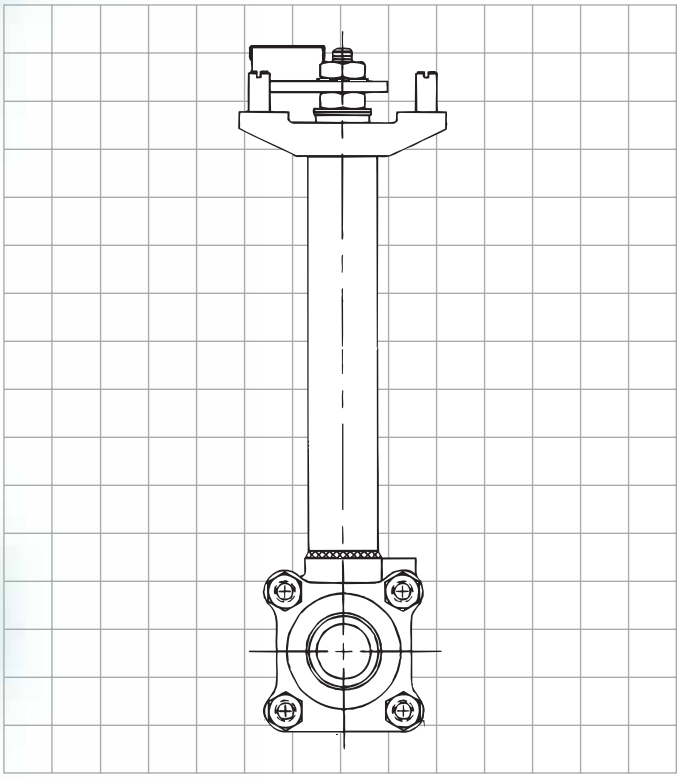
FLOWSERVE
Worcester Controls

AN ISO 9001 REGISTERED COMPANY

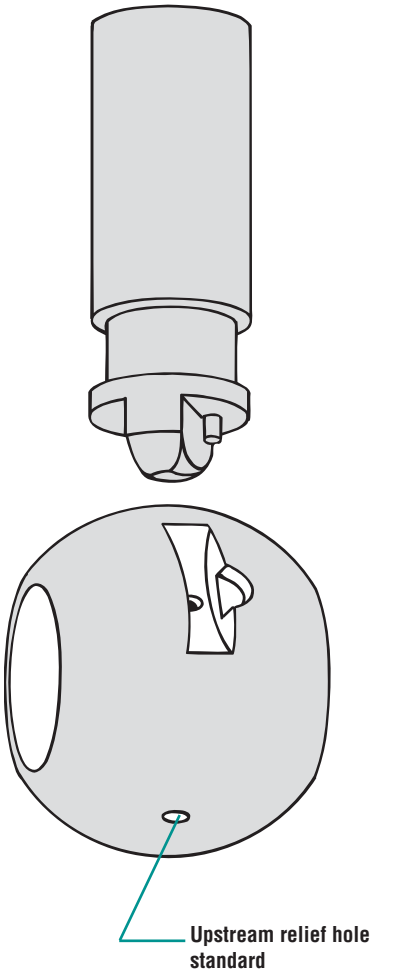


C4, C44, and C51 Ball Valves for Cryogenic Service

High-performance, shutoff valves for intermittent and continuous flow applications with temperatures to -425°F

Flowserve Worcester Controls presents the quality solution to problems of manual and automatic control of cryogens.

Flowserve Worcester Controls has the quality solution for tough applications involving all types of cryogens; oxygen, hydrogen, methane, ammonia, nitrogen, fluorine, LNG and deuterium. Our complete line of cryogenic valves, backed by years of successful field experience, incorporates superior technology and design. This means automatic or manual control of cryogenic fluids with no contamination, no fluid degradation and no waste while assuring safety for workers, property and the environment. The wrong specifications here can turn an inferior valve into a time bomb. Tough applications demand Worcester Controls' special service cryogenic valves.



Here's Why:

Positive Ball Cavity Relief – An upstream relief hole in the ball prevents dangerous overpressure due to thermal expansion. On extended stem valves through 2", a one-piece stem with alignment pin assures proper orientation of the ball.

Pressure Safe Stem – Both one-piece and two-piece, assembled-inside-the-body stems are safe from blowout and are supported with Polyfill® thrustwashers.

Zero Leak Packing – Belleville live-loaded TFE packing rings and stem centering followers assure zero leakage through the toughest, high-cycle applications.

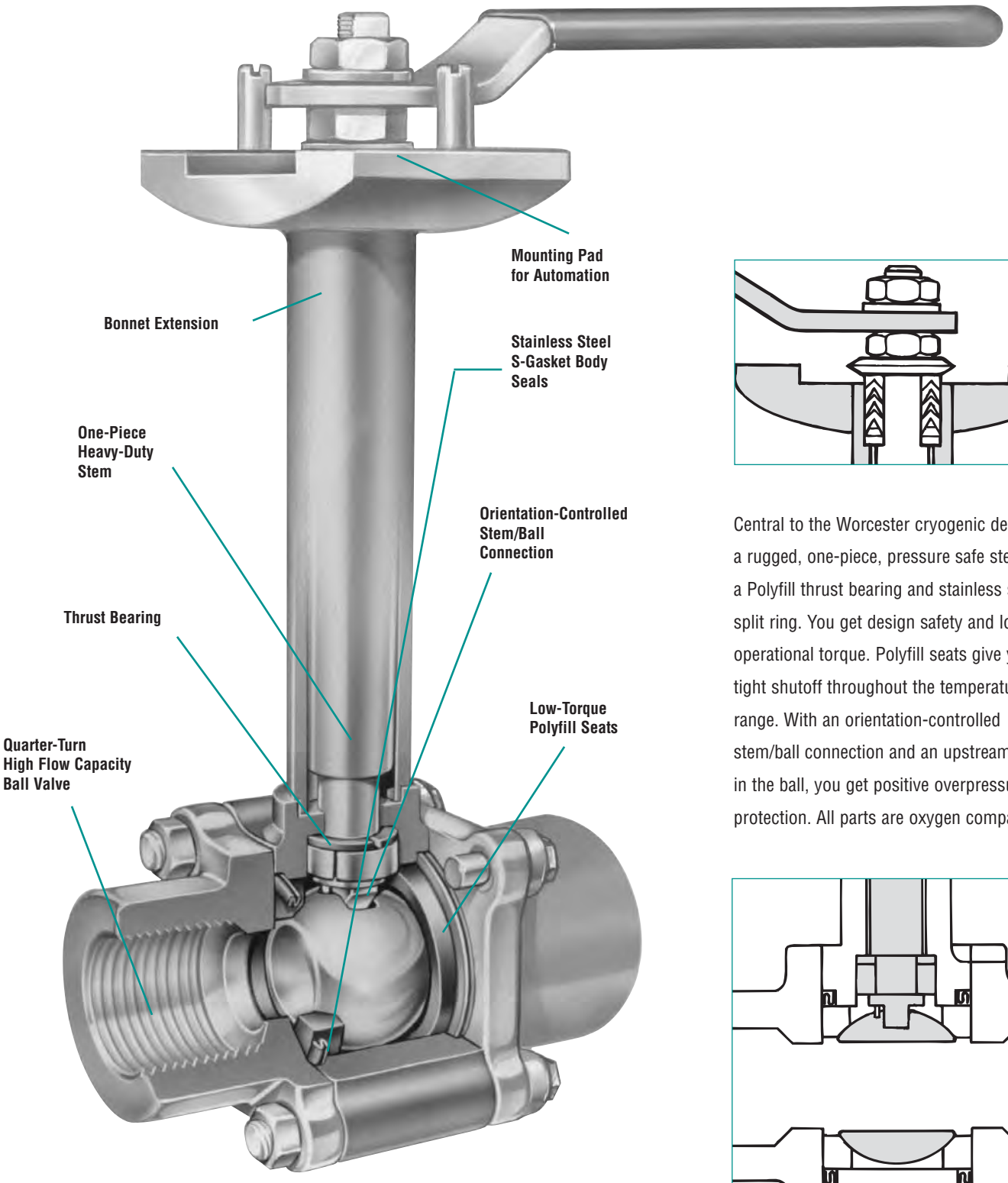
Effective Bonnet Extensions – The stem extensions of Worcester Controls' cryogenic valves conform to standard industrial practices. That means wall thickness and lengths that keep heat transfer down, the packing frost-free, operational torques low, and actuators solidly supported.

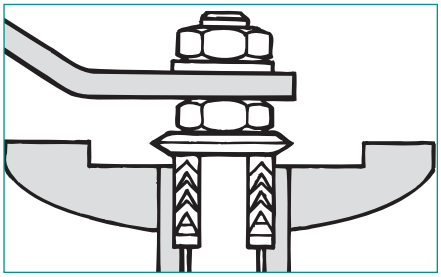
High-Performance/Low-Thermal Stress – The special "part compatibility" design of valve parts, Polyfill seats and body seals assure tight shutoff, zero body leakage and low torque through large thermal excursions from ambient to -425°F.

Valves Designed for Automation – Approximately 40% of cryogenic installations require fail-safe operation or automatic on/off control. Worcester Controls has the pneumatic and electronic, computer-compatible controls for your installation.

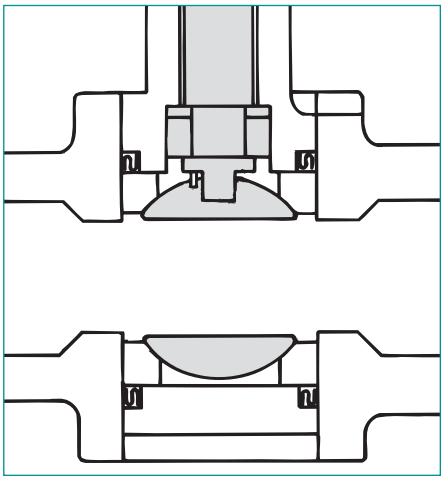
Valves Designed for Fire Safety – A Series 94 double-graphite, stem-sealed fire-tight version of our cryogenic valve is available through the Custom Products Department. These valves are especially effective in hydrogen and liquefied natural gas systems.

No Leak Seats and Seals





Central to the Worcester cryogenic design is a rugged, one-piece, pressure safe stem with a Polyfill thrust bearing and stainless steel split ring. You get design safety and low operational torque. Polyfill seats give you tight shutoff throughout the temperature range. With an orientation-controlled stem/ball connection and an upstream hole in the ball, you get positive overpressure protection. All parts are oxygen compatible.



C44 Brass or Stainless Steel

C44 Diverter

C4 Wafer

C4 Flanged

Valves Without Stem Extensions

Cryogenic Valve Configurations

Flowserve Worcester Controls cryogenic valves are available in four basic body configurations; C44 (¼"-2"), C44 Diverter (½"-2"), C4 Wafer (3"-6"), and C51 Flanged (3"-6"). All four valve styles offer the same features: exclusive Polyfill seats, all stainless steel construction, pressure-safe stem, extension bonnet lengths, positive ball cavity relief and low operational torques.

C44 – The Worcester cryogenic valve incorporates many of the features of the Series 44 line of valves. Three-piece construction makes it easy to install, versatile in application and simple to maintain. By removing three of the body bolts and loosening the fourth, the valve may be swung out of line. In welded or soldered piping systems, all four body bolts may be removed and the center section lifted out for maintenance or replacement. A variety of connections are available; screwed end, socket weld, butt weld and solder/sweat ends.

C44 Diverter – The cryogenic diverter valve accepts media through the bottom inlet port and directs it to one of two side ports. There are two ball porting configurations; Porting No. 1 directs flow from one outlet port to the other through a 90° rotation. Porting No. 2 diverts media from one outlet port to the other through a 180° rotation. With Porting No. 2, the flow can be turned off by positioning the valve at 90° rotation. A Porting No.1 diverter valve can be automated pneumatically or electrically. A Porting No. 2 valve may be operated by a Series 75 electric actuator. Bottom connection options are the same as standard valve (except butt weld).

C4 Wafer – The Worcester wafer is a flangeless cryogenic valve that mounts between ANSI Class 150 or 300 flanges. The extension construction is slightly different than the smaller C4 valves and includes a two-piece pinned stem extension and solid ring 15% glass-filled TFE stem seals and a virgin TFE body seal.

C51 Flanged – The C51 is identical in internal construction to the wafer cryogenic valve. The body is cast with ANSI Class 150 flanges.

Valves Without Stem Extension – Valves in all four configurations are available without stem extensions for intermittent cryogenic service.

Codes and Standards: Praxair® Specification GS-38 and GS-40. Valves may comply with ANSI B16.34 if ordered with V58 suffix. Brass and wafer valve bodies are not covered by ANSI B16.34.

Applications

- Over-the-Road LNG-LPG Trailers
- Terminal Unloading Stations
- High-Purity Cryogenic/Gas Systems
- LNG Storage and Distribution
- CO_2 and Nitrogen Injection for Enhanced Oil Recovery
- Over-the-Road CO_2, LNG, Food Carriers
- Petroleum Refining Unleaded Gasoline (Gas Treatment Skids)
- Lyophilization Systems
- Air Separation Plants
- Liquid and Gaseous Oxygen for Steel Production
- Inerting and Heat Treatment
- Liquid Ammonia Systems (consult factory)

Clean Room Assembly

Environmental Control

Before final assembly, valve components are cleaned and degreased. Cleaning and tagging procedures for Flowserve Worcester cryogenic valves are based on Praxair Specification GS-38 and GS-40.

Assembly occurs in a Class 100 environment, per Federal Standard 209B for assembly and test.

Stainless Steel Passivation – Worcester engineering specifications strictly define procedures for cleaning, descaling and passivating stainless steel parts. Inspection is performed with a copper sulfate test per ASTM A380.

Wipe Test – All wetted components are wipe tested using Whatman® #44 paper.

Helium Leak Test – Valves are dry tested, internally pressurized with 80 psi helium and checked with a helium leak detector (Helium Mass Spectrometer sensitive to 1 x 10^{-5} cc/sec.).

Vacuum Sealed – After all testing has been completed, cryogenic valves are capped with protective plastic end caps, stamped, tagged and heat sealed in 4 mil polyethylene bags. This ensures valve integrity up to the point of installation.

Custom Testing – On request, special material, valve integrity, tightness and operational testing can be performed with valves submerged in liquid nitrogen.

Throttling Control of Cryogenics

Worcester's characterized metal-seated control valves for modulating service offer many advantages over traditional globe valves for demanding cryogenic applications.

Rotary Concept

Eliminates expensive high-maintenance stuffing box design of rising stem globe valves.

Eliminates the unbalanced, heavy actuators of extended bonnet globe valves.

Reduces the size of the control valve package by one third.

Characterized Seats

- High accuracy
- High rangeability
- Class VI shutoff or better
- Modified characteristics for better control
- Smaller valve sizes than conventional globe valves

Lower Material Cost

For applications such as oxygen, the added cost is significantly lower than globe valves.

Choice of Pneumatic or Electric Actuation

Pneumatic Series 39 actuators available with Pulsair® loop-powered, intrinsically safe positioner or all-pneumatic positioners for precise throttling control.

Economical, Series 75 electric actuators with Series DFP17 DataFlo™ positioner or Series DFC17 DataFlo controller allow for dependable throttling control in colder environments where moisture in the airlines can freeze or in systems where compressed air is not available.

Easier direct electronic interface.

Characterized seat control valves for cryogenic service are available through Worcester's Custom Products Department.

Pneumatic and Electric Automation

Easy automation for on/off service is assured by our Series 39 pneumatic or Series 75 electric actuators. Both are backed by our exclusive two-year warranty. The Series 39 actuator is the toughest and most versatile rotary actuator available. Fail-safe capability, and mechanical and proximity limit switches provide system safety and valve position feedback. Refer to Brochure WCABR1003.

Mount a Series 75 electric actuator and you have a high-performance control valve package specifically designed for computer or PLC control. A variety of options allow you to select the performance criteria and feedback information you desire. The Series 75 is available with TYPE 1, 4, 7 or 9 enclosures. Refer to Brochure WCABR1014.

