bolt in the jack screw hole, tapped in the post, will help in removing the post.)

   On stationary post designs: Drive the shaft pin into the center of the shaft until the outward end of the pin clears the ball splines. Be careful to not damage the shaft. The pin can then be punched out of the shaft after the shaft is removed. Remove the anti-rotation clamp. Remove the post and the post O-rings.
4. On 3 through 12-inch designs, remove the shaft by pulling it out through the outboard end of the body. On 1 through 2-inch designs, remove the shaft by pulling it out through the inboard end of the body

⚠ CAUTION: Take special care to not damage the splined end of valve shaft during disassembly.

5. Rotate the ball inside the body so the non-splined end of the ball is toward the back port of the valve and remove the ball straight out of the body. If necessary, on stationary post designs remove the post bearing from the ball by pushing it out with a press.

⚠ CAUTION: Be extremely careful not to gall or scratch the sealing surface of the ball when removing it from body. Scratches may later cause excessive leakage and seal wear.

6. Push the packing and bearings out of the body using a bronze dowel with the appropriate diameter. Push the packing out of the body from the center of the valve.

Body Reassembly

To reassemble the body subassembly, refer to Figures 1 or 2, 3, 4, and 5 and proceed as follows:

1. Clean all parts and replace all O-rings and soft seals.
2. Check the ball sealing surface to make sure it is smooth and free of scoring and scratches.

⚠ CAUTION: Damaged or dirty seal surfaces can cause excessive seat wear and high torque requirements. Damaged balls should be replaced.

3. Inspect the shaft and post for scratches or galled surfaces. For maximum performance, Optimux shafts and posts are machined to a very smooth finish. If damage exists, replace the shaft or contact the factory representative.

***Note:* Ball and shaft are interchangeable. Replacing the ball does not require replacing the shaft.**

4. It is recommended to use a press to install new bearings in the body and/or ball. When correctly installed, the ends of the body bearings should be flush with the inside of the body.
5. Position the ball in the body by lowering it, splined hole first, into the back of the body. Rotate the ball surface toward the front of the body so that the splined hole is toward the packing box.

> ⚠ **CAUTION: Be extremely careful not to gall or scratch the sealing surface of the ball when replacing it in the body. Scratches may later cause excessive leakage and seal wear.**

6. On 3 through 12-inch designs, insert the shaft through the outboard end of the body and through the splined hole of the ball into the packing box. On 1 through 2-inch designs, insert the shaft through the inboard end of body and through the packing box into the splined hole of the ball. (For 1-inch body designs, the thrust bearing, packing spacer, packing, and packing follower must be inserted before installing the shaft.)
7. Position the shaft so that the pin hole in the shaft and ball are in alignment. (Some shafts have a half circle mark and line on the end. Align the line mark with the pin and the half circle symbol with the ball.) Install the shaft pin and drive it firmly into place so that half is in the ball and half in the shaft.
8. **On rotating post designs:** Insert the post through the outboard end of the body and into the hole of the ball. (For 1 through 2-inch valves sizes, insert thrust bearing before installing post.) Position the post so that the pin hole in the post and ball are aligned. (For 6 through 12-inch valve sizes, be certain that the ball pin hole is aligned with the smallest diameter pin hole in the post. Some posts have a half circle mark on the end. Align this mark with the ball.) Install the post pin and drive it firmly into place so that half is in the ball and half is in the post. Torque the plug per Table II.

   On stationary post designs: Ensure that the post and post threads are well lubricated with a high temperature bearing grease (or as required by the application) before installation. Replace the post O-ring and reinstall the post. Torque the post per Table II. Install the anti-rotation clamp kit.
9. Slide the thrust bearing, packing spacer, packing, and packing follower over the splined end of the shaft and into the body. Typical packing configurations are shown in Figure 3. (1-inch designs refer to Step 6.)

***Note:* Always use new packing whenever rebuilding the packing box.**

Valve Size (inches)	Stationary Design Post	Rotating Design Shaft Plug
1, 1 1/2	N/A	50
2	175	85
3, 4	300	150
6,8	500	250
10, 12	600	300

Table II: Post/Shaft Plug Torques (ft.-lbs.)

> ⚠ **CAUTION: Since the sealing on V-ring packing takes place at the feather edge, it is imperative to avoid damage to that edge.**

10. Reinstall the gland flange and packing nuts and leave loose.

⚠ CAUTION: Do not over-tighten packing. This can cause excessive packing wear and shaft friction, which may impede shaft rotation.

11. Place the valve on a flat surface with the threaded (retainer) port facing up and pull the shaft toward the actuator until it is fully against the thrust bearing.
12. On 3 through 12-inch designs, make certain the ball surface is facing up and position the ball as close as possible in the center of the body's inside diameter. (The pinned connection between the ball and shaft is not a tight connection; the design includes a considerable amount of axial play between the ball and shaft.)

    On 1 through 2-inch designs, make certain the ball surface is facing up and pull on the shaft until the post is fully against the thrust bearing. (The ball does not self center. There will be no axial play between the ball and shaft.)
13. Replace the soft and/or metal seal rings, as applicable to the application. (Refer to Figure 4.)

    For soft seal applications: Insert the soft seal ring, followed by the two metal seal rings into the body.

    For metal seal applications: Insert the two metal seal rings into the body. (For 1-inch designs, there is only one seal ring.)
14. With screwed-in retainer designs, replace the O-rings in the retainer (except on high temperature valves, which do not use O-rings). Refer to Figure 1 or 2. Lubricate the retainer threads and rings and reinstall the retainer in the front of the body. Torque the seal retainer according to Table III.
15. On some 10 and 12-inch valves where the retainer is held in place with set screws, reinsert the lock ring into the body with the words “Ball Side” facing toward the ball. The lock ring has “Ball Side” and “Port Side” marked on it. Insert the retaining ring into the inner groove of the body, being certain it is fully seated. Tighten the lock ring setscrews evenly to a torque of 225 inch-pounds.
16. After the seal retainer is in tight, tighten the packing nuts just over finger-tight. Packing nuts should be tightened as necessary to prevent stem leakage.

Valve Size (inches)	Torque Value (ft.-lbs.)	Valve Size (inches)	Torque Value (ft.-lbs.)
1, 1½, 2	150-175	8, 10	650-700
3	250-300	12	900-950
4, 6	550-600		

Table III: Screwed-in Retainer Torques

⚠ CAUTION: Do not over-tighten packing. This can cause excessive packing wear and high shaft friction, which may retard shaft rotation.

REMOUNTING ACTUATOR

Before mounting an Optimux actuator on the valve body, verify that the ball rotation matches the actuator rotation and complies with the air failure requirements. Procedure for mounting the actuator is as follows:

1. Slide the entire actuator assembly onto the shaft. (If necessary on Optimux actuator designs with clamped lever-arm design, wedge the splined lever arm apart to loosen it on the shaft splines.)
2. Bolt the yoke to the valve body.
3. Position the actuator lever arm on the shaft so the actuator stem is centered in the transfer case.
4. On clamped lever-arm actuator designs, firmly tighten the linkage bolt. Bolt the transfer case cover plate into place.

5. Align the stroke indicator plate on the end of spline lever so it accurately indicates ball position.

CAUTION: On clamped lever-arm actuators, never apply air to the actuator without the cover plate installed; otherwise, the unsupported shaft may sustain damage.

6. Install the valve in the line as outlined in the “Installation” section.

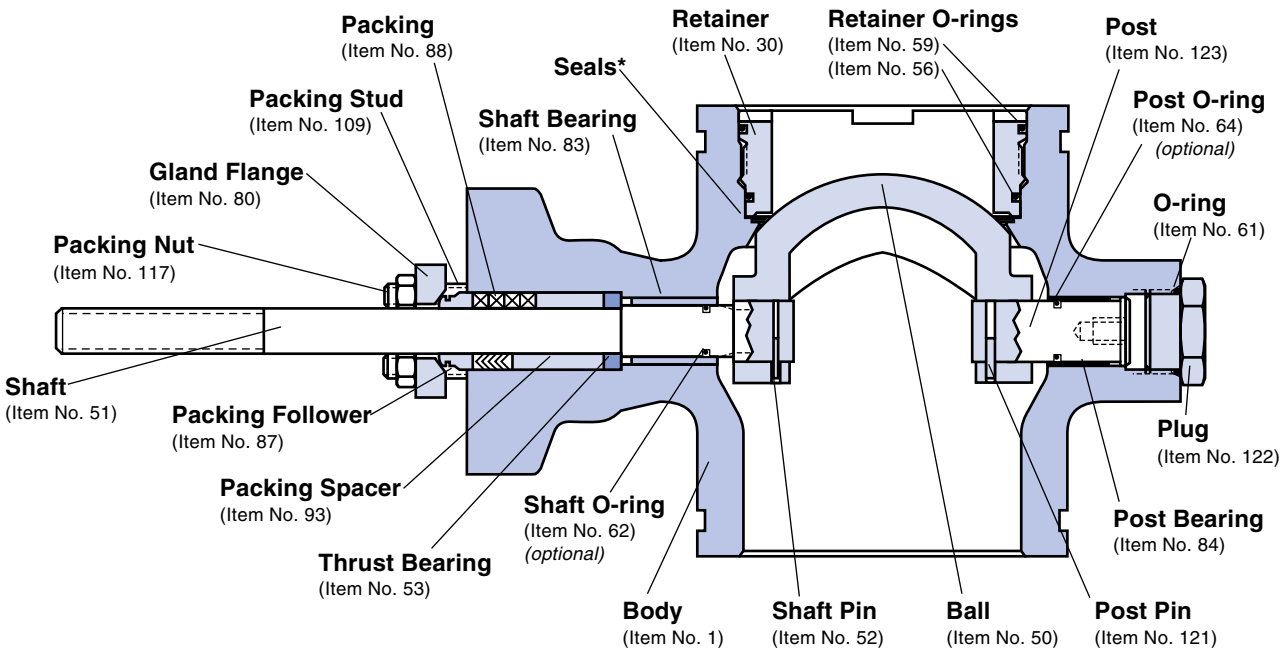
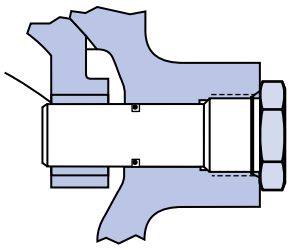


Figure 1: 3 through 12-inch OpVee Body Assembly with Rotating Post Design

(*See Figure 4 for seal configurations and item numbers.)

Note: *Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.*



Stationary Post Design

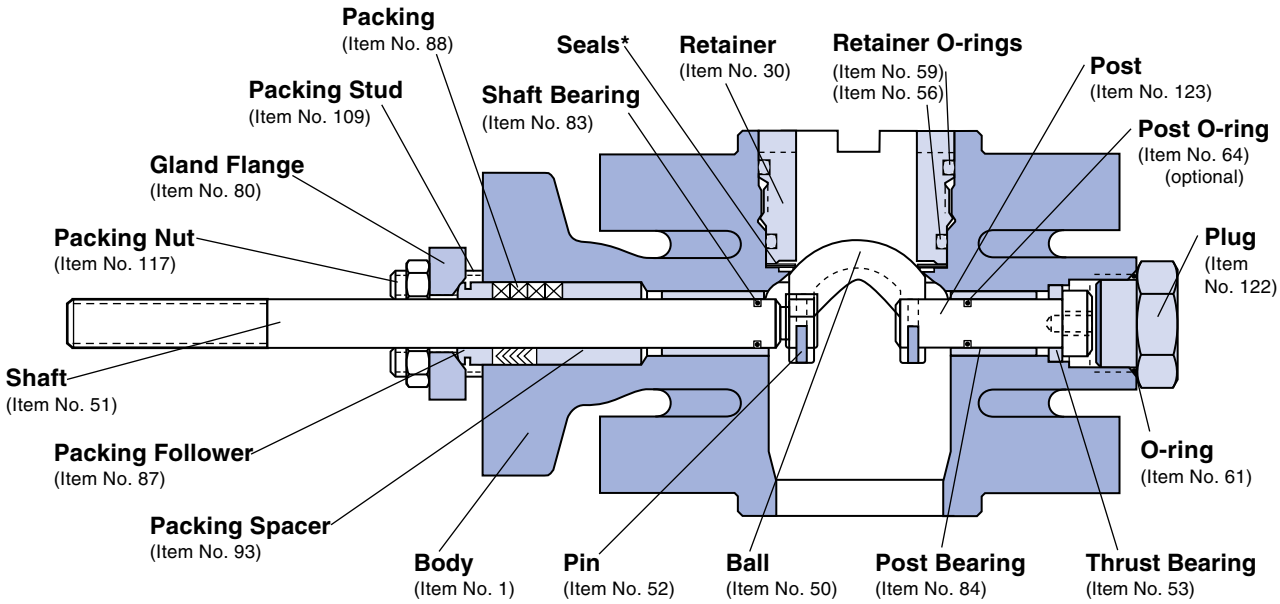


Figure 2: 1 through 2-inch OpVee Body Assembly

(*See Figure 4 for seal configurations and item numbers.)

Note: *Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.*

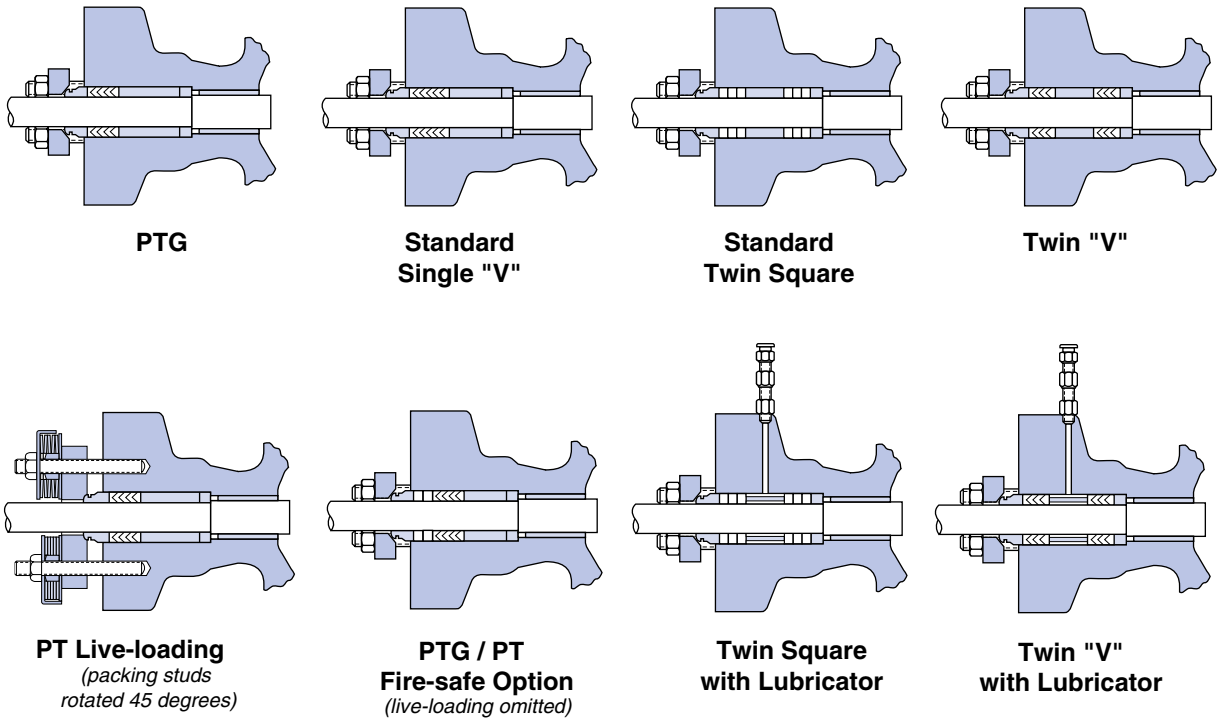


Figure 3: OpVee Packing Configurations

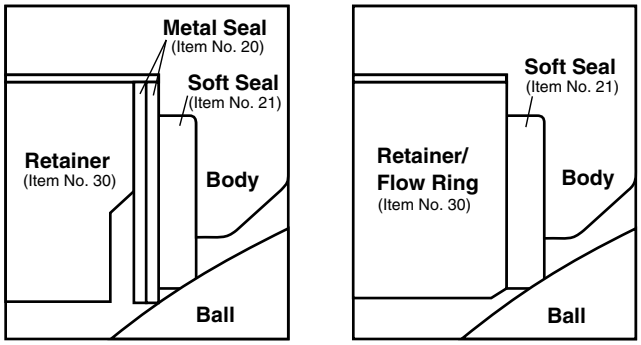


Figure 4: Soft Seals

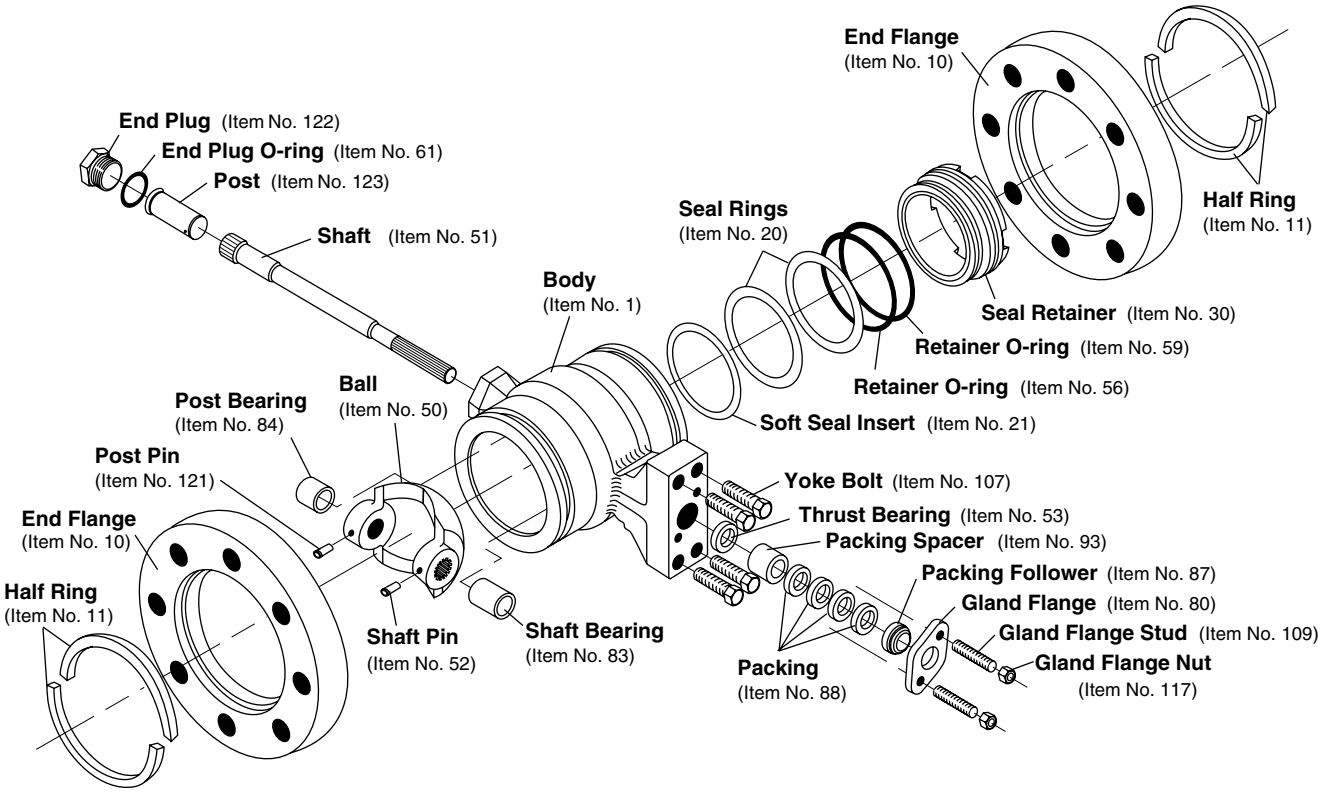
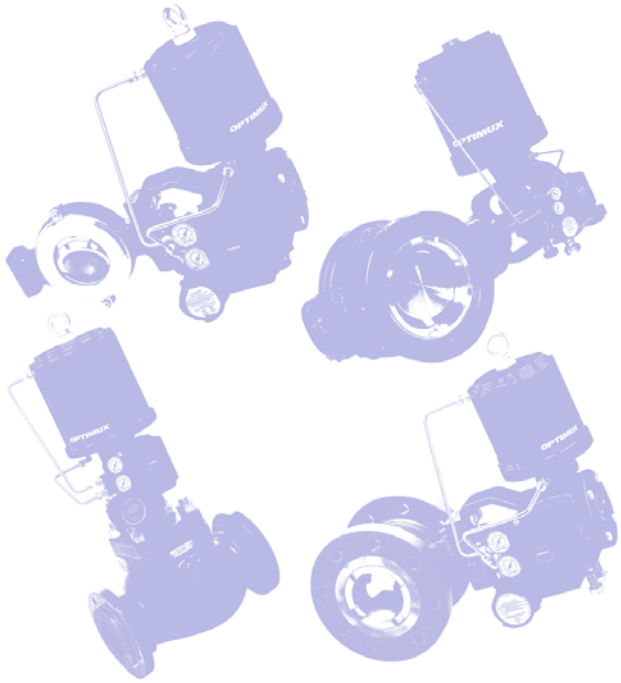


Figure 5: Exploded Body Subassembly, 3 through 12-inch Rotating Post Design

Note: *Item numbers correspond directly to the valve's bill of material. Refer to it for specific part numbers.*

Troubleshooting OpVee Vee Ball Valve

Failure	Probable Cause	Corrective Action
Valve moves to failure position, excessive air bleeding from transfer case	1. Failure of actuator stem O-ring 2. Failure of sliding seal assembly	1. Replace actuator stem O-ring 2. Repair or replace stem adapter/ linkage assembly
Jerky shaft rotation	1. Overtightened packing box 2. Improper adjustment of lever arm on shaft causing arm to contact transfer case, thus failing to convert torque 3. Actuator cylinder wall not lubricated 4. Worn piston O-ring allowing piston to gall on cylinder wall 5. Worn actuator stem O-ring causing actuator stem to gall on stem collar 6. Worn (or damaged) thrust bearing, shaft bearing or packing followers	1. Retighten packing box nut to slightly over finger-tight 2. Readjust lever arm; see actuator maintenance instructions 3. Lubricate actuator cylinder wall with silicone lubricant 4. Replace O-ring; if galling occurred, replace all damaged parts 5. Replace O-ring; if actuator stem is galled, replace it 6. Disassemble and inspect parts; replace any worn or damaged parts
Excessive leakage through seal	1. Improper adjustment of external stroke stops on actuator 2. Worn or damaged seal 3. Damaged ball sealing surface 4. Improper handwheel adjustment acting as limitstop 5. Ball not centered in body I.D.	1. Adjust the external stroke stops; see maintenance instructions 2. Replace seal 3. Replace ball (and shaft, if worn) 4. Adjust handwheel until ball seals properly 5. Center ball; replace damaged seals
Leakage through line flanges	1. Dirty line gasket surfaces 2. Worn gaskets 3. Improper torque on line flanges 4. Flange or pipe misalignment	1. Clean gasket surfaces and reinstall valve 2. Replace gaskets 3. Tighten line flanges evenly and completely (see Table I for proper torque) 4. Realign flanged ends with piping
Leakage through packing box	1. Loose packing box nuts 2. Worn or damaged packing 3. Dirty or corroded packing box	1. Tighten packing box nuts over finger-tight 2. Replace packing 3. Clean body bore, stem, replace packing
Valve slams, won't open, or causes severe water hammer	1. Improper valve installation	1. See step 2 in the "Installation" section and correct flow direction
Shaft rotates, ball remains open or closed	1. Broken shaft	1. Replace shaft
Actuator operates, shaft does not rotate	1. Broken internal actuator parts	1. Refer to appropriate actuator maintenance instructions



Optimux customers should be aware that Optimux products might be used in numerous applications under a wide variety of industrial service conditions. Although Optimux can (and often does) provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation and maintenance of Optimux products. The purchaser/user should read and understand the Product Instruction Manual (PIM) included with the product, and train its employees and contractors in the safe use of Optimux products in connection with the specific application.

While the information and specifications presented in this literature are believed to be accurate, they are supplied for informative purposes only and should not be considered certified or as a guarantee of satisfactory results by reliance thereon. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding any matter with respect to this product. Because Optimux is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice. Should any question arise concerning these provisions, the purchaser/user should contact TRIMTECK, LLC at any of its worldwide operations or offices.

For more information, contact:

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FORM # PIM0910

OPTIMUX® CUSTOM FABRICATED VALVES

Description

In addition to our rugged, versatile line of standard Optimux® OpGL™ Globe Control Valves, which are typically built with cast bodies in stainless or carbon steels, Trimteck also excels at engineering, designing, and manufacturing custom sliding stem valves with bodies fabricated from bar stock. We call these fabricated bar stock valves Optimux OpGL-XT Control Valves.

Why use a fabricated OpGL-XT?

- **Quick Lead Time –** fabricated OpGL-XT bar stock bodies are not subject to foundry delays
- **Availability of Exotic Alloys –** no limitation on construction material, which allows quick turnaround of valves fabricated from uncommon alloys
- **Availability of High Pressure Valves –** the OpGL-XT can be machined up to ANSI Class 4500; again, with a faster turnaround than cast valves
- **Customizability –** body styles, end connections, and face-to-face dimensions can all be customized as required
- **Severe Service –** available with an array of severe service trims including venturi seats for flashing service - as well as oversized wall thickness for noise abatement and added durability

Case Studies

Production of Polyethylene Terephthalate (PET)
Level Control for Titanium Dioxide Flash Tank

Location: DAK Americas
North Carolina, USA

Requirements: A custom-built level control valve with an inverted plug; body to be built entirely in Grade 2 Titanium with Grade 7 Titanium welded inlays to protect against the extremely erosive effects of TiO_2.

Solution: Working closely with the customer, Trimteck designed a 3" CL600 X 10" CL300 OpGL-XT Angle Body Control Valve, with an inverted plug and catch-plate. Manufacturing of the valve took place under a very tight delivery schedule, and Trimteck was able to meet it in time for the customer's shutdown. All wetted components were machined from Grade 2 Ti bar stock, and treated with a Grade 7 Ti welded inlay.

Photo: 3" CL600 X 10" CL300 Titanium OpGL-XT Angle Body Level Control Valve

Photo (right): 2" CL300 316SS OpGL-XTSB Cryogenic Angle/Split Body Valve

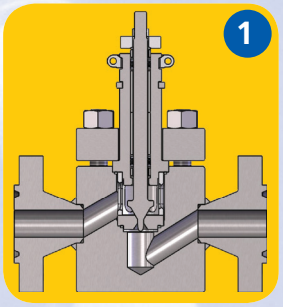
Rocket Propulsion System Testing
Bubble-tight Shutoff of Liquid Oxygen in Chemical Steam Generator

Location: NASA Stennis Space Center
Mississippi, USA

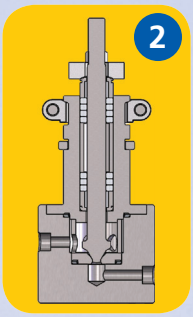
Requirements: A cage-less cryogenic globe valve for quick, safe, and repeatable Class VI shutoff of LOX in a new CSG system used by NASA to create a vacuum chamber for rocket testing.

Solution: In close collaboration with NASA engineers, Trimteck designed and manufactured QTY27 custom 2" CL300 316SS OpGL-XTSB Cryogenic Angle/Split Body valves fitted with OpTK piston-cylinder actuators. The rugged, fabricated split body configuration allowed for the seat to be held in place without the need for a retainer or a cage – a requirement for most LOX valves at Stennis Space Center. The force applied by six equidistant bolts holding the upper and lower body segments together ensures that the seat is "sandwiched," subjected to even pressure, and held in place to reduce the effects of line torsion or vibration on the seal. Tight shutoff was achieved using our standard soft wafer seat insert that is easily and inexpensively replaceable when servicing the valve.

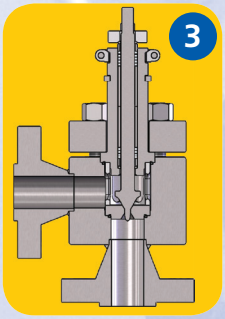
OpGL-XT Bar Stock Body Styles



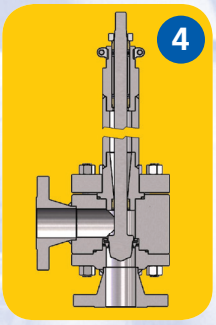
In-Line Globe
Standard T-Style globe body configuration accommodates in-line piping systems



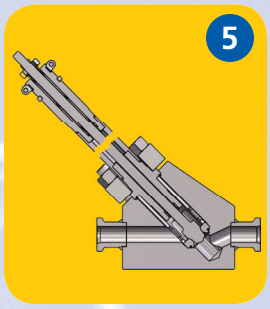
Offset Globe
If piping can be offset, this allows for a more economical machining process and thus a more economical valve



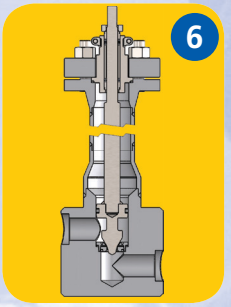
Angle Body
Often employed to displace the effects of cavitation; and is available with an extended venturi seat ring to protect the outlet passage



Angle Split Body
Two body segments lend this configuration in-line serviceability of trim, and eliminate the need for a retainer or cage



Y-Body
Nearly straight-through flow passage is less restrictive than standard globe valves, which helps reduce turbulence and vibration

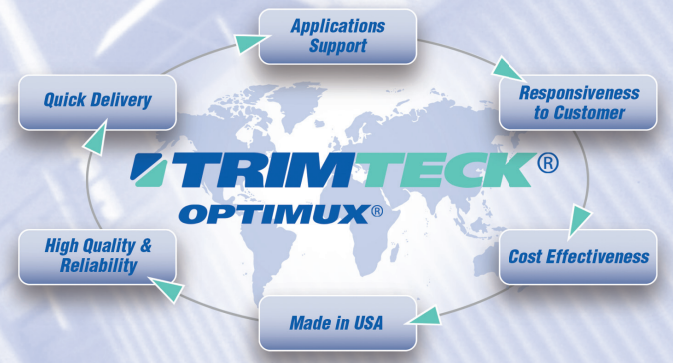


Cold Box
Welded cryogenic bonnet extension design permits easy access and removal of the trim from outside the cold box

About Trimteck

Trimteck is a NASA VDB-approved, ISO 9001-2008-certified U.S. company (Registration No. 2012-98243) with over thirty years of experience engineering, manufacturing, and marketing high-quality, cost-effective flow, pressure, and temperature control solutions and equipment for critical processes, and our products are currently helping customers safely improve quality, optimize throughput, and reduce emissions and energy costs across an array of industries in more than 42 countries.

We manufacture a comprehensive line of control valves – and variety of actuators, positioners, severe service trims, and other accessories – that our applications engineers and representatives use to solve even the most complex flow control problems quickly and economically.



nqa. ISO 9001 Registered

Products in compliance with:
ASME B16.34
ANSI/ISA-75.05.01-2000 (R2005)

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TRIMTECK®
OPTIMUX®

OpGL™ Globe Control Valve

TECHNICAL BROCHURE

OpGL™
Globe Control Valve

Introduction

The OpGL Globe Control Valve has been engineered to provide superior control and on-off performance while permitting easy, fast, and cost-effective maintenance. Unlike diaphragm-operated, cage-guided control valves, the Piston Cylinder-actuated, top-guided OpGL™ provides stiffness and maintains high positioning accuracy – making for the world's most rugged, efficient, and accurately responsive control valve.

Sections **Page**

OpGL Globe Control Valve Specifications

Table1: OpGL Globe Control Valve Specifications	
Type	Globe Valve, Sliding Stem
Sizes (NPS)	½" to 24"
Body Styles	Globe, Angle, 3-Way, Y-Pattern, Vacuum Jacketed, Steam Jacketed, Fabricated (XT)
Body Materials	Carbon Steel, Stainless Steel, Chrome Moly, Alloy, Others
Pressure Classes (ASME/ANSI)	CL150 to CL4500
Shutoff Classes (ANSI)	Class IV, V, VI
End Connections	RF Integral Flange, NPT, RTJ, Buttweld, Socketweld, Grayloc, SAE AS5202, Others
Service	General, Special (Low Flow, Corrosive, Erosive, Dirty, Zero Fugitive Emissions), Severe (Cavitation, Noise, Flashing)
Operating Temperature	Standard, High, Cryogenic
Flow Characteristics	Equal Percent, Linear, Bi-Linear, Quick Open, Custom
Industries	Power, Aerospace & Defense, Oil & Gas, Chemical/Petrochemical, Industrial Gases, Refining, Food & Beverage, Metals & Mining, Pulp & Paper
Certifications/Norms	ASME, PED, ANSI/ISA, CRN, NACE

OpGL™
Globe Control Valve

Features & Advantages

Precise Control – Broad range of control through a top-guided, unbalanced, single-piece plug with flow characterization built in to the geometry of the plug head.

Exceptional Shutoff Standard – ANSI Class V metal-to-metal shutoff in process achieved with unique plug and seat ring design. ANSI Class VI available in soft seated configuration.

High Thrust Fast-Acting Piston Actuator – More accurate and quicker than diaphragm actuators, and offering a smaller and lighter footprint – ideal for skid-mounted process equipment.

Maintainability – Top-entry design facilitates maintenance, even though the valve has a much longer MTBS Cycle than competing diaphragm-actuated valves.

Range of Trim Configurations – From micro-flows to full capacity trims, and everything in between, the OpGL can be sized to optimally control according to your specific process parameters. A full line of anti-cavitation and noise abatement trims available.

