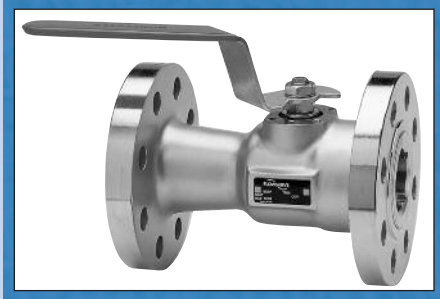


RATERMANN Cryogenics

FLOWSERVE

INDEX

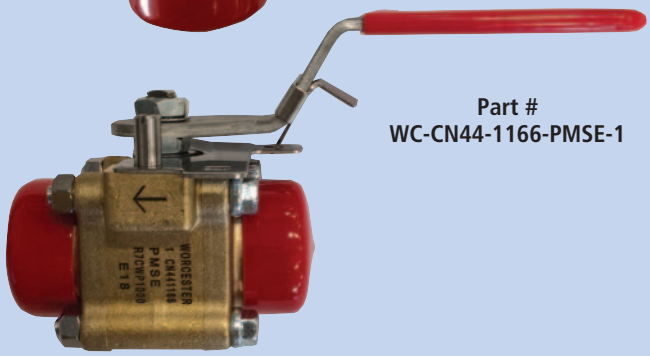
COMMON ITEMS Worcester Control Valves

FLOWSERVE

Part #
WC-C44-1166-PMSE-1

Part #
WC-C44-6666-PMSE-2

Part #
WC-CN44V1-6666-PMSE-1



Part #
WC-CN44-1166-PMSE-1

⚠ **WARNING:** Cancer and Reproductive Harm – www.P65Warnings.ca.gov
For further information on Proposition 65, please go to www.oehha.ca.gov/proposition-65

Cryogenic Ball Valves & Cryogenic Diverter Ball Valves with Extended and Non-Extended Stem

Brass Body Part #	Stainless Steel Body Part #	Description	Size	Repair Kit Part #
WC-C44-1166-PMSE-14	WC-C44-6666-PMSE-14	Cryogenic Ball Valve Extended Stem	1/4" NPT	WC-CRK44PM-R8-12
WC-C44-1166-PMSE-38	WC-C44-6666-PMSE-38	Cryogenic Ball Valve Extended Stem	3/8" NPT	WC-CRK44PM-R8-12
WC-C44-1166-PMSE-12	WC-C44-6666-PMSE-12	Cryogenic Ball Valve Extended Stem	1/2" NPT	WC-CRK44PM-R8-12
WC-C44-1166-PMSE-34	WC-C44-6666-PMSE-34	Cryogenic Ball Valve Extended Stem	3/4" NPT	WC-CRK44PM-R8-34
WC-C44-1166-PMSE-1	WC-C44-6666-PMSE-1	Cryogenic Ball Valve Extended Stem	1" NPT	WC-CRK44PM-R8-1
WC-C44-1166-PMSE-112	WC-C44-6666-PMSE-112	Cryogenic Ball Valve Extended Stem	1-1/2" NPT	WC-CRK44PM-R8-112
WC-C44-1166-PMSE-2	WC-C44-6666-PMSE-2	Cryogenic Ball Valve Extended Stem	2" NPT	WC-CRK44PM-R8-2
WC-CN44-1166-PMSE-14	WC-CN44-6666-PMSE-14	Cryogenic Ball Valve Non-Extended Stem	1/4" NPT	WC-CNRK44PM-R8-12
WC-CN44-1166-PMSE-38	WC-CN44-6666-PMSE-38	Cryogenic Ball Valve Non-Extended Stem	3/8" NPT	WC-CNRK44PM-R8-12
WC-CN44-1166-PMSE-12	WC-CN44-6666-PMSE-12	Cryogenic Ball Valve Non-Extended Stem	1/2" NPT	WC-CNRK44PM-R8-12
WC-CN44-1166-PMSE-34	WC-CN44-6666-PMSE-34	Cryogenic Ball Valve Non-Extended Stem	3/4" NPT	WC-CNRK44PM-R8-34
WC-CN44-1166-PMSE-1	WC-CN44-6666-PMSE-1	Cryogenic Ball Valve Non-Extended Stem	1" NPT	WC-CNRK44PM-R8-1
WC-CN44-1166-PMSE-112	WC-CN44-6666-PMSE-112	Cryogenic Ball Valve Non-Extended Stem	1-1/2" NPT	WC-CNRK44PM-R8-112
WC-CN44-1166-PMSE-2	WC-CN44-6666-PMSE-2	Cryogenic Ball Valve Non-Extended Stem	2" NPT	WC-CNRK44PM-R8-2
WC-C44V1-1166-PMSE-12	WC-C44V1-6666-PMSE-12	Cryogenic Diverter Ball Valve Extended Stem	1/2" NPT	WC-CRK44PM-R8-12
WC-C44V1-1166-PMSE-34	WC-C44V1-6666-PMSE-34	Cryogenic Diverter Ball Valve Extended Stem	3/4" NPT	WC-CRK44PM-R8-34
WC-C44V1-1166-PMSE-1	WC-C44V1-6666-PMSE-1	Cryogenic Diverter Ball Valve Extended Stem	1" NPT	WC-CRK44PM-R8-1
WC-C44V1-1166-PMSE-112	WC-C44V1-6666-PMSE-112	Cryogenic Diverter Ball Valve Extended Stem	1-1/2" NPT	WC-CRK44PM-R8-112
WC-C44V1-1166-PMSE-2	WC-C44V1-6666-PMSE-2	Cryogenic Diverter Ball Valve Extended Stem	2" NPT	WC-CRK44PM-R8-2
WC-CN44V1-1166-PMSE-12	WC-CN44V1-6666-PMSE-12	Cryogenic Diverter Ball Valve Non-Extended Stem	1/2" NPT	WC-CNRK44PM-R8-12
WC-CN44V1-1166-PMSE-34	WC-CN44V1-6666-PMSE-34	Cryogenic Diverter Ball Valve Non-Extended Stem	3/4" NPT	WC-CNRK44PM-R8-34
WC-CN44V1-1166-PMSE-1	WC-CN44V1-6666-PMSE-1	Cryogenic Diverter Ball Valve Non-Extended Stem	1" NPT	WC-CNRK44PM-R8-1
WC-CN44V1-1166-PMSE-112	WC-CN44V1-6666-PMSE-112	Cryogenic Diverter Ball Valve Non-Extended Stem	1-1/2" NPT	WC-CNRK44PM-R8-112
WC-CN44V1-1166-PMSE-2	WC-CN44V1-6666-PMSE-2	Cryogenic Diverter Ball Valve Non-Extended Stem	2" NPT	WC-CNRK44PM-R8-2
	WC-C51-6666-PT150-3	Cryogenic Ball Valve Extended Stem 150#	3" 150 Flange	WC-CRK44PT-3

Brass Body Options: For Socket Weld (SW) or Sweat Ends (TE) replace "SE" in the part number with "SW" or "TE"
Stainless Steel Body Options: For Socket Weld (SW) or Butt Weld (BW1) replace "SE" in the part number with "SW" or "BW1"

For all **C4, C44, AND C51 CRYOGENIC BALL VALVES**
part numbers and information, see pages 37K 5-10

Rev: 9/9/19

Part #
WC-C51-6666-PT150-3

Image above depicts T-Handle that is included with Valves.

Worcester Cryogenic Ball Valve

Part #	Description
WC-C51-6666-PT150-3	Worcester Cryogenic Ball Valve Extended All Stainless Steel 3" 150# Flanged
WC-C51-6666-PT150-4	Worcester Cryogenic Ball Valve Extended All Stainless Steel 4" 150# Flanged
WC-C51-6666-PT150-6	Worcester Cryogenic Ball Valve Extended All Stainless Steel 6" 150# Flanged

For all **SERIES 51/52 FLANGED BALL VALVES**
part numbers and information, see pages 37M 2-6
in the **Ratermann Cryogenics Catalog**

Part #
WC-F39S-15N-8

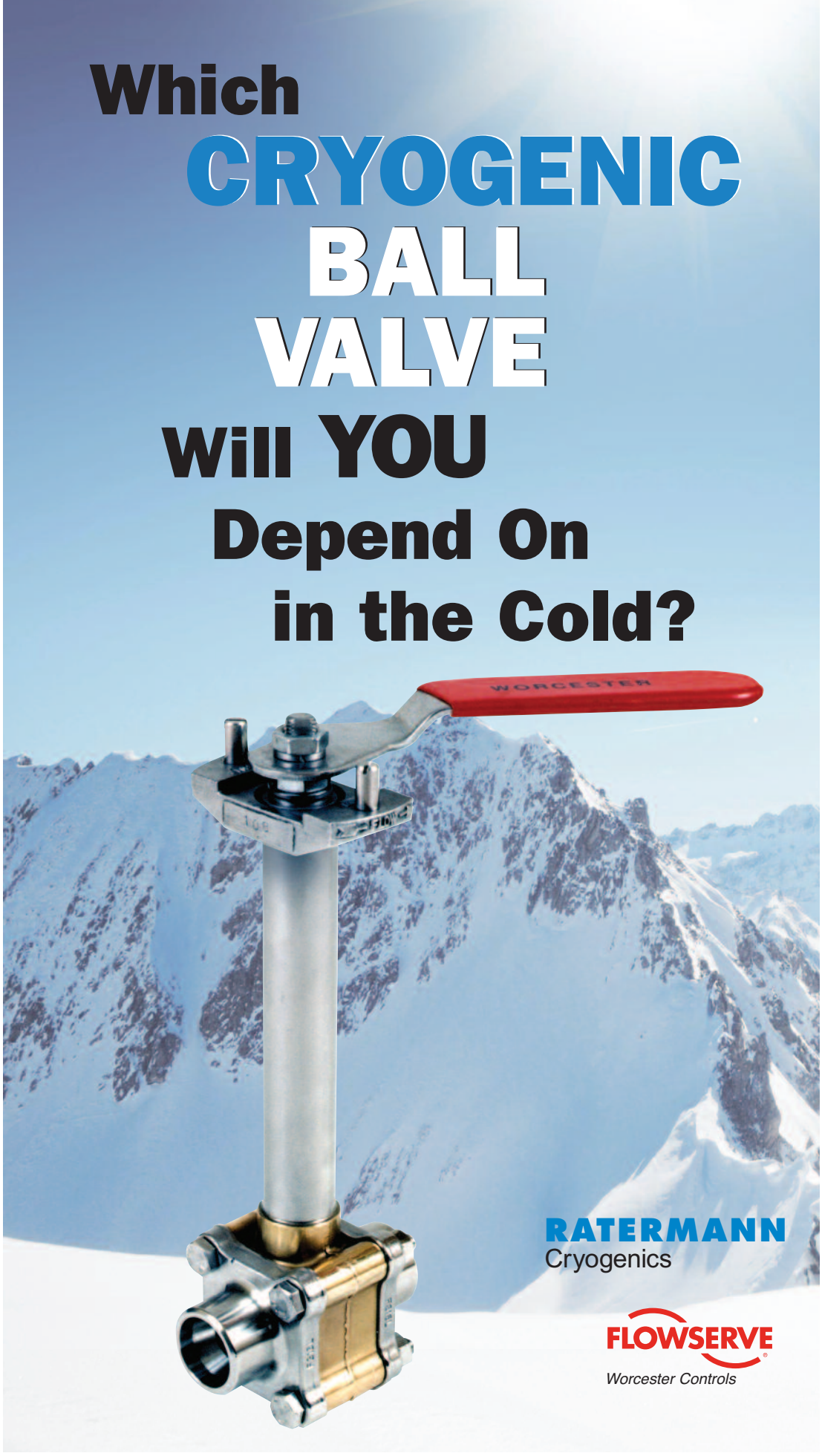
Worcester Spring Return Pneumatic Actuators

Brass Body Part #	Stainless Steel Body Part #	Size	Worcester Actuator	Description	Worcester Mounting Kits
WC-C44-1166-PMSE-14	WC-C44-6666-PMSE-14	1/4" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK703S
WC-C44-1166-PMSE-38	WC-C44-6666-PMSE-38	3/8" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK703S
WC-C44-1166-PMSE-12	WC-C44-6666-PMSE-12	1/2" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK703S
WC-C44-1166-PMSE-34	WC-C44-6666-PMSE-34	3/4" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-C44-1166-PMSE-1	WC-C44-6666-PMSE-1	1" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-C44-1166-PMSE-112	WC-C44-6666-PMSE-112	1-1/2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-C44-1166-PMSE-2	WC-C44-6666-PMSE-2	2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-CN44-1166-PMSE-14	WC-CN44-6666-PMSE-14	1/4" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK701S
WC-CN44-1166-PMSE-38	WC-CN44-6666-PMSE-38	3/8" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK701S
WC-CN44-1166-PMSE-12	WC-CN44-6666-PMSE-12	1/2" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK701S
WC-CN44-1166-PMSE-34	WC-CN44-6666-PMSE-34	3/4" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK707S
WC-CN44-1166-PMSE-1	WC-CN44-6666-PMSE-1	1" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-CN44-1166-PMSE-112	WC-CN44-6666-PMSE-112	1-1/2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-CN44-1166-PMSE-2	WC-CN44-6666-PMSE-2	2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-C44V1-1166-PMSE-12	WC-C44V1-6666-PMSE-12	1/2" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK703S
WC-C44V1-1166-PMSE-34	WC-C44V1-6666-PMSE-34	3/4" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-C44V1-1166-PMSE-1	WC-C44V1-6666-PMSE-1	1" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-C44V1-1166-PMSE-112	WC-C44V1-6666-PMSE-112	1-1/2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-C44V1-1166-PMSE-2	WC-C44V1-6666-PMSE-2	2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-CN44V1-1166-PMSE-12	WC-CN44V1-6666-PMSE-12	1/2" NPT	WC-F39S-10N-8	Spring Return 80 PSI Actuator Size 10	WC-MK701S
WC-CN44V1-1166-PMSE-34	WC-CN44V1-6666-PMSE-34	3/4" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-CN44V1-1166-PMSE-1	WC-CN44V1-6666-PMSE-1	1" NPT	WC-F39S-15N-8	Spring Return 80 PSI Actuator Size 15	WC-MK708S
WC-CN44V1-1166-PMSE-112	WC-CN44V1-6666-PMSE-112	1-1/2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
WC-CN44V1-1166-PMSE-2	WC-CN44V1-6666-PMSE-2	2" NPT	WC-F39S-25N-8	Spring Return 80 PSI Actuator Size 25	WC-MK715S
	WC-C51-6666-PT150-3	3" 150 Flange	WC-F39S-33N-8	Spring Return 80 PSI Actuator Size 33	WC-MK728

Stock actuators are based on 80 PSI Air Supply (Other pressures available)

For all **SERIES F39 PNEUMATIC ACTUATOR**
part numbers and information, see pages 37N 2-7

Which CRYOGENIC BALL VALVE Will YOU Depend On in the Cold?



RATERMANN
Cryogenics

FLOWSERVE
Worcester Controls

Cryogenic Valve Configurations

Flowserve Worcester Controls cryogenic valves are available in four basic body configurations; C44 (1/4"-2"), C44 Diverter (1/2"-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.

C44 Brass or Stainless Steel

C44 Diverter

C4 Wafer

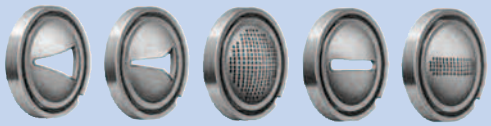
C4 Flanged

Valves Without Stem Extensions

Flow Control

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.

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.

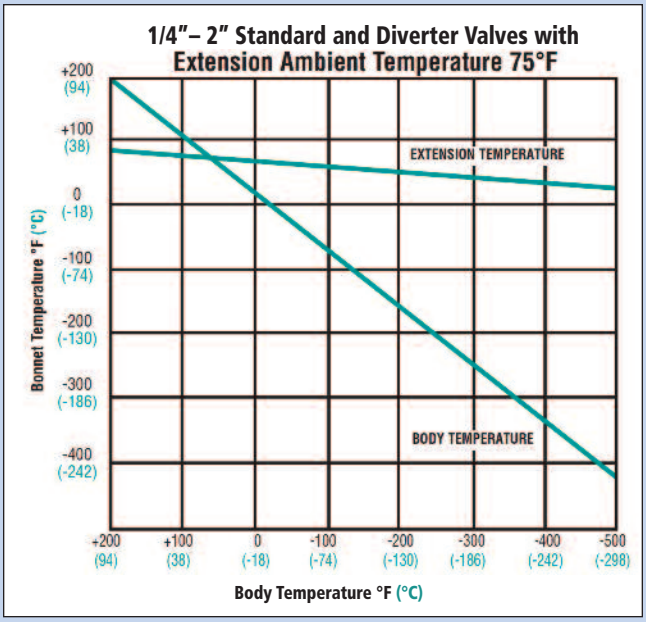
Series 75 Electric Actuator

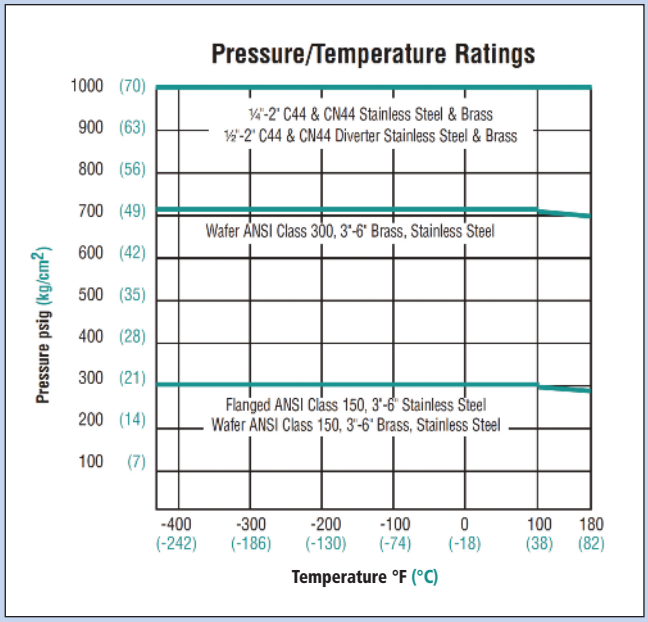
Series 39 Pneumatic Actuator

Series 39 Pneumatic Actuator with Pulsair Positioner

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

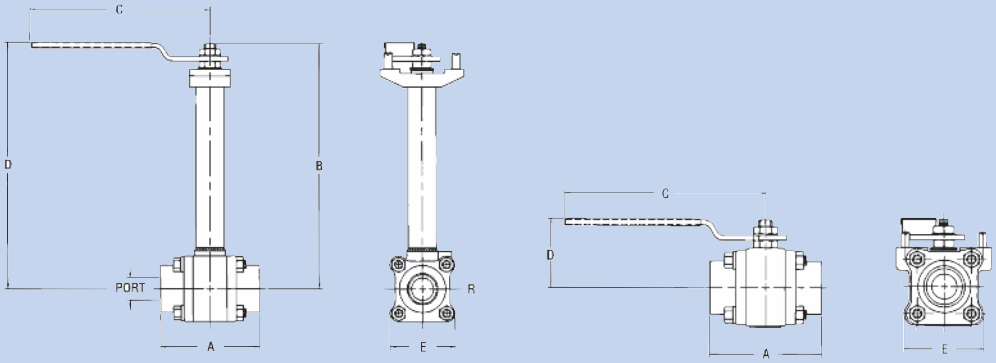
Pressure and Torque for Automated Valves

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.