Series 75
Electric Actuator

Series 39
Pneumatic Actuator

Series 39 Pneumatic Actuator
with Pulsair Positioner

Specifications

C44 and C44 Diverter Valves Without Extensions

Valve Sizes:	1/4", 3/8", 1/2", 3/4", 1", 1½" and 2" (diverter not available in 1/4" and 3/8").
Styles:	Unidirectional flow, three-piece design Bottom entry, one-piece, blowout-proof stem diverter-V1, V2 porting
Body:	ASTM A351 CF8M, 316 or CF3M, 316L stainless steel ASTM B283 C37700, brass
Pipe Ends:	ASTM A351 CF3M (316L) stainless steel ASTM A351 CF8M (316) stainless steel ASTM B283 C37700, brass
Ball:	ASTM A479 316 Condition A stainless steel or ASTM A351 CF8M stainless steel ASTM B16 HO2 Upstream relief hole (V3) in ball to relieve cavity pressure.
Stem:	ASTM A479 316 stainless steel, Condition A ASTM B16 HO2
Seats:	Polyfill
Body Seals:	TFE coated 316 stainless steel gaskets
Externals:	300 series stainless steel
End Connections:	SE – Screwed pipe ends (NPT) (dimensions to ANSI B1.20.1) SW – Socket weld ends (dimensions to ANSI B16.34) SW0 – Socket weld ends for O.D. tubing to ASTM A269 (stainless steel only) BW1 – Butt weld ends for schedule 10 pipe (dimensions to ANSI B16.25) (stainless steel only) TE – Tube ends (sweat ends for type K, L and M copper tubing to ASTM B88) (brass only)
Follower:	AISI 316L stainless steel
Packing:	Polyfill

C4 Wafer Valves and C51 Flanged Valves with and without Extensions

Valve Sizes:	3", 4" and 6"
Style:	Unidirectional flow, wafer/flangeless and flanged design Blowout-proof stem
Valve Ratings:	Wafer – fits between ANSI Class 150 and 300 flanges Flanged – ANSI Class 150
Body and End Plug:	ASTM A351 CF8M stainless steel ASTM B584 C83600 brass (wafer only)
Ball:	ASTM A351 CF8M ASTM B584 C83600 brass (wafer only)
Stem:	ASTM A479 316 stainless steel Condition A
Seats:	Polyfill
Body Seal:	TFE Virgin
Stem Seals:	TFE – 15% glass filled
Centering Washers:	AISI 316 stainless steel ASTM B121 C34200 brass (wafer only)
Thrust bearing:	TFE – 25% glass filled
Follower:	3", 4" ASTM A479 316 stainless steel 6" ASTM A269 300 stainless steel
Externals:	300 series stainless steel

C44 and C44 Diverter Valves With Stem Extensions

Valve Sizes:	1/4", 3/8", 1/2", 3/4", 1", 1½" and 2" (diverter not available in 1/4" and 3/8")
Styles:	Unidirectional flow, three-piece design Extended, one-piece, blowout-proof stem diverter-V1, V2 porting
Body:	ASTM A351 CF3M, 316L stainless steel ASTM B283 C37700, Brass
Pipe Ends:	ASTM A351 CF3M (316L) stainless steel ASTM A351 CF8M (316) stainless steel ASTM B283 C37700, brass
Ball:	ASTM A479 316 Condition A stainless steel or ASTM A351 CF8M stainless steel ASTM B16 HO2
Stem:	ASTM A479 316L, 316L Condition A solution annealed. One-piece stem with alignment pin in bottom and arrow on top for proper orientation of ball in valve. Gives positive external indication of ball position.
Seats:	Polyfill
Body Seals:	TFE coated 316 stainless steel gaskets
Stem Packing:	V-ring packing (TFE style C-VH rings) Optional "G7" graphite chevron packing available for valve horizontal applications
Thrust bearing Upper:	(2) Polyfill
Followers:	ASTM A479 316L
Split Ring:	ASTM A479 316L
Split Thrust bearing Lower:	Polyfill (1"-2"), PBI (1/2", 3/4")
Externals:	300 series stainless steel
End Connections:	SE – Screwed pipe ends (NPT) (dimensions to ANSI B1.20.1) SW – Socket weld ends (dimensions to ANSI B16.34) SW0 – Socket weld ends for O.D. tubing to ASTM A269 (stainless steel only) BW1 – Butt weld ends for schedule 10 pipe (dimensions to ANSI B16.25) (stainless steel only) TE – Tube ends (sweat ends for type K, L and M copper tubing to ASTM B88) (brass only)

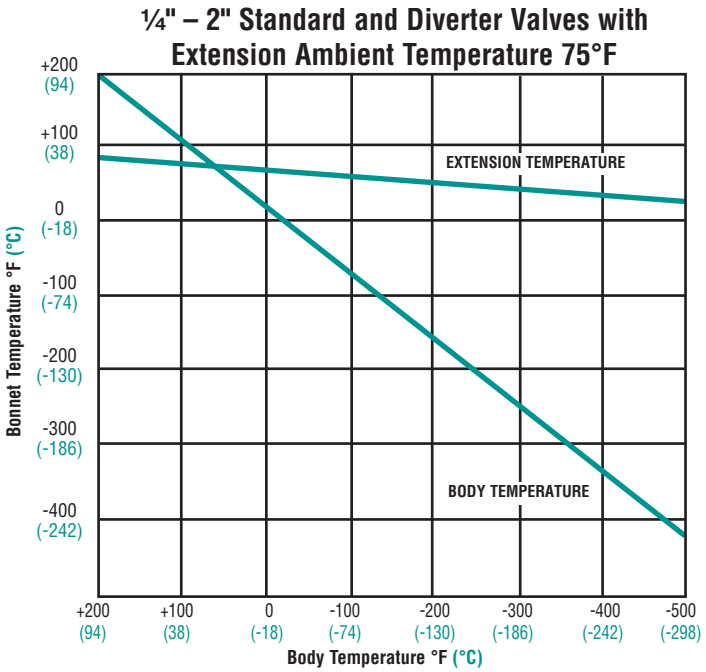
General Specifications

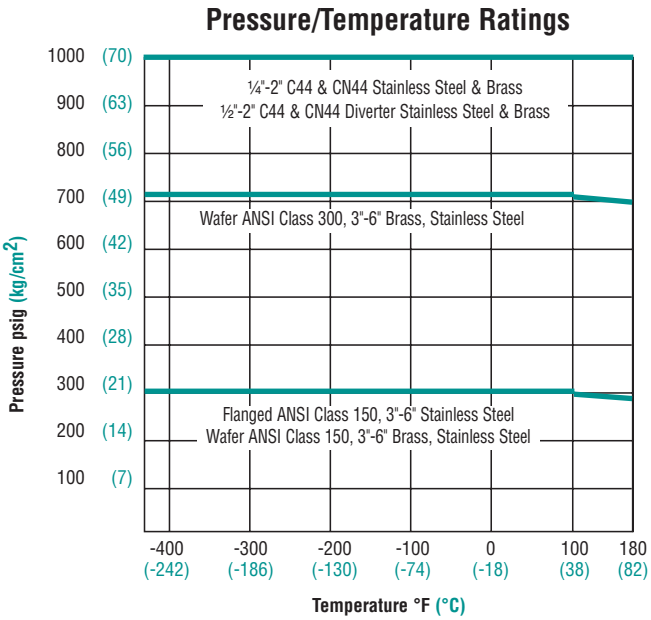
Worcester's stainless steel cryogenic valves are designed to meet B16.34 specifications. For compliance to the code, special hydro testing is required. Full CMTRs (Certified Material Tests Reports) on pressure vessels are available. Please order V-58 for complete B16.34 compliance and CMTRs.

Shutoff:	The valve exceeds the tightness requirements of recognized industry standards (.10 SCFH per inch of valve @ 100 psi helium and -320°F maximum leakage).
Packaging:	End connections are capped or plugged, and valves are placed in 4 mil thick (minimum) polyethylene bags and heat sealed.
Operation:	Lever handle, pneumatic or electric actuators. Valve must be installed with extension bonnet within 30° of true vertical.
Cleaning:	Cleaning for all valves is based on the oxygen cleaning procedures of Praxair (formally Linde Division) Spec. GS38 and GS40. Body, ball, stem and pipe ends degreased.
Lubrication:	Molykote® 321
Assembly:	Assembly and test in a Class 100 environment per Federal Standard 299B is available upon request.
Testing:	Valves are dry tested, internally pressurized with 80 psi helium, check with helium leak detector (Helium Mass Spectrometer) sensitive to 1 x 10^{-5} cc/sec. Upstream relief hole (V3) in ball to relieve cavity pressure. Slot in top of ball for insertion of stem alignment pin to ensure proper orientation in valve. Gives external positive indication of ball position (¼" - 2" valves).
Temperature Range:	-425°F to +180°F

Specifications

Body Temperature vs Bonnet Temperature





Flow Coefficient

Cv Values and Equivalent Lengths of Pipe

Valve Size	C_V				Equivalent Length of Schedule 40 Pipe (ft.)			
	C44	C44 Diverter	Wafer	Flanged	C44	C44 Diverter	Wafer	Flanged
¼"-½"	8	3			3.1	19.6		
¾"	12	5			6.3	30.4		
1"	32	10			3.1	27.8		
1½"	82	24			4.3	43.5		
2"	120	36			7.5	22.7		
3"			350	350			7.1	7.1
4"			720	720			6.9	6.9
6"			1020	1020			20.4	20.4

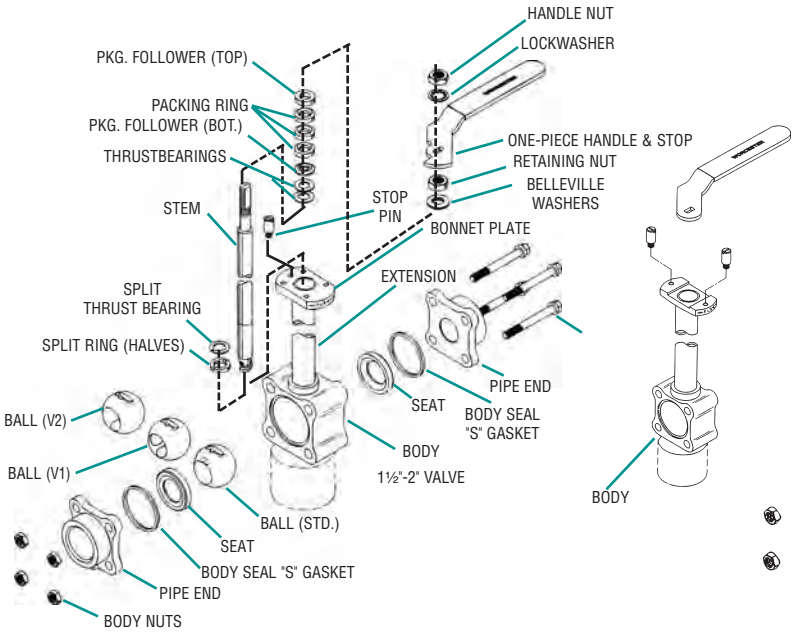
Pressure and Torque for Automated Valves

Before the actuator can be sized for any given valve application, the amount of torque required by the valve must be determined. The operating torque of the ball valve is influenced by a number of factors. Some are design and materials related, others are application (service conditions) related. Design related factors include the type of materials of the valve seats while application factors include system pressure, media, and frequency of operation.

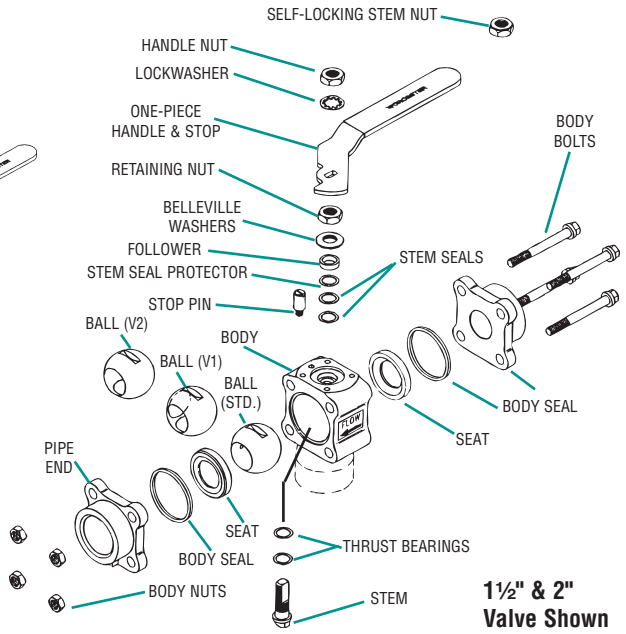
For complete valve operating torque data, refer to Worcester's Actuator Sizing Manual (WCASS0001). This 16-page publication explains the concept of valve torque, presents torque curves for each seat material, and provides correction factors for media and the type of service such as on/off operation, cycle frequency, etc.

Output torque charts for all Flowserve Worcester Controls actuators are provided in the Acutator Sizing Manual.

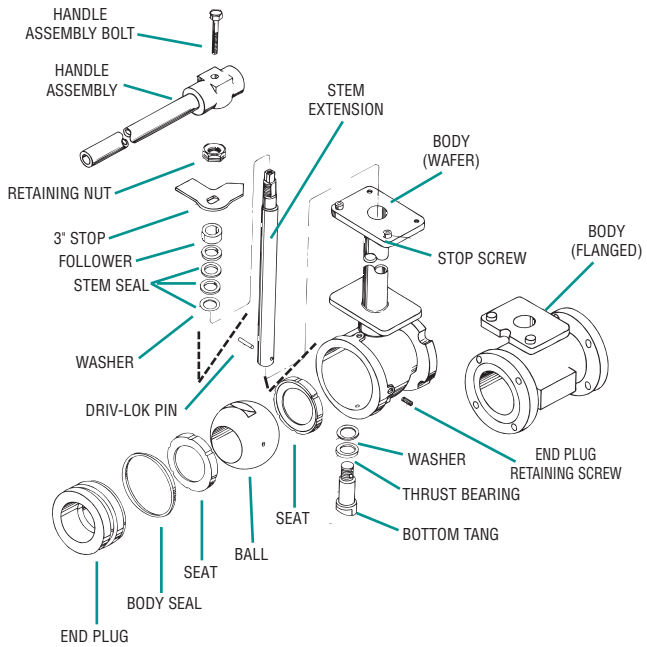
Parts Identification



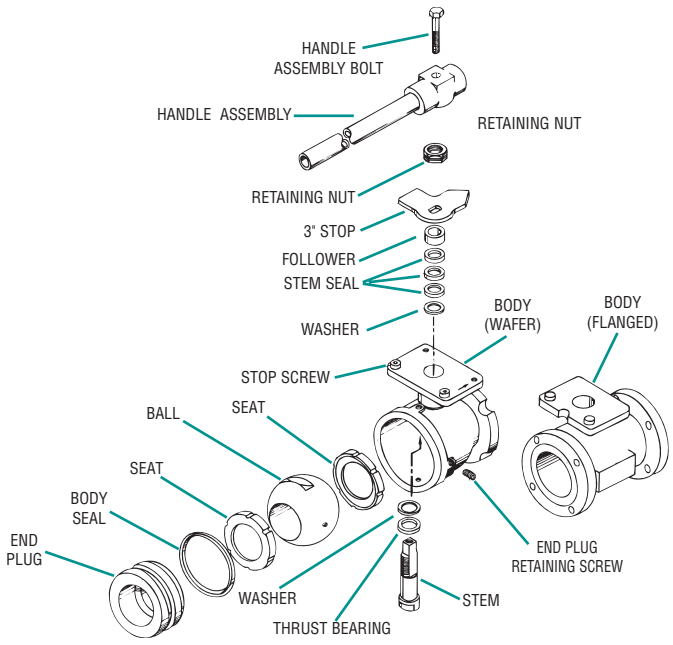
¼" - 2" Cryogenic C44 and C44 Diverter Valves with Extension