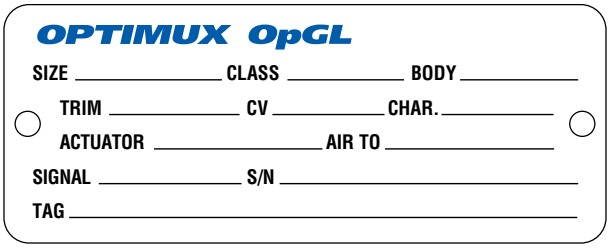

Figure 1: OpGL Stainless Steel Nameplate

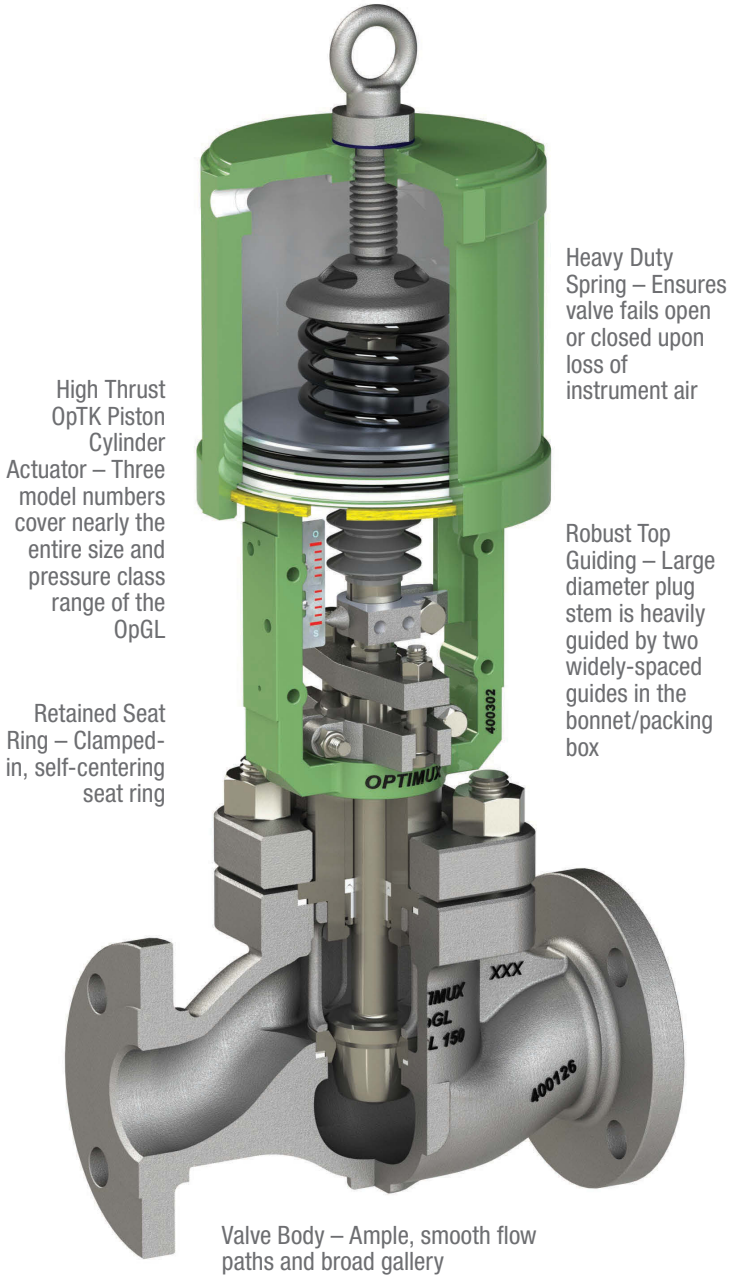

Figure 2: OpGL Globe Control Valve

OpGL™
Globe Control Valve

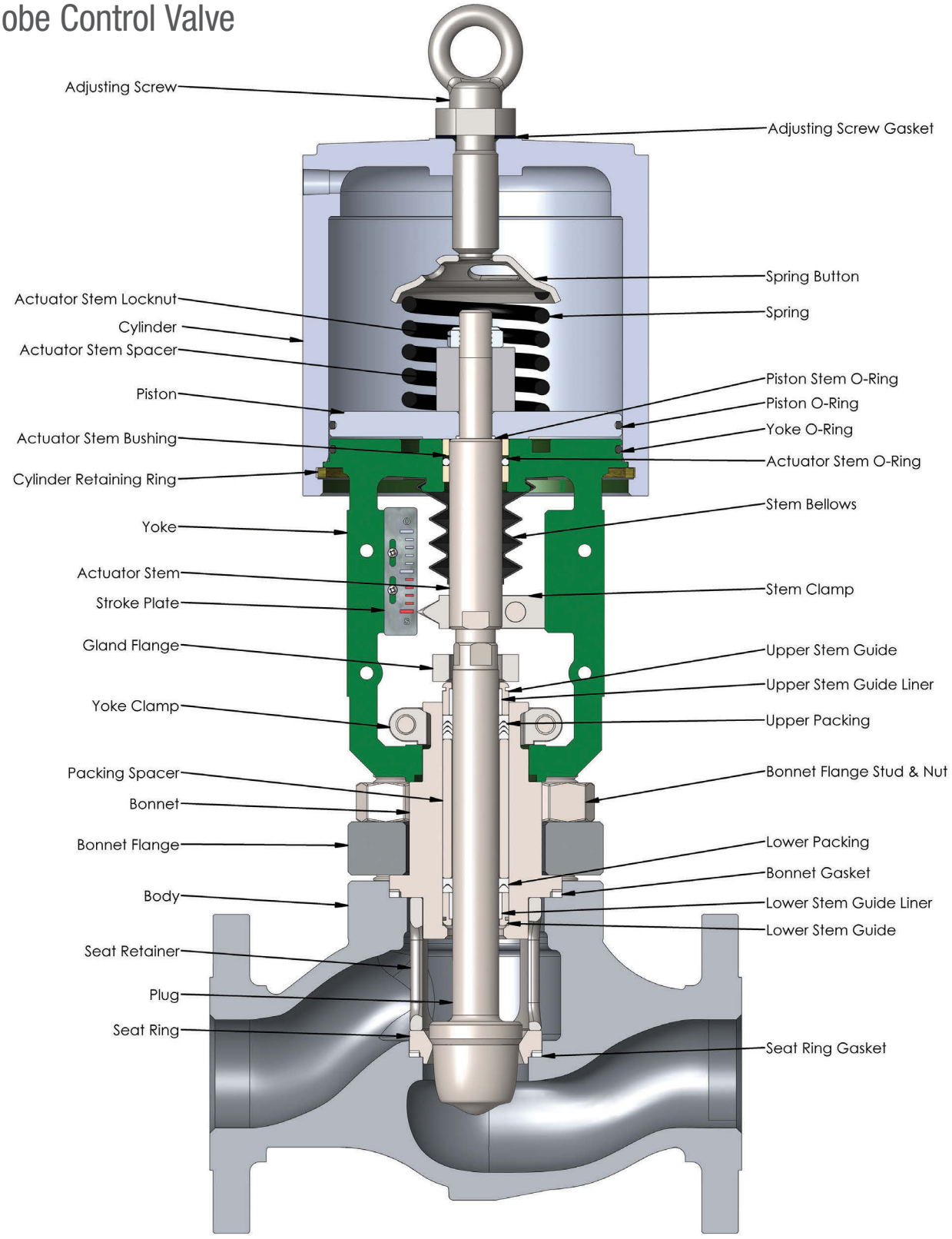

Figure 3: OpGL Globe Control Valve Component List

OpGL™
Globe Control Valve

OpTK™ Pneumatic Piston Cylinder Linear Actuator

Figure 4: OpTK Piston-Cylinder Actuator

The Optimux OpTK Piston-Cylinder Linear Actuator is a powerful, high-performance pneumatic actuator that provides positive throttling or on-off operation for automatic control valves and is a key element of the OpGL Globe Control Valve's performance and shutoff characteristics. The cylinders are double acting and designed for instrument air supply pressures of up to 150 psi (10.3 Bar) – allowing the OpTK to generate substantial thrust from a compact footprint.

This actuator is fully field reversible for air-to-open or air-to-close action without requiring additional parts; a spring provides fail-safe operation. The positioner supplies air to both sides of the piston, providing exceptionally stiff, precise movement together with very high frequency response.

Table 2: OpTK Piston Cylinder Actuator Specifications	
Actuator Type	Pneumatic Piston-Cylinder
Motion	Linear
Base Valve Type	Globe, Angle, 3-Way, Custom Engineered/Specialty
Air Supply (PSI)	30 to 150
Piston Size (in2)	25, 50, 100, 200, 300
Failure Position	Air-to-Open, Air-to-Close, Fail-Last
Stroking Speed	Less than 1 Second
Ambient Temperature Ranges (F)	-40˚ to 350˚ Note: For temperatures above 180F, Viton O-Rings are required. For temperatures below -40 Fluoro-Silicon O-Rings are required.
Options	Side-Mounted Hand Wheel, Top-Mounted Hand Wheel, Limit Stop, Lever Arm
Positioner Mounting	Trimteck HPP Series®, ABB®, Siemens®, Emerson®

Table 3: OpTK Piston Cylinder Actuator Standard Materials of Construction	
Yoke	A216 WCB Carbon Steel A351 CF8M Stainless Steel
Cylinder	A356 Gr T6 Aluminum A351 CF8M Stainless Steel
Piston	6061 T6 Aluminum Alloy
Spring Button	A351 CF8M Stainless Steel
Adjusting Screw	A351 CF8M Stainless Steel
Stem	F316 Stainless Steel
Spring	Alloy
Retaining Ring	Zinc Plated Alloy

OpGL™
Globe Control Valve

OpTK™ Features and Advantages

High thrust – 150 psi (10.3 Bar) operating pressure allows substantially higher thrust than comparable diaphragm actuators, which provides tighter valve shutoff.

High frequency - double-acting configuration responds quickly to signal changes response

Compact substantially – lighter and more compact than comparable linear diaphragm actuators, for a smaller overall valve footprint and easier installation and maintenance.

Versatile - standard actuator sizes 25, 50 and 100 will handle thrust requirements for over 95% of process applications. Larger sizes are available for special applications.

Fewer parts - 1/3 fewer parts than diaphragm linear actuators. Wear parts cost 1/10 of those for diaphragms, and less inventory is required to maintain actuators.

Dynamic positioning – supply pressure is sent to both sides of the piston for stiff, precise operation. Air volume between the piston and the bottom of the cylinder provides powerful pneumatic stiffness, allowing a high pressure drop – without plug slamming.

Field reversible failure mode is easily reversed without additional parts.

Fail-safe spring – internal spring provides fail-safe operation in the event of air system failure. Universal spring bench set is not required.

Stiff operation – supply pressure is sent to both sides of piston for stiff and precise actuator operation without hunting hysteresis.

Durable components – high quality materials require very little maintenance, no diaphragm to rupture.

Simple maintenance – periodic maintenance is easy to perform, since the spring cylinder actuator only requires the removal of two parts to access all internal parts.

Low air consumption – cylinder design uses less supply air than comparable diaphragm actuators.

Longer strokes – Size 25 spring cylinder linear actuator has a 1 1/2 -inch (38 mm) stroke, in contrast to a 3/4 -inch (19 mm) stroke on a comparable linear diaphragm actuator. Larger actuators have similar comparisons. Stroke lengths are available up to 24-inches.

OpGL™
Globe Control Valve

Bonnet Types

Standard Bonnet – The OpGL's standard bonnet is constructed of the same material as the body for general service applications. Bonnet material selection is dependent on process media and pressure.

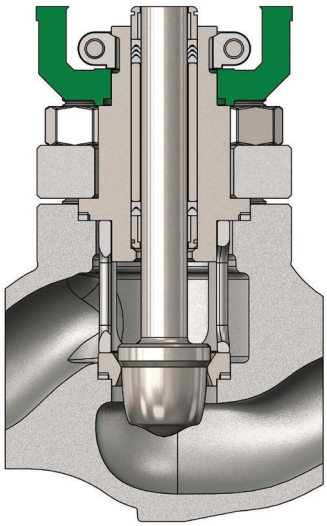

Figure 5: Standard Bonnet

Extended Bonnet – The extended bonnet is designed to protect the packing and top works of the valve from high process temperatures.

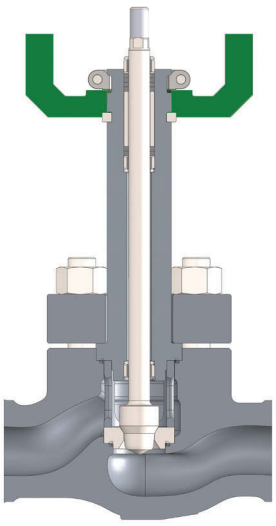

Figure 6: Extended Bonnet

Cryogenic Bonnet – Trimteck's cryogenic bonnet features a chamber that fills with the gasified process fluid to form a thermal barrier to protect the packing from the low process temperatures.

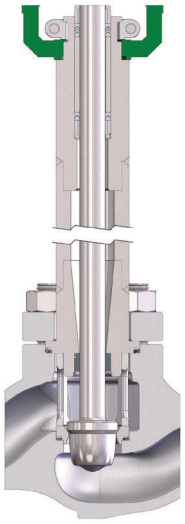

Figure 7: Cryogenic Bonnet

Cold Box Bonnet – Typically used for valves that will be installed inside of a cold box and require the ability to be serviced from the exterior of the box.

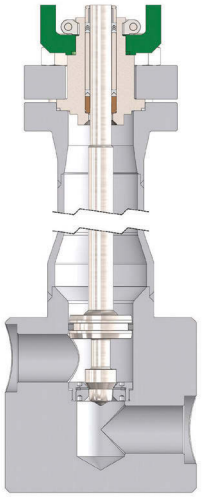

Figure 8: Cold Box Bonnet

Packing & Guiding

The OpGL's bonnet provides a far larger and deeper packing box than most control valves on the market, which allows for the following:

- The ability to install a wide range of packing configurations – including those designed to minimize or eliminate fugitive emissions in compliance with the latest international standards – without changing the bonnet.
- Available in Live-Loaded Configuration.
- Lower packing set functions as a wiper ring that cleans the process fluid off of the plug as it is retracted – and prevents contaminants from reaching the top packing stage.
- Guides are widely spaced and firmly hold the oversized plug stem in place over the course of the stroke.

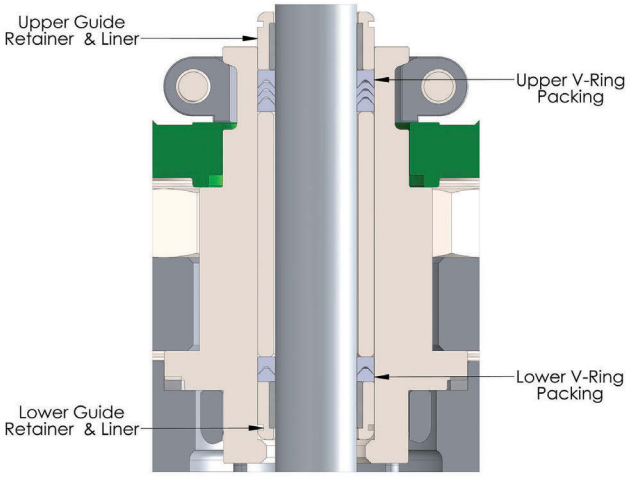

Figure 9: Standard Packing Box

Table 4: Guide Materials

Standard Material	Maximum Temperature		Minimum Temperature		Maximum Pressure
	°F	°C	°F	°C	
Grafoil Lined Stainless Steel	1500	816	-320	-196	1000 psig upto 2in. 600 psig 3in/4in. 500 Psig 6in and above
PTFE Glassfilled Lined Stainless Steel	350	177	-50	-45	600 psig @ 150 F
PTFE Virgin Lined Stainless Steel	350	177	-423	-253	100 psig @ 350°F
Solid Bronze	500	260	-423	-253	same as the body
A 479 S21800 Nitronic 60	1500	816	-423	-253	same as the body
Solid Stellite	1500	816	-423	-253	same as the body

OpGL™
Globe Control Valve

Eliminating Fugitive Emissions

Trimteck's GuardMaster Metal Bellows Seals are designed to protect against atmospheric emissions of caustic gases and liquids as a result of packing leakage.

- High quality, modular construction in Inconel or Hastelloy
- Built to withstand high temperatures and pressures
- Extraordinarily long lifecycle
- Can be retrofitted to valves of all sizes and pressure classes
- Sized and manufactured to specific customer requirements

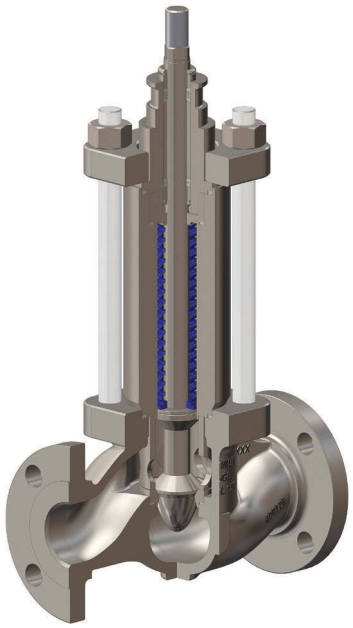

Figure 10: GuardMaster Metal Bellows Seal

Table 5: Packing Materials

	Material	TYPE	Standard Bonnet		Extended Bonnet		Fugitive Emissions Performance
			°F	°C	°F	°C	
Stadard Packing	Virgin PTFE	V-Ring	-20 to 450	-28 to 232			Good
	Glass Filled PTFE	V-Ring	-20 to 500	-28 to 260	-150 to 600	-101 to 316	Satisfactory
	Braided PTFE	Square					
	AFPI	Square	-20 to 750	-28 to 398	-20 to 1200	-28 to 649	Good
Fugitive Emissions Packing	PTG (25% Carbon Filled PTFE)	V-Ring Live-Loaded	-20 to 450	-28 to 232	-20 to 600	-28 to 316	Very Good (500 PPM)
	PT (25% Carbon Filled PTFE)	V-Ring	-20 to 450	-28 to 232	-20 to 600	-28 to 316	Excellent (100 PPM)
	PTXT (40% Carbon Fiber PEEK)	V-Ring	-20 to 550	-28 to 288	-20 to 700	-28 to 371	
	GuardMaster MBS	Hydroformed 2-Ply Seamless	-20 to 750	-28 to 398	-20 to 1200	-28 to 649	Zero Emissions

Note: PTFE can be used in temperatures down to -423° F (-253° C)

Gaskets

The OpGL's two most critical soft goods are its bonnet and seat gaskets. The OpGL's body, seat ring, seat retainer, and bonnet are all designed and machined to close tolerances and configured to transfer the force applied to the bonnet bolting down into the seat ring – clamping it securely into the body. As such the gaskets are compressed per their design but never over-compressed because the bonnet and the seat bottom out mechanically.

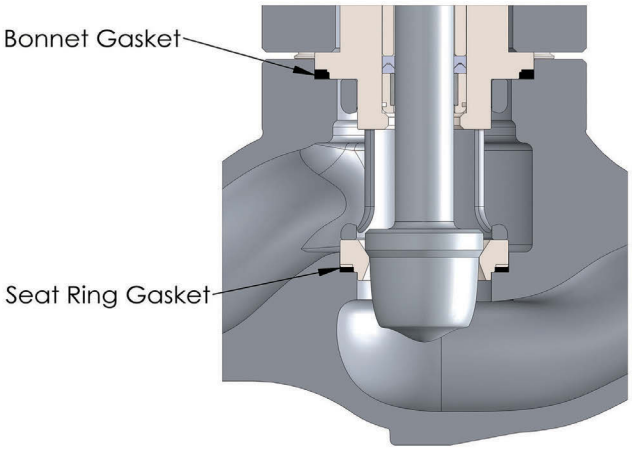

Figure 11: OpGL Body Gaskets

Table 6: Gasket Materials and Temperature

ANSI Class	TYPE	Gasket Material	Maximum Gasket Temperature		Minimum Gasket Temperature	
			°F	°C	°F	°C
Standard Gaskets	Flat	Teflon (TFE)	350	177	-200	-130
	Spiral Wound	304 SS / AFG	750	400	-20	-30
	Spiral Wound	316 SS / AFG	100	538	-20	-30
Alternate Gaskets	Flat	AFG	600	318	-20	-30
	Flat	KEL-F	350	177	-423	-253
	Flat	Teflon (FEP)	400	204	-423	-253
	Flat	Grafoil	1500	816	-320	-196
	Spiral Wound	316 SS / Grafoil	1500	816	-320	-196
	Hollow O-Ring	Inconel X-750	1500	816	-20	-30

OpGL™
Globe Control Valve

Body Styles

Globe – This most common single-seated body style forces fluid through two 90-degree turns, allowing for significant pressure drops.

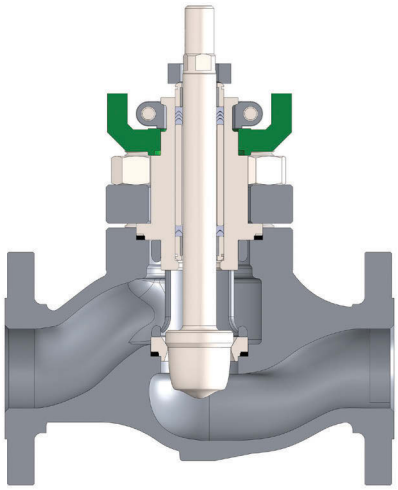

Figure 12: Globe Style Body

Angle – Body forms a 90-degree angle for cases in which piping allows for only such a configuration, or in cases of severe cavitation and/or flashing.

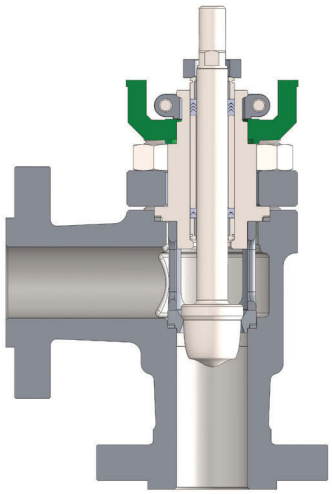

Figure 13: Angle Style Body

Y-Pattern – A nearly straight-through flow passage is less restrictive than the standard globe style, which helps to reduce turbulence and vibration in the line.

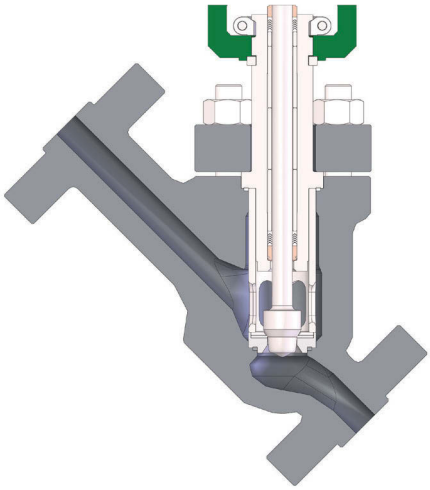

Figure 14: Y-Pattern Body

Three Way – Used to either combine or diverge the fluid, the OpGL 3Way configuration features a third port, dual seats, and extended plug.

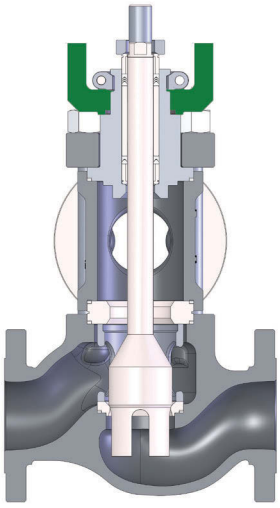

Figure 15: Three Way Body

Steam Jacketed – This style features a standard OpGL Globe Style Body with oversized blind integral flanges for full jacket (standard integral flanges for partial jacket). Trimteck's steam jackets are rated to 150 PSI (10.3 barg) and feature an NPT drain plug.

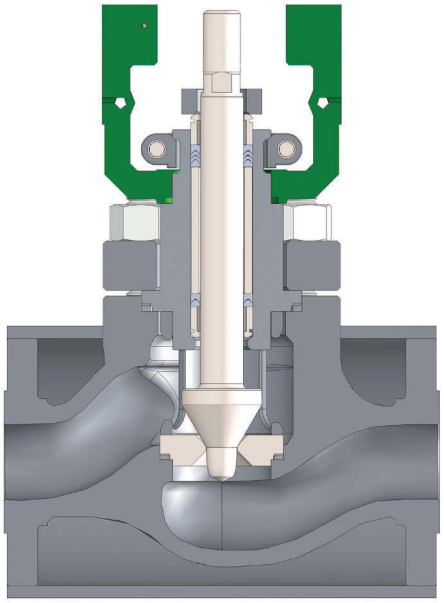

Figure 16: Steam Jacketed Body

Fabricated – Trimteck's XT, or fabricated, bodies are machined using bar stock and thus not subject to foundry delays, a bar stock body is a great solution for high pressure and special alloys – available with a variety of end connections.

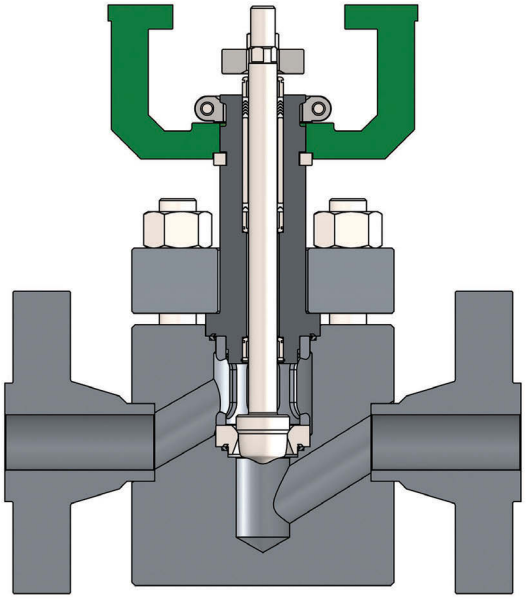

Figure 17: XT Fabricated Body

Table 7: Body Materials	
Materials	Standard: A216 WCB, LCC, A351 CF8M
	By Request: Monel Nickel, Chrome-Moly, Titanium, Alloy 20, Aluminum Bronze, Hastelloy, Duplex, Super Duplex and other materials

Table 8: Bonnet Materials	
Types	Standard, Extended, Special length extended, Bellows seal, Cryogenic
Bonnet Flanges	Separable, Bolted
Material	Bonnet: Same as body Bellows: Stainless Steel, other material as required Bellows Housing: Carbon Steel, 316 Stainless Steel, other materials as required Bonnet Flange: Carbon Steel, 316 Stainless Steel, other materials as requried

End Connections

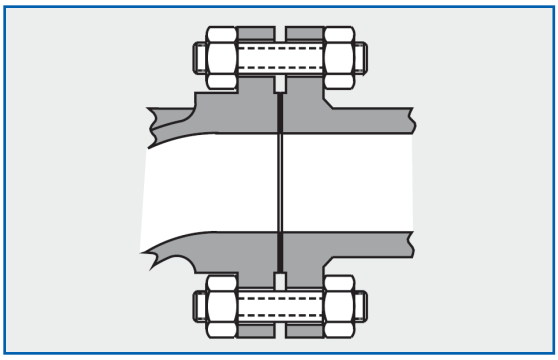

Fig. 18: Integral Flanges

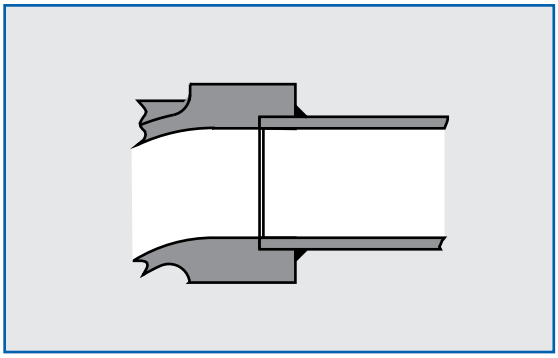

Fig. 19: Socketweld (SW)

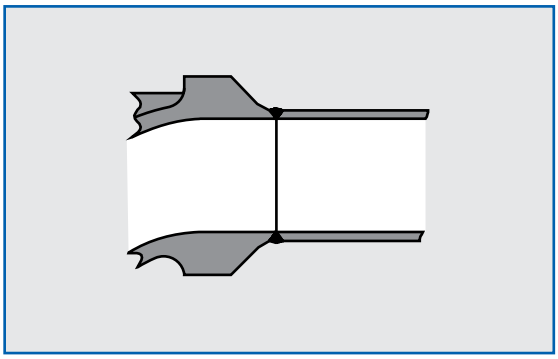

Fig. 20: Buttweld (BW)

Trimteck's standard end connections for OpGL bodies are raised face (RF) integral flanges with standard ANSI/ISA face-to-face dimensions. Options include NPT, RTJ, Buttweld, Socketweld, Grayloc, and others.

For ANSI Class 150 through 600 valves up to 10", standard wall thickness of the body is ANSI Class 600 and the flange bolt patterns and face-to-face dimensions change accordingly if the valve requires ANSI Class 150 or 300 end connections. Therefore, in the case of ANSI Class 150 and 300, the user is getting a more robust body, which has the benefit of a longer lifecycle in erosive and corrosive applications.

Table 9: End Connections

End Connections	Valve Size (Inches)	ANSI Class
Integral Flange	1/2 - 24	150 - 2500
NPT	1/2 - 2	150 - 2500
Socket Weld (SW)	1/2 - 2	150 - 2500
Butt Weld (BW)	3 - 24	150 - 600
	1/2 - 24	900 - 2500

Note: In compliance with ANSI/ISA S75.03

Bonnet Flanges & Bolting

The OpGL bonnet has a separate flange that attaches it to the body. Bonnet flange material is typically selected to match the body material, however, because it is not a wetted component it can be selected of a more economical metallurgy should the customer request it.

Bonnet flange bolting consists of studs and nuts – typically in 304 or 316 stainless steels – and specified according to the latest edition of ANSI B16.34 depending on process pressures and temperatures.

Flow Characteristics

A valve's flow characteristic is the relationship between the valve coefficient (Cv) 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. This is what allows a valve to control the flow in a predictable manner. In the case of the OpGL, the characteristic is inherent in the geometry of the plug head so that flow is controlled immediately once the plug lifts off of the seat – this offers a much broader range of control than cage-characterized valves i.e. ~5% to 95% open versus ~30% to 70% open respectively..

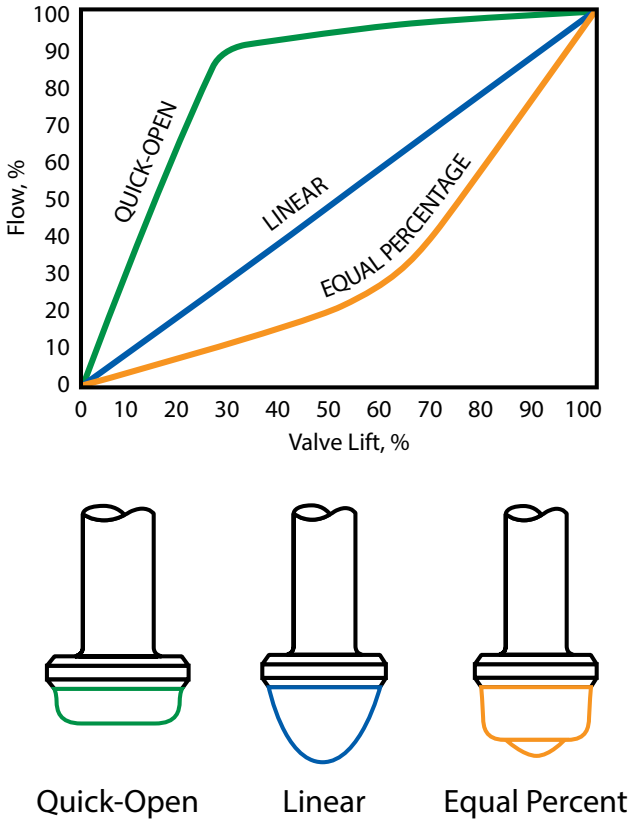

Figure 21: Flow Characteristics

Trim

The OpGL's standard unbalanced trim is designed to avoid many of the issues associated with cage-guided valves – some mechanical, such as preventing galling and corrosive sticking of the seat into the body; and some control-related, such as broadening rangeability and increasing the valve's resolution.

For some high-pressure drop applications, the OpGL has a balanced trim option to assist the actuator in stroking the plug through its range. Moreover, Trimteck offers an array of Severe Service Trims for controlling cavitation and minimizing noise.

Both balanced and unbalanced OpGL trim can be full area or reduced to achieve optimal Cv for each size valve.

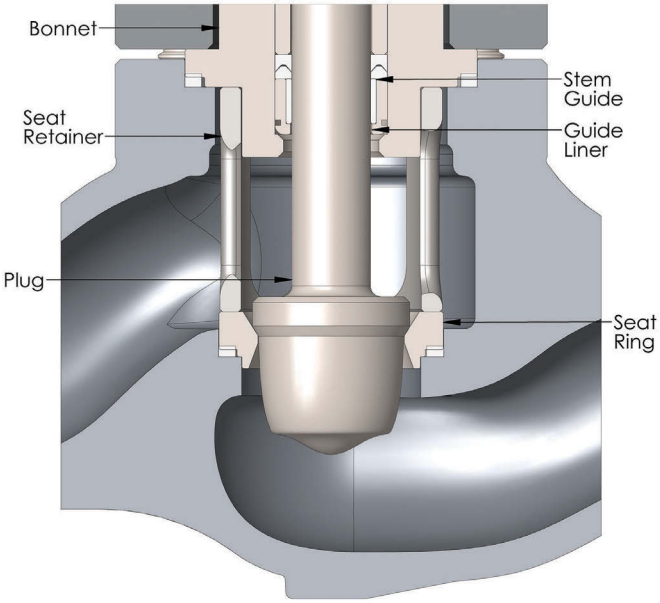

Figure 22: Unbalanced Trim

OpGL™
Globe Control Valve

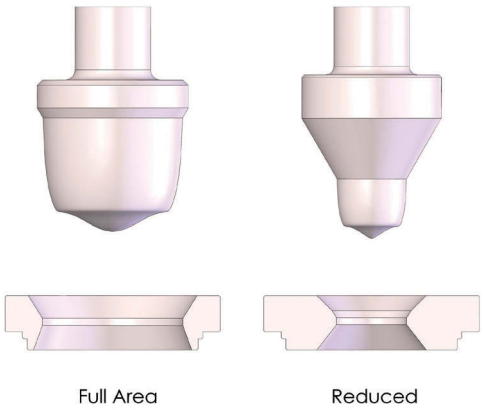

Figure 23: Full Area & Reduced Trim

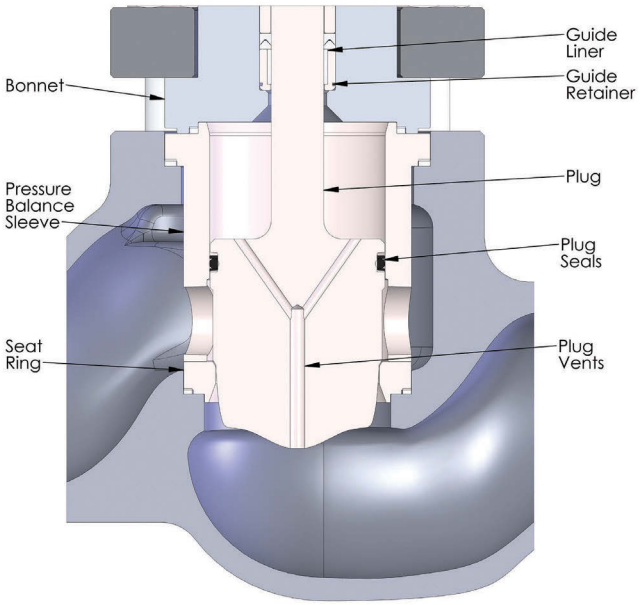

Figure 24: Balanced Trim

Seats

All OpGL seats are of a self-centering, clamped-in design. Self-centering refers to the fact that the seat will align itself with the plug the first time the valve is stroked closed. Clamped-in refers to the fact that the seat retainer transfers the force exercised on the bonnet bolting to clamp the seat into the body eliminating the need for threading and allowing the seat to be removed even after years in extremely corrosive service.

Metal Seats – all OpGL Globe Control Valves are ANSI Seat Leak tested prior to being delivered to the customer, and our metal seats routinely test to ANSI Class V though ANSI Class IV is common in certain services.

Soft Seats – for ANSI Leakage Class VI, or bubble tight, applications, the OpGL can be configured with a soft seat consisting of a temperature-appropriate elastomer sandwiched between two metal parts.

Table 10: Balanced Plug Seal Materials	
Teflon Seal	-320˚F @ Full Body rating or 300˚F @ 150psig
PBI Carbon Core w/ Inconel Wire	-22˚F to 800˚F
Buna-N O-Rings	-60˚F to 250˚F
Spring-Reinforced TFE	-365˚F to 575˚F
Viton	-40˚F to 437˚F

Table 11: Soft Seat Materials	
Materials	Virgin PTFE
	KEL-F (PCTFE)
	PEEK
	Glass-filled PTFE

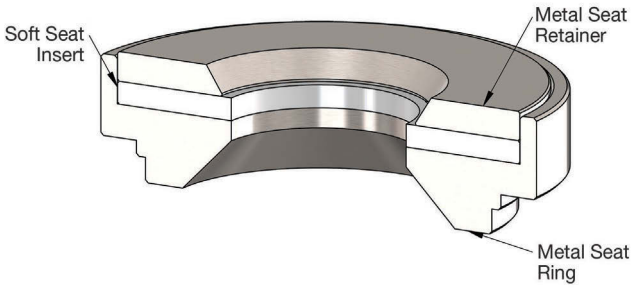

Figure 25: Soft Seat Configuration

Materials

As a standard, the OpGL is configured with plug and seat machined from 316 Stainless Steel. However, Trimteck offers a huge breadth of materials and material hardening processes in order to supply a control valve with internals that will stand up to even the harshest process conditions – whether they be corrosive, erosive, abrasive, cavitating, flashing, high temperature, or low temperature.