Flow Control

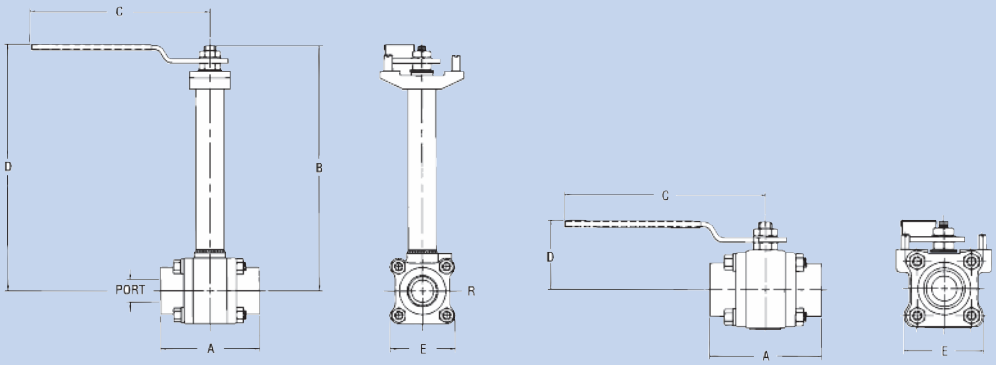
FLOWSERVE

Dimensions



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

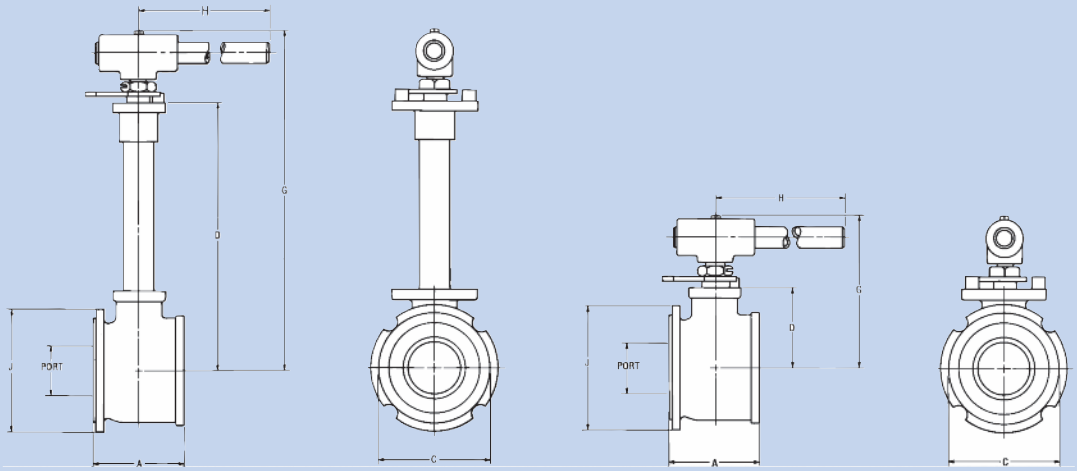
Valve Size	A	B	C		D		E	Port	Approx. Weight lbs. (kg.)	
			With Ext.	Without Ext.	With Ext.	Without Ext.			With Ext.	Without Ext.
¼", ⅜", ½"	2.54 (64.52)	7.86 (199.6)	6.53 (166)	5.53 (140)	7.87 (200)	1.76 (44.7)	1.75 (44.4)	.44 (11.8)	3.0 (1.4)	1.1 (0.5)
¾"	2.76 (70.10)	7.96 (202.2)	6.53 (166)	5.53 (140)	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

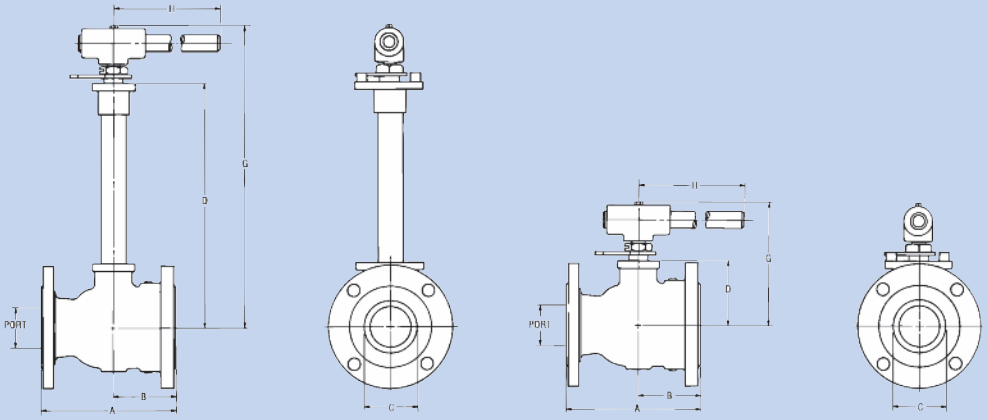
Valve Size	A	B	C		D		E	R	End Port Dia.	Bottom Port Dia.	Approx. Weight - lbs. (kg.)	
			With Ext.	Without Ext.	With Ext.	Without Ext.					With Ext.	Without Ext.
½"	2.54 (64.52)	7.86 (199.6)	6.53 (166)	5.53 (140)	7.87 (200)	1.76 (44.7)	1.75 (44.4)	2.25 (51.0)	.38 (9.70)	.34 (8.64)	3.2 (1.5)	1.6 (0.7)
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)

Flow Control How to Order

FLOWSERVE

WC-CN44 – 66 66 – P M SE – 34 – V58

SERIES	BODY: PIPE ENDS	BALL: STEM	SEAT	BODY SEAL	CONNECTION	SIZE	VARIATIONS
WC-C44 with Stem Extension **WC-CN44** without Stem Extension	**1-** Brass **6-** 316 Stainless Steel	**1-** Brass **6-** 316 Stainless Steel	**P-** Polyfill	**M-** TFE Coated Stainless Steel	**SE-** Screw End any Sch. pipe Brass or 316 S.S.† **SW-** Socket Weld any Sch. Pipe Brass or 316L S.S.† **SWO-** Socket Weld OD Tube 316L S.S.** **BW1-** Butt Weld Sch. **TE-** Solder/Sweat Ends. Brass only Type K, L, or M Copper Tube	**14-** 1/4” **38-** 3/8” **12-** 1/2” **34-** 3/4” **1-** 1” **112-** 1 1/2” **2-** 2”	**V5-** Hydrostatic Testing **V6-** Source Inspection **V14-** Handleless Valves 3”–6” **V32-** Stainless Steel Oval Handle 1/4” – 2” **V36-** Certificate of Compliance **V48-** Extended Lever Handle **V58-** B16.34 Compliance **V59-** Extended Oval Handle 1/4” – 2” **V60-** Locking Mechanism on Std. Lever Handle
Diverter (Porting option 1) **WC-C44V1** with Stem Extension **WC-CN44V1** without Stem Extension *Diverter (Porting option 2)* **WC-C44V2** with Stem Extension **WC-CN44V2** without Stem Extension	**1-** Brass **6-** 316 Stainless Steel	**1-** Brass **6-** 316 Stainless Steel	**P-** Polyfill	**M-** TFE Coated Stainless Steel	**SE-** Screw End any Sch. pipe Brass or 316 S.S.† **SW-** Socket Weld any Sch. Pipe Brass or 316L S.S.† **SWO-** Socket Weld OD Tube 316L S.S.** **TE-** Solder/Sweat Ends. Brass only Type K, L, or M Copper Tube	**12-** 1/2” **34-** 3/4” **1-** 1” **112-** 1 1/2” **2-** 2”	
Wafer **WC-C4** with Stem Extension **WC-CN4** without Stem Extension	**1-** Brass **6-** 316 Stainless Steel	**1-** Brass **6-** 316 Stainless Steel	**P-** Polyfill	**T-** TFE	**151-** between ANSI 150# flanges **301-** between ANSI 300# flanges	**3-** 3” **4-** 4” **6-** 6”	
Flanged **WC-C51** with Stem Extension **WC-CN51** without Stem Extension	**1-** Brass **6-** 316 Stainless Steel	**1-** Brass **6-** 316 Stainless Steel	**P-** Polyfill	**T-** TFE	**151-** ANSI 150 (ANSI 300 available as a custom product)	**3-** 3” **4-** 4” **6-** 6”	

MOST COMMON

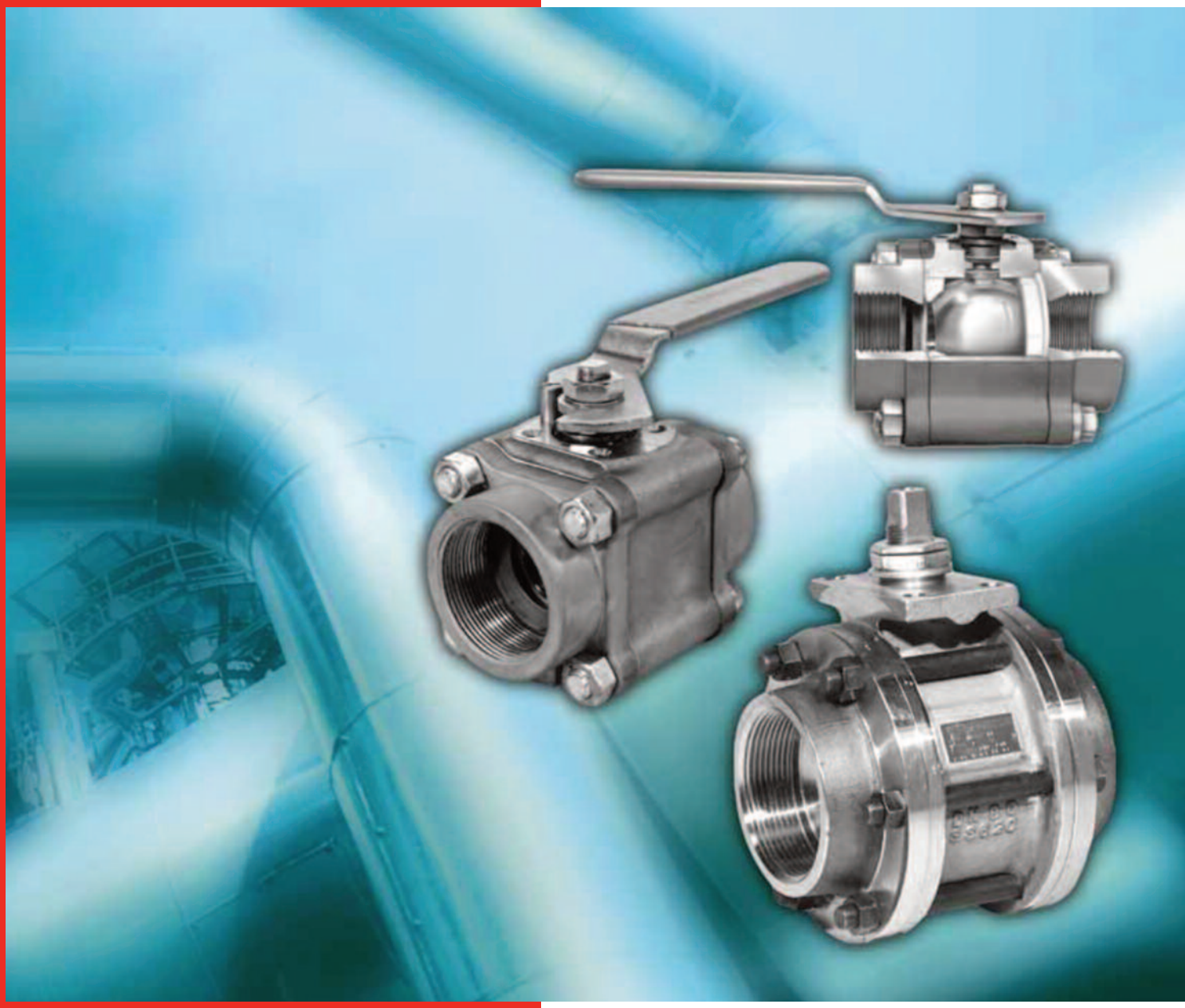
Cryogenic Ball Valves & Cryogenic Diverter Ball Valves with Extended and Non-Extended Stem

Brass Body Part #	Stainless Steel Body Part #	Description	Size
WC-C44-1166-PMSE-14	WC-C44-6666-PMSE-14	Cryogenic Ball Valve Extended Stem	1/4” NPT
WC-C44-1166-PMSE-38	WC-C44-6666-PMSE-38	Cryogenic Ball Valve Extended Stem	3/8” NPT
WC-C44-1166-PMSE-12	WC-C44-6666-PMSE-12	Cryogenic Ball Valve Extended Stem	1/2” NPT
WC-C44-1166-PMSE-34	WC-C44-6666-PMSE-34	Cryogenic Ball Valve Extended Stem	3/4” NPT
WC-C44-1166-PMSE-1	WC-C44-6666-PMSE-1	Cryogenic Ball Valve Extended Stem	1” NPT
WC-C44-1166-PMSE-112	WC-C44-6666-PMSE-112	Cryogenic Ball Valve Extended Stem	1-1/2” NPT
WC-C44-1166-PMSE-2	WC-C44-6666-PMSE-2	Cryogenic Ball Valve Extended Stem	2” NPT
WC-CN44-1166-PMSE-14	WC-CN44-6666-PMSE-14	Cryogenic Ball Valve Non-Extended Stem	1/4” NPT
WC-CN44-1166-PMSE-38	WC-CN44-6666-PMSE-38	Cryogenic Ball Valve Non-Extended Stem	3/8” NPT
WC-CN44-1166-PMSE-12	WC-CN44-6666-PMSE-12	Cryogenic Ball Valve Non-Extended Stem	1/2” NPT
WC-CN44-1166-PMSE-34	WC-CN44-6666-PMSE-34	Cryogenic Ball Valve Non-Extended Stem	3/4” NPT
WC-CN44-1166-PMSE-1	WC-CN44-6666-PMSE-1	Cryogenic Ball Valve Non-Extended Stem	1” NPT
WC-CN44-1166-PMSE-112	WC-CN44-6666-PMSE-112	Cryogenic Ball Valve Non-Extended Stem	1-1/2” NPT
WC-CN44-1166-PMSE-2	WC-CN44-6666-PMSE-2	Cryogenic Ball Valve Non-Extended Stem	2” NPT
WC-C44V1-1166-PMSE-12	WC-C44V1-6666-PMSE-12	Cryogenic Diverter Ball Valve Extended Stem	1/2” NPT
WC-C44V1-1166-PMSE-34	WC-C44V1-6666-PMSE-34	Cryogenic Diverter Ball Valve Extended Stem	3/4” NPT
WC-C44V1-1166-PMSE-1	WC-C44V1-6666-PMSE-1	Cryogenic Diverter Ball Valve Extended Stem	1” NPT
WC-C44V1-1166-PMSE-112	WC-C44V1-6666-PMSE-112	Cryogenic Diverter Ball Valve Extended Stem	1-1/2” NPT
WC-C44V1-1166-PMSE-2	WC-C44V1-6666-PMSE-2	Cryogenic Diverter Ball Valve Extended Stem	2” NPT
WC-CN44V1-1166-PMSE-12	WC-CN44V1-6666-PMSE-12	Cryogenic Diverter Ball Valve Non-Extended Stem	1/2” NPT
WC-CN44V1-1166-PMSE-34	WC-CN44V1-6666-PMSE-34	Cryogenic Diverter Ball Valve Non-Extended Stem	3/4” NPT
WC-CN44V1-1166-PMSE-1	WC-CN44V1-6666-PMSE-1	Cryogenic Diverter Ball Valve Non-Extended Stem	1” NPT
WC-CN44V1-1166-PMSE-112	WC-CN44V1-6666-PMSE-112	Cryogenic Diverter Ball Valve Non-Extended Stem	1-1/2” NPT
WC-CN44V1-1166-PMSE-2	WC-CN44V1-6666-PMSE-2	Cryogenic Diverter Ball Valve Non-Extended Stem	2” NPT

***Brass Body Options:** For Socket Weld (SW) or Sweat Ends (TE) replace “SE” in the part number with “SW” or “TE”*
***Stainless Steel Body Options:** For Socket Weld (SW) or Butt Weld (BW1) replace “SE” in the part number with “SW” or “BW1”*

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov** For further information on Proposition 65, please go to www.oehha.ca.gov/proposition-65

FLOWSERVE



Worcester Controls Three Piece Ball Valves

Series 44, Series 45, Series 59

Experience In Motion

37L

Series 44 Ball Valves

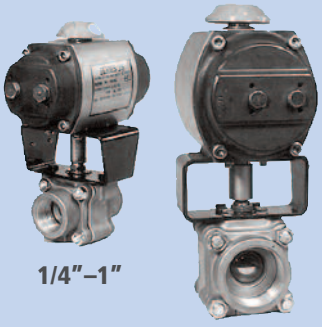
Three Piece Ball Valves

The range of Worcester Controls' seat materials is unmatched and includes Buna, Neoprene, TFE, Reinforced TFE, Polyfill, Lubetal™, High-per Fill and UHMWPE.