¼" - 2" Cryogenic C44 and C44 Diverter Valves without Extension

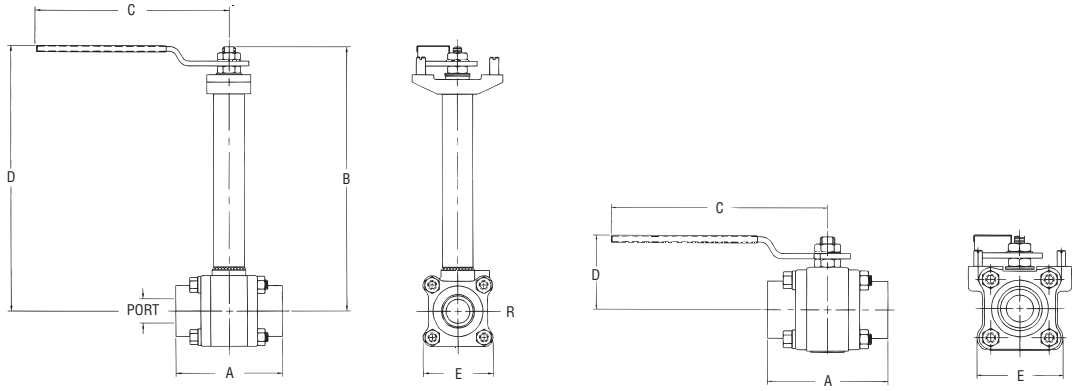


3" - 6" Cryogenic C4 and C51 Valves with Extension



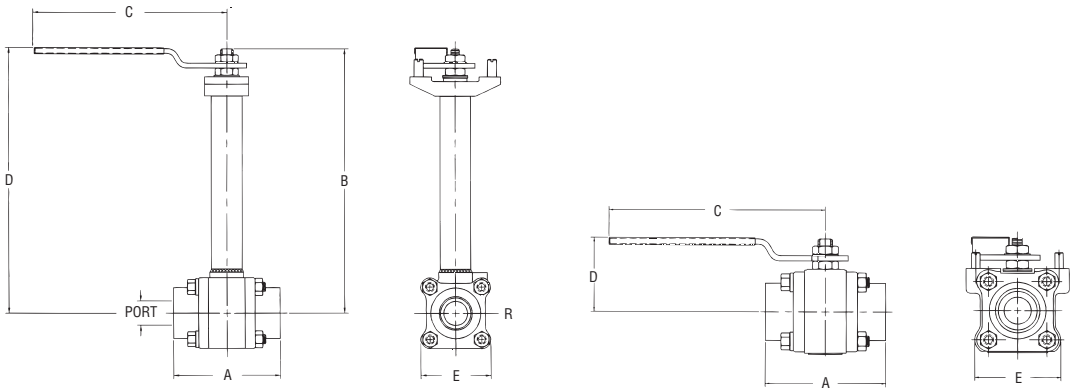
3" - 6" Cryogenic C4 and C51 Valves without Extension

Dimensions



¼" - 2" Cryogenic C44 Ball Valves Extended and Non-extended Bonnets

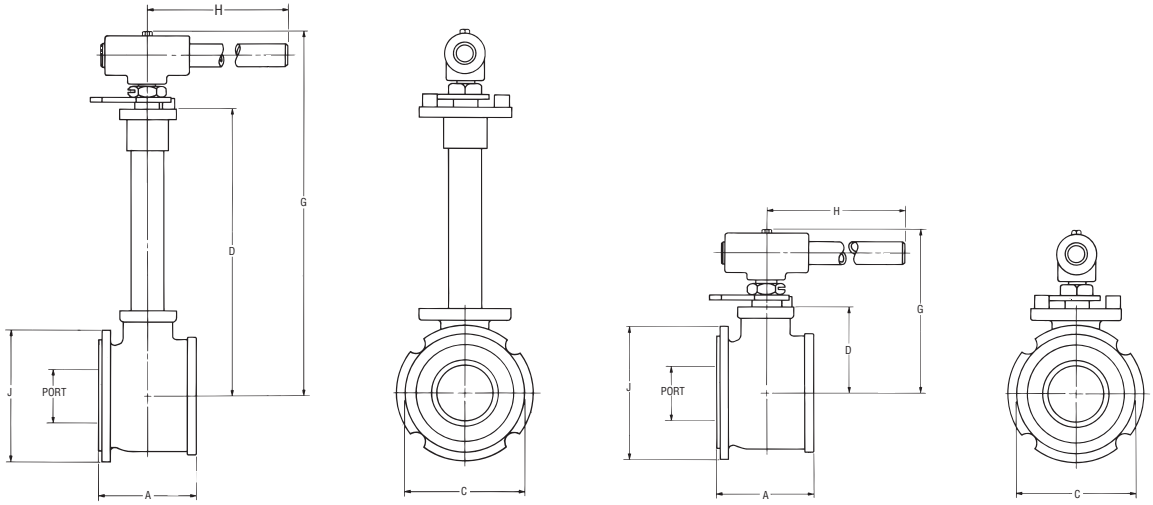
Valve Size	A	B	C		D		E	Port	Approx. Weight lbs. (kg.)	
			With Ext.	Without Ext.	With Ext.	Without Ext.			With Ext.	Without Ext.
¼", ⅜", ½"	2.54 (64.52)	7.86 (199.6)	6.53 (166)	5.53 (140)	7.87 (200)	1.76 (44.7)	1.75 (44.4)	.44 (11.8)	3.0 (1.4)	1.1 (0.5)
¾"	2.76 (70.10)	7.96 (202.2)	6.53 (166)	5.53 (140)	7.97 (202)	1.86 (47.2)	2.00 (50.8)	.56 (14.22)	3.5 (1.6)	1.8 (0.8)
1"	3.66 (92.96)	8.91 (226.3)	6.53 (166)	6.53 (1.66)	8.94 (227)	2.28 (57.8)	2.38 (60.4)	.81 (20.57)	5.0 (2.3)	3.1 (1.4)
1½"	4.50 (114.30)	10.23 (259.8)	8.03 (204)	8.03 (204)	10.25 (260)	2.83 (71.9)	3.16 (80.3)	1.25 (31.75)	11.1 (5.0)	6.2 (2.8)
2"	4.94 (125.48)	10.41 (264.4)	8.03 (204)	8.03 (204)	10.44 (261)	3.02 (76.7)	3.56 (90.4)	1.50 (38.10)	14.4 (6.5)	9.5 (4.3)



½" - 2" Cryogenic C44 Diverter Ball Valves Extended and Non-extended Bonnets

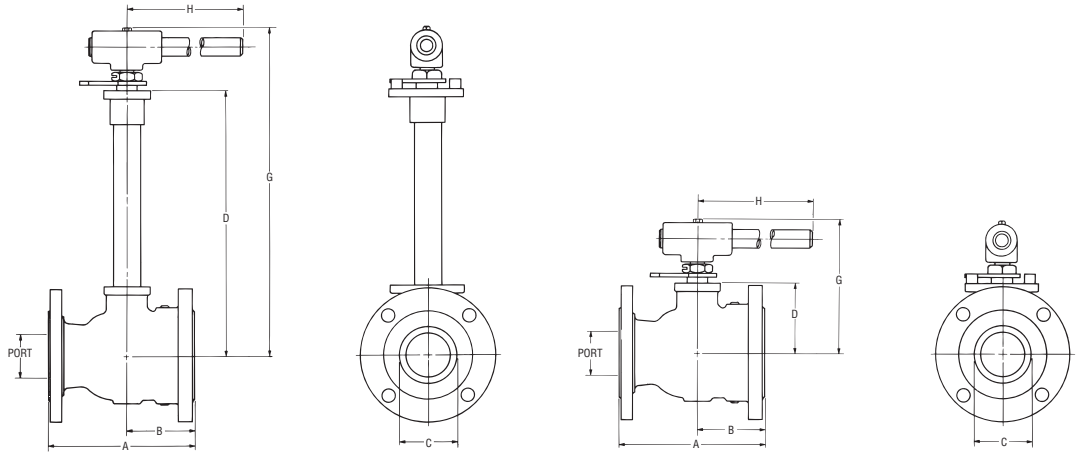
Valve Size	A	B	C		D		E	R	End Port Dia.	Bottom Port Dia.	Approx. Weight - lbs. (kg.)	
			With Ext.	Without Ext.	With Ext.	Without Ext.					With Ext.	Without Ext.
½"	2.54 (64.52)	7.86 (199.6)	6.53 (166)	5.53 (140)	7.87 (200)	1.76 (44.7)	1.75 (44.4)	2.25 (51.0)	.38 (9.70)	.34 (8.64)	3.2 (1.5)	1.6 (0.7)
¾"	2.76 (70.10)	7.96 (202.2)	6.53 (166)	5.53 (140)	7.97 (202)	1.86 (47.2)	2.00 (50.8)	2.50 (63.5)	.52 (13.20)	.50 (12.70)	3.8 (1.7)	2.0 (0.9)
1"	3.66 (92.96)	8.91 (226.3)	6.53 (166)	6.53 (166)	8.94 (227)	2.28 (57.8)	2.38 (60.4)	3.06 (77.7)	.75 (19.10)	.72 (18.29)	5.3 (2.4)	3.6 (1.6)
1½"	4.50 (114.30)	10.23 (259.8)	8.03 (204)	8.03 (204)	10.25 (260)	2.83 (71.9)	3.16 (80.3)	3.56 (90.4)	1.25 (31.75)	1.12 (28.45)	12.5 (5.7)	7.2 (3.3)
2"	4.94 (125.48)	10.41 (264.4)	8.03 (204)	8.03 (204)	10.44 (261)	3.02 (76.7)	3.56 (90.4)	3.94 (100.1)	1.50 (38.10)	1.38 (35.05)	14.7 (6.7)	9.6 (4.4)

Dimensions



3" - 6" Cryogenic C4 Wafer Ball Valves Extended and Non-extended Bonnets

Valve Size	A	C Diam.	D		G		H	J Diam.	Port Dia.	Approx. Weight - lbs. (kg.)	
			With Ext.	Without Ext.	With Ext.	Without Ext.				With Ext.	Without Ext.
3"	4.50 (114.3)	5.31 (135)	15.38 (391)	3.88 (98.6)	18.73 (476)	7.22 (183.4)	22.0 (559)	5.88 (149)	2.50 (63.5)	27 (12.3)	21 (9.5)
4"	5.81 (147.6)	6.81 (173)	15.94 (405)	4.48 (114)	19.30 (490)	7.84 (199.1)	22.0 (559)	7.50 (190)	3.25 (82.5)	41 (18.6)	34 (15.4)
6"	7.38 (187.5)	8.69 (221)	17.98 (457)	6.19 (157)	23.00 (584)	11.21 (284.7)	26.0 (660)	9.88 (251)	4.38 (111.2)	94 (42.7)	64 (29)



3" - 6" Cryogenic C51 Flanged Ball Valves Extended and Non-extended Bonnets

Valve Size	A	B	C Diam.	D		G		H	Port Dia.	Approx. Weight - lbs. (kg.)	
				With Ext.	Without Ext.	With Ext.	Without Ext.			With Ext.	Without Ext.
3"	8.00 (203.2)	3.62 (91.9)	3.06 (77.7)	15.38 (391)	3.88 (98.6)	18.73 (476.0)	7.22 (183.4)	22.0 (549)	2.50 (63.5)	46 (20.9)	39.5 (17.9)
4"	9.00 (228.6)	4.00 (101.6)	4.03 (102)	15.94 (405)	4.48 (114.0)	19.30 (490.0)	7.84 (199.1)	22.0 (559)	3.25 (82.5)	69 (31.3)	62 (28.1)
6"	10.50 (266.7)	4.25 (108.0)	6.06 (154)	17.98 (457)	6.19 (157.0)	23.00 (584.0)	11.21 (284.7)	26.0 (660)	4.38 (111.2)	139 (63.1)	125 (56.7)

WORCESTER 3-PIECE VALVES

IDENTIFICATION CHART

05444466TTSEV77							
05		44	44	66	TT	SE	V77
1/2" PIPE DIAMETER	NO STANDARD VARIATIONS	44 SERIES, STANDARD PORT	CARBON STEEL BODY & ENDS	STAINLESS STEEL BALL & STEM	TFE SEATS & SEALS	FEMALE NPT THREADED ENDS	SUPPLIED WITH MTRS
ORDER EXAMPLE							

BLOCK A

NOMINAL PIPE SIZE		Code	
INCHES	MM		
1/4"	8	0	2
3/8"	10	0	3
1/2"	15	0	5
3/4"	20	0	7
1"	25	1	0
1 1/4"	32	1	2
1 1/2"	40	1	5
2"	50	2	0
2 1/2"	65	2	5
3"	80	3	0
4"	100	4	0
6"	150	6	0

BLOCK C

Code	DESCRIPTION
44	STD. PORT
H44	HIGH PRESSURE 44
45	STD. PORT >2"
59	FULL PORT
70	FORGED TUBE BORE CLEAN VALVE
74	TUBE BORE CLEAN VALVE
H71	HIGH PRESSURE FULL PORT
94	STD. PORT FUGUTIVE EMISSIONS
95	FULL PORT FUGITIVE EMISSIONS

BLOCK E

Code	MATERIAL
B	BUNA N
N	NEOPRENE
T	TFE
R	REINFORCED TFE
Y	DELRIN (LUBETAL)
P	POLYFILL
U	UHMWPE
A	METAL A (TFE)
G	METAL G (GRAPHITE)
X	PEEK (HIGH-PER FILL)
TFM	TFM (WK SERIES ONLY)

BLOCK F

Code	MATERIAL
B	BUNA N
N	NEOPRENE
T	TFE
E	EPR
V	VITON
M	TFE COATED 316SS
Z	GRAFOIL
U	UHMWPE
G	GRAPHITE COATED 316SS

BLOCK H

FOLLOWS BLOCK G MATERIAL	CUT
A	02
STAINLESS	03
STEEL WITH	06
PTFE	12
G	15
STAINLESS	30
STEEL WITH	60
GRAPHITE	90
	120

A	B	C	D				E	F	G		H	I	J	K
SIZE	STANDARD VARIANT (BLANK IF NONE)	SERIES	BODY MAT.	END MAT.	BALL MAT.	STEM MAT.	SEAT MAT.	SEAL MAT.	END 1	END 2 (ONLY SPECIFY IF OUTLET END IS DIFFERENT THAN INLET)	CHARACTERIZED CONTROL SEAT MATERIAL & CUT (CPT ONLY)	STANDARD VARIATION V-CODE(S) IF ANY	4-DIGIT C/N/P/T-NUMBER (CUSTOM APPLICATION ONLY)	REVISION LEVEL (NOT SPECIFIED WHEN ORDERING VALVES)

BLOCK B

Code	VARIANT DESCRIPTION
E	BARE STEM, AUTOMATION STEM BUILD
A	BARE STEM W/ MOUNTING KIT FOR 34, 36 SERIES ACTUATORS
B	BARE STEM W/ MOUNTING KIT FOR 75 SERIES ACTUATORS
G	STEM GROUNDING SPRING
K	LOCKING LEVER HANDLE
V	VACUUM SERVICE PREPARATION
X	CLEANED FOR OXYGEN SERVICE
C	CRYOGENIC VALVE WITH EXTENSION
CN	CRYOGENIC VALVE WITHOUT EXTENSION
W	STEAM SERVICE VALVE
WK	CLEAN VALVE
AF/FZ	API-607 COMPLIANT
D	DIVERTER, SPECIFY V1 OR V2 PORTING
PT	HIGH PRESSURE/TEMP SERVICE VALVE SERIES
P	WK SERIES ELECTROPOLISHED
MP	MOLDING PRESS 44 SERIES
TB	TANK BOTTOM VALVE
CPT	CHARACTERIZED SEAT CONTROL VALVE

BLOCK D

Code	MATERIAL
1	BRASS
4	CARBON STEEL
6	STAINLESS STEEL
7	MONEL
C	HASTELLOY C
A	ALLOY 20
I	INCONEL

BLOCK G

Code	CONNECTION TYPE
SE	FEMALE NPT THREADED
BW5	SCH 5 BUTT WELD
BW1	SCH 10 BUTT WELD
BW4	SCH 40 BUTT WELD
BW8	SCH 80 BUTT WELD
BW6	SCH 160 BUTT WELD
XBO	EXTENDED TUBE ENDS
TE	SOLDER SWEAT ENDS (BRASS ONLY)
SW	SOCKET WELD
SWO	SOCKET WELD OD TUBE
TC	QUICK DISCONNECT
MS	MS (SPEC REQUIRED)
SAE	FEMALE SAE THREADED
NP	NO PIPE ENDS

BLOCK K

VALVE REVISION LEVEL INDICATES THE SPECIFIC BILL OF MATERIALS USED IN MANUFACTURE AND IS TO BE SPECIFIED WHEN ORDERING REPAIR PARTS ONLY

WORCESTER FLANGED VALVES

IDENTIFICATION CHART

BLOCK A			
NOMINAL PIPE SIZE			
INCHES	MM	Code	
1/2"	15	0	5
3/4"	20	0	7
1"	25	1	0
1 1/2"	40	1	5
2"	50	2	0
2 1/2"	65	2	5
3"	80	3	0
4"	100	4	0
6"	150	6	0
8"	200	8	0
10"	250	A	0