In addition to the more common hardening processes, such as Stellite 6 overlays, Trimteck has pioneered the use of CVD-5B, a chemical vapor deposition of boron wherein a hard metal mesh is fused into the base material. Unlike a coating, this deposition process permeates the material with a boride layer up to .015" deep. In many cases this increases the useful life of our valves by 10-fold.

Figure 26: CVD-5B

Table 12: Trim Material Characteristics							
Trim Material	**Hardness Rockwell C**	**Impact Strength**	**Corrosion Resistance**	**Maximum Temp. Recomm.**		**Erosion Resistance**	**Abrasion Resistance**
				°F	**°C**		
316 Stainless Steel	8	Excellent	Excellent	600	316	Fair	Fair
Duplex 2205	31	Excellent	Excellent	572	300	Fair	Fair
Monel	32	Good	Excellent	600	316	Fair-Good	Good
416 Stainless Steel	40	Good	Fair	800	427	Good	Good
17-4PH (H900)	44	Good	Good	800	427	Good	Good
n° 6 Stellite	44	Excellent	Excellent	1500	816	Good	Good
440C Stainless Steel	60	Fair	Fair	800	427	Excellent	Excellent
Tungsten Carbide	72	Fair	Good on Bases Poor on Acids	1200	649	Excellent	Excellent
440C + CVD-5B	72	Excellent	Good	1200	649	Excellent	Excellent

OpGL™
Globe Control Valve

Table 13: Wear and Galling Resistance of Material Combinations																	
	304 Stainless Steel	316 Stainless Steel	Bronze	Inconel 600	Monel 400	Hastelloy B	Hastelloy C	Titanium 75A	Nickel	Alloy 20	416 Hard.	440 Hard.	17-4 PH	Stellite	NDE*	Cr. Plate	Al. Bronze
304 Stainless Steel	P	P	G	P	P	P	G	P	P	P	G	G	G	G	G	G	G
316 Stainless Steel	P	P	G	P	P	P	G	P	P	P	G	G	G	G	G	G	G
Bronze	G	G	E	E	E	E	E	E	E	E	G	G	G	G	G	G	G
Inconel 600	P	P	E	P	P	P	G	P	G	G	G	G	G	G	G	G	E
Monel 400	P	P	E	P	P	P	G	G	G	G	G	G	G	E	G	G	E
Hastelloy B	P	P	E	P	P	P	G	G	E	G	G	G	G	E	G	E	E
Hastelloy C	P	P	E	P	P	P	G	G	E	G	G	G	G	E	G	E	E
Titanium 75A	P	P	E	P	G	G	G	P	G	G	G	G	G	E	G	G	E
Nickel	P	P	E	G	G	E	G	G	P	P	G	G	G	E	G	G	E
Alloy 20	P	P	E	G	G	G	G	G	P	P	G	G	G	E	G	G	E
416 Hard.	G	G	G	G	G	G	G	G	G	G	G	G	G	E	E	E	E
440 Hard.	G	G	G	G	G	G	G	G	G	G	E	G	E	E	E	E	E
17-4 PH	G	G	G	G	G	G	G	G	G	G	G	E	P	E	E	E	E
Stellite	G	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E
NDE*	G	G	G	G	G	G	G	G	G	G	E	E	E	E	P	E	E
Cr. Plate	G	G	G	G	G	E	E	G	G	G	E	E	E	E	E	P	P
Al. Bronze	G	G	G	E	E	E	E	E	E	E	E	E	E	E	E	E	P

E: Excellent, B: Good, P: Poor

* Electrolytic Nickel Coating

Table 14: Pressure Differential (PSI) Requiring Hardened Seating Surfaces																				
Valve Size (inches)	Gases (Clean)				Steam (Superheated)				Steam (Saturated)				Water				Process Fluids (General)			
	Control		On-Off		Control		On-Off		Control		On-Off		Control		On-Off		Control		On-Off	
	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar
1/2 - 1 1/2	600	41	900	62	300	21	600	41	100	7	200	14	175	12	250	17	175	12	250	17
2 - 3	350	24	600	41	200	14	300	21	25	2	50	3	150	11	200	14	150	10	200	14
4 - 6	200	14	300	21	100	7	150	10	All		25	2	100	7	125	9	75	5	125	9
8 - 12	125	9	175	12	50	3	100	7	All applications				50	3	100	7	50	3	100	7

OpGL™ Flow Capacity (C_V)

Trim: Unbalanced
Body Rating: 150-300-600
Trim Characteristics: Equal Percentage
Flow Direction: Flow Over

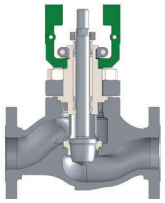

Table 15: Flow Capacity, Cv

Size (inch)	Trim no.	Stroke (inch)	F_L@ 100%	Cv at Percent Open										
				100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.00	5.00
1/2	0.12	0.50	0.80	0.46	0.45	0.38	0.27	0.17	0.10	0.07	0.04	0.03	0.01	0.01
	0.25A	0.75	0.80	2.00	1.60	1.10	0.81	0.56	0.37	0.23	0.14	0.09	0.06	0.03
	0.25B	0.75	0.80	1.30	1.00	0.63	0.40	0.25	0.16	0.10	0.05	0.03	0.01	0.01
	0.31	0.75	0.80	2.90	2.60	1.80	1.20	1.00	0.59	0.34	0.22	0.15	0.10	0.05
	0.38	0.75	0.80	3.80	3.40	2.50	1.70	1.20	0.86	0.50	0.31	0.19	0.13	0.07
	0.50	0.75	0.85	5.10	4.70	3.70	2.60	1.90	1.40	0.91	0.56	0.33	0.25	0.13
3/4	0.12	0.50	0.80	0.47	0.48	0.37	0.24	0.15	0.09	0.06	0.04	0.02	0.01	0.00
	0.25A	0.75	0.80	2.00	1.80	1.20	0.92	0.58	0.35	0.21	0.14	0.09	0.06	0.03
	0.25B	0.75	0.80	1.30	1.00	0.63	0.40	0.25	0.16	0.10	0.05	0.03	0.01	0.01
	0.31	0.75	0.80	2.90	2.60	1.60	1.20	0.87	0.58	0.31	0.20	0.15	0.09	0.05
	0.38	0.75	0.80	4.30	3.80	2.90	1.80	1.40	0.88	0.47	0.29	0.17	0.11	0.05
	0.50	0.75	0.80	6.40	5.80	4.60	3.00	1.90	1.50	1.00	0.62	0.37	0.24	0.12
	0.62	0.75	0.80	9.10	8.40	6.60	4.60	3.00	2.30	1.60	0.95	0.59	0.32	0.16
	0.72	0.75	0.85	9.50	9.00	7.60	5.60	3.90	3.20	2.30	1.60	1.00	0.63	0.32
1	0.12	0.50	0.80	0.47	0.46	0.29	0.22	0.16	0.11	0.09	0.06	0.04	0.03	0.01
	0.25A	0.75	0.80	1.90	1.50	1.10	0.83	0.56	0.31	0.21	0.13	0.08	0.06	0.03
	0.25B	0.75	0.80	1.30	1.00	0.63	0.40	0.25	0.16	0.10	0.05	0.03	0.01	0.01
	0.31	0.75	0.80	2.90	2.40	1.60	1.10	0.92	0.61	0.35	0.20	0.14	0.09	0.04
	0.38	0.75	0.80	4.10	3.40	2.30	1.50	1.30	0.84	0.51	0.33	0.22	0.14	0.07
	0.50	0.75	0.80	6.50	5.70	4.40	2.90	1.90	1.50	1.09	0.72	0.46	0.26	0.13
	0.62	0.75	0.80	10.20	8.70	6.50	4.20	2.70	2.30	1.50	1.00	0.61	0.35	0.18
	0.72	0.75	0.80	13.40	11.70	8.90	6.10	3.90	3.10	2.30	1.60	1.10	0.70	0.35
	0.81	0.75	0.85	15.50	14.10	11.20	8.00	4.90	3.30	2.80	2.10	1.60	1.10	0.53
1 1/2	0.38	0.75	0.80	3.60	2.80	1.90	1.40	1.20	0.86	0.58	0.30	0.18	0.11	0.05
	0.62	0.75	0.80	9.20	8.00	6.20	4.40	3.00	2.00	1.40	0.76	0.47	0.26	0.13
	0.81	0.75	0.80	13.00	11.00	8.90	6.30	4.00	2.60	1.80	1.10	0.69	0.33	0.17
	1.00	0.75	0.80	19.00	17.00	14.00	11.00	7.10	4.50	3.30	2.40	1.60	1.00	0.52
	1.25	1.00	0.85	27.00	25.00	21.00	15.00	10.00	6.60	4.90	3.50	2.30	1.50	0.77
2	0.38	0.75	0.80	3.50	3.20	2.60	1.70	1.10	0.91	0.55	0.34	0.22	0.15	0.07
	0.62	0.75	0.80	8.90	7.90	6.10	4.20	2.60	2.00	1.40	0.88	0.52	0.31	0.16
	0.81	0.75	0.80	14.00	12.00	9.00	6.20	4.00	2.60	2.10	1.40	1.00	0.67	0.34
	1.00	0.75	0.80	21.00	19.00	15.00	11.00	7.50	4.70	3.30	2.50	1.60	1.10	0.53
	1.25	1.00	0.80	31.00	27.00	22.00	16.00	10.00	6.60	5.20	3.60	2.30	1.60	0.78
	1.62	1.50	0.85	46.00	41.00	34.00	25.00	16.00	11.00	9.00	5.90	3.80	2.60	1.30
3	1.25	1.00	0.80	33.00	29.00	24.00	18.00	12.00	6.60	4.20	3.10	2.00	1.40	0.69
	1.62	1.50	0.80	52.00	46.00	36.00	24.00	16.00	11.00	8.40	5.70	3.60	2.50	1.20
	2.00	1.50	0.80	78.00	73.00	66.00	55.00	40.00	24.00	13.00	8.80	6.30	3.70	1.90
	2.62	2.00	0.85	104.00	95.00	85.00	76.00	60.00	38.00	22.00	16.00	10.00	5.80	2.90
4	1.62	1.50	0.80	55.00	48.00	37.00	25.00	16.00	11.00	8.40	5.70	3.60	2.50	1.30
	2.25	2.00	0.80	104.00	96.00	83.00	63.00	40.00	24.00	15.00	12.00	7.40	4.60	2.30
	2.62	2.00	0.80	133.00	124.00	111.00	89.00	63.00	39.00	24.00	16.00	11.00	7.40	3.70
	3.50	2.50	0.85	179.00	169.00	154.00	130.00	96.00	57.00	35.00	26.00	20.00	13.00	6.50
6	2.62	2.00	0.80	141.00	133.00	118.00	95.00	65.00	37.00	22.00	16.00	11.00	6.90	3.50
	3.00	2.00	0.80	192.00	154.00	121.00	102.00	61.00	38.00	26.00	17.00	12.00	8.00	4.00
	3.50	2.50	0.80	230.00	215.00	192.00	152.00	102.00	58.00	35.00	23.00	17.00	11.00	5.50
	5.00	3.00	0.85	355.00	333.00	302.00	264.00	202.00	125.00	59.00	33.00	20.00	14.00	6.90
8	2.62	2.00	0.80	144.00	135.00	119.00	95.00	65.00	37.00	22.00	16.00	11.00	7.00	3.50
	3.50	2.50	0.80	250.00	233.00	205.00	161.00	110.00	61.00	34.00	21.00	13.00	7.00	3.50
	5.00	3.00	0.80	461.00	428.00	369.00	290.00	202.00	125.00	59.00	33.00	20.00	14.00	7.00
	6.25	4.00	0.85	606.00	564.00	499.00	413.00	305.00	181.00	107.00	73.00	55.00	34.00	17.00
10	5.00	3.00	0.80	495.00	455.00	385.00	290.00	202.00	125.00	59.00	33.00	20.00	14.00	7.00
	6.25	4.00	0.80	690.00	635.00	548.00	425.00	305.00	181.00	107.00	73.00	49.00	34.00	17.00
	8.00	4.00	0.85	897.00	843.00	762.00	656.00	525.00	371.00	192.00	99.00	60.00	42.00	21.00
12	6.25	4.00	0.80	770.00	712.00	589.00	440.00	305.00	181.00	107.00	73.00	49.00	34.00	17.00
	7.38	4.00	0.80	960.00	884.00	750.00	585.00	421.00	250.00	149.00	101.00	68.00	46.00	23.00
	9.50	4.00	0.85	1310.00	1215.00	1080.00	920.00	697.00	428.00	230.00	153.00	108.00	73.00	37.00
14	6.25	4.00	0.80	800.00	736.00	613.00	461.00	305.00	181.00	107.00	73.00	49.00	34.00	17.00
	8.00	4.00	0.80	1150.00	1069.00	976.00	841.00	615.00	371.00	192.00	99.00	60.00	42.00	21.00
	11.00	4.00	0.85	1695.00	1577.00	1440.00	1240.00	1023.00	759.00	462.00	215.00	145.00	98.00	49.00

OpGL™ Flow Capacity (C_V)

Trim: Unbalanced
Body Rating: 150-300-600
Trim Characteristics: Equal Percentage
Flow Direction: Flow Under

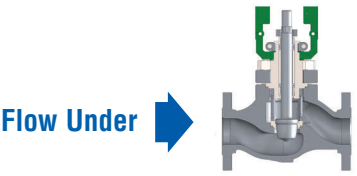

Table 16: Flow Capacity, Cv

Size (inch)	Trim no.	Stroke (inch)	F_L@ 100%	Cv at Percent Open										
				100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.00	5.00
1/2	0.12	0.50	0.90	0.44	0.43	0.41	0.25	0.16	0.10	0.07	0.04	0.03	0.02	0.01
	0.25A	0.75	0.90	1.80	1.60	1.00	0.67	0.43	0.27	0.18	0.11	0.07	0.05	0.03
	0.25B	0.75	0.90	1.20	0.73	0.48	0.31	0.21	0.13	0.08	0.05	0.03	0.01	0.01
	0.31	0.75	0.90	2.60	2.30	1.70	1.10	0.72	0.47	0.29	0.21	0.15	0.11	0.05
	0.38	0.75	0.90	3.50	3.10	2.30	1.50	1.00	0.68	0.41	0.27	0.18	0.13	0.07
	0.50	0.75	0.90	4.90	4.70	3.90	2.30	1.60	1.10	0.72	0.45	0.30	0.20	0.10
3/4	0.12	0.50	0.90	0.46	0.46	0.45	0.27	0.16	0.09	0.06	0.03	0.01	0.00	0.00
	0.25A	0.75	0.90	1.90	1.80	1.30	0.84	0.48	0.31	0.20	0.13	0.08	0.05	0.03
	0.25B	0.75	0.90	1.20	0.73	0.48	0.31	0.21	0.13	0.08	0.05	0.03	0.01	0.01
	0.31	0.75	0.90	2.70	2.40	1.60	1.10	0.69	0.45	0.26	0.18	0.13	0.08	0.04
	0.38	0.75	0.90	3.80	3.50	2.70	1.80	1.10	0.71	0.43	0.27	0.16	0.10	0.05
	0.50	0.75	0.90	6.00	5.70	4.70	2.90	1.80	1.20	0.76	0.47	0.30	0.18	0.09
	0.62	0.75	0.90	8.60	8.50	6.40	4.40	2.80	1.80	1.20	0.76	0.46	0.27	0.14
	0.72	0.75	0.90	10.00	8.90	7.50	5.50	3.20	2.20	1.40	0.94	0.67	0.43	0.21
1	0.12	0.50	0.90	0.51	0.50	0.33	0.20	0.13	0.09	0.06	0.04	0.03	0.01	0.01
	0.25A	0.75	0.90	1.80	1.60	1.20	0.72	0.47	0.30	0.19	0.14	0.08	0.06	0.03
	0.25B	0.75	0.90	1.20	0.73	0.48	0.31	0.21	0.13	0.08	0.05	0.03	0.01	0.01
	0.31	0.75	0.90	2.80	2.40	1.60	1.10	0.71	0.47	0.26	0.18	0.12	0.08	0.04
	0.38	0.75	0.90	3.90	3.40	2.30	1.50	1.00	0.66	0.43	0.29	0.19	0.13	0.07
	0.50	0.75	0.90	6.50	5.90	4.50	2.70	1.80	1.20	0.77	0.47	0.29	0.19	0.10
	0.62	0.75	0.90	9.70	9.00	6.10	3.90	2.50	1.70	1.10	0.70	0.45	0.29	0.15
	0.72	0.75	0.90	12.00	11.00	8.00	5.60	3.50	2.30	1.50	1.00	0.69	0.46	0.23
	0.81	0.75	0.90	13.00	12.00	9.20	6.60	4.10	2.80	1.90	1.30	0.94	0.66	0.33
1 1/2	0.38	0.75	0.90	3.70	3.20	1.90	1.30	0.88	0.60	0.36	0.23	0.14	0.09	0.04
	0.62	0.75	0.90	10.00	8.30	6.30	5.30	3.20	1.90	1.10	0.78	0.43	0.27	0.13
	0.81	0.75	0.90	16.00	14.00	9.40	6.10	4.50	2.60	1.60	0.93	0.59	0.33	0.16
	1.00	0.75	0.90	22.00	22.00	17.00	11.00	6.60	4.50	3.00	1.90	1.30	0.90	0.45
	1.25	1.00	0.90	30.00	28.00	24.00	16.00	11.00	6.80	4.40	2.90	1.90	1.30	0.64
2	0.38	0.75	0.90	3.00	2.90	2.60	1.90	1.20	0.80	0.49	0.32	0.21	0.15	0.07
	0.62	0.75	0.90	10.00	9.00	6.70	4.50	2.70	1.80	1.10	0.74	0.44	0.28	0.14
	0.81	0.75	0.90	17.00	14.00	8.80	6.00	4.00	2.70	1.80	1.20	0.87	0.61	0.30
	1.00	0.75	0.90	23.00	22.00	18.00	12.00	6.80	4.70	3.00	1.90	1.30	0.89	0.44
	1.25	1.00	0.90	30.00	29.00	24.00	15.00	10.00	6.40	4.30	2.80	1.90	1.20	0.62
	1.62	1.50	0.90	47.00	45.00	41.00	30.00	16.00	10.00	7.00	4.60	3.10	2.20	1.10
3	1.25	1.00	0.90	33.00	30.00	24.00	18.00	11.00	6.70	4.00	2.50	1.70	1.20	0.61
	1.62	1.50	0.90	49.00	47.00	42.00	28.00	17.00	11.00	7.40	4.80	3.20	2.20	1.10
	2.00	1.50	0.90	82.00	77.00	71.00	63.00	43.00	25.00	14.00	8.70	5.20	3.30	1.60
	2.62	2.00	0.90	108.00	101.00	92.00	88.00	71.00	36.00	21.00	13.00	7.80	4.50	2.20
4	1.62	1.50	0.90	56.00	52.00	42.00	28.00	17.00	11.00	7.40	4.80	3.20	2.20	1.10
	2.25	2.00	0.90	98.00	90.00	81.00	67.00	41.00	26.00	16.00	10.00	6.30	4.20	2.10
	2.62	2.00	0.90	133.00	123.00	111.00	100.00	67.00	42.00	27.00	17.00	10.00	6.80	3.40
	3.50	2.50	0.90	195.00	183.00	168.00	156.00	114.00	57.00	36.00	24.00	15.00	11.00	5.30
6	2.62	2.00	0.90	130.00	119.00	106.00	93.00	68.00	37.00	23.00	15.00	8.90	5.60	2.80
	3.00	2.00	0.90	170.00	153.00	134.00	115.00	73.00	37.00	25.00	17.00	11.00	7.80	3.90
	3.50	2.50	0.90	224.00	202.00	176.00	152.00	114.00	65.00	41.00	26.00	16.00	11.00	5.40
	5.00	3.00	0.90	400.00	374.00	339.00	297.00	249.00	148.00	62.00	35.00	18.00	14.00	6.80
8	2.62	2.00	0.90	143.00	132.00	117.00	100.00	68.00	37.00	23.00	15.00	8.70	6.00	3.00
	3.50	2.50	0.90	245.00	220.00	196.00	161.00	114.00	65.00	41.00	26.00	16.00	11.00	5.50
	5.00	3.00	0.90	457.00	412.00	359.00	298.00	212.00	134.00	65.00	36.00	19.00	14.00	7.00
	6.25	4.00	0.90	691.00	643.00	589.00	497.00	334.00	184.00	115.00	76.00	46.00	28.00	14.00
10	5.00	3.00	0.90	482.00	434.00	378.00	298.00	212.00	134.00	65.00	36.00	19.00	14.00	7.00
	6.25	4.00	0.90	693.00	644.00	590.00	498.00	335.00	184.00	115.00	76.00	46.00	28.00	14.00
	8.00	4.00	0.90	1013.00	921.00	817.00	723.00	603.00	424.00	191.00	112.00	70.00	41.00	20.00
12	6.25	4.00	0.90	750.00	683.00	612.00	508.00	334.00	184.00	115.00	76.00	46.00	28.00	14.00
	7.38	4.00	0.90	935.00	858.00	756.00	637.00	480.00	267.00	142.00	97.00	65.00	44.00	22.00
	9.50	4.00	0.90	1410.00	1290.00	1140.00	960.00	766.00	534.00	269.00	158.00	99.00	58.00	29.00
14	6.25	4.00	0.90	800.00	720.00	629.00	525.00	334.00	184.00	115.00	76.00	46.00	28.00	14.00
	8.00	4.00	0.90	1150.00	1040.00	921.00	789.00	643.00	424.00	191.00	112.00	70.00	41.00	21.00
	11.00	4.00	0.90	1790.00	1700.00	1540.00	1340.00	1100.00	840.00	529.00	295.00	145.00	98.00	49.00

OpGL™ Flow Capacity (C_V)

Trim: Unbalanced
Body Rating: 150-300-600
Trim Characteristics: Linear
Flow Direction: Flow Over

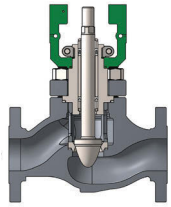

Table 17: Flow Capacity, Cv

Size (inch)	Trim no.	Stroke (inch)	F_L@ 100%	Cv at Percent Open										
				100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.00	5.00
1/2	0.12	0.50	0.80	0.46	0.44	0.39	0.33	0.29	0.25	0.19	0.15	0.08	0.03	0.01
	0.25A	0.75	0.80	2.00	2.00	1.90	1.70	1.50	1.20	1.00	0.79	0.42	0.21	0.10
	0.25B	0.75	0.80	1.20	1.10	1.00	0.89	0.77	0.65	0.51	0.39	0.26	0.12	0.06
	0.31	0.75	0.80	2.90	2.90	2.80	2.50	2.30	2.00	1.60	1.20	0.86	0.46	0.23
	0.38	0.75	0.80	4.10	4.10	3.90	3.50	3.10	2.80	2.20	1.80	1.20	0.63	0.31
	0.50	0.75	0.85	5.60	5.40	5.20	4.80	4.30	3.80	3.20	2.50	1.70	0.84	0.42
3/4	0.12	0.50	0.80	0.47	0.47	0.41	0.36	0.30	0.25	0.20	0.14	0.09	0.03	0.01
	0.25A	0.75	0.80	2.00	2.00	1.90	1.70	1.50	1.20	0.99	0.71	0.45	0.19	0.10
	0.25B	0.75	0.80	1.20	1.10	1.00	0.89	0.77	0.65	0.51	0.39	0.26	0.12	0.06
	0.31	0.75	0.80	3.00	3.00	2.70	2.40	2.20	1.90	1.40	1.10	0.73	0.37	0.18
	0.38	0.75	0.80	4.30	4.30	4.00	3.50	3.10	2.70	2.10	1.60	1.10	0.49	0.25
	0.50	0.75	0.80	6.90	6.60	6.10	5.50	4.80	4.00	3.30	2.40	1.70	0.74	0.37
	0.62	0.75	0.80	9.10	8.90	8.50	8.20	7.60	6.20	4.90	3.80	2.40	1.30	0.65
	0.72	0.75	0.85	10.10	9.90	9.60	9.20	8.80	8.10	7.20	5.40	3.60	1.50	0.77
1	0.12	0.50	0.80	0.49	0.48	0.41	0.36	0.30	0.26	0.22	0.16	0.10	0.06	0.03
	0.25A	0.75	0.80	1.90	1.90	1.80	1.60	1.40	1.20	0.97	0.80	0.48	0.24	0.12
	0.25B	0.75	0.80	1.20	1.10	1.00	0.89	0.77	0.65	0.51	0.39	0.26	0.12	0.06
	0.31	0.75	0.80	2.90	2.90	2.60	2.30	2.10	1.80	1.40	1.10	0.75	0.33	0.17
	0.38	0.75	0.80	4.40	4.30	3.80	3.30	2.90	2.50	2.10	1.60	1.10	0.56	0.28
	0.50	0.75	0.80	6.80	6.50	5.90	5.20	4.40	3.70	3.00	2.40	1.60	0.83	0.41
	0.62	0.75	0.80	12.00	12.00	11.00	9.00	7.70	6.20	4.90	3.80	2.40	1.30	0.66
	0.72	0.75	0.80	16.00	15.00	14.00	13.00	11.00	8.50	6.70	5.00	3.20	1.40	0.72
	0.81	0.75	0.85	18.00	17.00	16.00	15.00	14.00	11.00	8.40	6.20	3.70	1.90	0.95
1 1/2	0.38	0.75	0.80	4.00	4.00	4.00	3.00	3.00	3.00	2.00	2.00	1.00	0.56	0.28
	0.62	0.75	0.80	12.00	12.00	11.00	9.00	7.70	6.20	4.90	3.80	2.40	1.30	0.65
	0.72	0.75	0.80	15.00	14.00	13.00	12.00	11.00	8.50	6.70	5.00	3.20	1.40	0.70
	0.81	0.75	0.80	15.00	15.00	14.00	13.00	11.00	9.60	7.70	5.70	3.70	1.90	0.95
	1.00	0.75	0.80	21.00	21.00	20.00	18.00	16.00	14.00	11.00	8.50	5.50	2.61	1.31
	1.25	1.00	0.85	31.00	30.00	28.00	25.00	23.00	19.00	16.00	12.00	8.00	3.70	1.90
2	0.38	0.75	0.80	4.40	4.30	3.80	3.30	2.90	2.60	2.10	1.60	1.10	0.56	0.28
	0.62	0.75	0.80	12.00	12.00	11.00	9.00	7.70	6.20	4.90	3.80	2.40	1.30	0.65
	0.72	0.75	0.80	15.00	14.00	14.00	12.00	11.00	8.50	6.70	5.00	3.20	1.40	0.70
	0.81	0.75	0.80	15.00	15.00	14.00	13.00	11.00	10.00	7.70	5.70	3.70	1.90	1.10
	1.00	0.75	0.80	23.00	22.00	21.00	19.00	17.00	15.00	12.00	8.60	5.50	2.60	1.30
	1.25	1.00	0.80	35.00	33.00	31.00	29.00	25.00	22.00	17.00	13.00	8.40	4.10	2.00
	1.62	1.00	0.93	56.00	54.00	51.00	48.00	43.00	36.00	29.00	22.00	14.00	6.50	3.30
3	1.25	1.00	0.80	35.00	34.00	32.00	29.00	26.00	22.00	18.00	13.00	9.10	4.70	2.30
	1.62	1.50	0.80	57.00	55.00	51.00	47.00	41.00	34.00	27.00	21.00	14.00	6.50	3.30
	2.00	1.50	0.80	79.00	77.00	73.00	69.00	62.00	54.00	44.00	33.00	22.00	13.00	6.40
	2.62	2.00	0.85	116.00	113.00	110.00	105.00	97.00	83.00	71.00	56.00	38.00	17.00	8.70
4	1.62	1.50	0.80	59.00	56.00	53.00	49.00	42.00	35.00	28.00	20.00	14.00	6.90	3.40
	2.25	2.00	0.80	117.00	108.00	99.00	89.00	78.00	66.00	54.00	41.00	28.00	14.00	7.00
	2.62	2.00	0.80	137.00	133.00	126.00	115.00	103.00	87.00	69.00	50.00	33.00	16.00	7.90
	3.50	2.50	0.85	193.00	184.00	176.00	170.00	165.00	153.00	132.00	102.00	67.00	30.00	15.00
6	2.62	2.00	0.80	162.00	150.00	135.00	121.00	103.00	87.00	69.00	50.00	33.00	16.00	8.00
	3.00	2.00	0.80	196.00	183.00	168.00	152.00	134.00	115.00	94.00	72.00	49.00	25.00	13.00
	3.50	2.50	0.80	247.00	235.00	220.00	202.00	182.00	159.00	133.00	103.00	70.00	36.00	18.00
	5.00	3.00	0.85	453.00	437.00	413.00	383.00	346.00	302.00	254.00	199.00	126.00	61.00	31.00
8	2.62	2.00	0.80	173.00	158.00	143.00	126.00	110.00	90.00	69.00	50.00	33.00	16.00	8.00
	3.50	2.50	0.80	298.00	274.00	248.00	221.00	193.00	163.00	132.00	102.00	67.00	30.00	15.00
	5.00	3.00	0.80	575.00	533.00	488.00	439.00	387.00	330.00	271.00	209.00	143.00	73.00	37.00
	6.25	4.00	0.85	713.00	687.00	648.00	600.00	541.00	474.00	397.00	311.00	216.00	112.00	56.00
10	5.00	3.00	0.80	590.00	545.00	496.00	444.00	388.00	329.00	254.00	192.00	126.00	61.00	31.00
	6.25	4.00	0.80	739.00	711.00	675.00	624.00	562.00	492.00	404.00	305.00	202.00	99.00	50.00
	8.00	4.00	0.85	1056.00	1014.00	963.00	900.00	824.00	732.00	621.00	490.00	340.00	174.00	87.00
12	6.25	4.00	0.80	829.00	774.00	713.00	646.00	571.00	489.00	404.00	305.00	202.00	99.00	50.00
	7.38	4.00	0.80	947.00	918.00	877.00	825.00	750.00	654.00	544.00	356.00	212.00	68.00	34.00
	9.50	4.00	0.85	1470.00	1430.00	1370.00	1280.00	1160.00	1020.00	850.00	660.00	494.00	259.00	130.00
14	6.25	4.00	0.80	878.00	814.00	744.00	668.00	586.00	499.00	404.00	305.00	202.00	99.00	50.00
	8.00	4.00	0.80	1184.00	1125.00	1057.00	976.00	881.00	771.00	644.00	501.00	344.00	175.00	88.00
	11.00	4.00	0.85	1970.00	1910.00	1820.00	1690.00	1520.00	1320.00	1080.00	820.00	610.00	344.00	172.00

OpGL™ Flow Capacity (C_V)

Trim: Unbalanced
Body Rating: 150-300-600
Trim Characteristics: Linear
Flow Direction: Flow Under