Body-Mounted Actuator Design

Actuators for Worcester Controls Series 44 three-piece valves are mounted on rigid, precisely machined, box-style brackets bolted to the valve center section. This brings a number of advantages to the valve user:

- Actuator loads are on the valve body;
- Actuators and brackets can be removed for service without affecting valve or piping integrity;
- Easy access for stem seal adjustment;
- Inventory simplification. Mounting brackets are common to three-piece and equivalent flanged valves.



1/4"–1"

1 1/4"–2"

Multiple End Connections, Seat and Seal Combinations

Available through a nationwide network of distributors, Worcester Controls Series 44 quarter-turn ball valves and replacement parts are stocked and ready to be adapted to each individual application.

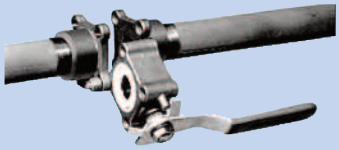
Features that make this tough, reliable ball valve so unique include tight shutoff, smooth two-way flow, advanced seat materials, a variety of interchangeable end connections, swing away three-piece construction, and a design ready for automation.

A variety of pipe ends, including socket weld, screw ends, butt weld or any combination of these, enables Series 44 valves to be adapted to fit standard and more unusual piping situations. Series 44 (V67) valves can also be welded in place, fully assembled with "G" graphite-coated 316 stainless steel body seals and reinforced TFE, Polyfill, or High-per Fill® seats.

The range of Worcester Controls' seat materials is unmatched and includes Buna, Neoprene, TFE, Reinforced TFE, Polyfill, Lubetal™, High-per Fill and UHMWPE. These seats easily handle a great majority of industrial fluids with temperatures from -50°F to +600°F including steam, chemicals, petrochemicals, petroleum products, caustics and fluids containing solids, fibrous or abrasive materials.

Series 44 Ball Valves
Three Piece Ball Valves

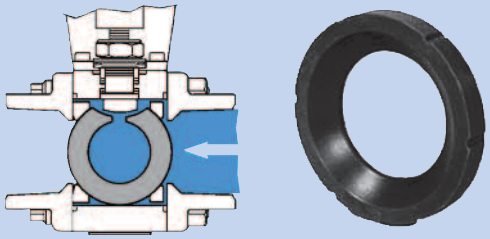
Swing-Out Design For Easy Maintenance



The Series 44 is especially well suited for use in piping systems where line breaks are required and total entry into the line is necessary. The center section can swing out, eliminating the need to cut a valve out of line and having to replace both the valve and the pipe. Because of this design, the seats, seals and ball can all be replaced quickly and easily without disturbing pipe alignment. Acting as both a valve and a union, the Series 44 eliminates the need for a separate union.

Tight Shutoff and Bidirectional Sealing

Worcester's three-piece ball valves are designed to seal bidirectionally against resilient seats. Relief slots assist in downstream sealing and reduce torque. The ball is forced to the downstream side under pressure and forced against the downstream seat to effect and maintain a seal. Consequently, the valve will give bubble-tight shutoff throughout a long service life even with seats of relatively non-resilient materials such as TFE or Polyfill. The seats are also designed to perform a wiping action during each cycle—cleaning foreign materials off both the seat and ball, assuring leak-tight sealing.



Valve shown in closed position, full pressure

The downstream sealing of Worcester Controls' three-piece valves overcomes the two most common difficulties in the use of conventional ball valves: seat damage and high operating torque. A hole in the stem slot prevents any possibility of damage due to trapped cavity pressure when the ball is open. An optional ball cavity vent is available for specific applications. The Flowserve Worcester Controls design results in smoother, more efficient valve operation.

Special Service and Approvals

Underwriter Laboratory Listed

- Flammable liquid shutoff (YRBX)
- Gas shutoff (YRPV)
- LP gas shutoff (YSDT)
- Anhydrous ammonia shutoff (YQAR)
- Compressed gas shutoff, including oxygen (YQNZ)
- Trim and Drain Valves (VQGU)

Factory Mutual Approval for:

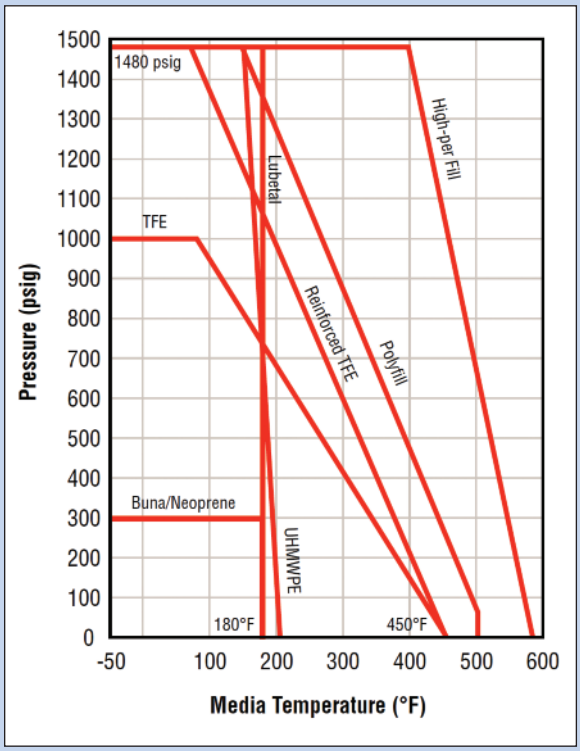
- Gas and Oil Safety Shutoff

Other Approvals

- U.S.C.G. – United States Coast Guard
- U.S.D.A. – United States Dept. of Agriculture

Consult Ratermann Cryogenics when ordering approved valves.

Seat Pressure/Temperature Ratings



Series 44 Ball Valves

Three Piece Ball Valves

- Maximum Temperature for Seals:

UHMWPE:	200°F	Neoprene:	250°F
Buna:	250°F	EPR:	350°F
TFE:	400°F	Viton:	450°F
TFE coated Stainless Steel:	650°F	Graphite coated Stainless Steel:	1000°F

- "R" (Reinforced TFE) and "P" (Polyfill) seats may be used up to a maximum of 1480 psig as shown. Some decrease in optimum seat life may be expected in some cases above 1000 psig.
- TFE body seals are limited to 200°F temperature swings. (Thermal cycles)
- For high-pressure applications to 3000 psi, Flowserve recommends the Series 4 three-piece valves with Lubetal seats. For pressures to 5000 psi, specify the Series H44 Dyn-O-Miser® valve with Lubetal or High-per Fill seats.

Caution: For high pressure media that are highly flammable, explosive or toxic, consult Ratermann Cryogenics.

NOTE: *Standard Worcester Controls valves are assembled with silicon-based break-in lubricant. For other options, consult Ratermann Cryogenics.*

Flow Coefficient

Valve Size	C_V	Equivalent Length of Schedule 40 Pipe (feet)
1/4", 3/8"	8	0.9
1/2"	8	3.1
3/4"	12	6.3
1"	32	3.1
1 1/4"	46	6.3
1 1/2"	82	4.3
2"	120	7.5

Operating Torque for Automated Valves

Valve Torque:

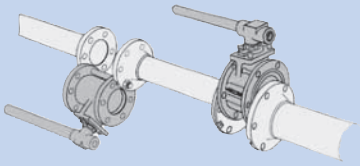
Before the actuator can be sized for any given valve application, the operating torque required for the valve must be determined. The operating torque of the ball valve is influenced by a number of factors—some are design- and materials-related, others are application- (service conditions) related. Design-related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

Series 45 Ball Valves
Three Piece Ball Valves

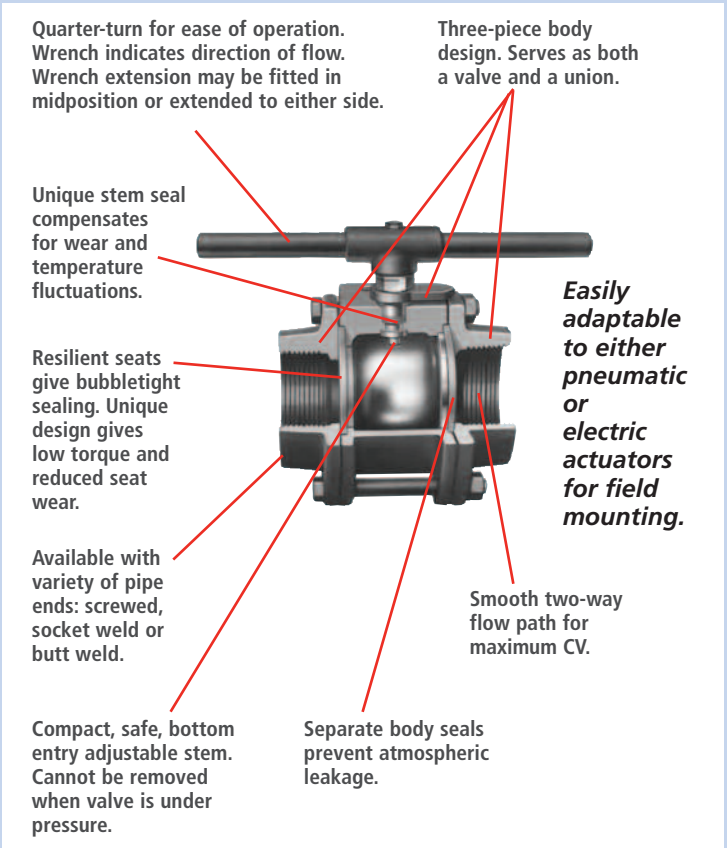
Compact, Large Diameter, Three-piece Ball Valves

Substantially Reduced Installation and Maintenance Costs

For OEM equipment and packaged piping systems, Worcester Controls Series 45 ball valves provide the best performance for the least installed cost in the 2 1/2"–6" size range. Flanges are an integral part of the valve design, providing savings in flanges, nuts, bolts and labor. Three-piece construction also means that the valve functions as both valve and union. This is a valuable feature in welded piping systems where line breaks are required.



The Series 45 valves offer all the advantages of Worcester's Series 44 three-piece and Series 51/52 flanged valves: downstream seat sealing, low operational torque, and bottom entry, blowout-proof stem. Multiple stem seal rings in a deep packing box assure zero leakage and Worcester Controls' unique seat design assures positive shutoff.



Easily Automated for On/Off or Modulating Control

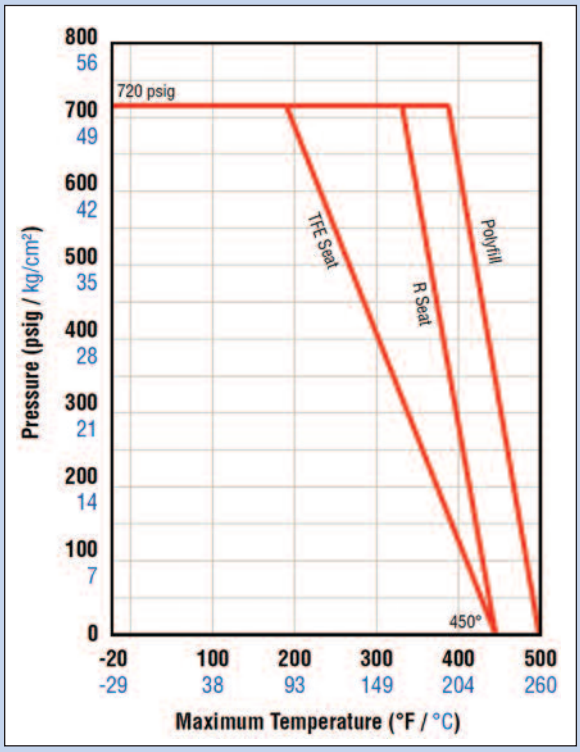
The lightweight, compact design of the Series 45 valves combined with Worcester Controls' own Series 39 pneumatic actuators creates a control package that's small yet efficient. Worcester Controls' actuators are engineered to match the performance of the valve for optimum power and safety. A wide range of options is available to complement your pneumatic or electric package, from computer compatible controls to limit switches to Cycle Length Control. For on/off or throttling applications, when used with a positioner, the actuated 45 Series valve is a dependable, precise unit. Because Flowserve Worcester Controls supplies all the elements of your control packages, we are your single source if you ever need replacement parts or service.

Flow Coefficient

Valve Size	C_v	Equivalent Length of Schedule 40 Pipe (feet)
2 1/2"	240	5
3"	350	8.3
4"	720 1	0.4
6"	1020	20.4

Body seals have pressure/temperature ratings that equal or exceed the rating of the seat.

Seat Pressure/Temperature Ratings



Series 59 Full-Port Ball Valves

Three Piece Ball Valves

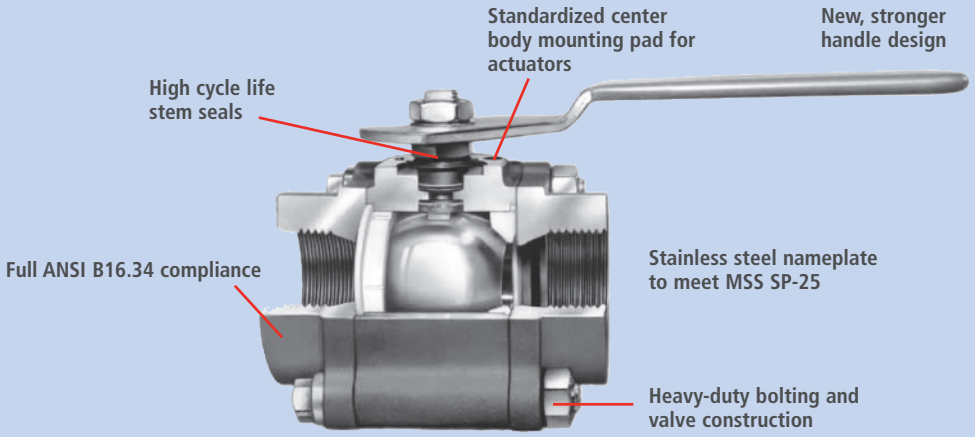
Manual and automated valves for processes requiring maximum flow area

Full-port ball valves are recommended for processes requiring minimum restriction through piping, shutoff valves, and other equipment. For example, pump inlet valves are often full-port valves. Full-port valves are also useful in systems handling slurries, viscous fluids and fluids with residues, and where the capacity to pig lines is desired.

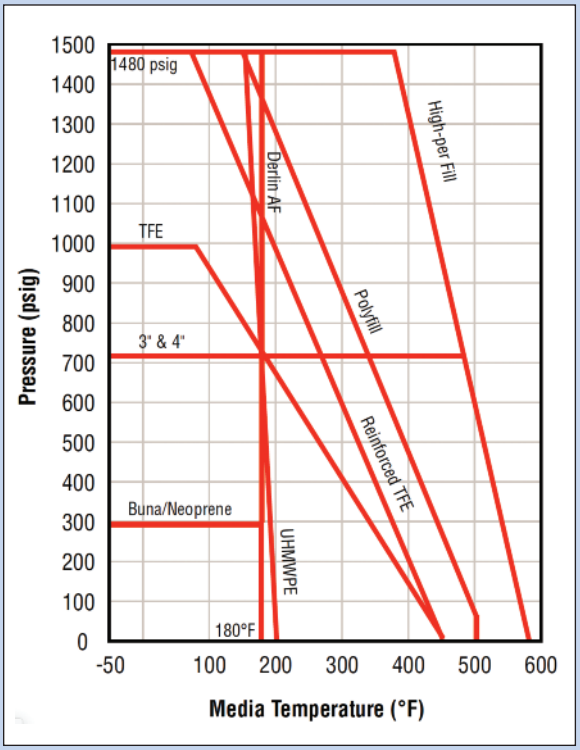
1/4"–2" Series 59 valves are rated to ANSI Class 600. 3" and 4" valves are rated to ANSI Class 300.

Flowserve Worcester Controls offers a complete line of pneumatic and electric automation packages for on/off or throttling control, including the Series 39 twin piston pneumatic actuator and the Series 75 electric actuator.

Series 59 full-port valves are available in a fire-rated configuration AF59 in sizes 1/2", 3/4", 1", 1 1/2", and 2". Flanged ANSI Class 150 and 300 full-port valves are available in sizes 1/2"–10".