BLOCK C	
Code	DESCRIPTION
51, 52	STD. PORT 150, 300 CLASS
818, 828	FULL PORT 150, 300 CLASS
94	STD. PORT FUGUTIVE EMISSIONS
4	STD. PORT WAFER VALVE

BLOCK E	
Code	MATERIAL
T	TFE
R	REINFORCED TFE
P	POLYFILL
U	UHMWPE
A	METAL A (TFE)
G	METAL G (GRAPHITE)
X	PEEK (HIGH-PER FILL)

BLOCK F	
Code	MATERIAL
B	BUNA N
T	TFE
V	VITON
M	TFE COATED 316SS
Z	GRAFOIL
U	UHMWPE
G	GRAPHITE COATED 316SS*
	*varies by valve size

10514466TT150V77							
10		51	44	66	TT	150	V77
1" PIPE DIAMETER	NO STANDARD VARIATIONS	51 SERIES, STANDARD PORT	CARBON STEEL BODY	STAINLESS STEEL BALL & STEM	TFE SEATS & SEALS	150 CLASS RAISED-FACE FLANGES	SUPPLIED WITH MTRS
ORDER EXAMPLE							

A	B	C	D				E	F	G	H	I	J	K
SIZE	STANDARD VARIANT (BLANK IF NONE)	SERIES	BODY MAT.	END PIECE MAT.	BALL MAT.	STEM MAT.	SEAT MAT.	SEAL MAT.	FLANGE CLASS	CHARACTERIZED CONTROL SEAT MATERIAL & CUT (CPT ONLY)	STANDARD VARIATION V-CODE(S) IF ANY	4-DIGIT C/N/P/T-NUMBER (CUSTOM APPLICATION ONLY)	REVISION LEVEL (NOT SPECIFIED WHEN ORDERING VALVES)

BLOCK B	
Code	VARIANT DESCRIPTION
E	BARE STEM, AUTOMATION STEM BUILD (EXCEPT 818/828)
G	STEM GROUNDING SPRING
K	LOCKING LEVER HANDLE
V	VACUUM SERVICE PREPARATION
X	CLEANED FOR OXYGEN SERVICE
C	CRYOGENIC VALVE WITH EXTENSION
CN	CRYOGENIC VALVE WITHOUT EXTENSION
W	STEAM SERVICE VALVE
AF/FZ	API-607 COMPLIANT
D	DIVERTER, SPECIFY V1 OR V2 PORTING
PT	HIGH PRESSURE/TEMP SERVICE VALVE SERIES
CPT	CHARACTERIZED SEAT CONTROL VALVE
	818/828 SERIES ONLY:
E	FUGITIVE EMISSIONS BONNET W/PURGE PORT
J	BARE STEM, AUTOMATION STEM BUILD

BLOCK D	
Code	MATERIAL
4	CARBON STEEL
6	STAINLESS STEEL
7	MONEL
C	HASTELLOY C
A	ALLOY 20
I	INCONEL

BLOCK G	
Code	CONNECTION TYPE
150	ANSI 150, B16.5
300	ANSI 300, B16.5
600	ANSI 600, B16.5 (94 SERIES ONLY)
	4 SERIES WAFER ONLY:
151	FITS BETWEEN ANSI 150 RFF
301	FITS BETWEEN ANSI 300 RFF

BLOCK H	
FOLLOWS BLOCK G	
MATERIAL	CUT
A	02
STAINLESS	03
STEEL WITH	06
PTFE	12
G	15
STAINLESS	30
STEEL WITH	60
GRAPHITE	90
	120

BLOCK K
VALVE REVISION LEVEL INDICATES THE SPECIFIC BILL OF MATERIALS USED IN MANUFACTURE AND IS TO BE SPECIFIED WHEN ORDERING REPAIR PARTS ONLY

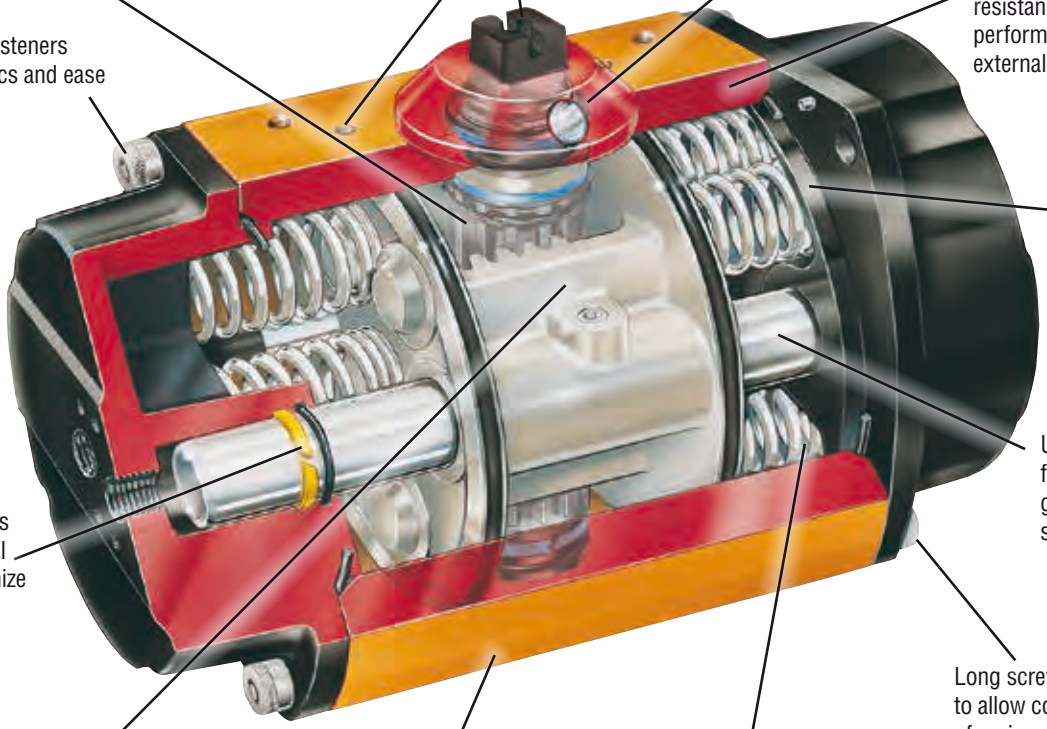
FLOWSERVE

Worcester Controls
Series F39 Pneumatic Actuator
Twin-piston, double rack-and-pinion

Experience In Motion

Series F39 Pneumatic Actuators

High cycle pneumatic power for on/off or throttling control of rotary valves and dampers



* Size 05F39 does not utilize piston guide rods.

Features and Benefits

- Available as spring-return or double-acting
- Large range of sizes for efficient torque matching
- Internal parts are factory lubricated for maximum service life
- Safe disassembly, no special tools required
- Can be mounted for fail-open or fail-closed operation
- Limit stop for accurate rotational positioning
- Standard NAMUR ancillary attachment
- International ISO5211 actuator mounting pattern

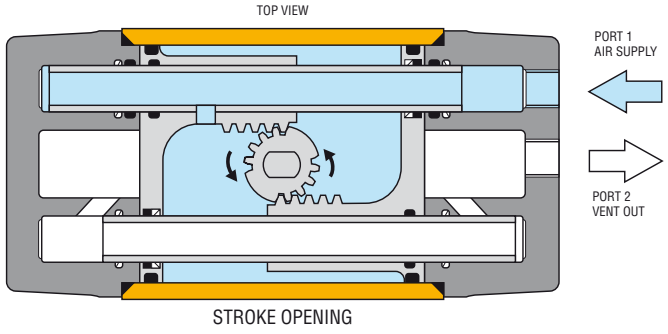
Operating Principle

The Series F39 Pneumatic Actuator design is based on the opposed rack-and-pinion principle utilizing piston guide rods to guarantee part alignment. The fully supported guide rods minimize friction and wear between the pistons and the body bore.

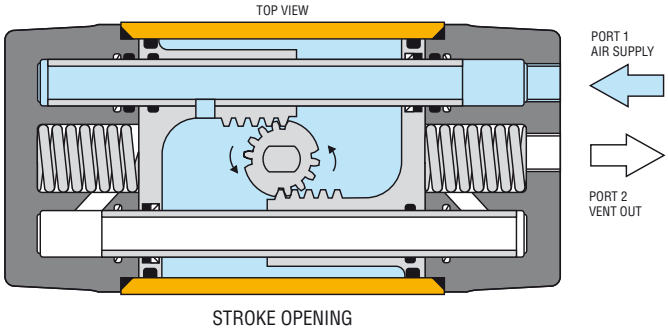
In the double-acting actuator, compressed air is applied to Port 1. The air flows through the rear guide rod and enters the center chamber to push the pistons apart, turning the shaft counterclockwise (as seen from above) to open the valve. During this action, air in the end caps is vented through Port 2 via the front guide rod. Action is reversed, i.e., the valve is closed by applying air to Port 2 and venting air through Port 1.

In a fail-safe spring-return actuator, springs are located in the end caps. The number of springs in each cap depends on the available supply air pressure and required torque output. Air is supplied through Port 1 to the center chamber to push the pistons apart, which compresses the springs. During this action, air in the end caps is vented through Port 2 via the front guide rod. When air is vented out through Port 1 (via a three-way solenoid valve) the springs push the pistons back together thus closing the valve. Port 2 is continuously vented. The springs provide a dependable, safe closure in the event of electrical or air supply failure.

DOUBLE-ACTING ACTUATOR F39



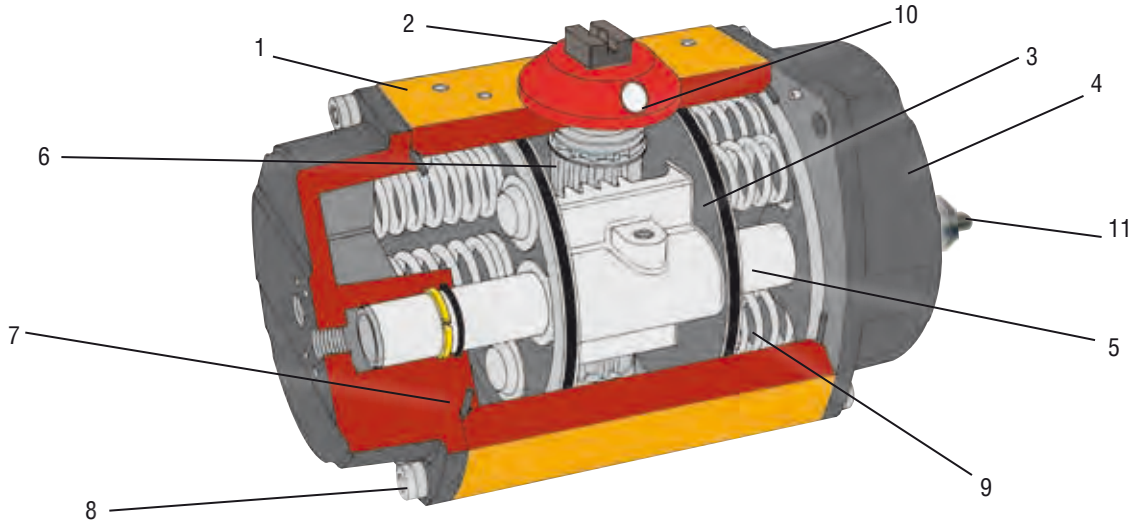
SPRING-RETURN ACTUATOR F39S



Product Specifications

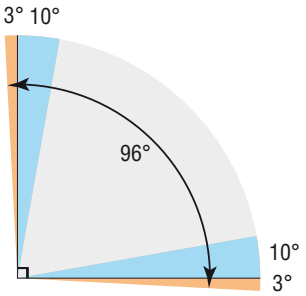
- Pneumatic Actuators are of a dual-piston design for compactness, highest torque output, minimal air consumption and even weight distribution (balanced) on the valve stem.
- Actuators are equipped with two piston guide rods to bear the lateral rack-and-pinion thrust forces, increasing piston seal life and eliminating the possibility of cylinder scratching by the pistons. Elastomeric seals are not loaded as bearings.
- The torque is generated through a double rack-and-pinion gearing mechanism with full-length, uninterrupted engagement of the rack-and-pinion teeth.
- The rack is machined as part of the piston in order to extend the actuator life and eliminate hysteresis.
- Actuator housings are protected both internally and externally from corrosion using an anodizing process.
- Single-acting actuators use multi-springs at each end to eliminate uneven forces on the pistons and are field adaptable to balance reduced pressure air supplies.
- Actuators are supplied with end mounted limit stops for accurate position control
- Actuators can have optional integral end-mounted limit switches, reducing overall height and allowing the use of the actuator pinion for manual override (cannot be combined with limit stops).
- Actuators can be supplied with integral solenoid valving without the use of transfer tubes. Valving incorporates fail-safe action upon interruption of electrical signal.

Parts List/Material Specifications



Item No.	Description	Material/Finish
1	Body	Aluminum (Extrusion) Anodized
2	Pinion	Carbon Steel (Corrosion-Resistant Nitride Treatment)
3	Pistons	Aluminum
4	End Caps	Aluminum Anodized
5	Guide Rods	Stainless Steel
6	Bearings	Acetal
7	“O” Rings	Nitrile Rubber
8	End Cap Screws	Stainless Steel
9	Springs	Chrome Silicon (Corrosion-Resistant Coated)
10	Position Indicator	Polyethylene
11	Limit Stops	Stainless Steel

End Mounted Limit Stops



Recognizing the increasing need for accurate rotation adjustment on many applications within the process industry, Worcester Controls has developed a unique method of providing this feature which is now standard on the actuator. The design takes advantage of the moving guide rods within the actuator and uses two stops in the end cap to limit their travel and therefore adjust the rotation of the actuator in both directions.

The design allows for a nominal rotation of 90° providing 3° of adjustable over travel at each end of the actuator stroke. The limit stop screws can also be used to adjust the under travel of the actuator by 10° at each end of the actuator stroke.

End Mounted Solenoid Block

The solenoid end cap of each actuator is pre-drilled to VDE/ VDI NAMUR 3845 to allow rapid attachment of either a double-acting or spring-return solenoid control block.

The double-acting solenoid control block provides extremely fine and independent adjustments for speed control on the opening and closing strokes of a double-acting actuator (20:1 ratio). The double-acting solenoid control block can be overridden by manual operation of the control block spool.

The spring-return solenoid control block provides an optional adjustment for speed control on the spring stroke of a spring-return actuator. The advanced design prohibits environmental ingress to spring chamber during piston stroke extending actuator life.

Both double-acting and spring-return styles return to the actuator “closed” position (pistons together) upon electrical failure.

An extensive range of Weatherproof and Explosionproof coil options is available, along with a wide voltage selection including low-power and intrinsically safe.

Watertight Class F Coil (Type 4, 4x)

Voltage	Inrush amps	Holding Amps
24/60. 22/50 VAC	0.36	0.24
120/60. 110/50 VAC	0.08	0.05
240/60. 220/50 VAC	0.04	0.03
12 VDC	0.38	0.38
24 VDC	0.20	0.20
120 VDC	0.04	0.04

Hazardous Class H Coil (Type 4, 4x, 7, 9)

Voltage	Inrush amps	Holding Amps
24/60. 22/50 VAC	Consult Factory	
120/60. 110/50 VAC	0.10	0.05
240/60. 220/50 VAC	0.05	0.03
12 VDC	0.38	0.38
24 VDC	0.19	0.19
120 VDC	Consult Factory	

Type 7 (UL & CSA listed for Class I, Division I, groups A, B, C & D) and Type 9 (UL & CSA listed for class II E, F & G) The type 7 solenoid is also rated 4, 4x

W25NFA 2-position, 3-Way, Single Operator and W25NAA 2-position, 4-way, Single Operator

- NAMUR mounting
- Weatherproof and Hazardous Area
- Speed control – Standard
- Momentary override – Standard
- Interchangeable coils – Standard
- -40F to 180F - Standard
- Rebreather design - Standard

W25NFA Three-Way Spring-Return Solenoid

W25NAA Four-Way Double-Acting Solenoid

FLOWSERVE

Torque Output

Sizing

Determine appropriate valve torque requirements from valve literature. For double-acting actuators, select the actuator whose torque output at available air supply exceeds breakaway torque requirements of the valve. For detailed instructions, consult Worcester Controls Ball Valve Actuator Selection Manual.

For fail-closed, spring-return actuators, select the appropriate size actuator whose torque output at the end of the spring stroke (at available air supply) is sufficient to close the valve.