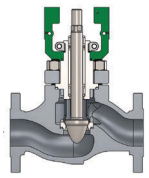

Table 18: Flow Capacity, Cv

Size (inch)	Trim no.	Stroke (inch)	F_L@ 100%	Cv at Percent Open										
				100.00	90.00	80.00	70.00	60.00	50.00	40.00	30.00	20.00	10.00	5.00
1/2	0.12	0.50	0.90	0.42	0.43	0.40	0.34	0.29	0.25	0.19	0.13	0.09	0.04	0.02
	0.25A	0.75	0.90	1.70	1.70	1.60	1.40	1.30	1.00	0.82	0.61	0.38	0.20	0.10
	0.25B	0.75	0.90	1.20	1.10	0.95	0.82	0.71	0.59	0.47	0.36	0.23	0.10	0.05
	0.31	0.75	0.90	2.70	2.50	2.30	2.10	1.80	1.50	1.20	0.92	0.57	0.29	0.15
	0.38	0.75	0.90	3.60	3.50	3.30	3.00	2.60	2.20	1.70	1.30	0.86	0.34	0.17
	0.50	0.75	0.90	5.10	5.00	4.70	4.40	3.90	3.50	2.80	2.20	1.40	0.68	0.34
3/4	0.12	0.50	0.90	0.46	0.44	0.41	0.35	0.30	0.25	0.20	0.14	0.08	0.03	0.02
	0.25A	0.75	0.90	1.90	1.90	1.80	1.60	1.30	1.10	0.88	0.61	0.39	0.17	0.08
	0.25B	0.75	0.90	1.20	1.10	0.95	0.82	0.71	0.59	0.47	0.36	0.23	0.10	0.05
	0.31	0.75	0.90	2.80	2.70	2.50	2.20	1.90	1.60	1.20	0.92	0.56	0.23	0.11
	0.38	0.75	0.90	3.90	3.80	3.40	3.10	2.70	2.30	1.80	1.30	0.92	0.36	0.18
	0.50	0.75	0.90	6.20	6.00	5.60	5.10	4.50	3.80	3.10	2.30	1.60	0.62	0.31
	0.62	0.75	0.90	9.00	8.80	8.50	8.10	7.10	6.10	4.70	3.60	2.30	1.20	0.60
	0.72	0.75	0.90	9.20	9.20	9.20	9.00	8.30	7.10	6.00	4.40	3.10	1.30	0.67
1	0.12	0.50	0.90	0.49	0.47	0.42	0.36	0.30	0.26	0.20	0.14	0.10	0.06	0.03
	0.25A	0.75	0.90	1.80	1.70	1.70	1.50	1.30	0.95	0.77	0.54	0.37	0.16	0.08
	0.25B	0.75	0.90	1.20	1.10	0.95	0.82	0.71	0.59	0.47	0.36	0.23	0.10	0.05
	0.31	0.75	0.90	2.90	2.80	2.50	2.20	1.90	1.60	1.30	0.97	0.62	0.27	0.14
	0.38	0.75	0.90	4.00	3.80	3.50	3.10	2.60	2.10	1.70	1.30	0.86	0.37	0.18
	0.50	0.75	0.90	6.70	6.40	5.90	5.20	4.60	3.80	3.00	2.20	1.40	0.63	0.31
	0.62	0.75	0.90	10.00	9.80	9.20	8.10	7.10	6.10	4.70	3.60	2.30	1.20	0.60
	0.72	0.75	0.90	13.00	13.00	12.00	10.00	9.10	7.60	5.80	4.40	2.60	0.98	0.49
	0.81	0.75	0.90	15.00	15.00	15.00	13.00	12.00	9.70	7.90	6.00	3.80	2.10	1.00
1 1/2	0.38	0.75	0.90	4.10	3.60	3.20	2.80	2.40	2.00	1.60	1.20	0.82	0.41	0.21
	0.62	0.75	0.90	11.00	9.70	8.60	7.60	6.60	5.50	4.40	3.40	2.30	1.10	0.55
	0.72	0.75	0.90	13.00	13.00	12.00	11.00	9.10	7.60	5.80	4.40	2.60	1.00	0.50
	0.81	0.75	0.90	14.00	13.00	13.00	13.00	12.00	10.00	8.10	5.50	3.20	1.60	0.80
	1.00	0.75	0.90	21.00	21.00	20.00	19.00	17.00	15.00	13.00	9.90	6.70	2.90	1.50
	1.25	1.00	0.90	32.00	30.00	29.00	28.00	26.00	23.00	19.00	15.00	11.00	5.40	2.70
2	0.38	0.75	0.90	4.10	3.60	3.20	2.80	2.40	2.00	1.60	1.20	0.82	0.41	0.21
	0.62	0.75	0.90	11.00	9.70	8.60	7.60	6.60	5.50	4.40	3.40	2.30	1.10	0.55
	0.72	0.75	0.90	13.00	13.00	12.00	11.00	9.10	7.60	5.80	4.40	2.60	1.00	0.50
	0.81	0.75	0.90	15.00	15.00	13.00	11.00	9.30	7.80	6.20	4.40	2.90	1.50	0.73
	1.00	0.75	0.90	22.00	21.00	20.00	19.00	17.00	15.00	12.00	9.20	5.60	2.70	1.30
	1.25	1.00	0.90	35.00	34.00	31.00	29.00	26.00	22.00	18.00	14.00	9.10	3.70	1.90
	1.62	1.00	0.87	51.00	50.00	50.00	49.00	44.00	37.00	30.00	23.00	15.00	6.70	3.30
3	1.25	1.00	0.90	35.00	34.00	32.00	29.00	25.00	21.00	18.00	14.00	10.00	4.90	2.50
	1.62	1.50	0.90	52.00	50.00	46.00	42.00	37.00	33.00	29.00	22.00	15.00	6.50	3.30
	2.00	1.50	0.90	82.00	77.00	73.00	66.00	59.00	52.00	43.00	34.00	24.00	14.00	6.90
	2.62	2.00	0.90	114.00	112.00	109.00	105.00	99.00	88.00	73.00	55.00	37.00	18.00	8.80
4	1.62	1.50	0.90	53.00	50.00	46.00	42.00	37.00	32.00	29.00	22.00	15.00	7.30	3.60
	2.25	2.00	0.90	102.00	96.00	89.00	82.00	73.00	63.00	52.00	40.00	27.00	14.00	7.00
	2.62	2.00	0.90	134.00	128.00	118.00	106.00	92.00	80.00	65.00	53.00	35.00	16.00	8.00
	3.50	2.50	0.90	195.00	187.00	177.00	165.00	151.00	134.00	113.00	89.00	62.00	32.00	16.00
6	2.62	2.00	0.90	149.00	139.00	129.00	115.00	100.00	84.00	67.00	53.00	37.00	21.00	10.00
	3.00	2.00	0.90	182.00	173.00	160.00	143.00	125.00	108.00	88.00	68.00	49.00	25.00	13.00
	3.50	2.50	0.90	233.00	218.00	201.00	180.00	157.00	132.00	109.00	87.00	70.00	40.00	20.00
	5.00	3.00	0.90	433.00	418.00	395.00	367.00	332.00	291.00	245.00	193.00	134.00	70.00	35.00
8	2.62	2.00	0.90	166.00	156.00	144.00	128.00	111.00	92.00	74.00	55.00	38.00	22.00	11.00
	3.50	2.50	0.90	273.00	254.00	233.00	210.00	185.00	158.00	129.00	99.00	67.00	34.00	17.00
	5.00	3.00	0.90	481.00	456.00	426.00	392.00	352.00	306.00	255.00	197.00	135.00	68.00	34.00
	6.25	4.00	0.90	681.00	657.00	620.00	575.00	520.00	456.00	383.00	301.00	210.00	109.00	55.00
10	5.00	3.00	0.90	557.00	518.00	476.00	429.00	378.00	323.00	257.00	190.00	136.00	69.00	35.00
	6.25	4.00	0.90	702.00	664.00	610.00	548.00	477.00	403.00	325.00	244.00	165.00	109.00	54.00
	8.00	4.00	0.90	1056.00	1014.00	963.00	900.00	824.00	732.00	621.00	490.00	340.00	174.00	87.00
12	6.25	4.00	0.90	852.00	795.00	728.00	642.00	548.00	440.00	340.00	250.00	165.00	107.00	54.00
	7.38	4.00	0.90	983.00	928.00	858.00	771.00	669.00	561.00	451.00	339.00	233.00	149.00	74.00
	9.50	4.00	0.90	1400.00	1370.00	1310.00	1220.00	1110.00	980.00	820.00	639.00	480.00	252.00	126.00
14	6.25	4.00	0.90	880.00	820.00	740.00	650.00	555.00	450.00	345.00	250.00	165.00	107.00	54.00
	8.00	4.00	0.90	1237.00	1152.00	1057.00	954.00	841.00	719.00	588.00	448.00	303.00	175.00	88.00
	11.00	4.00	0.90	1880.00	1830.00	1740.00	1610.00	1460.00	1270.00	1050.00	790.00	642.00	336.00	168.00

OpGL™
Dimensions & Weight Tables

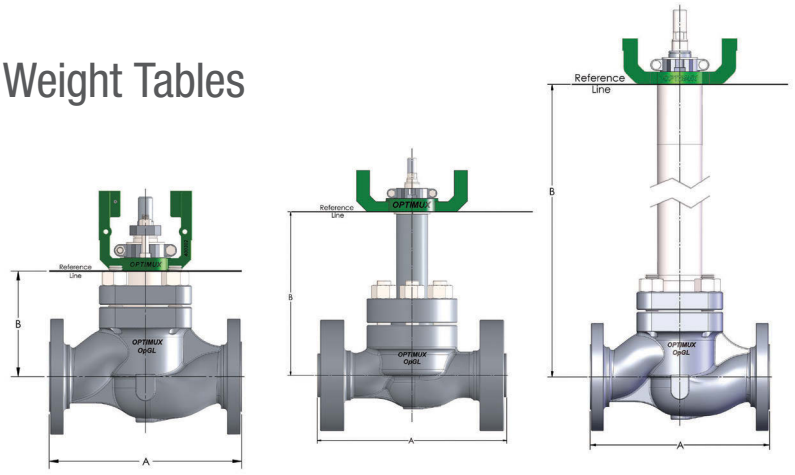

Table 19: Valve Dimensions - Class 150-300-600

Body Size (Inch)	A						B						Space Needed for Disassembling Above Actuator	
	ANSI/ISA						Standard Bonnet		Extended Bonnet		Cryogenic Bonnet			
	Class 150		Class 300		Class 600									
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/2 & 3/4	7.30	185	7.60	193	8.10	206	3.84	98	8.42	214	17.80	452	2.50	64
1	7.30	185	7.80	198	8.30	211	3.84	98	8.42	214	17.80	452	2.50	64
1 1/2	8.80	224	9.30	236	9.90	251	5.22	133	9.70	246	20.20	513	4.00	102
2	10.00	254	10.50	267	11.30	287	5.48	139	9.98	253	20.50	521	4.50	114
3	11.80	300	12.50	318	13.30	338	6.89	175	12.38	314	21.90	556	5.80	147
4	13.90	353	14.50	368	15.50	394	8.62	219	14.13	359	24.00	610	7.50	191
6	17.80	452					10.14	258	15.60	396	26.50	673	10.00	254
6			18.60	472	20.00	508	12.48	317	17.80	452	26.50	673	10.00	254
8	21.40	544					12.92	328	18.00	457	CF		11.40	290
8			22.40	569	24.00	610	14.72	374	20.25	514			11.40	290
10	26.50	673					14.30	363	CF				11.90	302
10			27.90	709	29.60	752	16.31	414					12.10	307
12	29.00	737					17.31	440					12.60	320
12			30.50	775	32.30	820	17.31	440					12.60	320

Table 20: Valve Dimensions - Class 900-1500-2500

Body Size (Inch)	A				B								Space Needed for Disassembling			
	Distance Between Flanges				Standard Bonnet				Extended Bonnet							
	Class 900/1500		Class 2500		Class 900/1500		Class 2500		Class 900/1500		Class 2500		Class 900/1500		Class 2500	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
1	11.00	279	12.02	305	6.10	155	6.80	173	10.10	257	11.30	287	3.60	91	3.60	91
1 1/2	13.00	330	15.01	381	9.10	231	8.70	221	13.20	335	13.20	335	5.60	142	5.60	142
2	14.80	376	15.80	401	9.10	231	8.70	221	13.20	335	13.20	335	6.10	155	6.10	155
3	18.10	460	26.01	661	10.90	277	12.90	328	18.40	467	19.90	505	8.40	213	8.30	211
4	20.90	531	29.01	737	12.40	315	14.60	371	19.40	493	21.60	549	9.70	246	10.70	272
6	30.02	763	34.01	864	16.40	417	17.40	442	23.40	594	27.30	693	12.20	310	13.60	345
8	32.80	833	40.30	1024	18.60	472	24.30	617	24.20	615	31.30	795	16.70	424	17.80	452
10	39.00	991	50.00	1270	21.90	556	26.00	660	28.90	734	33.00	838	18.30	465	19.50	495
12	44.50	1130	56.00	1422	26.60	676	28.00	711	33.60	853	35.00	889	19.40	493	20.50	521
14	49.50	1257			24.80	630			31.80	808			20.50	521		

OpGL™
Dimensions & Weight Tables

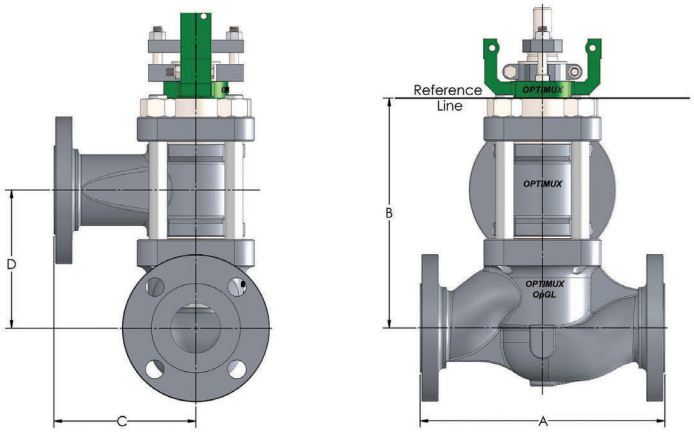

Table 21: 3-Way Valve Dimensions - Class 150-300-600

Body Size (Inch)	A						B				C		D		Space Needed for Disassembling above Actuator	
	ANSI/ISA						Standard Bonnet		Extended Bonnet							
	Class 150		Class 300		Class 600											
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
1/2 & 3/4	7.30	185	7.60	193	8.10	206	6.70	170	11.20	284	4.30	109	3.40	86	3.40	86
1	7.30	185	7.80	198	8.30	211	6.70	170	11.20	284	4.30	109	3.40	86	3.40	86
1 1/2	8.80	224	9.30	236	9.90	251	9.10	231	13.40	340	4.80	122	5.40	137	5.00	127
2	10.00	254	10.50	267	11.30	287	9.30	236	13.70	348	5.80	147	5.60	142	5.50	140
3	11.80	300	12.50	318	13.30	338	13.00	330	18.50	470	7.00	178	7.60	193	7.10	180
4	13.90	353	14.50	368	15.50	394	16.70	424	22.10	561	8.50	216	9.90	251	9.40	239
6	17.80	452					21.60	549	26.60	676	8.90	226	14.00	356	11.60	295
6			18.60	472	20.00	508	25.80	655	31.30	795	10.00	254	16.00	406	11.60	295
8	21.40	544					23.90	607	29.40	747	10.70	272	15.00	381	12.20	310
8			22.40	569	24.00	610	30.20	767	35.70	907	12.00	305	18.30	465	12.20	310

Table 22: Estimated Shipping Weights

Size (Inches)	Weight in Pounds / Kilograms												Add for Extended Bonnet	
	Class 150		Class 300		Class 600		Class 900		Class 1500		Class 2500			
	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg	lbs	Kg
1/2 - 3/4	40	18	40	18	40	18							5	2
1	50	23	50	23	50	23	100	45	120	54	150	68	5	2
1 1/2	65	29	65	29	65	29	170	77	180	82	210	95	5	2
2	75	34	75	34	75	34	200	91	220	100	300	136	5	2
3	160	73	170	77	180	82	400	181	430	195	500	227	15	7
4	240	109	250	113	365	166	590	268	610	277	940	426	20	9
6	360	163	570	259	600	272	1000	454	1170	531	1400	635	40	18
8	590	268	790	358	830	376	1100	499	1320	599	1740	789	65	30
10	1050	476	1405	637	1600	726	2050	930	2200	998	2600	1179	90	41

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The information and specifications described in this document are considered accurate. However, they are intended for informational purposes only. Any specification and selection of the products herein described should be reviewed by a Trimteck applications engineer.

Trimteck products are continuously improved and upgraded. Therefore the information herein is subject to change without notice.

For further information about this product, consult your local Authorized Trimteck Sales Representative, Distributor, or Certified Service Center. Instructions for installation, operation, preventive maintenance, and troubleshooting are contained in the OpGL Globe Control Valve Product Instruction Manual (PIM).

For more information visit our website at www.trimteck.com

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DX Series

OpDX™ Butterfly Control Valve

OpDX
Control Valve

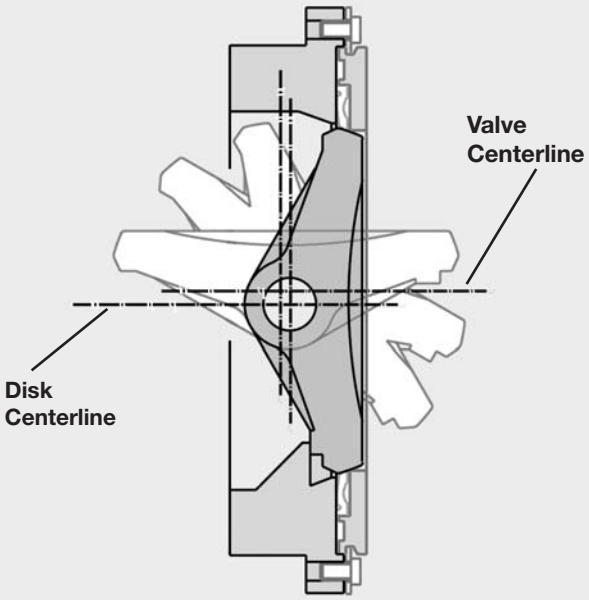

Figure 1: Eccentric-Cammed Disk Rotation

The high performance OpDX, rotary valve uses a pressure assisted seating concept, to achieve a bi-directional bubble-tight shutoff while maintaining low breakout torque, specially at every first opening actuation, at both high and low pressure drops. It is available in ANSI Classes 150 thru 2500 and in sizes from 2 to 30-inch. OpDX is available in carbon steel, stainless steel and other alloys. The seat design assures low breakout torque by utilizing the pressure drop across the valve to aid the seating process. Combined with a high-thrust cylinder actuator and eccentric-cammed disk, it is possible to achieve a high performance throttling – even under large pressure drops in the valve.

OpDX's Eccentric Cammed Disk

A double offset has been designed into the disk to lift it out of the seat immediately upon opening actuation, this avoids wear on the seat and disk, by reducing leakage and parts replacement. It also improves throttling by eliminating friction.

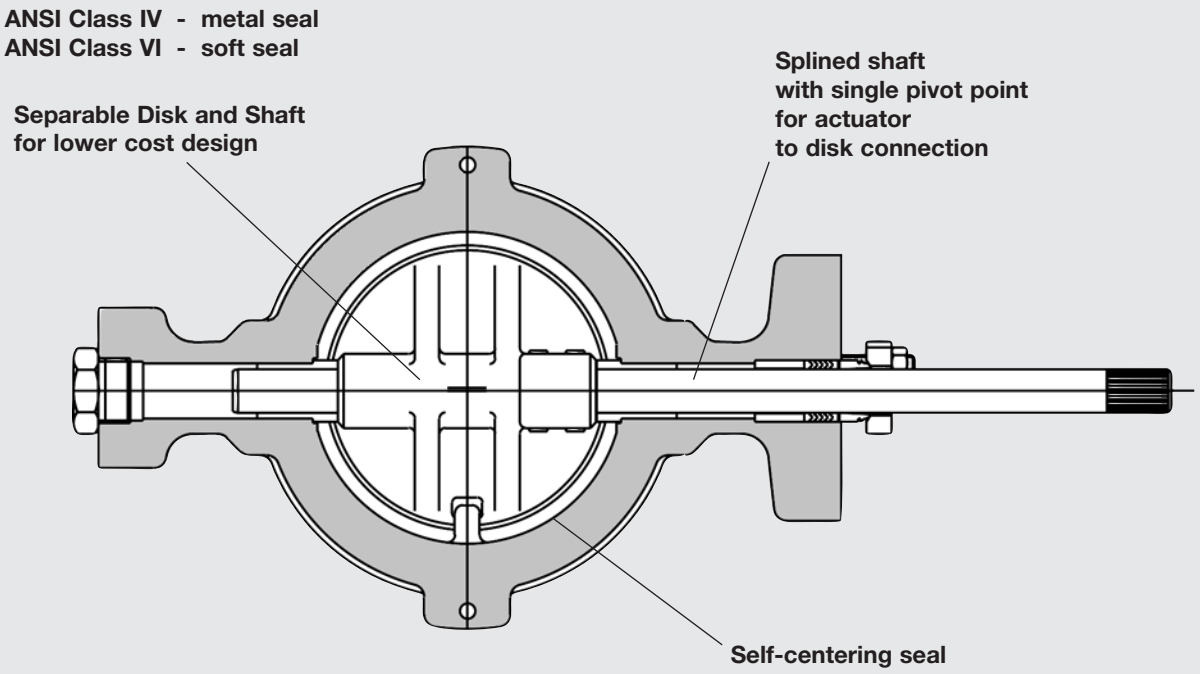

Figure 2: Body subassembly

OpDX
Seating Principles

The OpDX seating concepts utilize the pressure drop across the valve to force the soft seat to bubble-tight shutoff in either flow direction, including alternating flow applications. It is done in such a way that seating capacity is increased, as differential pressure is increased. The soft seats achieve ANSI Class VI shutoff.

Table I: Seat Leakage

Metal Seat`	ANSI Class IV
Soft Seat	ANSI Class VI
Flow Seat	2% of Rated C_V
Double Seat	ANSI Class IV

Figure 3
As pressure enters the seat cavity formed between the seat and the shaft downstream, the seat jams into the disk, causing it to seat tighter against the disk.

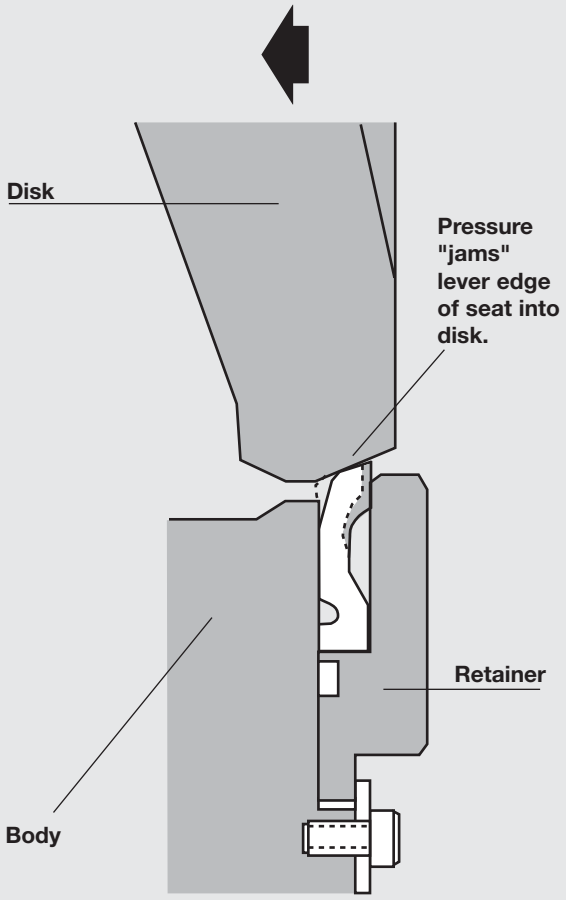

Figure 3
Seating Principles
Soft seat - Flow Upstream

Figure 4
As pressure enters the seat cavity formed between the seat with the shaft upstream, the seat tends to toggle or flatten out, causing it to seal tighter against the disk.

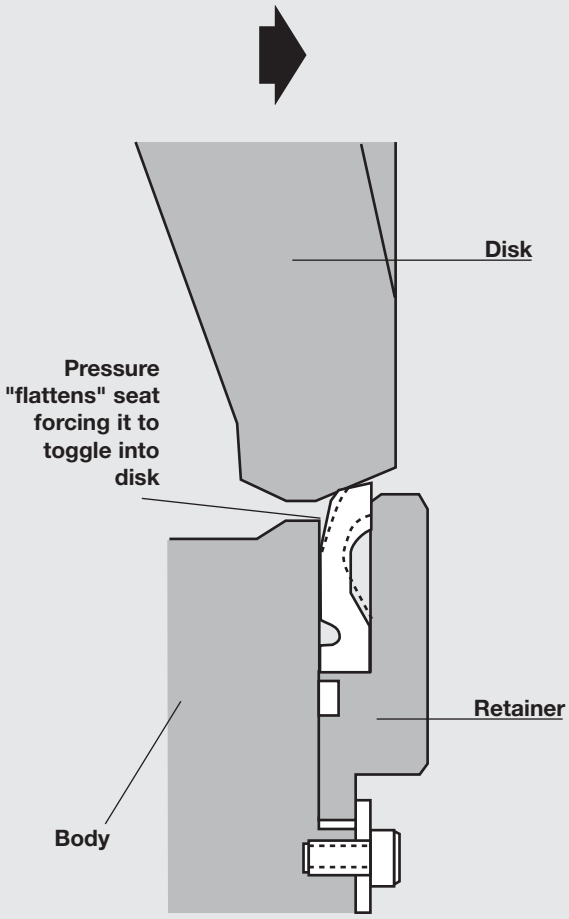

Figure 4
Seating Principles
Soft Seat - Flow Downstream

OpDX
Flow

Flow Direction

OpDX allows two different operating directions: shaft upstream or shaft downstream, depending on service conditions. With the shaft downstream, the flow tends to open the valve, and with the shaft upstream the flow tends to close the valve.
Whenever possible it is recommended that OpDX valves be installed with the shaft downstream so as to result in a lower dynamic torque when the valve is open. On liquid service, with the shaft installed upstream, the forces produced from liquid inertia can cause system and valve serious problems such as waterhammer or flow instability as the valve closes.
For gas service, if the flow must assist fail-open applications, the valve must be installed with the shaft downstream and with the shaft upstream if flow must assist fail-closed applications.
However shaft installation must be always upstream if the flow must assist fail-closed applications and to insure the valve disk moves to the closed position.
For liquid services, all the valves must be installed with the shaft downstream whatever fail-safe application is required.

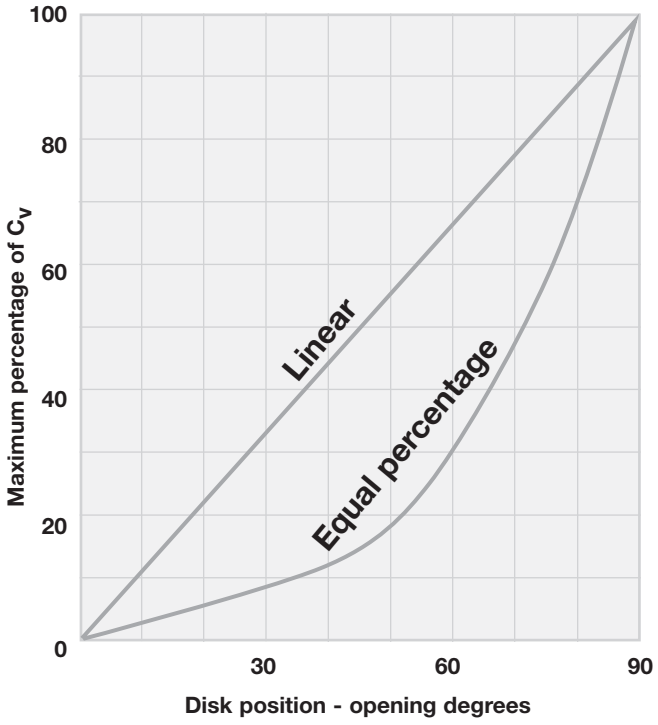

Figure 5: Flow Characteristics

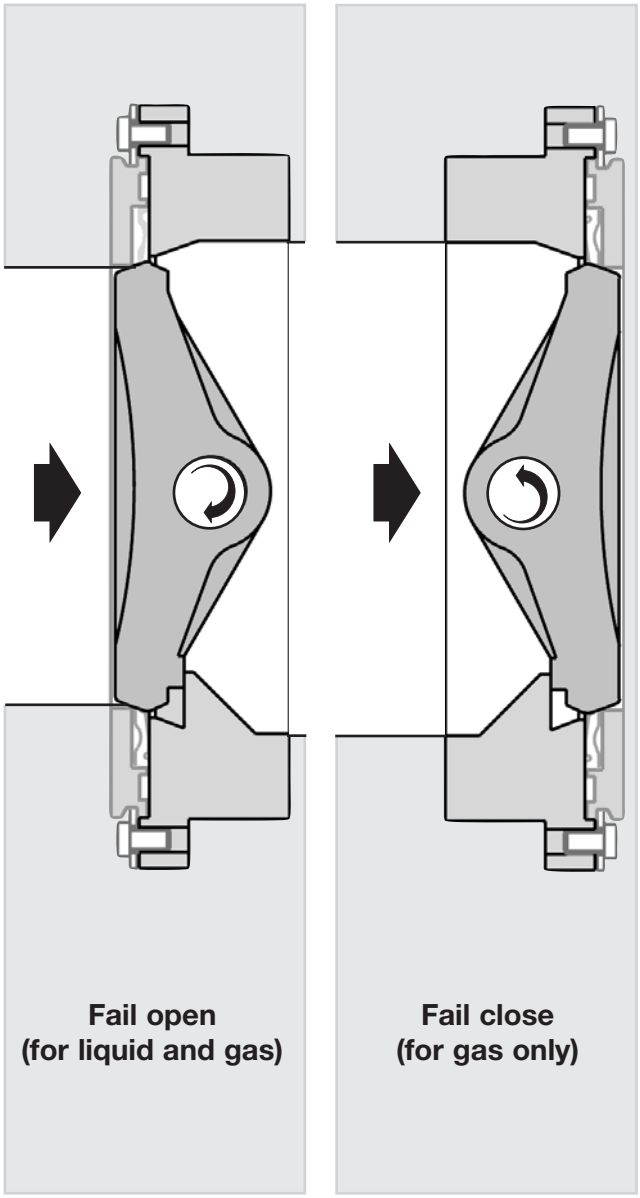

Figure 6: Flow direction

Flow Characteristic

The inherent characteristic of OpDX is a modified parabolic characteristic curve. Other characteristics are available by simply replacing the positioner cam to obtain the proper characteristic curve required.
Other cams for flow characteristics such as inherent linear and equal-percentage as well as a linear rate between signal and shaft rotation are also available.

OpDX
Disk, Seats

Disk
OpDX body and disk assembly was designed to ensure a wide range of flow capacity. The concave profile on one side of the disk allows for an increased flow capacity while reinforcement ribs on the other side prevents the disk from flection effects specially under high differential pressures. The disk is also provided with a disk-stop to protect the seat from damage due to overstroking.

Soft Seat
OpDX soft seat maintains a properly designed configuration that provides a bubble-tight shutoff equal to ANSI Class IV to be achieved.

Dual Seat
OpDX dual seats incorporates both soft seat and the flexible lip metal seat for added protection.

Metal Seat
Metal seats are used for applications involving higher temperatures than those permitted by the soft seat. The design incorporates a highly flexible lip which assures full circle contact between the seat and disk when the valve is closed.
Because of lip flexibility, breakout torque for the metal seat is the same or less than soft seat breakout torque. OpDX metal seat assures a tight shutoff above that of ANSI Class IV.

Flow Direction
The tight shutoff system allows OpDX to flow either shaft downstream or shaft upstream, depending on service conditions.

Seat Configurations

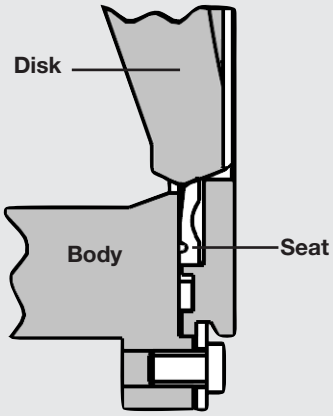

Figure 7: Soft Seat

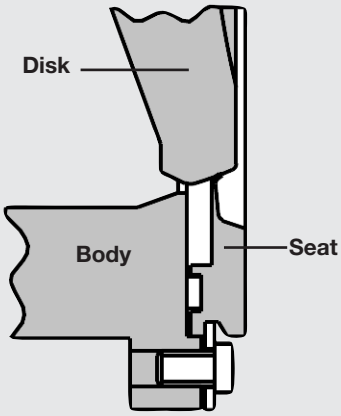

Figure 8: Metal Seat

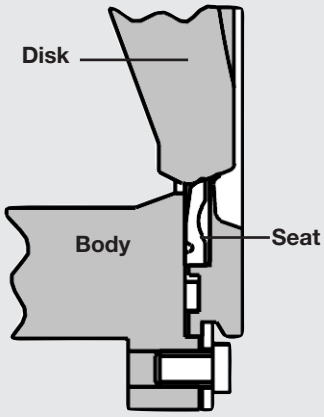

Figure 9: Dual Seat

OpDX
Features and Advantages

Soft Seat
- Bubble-tight shutoff , according to ANSI Class VI
- Low breakout torque assures accurate throttling, even close to the seat
- Flow -free profile
- Easy removal

Metal Seat
- Tight shutoff superior to ANSI Class IV

Eccentric-cammed disk
- Disk pulls out of seat immediately, preventing seat wear
- Accurate throttling due to disk profile when rotating into the seat

Single pivot-point, splined shaft
- Lost motion minimized between shaft and actuator

Bolted seat retainer
- Uninterrupted gasket surfaces allows for a wide variety of gasketing

Non-selective disk and shaft
- Easy maintenance
- Reduced cost – replace part needed, not entire assembly

Flangeless body (wafer)
- Rugged and lightweight for easy handling and maintenance; one body (wafer) serves ANSI Classes 150, 300 and 600 in sizes 2, 3, 4, 6 and 8 inches.
- Industry standard MSS SP-67 permits shorter flange bolting than ball or cammed valves, increasing safety and reducing possibility of leakage.

Flow capacity
- Capacity greater than globe, plug and cammed control valves.

Concave disk
- Increased flow capacity

Disk stop in the body
- Prevents damage to seat due to overstroking
- Permits in-line disk relocation during maintenance

Wide variety of packing configurations
- Purged bonnet and lubricator options

Fully enclosed, air plugged transfer case
- Extra safety
- Prevents environment corrosion to actuator parts
- Disk position indicator mounted on the transfer case

Piston and cylinder actuator
- High thrust for high-performance throttling in extreme pressure drops
- Compact and lightweight for easier servicing and maintenance
- Fully interchangeable with rotary valves actuator
- Actuator air pressures allowable up to 150 psi

Wide interchangeability
- Spare parts stocking requirements minimized
- Inventory costs reduced
- Many parts of other Optimux products interchangeable with OpDX

Available in a variety of materials
- Carbon steel, stainless steel and other alloys

Seat interchangeability

Metal or Teflon seats easily installed

Spool-type four-way position
- High performance with double switch
- P/P and I/P convertible
- Calibration and maintenance easy due to fewer parts

The combined features designed into OpDX create a valve measurably superior to all other rotary valves. The information and specification contained in the following pages are provided for comparison.

OpTK
Actuator

RA Piston Cylinder Actuators

Optimux's Series RA Piston-Cylinder-Rotary-Actuators are an excellent actuation choice to obtain maximum performance of our **OpDX** eccentric plug control valves. The Optimux Series RA piston cylinder rotary actuators with fail-safe spring combine high torques with pneumatic stiffness which together deliver excellent throttling characteristics. The Series RA compared to regular spring-diaphragm actuators, are lightweight, compact, efficient and in general, they take a smaller foot-print for installation in pipelines, they are simply, one of the best choices in actuation systems for rotary control valves.

The Series RA piston cylinder actuators are offered as our standard offer for all of our Rotary valves: Series XL and Series VB.

The Optimux Series RA piston cylinder actuator was designed to work with supply pressures of up to 150 psi (10.3 bars), which significantly increases torque capacity. The Series RA performance and reliability in the field has no par, as it has proven life service above one million cycles.

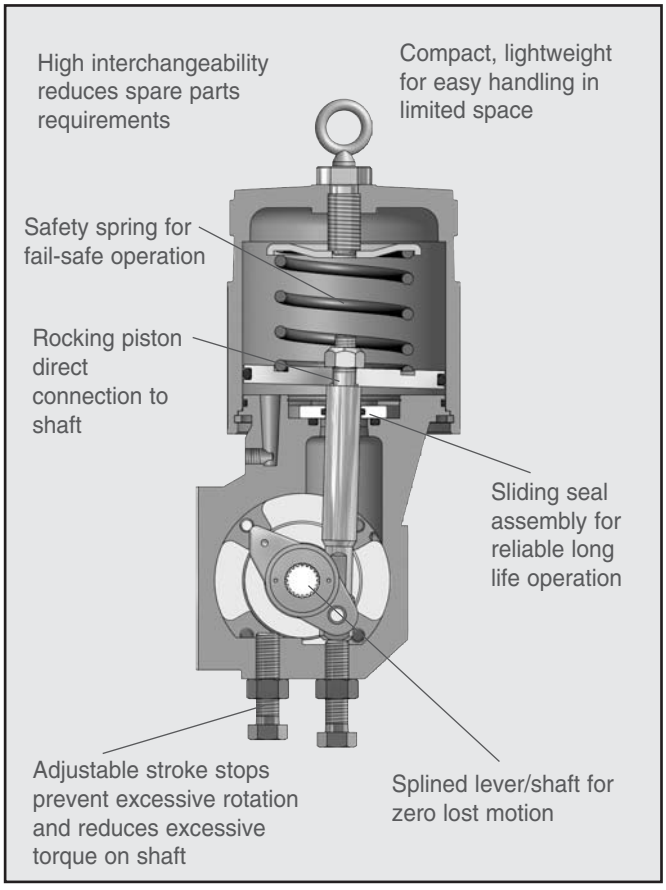

Figure 10: RA Rotary Actuator

The pneumatic stiffness achieved by the Series RA assures excellent throttling and control characteristics specially in near closing control positions.

Table II: Rotary Actuator Specifications

Type	Double-acting piston and cylinder with fail-safe spring
Sizes	25, 50
Action	Air-to-open Air-to-close Last position Field reversible
Operating Pressure	Max 150 psig Max 10,3 bars
Stroking Speed	≤ 1 second
*Temperature Range	-40˚ to 350˚F (-40˚ to 175˚ C)
Auxiliary Handwheels	Declutchable side-mounted handwheel Lever-gear operated handwheel Lever operator
Positioners	Digital HPP-3000 Digital HPP-3500

Table III: Construction Materials

Yoke	Ductile iron
Transfer Case	Anodized aluminum
Splined Lever Arm	Nickel-plated ductile iron
Stem	UNS S 41600 Stainless Steel
Bearings	Filament wound fiberglass with Teflon liner
Sliding Seal	Delrin, aluminum
Retaining Ring	Cadmium plated steel
Piston	Anodized Aluminum
Cylinder	Anodized Aluminum
O-Ring*	Buna-N (standard)
Actuator spring	Coated steel (rust proof)
Spring button	Cadmium-plated steel

* Ambient temperatures greater than 180˚ F (82˚ C) require Viton O-rings. Ambient temperatures below -40˚ F (-40˚C) require fluorosilicone O-rings.