Seat Pressure/Temperature Ratings



Flow Coefficient

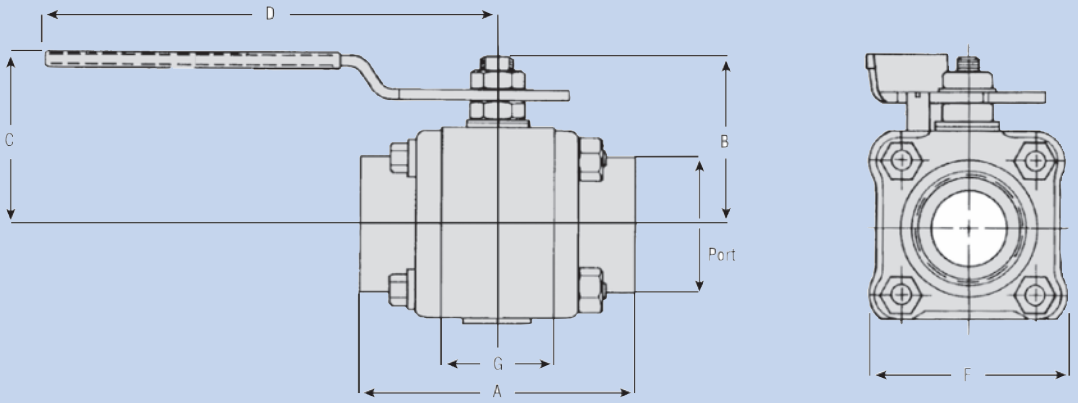
Valve Size	C_v	Equivalent Length of Schedule 40 Pipe (feet)
1/4", 3/8"	8	0.9
1/2"	38	1.4
3/4"	71	1.0
1"	110	1.9
1 1/4"	230	2.1
1 1/2"	350	2.1
2"	600	2.1
3"	1330	3.0
4"	2420	2.7

NOTE: *Body seals have a pressure/temperature rating that equals or exceeds the seat. Oxygen service valves use Polyfill in place of PEEK.*

Series 44 Ball Valves
Three Piece Ball Valves

FLOWSERVE

Dimensions



Series 44

***inches** / millimeters*

Valve Size	A	B	C	D	F	G	Socket Weld SW		O.D. Tube End SWO		O.D. Tube End TE	
							H	J	K	L	M	N
¼"	2.54	1.55	1.76	5.53	1.75	.813	.555	.44	—	—	.378	.37
	64.5	39.4	44.7	140	44.5	20.7	14.1	11.2	—	—	9.6	9.4
⅜"	2.54	1.55	1.76	5.53	1.75	.813	.690	.44	—	—	.503	.44
	64.5	39.4	44.7	140	44.5	20.7	17.5	11.2	—	—	12.8	11.2
½"	2.54	1.55	1.76	5.53	1.75	.813	.855	.44	.510	.44	.628	.56
	64.5	39.4	44.7	140	44.5	20.7	21.7	11.2	13.0	11.2	15.6	14.2
¾"	2.76	1.64	1.86	5.53	2.00	.969	1.065	.56	.760	.56	.878	.81
	70.1	41.7	47.2	140	50.8	24.6	27.1	14.2	19.3	14.2	22.3	20.6
1"	3.66	2.19	2.28	6.53	2.38	1.25	1.330	.72	1.01	.56	1.129	.97
	93.0	55.6	57.9	166	60.5	31.8	33.8	18.3	25.7	14.2	28.7	24.5
1¼"	4.16	2.38	2.47	6.53	2.70	1.63	1.675	.72	1.26	.62	1.379	1.03
	105	60.5	62.7	166	68.6	41.3	42.5	18.3	32.0	15.8	35.0	26.2
1½"	4.50	2.88	2.83	8.03	3.16	1.91	1.915	.72	1.51	.62	1.629	1.15
	114	73.2	71.9	204	80.3	48.4	48.6	18.3	38.4	15.8	41.4	29.2
2"	4.94	3.06	3.02	8.03	3.56	2.22	2.406	.84	2.01	.67	2.129	1.15
	126	77.7	76.7	204	90.4	56.3	61.1	21.3	51.1	17.0	54.1	29.2

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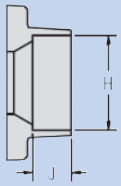
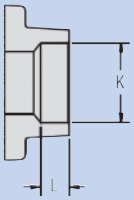
Series 44 Ball Valves
Three Piece Ball Valves

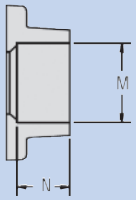
Dimensions *Continued from previous page*



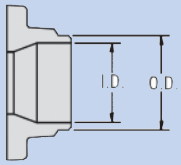
Socket weld
SW



O.D. Tube End*
SWO



Tube End TE
K, L or M
(Copper Tube)



Butt Weld BW
Sch. 5, 10 (Stainless Steel)
Sch. 40, 80 (Carbon Steel)

* The inside configuration of O.D. tube pipe ends varies by size and material.

NOTE: *For XBO and TC ends, call Ratermann Cryogenics.*

Series 44 (continued)
***inches** / millimeters*

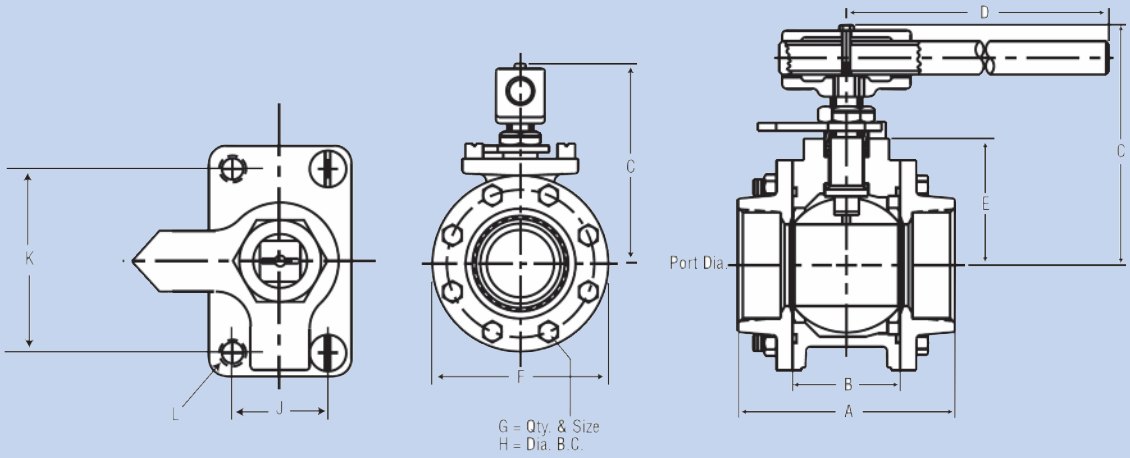
Valve Size	Butt Weld Stainless Steel				Butt Weld Carbon Steel				Port	Approx. Weight lb. / kg
	BW5 Sch. 5		BW1 Sch. 10		BW4 Sch. 40		BW8 Sch. 80			
	O.D.	I.D.	O.D.	I.D.	O.D.	I.D.	O.D.	I.D.		
¼"	—	—	.55	.406	.550	.344	—	—	.44	1.10
	—	—	14.0	10.3	14.0	8.7	—	—	11.2	.50
⅜"	—	—	.67	.547	.670	.516	—	—	.44	1.10
	—	—	17.0	13.9	17.0	13.1	—	—	11.2	.50
½"	.840	.710	.84	.672	.840	.625	.840	.550	.44	1.10
	21.3	18.0	21.3	17.1	21.3	15.9	21.3	14.0	11.2	.50
¾"	1.05	.920	1.05	.875	1.05	.812	1.05	.753	.56	1.75
	26.7	23.4	26.7	22.2	26.7	20.6	20.6	26.7	14.2	.79
1"	1.31	1.18	1.31	1.09	1.31	1.05	1.31	.957	.81	3.10
	33.3	30.1	33.3	27.8	33.3	26.6	33.3	24.3	20.6	1.41
1¼"	1.66	1.53	1.66	1.44	1.66	1.38	1.66	1.27	1.00	4.50
	42.2	38.9	42.2	36.5	42.2	35.1	42.2	32.3	25.4	2.04
1½"	1.91	1.77	1.91	1.67	1.91	1.59	1.91	1.52	1.25	6.20
	48.5	45.0	48.5	42.5	48.5	40.5	48.5	38.6	31.8	2.82
2"	2.38	2.24	2.38	2.15	2.38	2.06	2.38	1.93	1.50	9.50
	60.5	57.0	60.5	54.5	60.5	52.4	60.5	48.9	38.1	4.31

Dimensions are for reference only. For tolerances, consult Ratermann Cryogenics.

Series 45 Ball Valves
Three Piece Ball Valves

FLOWSERVE

Dimensions



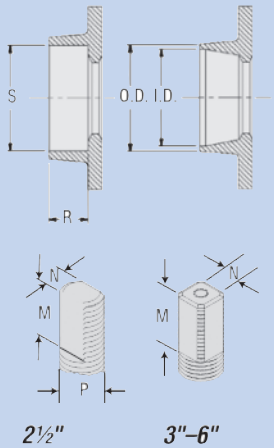
Series 45

***inches** / millimeters*

Valve Size	Port	A	B	C	D	E	F	G	H	J	K	L
2½"	2.00	5.86	2.86	5.58	8.82	2.92	5.84	6 x 7/16–20	4.92	1.25	2.75	M8
	50.8	148.8	72.6	141.7	224.0	74.2	148.3		124.9	31.8	69.9	
3"	2.50	6.66	3.28	7.22	22.00	3.88	6.44	6 x ½–20	5.50	1.75	3.38	M10
	63.5	169.2	83.3	183.4	558.8	98.6	163.6		139.7	44.5	85.9	
4"	3.25	8.41	4.28	7.84	22.00	4.48	8.12	8 x 9/16–18	6.87	1.75	3.38	M10
	82.6	213.6	108.8	199.1	558.8	113.8	206.2		174.5	44.5	85.9	
6"	4.38	11.75	5.75	11.21	26.00	6.19	11.12	8 x ¾–10	9.37	3.00	4.00	M12
	111.3	298.5	146.0	284.7	660.4	157.2	282.4		238.0	76.2	101.6	

Valve Size	M	N	P	Socket Weld		Butt Weld				Weight lbs. kg
						BW1		BW4		
				R	S	O.D.	I.D.	O.D.	I.D.	
2½"	.73	.55	.79	1.17	2.90	2.87	2.64	2.87	2.47	21.0
	18.5	13.9	20.0	29.7	74.2	72.9	67.1	72.9	63.2	9.53
3"	.65	.75	.88	1.31	3.53	3.50	3.25	3.50	3.07	30.0
	16.5	19.1	22.4	33.3	89.6	89.9	82.5	88.9	77.9	13.56
4"	.65	.75	.88	1.56	4.53	4.50	4.26	4.50	4.03	50.2
	16.5	19.1	22.4	39.6	115.0	114.3	108.2	114.3	102.0	22.7
6"	1.03	1.12	1.39	2.00	6.65	6.63	6.36	6.63	6.07	80.1
	26.2	28.4	35.3	50.8	168.9	168.3	161.5	168.3	154.3	36.33

Dimensions are for layout purposes only. For tolerances, contact Ratermann Cryogenics. Metric dimensions are converted from standard English.



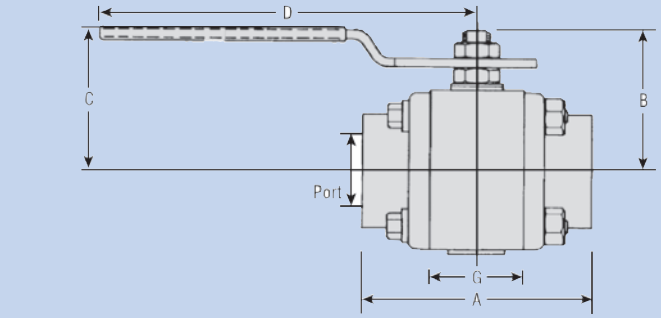
2½" *3"–6"*

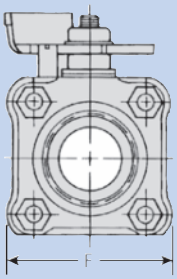
WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

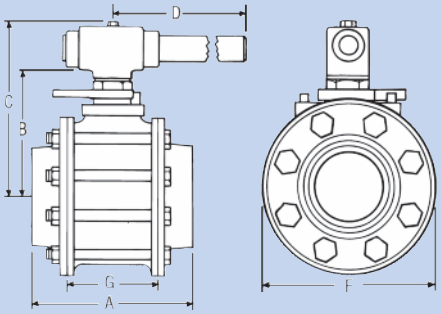
Series 59 Ball Valves
Three Piece Ball Valves

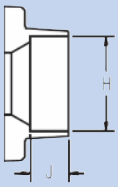
FLOWSERVE

Dimensions

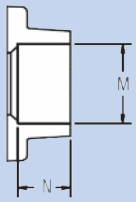




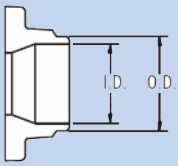




Socket Weld
SW



Tube End TE
(Brass Only)



Butt Weld BW
Sch. 10 Stainless Steel
Sch. 40 Carbon Steel

Series 59

***inches** / millimeters*

Valve Size	A	B	C	D	F	G	Socket Weld		Tube End		Butt Weld Schedule 10		Butt Weld Schedule 40		Port	Weight lb. / kg
							H	J	M	N	O.D.	I.D.	O.D.	I.D.		
¼"	2.54	1.55	1.76	5.53	1.75	.813	.555	.440	.378	.370	.550	.406	.550	.344	.440	1.10
	64.52	39.4	44.7	140.5	44.5	20.7	14.1	11.2	9.6	9.40	14.4	10.3	14.4	8.7	11.2	0.5
⅜"	2.54	1.55	1.76	5.53	1.75	.813	.690	.440	.504	.449	.670	.547	.670	.516	.440	1.10
	64.52	39.4	44.7	140.5	44.5	20.7	17.5	11.2	12.8	11.2	17.0	13.9	17.0	13.1	11.2	0.5
½"	2.76	1.64	1.86	5.53	2.00	.969	.855	.440	.628	.560	.840	.672	.840	.625	.560	1.80
	70.1	41.7	47.24	140.5	50.8	24.6	21.7	11.2	15.6	14.2	21.3	17.1	21.3	15.9	14.2	0.82
¾"	3.66	2.19	2.28	6.53	2.38	1.25	1.07	.560	.878	.810	1.05	.875	1.05	.812	0.81	3.10
	92.96	55.6	57.91	165.9	60.5	31.8	27.1	14.2	22.3	20.6	26.7	22.2	26.7	20.6	20.6	1.41
1"	4.16	2.38	2.47	6.53	2.70	1.63	1.33	.720	1.13	.97	1.31	1.09	131	1.05	1.00	4.50
	105.7	60.5	62.74	165.9	68.6	41.3	33.8	18.3	28.7	24.6	33.3	27.8	33.3	26.6	25.4	2.05
1¼"	4.50	2.88	2.83	8.03	3.16	1.91	1.68	.720	1.38	1.03	1.66	1.44	1.66	1.38	1.25	6.20
	114.3	73.2	71.88	204.0	80.3	48.4	42.5	18.3	35.0	25.2	42.2	36.5	42.2	35.1	31.8	2.81
1½"	4.94	3.06	3.02	8.03	3.56	2.22	1.92	.720	1.63	1.15	1.91	1.67	1.91	1.59	1.50	9.50
	125.5	77.7	76.71	224.0	9.04	56.3	48.6	18.3	41.4	29.2	48.5	42.5	48.5	40.5	38.1	4.31
2"	5.86	4.56	5.58	8.82	4.57	2.86	2.41	.840	—	—	2.38	2.15	2.38	2.06	2.00	25.00
	149.0	116	142.0	224.0	116.0	72.6	61.2	21.34			60.5	54.5	60.5	52.3	50.8	11.3
3"	7.54	6.31	7.84	22.00	8.13	4.28	3.54	1.31	—	—	3.50	3.25	3.50	3.07	3.25	50.20
	191.0	160.3	199.0	558.8	206.0	108.0	89.9	33.27			88.9	82.55	88.9	77.98	82.55	22.8
4"	11.75	8.96	11.21	26.00	11.13	5.75	4.53	1.56	—	—	4.50	4.26	4.50	4.03	4.03	80.10
	298.0	227.9	284.0	660.0	282.0	146.0	115.1	39.62			114.3	108.2	114.3	102.4	102.4	36.4

Dimensions are given for layout purposes only. For tolerances, consult Ratermann Cryogenics. Metric equivalents are converted from Standard English.

Three Piece Ball Valves

How to Order – Series 44

Series 44

WC-44 – 66 66 – T T SW – 114 – ____

SERIES	BODY: PIPE ENDS	BALL: STEM	SEAT	BODY SEAL	END TYPE	SIZE	OPTIONS
WC-44	**1-** Brass **4-** Carbon Steel **6-** 316 Stainless **A-** Alloy 20	**1-** Brass (chrome plated) **4-** Carbon Steel (chrome plated) **6-** 316 S.S. **7-** Monel **A-** Alloy 20 **C-** Hastelloy C	**B-** Buna **N-** Neoprene **T-** TFE **R-** Reinforced TFE **P-** Polyfill **U-** UHMWPE **X-** High-per Fill **Y-** Lubetal	**B-** Buna **N-** Neoprene **T-** TFE **E-** EPR **V-** Viton **M-** TFE Coated 316 S.S. **G-** Graphite – Coated 316 S.S. **U-** UHMWPE	**SE-** Screwed Pipe Ends (NPT) Any Sch. Pipe† Carbon Steel, Stainless Steel Alloy Butt Weld (BW) ends: **BW1-** Stainless Steel Sch. 10 **BW4-** Carbon Steel Sch. 40 **BW4-** Stainless Steel Sch. 40 **BW5-** Stainless Steel Sch. 5 **BW8-** Carbon Steel Sch. 80 **TE-** Solder/Sweat Ends Brass – Type K, L, or M Copper **SW-** Socket Weld Ends, Any Sch. Pipe†, Carbon Steel, Stainless Steel, Alloy 20 **SWO-** Socket Weld Ends OD Tube S.S. (not available in 1/4" and 3/8" sizes) **TC-** Quick Disconnect **XBO-** Extended Butt Weld **NP-** No Pipe Ends, body bolts and nuts	**14-** 1/4" **38-** 3/8" **12-** 1/2" **34-** 3/4" **1-** 1" **1 14-** 1 1/4" **1 12-** 1 1/2" **2-** 2"	(blank) Built with Level Handle **E-** No Handle valve built for automation **A-** No Handle†† **B-** No Handle†† **G-** Stem Grounding Spring **K-** Locking Handle **V-** Vacuum Service Prep **X-** Oxygen Service Prep

***Variations (V–Numbered Options) are noted at the end of the order number if needed. Leave blank if no variations. See list to the right for details.*

NOTE: TO ORDER V67 WELD–IN–PLACE VALVES: Series 44 valves with "G" body seals and seats of Reinforced TFE (R), Polyfill (P), or High–per Fill (X) may be welded in a line in the assembled condition.

Add V58 to ordering code if full B16.34 compliance is required.

Full ANSI B16.34 compliance requires a hydrotest and certified material test reports.

ORDERING EXAMPLE: 11/4" Series 44 valve with 316 S.S. body, ball and stem, TFE seats and seals, and socket weld ends.

EXTERNALS: Externals, including handles, are normally constructed of zinc plated carbon steel. Handles are vinyl coated. When required, the body bolts, nuts, retaining nut, handle nut, lock washer, stop pin and handle are also available in stainless steel by special order (S–7 suffix in ordering code), and come standard when ordering 4466 Stainless Steel or 44AA Alloy 20 valves.

†All IPS schedules of stainless, carbon and alloy steel pipe, S.P.S. copper pipe and red brass pipe.

††To order a Series 44 valve for use with: 34 or 36 actuators, use prefix ordering code "A". EXAMPLE: 1" A 4446 6 PMSE, or with 39 or 75 actuators, use prefix ordering code "B".

⚠ **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.