For fail-open spring-return actuators, select appropriate actuator whose torque output at the end of the air stroke is sufficient to close the valve For fail-open actuators, it is also necessary to determine that the torque output at the start of the spring stroke exceeds breakaway requirements of the valve.

Spring-Return Actuator Torque Output Series 05F39 (in-lb/Nm)

Model No.	Stroke	Operating Pressure psi (Bar) 50 (3.4) 2 Springs Start	End	60 (4.1) 2 Springs Start	End	70 (4.8) 2 Springs Start	End	80 (5.5) 4 Springs Start	End
05F39	Air	27	16	35	24	49	38	53	37
		3.1	1.8	4.0	2.7	5.5	4.3	6.0	4.2
	Spring	42	32	42	32	42	32	53	41
		4.7	3.6	4.7	3.6	4.7	3.6	6.0	4.6

Spring-Return Actuator Torque Output (in-lb/Nm)

Model No.	Stroke	Operating Pressure psi (Bar) 30 (2.0) 4 Springs Start	End	40 (2.7) 4 Springs Start	End	50 (3.4) 6 Springs Start	End	60 (4.1) 8 Springs Start	End	70 (4.8) 8 Springs Start	End	80 (5.5) 10 Springs Start	End	90 (6.2) 10 Springs Start	End
10F39	Air	57	27	89	60	105	60	118	60	152	91	168	89	201	114
		6.4	3.0	10.0	6.8	11.9	6.8	13.3	6.8	17.2	10.3	19.0	10.0	22.7	12.9
	Spring	70	42	70	42	105	63	140	84	140	84	175	104	175	104
		7.9	4.7	7.9	4.7	11.9	7.1	15.8	9.5	15.8	9.5	19.8	11.8	19.8	11.8
15F39	Air	115	70	181	133	193	140	239	145	284	193	335	219	399	282
		13.0	7.9	20.5	15.0	21.8	15.8	27.0	16.4	32.1	21.8	37.8	24.8	45.1	31.9
	Spring	115	74	115	74	173	112	231	149	231	149	289	186	289	186
		13.0	8.4	13.0	8.4	19.5	12.6	26.1	16.8	26.1	16.8	32.6	21.0	32.6	21.0
20F39	Air	210	128	332	243	389	257	443	274	558	389	612	404	735	513
		23.7	14.5	37.5	27.5	44.0	29.0	50.0	31.0	63.0	44.0	69.2	45.6	83.0	58.0
	Spring	210	135	210	135	315	212	419	272	419	272	525	339	525	339
		23.7	15.3	23.7	15.3	35.6	23.9	47.4	30.7	47.4	30.7	59.3	38.3	59.3	38.3
25F39	Air	345	188	549	381	637	398	730	398	925	549	1009	611	1212	797
		39.0	21.2	62.0	43.0	72.0	45.0	82.5	45.0	104.5	62.0	114.0	69.0	137.0	90.0
	Spring	379	232	379	232	568	348	758	465	758	465	947	581	947	581
		42.8	26.2	42.8	26.2	64.2	39.3	85.6	52.5	85.6	52.5	107.0	65.6	107.0	65.6
30F39	Air	577	320	912	628	1044	646	1204	690	1531	991	1682	1027	2009	1345
		65.2	36.2	103.0	71.0	118.0	73.0	136.0	78.0	173.0	112.0	190.0	116.0	227.0	152.0
	Spring	609	372	609	372	912	558	1221	744	1221	744	1522	929	1522	929
		68.8	42.0	68.8	42.0	103.0	63.1	138.0	84.1	138.0	84.1	172.0	105.0	172.0	105.0
33F39	Air	1053	564	1682	1177	1947	1221	2213	1221	2832	1859	3098	1850	3735	2460
		119	64	190	133	220	138	250	138	320	210	350	209	422	278
	Spring	1257	804	1257	804	1885	1204	2513	1611	2513	1611	3151	2009	3151	2009
		142	91	142	91	213	136	284	182	284	182	356	227	356	227
35F39	Air	1345	780	2133	1522	2478	1593	2814	1682	3717	2434	3938	2487	4752	3230
		152	88	241	172	280	180	318	190	420	275	445	281	537	365
	Spring	1451	929	1451	929	2177	1398	2903	1859	2903	1859	3629	2328	3629	2328
		164	105	164	105	246	158	328	210	328	210	410	263	410	263
40F39	Air	2142	1080	3407	2301	3983	2354	4469	2390	5620	3452	6257	3567	7523	4779
		242	122	385	260	450	266	505	270	635	390	707	403	850	540
	Spring	2487	1496	2487	1496	3726	2239	4974	2982	4974	29798	6213	3735	6213	3735
		281	169	281	169	421	253	562	337	562	337	702	422	702	422
42F39	Air	3717	1797	5974	3983	6859	3938	7744	3894	9912	6018	10859	6000	13054	8142
		420	203	675	450	775	445	875	440	1120	680	1227	678	1475	920
	Spring	4390	2593	4390	2593	6584	3885	8779	5177	8779	5177	10974	6469	10974	6469
		496	293	496	293	744	439	992	585	992	585	1240	731	1240	731
		8 springs		12 springs		16 springs		20 springs		20 springs		24 springs		24 springs	
45F39	Air	6275	3142	7965	3452	9735	3717	11505	3894	14868	6992	16470	7204	19736	10399
		709	355	900	390	1100	420	1300	440	1680	790	1861	814	2230	1175
	Spring	6107	3159	9160	4735	12213	6319	15266	7894	15266	7894	18320	9478	18320	9478
		690	357	1035	535	1380	714	1725	892	1725	892	2070	1071	2070	1071
50F39	Air	9717	4876	12169	5310	15045	5664	17700	5753	20355	10399	24877	10585	30533	15488
		1098	551	1375	600	1700	640	2000	650	2300	1175	2811	1196	3450	1750
	Spring	9647	4885	14470	7319	19293	9762	24116	12204	24116	12204	28940	14638	28940	14638
		1090	552	1635	827	2180	1103	2725	1379	2725	1379	3270	1654	3270	1654

Double-Acting Actuator Torque Output (in-lb/Nm)

Model No.	Operating Pressure psi (Bar)									
	30 (2.0)	40 (2.7)	50 (3.4)	60 (4.1)	70 (4.8)	80 (5.5)	90 (6.2)	100 (6.9)	110 (7.6)	120 (8.3)
05F39	34	49	60	73	87	97	106	126	137	148
	3.8	5.5	6.8	8.3	9.8	11.0	12.0	14.2	15.5	16.7
10F39	89	130	173	202	239	274	310	350	385	425
	10.0	14.7	19.5	22.8	27.0	31.0	35.0	39.6	43.5	48.0
15F39	177	248	319	389	460	531	602	673	743	814
	20.0	28.0	36.0	44.0	52.0	60.0	68.0	76.0	84.0	92.0
20F39	327	451	584	708	841	965	1097	1221	1354	1478
	37.0	51.0	66.0	80.0	95.0	109	124	138	153	167
25F39	540	752	965	1177	1389	1620	1841	2062	2283	2505
	61.0	85.0	109	133	157	183	208	233	258	283
30F39	885	1239	1593	1947	2301	2655	3009	3363	3717	4071
	100	140	180	220	260	300	340	380	420	460
33F39	1735	2390	3053	3717	4514	5195	5885	6638	7346	8054
	196	270	345	420	510	587	665	750	830	910
35F39	2124	2974	3806	4691	5531	6372	7213	8098	8983	9824
	240	336	430	530	625	720	815	915	1015	1110
40F39	3390	4717	6062	7390	8717	10169	11505	12921	14337	15753
	383	533	685	835	985	1149	1300	1460	1620	1780
42F39	5885	8319	10620	12833	15222	17638	20134	22568	25001	27435
	665	940	1200	1450	1720	1993	2275	2550	2825	3100
45F39	8806	12213	15753	19293	22833	26408	29913	33630	37170	40710
	995	1380	1780	2180	2580	2984	3380	3800	4200	4600
50F39	13620	19028	24338	29913	35400	40860	46374	51861	57348	62835
	1539	2150	2750	3380	4000	4617	5240	5860	6480	7100

Engineering Data

Stroke Time (seconds)*

Model No.	Double Acting	Spring Return	With Max.* Speed Control
05F39	Less than 1	Less than 1	10
10F39	Less than 1	Less than 1	10
15F39	Less than 1	1	15
20F39	1	1-2	15
25F39	2-3	2-3	18
30F39	3-4	3-4	20
33F39	4-5	7-8	25
35F39	4-5	8-9	25
40F39	5-6	9-10	30
42F39	10-11	11-12	36
45F39	10-12	11-13	40
50F39	12-14	13-15	60

Actuator Free Internal Volume

Open		Close DA Only	
Cubic Inches (in^3)	Litres	Cubic Inches (in^3)	Litres
3	0.05	3	0.05
10	0.17	13	0.22
21	0.35	24	0.39
42	0.69	45	0.74
74	1.22	80	1.31
114	1.86	125	2.05
207	3.39	292	4.79
240	3.93	338	5.54
411	6.73	500	8.19
732	12.00	848	13.89
824	13.51	1220	20.00
1457	23.87	1861	30.50

Tubing Requirements

Under 4 ft. Run	Over 4 ft. Run
1/8"	1/4"
1/8"	1/4"
1/8"	1/4"
1/8"	1/4"
1/8"	1/4"
1/4"	1/2"
1/4"	1/2"
1/4"	1/2"
1/4"	1/2"
1/4"	1/2"
1/4"	1/2"
1/4"	1/2"

Weights lb. (kg)

Double Acting	Spring Return
1.6 (0.7)	1.8 (0.8)
3 (1.3)	3.5(1.6)
6 (2.7)	7 (3.1)
10 (4.5)	12 (5.5)
16 (7.4)	18.5 (8.4)
24 (11)	27 (12)
50 (22.5)	57 (26)
57 (26)	66 (30)
96 (43.6)	107 (48.6)
158 (71.8)	177 (80.6)
213 (97)	253 (115)
304 (138)	354 (161)

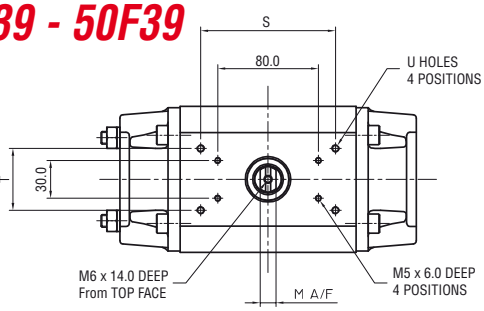
* **NOTE:** These figures are meant as an indication of obtainable speeds only. For more precise figures for any particular application, contact your Flowserve rep. Faster speeds are obtainable, if required, by using additional control equipment. Speed control with spring-return actuators only available on exhaust air (spring stroke).

Operating Conditions

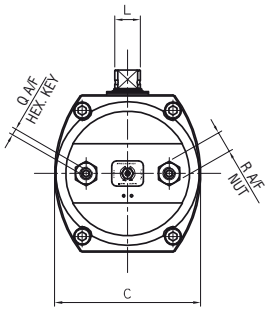
Pressure Range	30–120 psi Double-Acting, 40–120 psi All Spring-Return Versions (Standard spring-return units require 80 psi minimum. Reduced-pressure versions are available).
Media	Air or non-corrosive gas.
Temperature Range	**Standard temperature option:** Actuator only 0° to 212°F (-18° to 100°C) Actuator with Watertight Type 4, 4x or Hazardous Locations Type 4, 4x, 7 & 9 solenoid to 180°F (82°C) continuous **High temperature option** to 250°F continuous, to 300°F intermittent (without solenoid) **Low temperature option** to -40°F (without Solenoid)
Rotation	Actuators rotate in counterclockwise direction when the outer air connection is pressurized.
Movement	90° with 3° over travel and 10° under travel controllable
Supply Air	The Series F39 Actuator is factory lubricated. For optimum performance, standard filtered and lubricated air is recommended.

Dimensions Sizes 10F39 - 50F39

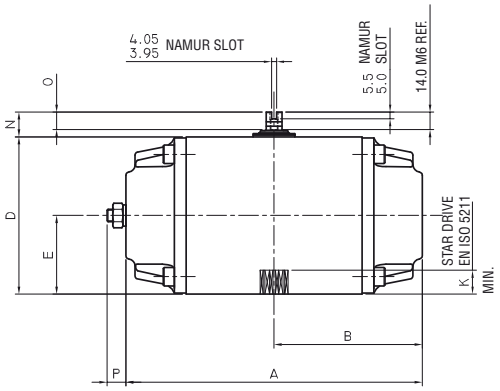
Inches (mm)

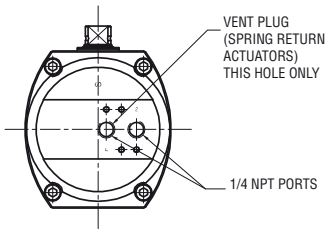


EN 15714-3 NAMUR TOP ACCESSORY MOUNTING

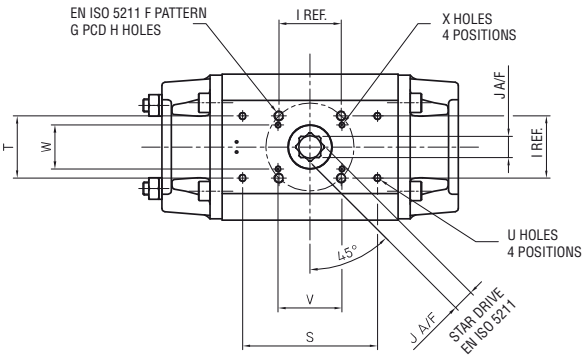


LIMIT STOP ENDCAP





EN 15714-3 NAMUR
INLET ENDCAP



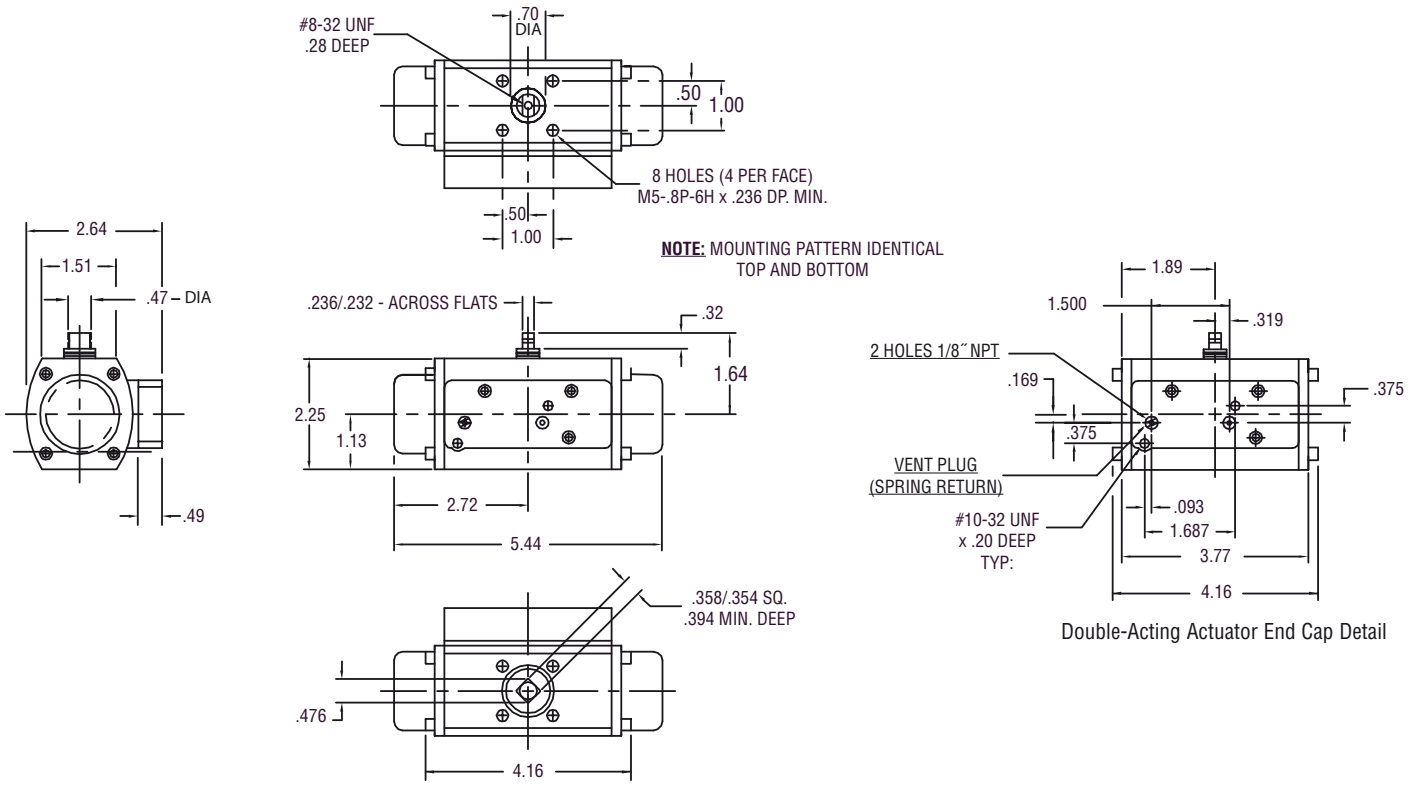
ACTUATOR MOUNTING
ATTACHMENT EN ISO 5211