OpTK
Rotary Actuators, Features and Characteristics

RPA Rack and Pinion Actuators

Optimux's Series RPA represent an excellent alternative to our RA Piston-Cylinder Series for rotary valves applications. As with the RA Series the RPA actuators are compact, allow for field reversibility, provide adequate torque for most standard applications and are easy to maintain. RPA actuators are designed for extremely long cycle life when utilized in normal loading applications. The RPA actuators will take service temperatures of -10º to 275º F (-23º to 135º C).

The Series RPA actuators are also offered for all our rotary valves: Series XL and Series VB.

Table IV: Double Acting Torque Values (in. Lbs)

PSI	40	60	80	100	120
RPA052	263	395	526	658	789
RPA148	740	1,109	1,479	1,849	2,219
RPA222	1,109	1,664	2,218	2,773	3,327
RPA470	2,071	3,106	4,142	5,177	6,213
RPA900	4,550	6,825	9,100	11,375	13,650

* Other model numbers and torque options are also available

Optimux® HPP4000 Smart Valve Positioners

Our new HPP4000 brings to the market all the field proven attributes of our former HPP3000 plus all the additional features our users have requested for the past few years: LCD Display, 4-20mA feedback signal, HART® communication protocol and Auxiliary Limit Switches, all of these within our legendary and well proven robust enclosure capable of sustaining the most rigorous industrial plant conditions.

But this is not all, the HPP4000 was designed to accurately position your control valve and to operate it efficiently at the lowest possible air consumption (LPM) bellow 3 LPM @ 100 psi.

Optimux® HPP4500 Smart Valve Positioners

Our new HPP4500 microprocessor equipped, current-to-pneumatic digital positioner is a reliable, accurate and robust positioner which offers as a standard many features and technical characteristics traditionally offered as options by other digital positioner's manufacturers.

The HPP4500 offers as a standard, Hart® communication, 4-20mA Feedback Signal and a LCD display.

Figure 11: RPA Rack and Pinion Actuator

Figure 12: HPP4000 Digital Series

Figure 13: HPP4500 Digital Series

OpTK
Packings

The **OpDX** rotary valve is built with a large packing box which gives a longer service life to the packing assembly. The **OpDX** Packing box design allows for the use of a large number of packing system options, and fully complies with the most demanding fugitive emission control regulations in modern industrial processes.

Standard Packing

The **OpDX** standard packing set is composed by PTFE "V" rings, Figures 14A and 14B. The PTFE "V" rings are the most used packing system since their introduction, providing exceptional tight sealing. They provide a very low friction coefficient, good mechanical resistance and excellent resistance to corrosion. The PTFE "V" rings are the most common application choice for gasketing material.

The PTFE "V" rings are used within temperature ranges of -150º to 450°F (-101 to 232° C). High Temperature Packing The **OpDX** formed packing rings, Figures 15A and 15B, is an alternative choice whenever the operating temperature exceeds that determined for the use of PTFE "V" rings. The materials employed in the formed packing rings of the **OpDX** are braided PTFE for use in temperatures up to 500°F (260°C) and Grafoil for use in temperatures up to 752°F (400°C). The Grafoil formed packing rings are an excellent choice whenever packing is subjected to high operating temperatures, however it should be noted that the demand of high forces required to achieve a tight sealing results in a significant friction increase forces as the valve plug turns.

Special Packing

The PT type packing set, Figure 16A, is composed by a set of "V" type rings under compression by an assembly of disc springs that result in a "live-loading" effect. This system achieves a sealing level of below 500 ppm. The PT type packing combines the superior virgin PTFE "V" rings quality with the PTFE "V" rings combined with carbon filament wound. The PTG type packing, Fig. 16B, is composed of an advanced packing set that is capable of keeping a sealing rate very below 500 ppm (at a 10 ppm step rate). The PTG packing set is composed by the combination of PTFE "V" rings with carbon filament wound and Kalrez® "V" rings, an advanced material that provides a superior performance to the packing set. For temperatures higher than 450°F (232° C) the PTG XT packing set is employed. This type of packing utilizes Zymax® rings instead the PTFE/carbon rings.

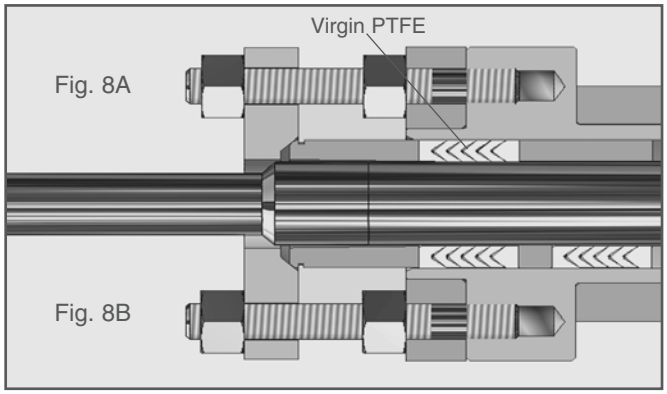

Figure 14A: Standard Packing: "V" rings
Figure 14B: Double Packing: "V" rings

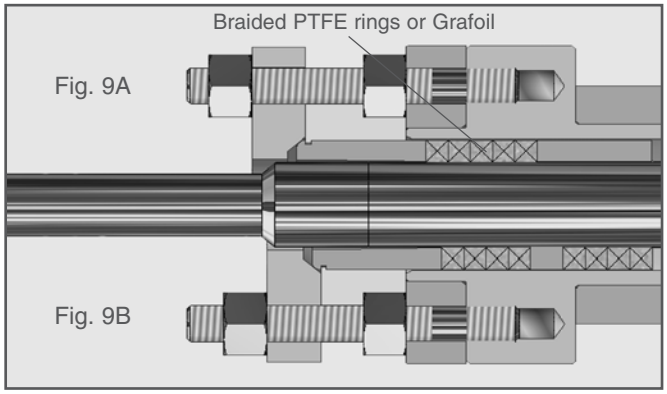

Figure 15A: Packing: Formed Rings
Figure 15B: Double Packing: Formed Rings

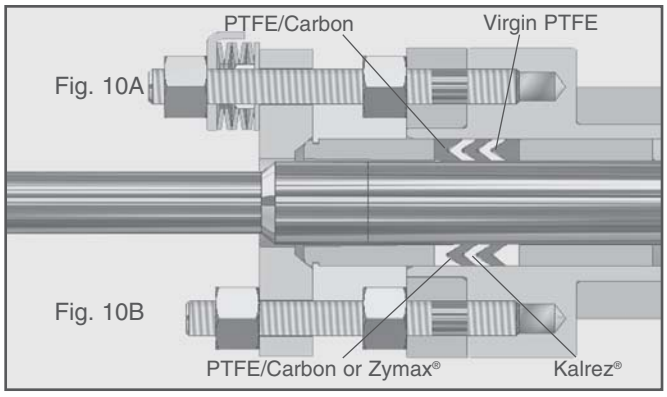

Figure 16A: PT Packing Set
Figure 16B: PTG Packing Set

OpDX
Packing – Specifications

Table V: Packing Temperature Limitations (˚F/˚C)

Packing Material	Standard bonnet (1)		Extended bonnet (1)		Cryogenic extended body	
	˚F	˚C	˚F	˚C	˚F	˚C
Teflon TFE	-20 a 450	-28 a 232	-150 a 600 (2)	-101 a 315	-420	-251
braided PTFE (3)	-20 a 500	-28 a 260	-150 a 650	-101 a 343	-420	-251
Glass-filled Teflon, PTFE	-20 a 500	-28 a 260	-150 a 650	-101 a 343	-420	-251
Asbestos-free w/ inconel (4)	-20 a 750	-28 a 398	-20 a 1200	-28 a 649	N/R	N/R
Grafoil (5)	-20 a 750	-28 a 398	-20 a 1500	-28 a 815	N/R	N/R
PTG	-20 a 450	-28 a 232	-150 a 600	-101 a 315	-420	-251
PT	-20 a 450	-28 a 232	-20 a 600	-28 a 315	-250	-156
PTXT	-20 a 550	-28 a 289	-20 a 700	-28 a 371	-250	-156

(1) The ANSI B16.4 standard specifies pressure/temperature limitations for the valve bodies. Consult our Engineering Dept.. for additional information.
(2) If the appropriate body and bonnet materials are used.
(3) 8 to 12-inch, Class 150-600; and 3 to 12-inch, Class 900 – 2500 can be used to 850°F (455°C).
(4) Asbestos-free, high temperature packing.
(5) Do not use Grafoil above 800°F (427°C) in oxiding services such as air or oxygen.

Table VI: Packing Maximum Allowable Pressure, Standard Bonnet (psi/bar)

Material		Maximum temperature																			
		˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C
		100	38	150	65	200	93	250	121	300	149	350	177	400	204	450	232	500	260	550	288
Teflon TFE	psi	1700		1200		800		470		400		280		170		110					
	bar		116		82		54		32		27		19		11		7.5				
Braided PTFE	psi	3500		1700		1200		1000		780		600		500		400		220			
	bar		238		116		82		68		53		41		34		27		15		
Glass-filled Teflon PTFE	psi	3500		1700		1200		1000		780		600		500		400		220			
	bar		238		116		82		68		53		41		34		27		15		
PTG	psi	1700		1200		900		700		580		480		370		320					
	bar		116		82		61		48		39		33		25		22				
PT	psi	1700		1200		900		700		580		480		370		320					
	bar		116		82		61		48		39		33		25		22				
PTXT	psi	6000		2000		1500		1100		960		700		590		440		390		300	
	bar		408		136		102		75		67		48		40		30		26		20

Table VII: Packing Maximum Allowable Pressure, Extended Bonnet (psi/bar)

Packing Material		Maximum temperature																			
		˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C	˚F	˚C
		200	93	300	149	350	177	400	205	450	232	500	260	550	288	600	316	650	343	700	371
Teflon TFE	psi	1300		800		650		500		380		280		200		175		160			
	bar		88		54		44		34		26		19		13.5		12		11		
Braided PTFE	psi	1300		1300		800		650		510		410		310		270					
	bar		88		88		54		44		35		29		21		18				
Glass-filled Teflon PTFE	psi	1300		1300		800		650		510		410		310		270					
	bar		88		88		54		44		35		29		21		18				
PTG	psi	1300		800		650		500		380		280		200		175		160			
	bar		88		54		44		34		26		19		13.5		12		11		
PT	psi	1300		800		650		500		380		280		200		175		160			
	bar		88		54		44		34		26		19		13.5		12		11		
PTXT	psi	1300		1300		1300		800		600		480		400		330		280		230	
	bar		88		88		88		54		41		33		27		22		19		15.6

OpDX

Specifications: △P / Temperature

Table VIII : SHAFTS - Maximum Allowable Pressure Drop (psi) versus Temperature

Temperature		Shaft material													
		17 - 4 PH							Nitronic						
		Valve Size (inches)													
°F	°C	2	3	4	6	8	10	12	2	3	4	6	8	10	12
600	315	1260	995	830	710	550	590	600	1466	710	590	500	395	420	430
425	218	1375	1080	905	780	605	640	650	1525	760	635	545	425	455	460
400	204	1395	1100	910	789	610	650	665	1536	770	640	550	428	460	465
300	149	1465	1150	960	830	645	690	700	1555	820	685	585	455	490	490
200	93	1530	1210	1000	870	675	720	730	1570	870	720	590	485	520	520
70	21	1600	1260	1050	910	700	750	760	1600	870	810	595	540	580	580
-50	-45	1600	1260	1050	910	700	750	760	1600	870	810	595	540	580	580
-100	-73	1600	1260	1050	910	700	750	760	1600	870	810	595	540	580	580
-400	-240								1600	970	810	595	540	580	580
Temperature		Shaft material													
		Inconel							Monel						
		Valve Size (inches)													
°F	°C	2	3	4	6	8	10	12	2	3	4	6	8	10	12
600	315	1460	1215	1010	875	420	705	735	1466	750	595	505	400	425	435
425	218	1525	1240	1030	890	455	730	740	1525	780	640	550	430	460	465
400	204	1530	1240	1035	895	460	740	750	1536	800	645	555	435	465	470
300	149	1555	1250	1040	900	485	745	755	1555	840	690	590	460	495	495
200	93	1570	1260	1050	905	520	750	760	1570	860	725	595	490	525	525
70	21	1605	1275	1060	910	580	760	770	1600	860	820	600	545	580	585
-50	-45	1605	1275	1060	910	580	760	770	1600	860	820	600	545	585	585
-100	-73	1605	1275	1060	910	580	760	770	1600	860	820	600	545	585	585
-400	-240	1605	1275	1060	910	580	760	770	1600	970	810	595	540	585	585

(1) Find the operating temperature.
(2) Select the shaft material according to the △P (lbf/inch²).
(3) Make sure that shaft material selected complies chemically with the process media.
(4) Shafts in Monel are not recommended for non-lubricating media applications.

Table IX: SEATS - Maximum Allowable Pressure Drop (psi) versus Temperature

Temperature		Seat Material													
		TFE							Glass-filled Teflon						
		Valve Size (inches)													
°F	°C	2	3	4	6	8	10	12	2	3	4	6	8	10	12
600	315														
425	218								20/20	20/20	20/20	20/20	20/20	20/20	20/20
400	204								80/80	80/80	80/80	80/80	80/80	80/80	80/80
300	149	140/140	140/140	140/140	140/140	140/140	140/140	140/140	400/400	400/400	400/400	400/400	400/400	400/400	400/400
200	93	430/430	430/430	430/430	430/430	430/430	430/430	430/430	720/720	720/720	720/720	720/720	720/720	720/720	720/720
70	21	720/720	720/720	720/720	720/720	720/720	720/720	720/720	945/945	945/945	945/945	945/945	945/945	945/945	945/945
-50	-45	720/720	720/720	720/720	720/720	720/720	720/720	720/720	945/945	945/945	945/945	945/945	945/945	945/945	945/945
-100	-73														
-400	-240														

OpDX

Specifications: △P / Temperature

Table X: SEATS – Maximum Allowable Pressure Drop (psi) versus Temperature (cont.)

Temperature		Shaft material													
		Inox 316							Kel - F						
		Valve Size (inches)													
°F	°C	2	3	4	6	8	10	12	2	3	4	6	8	10	12
600	315	180/600	180/600	180/600	180/600	180/600	180/600	180/600							
425	218	220/750	220/750	220/750	220/750	220/750	220/750	220/750							
400	204	230/770	230/770	230/770	230/770	230/770	230/770	230/770							
300	149	250/865	250/865	250/865	250/865	250/865	250/865	250/865							
200	93	260/950	260/950	260/950	260/950	260/950	260/950	260/950							
70	21	260/950	260/950	260/950	260/950	260/950	260/950	260/950							
-50	-45	260/950	260/950	260/950	260/950	260/950	260/950	260/950	925/925	925/925	925/925	925/925	925/925	925/925	925/925
-100	-73	260/950	260/950	260/950	260/950	260/950	260/950	260/950	750/750	750/750	750/750	750/750	750/750	750/750	750/750
-400	-240								200/200	200/200	200/200	200/200	200/200	200/200	200/200

(1) Select seat material and find the △P (ibf/inch²).
(2) Values shown at left are considered for shaft upstream; values at right for shaft downstream.
(3) Make sure that seat material selected complies chemically with the process flow media.

Table XI: BEARINGS – Maximum Allowable Pressure Drop (psi) versus Temperature

Temperature		Bearing Material													
		MBT							Ultimet						
		Valve Size (inches)													
°F	°C	2	3	4	6	8	10	12	2	3	4	6	8	10	12
600	315								750	750	750	750	750	750	750
425	218	350	350	350	350	350	350	350	925	925	925	925	925	925	925
400	204	375	375	375	375	375	375	375	925	925	925	925	925	925	925
300	149	490	490	490	490	490	490	490	925	925	925	925	925	925	925
200	93	600	600	600	600	600	600	600	925	925	925	925	925	925	925
70	21	740	740	740	740	740	740	740	925	925	925	925	925	925	925
-50	-45	925	925	925	925	925	925	925	925	925	925	925	925	925	925
-100	-73	925	925	925	925	925	925	925	925	925	925	925	925	925	925
-400	-240	925	925	925	925	925	925	925	925	925	925	925	925	925	925

Temperature		Bearing Material						
		Stellite						
		Valve Size (inches)						
°F	°C	2	3	4	6	8	10	12
600	315	850	850	850	850	850	850	850
425	218	925	925	925	925	925	925	925
400	204	925	925	925	925	925	925	925
300	149	925	925	925	925	925	925	925
200	93	925	925	925	925	925	925	925
70	21	925	925	925	925	925	925	925
-50	-45	925	925	925	925	925	925	925
-100	-73	925	925	925	925	925	925	925
-400	-240	925	925	925	925	925	925	925

(1) Select the bearing material.
(2) Make sure that the bearing material selected complies chemically with the process flow media.
(3) Ultimet bearings are not recommended for non-lubricating.

Table XII: BEARINGS - Temperature Limitations

Bearing Material	Temperature Range		Description
	°F	°C	
MBT	-420 to 425	-251 to 218	Stainless Steel with Teflon
Ultimet	-420 to 600	-251 to 315	Cobalt - Chrome - Nickel - Molybdenum - Tungsten
Stellite	-50 to 1200 (2)	-45 to 649	Alloy no. 6

(1) See Table X for maximum pressure drop versus temperature.
(2) For temperatures above 800° F (427° C) consult Optimux Engineering Dept.

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Specifications

Table XIII : Maximum Allowable Inlet Pressure * for various Body Ratings and Temperatures, Bar (psi)

Temperature		WCB Carbon Steel (A216)**						316 Stainless Steel (SA-351-CF8M)**						Alloy 20 (A351-CN7M)**						Hastelloy C™-276**						Monel™ 400**					
		Pressure Class						Pressure Class						Pressure Class						Pressure Class						Pressure Class					
		150		300		600		150		300		600		150		300		600		150		300		600		150		300		600	
°F	°C	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar	Psi	Bar
-20 to 100	-29 to 38	285	19	740	51	1480	102	275	18	720	49	1440	99	230	15	600	41	1200	82	290	20	750	51	1500	103	230	15	600	41	1200	82
200	93	260	17	675	46	1350	93	240	16	620	42	1240	85	215	14	555	38	1115	76	260	17	732	50	1465	101	200	13	530	36	1055	72
300	149	230	15	655	45	1315	90	215	14	560	38	1120	77	200	13	525	36	1045	72	230	15	693	47	1388	95	190	13	495	34	990	68
400	204	200	13	635	43	1270	87	195	13	515	35	1030	71							200	13	693	47	1388	95	185	12	480	33	955	65
500	260	170	11	600	41	1200	82	170	11	480	33	955	65							185	12	600	41	1200	82	170	11	475	32	950	65
600	316	140	9	550	37	1095	75	140	9	450	31	905	62							140	9	550	37	1095	75	140	9	475	32	950	65
700	371	110	7	535	36	1065	73	110	7	430	29	865	59							110	7	535	36	1065	73	110	7	475	32	950	65
800	427	80	5	410	28	825	56	80	5	415	28	830	57							80	5	410	28	825	56	80	5	460	31	915	63
900	482	50	3	170	11	345	23	50	3	395	27	790	54																		
1000	538	20	1	50	3	105	7	20	1	365	25	725	50																		
1100	593									325	22	645	44																		
1200	649									205	14	410	28																		

* For maximum ΔP values refer to Tables V to XI

** Values as recorded in ANSI B16.34 - 1988

Table XIV: Estimated Weights for Shipment
(with standard Actuator and Positioner)

Valve Size (in)	Weight		Valve Size (in)	Weight	
	pounds	kg		pounds	kg
2	40	18	14	280	127
3	50	23	16	320	145
4	60	27	18	390	177
6	80	36	20	540	245
8	120	55	24	680	309
10	190	86	30	830	377
12	250	114			

Table XV: Pressure Classes

Valve Size (in)	ANSI Standard (Pressure Class)*
2 3 4 6 8	150, 300 & 600
10 12	150, 300
14 16 18 20 24 30	150

* Consult Optimux for higher pressure classes

OpDX
Flow Coefficients, C_V

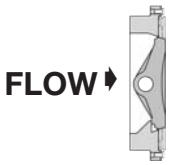

Table XVI: Flow Coefficients, C_V - Shaft UPSTREAM

Valve Size (in)	C_V - Percent Open									
	100	90	80	70	60	50	40	30	20	10
2	63	67	70	66	61	53	43	23	10.7	2.5
3	134	136	128	127	120	101	77	49	27	8.3
4	349	346	325	311	289	237	174	109	52	12.6
6	817	729	626	540	420	320	236	160	95	29
8	1644	1535	1244	1041	807	602	411	271	159	54
10	2780	2627	2185	1750	1363	991	668	434	245	100
12	4000	3838	3243	2622	2082	1553	1046	649	362	153
14	6640	6280	5280	4300	3340	2460	1670	1040	585	239
16	8400	7720	6430	5120	4100	3110	2120	1310	740	302
18	10350	9790	8240	6700	5210	3830	2610	1620	920	370
20	13670	12930	10880	8850	6880	5070	3450	2140	1210	490
24	20200	19120	16110	13080	10160	7490	5100	3160	1780	730

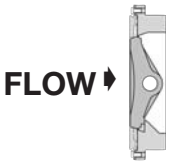

Table XVII: Flow Coefficients, C_V - Shaft DOWNSTREAM

Valve Size (in)	C_V - Percent open									
	100	90	80	70	60	50	40	30	20	10
2	58	59	60	60	57	49	38	22	10.2	2.4
3	123	124	120	115	111	99	81	54	29	8.8
4	242	252	232	200	187	173	135	87	45	10
6	819	775	647	521	419	330	246	172	101	32
8	1563	1522	1230	997	792	621	444	299	161	53
10	2640	2424	2023	1593	1227	924	618	343	193	62
12	3860	3590	2970	2380	1900	1420	985	655	384	180
14	6380	5870	4890	3890	3030	2270	1600	1080	677	287
16	8070	7410	6180	4930	3840	2870	2020	1360	856	364
18	9950	9150	7620	6070	4730	3540	2490	1680	1050	448
20	13300	12220	10170	8100	6310	4720	3320	2240	1410	600
24	19600	18070	15010	11980	9330	6980	4910	3320	2080	880

OpDX
Dimensions

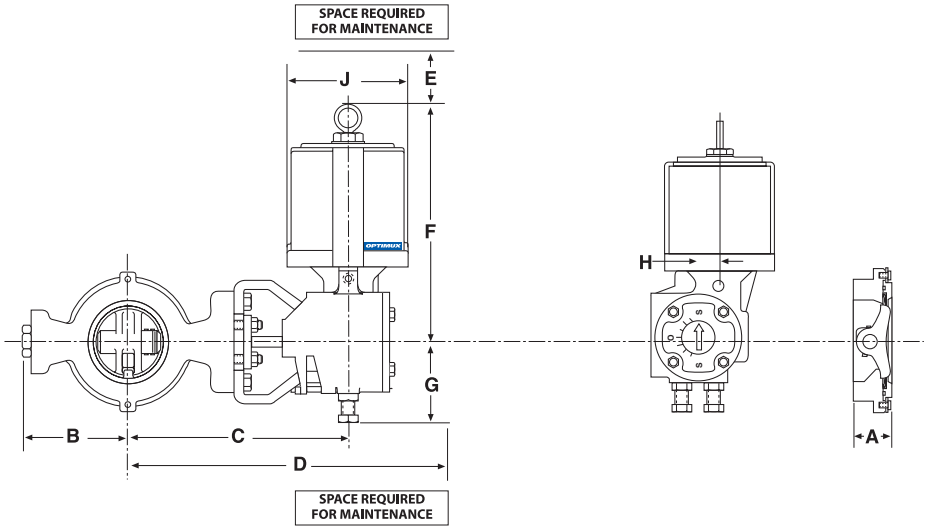

Table XVIII: OpDX - Dimensions (in/mm)
Body Class ratings 150, 300, 600 - 2" to 8"; 150, 300 - 10" and 12"
(with disk/shaft assembly in Classes 150/300)

Valve Size	Actuator	Shaft	A*		B		C		D		E		F		G		H		J	
(in)	Size	Diam. (inch)	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
2	25	.62	1.8	44	4.3	110	11.4	288	18.3	465	5.3	135	13,3	338	4.5	114	1.1	28	6.5	165
	50	.62	1.8	44	4.3	110	11.4	288	19.1	485	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
3	25	.62	1.9	48	5.1	130	11.7	298	18.7	475	5.3	135	13,3	338	4.5	114	1.1	28	6.5	165
	50	.62	1.9	48	5.1	130	11.7	298	19.5	495	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
4	25	.75	2.1	54	5.9	151	12.4	315	19.4	493	5.3	135	13,3	338	4.5	114	1.1	28	6.5	165
	50	.75	2.1	54	5.9	151	12.4	315	20.2	513	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
6	50	.87	2.3	57	7.6	192	14.3	363	22.1	561	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
	100	.87	2.3	57	7.6	192	14.3	363	24.5	622	8.5	216	22,9	582	7.5	191	2.4	61	12.5	318
8	50	1.12	2.5	64	8.6	219	16.3	415	24.1	612	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
	100	1.12	2.5	64	8.6	219	16.3	415	26.5	673	8.5	216	22,9	582	7.5	191	2.4	61	12.5	318
10	50	1.12	2.8	71	9.7	246	17.5	444	25.2	640	7.5	191	18,3	465	5.8	147	2.0	51	9.1	231
	100	1.12	2.8	71	9.7	246	17.5	444	27.7	704	8.5	216	22,9	582	7.5	191	2.4	61	12.5	318
12	100	1.50	3.2	81	11.2	283	18.7	474	28.9	734	8.5	216	22,9	582	7.5	191	2.4	61	12.5	318

- Dimensions for reference only. Certified drawings provided if required. - For sizes 14" to 30" consult Optimux.
* Body according to MSS SP67.

TRIMTECK®
OPTIMUX®

OpDX

Additional Information

The following information is required when ordering a OpDX control valve:

1. Preferably, the body size and eventual limitations of assembly and disassembling dimensions.
2. Original operating conditions: upstream/downstream pressures, temperature, flow rate, specific gravity or molecular weight of the fluid, steam pressure or gas compressibility factor.
3. Maximum temperatures and operating pressures.
4. Body and disk pressure class.
5. Material required for the body, disk, shaft, packing and bearings.
6. Pipeline diameter and schedule.
7. Actuator data type: (pneumatic or hand-operated). Fail-safe position, shut off pressure, and minimum air supply pressure.
8. Mounting orientations.
9. Accessories required.

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Considered that Optimux products design are continuously improved and upgraded, specifications, dimensions, and information described herein are subjected to change without notice.
For further information or verification, consult your Optimux representative. Specific instructions for the installation, operation, troubleshooting and maintenance of the Optimux control valves are contained on the Optimux Maintenance bulletin.

For more information, visit our website at www.trimteck.com

nqa.
ISO 9001
Registered

Cat. OPTIMUX OpDX - Rev.05 ENG - 09/2010

Printed in USA

TRIMTECK®
OPTIMUX®

HPP5500™ HART® Smart Valve Positioner

HPP5500™ HART® Smart Valve Positioners
Introduction

Our new HPP5500 microprocessor equipped, current-to-pneumatic digital positioner is a reliable, accurate and robust positioner which offers as a standard many features and technical characteristics traditionally offered as options by other digital positioner's manufacturers.

The HPP5500 offers as a standard, Hart® communication, 4-20mA Feedback Signal and a LCD display that allows programming and set up without the need of a Hart® communicator.

The HPP5500 was designed to accurately position your control valve and to operate it efficiently at the lowest liters per minute (LPM) air consumption: Below 3 LPM @ 100 psi. This feature alone represents considerable potential savings in compressed air plant capacity.

The HPP5500 incorporates all the smart features you would expect from a state-of-the-art digital positioner: Auto setup and calibration, flow characteristics customization in 16 points, tight shut-close and Shut-open settings, self diagnostics, PID parameters selection, A/M switch, 4-20mA signal feedback, split range 4-12mA or 12-20mA, and others.

When the HPP5500 receives a signal from a Hart® or regular 4-20mA control instrument, it modulates the air supply to the control valve actuator, thus providing accurate valve position, which is proportional to the 4-20mA control signal. The accuracy and responsiveness of the HPP5500 greatly contributes to obtain the best performance from any control valve, within a process control loop, or as a stand-alone application.

HPP5500™ Features & Advantages

EASY TO USE

• Auto Setup

The Auto-setup function is a fully automatic configuration internal program which optimizes the HPP5500 to fit the unique operating characteristics of the actuator and valve in which it is installed on. During the Auto-setup cycle the HPP5500 recognizes, measures and stores in its memory key performance parameters such as hysteresis, air volume required by the actuator, valve packing friction and others and configures itself for an optimal performance.

• Flexibility in Installation

The HPP5500 is available to be mounted in Linear or Rotary valves. Stroke levers, fork levers and direct NAMUR mounting are available within the same model.

• High reliability

The Tight shut-off and shut-open functions assure positive seal between the plug and seat or a fully open position upon the 4-2mA command signal.

• Single Model for Multiple Applications

The HPP5500 settings can be changed without replacing any parts. A single model can be easily modified to suit any application.

– Flow characteristics: Linear, Equal Percentage, Quick Open or customized for any type of characterization by using 16 individual points.

– Actuator type: Double or single acting actuator.

• Hart Communication

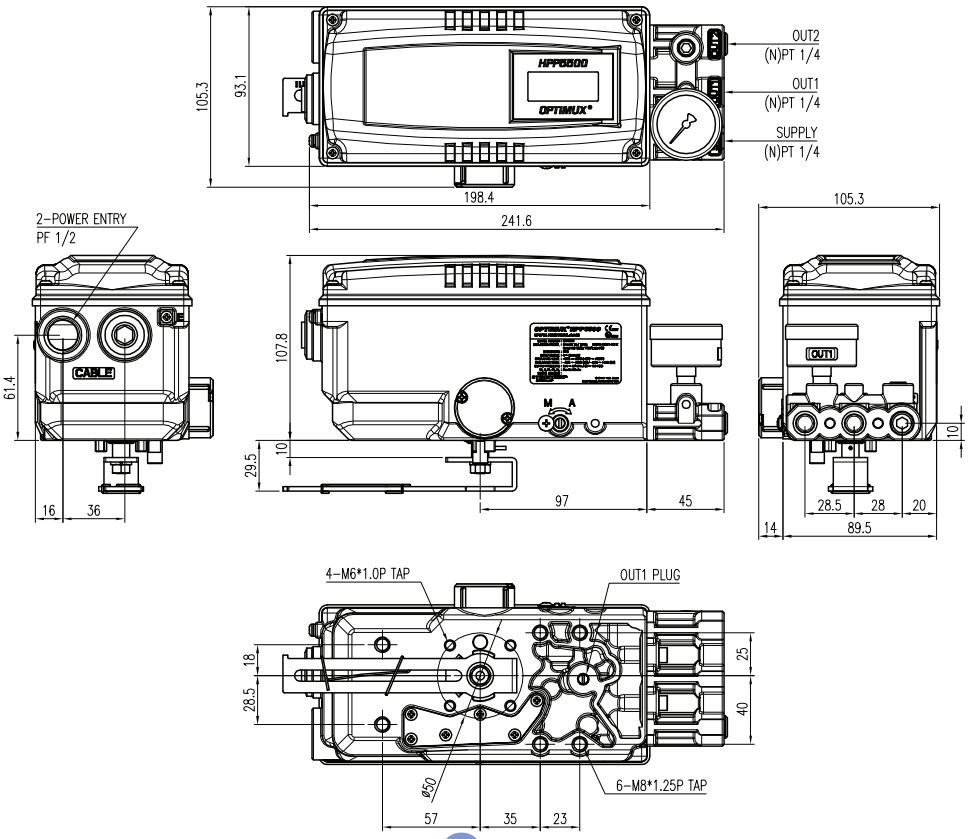
Any available Hart® communicator can be used for calibration, configuration and diagnostics.

Figure 1: HPP5500™ Auto Setup

HPP5500™
Technical Specifications

Control Signal Input:	**4-20mA DC**
Minimum Current Signal:	**3.8 mA**
Output Characteristics:	**Linear, equal percentage, quick open, configurable -16 Points**
Power Requirements:	**8.5 V**
Impedance:	**Max. 500 Ohms/20 mA Dc**
Enclosure:	**NEMA 4X, IEC IP66**
Safety Certification:	**Intrinsically Safe Ex ia IIC T6/T5**
Digital Communications:	**Hart®**
Digital Display:	**LCD**
Air Supply Pressure:	**20 to 100 psi/0.14 to 0.69 Mpa/1.38 to 6.9 Bar**
Air Consumption:	**Below 2 LPM@20psi, Below 3 LPM@100psi**
Flow Capacity:	**70 LPM**
Air Connection:	**NPT 1/4**
Gauge Connection:	**NPT 1/8**
Vibration Tolerance:	**6 G**
Feedback Signal:	**4-20mA DC**
Ambient Temperature:	**- 22 F to 185 F (-30 C to 85 C)**
Relative Humidity:	**5 – 95% RH @ 40 C**
Linearity:	**+/- 0.5 F.S.**
Hysteresis:	**+/- 0.5 F.S.**
Sensitivity:	**+/- 0.2 F.S.**
Repeatability:	**+/- 0.3 F.S.**
Weight:	**4.4 Lbs (2.0 Kg)**

HPP5500™ Dimensions



HPP5500™
Selection Guide

HPP5500™ | HART® Smart Valve Positioners

Code	Motion Type
L	Linear
R	Rotary

Code	Positioner Action
D	Direct
R	Reverse

Code	Hazardous Rating
F	Intrinsically Safe Ex ia IIC T6/T5*
N	Non-Explosion Proof

Code	Connections
N	Electrical Connection 1/2 NPT Air Pipe Connection 1/4 NPT Gauge Connection 1/8 NPT

Code	Supply Air Pressure
S	20-100 psi (0.14 – 0.7Mpa)

Code	Pressure Gauges
Y	0-116 psi / 0-8 Bar / 0-0.8 Mpa*

Code	Pressure & Filter Regulator
X	Not included
Y	Included

Code	Feedback Lever Type
1	10-40mm
2	20-70mm*
3	50-100mm
4	100-150mm

Code	Rotary
1	M6x34L
2	M6x63L
3	M8x34L
4	M6x63L
5	NAMUR*

Code	Communication
H	Hart® *

Code	Enclosure
A	Aluminum Diecasting/Epoxy Polyester Powder Coating
S	Stainless Steel

*Standard Offering

Also available are a large selection of mounting brackets for Fisher®, Masoneilan® and Neles® actuators. Mounting brackets for other valve actuators can be designed and manufactured upon request.