Variations (V-numbers): Listing of V-Number Descriptions

V3	Upstream Relief Hole
V5	Hydrostatic Testing
V6	Source Inspection
V17	Grounding Thrust bearing
V20	Oxygen Service
V32	Oval Handle
V33	Oxygen Service without Source Inspect.
V36	Certificate of Compliance
V37	Certificate of Compliance and Hydro Testing
V38	Assemble without Lubricant
V46	Silicon-free Lubricant
V48	Extended Lever Handle
V58	B16.34 Compliance
V59	Extended Oval Handle
V60	OSHA Lockout
V67	Weld-in-Place Valves
V72	Cert. of Comp. European Pressure
V73	Valves or repair kits with cavity filler seat
V74	CMTRs and Hydro Testing and report
V77	CMTRs

⚠ **WARNING:** Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

Three Piece Ball Valves

FLOWSERVE

How to Order – Series 45

Series 45

WC-45 – 66 66 – R T SE – 4

SERIES	BODY: PIPE ENDS	BALL: STEM	SEAT	BODY SEAL	END TYPE	SIZE
WC-45	**4-** Carbon Steel **6-** 316 Stainless Steel	**6-** 316 S.S.	**T-** TFE **R-** Reinforced TFE **P-** Polyfill **U-** UHMWPE (2 1/2" only)	**T-** TFE **M-** TFE Coated 316 S.S. (2 1/2" only **U-** UHMWPE (2 1/2" only)	**SE-** Screw Ends **SW-** Socket Weld **BW4-** Butt Weld Carbon Steel Sch. 40 **BW1-** Butt Weld Stainless Steel Sch. 10 **NP-** No Pipe Ends	**212-** 2 1/2" **3-** 3" **4-** 4" **6-** 6"

***Variations (V–Numbered Options) are noted at the end of the order number if needed. Leave blank if no variations. See list below for details.*

Ordering example above depicts: A 4" Series 45 Valve with a 316 Stainless Steel Body, Pipe Ends, Ball and Stem, Reinforced TFE and TFE Seals, with Screw Ends.

Variations (V-numbers): Listing of V-Number Descriptions

Blank - No Variations
V3 - Upstream Relief Hole
V5 - Hydrostatic Testing
V6 - Source Inspection
V14 - Handleless Valve
V17 - Grounding Thrust Bearing
V20 - Oxygen Service Source Inspection
V33 - Source Inspection
V36 - Certificate of Compliance
V37 - Certificate of Compliance & Hydro Testing
V46 - Silicone Free Lubricant
V51 - High Cycle Stem Build
V73 - Valves or repair kits with cavity filler seat
V74 - CMTRs and Hydro Testing and report
V77 - CMTRs

How to Order – Series 59

Series 59

WC-59 – 66 66 – T T SW – 114 – ____

SERIES	BODY: PIPE ENDS	BALL: STEM	SEAT	BODY SEAL	END TYPE	SIZE	OPTIONS
WC-59	**1-** Brass **4-** Carbon Steel **6-** 316 Stainless Steel	**1-** Brass **6-** 316 S.S.	**B-** Buna **N-** Neoprene **T-** TFE **R-** Reinforced TFE **P-** Polyfill **U-** UHMWPE **X-** High-per Fill **Y-** Delrin AF	**B-** Buna **N-** Neoprene **T-** TFE **E-** EPR **V-** Viton **M-** TFE Coated 316 S.S. **G-** Graphite – Coated 316 S.S. **U-** UHMWPE	**SE-** Screw Ends **SW-** Socket Weld **TE-** Tube End (brass only) **BW4-** Butt Weld Carbon Steel Sch. 40 **BW1-** Butt Weld Stainless Steel Sch. 10 **NP-** No Pipe Ends	**14-** 1/4" **38-** 3/8" **12-** 1/2" **34-** 3/4" **1-** 1" **114-** 1 1/4" **112-** 1 1/2" **2-** 2"	(blank) Built with Level Handle **E-** No Handle valve built for automation **A-** No Handle†† **B-** No Handle†† **G-** Stem Grounding Spring **K-** Locking Handle **V-** Vacuum Service Prep **X-** Oxygen Service Prep
	4- Carbon Steel **6-** 316 Stainless Steel	**6-** 316 S.S.	**T-** TFE **R-** Reinforced TFE **P-** Polyfill	**T-** TFE **Z-** Graphite (2" only)	**SE-** Screw Ends **SW-** Socket Weld **BW4-** Butt Weld Carbon Steel Sch. 40 **BW1-** Butt Weld Stainless Steel Sch. 10 **NP-** No Pipe Ends	**2-** 1/4" **3-** 3/8" **4-** 1/2"	**E-** No Handle valve built for automation **V-** Vacuum Service Prep **X-** Oxygen Service Prep

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

***Variations (V–Numbered Options) are noted at the end of the order number if needed. Leave blank if no variations. See list below for details.*

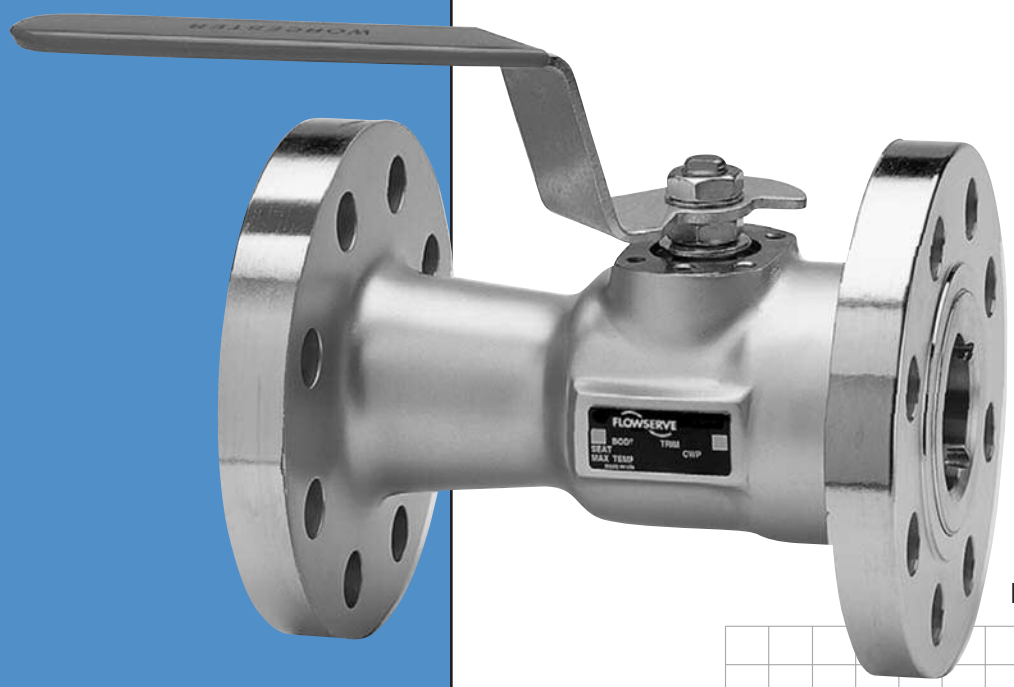
Ordering example depicts 1½" Series 59 with 316 stainless steel body, pipe ends, ball and stem, reinforced TFE seats, TFE body seals, and socket weld ends.

†† To order a Series 59 Valve for use with: 34 or 36 actuators, use prefix ordering code "A". Example: 1" A 5946 PMSE. With 39 or 75 actuators, use prefix ordering code "B".

Variations (V-numbers): Listing of V-Number Descriptions

V 3 - Upstream Relief Hole
V 5 - Hydrostatic Testing
V 6 - Source Inspection
V14 - Handleless Valve (2"–4")
V17 - Grounding Thrust Bearing
V20 - Oxygen Service
V32 - Oval Handle (¼"–1½")
V33 - Oxygen Service without Source Inspect.
V36 - Certificate of Compliance
V37 - Certificate of Compliance & Hydro Testing
V38 - Assemble without Lubricant
V46 - Silicon Free Lubricant
V48 - Extended Lever Handle (¼"–1½")
V51 - High Cycle Stem Build (2"–4")
V58 - B16.34 Compliance
V59 - Extended Oval Handle (¼"–1½")
V60 - OSHA Lockout (¼"–1½")
V67 - Weld-in-Place Valve (¼"–1½")
V72 - Cert. of Comp., European Pressure Equipment Directive Conformance
V73 - Valves or repair kits with cavity filler seat
V74 - CMTRs and Hydro Testing and report
V77 - CMTRs

FLOWSERVE



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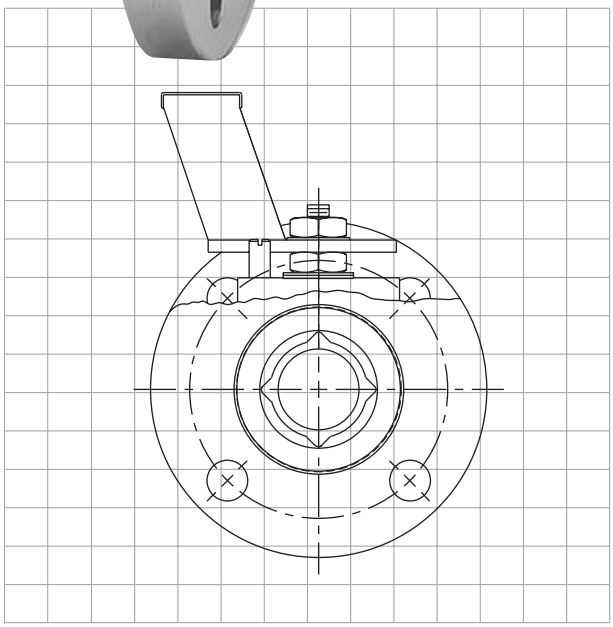


Series 51/52 Flanged Ball Valves

Standard and Anti-Static Valves in ANSI Class 150 and 300

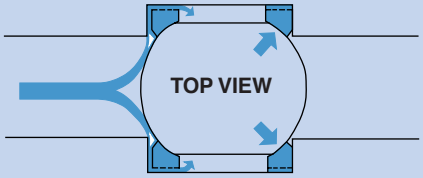
Series 51/52 Flanged Ball Valves

Designed to Automate, Control, Contain and Shut Off Your Process

Flowserve's Series 51/52 is a standardized line of flanged ball valves in sizes ½"–10" with flange ratings of ANSI Class 150 and 300. The combination of elements of this standardization provides a manually operated or automated valve which exceeds the production requirements of your process. Such requirements include high-cycle operation, pressure integrity, material compatibility, speed of operation, automatic control and high temperature endurance.

Tight Shutoff

Series 51/52 valves are two-way flow ball valves designed to seal bi-directionally against resilient seats. The ball is forced downstream under pressure against the downstream seat to effect and maintain a seal. The resiliency of the seats is a result of design as well as the characteristics of materials used. Consequently, the valve will give bubble-tight shutoff throughout a long service life. The seats are also designed to perform a wiping action during each cycle. This wiping action cleans foreign materials off both the seat and ball, assuring leak-tight sealing.



A pair of unique seats with relief slots makes downstream sealing possible. The result is less friction, lower operating torque, less seat wear, and longer service life. The unique seats also permit the valve to operate at a higher pressure differential with lower torques than double-sealing valves in which there is sealing between both seats and the ball.

Downstream sealing prevents seat damage and lowers operating torque while providing full bidirectional capability. The Flowserve design results in smoother, more efficient valve operation.

Leak-Tight Stem Design

Flowserve's Series 51/52 valves outperform globe and gate valves. Not only are they easier to automate, best of all, they won't leak as sliding stem valves often do. The no-leak rotary stem seal features a bottom-entry, adjustable, self-compensating stem design. A hole in the ball's stem slot prevents any possibility of damage due to trapped cavity pressure when the ball is open. The stem seal package consists of one or two thrust washers and one or a series of stem seal rings, depending on valve size. On ½"–2" valves, a pair of Belleville washers acts as a spring to compensate for wear and thermal expansion. On larger valves, the deep stuffing box with additional packing provides resiliency.

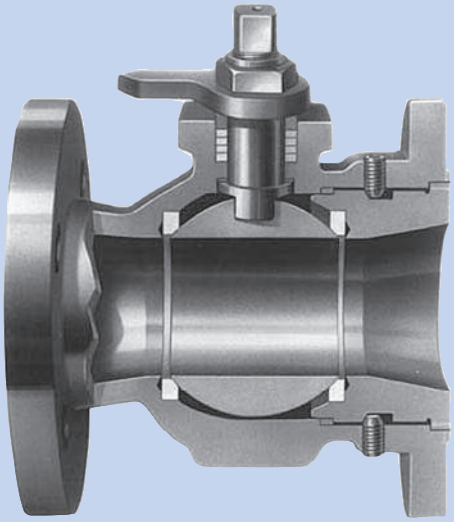
Performance to Match Your Process

A wide variety of body, seat and seal materials coupled with advanced seat technology means dependable, high-cycle control on steam, petroleum products, chemicals, and abrasive liquids.

Series 51/52 flanged ball valves are used for manual on/off operation with lever handles or gear operators. They are also easy to automate pneumatically or electrically. In addition, these valves can be very flexible in operation. You can open and close them as frequently as necessary and at any speed you choose. Closing too rapidly, however, may cause pressure shock (hammer) in the piping system.

As for special applications, Flowserve can provide flanged valves to handle them. Special applications include toxic chemicals, cryogenics, viscous fluids, vacuum sealing, chlorine, steam and high-cycle production.

For the Series 51/52 solution to your control problems, contact your local Worcester Controls stocking distributor or area sales manager.



- One-Piece Body Construction
- High-Cycle Stem Seals
- Compact, Safe, Blowout-Proof Stem
- Smooth, Two-Way Flow Path
- Unique Seat Design Downstream Sealing
- Separate Body Seal
- 150# or 300# ANSI Flanges
- Pre-Drilled Mounting Pad For Actuation

Series 51/52 Flanged Ball Valves

Features and Benefits

Sizes: ½", ¾", 1", 1½", 2", 3", 4", 6", 8", 10"

Flanges: Series 51 – ANSI 150#
Series 52 – ANSI 300#

Body Materials: Cast Carbon Steel to ASTM A216 Grade WCB
Cast Stainless Steel to ASTM A351 Grade CF8M (316)
Ductile Iron to ASTM A536 (Series 51 3"–8" only)

Thrustbearing: (½"–2" only) Polyfill® or UHMWPE
(3"–10" only) 25% glass filled TFE

Stem: One-piece bottom-entry design. 316 S.S. stem available with all body materials and sizes. Alloy 20® (through 4"), Monel® (through 8"), Hastelloy® C (through 8")

Stem Seals: (½"–2") Polyfill or UHMWPE
(3"–10") 15% glass filled TFE

Seats*: TFE, Reinforced TFE, Polyfill and UHMWPE

Body Seals: TFE, Buna (through 8"), Viton® (through 8"), Graphite (3"–10"), EPR (½"–2"), 316 "S" Gasket (½"–2"), UHMWPE (½"–8")

Ball: 316 S.S., Monel (through 8"), Alloy 20 (through 4"), Hastelloy C (through 8")

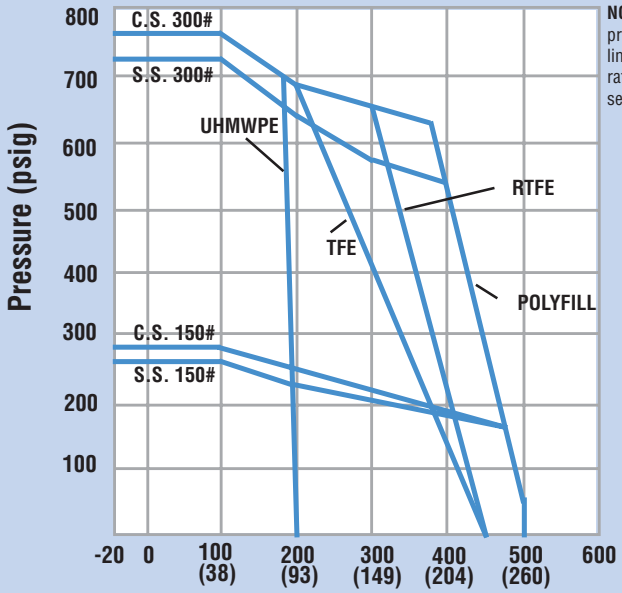
End Plug: Retention bolt style (3"–10"), threaded style (½"–2")

Operation: ½"–8" with handle. 10" supplied without handle. For use with gear operators and electric or pneumatic actuators.

Standards:
ANSI B16.10, face-to-face dimensions
ANSI B16.5, 150# and 300# flange dimensions
MSS SP-72, ball valves for general service
NACE MR-01-75, Pipeline valve standard for sour gas service (½"–8" only).
API 6D, Pipeline valves (2"–8" carbon steel and stainless steel). Specify V-39 option.
ANSI B16.34.
MSS SP6 flange finish (125–250 Ra)
Factory Mutual Approval for Oil & Gas Safety Shutoff. Consult Ratermann Cryogenics.

NOTE: *Certifications to above standards are available upon request. Specify when ordering.*

Pressure/Temperature Rating



NOTE: Max. working pressure/temperature limited by both flange rating, seat and body seal capability.