Model	Legacy Mount Dimensions		
	V	W	X
10F39	2.00 50.8	1.37 34.9	10-32 UNF x 0.3 (7.7) DP
15F39	2.00 50.8	1.37 34.9	10-32 UNF x 0.31 (8.0) DP
20F39	2.00 50.8	1.37 34.9	10-32 UNF x 0.31 (8.0) DP

Model	Basic Dimensions					Bottom ISO Mounting Dimensions						Top Pinion Dimensions				Limit Stop Dimensions			Ancillary Hole Dimensions (Note 2)		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
10F39	6.11 155.3	3.06 77.7	3.02 76.8	3.37 85.5	1.69 42.8	F04	1.65 42.0	M5 x 0.25 6.25 DP	1.17 29.7	0.43 11.0	0.47 12.0	0.59 15.0	0.35 9.0	0.79 20.0	0.63 16.0	0.39 10.0	0.16 4.0	0.51 13.0	2.87 73.0	1.25 31.8	M5 x 0.25 6.3 DP
15F39	7.69 195.3	3.84 97.7	3.70 94.0	4.09 104.0	2.05 52.0	F05	1.97 50.0	M6 x 0.30 7.5 DP	1.39 35.4	0.55 14.0	0.63 16.0	0.63 16.0	0.50 12.6	0.79 20.0	0.55 13.9	0.43 11.0	0.16 4.0	0.51 13.0	2.87 73.0	1.25 31.8	M5 x 0.24 6.0 DP
20F39	9.27 235.4	4.63 117.7	4.57 116.0	4.92 125.0	2.46 62.5	F07	2.76 70.0	M8 x 0.40 10.0 DP	1.95 49.5	0.67 17.0	0.75 19.0	0.80 20.3	0.50 12.6	0.79 20.0	0.54 13.8	0.59 15.0	0.20 5.0	0.67 17.0	4.22 107.2	1.94 49.2	M6 x 0.27 7.0 DP
25F39	10.67 271.0	5.33 135.5	5.33 135.5	5.77 146.6	2.89 73.5	F07	2.76 70.0	M8 x 0.40 10.0 DP	1.95 49.5	0.67 17.0	0.75 19.0	0.75 19.0	0.75 19.0	1.18 30.0	0.87 22.2	0.83 21.0	0.24 6.0	0.75 19.0	4.22 107.2	1.94 49.2	M6 x 0.4 10.0 DP
30F39	12.80 325.1	6.40 162.6	6.10 155.0	6.59 167.5	3.30 83.8	F10	4.02 102.0	M10 x 0.50 12.5 DP	2.84 72.1	0.87 22.0	0.94 24.0	0.87 22.1	0.87 22.1	1.18 30.0	0.86 21.9	0.91 23.0	0.24 6.0	0.75 19.0	6.34 161.1	2.87 73.0	M6 x 0.4 10.0 DP
33F39	15.70 398.7	7.85 199.4	8.11 206.0	8.43 214.0	4.21 107.0	F12	4.92 125.0	M12 x 0.70 18.0 DP	3.48 88.4	1.06 27.0	1.14 29.0	1.12 28.5	1.12 28.5	1.18 30.0	0.83 21.2	0.91 23.0	0.31 8.0	0.94 24.0	6.34 161.1	3.39 86.0	M8 x 0.5 13.0 DP
35F39	16.69 423.9	8.34 212.0	8.39 213.0	8.54 217.0	4.27 108.5	F12	4.92 125.0	M12 x 0.63 16.0 DP	3.48 88.4	1.06 27.0	1.14 29.0	1.12 28.5	1.12 28.5	1.18 30.0	0.82 20.9	1.18 30.0	0.31 8.0	0.94 24.0	8.37 212.7	4.00 101.6	M8 x 0.6 14.0 DP
40F39	20.15 511.8	10.07 255.9	9.64 244.9	10.87 276.0	5.87 149.0	F14	5.51 140.0	M16 x 0.95 24.0 DP	3.90 99.0	1.42 36.0	1.57 40.0	1.37 34.9	1.37 34.9	1.97 50.0	1.46 37.0	1.06 27.0	0.39 10.0	1.18 30.0	9.59 243.6	4.63 117.5	M10 x 0.6 15.0 DP
42F39	24.40 619.7	12.20 309.9	11.14 283.0	12.44 316.0	6.69 170.0	F16	6.50 165.0	M20 x 1.20 30.0 DP	4.59 116.7	1.81 46.0	1.97 50.0	2.00 50.8	2.00 50.8	1.97 50.0	1.36 34.5	1.18 30.0	0.39 10.0	1.18 30.0	5.25 133.4	4.00 101.6	M8 x 0.5 13.0 DP
45F39	22.67 575.9	11.34 288.0	13.19 334.9	14.70 373.5	7.99 203.0	F16	6.50 165.0	M20 x 1.20 30.0 DP	4.59 116.7	1.81 46.0	1.89 48.0	2.00 50.8	2.00 50.8	1.97 50.0	1.36 34.5	1.10 28.0	0.39 10.0	1.18 30.0	13.00 330.2	6.25 158.7	M16 x 0.95 24.0 DP
50F39	24.65 626.0	12.32 313.0	15.26 387.5	16.70 424.2	8.95 227.4	F25	10.00 254.0	M16 x 0.95 24.0 DP	Note 1	2.17 55.0	2.24 57.0	2.24 57.0	2.24 57.0	1.97 50.0	1.29 32.8	1.38 35.0	0.39 10.0	1.18 30.0	9.59 243.7	4.63 117.5	M10 x 0.6 15.0 DP

1. The model 50F39 uses 8 mounting holes on a 10.0 inch (254mm) PCD distributed evenly about the center lines of the actuator.
2. On models 42F39, 45F39 and 50F39 ancillary mounting holes are only on the top of the actuator, on 40F39, only on the base. These sizes also have a location spigot on the base of the actuator in accordance with ISO 5211

Dimensions Size 05F39
Inches



Spring Return Actuator End Cap Detail

Double-Acting Actuator End Cap Detail

How to Order

10	E	F39	S	W	Z	120A	-----	----
Actuator Sizes	**Special Services**	**Series**	**Operating Mode**	**Solenoid**	**End Mount Limit Switches**	**Solenoid Voltage**	**Spring Return Supply Pressure**	**Options †**
05 10 15 20 25 30 33 35 40 42 45 50	Blank - None 9 - Fail-Open Mount H - High Temperature** (N & SN Models Only) E - End mounted Limit Switch Module* L - Low Temperature** (N, SN, W models only)	F39	Blank - Double Acting S - Spring Return	W - Watertight Solenoid (Type 4, 4x) X - Hazardous Locations Solenoid (Type 4, 4x, 7 & 9) N - No Solenoid	(must specify "E" in Special Service Column)† Z - Watertight/Hazardous Locations, SPDT Switches ZD - Watertight/Hazardous Locations, DPDT Switches Z1 - Watertight/Hazardous Locations, 2-Wire AC/DC Proximity Sensors	12D - 12 DC 24D - 24 DC 24A - 24/60 AC 120A - 120/60 AC 240A - 240/60 AC	Blank - 80 psig 7 - 70 psig 6 - 60 psig 5 - 50 psig 4 - 40 psig	V54 - SST Springs (Sizes 10-30 only) V90 - Reverse Rotation (FCCW) V95 - NorGuard Severe Service Actuator*** V96 - CE Marking***

† Not available on Series 05F39.

* NOTE: Not available with end mounted travel stops. Top-mounted travel stops available on 10-30 Sizes only - consult factory. End-mounted travel stops standard on all size 10-42 actuators, excluding end mount switches.

** NOTE: Consult Factory for high and low temperature solenoid variations.

*** NOTE: Applies to actuator only.

Positioners and limit switches

Pulsair® Zero Air Bleed Positioner

For pneumatically actuated control valves such as the characterized seat control valve shown here, Flowserve offers the Pulsair® loop-powered positioner with auto-calibration and zero air bleed. Operated by a 4-20 mA analog signal, Pulsair's® microprocessor and three-button keypad provide on-site automatic calibration, split-range, speed adjustment, fault delay etc. Available with HART Protocol®, FOUNDATION Fieldbus and Profibus.

Position Indication Switches

The UltraSwitch series of position indicators provides a compact and economical package for both visual and remote electrical indication of valve position. Hazardous location approvals and corrosion resistant materials make the Worcester Controls rotary position indicators ideal for even the most hostile environments.

End-mounted Limit Switches (CSA and FM approved)

Where compact installation is required, an end-mounted limit switch module is available. This module comes as a combined Watertight TYPE 4 and Hazardous Location (Class I, Division 1,2, Group C, D; and Class II, Division 1, 2, Group E, F, G) and comes with two SPDT or two DPDT mechanical switches. It is also available with SPST AC or DC proximity switches.

Solenoid Accessories

S25N NAMUR / In-Line solenoid

- Standard NAMUR or In-Line options
- 3-way or 4-way convertible
- Interchangeable coils

NAMUR accessories include speed control, actuator ingress protection and lockout and vent module

Accessories and Options

NorGuard surface treatment can be supplied for severe service protection.

NorGuard coating complies with:

- MIL-A-63576A-Type 1-Aluminium Oxide Coating - Lubrication
- MIL-A-8625 (Anodic Coatings)
- ASTM B 117 (Salt Spray Testing)

Declutchable Gear Override

Also Available:

- Top-Mounted, Stainless Steel Rotary Switches
- Stainless Steel Springs
- Fast Acting

ACCESS™

Limit switches, solenoid and diagnostics integrated with the actuator

There's never been this much performance in such a small package - until now. ACCESS is an industry innovation which integrates the pneumatic actuator, limit switches, solenoid and diagnostics into a single package!

The ACCESS is available for either conventional wiring applications or for simple communications with the most common digital protocols.

The ACCESS is significantly more compact than conventional actuators with accessories and eliminates unnecessary brackets, couplings and additional enclosures. Advanced digital technology provides instant valve/actuator status. A simple cable connection - for both power supply and communications - reduces engineering time, wiring and installation costs.

Member of ASI Trade Organization and the Open DeviceNet Vendor Association

FLOWSERVE

Worcester Controls
CPT Characterized Seat Control Valve

Customized Control for Severe Throttling Services

Experience In Motion

Flowserve Worcester CPT Characterized Seat Control Valves

After years of research and performance evaluation under severe throttling services, where precise computer control was required, Flowserve Worcester Controls has developed the CPT characterized seat control valve series. These valves exceed the performance features of traditional linear valves, as well as that of segmented ball and eccentric plug designs.

The CPT characterized seat control valve is a ball valve, but that's where the similarity ends. The control capacity is defined by a revolutionary seat technology. These seats consist of a sintered stainless steel material that has been fully impregnated with TFE or Graphite, then laser-cut to a customized shape to best suit the individual application.

Combine these capabilities with Flowserve's high-cycle pneumatic, electric, or electro-pneumatic actuators, positioners, and accessories, and you have a control valve package that will meet the performance capabilities available with computers and PLC controllers.

- Precision control
- Zero external leakage
- High cycle capability
- Interchangeable characterized seats
- High rangeability (turn down)
- Efficient shearing action for solids and fibers
- Tight shutoff–bubbletight
- Low maintenance, few parts
- Compact design, light weight
- High flow capacity
- Energy efficient

Advanced Control Technology

Look beyond traditional globe control valves to a valve technology that gives you high pressure drop capability with straight-through flow, precision control, shearing action, erosion control and bubbletight shutoff. This technology is the CPT's self-lubricated, full contact seat of sintered stainless steel impregnated with TFE or graphite. The flow characteristic is laser cut to a "V" shape, slots, or customized shapes to meet any control requirement. The V-shaped port is available in seven standard angles for equal-percent characteristic with capacity closely matched to system needs. The lubricating action of the special coating on the ball and TFE or graphite impregnation throughout the thickness of the characterized seat results in amazingly smooth, stable throttling control.

The characterized seat design allows use of exotic materials such as Inconel 600®, Hastelloy C22®, Stellite 6 or Monel®.

FM Oil and Gas Safety Shutoff

The ¼"–2" CPT 44 series valves and ½"–4" CPT 51/52 valves with Pulsair III are approved by Factory Mutual for oil and gas safety shutoff service and flow control. For further information, contact the Custom Products Department.

Standard ΔP Capabilities

Liquids to 500 psi

Steam to 300 psi

316 sintered metal seats are impregnated with TFE or graphite to provide positive shutoff and lubrication when contacting the hard coated ball.

Characterized Seats with Metal A (TFE impregnation) or Metal G (graphite impregnation) are available in sizes ¼"–4".

A High Pressure Drop Control Valve with Custom Characteristics and Bubbletight Shutoff

The characterized seat control valve gives you extremely accurate control through the entire valve stroke with seat openings designed specifically for your process. This design means efficient, straight-through flow, rotary shaft sealing and bubbletight shutoff.

The seat design makes a throttling control valve that is both forgiving and accommodating. If a valve is sized incorrectly or if process conditions change, you can change the Cv and/or the control characteristic by merely changing out the seat.

At last! A control valve that shuts off bubbletight. The floating ball concept and Worcester Controls proprietary metal CPT seat design allows the valve to be bi-directional and still exceed ASME Class VI shutoff. The unique design of the Worcester CPT utilizes both a 316 stainless steel metal seat and a resilient seat, allowing for less operating torque than traditional ball control valves.

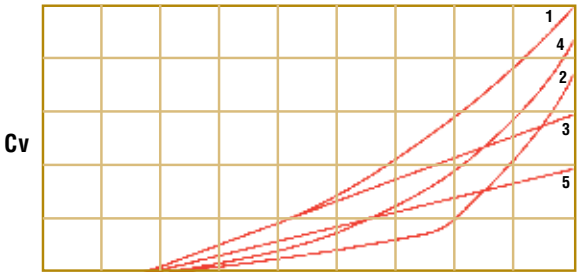
- Characterized seat
- Resilient or round metal seat

The characterized seat control valve is a bi-directional valve.

Flowserve recommends that the CPT seat be located in the downstream position in applications where the potential for erosion exists so any potential damage will occur away from the valve body. This is a major improvement in applications where damage by erosion in the valve body has been an expensive and time consuming problem.

Control Valve Sizing Software

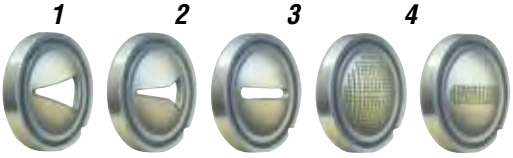
Flowserve Performance! Software is now available to support your applications and project activities. Order your copy of Performance! today! For more information, or to download a trial version, go to http://performance.flowserve.com.



Virtually Limitless Seat Designs

The V-shape of the standard seat (1) in CPT characterized seat control valves is precision laser cut and offers inherent modified equal percentage flow characteristic. Slotted seat valves (3) have inherent linear flow characteristics. If your requirements are different, we change the seat cut. Seats with multiple ports and custom openings (2, 4, and 5) are available to meet your unique control needs.

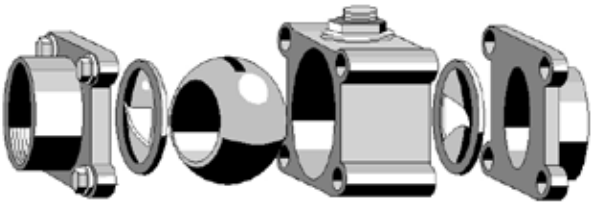
Simple changeout of the seat permits change of valve characteristic to match your process requirements.