For more information, visit our website at www.trimteck.com

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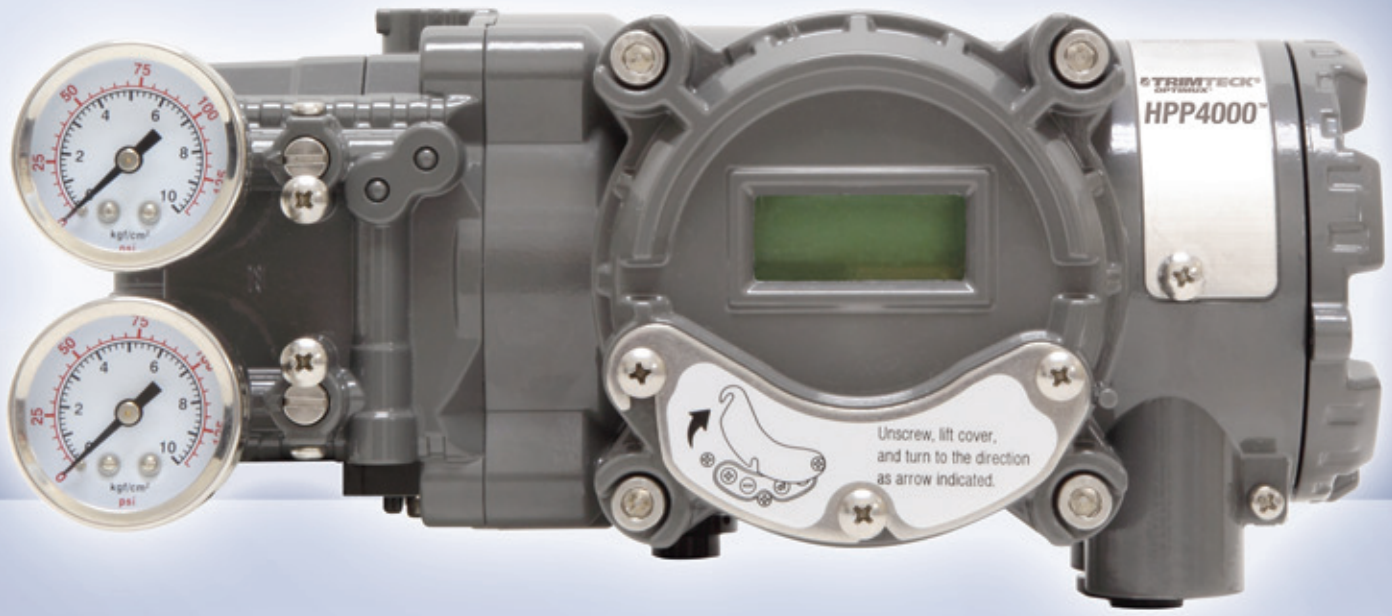
Leading Technologies for Control

TRIMTECK® OPTIMUX®

HPP Series

HPP4000™ HART® Smart Valve Positioner



www.trimteck.com

Flow Control Products

HPP4000™ HART® Smart Valve Positioners

Introduction

Our new HPP4000 brings to the market all the field proven attributes of our former HPP3000 plus all the additional features our users have requested for the past few years: LCD Display, 4-20mA feedback signal, HART® communication protocol and Auxiliary Limit Switches, all of these within our legendary and well proven robust enclosure capable of sustaining the most rigorous industrial plant conditions.

But this is not all, the HPP4000 was designed to accurately position your control valve and to operate it efficiently at the lowest possible air consumption (LPM) bellow 3 LPM @ 100 psi. This feature alone represents considerable potential savings in compressed air plant capacity.

Pipeline vibration continues to be the main cause for unexpected failures on digital positioners which in turn causes downturns on control valves performance. The HPP4000 offers an outstanding vibration tolerance of 6 G at 5 to 400 Hz, three times higher than what we offered with our former Optimux HPP3000.

The HPP4000 incorporates all the smart features you would expect from a truly state-of-the art digital positioner: Quick - Auto Set Up and calibration, flow characteristics customization in 16 points, tight shut off, PID parameters selection, A/M switch, 4-20mA feedback signal, split range 4-12mA or 12-20mA, Auxiliary limit switches which eliminates the need for external cumbersome switches, and others.

When the HPP4000 receives a signal from a Hart® or regular 4-20mA control instrument, it accurately modulates the air supply to the control valve actuator, thus providing accurate and fast valve position, which is proportional to the 4-20mA control signal. The accuracy and responsiveness of the HPP4000 greatly contributes to obtain the best performance from any control valve, within a process control loop, or as a stand-alone application.

HPP4000™ Features & Advantages

EASY TO USE

• Auto Setup

The Auto-setup function is a fully automatic configuration internal program which optimizes the HPP4000 to fit the unique operating characteristics of the actuator and valve in which it is installed on. During the Auto-setup cycle the HPP4000 recognizes, measures and stores in its memory key performance parameters such as hysteresis, air volume required by the actuator, valve packing friction and others and configures itself for an optimal performance.

• Flexibility in Installation

The HPP4000 is available to be mounted in Linear or Rotary valves. Stroke levers, fork levers and direct NAMUR mounting are available within the same model.

• High reliability

The Tight shut-off and shut-open functions assure positive seal between the plug and seat or a fully open position upon the 4-2mA command signal.

• Single Model for Multiple Applications

The HPP4000 settings can be changed without replacing any parts. A single model can be easily modified to suit any application.

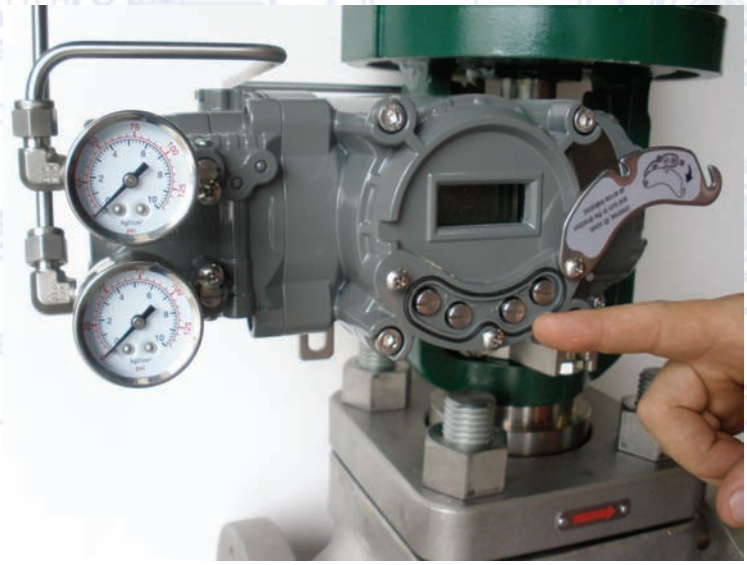
– Flow characteristics: Linear, Equal Percentage, Quick Open or customized for any type of characterization by using 16 individual points.

– Actuator type: Double or single acting actuator.

• Hart Communication

Any available Hart® communicator can be used for calibration, configuration and diagnostics.

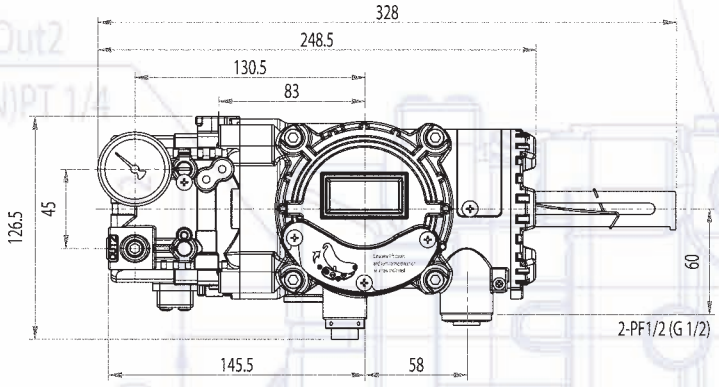
Figure 1: HPP4000™ Auto Setup

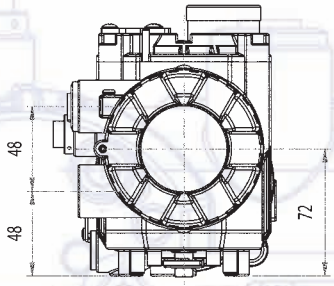


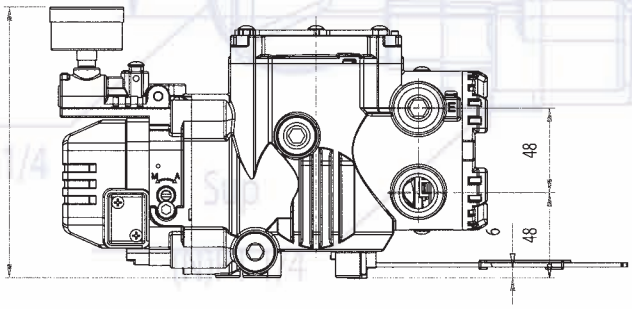
HPP4000™
Technical Specifications

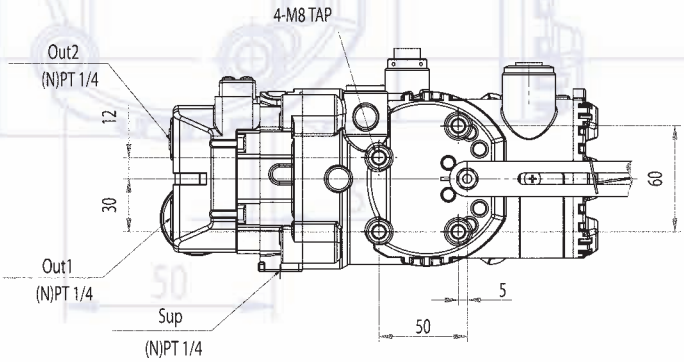
Control signal input:	**4-20mA DC**
Minimum current signal:	**3.8mA**
Output characteristics:	**Linear, equal percent. , quick open, 16 points**
Power requirement:	**8.5 V**
Impedance:	**Max. 500 Ohms/20mA DC**
Enclosure:	**IP66**
Safety certification:	**Explosion Proof Ex d IIC T6**
Digital communications:	**HART®**
Digital display:	**LCD**
Air supply pressure:	**20 – 100 psi / 130 – 700 kPa / 1.4 – 7 Kgf/cm2**
Air consumption:	**Bellow 2 LPM @ 20 psi, 3 LPM @ 100 psi**
Flow capacity:	**70 LPM**
Air connection:	**NPT 1/4**
Gauge connection:	**NPT 1/8**
Vibration tolerance:	**6 G**
Feedback signal:	**4-20 mA DC**
Auxiliary switches:	**Dual limit switches**
Ambient temperature:	**- 40 F to 158 F (- 40 C to 85 C)**
Relative humidity:	**5 – 95% RH @ 40 C**
Linearity:	**+/- 0.5% F.S.**
Hysteresis:	**+/- 0.5% F.S.**
Sensitivity:	**+/- 0.2% F.S.**
Repeatability	**+/- 0.3% F.S.**
Weight:	**7.5 Lb (3.4 Kg)**

HPP4000™ Dimensions









HPP4000™
Selection Guide

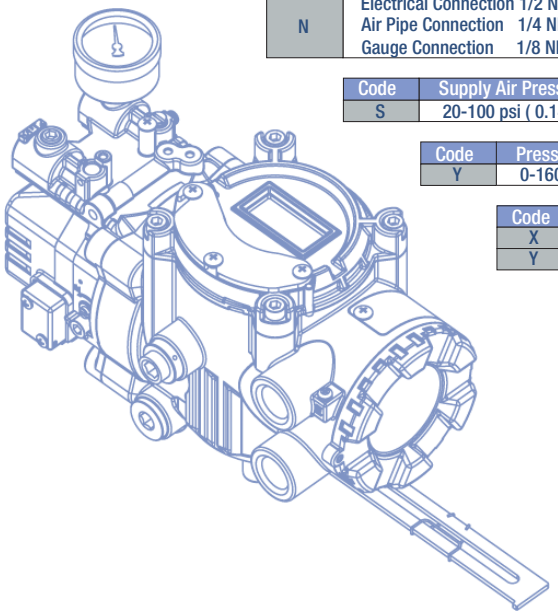
HPP4000™ | HART® Smart Valve Positioners

Code	Motion Type
L	Linear
R	Rotary

Code	Positioner Action
D	Direct
R	Reverse

Code	Hazardous Rating
F	Explosion Proof Ex d IIC T6*

Code	Connections
N	Electrical Connection 1/2 NPT Air Pipe Connection 1/4 NPT Gauge Connection 1/8 NPT



Code	Supply Air Pressure
S	20-100 psi (0.14 – 0.7Mpa)

Code	Pressure Gauges
Y	0-160 psi / 0 – 11 Bar*

Code	Pressure & Filter Regulator
X	Not included
Y	Included

Code	Feedback Lever Type
1	10-40mm
2	20-70mm*
3	50-100mm
4	100-150mm

Code	Rotary
1	M6x34L
2	M6x63L
3	M8x34L
4	M6x63L
5	NAMUR*

Code	Communication
H	Hart® *

Code	Enclosure
A	Aluminum Diecasting/Epoxy Polyester Powder Coating

Also available are a large selection of mounting brackets for Fisher®, Masoneilan® and Valtek® actuators. Mounting brackets for other valve actuators can be designed and manufactured upon request.

*Standard Offering

For more information, visit our website at www.trimteck.com

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TRIMTECK®

OpGL Guard Master™

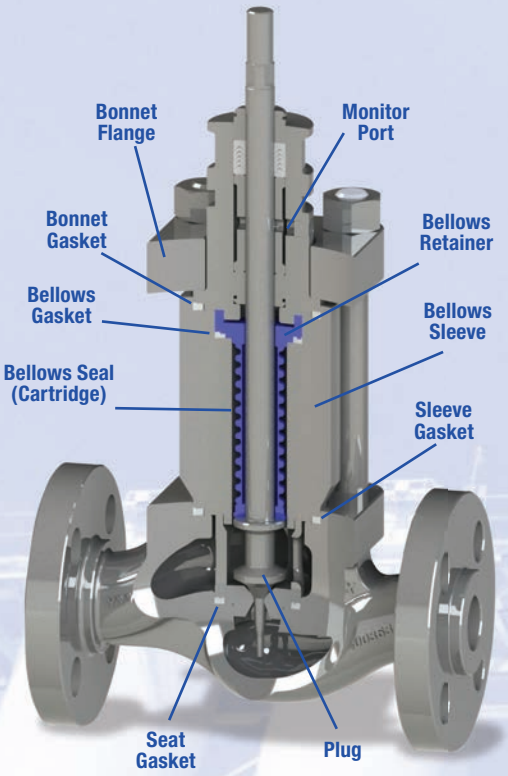
OPTIMUX®

Metal Bellows Seal

Features & Benefits of our Zero Emissions Technology

Description

In addition to a variety of effective fugitive emissions packing configurations, including: live-loading and special materials, Trimteck offers its unique Guard Master™ Metal Bellows Seal on the Optimux OpGL Globe Control Valve to ensure reliable compliance with stringent environmental and safety regulations.



Advantages

- **High quality, modular construction**
- **Built to withstand high pressures and temperatures**
- **Extraordinarily long service life**
- **Can be retrofitted to valves of all sizes and pressure classes**
- **Sized and manufactured to specific customer requirements**

Materials

- Inconel standard
- Available in Hastelloy Variations
- Full traceability

Robust materials and precision machining ensure long life cycles with zero emissions

Construction

- Modular
- Tight tolerances
- Few weld-points
- Monitoring Port available on bonnet for simple and frequent testing

Life Cycle

- Up to 6 million cycles
- -380°F to 1,120°F Operating Temperatures
- Up to 1,300psi Operating Pressures

TRIMTECK® OPTIMUX®

OpGL Guard Master™ Metal Bellows Seal

Quality Assurance

We at Trimteck are obsessed with Quality, and – according to our ISO 9001:2008 System – every control valve that leaves our facility is tested on digital benches to ensure that it exceeds the expectations and requirements of the customer.

About Trimteck

Trimteck is a NASA VDB-approved, ISO 9001-2008-certified U.S. company (Registration No. 2012-98243) with over thirty years of experience engineering, manufacturing, and marketing high-quality, cost-effective flow, pressure, and temperature control solutions and equipment for critical processes, and our products are currently helping customers safely improve quality, optimize throughput, and reduce emissions and energy costs across an array of industries in more than 42 countries.

We manufacture a comprehensive line of control valves – and variety of actuators, positioners, severe service trims, and other accessories – that our applications engineers and representatives use to solve even the most complex flow control problems quickly and economically.

nqa. ISO 9001 Registered

Trimteck is committed to environmental sustainability and energy efficiency.

Products in compliance with:

ASME B16.34
ANSI/ISA-75.05.01-2000 (R2005)
PED 92/93/EC Module H1

TRIMTECK Headquarters
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Email – info@trimteck.com

For more information, contact:

TRIMTECK®

CVD-5B

OPTIMUX®

Metal Hardening

Description

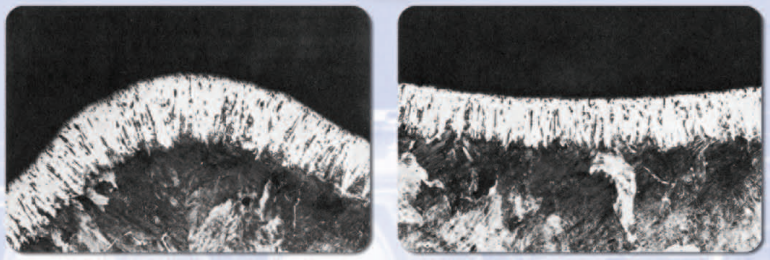
Trimteck® is at the forefront of applying innovations in material science to extend the life of its process control equipment. First used in the aerospace industry to harden rocket nozzles on the space shuttle, CVD-5B is a chemical vapor diffusion process using boron wherein a hard wear-resistant metal mesh is fused into the surface of a wide variety of ferrous and non-ferrous materials.

Unlike coatings, during the CVD-5B process, superheated boron atoms are diffused deep into a host surface to form a metal boride layer that permeates evenly up to .015". Trimteck has harnessed and perfected this advanced technology to, in many cases, effectively extend the life of our valves more than 10 fold.

- **Economical alternative to Tungsten Carbide**
- **Corrosion resistant**
- **Lends extended life to severe service trims**
- **Resists temperatures of up to 1200° F**
- **Reduces coefficient of friction**
- **Not a ceramic, will not crack under duress**

CVD-5B

316 SS Optimux OpGL body and trim set hardened with CVD-5B. Note the distinctive dark gray color.



Magnified view of .015" CVD-5B compound layers on 1045 steel. Note the hardened layer distributes itself evenly along concave and convex surfaces.

Case Studies

Application: Offshore Oil Production

Location: Gulf of Mexico

Background: When a production valve on an offshore platform pumping crude oil with high sulfur content and 30 percent sand needed its internals replaced every eight months, the owner and operator decided it was time for a change.

Trimteck's Solution: We designed a 18" 1500# Optimux OpGL globe valve with an anti-cavitation trim treated with our proprietary CVD-5B metal hardening process. It has been working uninterrupted for over two years.

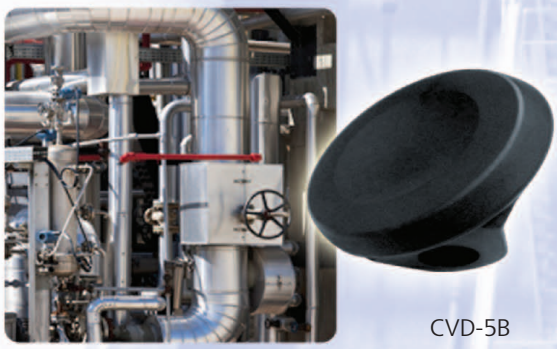
CVD-5B
Hardened Severe
Service Trim

Application: Potato Steam Peeling

Location: California (USA)

Background: Steam peeler valves operate constantly and open intermittently to release high pressure steam and abrasive solids. A potato steam peeler control valve with leaky seats caused by high pressures and abrasion from solids needed expensive replacing every thirty days. The plant manager came to Trimteck with the problem.

Trimteck's Solution: We proposed an Optimux OpEXL eccentric plug valve with a CVD-5B treated trim, and it extended the life of the previous valve ten-fold.



CVD-5B
Hardened Eccentric Plug

Trim Material Characteristics

Trim Material	Hardness Rockwell C	Impact Strength	Corrosion Resistance	Max Temperature °F	Max Temperature °C	Erosion Resistance	Abrasion Resistance
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

In addition to CVD-5B, Trimteck provides other common metal hardening processes:

- Tungsten Carbide
- Stellite
- Nickel
- Hard Chrome
- Titanium
- Zirconium

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.

nqa. ISO 9001 Registered

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Email – info@trimteck.com

For more information, contact:

ABB MEASUREMENT & ANALYTICS | DATA SHEET

PositionMaster EDP300

Digital Positioner

Compact, well-proven, and flexible

High air capacity

Diagnostics capability

Resistant to overpressure

Robust and environmentally ruggedized

Easy to commission

Approvals for explosion protection
- ATEX
- IECEx
- FM / CSA
- EAC TR-CU-012

Global approval for marine applications
- DNV_GL

For SIL2 safety loops

Advanced diagnostics

Brief description

The PositionMaster EDP300 is an electronically configurable positioner with communication capabilities designed for mounting on pneumatic linear or rotary actuators. It features a small and compact design, a modular construction, and an excellent cost-performance ratio.
Fully automatic determination of the control parameters and adaptation to the positioner allow for considerable time savings as well as optimum control behavior.

Pneumatics

An I/P module with subsequent pneumatic amplifier is used to control the pneumatic actuator. The well-proven I/P module proportionally converts the permanent electrical setpoint signal from the CPU into a pneumatic signal used to adjust a 3/3-way valve.
Dosing of the air flow for pressurizing or depressurizing the actuator is continuously adjusted. As a result, excellent control results are achieved. When reaching the setpoint, the 3/3-way valve is closed in center position to minimize the air consumption.
The pneumatic system can be supplied in four versions: for single acting and double acting actuators and each with the ‘fail-safe’ / ‘fail-freeze’ safety function.

‘Fail-safe’ safety function

If the electric power supply fails, the positioner output 1 is depressurized and the return spring in the pneumatic actuator moves the valve to the safe position. In case of a ‘double-acting’ version, output 2 is additionally pressurized.

‘Fail-freeze’ function

If the electric power supply fails, the positioner Output 1 (and Output 2 if applicable) is closed and the pneumatic actuator blocks the valve in the current position. If the compressed air supply power fails, the positioner depressurizes the actuator.

Use

The positioner has a built-in LCD indicator with a multi-line LCD display and 4 operating buttons for commissioning, configuration, and monitoring during live operation. Alternatively, the appropriate DTM/EDD can be used via the available communication interface.

Communication

The positioner supports HART5 and HART7 communication.

Inputs / Outputs

In addition to its input for the analog position setpoint, the positioner is equipped with a digital input which can be used to activate control system functions in the device. A digital output allows you to output collective messages (alarms / faults).

Modular design

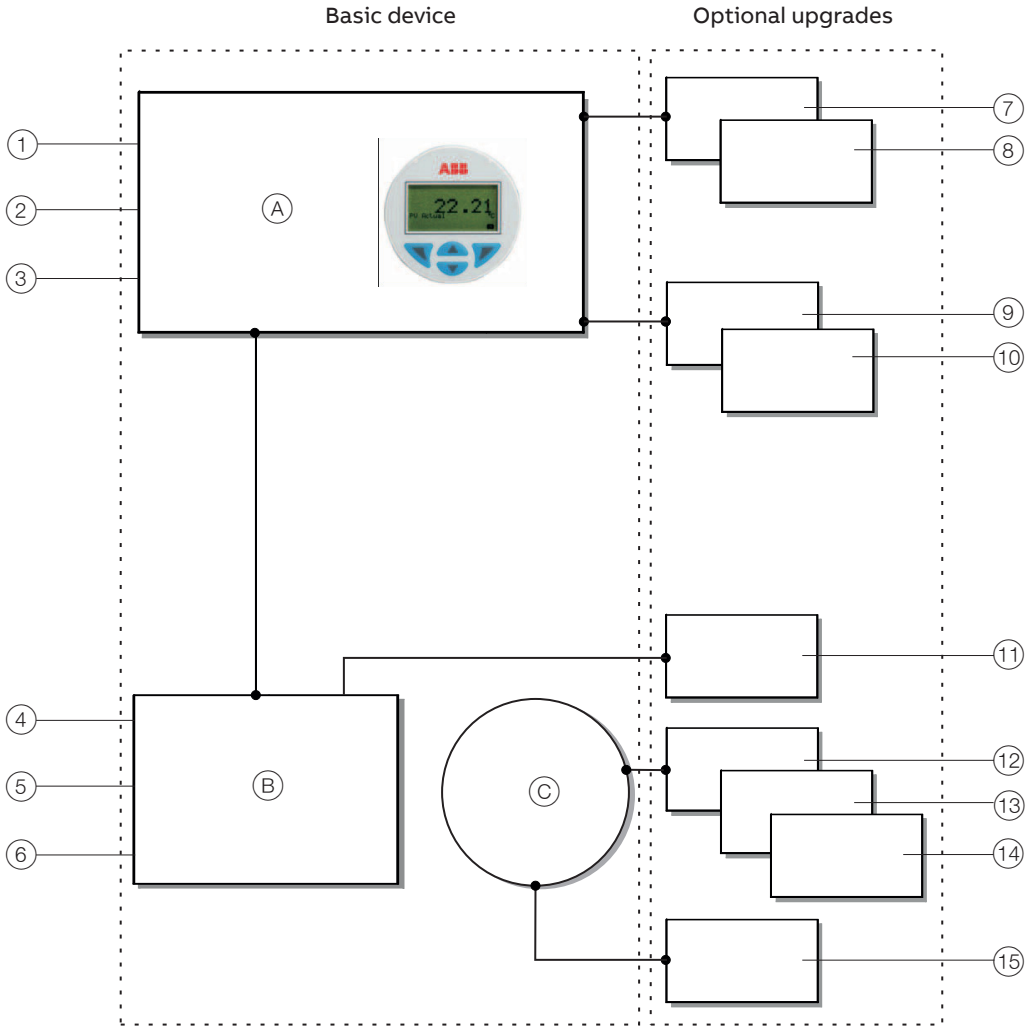
The basic model can be enhanced at any time by retrofitting optional equipment.
Option modules for analog and digital feedback, an emergency shutdown module, and pressure sensors for valve diagnostics can be installed.
A module for a universal analog input can also be installed to which any device supplying a 4 to 20 mA signal can be connected.
Additionally, a mechanical position indicator, proximity switches or 24 V microswitches are available for indicating the position independently of the mother board function.

Diagnostics

The positioner has three optional pressure sensors which can be used for reliable diagnostics of the valve, the pneumatic drive, and the positioner.

… Brief description

Schematic diagram



Ⓐ Electronics
Ⓑ Pneumatics
Ⓒ Position sensor
① 4 to 20 mA / Bus connection
② Digital input
③ Alarm output
④ Supply air
⑤ Output 1
⑥ Output 2
⑦ Analog feedback
⑧ Digital feedback
⑨ Emergency shutdown module
⑩ Universal input
⑪ Pressure sensor
⑫ Limit alarm with 24 V microswitch
⑬ Limit alarm with proximity switch (NC)
⑭ Limit alarm with proximity switch (NO)
⑮ Visual position indication

Figure 1: Schematic diagram of the positioner

Note

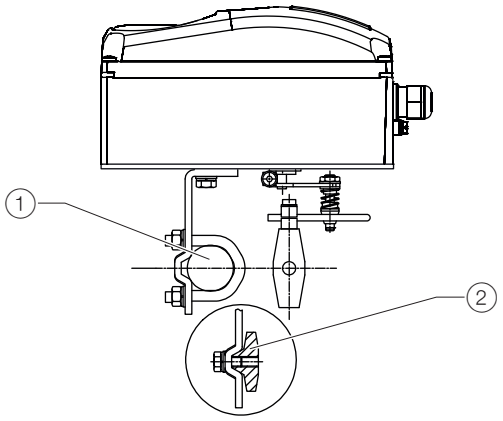
In optional extensions, either the “Limit switch with proximity switch” (pos. ⑬ or pos. ⑭) or der “Limit switch with microswitch 24 V” (pos. ⑫) can be used.
It is not possible to combine both variants.

Mounting versions

Mounting to linear actuators in accordance with the standard

Lateral attachment is in accordance with DIN / IEC 534 (lateral attachment to NAMUR).

The required attachment kit is a complete set of attachment material, but does not include the pipe fittings and air pipes.



① Columnar yoke ② Cast iron yoke

Figure 2: Mounting to linear actuators in accordance with DIN / IEC 534

To pneumatic rotary actuators in accordance with the standard

This attachment is designed for mounting according to the standard VDI / VDE 3845.
The attachment kit consists of a console with mounting screws for mounting on a rotary actuator. The corresponding feedback shaft adapter has to be ordered separately.
Screwed pipe connections and air pipes have to be provided on site.

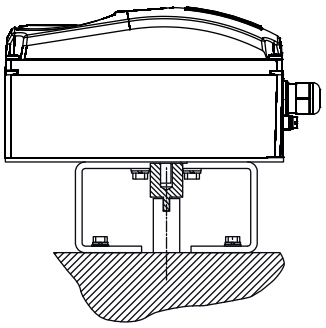


Figure 3: Mounting to rotary actuators in accordance with VDI/VDE 3845

Integral mounting on control valves

The positioner featuring standard pneumatic action is available as an option for integral mounting.
The required holes are found at the back of the device.
The benefit of this design is that the point for mechanical stroke measurement is protected and that the positioner and actuator are linked internally. No external tubing is required.

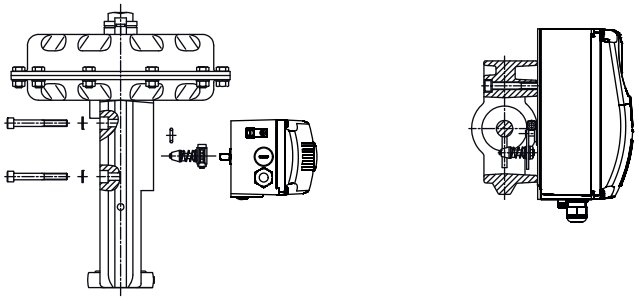


Figure 4: Integral mounting to control valves

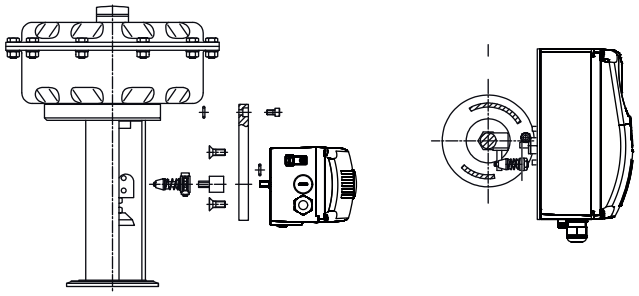


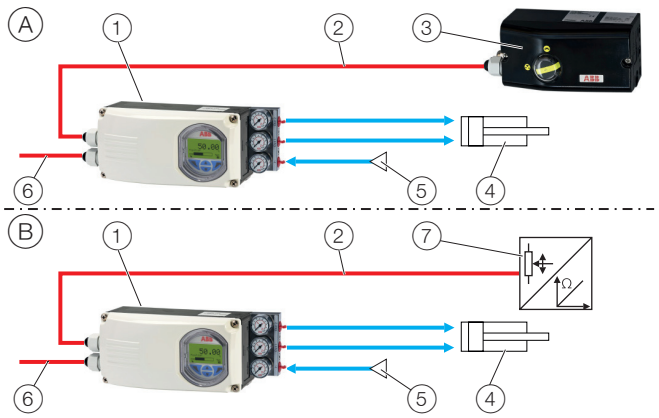
Figure 5: Integral mounting to control valves using adapter plate

Special actuator-specific mounting versions

In addition to the mounting methods described above, there are special actuator-specific attachments.

… Mounting versions

External position sensors



1 EDP300 Control Unit
2 Connection cable
3 EDP300 Remote Sensor
4 Actuator
5 Compressed air supply
6 Set point signal
7 Remote position sensor

Figure 6: EDP300 with external position sensors

Note
If the device is being operated on a cylinder, for reasons associated with linearity you should run the Auto Adjust function for rotary actuator.

(A) EDP300 control unit with EDP300 remote sensor
In this version, the components are supplied in two housings, which together form one harmonized unit.
The following points should be observed during installation:

- Housing 1 (EDP300 Control Unit) contains the electronics and pneumatics and is mounted separately from the actuator.
- Housing 2 (EDP300 Remote Sensor) contains the position sensor and is mounted on the linear and rotary actuator.

Note
To connect the EDP300 Remote Sensor, a cable with the following specifications needs to be used:

- 3-wire, cross-section 0.5 to 1.0 mm²
- shielded, with at least 85 % coverage
- Temperature range up to at least 100 °C (212 °F)

The cable glands must also be approved for a temperature range up to at least 100 °C (212 °F). The cable glands require a mounting for the shielding and strain relief for the cable in addition.
ABB optionally offers a cable gland and cable for the EDP300 Remote Version.

(B) EDP300 Control Unit for remote position sensor
In this version the positioner is supplied without a position sensor.
The following points should be observed during installation:

- Housing 1 (EDP300 Control Unit) contains the electronics and pneumatics and is mounted separately from the actuator.
- The remote position sensor is mounted on the linear actuator or rotary actuator. Follow the operating instructions for the remote position sensor for mechanical mounting!

Device parameters

General

Microprocessor-based position control in the positioner optimizes control. The positioner features high-precision control functions and high operational reliability. Due to their elaborate structure and easy accessibility, the device parameters can be quickly adapted to the respective application.

The total range of parameters includes:

- Operating parameters
- Adjustment parameters
- Operation monitoring parameters
- Diagnosis parameters
- Maintenance parameters

Operating parameters

The following operating parameters can be set manually if required:

Setpoint signal
0 to 100 % freely selectable for split-range operation

For 4 to 20 mA and HART® version:

- Signal min. 4 mA, max. signal 20 mA (0 to 100 %)
- Min. range 20 % (3.2 mA)
- Recommended range > 50 % (8.0 mA)

Action (setpoint signal)
Increasing:
Position value 0 to 100 % = direction 0 to 100 %
Decreasing:
Setpoint signal 100 to 0 % = direction 0 to 100 %

Characteristic curve (travel = f {setpoint signal})
Linear, equal percentage 1:25 or 1:50 or 25:1 or 50:1 or freely configurable with 20 reference points.

Travel limit
The positioning travel, i.e. the stroke or angle of rotation, can be reduced as required within the full range of 0 to 100 %, provided that a minimum value of 20% is observed.

Shut-off function
This parameter can be set separately for each end position. When the respective configured limit value is exceeded, the shut-off function causes immediate travel of the actuator until reaching the set end position.
When the shut-off value is set to “0”, the position is further controlled, even in the respective end position.

Travel time prolongation
This function can be used to increase the max. travel time for full travel. This time parameter can be set separately for each direction.

Switching points for the position
You can use these parameters to define two position limits for signaling (see option “Module for digital position feedback”).

Alarm output
The alarms generated in the positioner can be polled via the digital output as a collective alarm.
The desired information can be selected via the LCD display or remotely via the configuration program.
The output can be set to “active high” or “active low”, as required.

Digital input
For the digital input, one of the following safety options can be selected. You may use the LCD display or configuration program to select an option.

- No function (default)
- Move to position substitute value (freely selectable)
- Start "Partial Stroke Test"
- Ventilate output 1, evacuate output 2
- Ventilate output 2, evacuate output 1
- Service required
- Move to 0 % position
- Move to 100 % position
- Hold previous position
- Disable local configuration
- Disable local configuration and operation
- Disable all access (no local or remote access via a PC)

The selected function is activated once the 24 V DC signal is no longer applied (< 11 V DC).

… Device parameters

Adjustment parameters

The positioner has a special function for automatic adjustment of the parameters. Additionally, the control parameters can be set automatically (in adaptive control mode) or manually to optimally adapt them to the process requirements.

Zone
Upon reaching this value, the position is readjusted more slowly until the dead band is reached.

Dead band (sensitivity)
When reaching the dead band, the position is held.

Display 0 to 100 %
Adjusting the display (0 to 100 %) according to the direction of action for opening or closing the actuator.