C_v Data

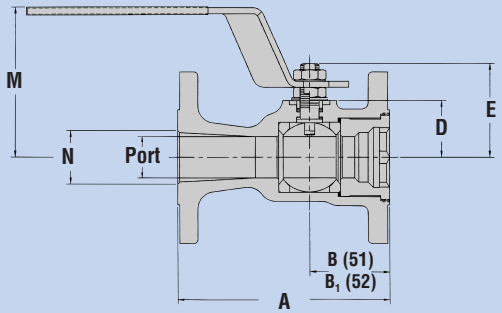
Valve Size	C_v	Equiv. Length of Sched. 40 pipe, feet
½"	8	**3.9**
¾"	12	**8.7**
1"	32	**3.6**
1½"	82	**3.7**
2"	120	**6.5**
3"	350	**7.1**
4"	720	**6.9**
6"	1020	**20.4**
8"	1800	**37.7**
10"	2970	**42.6**

Variation (V-Numbered Options)

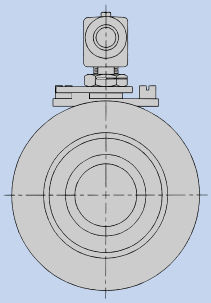
V 3	Upstream Relief Hole
V 5	Hydrostatic Testing
V 6	Source Inspection
V 14	Handleless Valves (3"–8")
V 17	Grounding Thrust Bearing
V 20	Oxygen Service (½"–2")
V 32	Oval Handle (½"–2")
V 33	Oxygen Service w/o Source Inspect. (½"–2")
V 34	51/52 Threaded End Plug (3"–8")
V 36	Certificate of Compliance
V 37	Certificate of Compliance & Hydro Testing
V 39	API-6D Approved Valves (2"–8")
V 46	Silicone Free Lubricant
V 48	Extended Lever Handle (½"–2")
V 51	High Cycle Stem Build (3"–8")
V 58	B16.34 Compliance
V 59	Extended Oval Handle (½"–2")
V 66	Certificate of Compliance for European Valve Orders
V 72	Cert. of Comp. for European Pressure Equipment Directive Conformance

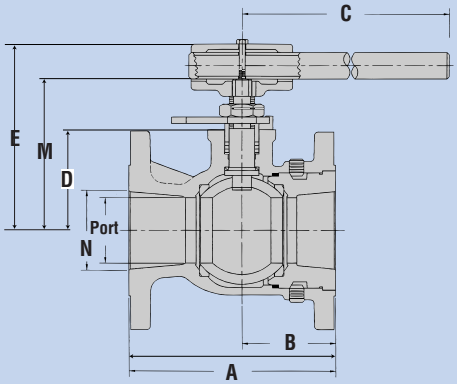
Series 51/52 Flanged Ball Valves

Dimensions – inches (mm) — *See Page 37M-5 for Class 150 and 300 flange dimensions*



½"–2"
Threaded End Plug Retention

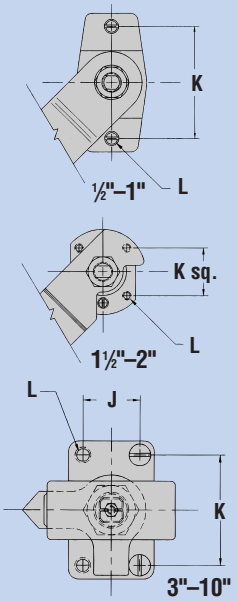


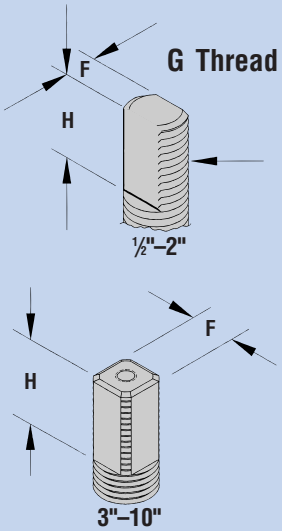


3"–10"
(shown with antistatic option 3"–10" AF 51/52 only)
Bolted End Plug Retention
(Threaded Retention available)

Valve Size	51,AF51 52,AF52 Port	A	A	B	B_1	C	D	E	M	N	Weight lb. (kg) 51/AF51 52, AF52	
½"	.44 (11.2)	4.25 (108.0)	5.50 (139.7)	1.81 (46.0)	2.31 (58.7)	5.53 (140.5)	.94 (23.9)	1.55 (39.4)	2.88 (73.2)	.59 (15.0)	4.5 (2.0)	5.5 (2.5)
¾"	.56 (14.2)	4.62 (117.4)	6.00 (152.4)	1.94 (49.3)	2.44 (62.0)	5.53 (140.5)	1.03 (26.2)	1.64 (41.7)	2.98 (75.7)	.83 (21.1)	6.6 (3.0)	7.5 (3.4)
1"	.81 (20.1)	5.00 (127.0)	6.50 (165.1)	2.25 (57.0)	2.75 (70.0)	6.53 (165.9)	1.27 (32.3)	2.19 (55.6)	3.40 (86.4)	1.05 (26.7)	7.9 (3.6)	9.5 (4.3)
1½"	1.25 (31.8)	6.50 (165.0)	7.50 (109.5)	2.45 (62.2)	2.95 (74.9)	8.10 (205.7)	1.73 (43.9)	2.88 (73.1)	4.58 (116.3)	1.63 (41.4)	13.0 (5.9)	16.1 (7.3)
2"	1.50 (38.1)	7.00 (178.0)	8.50 (215.9)	2.67 (67.8)	3.17 (80.5)	8.10 (205.7)	1.92 (48.8)	3.06 (77.8)	4.77 (121.2)	2.01 (51.1)	18.1 (8.2)	22.1 (10.0)
3"	2.50 (63.5)	8.00 (203.2)	11.12 (282.6)	3.62 (92.0)	—	22.0 (558.8)	3.88 (98.6)	5.69 (144.5)	7.22 (183.4)	3.06 (77.7)	39.5 (17.9)	50 (22.7)
4"	3.25 (82.6)	9.00 (228.6)	12.00 (304.8)	4.00 (101.6)	—	22.0 (558.8)	4.48 (113.8)	6.31 (160.3)	7.84 (199.1)	4.03 (102.4)	62 (28.1)	80 (36.3)
6"	4.38 (111.3)	10.50 (266.7)	15.88 (403.3)	4.25 (108.0)	—	26.0 (660.4)	6.19 (157.2)	8.96 (227.6)	11.21 (284.7)	6.06 (153.9)	125 (56.7)	150 (68.0)
8"	5.69 (144.5)	11.50 (292.0)	16.50 (419.1)	5.69 (144.5)	—	26.0 (660.4)	7.28 (184.9)	10.05 (255.3)	12.31 (312.7)	8.00 (203.2)	184 (83.5)	225 (102.1)
10"	7.38 (187.5)	13.00 (330.2)	18.00 (457.0)	7.12 (180.9)	—	— —	9.28 (235.7)	12.76 (324.1)	— —	10.00 (254.0)	310 (139.5)	490 (220.5)

Valve Size	F	G	H	J	K	L
½"	.217 (5.51)	3/8 UNF	.28 (7.11)	— —	1.89 (48.01)	¼-20
¾"	.217 (5.51)	3/8 UNF	.28 (7.11)	— —	2.13 (54.10)	¼-20
1"	.296 (7.52)	7/16 UNF	.43 (10.92)	— —	2.50 (63.50)	¼-20
1½"	.343 (8.71)	9/16 UNF	.61 (15.49)	— —	1.39 (35.31)	¼-20
2"	.343 (8.71)	9/16 UNF	.61 (15.49)	— —	1.39 (35.31)	¼-20
3"	.745 (18.92)	— —	.653 (16.6)	1.75 (44.45)	3.38 (85.85)	M10
4"	.745 (18.92)	— —	.653 (16.6)	1.75 (44.45)	3.38 (85.85)	M10
6"	1.120 (28.45)	— —	1.031 (26.2)	3.00 (76.2)	4.00 (101.6)	M12
8"	1.120 (28.45)	— —	1.031 (26.2)	3.00 (76.2)	4.00 (101.6)	M12
10"	1.375 (34.93)	— —	1.252 (31.8)	2.25 (57.15)	8.25 (209.5)	5/8-11





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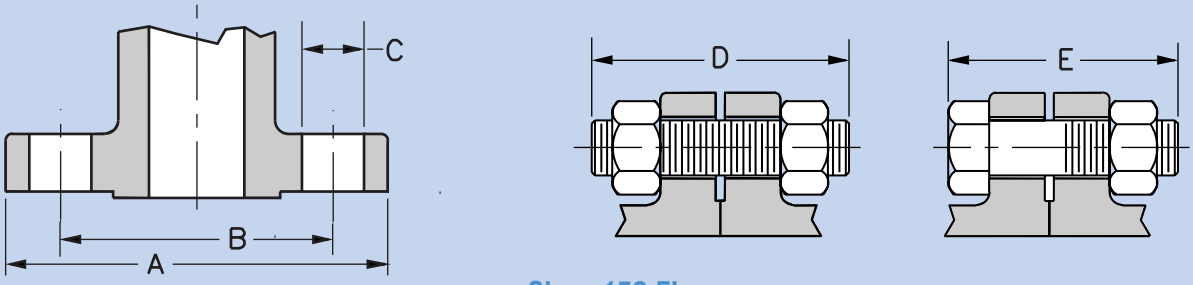
Series 51/52 Flanged Ball Valves

Dimensions – inches

Class 150 and 300 Flanged Valves ASME B16.5-1966



Class 150 Flanges

Nominal Pipe Size	Outside Diameter of Flange A	Diameter of Bolt Circle B	Diameter of Bolt Holes C	Number of Bolts	Diameter of Bolts	Length of Stud Bolts with 2 Nuts D	Length of Bolts E
½"	3.50	2.38	0.62	4	½"	2.25	2.00
¾"	3.88	2.75	0.62	4	½"	2.25	2.00
1"	4.25	3.12	0.62	4	½"	2.50	2.25
1½"	5.00	3.88	0.62	4	½"	2.75	2.50
2"	6.00	4.75	0.75	4	⅝"	3.25	2.75
3"	7.50	6.00	0.75	4	⅝"	3.50	3.00
4"	9.00	7.50	0.75	8	⅝"	3.50	3.00
6"	11.00	9.50	0.88	8	¾"	4.00	3.25
8"	13.50	11.75	0.88	8	¾"	4.25	3.50
10"	16.00	14.25	1.00	12	⅞"	4.50	4.00

Class 300 Flanges

Nominal Pipe Size	Outside Diameter of Flange A	Diameter of Bolt Circle B	Diameter of Bolt Holes C	Number of Bolts	Diameter of Bolts	Length of Stud Bolts with Nuts D	Length of Bolts E
½"	3.75	2.62	0.62	4	½"	2.50	2.25
¾"	4.62	3.25	0.75	4	⅝"	3.00	2.50
1"	4.88	3.50	0.75	4	⅝"	3.00	2.50
1½"	6.12	4.50	0.88	4	¾"	3.50	3.00
2"	6.50	5.00	0.75	8	⅝"	3.50	3.00
3"	8.25	6.62	0.88	8	¾"	4.25	3.50
4"	10.00	7.88	0.88	8	¾"	4.50	3.75
6"	12.50	10.62	0.88	12	¾"	4.75	4.25
8"	15.00	13.00	1.00	12	⅞"	5.50	4.75
10"	17.50	15.25	1.12	16	1"	6.25	5.50

Flowserve flanged valves are designed to conform to ASME B16.5-1996 standards. Selected dimensions from that publication are shown here for basic planning purposes only. For detailed flange dimensions, always refer to ASME B16.5-1996, available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

Series 51/52 Flanged Ball Valves

How to Order

WC-51	–	66	66	–	T	T	150	–	112	–	____

SERIES	BODY: END PLUGS	BALL: STEM	SEAT	SEALS**	END TYPE	SIZE	OPTIONS
WC-51 Series 51 **WC-52** Series 52	**2-** Ductile Iron* **4-** Carbon Steel **6-** 316 Stainless Steel	**6-** 316 S.S. **7-** Monel **A-** Alloy 20 **C-** Hastelloy C	**T-** TFE **R-** Reinforced TFE **P-** Polyfill **U-** UHMWPE	**T-** TFE **B-** Buna **V-** Viton **E-** EPR **Z-** Graphite **M-** TFE Coated 316 S.S. **U-** UHMWPE	**150-** ANSI 150# Flanges **300-** ANSI 300# Flanges	**12-** 1/2" **34-** 3/4" **1-** 1" **112-** 1 1/2" **2-** 2" **3-** 3" **4-** 4" **6-** 6" **8-** 8" **10-** 10"	(blank) No Variations **S7-** Complete S.S. Externals (manually operated valves only) **V-** Numbers *See page 37M-3 for listings*

**Use only one letter if body seal is same material as seat. TM, RM, PM, TZ, RZ, PZ qualified to API 607.
*Ductile Iron valves available in Style 51, sizes 3"–8" only.
†To order a ½"–2" Series 51 or 52 valve for use with: 34 or 36 actuators, use prefix ordering code "A". (EXAMPLE: 1" A 5146 6 PM150)
39 or 75 actuators, use prefix ordering code "B".

Ordering Example: A 3" Series 51 with Ductile Iron body and end plug, Stainless Steel ball and Stainless Steel stem, Reinforced TFE seats, TFE seals and 150# flanges.

NOTE: Please refer to Specification sections for material availability. Standard Flowserve valves are assembled with silicon-based break-in lubricant. For other options, consult Ratermann Cryogenics.

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. Due to continuous development of our product range, we reserve the right to alter the product specifications contained in this brochure, as required.

MOST COMMON

Worcester Cryogenic Ball Valve

Part #	Description
WC-C51-6666-PT150-3	Worcester Cryogenic Ball Valve Extended All Stainless Steel 3" 150# Flanged
WC-C51-6666-PT150-4	Worcester Cryogenic Ball Valve Extended All Stainless Steel 4" 150# Flanged
WC-C51-6666-PT150-6	Worcester Cryogenic Ball Valve Extended All Stainless Steel 6" 150# Flanged

Pneumatic and Electric Actuators for Series 51/52 Valves

For Details...

Series 39
Pneumatic Actuator
See pages
37N 1-7

Series 75
Electric Actuator
See pages
37O 1-6

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

FLOWSERVE

Worcester Controls Series F39 Pneumatic Actuator

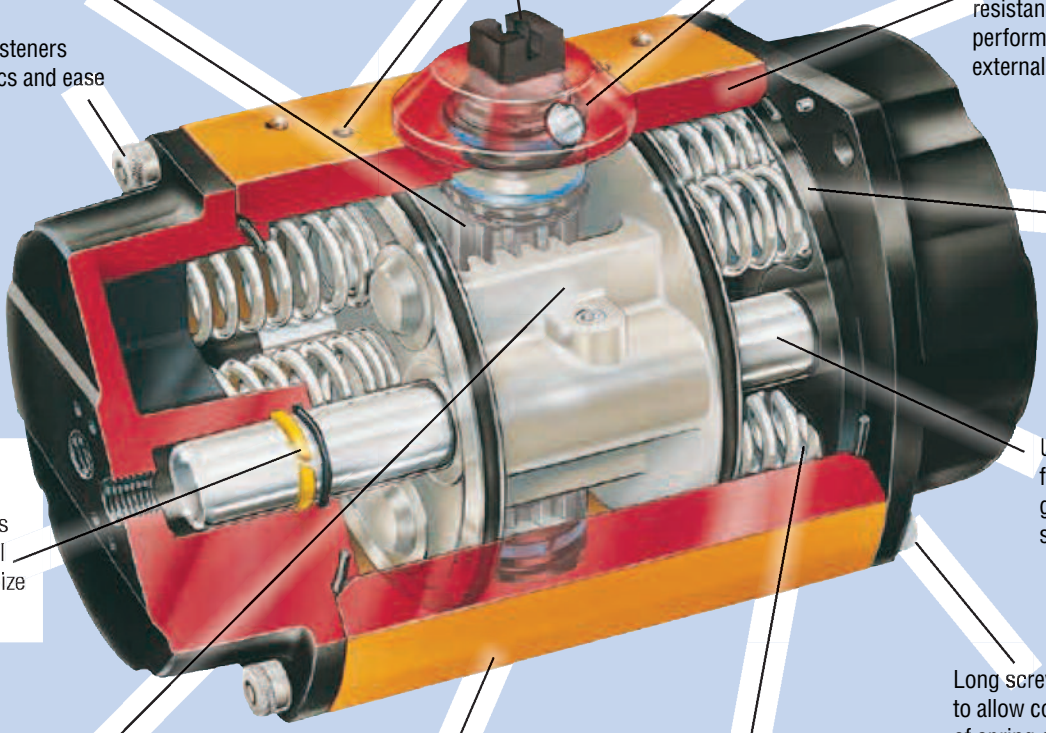
Twin-piston, double rack-and-pinion

37N

Series F39 Pneumatic Actuators

FLOWSERVE

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



One-piece steel pinion drive with full-length, black nitrided rack-and-pinion tooth engagement for greater operational life

NAMUR (VDI/VDE) top mounting for easy fitting and interchangeability of switches, positioners, etc.

Position indicator provides external indication of valve position

Coro-lube™ coated aluminum construction for corrosion resistance and superior wear performance on internal and external surfaces

Stainless steel fasteners improve aesthetics and ease of maintenance

Corrosion-protected springs for long service life

*Polished stainless steel piston guide rods minimize internal wear and maximize performance life

Unique unrestricted air flow through guide rods gives fast operation speeds as standard

Long screws to allow complete release of spring energy for safe disassembly when required

Balanced double rack-and-pinion eliminates side loads

ISO 5211 mounting pattern for interchangeability of mounting kits and greater mechanical strength

Multi-spring concept provides variable torque/air pressure performance from the same actuator

* 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

Series F39 Pneumatic Actuators

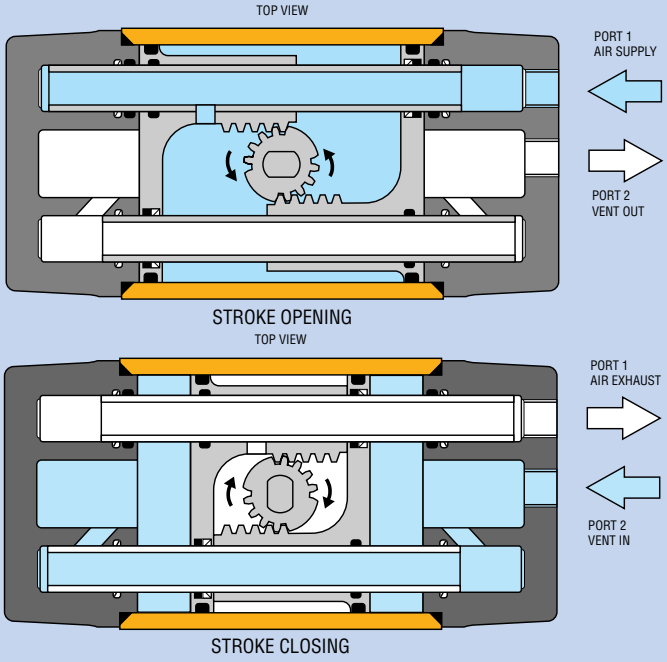
Operating Principle

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.