Vee-Twin Valves for the Most Severe Applications

Flowserve offers the CPT Vee-Twin for more severe applications. The Vee-Twin design combines two CPT seats into one body for staged pressure reduction. This results in better resistance to cavitation and reduced noise.

In addition to providing excellent resistance to cavitation, the dual Characterized V-port seats are not subject to fouling like conventional anticavitation trims that utilize many small holes. The Vee-Twin allows relatively large particles to pass through the valve, and the shearing action of the ball against the seat slices off fibrous contaminants and cleans the seating surface in every cycle.



Seat leakage is less than allowed by ANSI Class IV. The Vee-Twin option is available on all versions of the CPT, but special actuator sizing applies. Refer to page 22 for actuator sizing data and for flow coefficients, refer to page 20.

Complete Piping Versatility

One Control Valve, Six Valve Configurations, Hundreds of Characteristics

The CPT control valve is not locked into one body style. Now you can choose a characterized seat control valve for the compactness of skid-mounted systems, the ruggedness of flanged piping, the high pressure integrity of welded systems, and the leakproof containment of sterile fluids*, cryogenics*, and chemicals in the EPA's Toxic Release Inventory.

Valve Configuration
Cryogenic design, Three-piece (shown) or flanged

Model
C44, C51/C52

Sizes
¼", ½", ¾", 1", ½", 2", 3", 4"

Pressure Rating
1000 psi max.

End Connections
Screw end, socket weld, butt weld, ASME Class 150 or 300 flanges

Valve Configuration
Wafer

Model
CPT 151, CPT 301

Sizes
3", 4"

Pressure Rating
ASME Class 150, ASME Class 300

End Connections
Wafer – for use between ASME Class 150 or Class 300 flanges

Valve Configuration
Flanged

Model
CPT 51, CPT 52

Sizes
½", ¾", 1", 1½", 2", 3", 4"

Pressure Rating
ASME Class 150, ASME Class 300

End Connections
ASME Class 150 or Class 300 raised face flanges

Valve Configuration
Three-piece

Model
CPT 44

Sizes
¼", ½", ¾", 1", ½", 2"

Pressure Rating
1000 psi max.

End Connections
Screw end, socket weld, butt weld

Valve Configuration
Anti-fugitive emission three-piece

Model
CPT 94

Sizes
¼", ½", ¾", 1", 1½", 2"

Pressure Rating
1000 psi max.

End Connections
Screw end, socket weld, butt weld

Valve Configuration
Anti-fugitive emission flanged

Model
CPT 94

Sizes
½", ¾", 1", 1½", 2", 3", 4"

Pressure Rating
ASME Class 150, 300, 600

End Connections
Raised face flanges

** Characterized seat clean valves and cryogenic valves are available through Flowserve's Custom Products Department.*

Advanced Stem Design for Low Hysteresis, High Repeatability and Leak-Free, Stick-Free, High-Cycle Operation

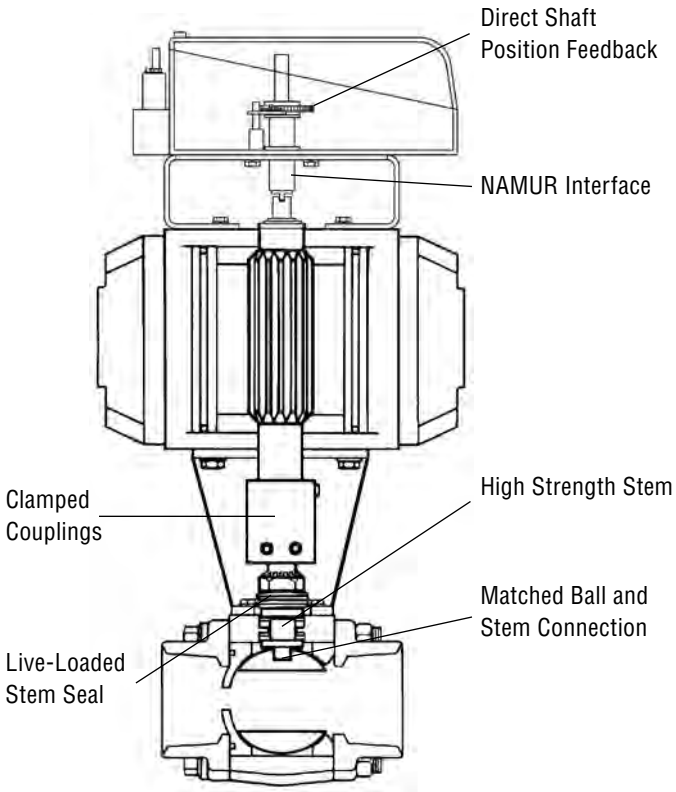
Flowserve Worcester Controls CPT characterized seat control valves represent a profound improvement over traditional globe and rotary valves that use heavy linear actuators, crank arms, and associated linkage. Worcester Controls has eliminated significant hysteresis and assured repeatability by powering through a solidly clamped, in-line stem. All shafts operate together: actuator, positioner, valve stem. The design also eliminates side load on the valve stem because components (valve, actuator, positioner) are mounted symmetrically and forces are balanced. This extends valve seal life far beyond conventional valves.

High-Performance Stem Seals

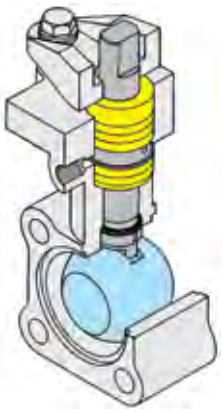
A new stem seal design, consisting of PEEK and Polyfill® thrust bearings and seals, significantly increases valve cycle life over conventional control valves and extends time between adjustments. The stem seal is live loaded to compensate for wear or thermal effects. Valve action is rotary. This means that toxic fluids, flammable fluids, and fluids that tend to crystallize or oxidize upon contact with atmosphere are fully contained and do not inhibit the freedom of motion of the valve.

Stem Seals for EPA Requirements

For an extended leak-free process environment, extended temperature application, and to meet EPA requirements, Worcester Controls offers the CPT 94 Control Valve. The Series CPT 94 valve is a NACE compatible, rugged, throttling ball control valve for fluids such as chlorine, phosgene, and many toxic liquids and gases. All Worcester Controls standard and characterized seats are available in this valve configuration. The heart of the Series 94 valve is a large diameter stem with double, live-loaded seal, and a Lantern-Ring connection. The connection may be used to detect and channel unlikely leakage from the primary seal, or may be used to create a liquid/gas seal for the stem, or for a steam purge to provide a sterile packing. A second connection is optional. Seal loading is kept constant with a series of Belleville washers. The standard seal consists of a TFE box ring with TFE V-ring packing. Graphite packing is optional.



Standard high-cycle, live-loaded, high-performance stem seal



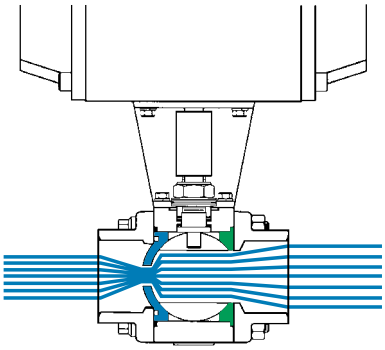
Series CPT 94 high-cycle, anti-fugitive emission stem seal

Applications

Steam Control

Controlling steam pressure is not easy. Typical problems associated with globe control valves in steam service have been stem leakage, sticking, poor shutoff, and high maintenance. Linear stem valves require frequent packing adjustment and over-tight packing may create added stem friction that could cause controller instability. Furthermore, Class V, IV, or III shutoff is usually too much leakage for many applications requiring tight shutoff.

Worcester Controls characterized seat valves solve these problems with tight shutoff exceeding Class VI. Self-compensating rotary stem seals and tailored seat characteristics provide a ramp-up condition quickly while maintaining precision low-flow control. Thousands of CPT valves are successfully operating in steam systems where globe valves were originally used. A typical user reaction: "We are removing our globe valves and replacing them with Worcester Controls characterized seat control valves because they work better and control better."



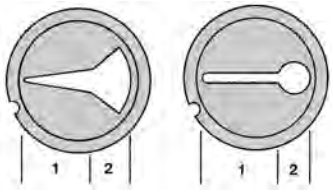
Toxic Fluids

Traditional rising stem globe valves cannot stand up to the demanding specifications implemented by the EPA, OSHA and other regulating agencies. The very nature of the design, even with double packing and/or bellows seals have relatively short cycle lives compared to rotary seals. The Series CPT 94 control valve shown on page 6 has been certified by third party testing, allowing less than 25 ppm leakage, whereas EPA requirements are 500 ppm. Self-adjusting stem seals with multiple Belleville washers make this valve ideal for throttling toxic chemicals.

pH Control

Low flow rates associated with pH process control loops require valves with very small openings. This creates a major problem in traditional rising stem control valves if any solids larger than the valve opening are in the system. Unfortunately, in most pH systems, it is impossible to eliminate solids in the liquid stream. They often clog control valves. This results in having to shut the line down and disassemble the valve for cleaning.

The CPT is the ideal control valve for pH control when using a low flow opening and solid removal hole. The special opening of the pH control seats, shown, provide the most ideal throttling characteristics and turndown while allowing solids to move out of the larger opening. Also, erosion problems are minimized and the valve body is protected since the vena contracta is located outside the valve body.



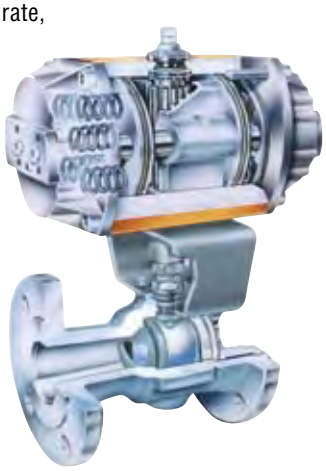
Applications

Cryogenics

Compactness, balanced weight, precision control, tight shutoff, and long service life are features considered unique and unmatched by conventional control valve designs and styles. The cryogenic characterized seat valve is also designed to handle large temperature swings with its special seats and self-compensating rotary stem seal design. All this has made CPT an ideal control valve for low temperature and cryogenic applications such as freezing systems, lyophilization systems, high-purity gas systems, terminal loading stations, over-the-road CO_2, LNG food carriers, and air separation systems. The characterized valve provides tailored flow characteristics for each process—in the body and trim materials you require. CPT valves can be easily and economically controlled by Worcester Controls Series 39 pneumatic or Series 75 electric actuators.

Series 39 Actuator

The heart of our pneumatic automation package is the Series 39 actuator. A Worcester Controls innovation, the Series 39 is an accurate, compact, powerful, double-piston, rack-and-pinion actuator with an impressive track record for reliability. That's why we back it with an exclusive two-year warranty. One plant reported 14 million complete cycles without appreciable original seal wear.



Piston tilting is prevented due to unique guide rods that always keep the pistons parallel with each other and perpendicular to the cylinder. This feature enables the Series 39 actuator to match the performance of diaphragm actuators in terms of high resolution. Internal friction is reduced with a nickel acetate-coated cylinder, low coefficient-of-friction acetal resin bearings and a special permanent lubricant with corrosion inhibitors.

Worcester's control valve packages are designed to function with virtually no inherent hysteresis, an important feature in throttling control. Precision parts within the Series 39 actuator permit very high torque performance with minimum backlash.

Series 75 Actuator

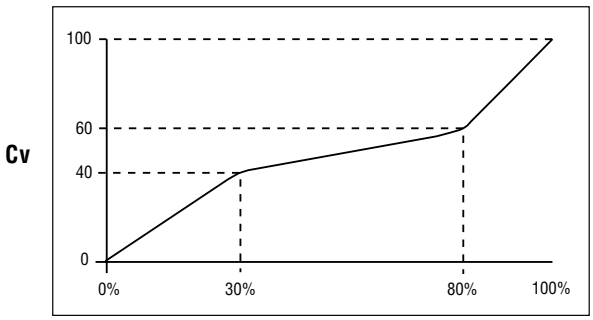
Presenting the ultimate actuator package for electronic process control: the Series 75. Ideal for analog or digital controlled systems where pneumatic control is neither possible nor desirable.

The Series 75 actuator adds a new dimension of operational dependability and flexibility to modern processes controlled by computers and programmable logic controllers. It is compact and powerful. Its brushless, split phase capacitor, start/run reversing AC motor or rugged and powerful DC motor, drives the valve through a permanently lubricated gear train which offers virtually lifetime maintenance-free, dependable operation. Precision throttling control is achieved by a choice of electronic positioners and controllers that can work with digital or analog control loops. A variety of options allow you to select the performance criteria, diagnostic data and feedback information you desire.

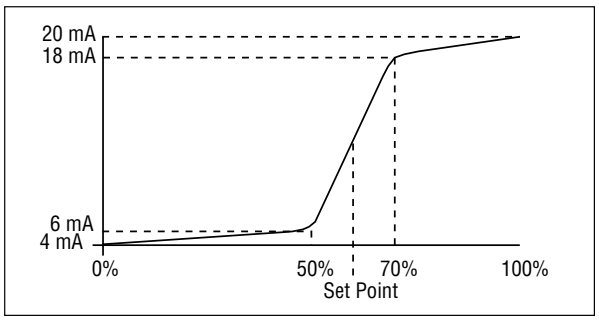
New Technology – Positioners and Accessories

STOP

Now is your opportunity to stop oscillation or hunting in your process. Most process control loops are unstable due to an improper valve characteristic, positioner characteristic or both. The Worcester Controls CPT characterized seat control valve with either the Pulsair III or DataFlo positioner puts a permanent stop to these problems. It is done by tailoring the characterized seat opening and free characteristic curve of the positioner for each process loop. Install our control valve package in any of your flow, temperature, pressure, vacuum or other demanding or critical control applications and find out how our new technology can give you the precise control you have always looked for but couldn't achieve with traditional control valves and positioners.



20% Cv change for 50% valve rotation is a tailored CPT valve characteristic. Result is 0.1°F control of temperature or 0.1 psi pressure control.



Above free tailored characteristic programmed in Pulsair III or DataFlo uses 75% of the available signal to move the valve around the set point position by only 20%.

Flowserve offers all the accessories you need for precise control valve positioning and position feedback.

For pneumatically actuated control valves

The Pulsair III loop-powered valve positioner with auto calibration and zero air bleed is a totally new concept in pneumatic control valve positioning. Operated and controlled by a 4–20 mA analog signal, Pulsair III is microprocessor-based with piezoelectric valves. Air is pulsed to the actuator pistons, eliminating constant air bleed and providing very accurate positioning without overshoot. With a 100-plus-function menu and a five-button keypad, you can automatically calibrate the positioner, change valve action, split range, modify the control characteristic and select many other control parameters. Intrinsically safe option available. Ask for brochure FCD WCABR1019.

Through-cover display
XP enclosure

For electrically actuated control valves

The DataFlo P™ Positioner, controlled by a 4–20 mA analog signal from a PLC or digitally from a computer, gives you calibration, monitoring and diagnostics both on-site or from a control room computer. This dramatically increases system dependability and lowers valve calibration, monitoring, and maintenance costs.

DataFlo P®

SMART POSITIONER

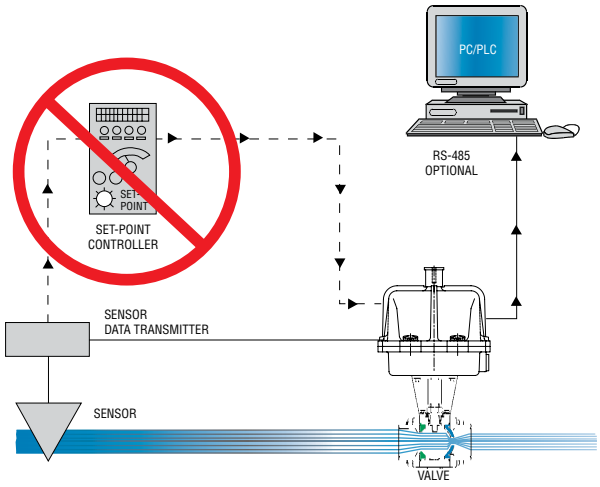
An electronic positioner with a built-in microcontroller for precise process control

DataFlo P controls your process better and turns your final control element into an efficient digital communications platform. Standard PM15 positioners are offered for 3–15 psi pneumatic control and AF17 positioners for analog control of electrically actuated control valves. Refer to brochures FCD WCABR1032 and FCD WCABR1000.