Diagnostics
Various functions for permanent operational monitoring are implemented in the PositionMaster EDP300 operating program. The following states will be detected and indicated, e.g.:

- Setpoint signal out of range 0 to 100 % or 4 to 20 mA
- Position out of the adjusted range
- Positioning time-out (adjustable time parameter)
- Position controller inactive
- Counter limit values exceeded (can be set via DTM/EDD)

LCD display
The LCD indicator has a cover to protect against unauthorized operation.

Commissioning the positioner is especially easy. Autoadjust is triggered by pressing just a few pushbuttons. Detailed configuration knowledge is not necessary in order to start the device.
Depending on the selected actuator type (linear or rotary), the displayed zero position is automatically adapted.

Besides this standard function, a customized “Autoadjust” function is available. The function is launched either via the LCD display or HART communication.

Figure 7: Open positioner with view of LCD indicator

The built-in LCD indicator with four pushbuttons supports the following functions:

- Operational monitoring
- Manual intervention during live operation
- Device configuration
- Fully automatic commissioning
- Display of diagnostic messages

Figure 8: LCD indicator with pushbuttons and LCD display

A menu-controlled configuration is available via the pushbuttons on the device.

The multi-line LCD indicator is permanently updated and adapted during operation to provide the user with optional information as relevant.

During control operation (control with or without adaptation) the following data can be called up by pressing the pushbuttons briefly:

- Position Pos [%]
- Position Pos [°]
- Setpoint SP [%]
- Setpoint SP [mA]
- Control deviation DEV [%]
- Electronics temperature [°C, °F, °R, K]
- Supply pressure PIN [unit]
- Pressure output 1 PY1 [unit]
- Pressure output 2 PY2 [unit]
- Differential pressure DP [unit]
- Universal input value UIN [unit]

- Malfunctions, alarms, messages
  The possible reason is also displayed, along with the recommended remedial action.
  In the event of an error, a message consisting of a symbol and text appears at the bottom of the process screen (e. g. electronics) The text displayed provides information about the area in which the error has occurred.
  The error messages are divided into four groups in accordance with the NAMUR classification scheme.

Symbol	Description
	Error / failure
	Function check
	Outside of the specification
	Maintenance required

(The group assignment can only be changed using a DTM or EDD).

The error messages are also divided into the following areas:

Range	Description
Actuator	Diagnosis notices affecting the valve or the pneumatic actuator
Operation	Diagnosis notices with a negative effect on the operation of the positioner
Process	Diagnosis notices that refer to the process and display impairments or states.
Sensor	Alarms indicating problems affecting the position feedback of the valve position
Electronic	Errors in the device electronics are displayed.
Configuration	Detects if the positioner configuration is missing or faulty

Histograms recording
- Positioning time-outs
- Valve movements
- Valve strokes
- Most used valve position
- Universal input

Access to extended monitoring parameters is possible via HART communication, the DTM, and the EDD.

The diagnostics parameters in the operating program provide information about the operating conditions of the actuator.
For example:
- Dead band time limit
- Leakage detection
- Temperature monitoring
- Stiction detection
- Sliding friction detection
- Hysteresis
- Valve seat wear

From this information the operator can derive what maintenance work is required, and when.

Diagnostics with DTM
Access to extended monitoring parameters is possible via HART communication, in particular the DTM (reduced functions only with the EDD).

… Device parameters

Butterfly diagnostics

The trend (which relates to a number of relevant positioner parameter values) can be used to draw conclusions about the stiction and friction of a valve with a view to enabling preventive maintenance.

If the diagnostic parameters have changed, a triangle is displayed in signal color. The color and size of this triangle represent the direction and scope of the change.

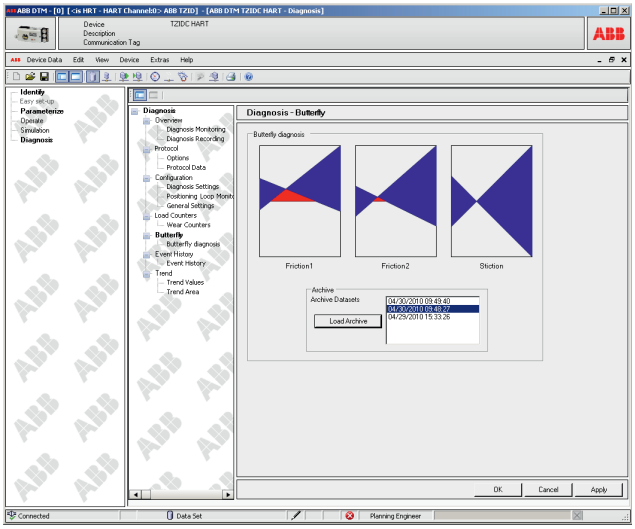


Figure 9: Example for increased friction

Online trend archive

The online trend archive does not merely indicate the current setpoint and actual value, but also the associated patterns, which can stretch back over a matter of hours. When you start the online trend archive, the saved data is read out and transmitted at such a high transmission rate (100 ms via HART®) that the latest data is displayed in next to no time.

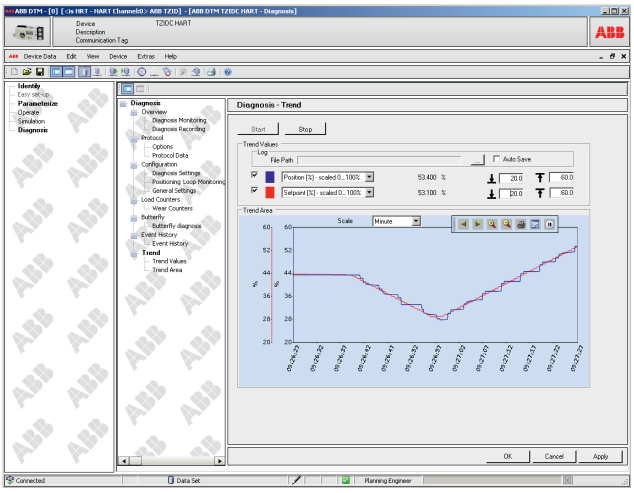


Figure 10: Example for online trend archive

Event history

Up to 100 events are saved in the event history in the device. The time each event occurred is also displayed, along with a suggested approach to solving the problem. The limit values for (pre-)alarms, e.g. a friction alarm, can be set.

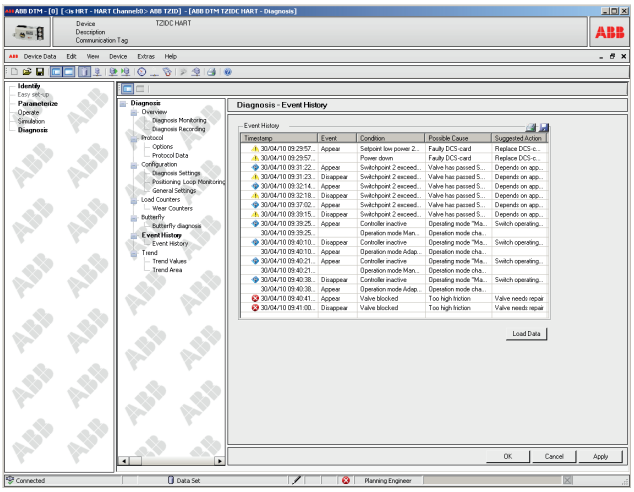


Figure 11: Example event history

Valve signature (only with pressure option)
When the valve signature starts, the entire valve operating range is covered for the "open and closed directions". High-resolution plots are generated for the pressure patterns at the diagnostic pressure sensors. In addition, the signal waveform for the universal input is recorded. Once the signature has expired, the parameters selected by the user are loaded from the device and displayed. Depending on the quantity of data selected, it may take several minutes to transfer all the parameter values. Up to 5 valve signatures can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.

Speed in relation to position test
When the "Speed in relation to position test" is started, the entire valve operating range is covered for the valve's "open and closed directions" in an uncontrolled manner using an adjustable degree of openness for the pneumatics. The positioning times for opening and closing the valves are displayed.

The pattern of the graph provides information about friction in the valve and actuator. Up to 5 archived graphs can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.

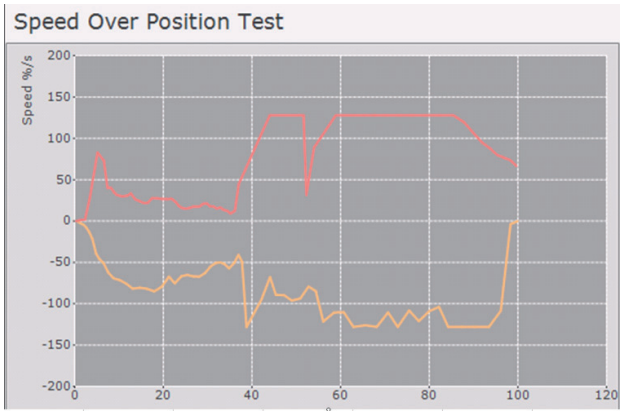


Figure 12: Example of Speed Over Position Test

Step response test
The step response allows the user to define the start position for the step change. When the start button is pressed, a setpoint step change is generated internally and a high-resolution plot is created for the valve position, pressure patterns, etc. At the end of the step response, the actuator automatically moves to the defined start position and reverts to control mode. Depending on the quantity of data selected, it may take several minutes to transfer all the parameter values and display them in the form of a graph.

The pattern of the graph provides information about friction in the valve and actuator. Up to 5 archived graphs can be saved in the device; these can be compared so that valve diagnostics can be performed for the purpose of preventive maintenance.

Valve seat test
During the valve seat test, the actuator is moved in the direction of the 0 % position with maximum force.
If the user-defined tolerance window for the 0 % position or the universal input signal is exceeded, this will be shown as an error. This error may be indicative of deposits or extreme wear of the valve seat.

If an ultrasonic sensor is used at the universal input for the purpose of measuring noise at the valve seat, even minor leakage at the valve fitting can be detected.

At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

Leakage test (only with pressure option)
During the leakage test, the positioner closes all pneumatic outputs. Then, if the valve position changes or there is a change in the pressure patterns at the diagnostic pressure sensors, the positioner will be able to detect leakage. It outputs a message indicating the area of the pneumatic piping or actuator that is leaking.

At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

… Device parameters

Partial Stroke Test
The Partial Stroke Test is used to check the function of the safe position of ESD (emergency shutdown) valves.
The test can be started both locally on the device, time-controlled or using the DTM. The positioner evacuates output 1 until the position change defined in advance occurs. If this does not happen within the set time, an alarm can be output.

This helps prevent unexpected failures of the valve.
At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

There are two separate parameters available for reducing the speed at which the valve moves in the corresponding direction.

Drag indicator
This diagram shows the minimum, maximum, and average values for a selectable parameter in 3 different intervals, which are offset in relation to one another. The drag indicator trend, which is plotted against time, makes it possible to plan preventive action so that a failure in terms of the valves and fittings can be avoided.

Trend histogram
This histogram shows, for example, the position range of the valve within which control is most frequently performed. The parameters to be displayed can be selected by the user. This graph can be used, for example, to determine the most commonly used valve position so that the valve design can be evaluated. The friction within a valve range can be determined on the basis of the differential pressure, dead band time limit alarms, etc.

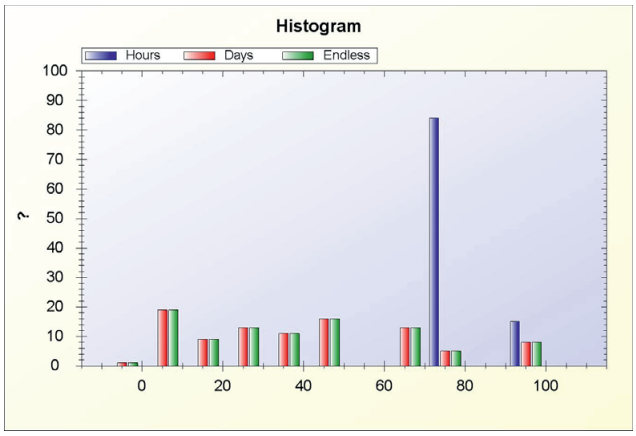


Figure 13: Example trend histogram

Trend diagram
This diagram indicates in which valve positioning range the greatest control deviation has occurred. This allows you to derive the valve friction, actuator size or supply air pressure.

Friction detection test (only with pressure option)
Once the function is initiated, a high-resolution plot of the differential pressure and universal input signal is generated for the valve's entire operating range.
At the end of the test, the positioner moves the valve to the last valid position and reverts to the most recently active control mode.

Limit values for the dynamic friction, stiction and universal input signal can be defined, using 11 reference points in each case. If the corresponding alarms are also activated in "Diagnostics -> Configure diagnostics", alarms can be output during operation as soon as the defined limit values are overshot.

Further diagnostic parameters are possible with the optional pressure sensors. They include:

- Supply air pressure too low
- Supply air pressure too high
- Pressure shocks in the supply air
- Valve signature
- Leakage localization

Additionally, limit values can be defined for these parameters. When they are exceeded, an alarm is reported.

The following values are e.g. determined:

- Number of movements performed by the actuator
- Total travel

Test cycles
Characteristic curves mapping a setpoint cyclically and internally are stored in the device. The DTM can be used to track the position of the actuator. This provides a means of checking the dynamic response of the entire actuator, for example, and determining the limit frequency automatically.

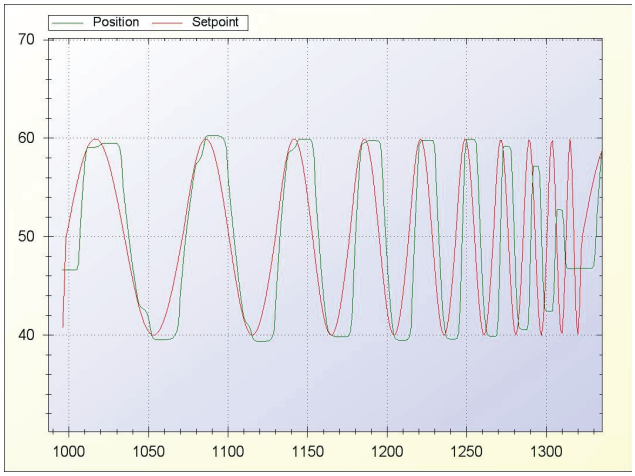


Figure 14: Example test cycles

Communication

DTM

The DTM (Device Type Manager) for the positioner PositionMaster EDP300 is based on FDT/DTM technology (FDT 1.2/1.2.1) and can be either integrated into a control system or loaded on a PC with DAT200 Asset Vision Basic. This allows you to work with the same user interface in the commissioning phase, during operation, and for service tasks involving monitoring the device, setting parameters, and reading out data.
Communication is based on the HART protocol. Reading data out from the device has no effect on active operation.
Newly set parameters are saved in the non-volatile memory directly upon download to the device, and become active immediately.

EDD

The EDD (Electronic Device Description) is used to read and modify simple device parameters on handheld terminals or in the vicinity of the system.

Specification

Actuator travel

Rotation angle	
Used range	25 to 270° for rotary actuator 25 to 60° for linear actuator
Actuator travel limit	Min. and max. limits, freely configurable in range 0 to 100 % Actuator travel (min. range > 20%
Actuator travel time prolongation	Range of 0 to 200 seconds, separately for each direction
Dead band time limit	Setting range 0 to 200 seconds (monitoring parameter for control until the deviation reaches the dead band)

Pneumatic connections

Input / Output	
Threaded holes	G ¼ in ¼-18 NPT

Compressed air output	
Range	0 to 10 bar (0 to 145 psi)
Air capacity	Standard: 40 kg/h (31 Nm^3/h / 20 scfm)
	Optional: 50 kg/h (40 Nm^3/h / 23 scfm)
Output function	For single acting or double acting actuators
	Air is vented from actuator or actuator is blocked in case of (electrical) power failure
Shut-off values	End position 0 % = 0 to 45 % End position 100 % = 55 to 100 %

Instrument air*	
Purity	Maximum particle size: 5 µm Maximum particle density: 5 mg/m³
Oil content	Maximum concentration 1 mg/m³
Pressure dew point	10 K below operating temperature
Supply pressure	Standard design: 1.4 to 10 bar (20 to 145 psi) Marine version: 1.5 to 8 bar (22 to 116 psi)
Air consumption**	< 0.03 kg/h / 0.015 scfm

* Free of oil, water and dust in accordance with DIN / ISO 8573-1. Pollution and oil content n accordance with Class 3

** Independent of supply pressure

Accessories

Mounting material

- Attachment kit for linear actuators in accordance with DIN / IEC 534 / NAMUR
- Attachment kit for rotary actuators in accordance with VDI / VDE 3845
- Attachment kit for integral mounting
- Attachment kit for actuator-specific mounting

Pressure gauge block

With pressure gauges for supply air and output pressure. Pressure gauges with housing ø 28 mm (1.10 in), with connection block in aluminum, black

PC adapter for communication

USB HART® Modem for HART® communication
(see data sheet 63-6.71)

Control program for operation and parameterization on a PC

DAT200 Asset Vision Basic with DTM for EDP300
(see data sheet DS/DTM/DAT200)

Housing

Material / Degree of protection	
Aluminum with ≤ 0.1% copper	Optional stainless steel 1.4404 (316L)
Degree of protection	IP 65 / NEMA 4X (NEMA 4X does not permit overhead mounting)

Surface / color (aluminum housing only)	
Dipping varnish	With epoxy resin, stove-hardened
Housing varnished black	RAL 9005 RAL 9002

Weight	
Aluminum	2.4 kg (5.29 lb)
Stainless steel 1.4404 (316L)	5.5 kg (12.13 lb)

Mounting orientation

Any

… Specification

Transmission data and contributing factors

Output Y1	
Increasing set point signal	0 to 100 %
	Increasing pressure at output
Decreasing set point signal	0 to 100 %
	Decreasing pressure at output

Action (set point signal)	
Increasing set point	4 to 20 mA
	= actuator position 0 to 100 %
Decreasing set point	20 to 4 mA
	= actuator position 0 to 100 %

Characteristic curve (actuator travel = f {set point signal})	
Linear	Equal percentage 1:25 or 1:50 or 25:1 or 50:1*
Deviation	< 0.5 %
Configurable zone	0 to 100 %,
Configurable dead zone	0.1 to 10 %,
Resolution (AD-conversion)	> 16,000 steps
Sampling frequency	20 ms
Ambient temperature effect	< 0.5 % for each 10 K
Influence of vibration	Standard design: < 1 % to 10 g and 80 Hz Marine version: < 1 % to 4 g and 100 Hz – EDP300 and remote design (control unit) < 1 % to 10 g and 100 Hz for remote design (position sensor)

* freely configurable with 20 reference points

Seismic vibration

Meets requirements of DIN / IEC 60068-3-3 Class III for strong and strongest earthquakes.

Influence of mounting orientation

Not measurable.

Noise emissions

Max. 100 db (A)
Noise-reduced version max. 85 db (A)

Ambient conditions

Ambient temperature range	
During operation, storage, and transport	−40 to 85 °C (−40 to 185 °F) −40 to 100 °C (−40 to 212 °F)*

* Increased temperature range only with EDP300 Remote Sensor.

Relative humidity	
During operation with housing closed and air supply switched on	95 % (annual average), condensation permissible
Transport and storage	75 % (annual average)

Electromagnetic compatibility

Component / Connection	Disturbance variable	EMC basic standard	Test value	Assessment criteria	
				Required	Complied
Housing	Discharge of static electricity (ESD)	IEC 61000-4-2	4 kV Contact discharge	B	A
			8 kV Air discharge	B	A
	Electromagnetic fields*	IEC 61000-4-3	10 V/m (80 MHz to 1 GHz)	A	A
			3 V/m (1.4 GHz to 2 GHz)	A	A
			1 V/m (2.0 GHz to 2.7 GHz)	A	A
	Supply frequency magnetic fields	IEC 61000-4-8	30 A/m (50 Hz, 60 Hz)	A	A
Input / Output signals	Fast transients (burst)	IEC 61000-4-4	2 kV (5 / 50 ns, 5 kHz)	B	A
	Impulse voltage (surge)	IEC 61000-4-5	1 kV (wire / wire), 2 kV (wire / PE)	B	A
	Conducted HF signals	IEC 61000-4-6	10 V (150 kHz to 80 MHz)	A	A

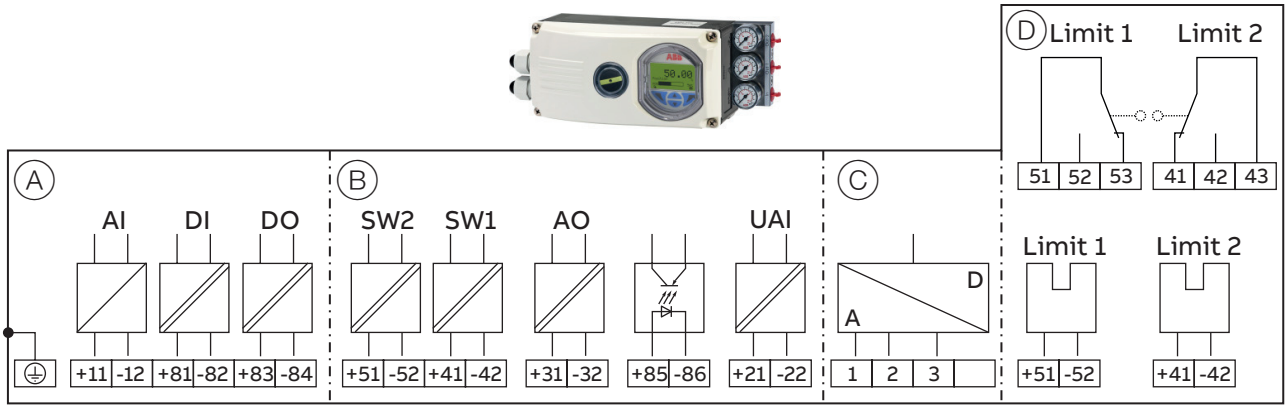
* The digital positioner meets the requirements of Class 3 for environments with heavy electromagnetic radiation. The distance between radio transmitters (e.g. mobile telephones) and the digital positioner, as well as its input and output signals must be at least 1 m (3.3 ft).

Assessment criteria A:
The device must work as intended during and after the test.

Assessment criteria B:
Impairment in operating performance of the device is permitted during the test. The device must continue to work as intended after the test.

Electrical connections

Positioner / EDP300 Control Unit Electrical Connection



Ⓐ Basic device

Ⓑ Options

Ⓒ Connection EDP Remote Sensor / remote position sensor (only for EDP Control Unit version)

Ⓓ Options, limit monitor with proximity switches or microswitches (not for EDP300 Control Unit)

Figure 15: EDP300 Electrical Connection

Connections for inputs and outputs

Terminal	Function / comments
+11 / –12	**Analog input AI or field bus connection**
+81 / –82	**Digital input DI**
+83 / –84	**Digital output DO2**
+51 / –52	**Limit alarm SW1** (Option module)
+41 / –42	**Limit alarm SW2** (Option module)
+31 / –32	**Analog feedback AO** (Option module)
+85 / –86	**Emergency shutdown module** (Option module)
+21 / –22	**Universal input UAI**
1 / 2 / 3	**EDP300 remote sensor** (Only for options EDP300 Remote Sensor or EDP300 for remote position sensor)

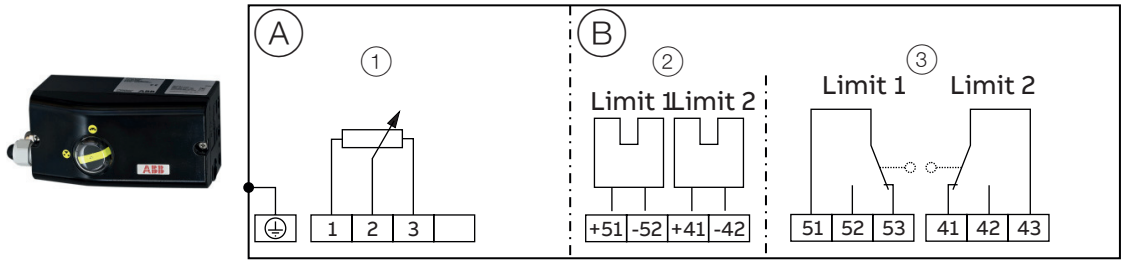
Terminal	Function / comments
+51 / –52	**Limit switch Limit 1 with proximity switch** (optional)
+41 / –42	**Limit switch Limit 2 with proximity switch** (optional)
51 / 52 / 53	**Limit switch Limit 1 with microswitch** (optional)
41 / 42 / 43	**Limit switch Limit 2 with microswitch** (optional)

Note

The EDP300 can be fitted either with proximity switches or microswitches as limit switches. It is not possible to combine both variants.

For the EDP300 Control Unit with EDP300 Remote Sensor version, the limit switches are located in the EDP300 Remote Sensor.

EDP300 Remote Sensor Electrical Connection



Ⓐ Basic device
Ⓑ Options
① Position sensor
② Limit monitor with proximity switches (optional)
③ Limit monitor with microswitches (optional)

Figure 16: EDP300 Remote Sensor Electrical Connection

Connections for inputs and outputs

Terminal	Function / comments
1 / 2 / 3	**EDP300 Control Unit**
+51 / −52	**Limit switch Limit 1 with proximity switch** (optional)
+41 / −42	**Limit switch Limit 2 with proximity switch** (optional)
51 / 52 / 53	**Limit switch Limit 1 with microswitch** (optional)
41 / 42 / 43	**Limit switch Limit 2 with microswitch** (optional)

Note
The EDP300 Remote Sensor can be fitted either with proximity switches or microswitches as limit switches. It is not possible to combine both variants.

… Electrical connections

Electrical data for inputs and outputs

Note

When using the device in potentially explosive atmospheres, note the additional data in chapters **Use in potentially explosive atmospheres in accordance with ATEX and** IECEx on page 27 and **Use in potentially explosive atmospheres in accordance with FM and** CSA on page 31!

Set point signal analog (two-wire technology)	
Terminals	+11 / −12
Nominal operating range	4 to 20 mA
Limit values	Maximum: 50 mA (overload) Minimum: 3.6 mA
Starting at	≥ 3.8 mA
Load voltage	9.7 V at 20 mA
Impedance	485 Ω at 20 mA

Digital input DI	
Terminals	+81 / −82
Supply voltage	24 V DC (12 to 30 V DC)
Input 'logical 0'	0 to 5 V DC
Input 'logical 1'	11 to 30 V DC
Input Current	Maximum 4 mA

Digital output DO	
Terminals	+83 / −84
Supply voltage	5 to 30 V DC (Control circuit to DIN 19234/NAMUR)
Switching state logical	'0': current > 0.35 mA to < 1.2 mA '1': Current > 2,1 mA
Direction of action	standard logical '0' or logical '1' (configurable)

Option modules

Module for analog feedback AO*

Without any signal from the positioner (e.g. 'no power' or 'initializing') the module sets the output to > 20 mA (alarm level).

Terminals	+31 / −32
Signal range	4 to 20 mA (split ranges can be parameterized)
Supply voltage, two-wire technology	24 V DC (10 to 30 V DC)
Characteristic curve	rising or falling (configurable)
Deviation	< 1 %

Module for digital feedback SW1, SW2*

Two switches for binary position feedback (position adjustable within the range of 0 to 100 %, ranges cannot overlap)

Terminals	+41 / −42, +51 / −52
Supply voltage	5 to 11 V DC (Control circuit to DIN 19234/NAMUR)
Signal current	< 1,2 mA: Switching state logical '0' > 2,1 mA: Switching state logical '1'
Direction of action	standard logical '0' or logical '1' (configurable)

Module for universal input UAI*

Module for a 4 to 20 mA input for universal use.
The range can be scaled. It is used for advanced valve diagnostics. For example, an ultrasonic sensor can be connected to detect a faulty valve seat or a phonometer can be connected to detect cavitation.
The limit values for detecting up-scaling can be freely selected.

Terminals	+21 / −22
Nominal operating range	4 to 20 mA
Load voltage	8 V at 20 mA
Impedance	400 Ω at 20 mA

Module for the emergency shutdown function*

When the 24 V DC signal is interrupted, the I/P module executes the respective safety function, depending on the mechanical construction.

The positioner output 1 is depressurized, and the valve is moved to the safe position. In case of a double-acting actuator, output 2 is additionally pressurized.

The emergency shutdown module works independently of the mother board, i.e., all information from the final control element is available in the control system at any time.

Terminals	+85 / −86
Supply voltage	24 V DC (20 to 30 V DC) (electrically isolated from the input signal)
Safe position	Active at < 5 V DC

* There are two slots for the option modules. Any combination of different option modules is possible. However, identical option modules cannot be combined.

Limit switch

The limit switch can either be equipped with proximity switches or with potential-free microswitches.

Limit switch Limit 1 / Limit 2 with proximity switches

Two proximity switches for independent position signaling.		
Terminals		+41 / −42, +51 / −52
Supply voltage		5 to 11 V DC (Control circuit in accordance with DIN 19234/NAMUR)
Output 'logical 0'		< 1.2 mA
Output 'logical 1'		> 2.1 mA
Switching point		Adjustable between 0 and 100 %
Direction of action	Metal tag in proximity switch	Metal tag outside proximity switch
Type SJ2-SN (NC; log. 1)	< 1.2 mA	> 2.1 mA

Limit switch Limit 1 / Limit 2 with 24 V - microswitches

Terminals	41 / 42 / 43, 51 / 52 / 53
Supply voltage	maximum 24 V AC/DC
Load rating	Maximum 2 A

Wire cross-sectional areas

Basic device

Electrical connections	
4 to 20 mA input	Screw terminals max. 2.5 mm^2 (AWG14)
Options	Screw terminals max. 1.0 mm^2 (AWG18)

Cross section	
Rigid / flexible wires	0.14 to 2.5 mm^2 (AWG26 to AWG14)
Flexible with wire end sleeve no plastic sleeve	0.25 to 2.5 mm^2 (AWG23 to AWG14)
Flexible with wire end sleeve with plastic sleeve	0.25 to 1.5 mm^2 (AWG23 to AWG17)
	0.14 to 0.75 mm^2 (AWG26 to AWG20)

Multi-wire connection capacity (two wire with the same cross-section)	
Rigid / flexible wires	0.14 to 0.75 mm^2 (AWG26 to AWG20)
Flexible with wire end sleeve no plastic sleeve	0.25 to 0.75 mm^2 (AWG23 to AWG20)
Flexible with wire end sleeve with plastic sleeve	0.5 to 1.5 mm^2 (AWG21 to AWG17)

Option modules

Cross section	
Rigid / flexible wires	0.14 to 1.5 mm^2 (AWG26 to AWG17)
Flexible with wire end sleeve no plastic sleeve	0.25 to 1.5 mm^2 (AWG23 to AWG17)
Flexible with wire end sleeve with plastic sleeve	0.25 to 1.5 mm^2 (AWG23 to AWG17)

Multi-wire connection capacity (two wire with the same cross-section)	
Rigid / flexible wires	0.14 to 0.75 mm^2 (AWG26 to AWG20)
Flexible with wire end sleeve no plastic sleeve	0.25 to 0.5 mm^2 (AWG23 to AWG22)
Flexible with wire end sleeve with plastic sleeve	0.5 to 1 mm^2 (AWG21 to AWG18)

Limit switch with proximity switches or 24 V microswitches	
Rigid wire	0.14 to 1.5 mm^2 (AWG26 to AWG17)
Flexible wire	0.14 to 1.0 mm^2 (AWG26 to AWG18)
Flexible with wire end sleeve no plastic sleeve	0.25 to 0.5 mm^2 (AWG23 to AWG22)
Flexible with wire end sleeve with plastic sleeve	0.25 to 0.5 mm^2 (AWG23 to AWG22)

Dimensions

All dimensions in mm (in)

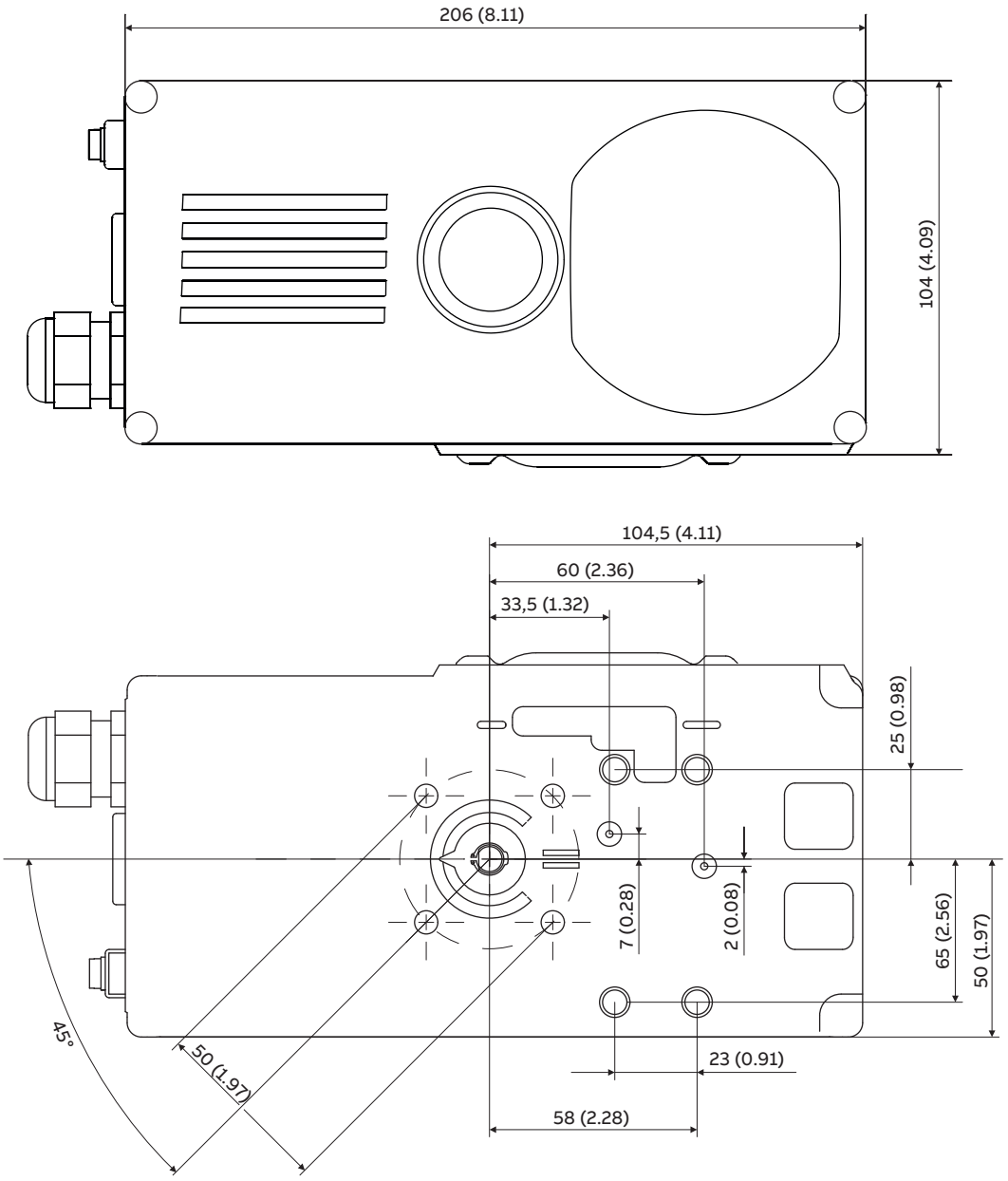


Figure 17: Front and rear views

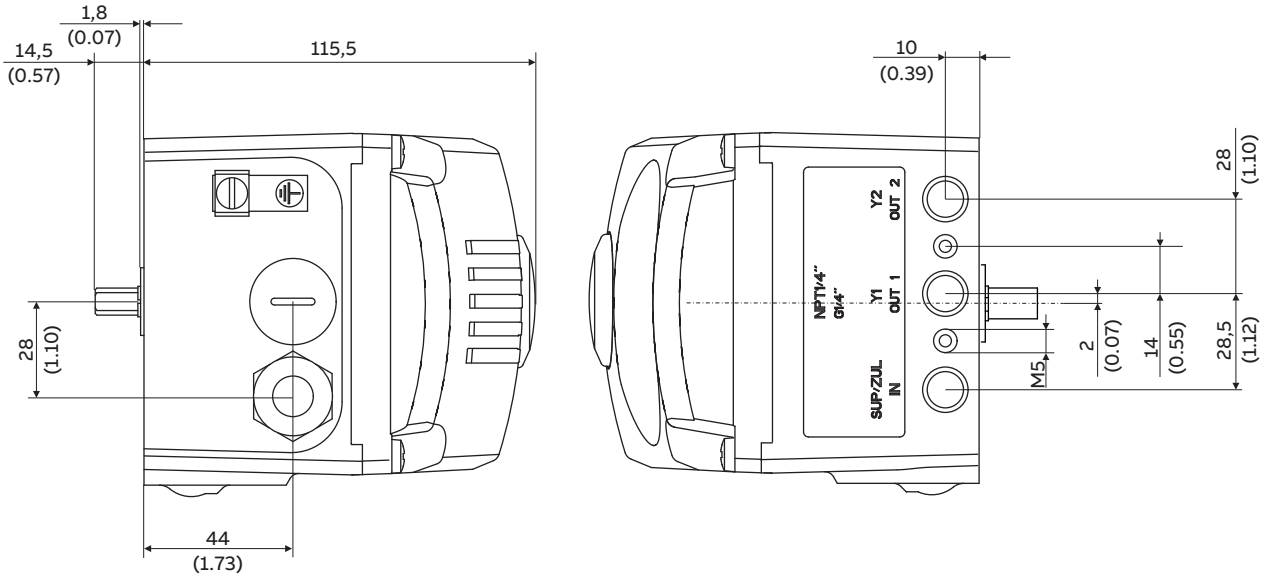


Figure 18: Side view (from left to right)