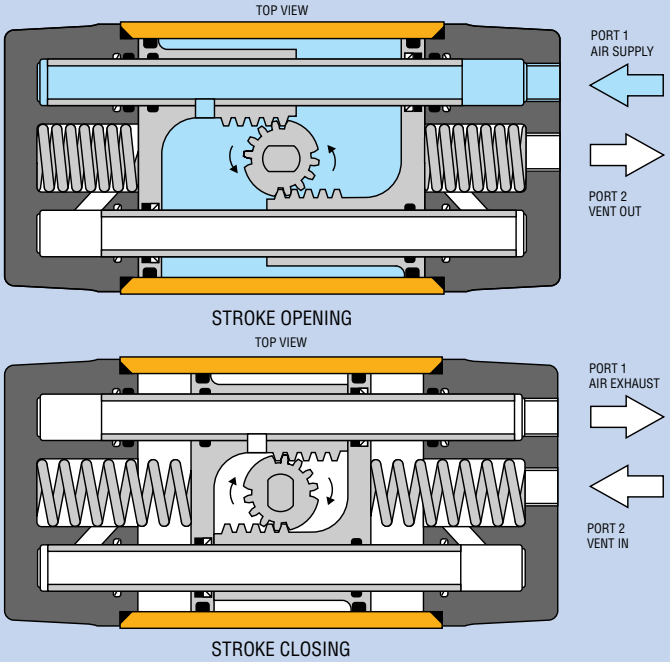
In the double-acting actuator, compressed air is applied to Port 1. The air flows through the rear guide rod and enters the center chamber to push the pistons apart, turning the shaft counterclockwise (as seen from above) to open the valve. During this action, air in the end caps is vented through Port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

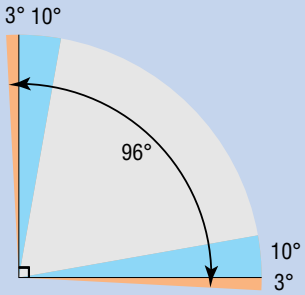


SPRING-RETURN ACTUATOR F39S



Series F39 Pneumatic Actuators

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

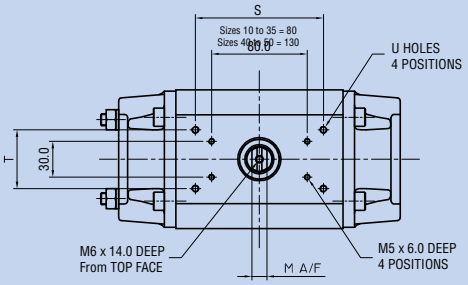
W25NAA Four-Way Double-Acting Solenoid

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

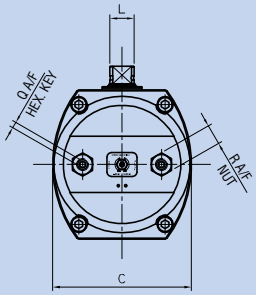
Series F39 Pneumatic Actuators

Dimensions Sizes 10F39 - 50F39

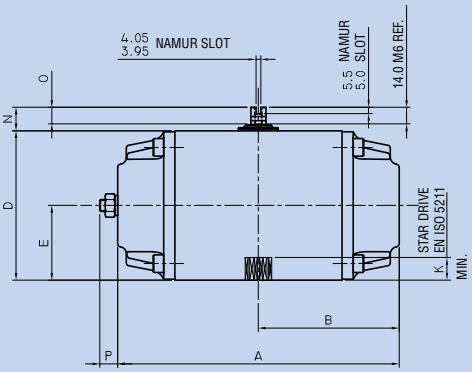
Inches (mm)

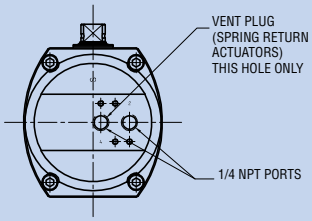


EN 15714-3 NAMUR TOP ACCESSORY MOUNTING

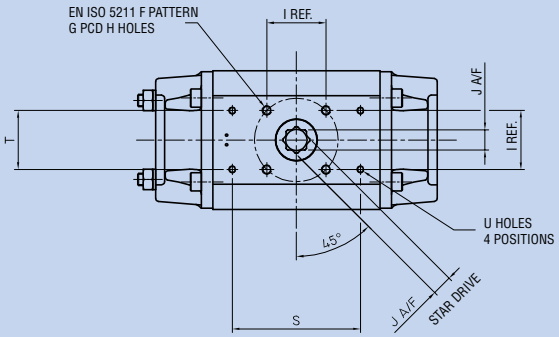


LIMIT STOP ENDCAP





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

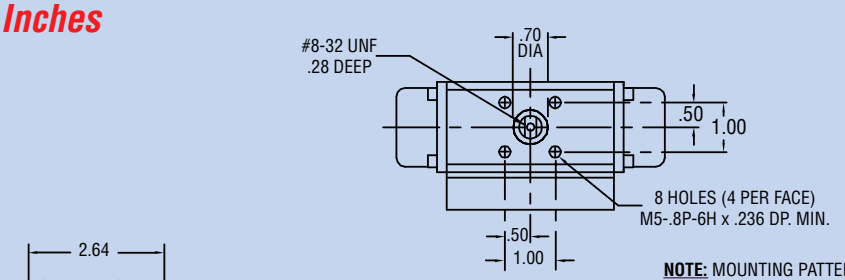
Model	Basic Dimensions					Bottom ISO Mounting Dimensions						Top Pinion Dimensions				Limit Stop Dimensions			Ancillary Hole Dimensions (Note 2)		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
10F39	6.11 155.3	3.06 77.7	3.02 76.8	3.37 85.5	1.69 42.8	F04	1.65 42.0	M5 x 0.25 6.25 DP	1.17 29.7	0.43 11.0	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

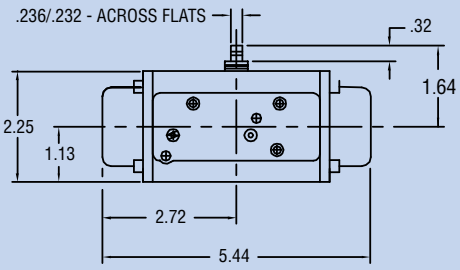
Series F39 Pneumatic Actuators

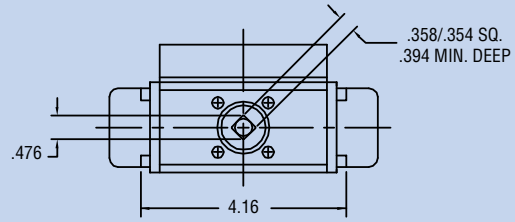
Dimensions Size 05F39

Inches

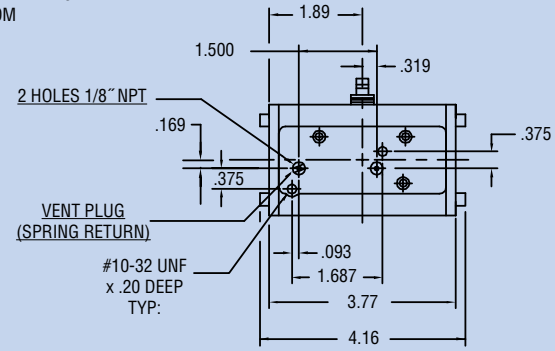


NOTE: MOUNTING PATTERN IDENTICAL TOP AND BOTTOM





Spring Return Actuator End Cap Detail



Double-Acting Actuator End Cap Detail

How to Order

WCA-F39 – 10 W – E Z – 120A – ____ – ____

SERIES	ACTUATOR SIZES	SOLENOID	SPECIAL SERVICES	END MOUNT LIMIT SWITCHES	SOLENOID VOLTAGE	SPRING RETURN SUPPLY PRESSURE	OPTIONS
WCA-F39 Double Acting **WCA-F39S** Spring Return	**-** 05 33 10 35 15 40 20 42 25 45 30 50	**W-** Watertight Solenoid (type 4, 4x) **X-** Hazardous Location Solenoid (type 4, 4x, 7 & 9) **N-** No Solenoid	(blank)- None **9-** Fail Open Mount **H-** High Temperature** (N & SN models only) **E-** End Mounted Limited Switch Module* **L-** Low Temperature** (N, SN, W models only)	Must specify "E" in under Special Services† **Z-** Watertight/ Hazardous Locations, SPDT Switches **ZD-** Watertight/ Hazardous Locations, DPDT Switches **Z1-** Watertight/ Hazardous Locations, 2-Wire AC/DC Proximity Sensors **n/a** without Solenoid	**12D-** 12 DC **24D-** 24 DC **24A-** 24/60 AC **120A-** 120/60 AC **240A-** 240/60 AC **n/a** without Solenoid	**8-** 80 psig **7-** 70 psig **6-** 60 psig **5-** 50 psig **4-** 40 psig **WCA-F39S series only**	**V54-** SST Springs (sizes 10-30 only) **V90-** Reverse Rotation (FCCW) **V95-** NorGuard Servere 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.

Worcester Spring Return Pneumatic Actuators

MOST COMMON

Part #	Description
WC-F39S-10N-8	Worcester Spring Return Pneumatic Actuator, Size 10
WC-F39S-15N-8	Worcester Spring Return Pneumatic Actuator, Size 15
WC-F39S-20N-8	Worcester Spring Return Pneumatic Actuator, Size 20
WC-F39S-25N-8	Worcester Spring Return Pneumatic Actuator, Size 25

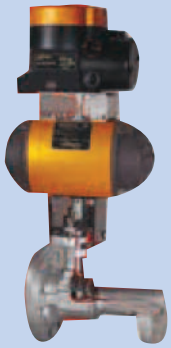
Stock actuators are based on 80 PSI Air Supply (Other pressures available)

Series F39 Pneumatic Actuators

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)

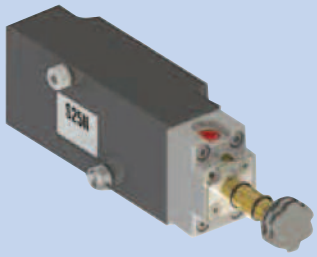
Where compact installation is required, an end-mounted limit switch module is available. This module comes as a combined Watertight TYPE 4 and Hazardous Location (Class I, Division 1,2, Group C, D; and Class II, Division 1, 2, Group E, F, G) and comes with two SPDT or two DPDT mechanical switches. It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



Which CRYOGENIC BALL VALVE Will YOU Depend On in the Cold?

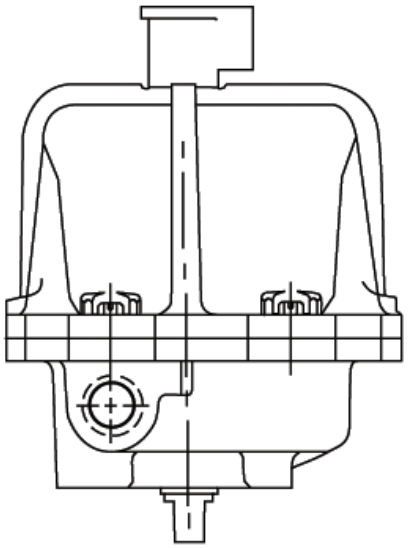
RATERMANN
Cryogenics

FLOWSERVE
Worcester Controls

FLOWSERVE

Worcester Actuation Systems

AN ISO 9001 REGISTERED COMPANY



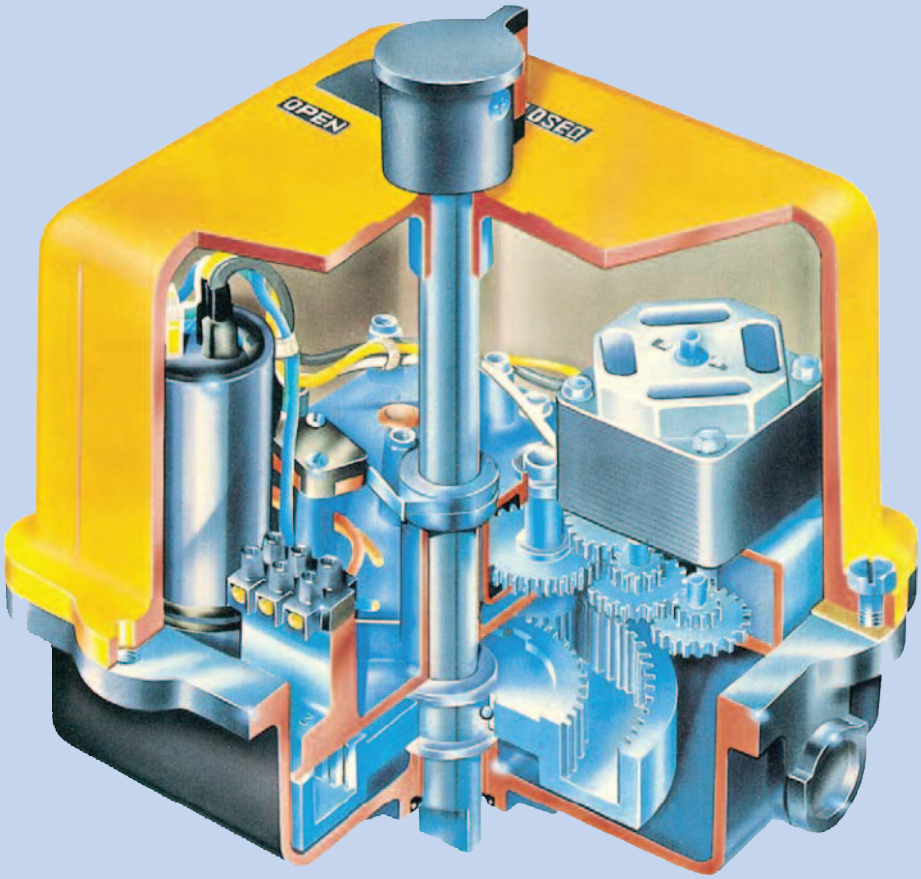
Series 75 Electric Actuator

Specifically designed for rotary valve applications, on/off and modulating

Series 75 Electric Actuator

Worcester Controls Series 75

A time-tested, high-quality state-of-the-art electric actuator for remote control of quarter-turn valves and other rotary devices. Simple, compact and reliable.



Series 75 Electric Actuators from Worcester Actuation Systems add a new dimension of operational dependability and flexibility to modern processes controlled by computers, programmable controllers and other electric control equipment. A multi-function capability permits use of the Series 75 actuator throughout the process for on/off, throttling, variable-cycle and any analog or digital control. One of the most reliable electric actuators on the market, the Series 75 is lightweight, compact and powerful. Its split phase capacitor AC reversing motor or DC motor drives a valve through a sealed, permanently lubricated gear train which offers virtually lifetime maintenance-free dependable operation.

The Series 75 is available in eight sizes and produces torques to 3000 in-lbs. Housings are designed to TYPE 1 General Purpose, TYPE 4 Watertight, and TYPE 7, Class 1, Division 1 and 2, Group C, D and TYPE 9, Class II, Division 1 and 2, Group E, F, G. A combined location TYPE 4, 4X, 7, 9 enclosure is also available as a "Z" option. A baked polyester finish is the standard coating, but special coatings are available for extreme hazardous-environment applications.

Series 75 actuators may be used on Worcester Controls complete line of ball valves, other quarter-turn valves or devices requiring rotary operators. Moreover, their ability to provide power in both directions through selected arcs from 20° through 300° makes them ideal for control of heating, ventilating and air conditioning duct systems and automatic, remotely operated equipment.

Series 75 Electric Actuator

Options to Fit Your Applications

The Series 75 can be ordered with a variety of options to tailor it to the needs of your application.

Cycle Length Control – This speed control feature allows field adjustment of opening and closing cycle times, 19 minutes for 25% duty and 57 minutes for 75% duty actuators.

Feedback (0-1000 ohm) Potentiometer – provides a variable resistance to signal the exact position of the output shaft and the valve it is powering.

Position Indicator Board – provides a 4-20 mA valve position feedback signal to the control room.

Heater/Thermostat – prevents condensation from collecting inside the actuator.

Condensation Drain Plug – drains accumulated water.

180° Center-Off Kit – provides an extra position for three-way valves and is used for dribble-feed applications in quarter-turn valves.

Additional Limit Switches – may be used to operate lights that indicate valve position or to operate other equipment.

AF-17 Positioner Board – for control valves positions the actuator based on an input signal of current, voltage or resistance.

DFP17 DataFlo P™ – is a microprocessor-controlled electronic positioner with software for on-site or remote operation and diagnostics. This new, smart positioner for Series 75 actuator driven control valves is controlled by a 4-20 mA analog signal from a PLC or digitally from a computer.

DFC17 DataFlo C™ – is a microprocessor based PID single-loop controller that accepts a variety of process inputs. All process parameters are easily programmed through the keypad or via a simple RS-485 computer interface.

I 75 Low-Current Circuit Interface – is a solid-state interface/relay between the PC/controller/computer and actuator motor(s). It protects controlling device outputs from destructive feedback. This high-voltage feedback is due to limit switch action, auto transformer effect of unused winding, and capacitor voltage. The unit, as a printed circuit board, is conveniently mounted inside of standard enclosures. Maximum output ratings are 4 A for 120 VAC and 2 A for 240 VAC. Controllers with outputs that have low current ratings cannot be connected to electric actuator motor(s) that require a current greater than the controller rating.

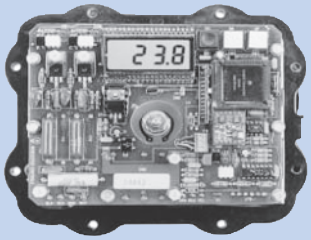
R 75 Remote Terminal Unit (RTU) – is an interface for DC powered actuators. This solid-state interface card allows you to control a DC-powered electric actuator by a control signal from the Remote Terminal or any low current system (such as a solar powered system). It is equipped with a field-adjustable current limiting circuit, which will trip the power in case of abnormal conditions (it will reset by reengaging the control signal). Optional contact closure to indicate the tripped condition; 0-5 VDC, 0-1000 ohm position feedback, and end of travel SPDT gold contact switches are available.

TYPE 4
Sizes 10, 12, 15, 20, 22
(Enclosure Option – W)

TYPE 1
Sizes 10, 12, 15, 20, 22
(Enclosure Option – Blank)

Combined TYPE 4, 4X, 7 & 9
Sizes 10, 12, 15, 20, 22, 23
(Enclosure Option – Z)

TYPE 7 & 9
Sizes 10, 12, 15, 20, 22
(Enclosure Option – X)



DFP17 Positioner for Control Valves

Combined TYPE 4, 7 & 9
Sizes 25, 30
(Enclosure – Z)

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

Series 75 Electric Actuator

FLOWSERVE

Specifications

Sizes:
Small: 10, 12, 15, 20, 22, 23
Large: 25, 30

Torque:
150-3000 in-lbs.