Three-button keypad for on-site calibration and functional setup

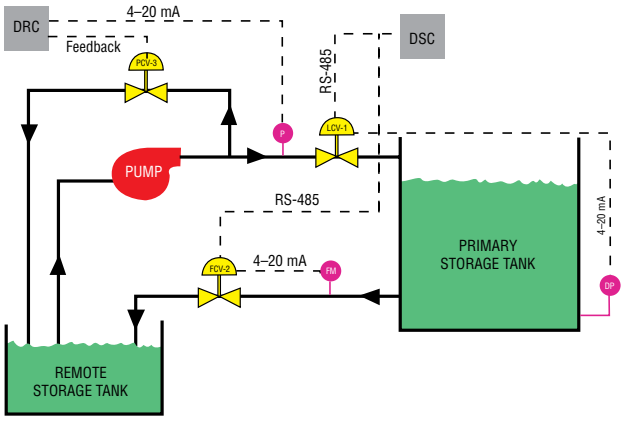
New Technology – Direct Process Control

The DataFlo C™ controller is a fresh approach to PID control. This combination microcontroller-based PID single-loop controller and final control element brings control to the point of use. The rugged compact package simplifies wiring requirements by directly accepting RTD, analog or thermocouple inputs.The signal does not have to be conditioned, improving reliability. All the parameters are easily programmable through the local keypad or via a simple RS-485 computer interface. The control valve/PID controller is easily tuned to the loop with the built-in auto tune program (excluding level control). Refer to brochure FCD WCABR1021.



PC/PLC/Computer Interface and Manual Valve Control

Remote interface capability allows the user to monitor their process and change the controller settings. An additional feature allows the user to take the controller off-line and operate in a manual positioning mode. The user can switch between PID control and a linear positioning mode by a discrete 24 VDC output from the PLC. An operator can also change set point input via an analog input to the controller.



Process Control Solutions

LCV-1: Level control – differential pressure
DataFlo supervisory controller (process interface)

FCV-2: Flow control (tank discharge) – flow meter
DataFlo supervisory controller (process interface)

PCV-3: Pressure control (pump bypass) – pressure transducer
DataFlo remote controller (process interface)

DRC/DSC

Flowserve introduces two new products that allow the customer the capability to control and monitor their process control valves from a remote location.

The DataFlo Remote Controller (DRC) is specifically designed to interface with electrically actuated control valves. This combined positioner-controller accommodates multiple I/O options for both set point and process inputs. Performance monitoring and maintenance diagnostic data is available locally for “real time” user interface and remotely for predictive maintenance programs. The DRC is packaged in a NEMA 4X enclosure and features a splash-proof keypad and bright alphanumeric LED display for user-friendly interface.

The DataFlo Supervisory Controller (DSC) is designed to interface with multiple process control valves via a two-wire fieldbus network. The DSC provides interface process control and performance monitoring for a maximum of 31 process control loops. (Performance monitoring and maintenance diagnostic data is available locally for “real time” user interface and remotely for predictive maintenance programs.) The DSC is packaged in a NEMA 4X enclosure and features a 16-key splash-proof keypad and four-line “avionics” grade LED display for user-friendly interface. The DSC is a cost effective solution that eliminates expensive traditional “PLC” type systems with central control and point-to-point wiring.

Specifications

Characterized Seat Control Valves

CPT 51/52 Flanged Control Valves

Valve Size: ½", ¾", 1", 1½", 2", 3", 4"

Valve Pressure Class:
CPT 51 – ASME Class 150 flanges
CPT 52 – ASME Class 300 flanges

Body and End Plug Materials:
Carbon steel, 316 stainless steel
Other materials available upon request.

Stem Seal Assembly:
PEEK and Polyfill (½"–2")
Refer to Series 51/52 brochure.

Maximum Valve Temperature: 650°F
For higher temperatures consult Flowserve.

C44, C51/C52 Cryogenic Control Valves

Valve Size: ¼", ½", ¾", 1", 1½", 2" (three-piece valves) 1"–4" flanged valves

Valve Pressure Class:
ASME Class 600 (This is the body pressure rating.)
Seat selection may derate the valve.

Body and Pipe End Materials:
Carbon steel, 316 stainless steel
Other materials available upon request.

End Connections:
Screw end, socket weld, butt weld

Stem Seal Assembly:
PEEK and Polyfill — Refer to Series 44 brochure.

Maximum Valve Temperature: 600°F
For higher temperatures consult Flowserve.

CPT 44 Three-Piece Control Valves

Valve Size: ¼", ½", ¾", 1", 1½", 2"

Valve Pressure Class:
ASME Class 600 (This is the body pressure rating.)
Seat selection may derate the valve.

Body and Pipe End Materials:
Carbon steel, 316 stainless steel
Other materials available upon request.

End Connections:
Screw end, socket weld, butt weld

Stem Seal Assembly:
PEEK and Polyfill — Refer to Series 44 brochure.

Maximum Valve Temperature: 650°F
For higher temperatures consult Flowserve.

CPT 151/301 Wafer Control Valves

Valve Size: 3" and 4"

Valve Pressure Ratings: To ASME Class 150 and 300

Body and End Plug Materials:
Carbon steel, 316 stainless steel

Stem Assembly:
PEEK and Polyfill — Refer to Wafer Ball Valve brochure.

Maximum Valve Temperature: 650°F
For higher temperatures consult Flowserve.

CPT 94 Three-Piece and Flanged Control Valves

Valve Size: ¼", ½", ¾", 1", 1½", 2" – three-piece valves
½", ¾", 1", 1½", 2", 3", 4" – flanged valves

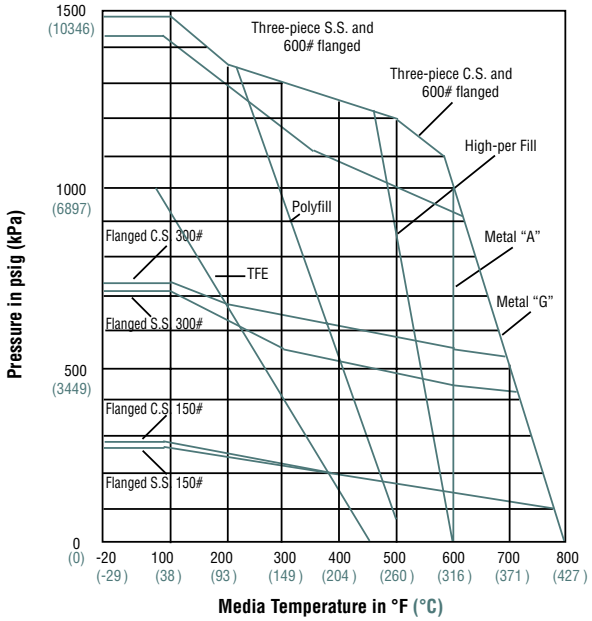
Valve Pressure Class:
ASME Class 600 – three-piece valves
ASME Class 150 and 300 – flanged valves

Body and Pipe End or End Plug Materials:
Carbon steel, 316 stainless steel

Stem Assembly:
Dual stem seal of TFE and/or Grafoil, 35% carbon-filled TFE or Grafoil — Refer to Series 94 brochure.

Maximum Valve Temperature:
600°F with Metal "A" characterized seat
800°F with Metal "G" characterized seat

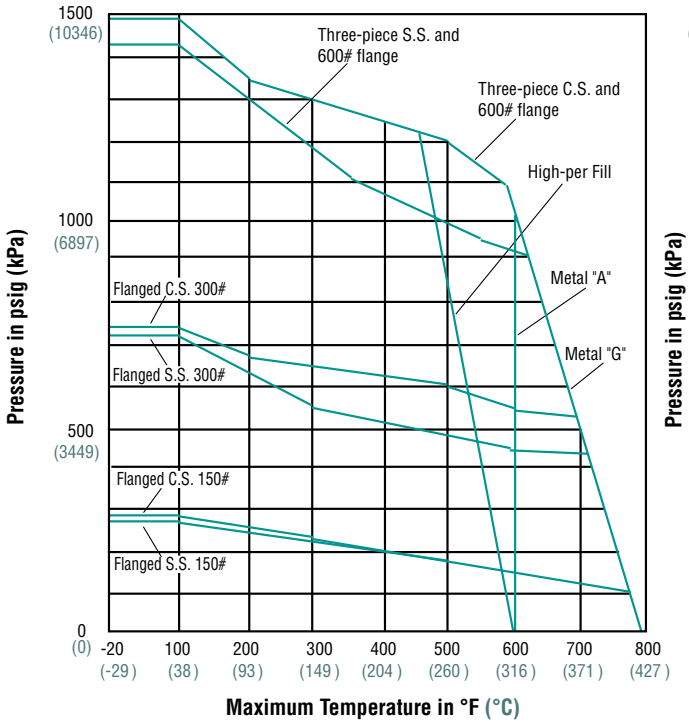
Series 44, 4, 51/52, 151/301 Pressure/Temperature Ratings*

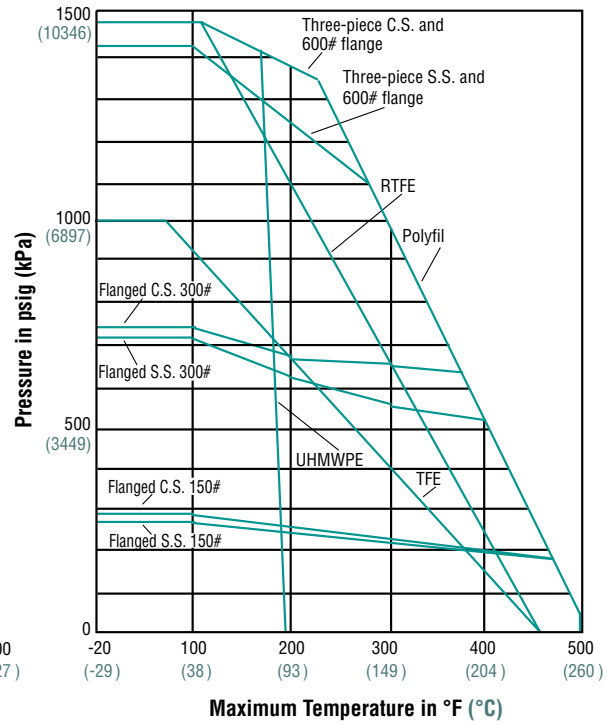


** For applications above 650°F, use Series CPT 94 valve.*

Series CPT 94 Pressure / Temperature Rating

NOTES: Body seals have pressure/temperature ratings that equal or exceed the rating of the seat. TFE body seals will not withstand thermal cycles in excess of 200°F.





General Specifications

CPT Control Valves

Valve Size: ¼" ½", ¾", 1", 1½", 2" three-piece valves

Characterized Seat:

Metal "A", TFE-impregnated sintered stainless steel Metal "G", graphite-impregnated sintered stainless steel
Optional materials available, consult Flowserve.

Characterized Seat Back Seal:

Graphite; optional Polyfill, silicone
Encapsulated TFE O-ring or Viton

Second Seat (Round):

TFE, Polyfill, High-per Fill, Metal "A", Metal "G"

Ball: 316 stainless steel, hard nickel-coated; optional materials available.

Valve Orientation and Shutoff:

Characterized seat upstream standard.

Shutoff is bubbletight.

Characterized seat downstream recommended for applications involving cavitation and flashing.

Shutoff exceeds requirements of ASME and ISA Class VI.

Standard Pressure Drop Limits:

300 psi – Steam
500 psi – Liquid service
Note: Consult Flowserve for applications about this pressure.

Recommended Product Specification for Characterized Seat Control Valves

Available with special stem design to meet fugitive emission requirements.

Impregnated Metal Seats – Graphite or TFE-impregnated in 316 stainless steel or other metals.

Metal seats to be full size (same as the resilient seats) in order to provide for ability to handle 800°F, pressures up to 1440 psig and pressure drops to 500 psi for liquids and 300 psi for steam.

Seats to be available in various openings for specific Cv and specific characteristics.

Seats to be available with a slotted opening for linear control characteristics.

Valves to offer rangeability in excess of two hundred to one if needed.

Valves to be bi-directional.

Valves to be available with a resilient upstream or downstream seat to reduce torque and provide tight shutoff.

Ball to be round and be coated with a hard nickel coating to provide for smooth control and long life.

Ball and stem engagement to be free of play to eliminate hysteresis.

The characterized seat to provide for shearing action in handling slurries and to be abrasion resistant.

Valve to be equipped with compact rotary pneumatic or electric actuator.

The valve should be available with inherent characteristics, linear and equal percentage or other characteristics as needed.

The valve to be rotary design, compact and low weight.

The valve to be available in one-piece flanged, flangeless wafer design, or three-piece body with various end connections.

The valve should be constructed with minimum parts and be easy to repair if necessary.

Valve Torque:

Before the actuator can be sized for any given application, determine the amount of torque required by the valve.

For complete valve operating torque data, refer to the Worcester Controls Actuator Sizing Manual. This publication explains the concept of valve torque, presents torque curves for each material, and provides output torque figures for the Series 39 pneumatic and Series 75 electric actuators.

Pneumatic Control:

Series 39 Actuator — Refer to brochure FCD WCABR1003.

Pneumatic Control Options:

PM-15 Pneumatic and Electro-Pneumatic Positioners — Refer to brochure FCD WCABR1032.

MAStermind dribble feed control

Pulsair Analog/Digital Positioner — Refer to brochures FCD WCABR1018 and FCD WCABR1019.

Electronic/Computer Control:

Series 75 Actuator — Refer to brochure FCD WCABR1014.

Electronic Control Options:

Step Control: I-75 Circuit Board — Refer to brochure FCD WCABR1046.

Analog control: AF 17 Positioner — Refer to brochure FCD WCABR1000.

Digital/Analog Control: DFP-17 Positioner — Refer to brochure FCD WCABR1021.

P.I.D. Control: DFC-17 Controller — Refer to brochure FCD WCABR1021.

How to Order Characterized Seat Control Valves

1"	CPT 44	4	6	P	M	SE	A30
Valve Size	**Valve Series**	**Body/Pipe Ends**	**Ball /Stem**	**Round Port Seal**	**Body Seals**	**End Connections**	**Specify Characterized Seat**
¼" **½"** **¾"** **1"** **1 ½"** **2"**	**CPT 44** **CPT94** 3-piece **C44** Cryogenic*	**4:** Carbon Steel **6:** 316 Stainless Steel **7:** Monel*** **A:** Alloy 20*** **C:**Hastelloy-C*** **1:** Brass	**6:** 316 Ni Plt Ball, 17-4 stem **S:** Stellite Ball, 17-4 stem **C:** Hastelloy C Ball, Hast-C stem***	**T:** Virgin PTFE **P:** Polyfill **H:** High-Per-Fill **A:** Metal A **C:** Hastelloy-C **G:** Metal G **S:** Stellite 6 **U:** UHMWPE **V:** Vee-Twin****	**M:** 316/TFE "S" gasket **G:** Grapite/316 "S" gasket **T:** PTFE **B:** Buna **N:** Neoprene **E:** EPDM **U:** UHMWPE **V:** Viton	**SE:** Female NPT **BW1:** Buttweld Sch 10 (SS only) **BW4:** Buttweld Sch 40 **BW5:** Buttweld Sch 5 (SS only) **BW8:** Buttweld Sch 80 **XBO:** Extended Buttweld (OD Tube) **XB(n):** Extended Buttweld (n=Sch) **SW:** Socketweld (pipe sizes) **SWO:** Socketweld (Tube OD sizes)	Specify Metallic seat material code and configuration **15:** 15° **30:** 30° **60:** 60° **90:** 90° **120:**120° **02:** 1/64 SLOT **03:** 1/32 SLOT **06:** 1/16 SLOT **12:** 1/8 SLOT
3" **4"**	**CPT151** Wafer 150 **CPT301** Wafer 300 **C151/301** Cryo**					**150:** ASME Class 150 Flanges **300:** ASME Class 300 Flanges	
½" **1"** **1 ½"** **2"** **3"** **4"**	**CPT51** Flgd 150 **CPT52** Flgd 300 **CPT94** Flgd 150 **CPT94** Flgd 300 **C51, C52** Cryo**						

94 rated to -20°F

*Cryo: Brass and stainless only
**Cryo in stainless only
***3-piece only
****All 3-piece valves. Flanged bodies 3" & 4" only

CAUTION: Ball valves can retain pressurized media in the body cavity when closed. Use care when disassembling. Always open valve to relieve pressure prior to disassembly.