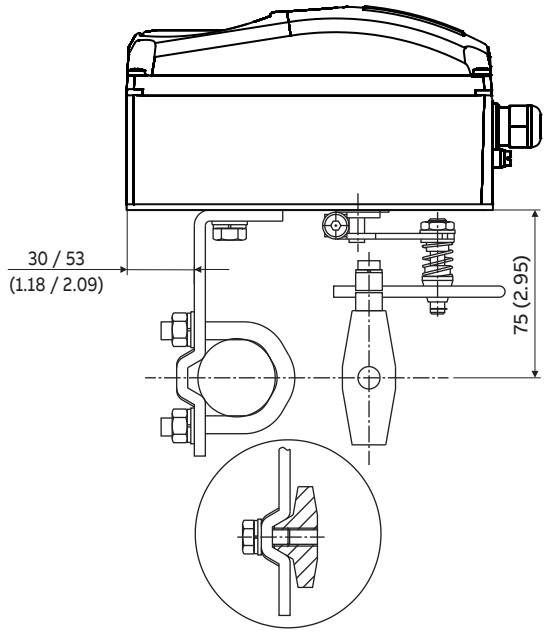
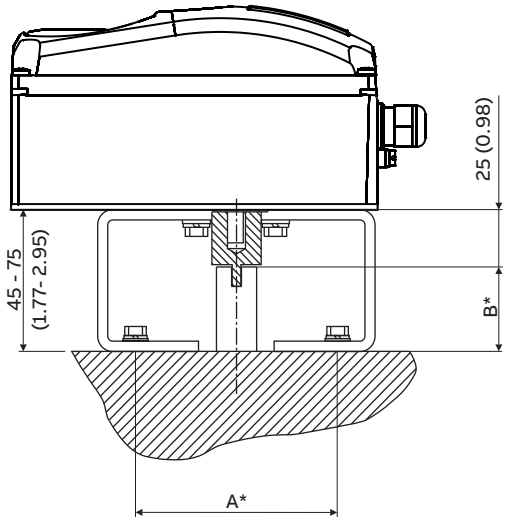


Figure 19: Mounting to linear actuators to DIN/IEC 534



* Dimensions A and B are dependent on the rotary actuator

Figure 20: Mounting to rotary actuators to VDI/VDE 3845

… Dimensions

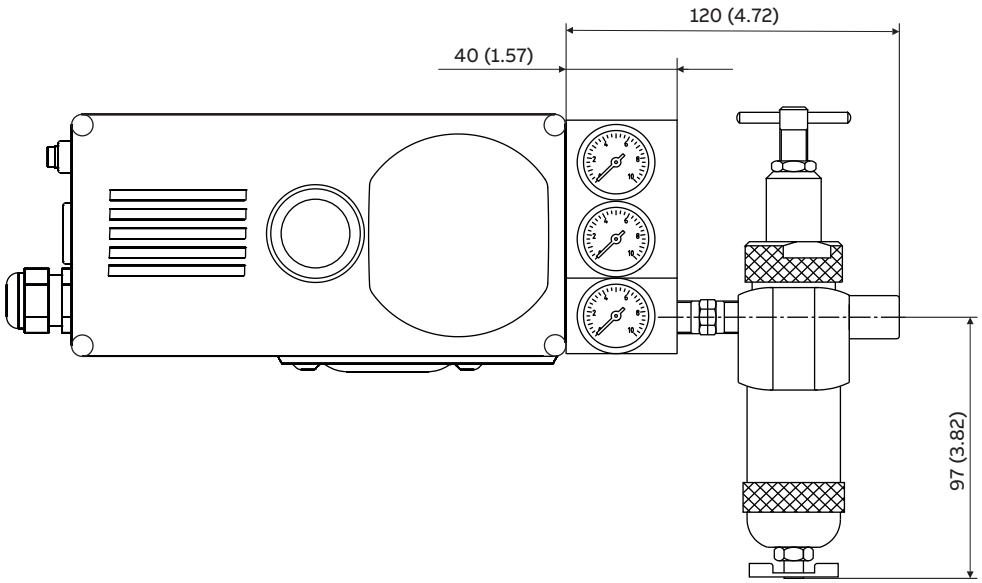


Figure 21: EDP300 positioner with pressure gauge block and filter regulator mounted

EDP300 Remote sensor dimensions (aluminum housing)

All dimensions in mm (in)

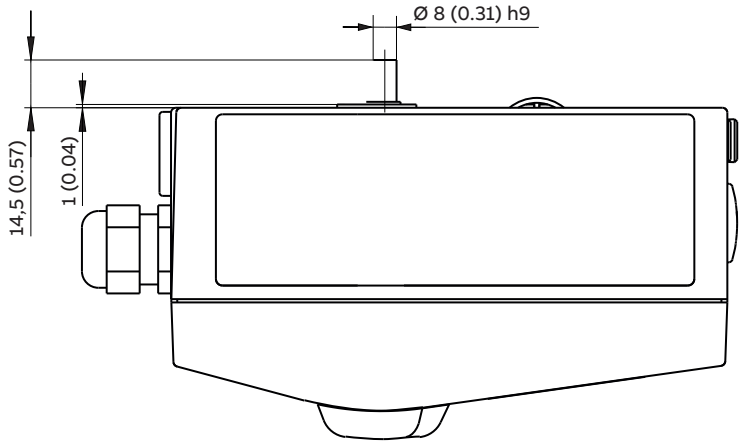
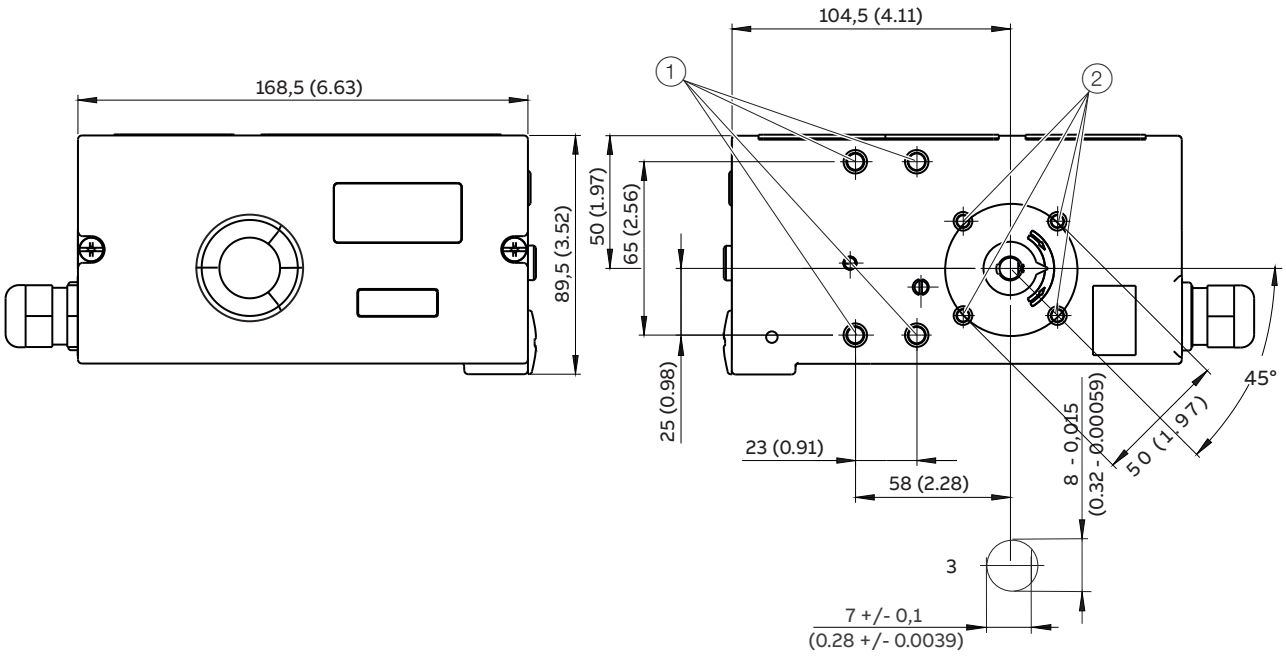


Figure 22: Top view



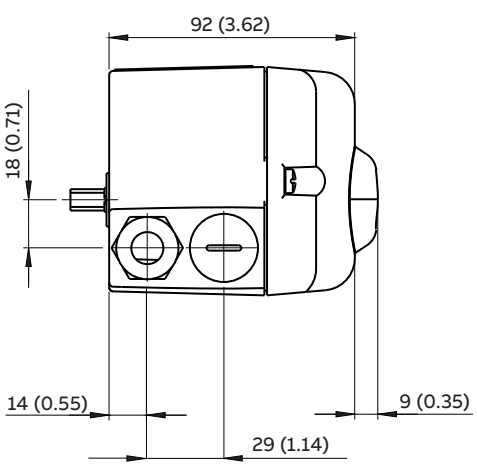
① Threaded hole M8 (10 mm [0.39 in] deep)

② Threaded hole M6 (8 mm deep [0.31 in])

③ Sensor shaft (shown enlarged)

Figure 23: Front and rear views

… Dimensions



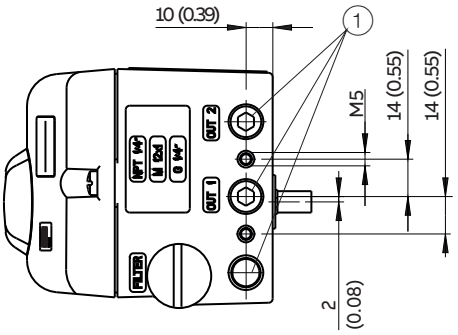


Figure 24: Side view (from left to right)

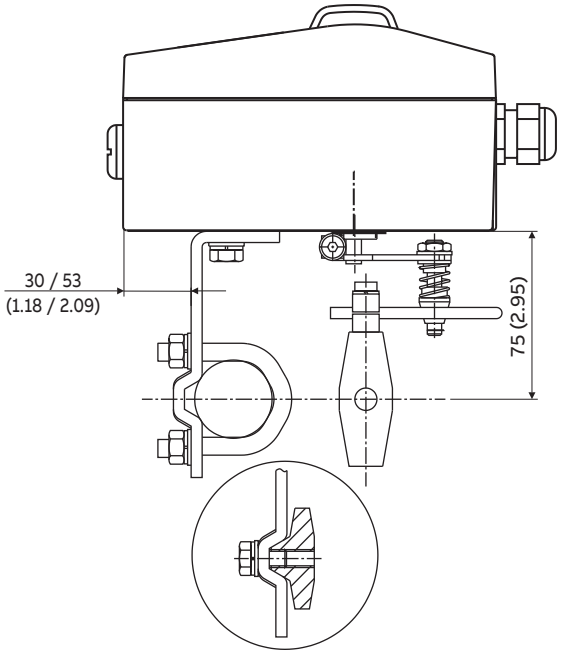
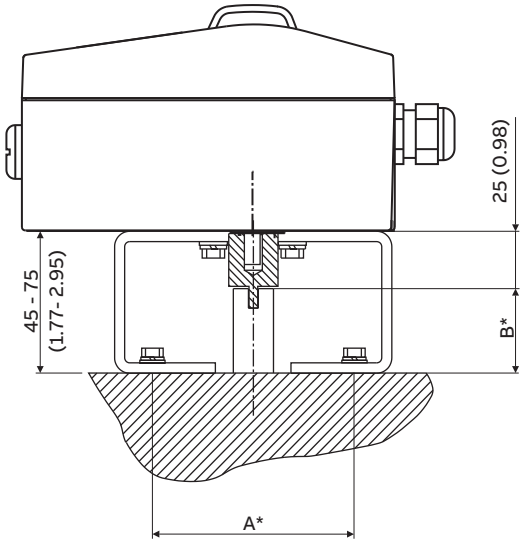


Figure 25: Mounting to linear actuators in accordance with DIN / IEC 534



* Dimensions A and B depend on the rotary actuator

Figure 26: Mounting on rotary actuators in accordance with VDI / VDE 3845

Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Note
Further information on the Ex-Approval of devices can be found in the type examination certificates or the relevant certificates at www.abb.com/positioners.

Product identification

Depending on the type of explosion protection, an Ex name plate is attached next to the main name plate on the positioner.
This indicates the level of explosion protection and the device's relevant Ex certificate.

Ex marking

ATEX	
Type Examination Test Certificate	ZELM 11 ATEX 0456 X
II 1G Ex ia IIC T6 or T4 Ga II 1D Ex iaD IIIC T55°C or T100°C Da Ta = −40°C to 40°C or 85°C	
II 3G Ex nA IIC T6 or T4 Gc II 2D Ex tb IIIC T55°C or T100°C Db Ta = 40°C to 40°C or 80°C	

IECEx	
Type Examination Test Certificate	IECEx ZLM 11.0001 X
Ex ia IIC T6 or T4 Ga Ex iaD IIIC T55 °C or T100°C Da Ta = −40 ° to 40 ° or 85 °C	
Ex nA IIC T6 or T4 Gc Ex tb IIIC T55 °C or T100°C Db Ta = −40 ° to 40 ° or 80 °C	

EAC TR-CU-012
Ex ia IIC T4/T6 Ga X Ex ia IIIC T100°C/T55°C Da IP65
EX nA IIC T4/T6 Gc X Ex tb IIIC T100°C/T55°C Db IP65

Mounting

The installation, commissioning, maintenance and repair of devices in potentially explosive atmospheres must only be carried out by appropriately trained personnel. Works may be carried out only by persons, whose training has included instructions on different types of protection and installation techniques, concerned rules and regulations as well as general principles of zoning. The person must possess the appropriate competences for the type of work to be conducted.
When operating with combustible dusts, comply with EN 60079-31.
The safety instructions for electrical apparatus in potentially explosive areas must be in accordance with Directive 2014/34/EU (ATEX) and IEC 60079-14 (Installation of electrical equipment in potentially explosive areas).
Comply with the applicable regulations for the protection of employees to ensure safe operation.

Note
Observe the device's applicable specifications and special conditions in accordance with the type examination certificate or other certificates!

- Any manipulation in the device by users is not permitted. Only the manufacturer or an explosion protection specialist may modify the device
- The device may only be operated using instrument air that is free from oil, water and dust.

… Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Cable gland
Limited temperature range of the M20 × 1.5 plastic cable gland for explosion protection variants.
The permissible ambient temperature range of the cable gland is −20 to 80 °C (−4 to 176 °F). When using the cable gland, make sure that the ambient temperature is within this range. The cable gland must be installed in the housing with a tightening torque of 3.8 Nm. When installing the connection of the cable gland and cable, check for tightness to ensure that the required IP rating is met.

Operation with flammable gases
Observe the following points when operating a device with flammable gases:

- The device must be used in accordance with the specifications in the relevant certificate.
- Only the design with the 'Intrinsic Safety' type of protection may be used for operation with natural gas. The pneumatic outputs must be vented in non-Ex areas.
- The maximum ambient temperature may not up-scale 60 °C (140 °F).
- During operation with flammable gases in type of protection 'Ex n', the device may only be operated with approved cable glands.
- During operation with flammable gases, the cover cap for the air outlets can be removed, and the air outlets can be tubed separately. Both pipes must not be joined in one pipe.

Operation in areas with combustible dust
Observe the following points when operating a device with combustible dust:

- To prevent loss of type of protection, the housing must not be opened.
- Only use cable glands which are approved for the type of protection and correspond to IP rating ≥ IP 6X.
- Danger due to propagating brush discharge must be avoided.

Operation in temperature class T6
During operation in temperature class T6, when the equipment is partially or fully depressurized, ensure that there is no possibility of a hazardous atmosphere getting into the pneumatic system or that any hazardous atmosphere is removed prior to compression by taking suitable action.
When commissioning in temperature class T6, flush the pneumatic system by applying 1.4 (+/- 0.1) bar until all traces of any explosive mixture have been removed, yet for at least 5 minutes. Ventilate and evacuate the EDP300 fully several times.

ATEX and IECEx temperature data

Type of protection Ex i, intrinsic safety

Temperature class	Ambient temperature	Surface temperature
T4	–40 to 85 °C (–40 to 185 °F)	100 °C (212 °F)
T6	–40 to 40 °C (–40 to 104 °F)	55° C (131 °F)

Type of protection Ex n - non-sparking

Temperature class	Ambient temperature	Surface temperature
T4	–40 to 80 °C (–40 to 176 °F)	100 °C (212 °F)
T6	–40 to 40 °C (–40 to 104 °F)	55° C (131 °F)

ATEX und IECEx electrical data

Type of protection Ex i, intrinsic safety Basic device

Signal circuit (AI)	
Terminals	+11 / –12
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1.1 W	P_i = 0.8 W
C_i = 6.5 nF without pressure option; 8.8 nF with pressure option	
L_i = negligibly small	

Digital input (DI)	
Terminals	+81 / –82
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Digital output (DO)	
Terminals	+83 / –84
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Option modules

Module for the emergency shutdown function
Terminals +85 / –86
Temperature class T1 – T6
U_i = 30 V
P_i = 1 W
C_i = 5.3 nF
L_i = negligibly small

… Use in potentially explosive atmospheres in accordance with ATEX and IECEx

Module for analog feedback (AO)	
Terminals	+31 / −32
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150 µH	

Module for universal input (UAI)	
Terminals	+21 / −22
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150 µH	

Module for digital feedback (SW1 / SW2)	
Terminals	SW 1: +41 / −42
	SW 2: +51 / −52
Temperature class T1 – T4	**Temperature class T6**
Per output:	Per output:
U_i = 30 V	U_i = 28 V
P_i = 0.5 W	P_i = 0.4 W
I_i = 250 mA	
C_i = 2.2 nF per output	
L_i = negligibly small	

Limit switch (Limit 1 / Limit 2) **Limit monitor with proximity switches**	
Terminals	Limit 1: +51 / −52
	Limit 2: +41 / −42
Temperature class T1 – T4	**Temperature class T6**
In accordance with type examination certificate PTB 00 ATEX 2049X	

* No IECEx approval

Type of protection Ex n - non-sparking
Basic device

Signal circuit (AI)	
Terminals	+11 / −12
Electrical values	$I_N \leq 22$ mA; $U_{max} \leq 30$ V

Digital input (DI)	
Terminals	+81 / −82
Electrical values	$U_N \leq 30$ V

Digital output (DO)	
Terminals	+83 / −84
Electrical values	$U_N \leq 30$ V

Option modules

Module for the emergency shutdown function	
Terminals	+85 / −86
Electrical values	$U_N \leq 30$ V

Module for analog feedback (AO)	
Terminals	+31 / −32
Electrical values	$I_N \leq 22$ mA; $U_N \leq 30$ V

Module for universal input (UAI)	
Terminals	+21 / −22
Electrical values	$I_N \leq 22$ mA; $U_{max} \leq 30$ V

Module for digital feedback (SW1 / SW2)	
Terminals	SW 1: +41 / −42
	SW 2: +51 / −52
Electrical values	Per output: $U_N \leq 30$ V

Limit switch (Limit 1 / Limit 2) **Limit monitor with proximity switches**	
Terminals	Limit 1: +51 / −52
	Limit 2: +41 / −42
Electrical values	Per output: $I_N \leq 25$ mA; $U_N \leq 16$ V

* No IECEx approval

Use in potentially explosive atmospheres in accordance with FM and CSA

Note
Further information on the Ex-Approval of devices can be found in the type examination certificates or the relevant certificates at www.abb.com/positioners.

Product identification

Depending on the type of explosion protection, an Ex name plate is attached next to the main name plate on the positioner.
This indicates the level of explosion protection and the device's relevant Ex certificate.

Ex marking

FM	
FM Approval	3043773
Control drawing	901305
IS, CL. I, Div. 1, Gr. A, B, C, D, T4 or T6	
IS, CL. II, Div. 1, Gr. E, F, G, T4 or T6	
IS, CL. III, Div. 1, T4 or T6	
Class I Zone 0, AEx ia IIC, T4 or T6	
NI, Cl. I, Div. 2, Gr. A, B, C, D, T4 or T6	
NI. Cl. II, Div. 2, Gr. E, F, G, T4 or T6	
NI, Cl. III, Div. 2, T4 or T6	
Class I Zone 2, IIC T4 or T6	
T4 Ta=(−40 to +85) °C; (−40 to +185) °F	
T6 Ta=(−40 to +40) °C; (−40 to +104) °F	
Type 4X	

CSA	
Certificate	2419437
Control drawing	901305
CL I, Div. 1, Gr. A, B, C, D, T4 or T6	
CL II, Div. 1, Gr. E, F, G, T4 or T6	
CL III, Div. 1	
Class I Zone 0, AEx ia IIC T4 or T6	
CL I, Div. 2, Gr. A, B, C, D, T4 or T6	
CL II, Div. 2, Gr. E, F, G, T4 or T6	
CL III, Div. 2, T4 or T6	
Class I Zone 2, AEx nA IIC, T4 or T6	
T4 Ta=(−40 to +85) °C; (−40 to +185) °F	
T6 Ta=(−40 to +40) °C; (−40 to +104) °F	
IP64	

Mounting

The installation, commissioning, maintenance and repair of devices in areas with explosion hazard must only be carried out by appropriately trained personnel.
The operator must strictly observe the applicable national regulations with regard to installation, function tests, repairs, and maintenance of electrical devices. (e. g. NEC, CEC).

Note
Observe the device's applicable specifications and special conditions in accordance with the relevant certificate.

- Any manipulation in the device by users is not permitted. Only the manufacturer or an explosion protection specialist may modify the device
- The device may only be operated using instrument air that is free from oil, water and dust.

… Use in potentially explosive atmospheres in accordance with FM and CSA

Cable gland
Limited temperature range of the M20 × 1.5 plastic cable gland for explosion protection variants.
The permissible ambient temperature range of the cable gland is −20 to 80 °C (−4 to 176 °F). When using the cable gland, make sure that the ambient temperature is within this range. The cable gland must be installed in the housing with a tightening torque of 3.8 Nm. When installing the connection of the cable gland and cable, check for tightness to ensure that the required IP rating is met.

Operation with flammable gases
Observe the following points when operating a device with flammable gases:

- The device must be used in accordance with the specifications in the relevant certificate.
- Only the design with the IS 'Intrinsic Safety ' type of protection may be operated with natural gas. The pneumatic outputs must be vented in non-hazardous areas.
- During operation with flammable gases, the cover cap for the air outlets must be removed and the air outlets tubed separately. Both pipes must not be joined in one pipe.
- The maximum ambient temperature must not up-scale 60 °C (140 °F).

See also **Control Drawing 901305**.

Operation in areas with combustible dust
Observe the following points when operating a device with combustible dust:

- To prevent loss of type of protection, the housing must not be opened.
- Only use cable glands which are approved for the type of protection and correspond to IP rating ≥ IP 6X.
- Danger due to propagating brush discharge must be avoided.

Operation in temperature class T6
During operation in temperature class T6, when the equipment is partially or fully depressurized, ensure that there is no possibility of an explosive atmosphere getting into the pneumatic system or that any explosive atmosphere is removed prior to compression by taking suitable action. When commissioning in temperature class T6, flush the pneumatic system by applying 1.4 (+/- 0.1) bar until all traces of any explosive mixture have been removed, yet for at least 5 minutes. Ventilate and evacuate the EDP300 fully several times.

Temperature data

Note
Legibility of the display is guaranteed at an ambient temperature of −20 to 70 °C. At 20 °C and lower, legibility can become limited. Legibility can be compensated by adjusting contrast. Contrast adjustment can be made manually directly on the device.
The display can fail at temperatures below −20 °C. Moreover, functioning of the device is guaranteed up to −40 °C.

FM	
Temperature class	**Ambient temperature T_{amb}**
T1 to T4	−40 °C to 85 °C
T6	−40 °C to 40 °C

CSA	
Temperature class	**Ambient temperature T_{amb}**
T4	−40 °C to 85 °C
T6	−40 °C to 40 °C

Electrical data

Basic device

Signal circuit (AI)	
Terminals	+11 / −12
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1.1 W	P_i = 0.8 W
C_i = 6.5 nF without pressure option; 8.8 nF with pressure option	
L_i = negligibly small	

Digital input (DI)	
Terminals	+81 / −82
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Digital output (DO)	
Terminals	+83 / −84
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
P_i = 500 mW	P_i = 400 mW
C_i = 4.2 nF	
L_i = negligibly small	

Option modules

Module for the emergency shutdown function	
Terminals	+85 / −86
Temperature class T1 – T6	
U_i = 30 V	
P_i = 1 W	
C_i = 5.3 nF	
L_i = negligibly small	

Module for analog feedback (AO)	
Terminals	+31 / −32
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150 µH	

Module for universal input (UAI)	
Terminals	+21 / −22
Temperature class T1 – T4	**Temperature class T6**
U_i = 30 V	U_i = 28 V
I_i = 320 mA	I_i = 320 mA
P_i = 1 W	P_i = 0.8 W
C_i = 11.3 nF	
L_i = 150 µH	

Module for digital feedback (SW1 / SW2)	
Terminals	SW 1: +41 / −42
	SW 2: +51 / −52
Temperature class T1 – T4	**Temperature class T6**
Per output:	Per output:
U_i = 30 V	U_i = 28 V
P_i = 0.5 W	P_i = 0.4 W
I_i = 250 mA	
C_i = 2.2 nF per output	
L_i = negligibly small	

Limit switch (Limit 1 / Limit 2)	
Limit monitor with proximity switches	
Terminals	Limit 1: +51 / −52
	Limit 2: +41 / −42
Temperature class T1 – T4	**Temperature class T6**
−25 to 85 °C	−25°C to 40°C

* No IECEx approval

Ordering Information

Main ordering information PositionMaster EDP300 digital positioner

Base model	**EDP300**	**XX**	**X**	**X**	**X**	**X**	**X**
PositionMaster EDP300 digital positioner							
Explosion Protection Certification							
Without		Y0					
ATEX II 1G Ex ia IIC / II 1D Ex ia IIIC		A1					
ATEX II 3G Ex nA IIC / II 2D Ex tb IIIC		B1					
FM / CSA Intrinsically Safe Class I, II, III Div. 1 Groups A, B, C, D, E, F, G		F1					
IEC ExEx ia IIC Ga / Ex ia IIIC Da		M1					
IEC ExEx nA IIC Gc / Ex tb IIIC Db		N1					
EAC TR-CU-012 Ex ia IIC T4/T6 Ga X		P1					
EAC TR-CU-012 Ex ia IIIC T100°C/T55 °C DA IP 65		P2					
EAC TR-CU-012 Ex nA IIC T4/T& Gc X		P3					
EAC TR-CU-012 Ex tb IIIC T100 °C/T55 °C Db IP 65		P4					
NEPSI China - Ex ia II C T6 (on request)		S1					
Input Signal / Communication Port							
4 to 20 mA			A				
HART digital communication and 4 to 20 mA			H				
Pneumatic Output Type							
Single acting				1			
Double acting				2			
Safe Position							
Fail-safe					S		
Fail-freeze					F		
Air Pipe Connection							
Thread G ¼ female						1	
Thread ¼ in -18 NPT female						2*	
Cable Conduits							
M20 × 1.5 with cable gland							A
NPT ½ in with cable gland							B
Thread M20 × 1.5 female							C
Thread NPT ½ in female							D*

* Needed for FM / CSA certification

Additional ordering information

PositionMaster EDP300 digital positioner	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Option Module Slot 1										
Analog feedback output	A1									
Digital feedback output	A2									
Analog universal input	A3									
Option Module Slot 2										
Analog feedback output		B1								
Digital feedback output		B2								
Analog universal input		B3								
Emergency shutdown module		B4								
Option, Air Power										
50kg/h			L5							
Usage Certifications										
Inspection certificate 2.1 acc. EN 10204, Declaration of Conformity				C4						
Inspection certificate 2.1 acc. EN 10204, Declaration of Conformity, with description				CP						
Test report 2.2 acc. EN 10204				C5						
Ships Register Certifications DNV_GL				CM						
Inspection Certificate 3.1 acc. EN 10204, with maximum deviation				C6						
SIL 2 - Declaration of Conformity				CS**						
Handling of Certificates										
Send via e-mail					GHE					
Send via mail					GHP					
Send via mail express					GHD					
Send with instrument					GHA					
Only archived					GHS					
Certificate preparation										
per device						GPD				
per salesorder item						GPP				
Position Indicator										
Visual Indicator, integrated into cover							D1			
Limit Switches										
Microswitches								F1**		
Proximity switches (NC) SJ2-SN								F2***		
Housing Material										
Stainless steel									H1	
Position Sensor Type										
With integrated (contactless) position sensor										K1
Control Unit for remote position sensor										K2**

* With single acting, fail safe pneumatic only

** Not for Ex-versions

*** Not for IECEx-versions

… Ordering Information

Additional ordering information	**XX**	**XX**	**XX**	**XX**
Documentation Language				
German	M1			
Italian	M2			
Spanish	M3			
French	M4			
English	M5			
Swedish	M7			
Finnish	M8			
Polish	M9			
Portuguese	MA			
Russian	MB			
Czech	MC			
Dutch	MD			
Danish	MF			
Greek	MG			
Crotian	MH			
Latvian	ML			
Hungarian	MM			
Estonian	MO			
Bulgarian	MP			
Romanian	MR			
Slovak	MS			
Lithuanian	MU			
Slovenian	MV			
Special Applications				
Operation with natural gas		P8*		
With noise reduction		P9		
Typ des Manometerblocks				
0 bis 1 MPa (0 bis 10 bar, 0 bis 145 psi)			R3	
Diagnosis Module				
Pressure sensors				S3

* Only with Explosion protection

Additional ordering information	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**
Additional TAG Plate							
Stainless steel 18.5 mm × 65 mm (0.73 in × 2.5 in)	T1						
Sticker 11 mm × 25 mm (0.44 in × 1 in)	T3*						
Mounting Options							
Prepared for integral mounting		V1					
Remote Sensor							
Basic unit			RS				
Remote Sensor Temperature Range							
Extended ambient temperature range −40 bis 100 °C (−40 bis 212 °F)				RT			
Remote Sensor Vibration Resistance							
Advanced vibration range 2 g @ 300 Hz					RV		
Remote Sensor Protection Class							
Protection class IP 66						RP	
Remote Sensor Cable							
5 m cable enclosed							R5
10 m cable enclosed							R6

* Not for Ex-versions

Accessories	**Order number**
Mounting bracket	
EDP300 / TZIDC Mounting bracket for rotary actuators (mounting to VDI / VDE 3845), dimension A/B = 80/20 mm	319603
EDP300 / TZIDC Mounting bracket for rotary actuators (mounting to VDI / VDE 3845), dimension A/B = 80/30 mm	319604
EDP300 / TZIDC Mounting bracket for rotary actuators (mounting to VDI / VDE 3845), dimension A/B = 130/30 mm	319605
EDP300 / TZIDC Mounting bracket for rotary actuators (mounting to VDI / VDE 3845), dimension A/B = 130/50 mm	319606
Mounting Kit	
EDP300 / TZIDC Mounting Kit Uhde Type 4 Stroke 400 mm cropped	7959500
Attachment kit for linear actuators	
EDP300 / TZIDC Attachment kit for linear actuators, stroke 10 to 35 mm	7959125
EDP300 / TZIDC Attachment kit for linear actuators, stroke 20 to 100 mm	7959126
Lever	
EDP300 / TZIDC Lever 30 mm	7959151
EDP300 / TZIDC Lever 100 mm	7959152

… Ordering Information

Accessories	Order number
Adapter	
EDP300 / TZIDC Adapter (shaft coupler) for rotary actuators (mounting to VDI / VDE 3845)	7959110
EDP300 / TZIDC Form – locking shaft adapter	7959371
Attachment kit	
EDP300 / TZIDC Attachment kit for Fisher 1051-30, 1052-30	7959214
EDP300 / TZIDC Attachment kit for Fisher 1061 size 130	7959206
EDP300 / TZIDC Attachment kit for Fisher 471	7959195
EDP300 / TZIDC Attachment kit for Fisher 657 / 667 Size 10 to 30 mm	7959177
EDP300 / TZIDC Attachment kit for Fisher Gulde 32/34	7959344
EDP300 / TZIDC Attachment kit for Gulde DK	7959161
EDP300 / TZIDC Attachment kit for Keystone 79U/E-002(S) … 79U/E-181(S)	7959147
EDP300 / TZIDC Attachment kit for Masoneilan CAMFLEX II, VARIMAX, MINITORK II	7959144
EDP300 / TZIDC Attachment kit for Masoneilan VariPak 28000 series	7959163
EDP300 / TZIDC Attachment kit for MaxFlo MaxFlo	7959140
EDP300 / TZIDC Attachment kit for NAF 791290	7959207
EDP300 / TZIDC Attachment kit for NAMUR stroke 100 to 170 mm	7959339
EDP300 / TZIDC Attachment kit for NELES BC6-20, B1C6-20, BJ8-20, B1J8-20	7959146
EDP300 / TZIDC Attachment kit for Valves Nuovo Pignone, lever for linear stroke, length 150 to 250 mm	7959210
EDP300 / TZIDC Attachment kit for Samson 241, 271, 3271	7959145
EDP300 / TZIDC Attachment kit for Samson 3277	7959136
EDP300 / TZIDC Attachment kit for Schubert&Salzer GS 8020 / 8021 / 8023	7959200
EDP300 / TZIDC Attachment kit for SED SED stroke 100 mm	7959141
EDP300 / TZIDC Attachment for remote sensor control unit (for wall or pipe mounting)	7959381

Trademarks

HART is a registered trademark of FieldComm Group, Austin, Texas, USA

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