Enclosures:
TYPE 1 General Purpose
TYPE 4 Watertight
TYPE 7, Class I, Division 1, 2, Group C, D
TYPE 9, Class II, Division 1, 2, Group E, F, G Hazardous Locations
TYPE 4, 4X, 7, & 9 Combined Locations

Enclosure Coatings: Corrosion resistant baked polyester finish standard. Consult Ratermann for special applications.

Voltages:
120 V and 240 VAC, 12 V and 24 VDC

Connection:
Male output shaft (female shaft available on request)

Gearing:
Small: Sealed, permanently lubricated spur gear module driving a final dual-torque bull gear
Large: Two-stage planetary gear, permanently lubricated self-locking gear train

Overload Protection:
AC only. Thermal overload protector with automatic reset.

Travel Stop Limit Switches:
Two SPDT, all sizes; internal, independent, adjustable. Actuated by cams mounted on drive shaft. Adjustable from 20° to 300°.

Manual Override:
All sizes, TYPE 4, 7 and 9 only.
Lift position indicator and turn shaft: Sizes 10,12,15, 20, 22, 23.
Turn side-mounted handwheel: Sizes 25 and 30.

Actuator Model	Stall Torque in.-lbs.	Start-up Torque in.-lbs.	Voltages		Duty Cycles	90° Time seconds	Current at rated stall torque – amps				Approx. Weight Lbs. (kg.)
			AC	DC			120 VAC	240 VAC	12 VDC	24 VDC	
1075	150	120	120, 240	—	10%	2.5	1.5	.60	—	—	8.20 (3.70)
			120, 240	12, 24	25%	5	.70	.40	1.40	.70	
			120, 240	12, 24	75%	17, 15	.30	.15	.50	.25	
			120	—	100%	17	.25	—	—	—	
1275	225	180	120, 240	—	10%	4	1.5	.60	—	—	8.20 (3.70)
			120, 240	12, 24	25%	8	.70	.40	1.20	.60	
			120, 240	12, 24	75%	27, 25	.30	.15	.50	.25	
			120	—	100%	27	.25	—	—	—	
1575	325	260	120	—	20%	5	.70	—	—	—	8.50 (3.83)
2075	600	480	120, 240	—	10%	2.5	2.90	1.30	—	—	9.50 (4.31)
			120, 240	12, 24	25%	5	1.50	.90	5	2.50	
			120, 240	12, 24	75%	17, 15	.70	.30	1.60	.80	
			120	—	100%	27	.50	—	—	—	
2275*	900	720	120, 240	—	10%	4	2.90	1.30	—	—	9.50 (4.31)
			120, 240	12, 24	25%	8	1.50	.90	4.20	2.10	
			120	12, 24	75%	27, 25	.70	.30	1.50	.75	
2375	1200	950	120, 240	12, 24	75%	25	.70	.30	2	1	17.70 (8.04)
2575	1800	1440	120, 240	—	25%	10	2.70	1.30	—	—	48 (21.80)
			120, 240	—	75%	15	2.20	1.20	—	—	
3075	3000	2400	120, 240	—	25%	15	3.50	1.40	—	—	48 (21.80)
			120, 240	—	75%	23	2.20	1.20	—	—	

Options:
All sizes, all enclosures. Cycle Length Control (CLC), dual- or single-feedback potentiometer, 4-20 mA position indicator, heater/thermostat, condensation drain plug (V-53), 180° center-off (three-position), additional limit switches, mechanical brake, I-75 computer interface unit, various duty cycles, positioner, set point controller.

Temperature Limits (All models):
-40°F (with heater and thermostat) to 150°F max. (At elevated temperatures, duty cycle must be derated. Consult Ratermann.)

Lubrication:
Permanently lubricated gear train. Self-lubricated bearings.

Conduit Connection:
One ½" NPT - Two ½" Optional (Size 23 has ¾" NPT)

Operation:
Reversing (bidirectional) for use with quarter-turn valves or rotating equipment to full rotation.

Actuator Sizing

There are a few terms associated with electric actuators that require definition. **Actuator Start-up Torque** is the amount of torque initially produced by an actuator when starting from rest. Use start-up torque when sizing an electric actuator for a ball valve that is used for either on/off or throttling service. **Actuator Stall Torque** is the amount of torque produced by the actuator just prior to the point where the motor stalls. Do not use stall torque for sizing.

OVERCURRENT PROTECTION WARNING!

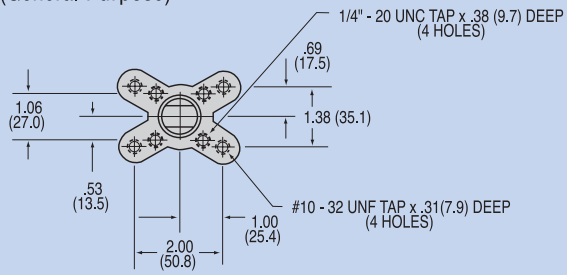
Where overcurrent protection is used in the actuator power circuit, it is recommended that the protection rating not be less than the values listed in the table:

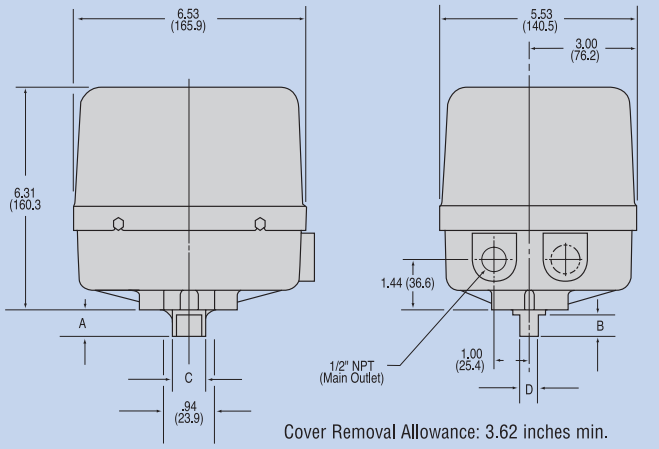
Actuator Size	Voltage	Protection Rating
10-23	120 VAC	5 amps
25/30	120 VAC	10 amps
10-23	240 VAC	3 amps
25/30	240 VAC	5 amps
10-23	12 VDC	10 amps
10-23	24 VDC	5 amps

Series 75 Electric Actuator

Dimensions inches (mm)

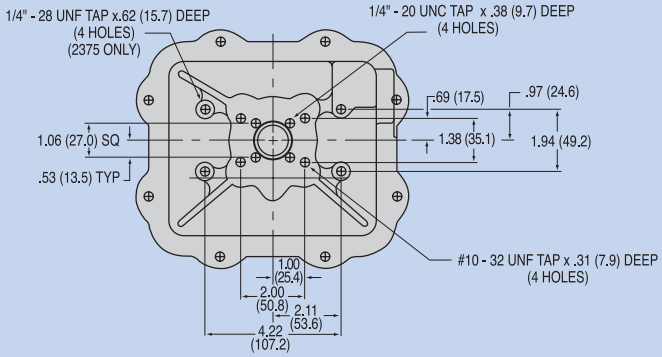
Sizes 10, 12, 15, 20, 22
TYPE 1 (General Purpose)

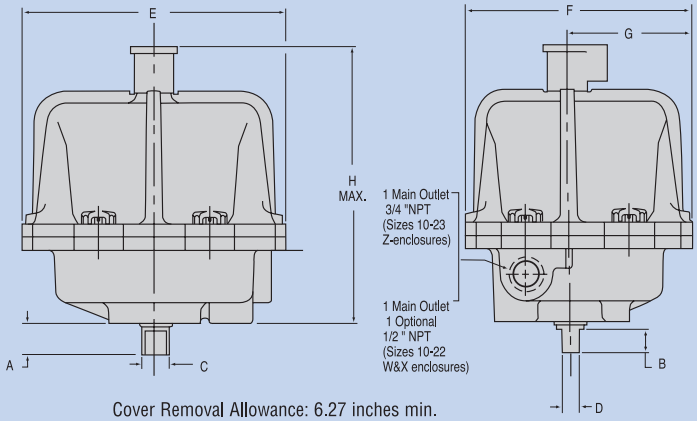




Cover Removal Allowance: 3.62 inches min.

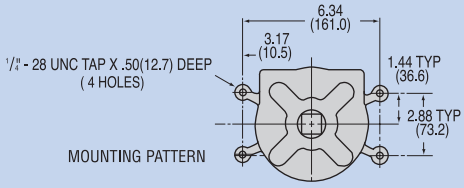
Sizes 10, 12,15, 20, 22, 23
TYPE 4 (Watertight) Enclosure - W,
TYPE 7 & 9 (Hazardous Locations) Enclosure - X,
TYPE 4, 7 & 9 (Combined) Enclosure - Z (shown)

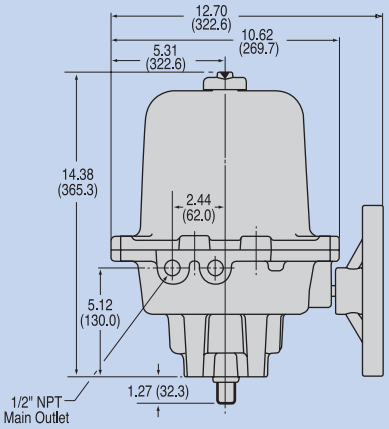


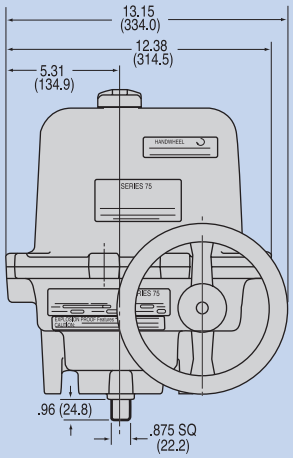


Cover Removal Allowance: 6.27 inches min.

Sizes 25, 30
TYPE 4 (Watertight) and
TYPE 7 & 9 (Hazardous Locations)
Combined Enclosure - Z







Type 1, Sizes 10, 12, 15, 20, 22

DIMENSIONS INCHES (mm)				
Size	A	B	C	D
10, 12	.74 (18.80)	.53 (13.50)	.59 (15)	.36 (9.14)
15, 20, 22	.90 (22.86)	.66 (16.80)	.80 (20.32)	.50 (12.70)

All other types and sizes

DIMENSIONS									
Size	Enclosure	A	B	C	D	E	F	G	H
10, 12	W X	.74 (18.80)	.53 (13.50)	.59 (15.00)	.36 (9.14)	7.80 (198.10)	6.75 (171.50)	3.61 (91.70)	8.50 (215.9)
15, 20 22	W X	.90 (22.86)	.66 (16.80)	.80 (20.32)	.50 (12.70)	7.80 (198.10)	6.75 (171.50)	3.61 (91.70)	8.50 (215.9)
15-23	Z	.90 (22.86)	.66 (16.80)	.80 (20.32)	.50 (12.70)	8.45 (124.60)	7.45 (189.20)	3.97 (100.90)	9.68 (245.90)
10-23	Z	.74 (18.80)	.53 (13.50)	.59 (15.00)	.36 (9.14)	8.45 (124.60)	7.45 (189.20)	3.97 (100.90)	9.68 (245.90)

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Series 75 Electric Actuator

FLOWSERVE

How to Order

WCA-75 – 20 – X MI – 120A –

SERIES	ACTUATOR SIZES	OPTIONS	DUTY CYCLE	ENCLOSURES	SECONDARY OPTIONS	VOLTAGE	OPTION OPERATION	STD VARIATIONS
WCA-75	10 12 15* 20 22 23* 25 30	**(Blank)-** *No special service option* **A-** AF17 or DRC17 or DFP17/DFC17 (240 VAC) Positioner/Controller ** **B-** For DFP17/DFC17 (DC only) *** ** **C-** CLC Module for cycle length control†† **D-** Feedback Dual Potentiometer **H-** Heater and thermostat for low–temperature and high humidity applications **I-** I–75 Interface Relay Unit (120/240 VAC only) **M-** Mechanical Brake (AC Only) **P-** Feedback Single Potentiometer **R-** Remote terminal relay board or AF17 Positioner (DC only) *** ** **4-** Position Indicator **9-** Cross–line mount	**2-** 10% duty cycle Size 10, 12, 20, 22 only **(Blank)-** 25% duty cycle **4-** 75% duty cycle **5-** 100% duty cycle. Sizes 10, 12, 20 only. (120 AC) **Note:** All duty cycles are at 70°F ambient temperature. At elevated temperatures duty cycle has to be derated. *Consult Ratermann Cryogenics.*	**(Blank)-** General purpose TYPE 1. Sizes 10, 12, 15, 20, 22 **W-** Watertight TYPE 4. Sizes 10, 12, 15, 20, 22 **X-** Hazardous Locations TYPE 7, Class 1, Div. 1, Group C, D, TYPE 9, Class 2, Div. 1, Group E, F, G Sizes 10, 12, 15, 20, 22 **Z-** Combined Locations TYPE 4, 4X, 7, 9 Sizes 10, 12, 15, 20, 22, 23, 25, 30	**(Blank)-** No additional switches **M1-** One additional switch **M2-** Two additional switches **D2-** 180° operation for 180° directional valves **D3-** Center off for 180° operation	**120A-** 120 VAC 60 Hz† **240A-** 240 VAC 60 Hz† **12D-** 12 DC **24D-** 24 DC	**CLC** **(Blank)**–Counter clockwise (open) and clockwise (closed) **C-** Clockwise (closed) **O-** Counter clockwise (open) **I75** I–75 Input Voltage Signal: **5V-** 5 VDC **XV-** 10 VDC **XX-** 24 VDC **15-** 120 VAC	**(Blank)-** No variations **V49-** Anodized and painted cover and base **V53-** Condensation drain **V65-** CE Marking Declaration of Conformity for Electric Actuator European Orders

*1575 can only be ordered with a 20% duty 120 VAC motor. The 2375 can only be ordered with a 75% duty motor.
†† Specify operation in Option Operation column for CLC.
† 120 and 240 VAC actuators will operate on 50 Hz. Torque will remain the same, cycle time will increase by a factor of 1.2 and duty cycle will be reduced by a factor of approximately 20%.
**These options must be ordered as a separate item in addition to being specified in the actuator code.
***Can only be ordered with a 75% duty motor.
NOTE: TYPE 7, 9, (X) UL approved units are available on request. TYPE 4, 7, 9, (X, W, Z) are furnished CSA Approved.
Due to continuous development of our product range, we reserve the right to alter the product specifications contained in this brochure as required.

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FLOWSERVE

Experience In Motion

Worcester WS/WM Series UltraSwitch™

Switch Box

37P

WS/WM Series Ultraswitch™ Switch Box

Compact
Reliable
Great Value

Description

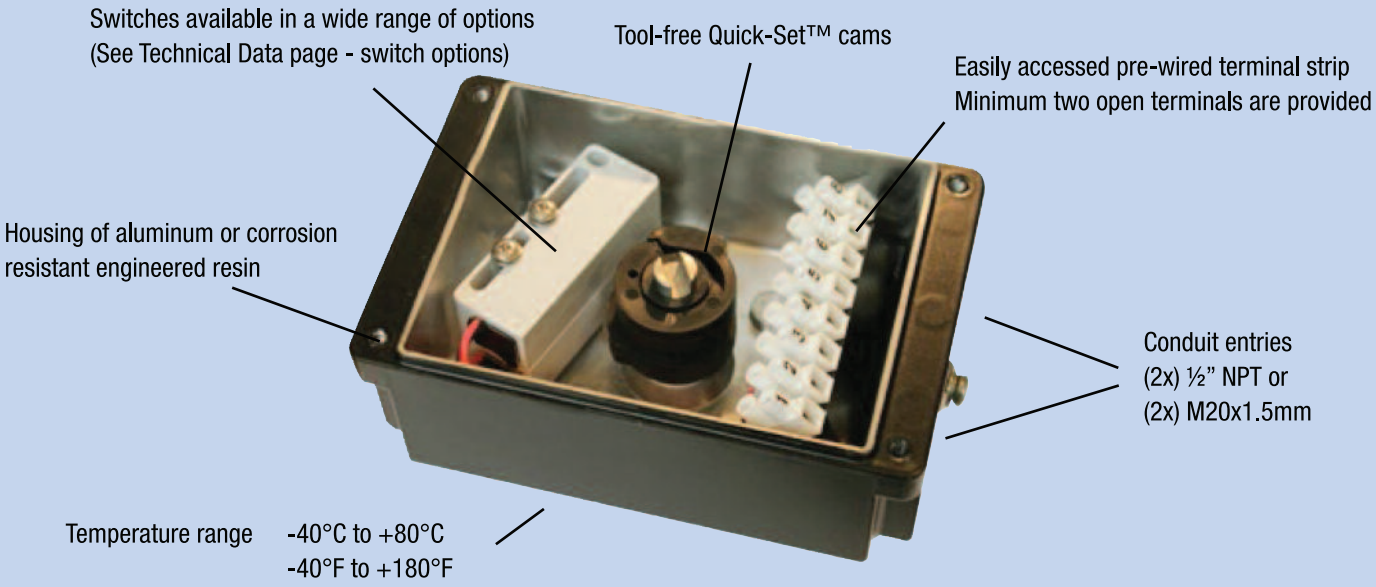
The WS/WM Series UltraSwitch™ provides cost efficient, accurate and reliable position signaling. The compact enclosure is offered in aluminum or corrosion resistant engineered resin and is provided with multiple switch options. A variety of covers and indicators are available in aluminum and resin.

The range covers domed and flat indicators as well as covers without indicator for a lower profile.

The WS/WM is designed to be directly and easily mounted onto actuators for both rotary and linear indication. It may also be used as a junction box for direct connection of solenoid valves. Minimum two open terminals are always provided.

Its compact housing has multiple mounting possibilities, up to four conduit entries and pre-wired switches to enable easy installation. It is designed to meet IP66/67 and NEMA Type 4X standards and is offered both for Intrinsically Safe and Non-Incendive hazardous locations.

Features and Benefits



WWS/WWM-Series Ultraswitch™ Switch Box Nomenclature

FLOWSERVE

How to Order

*(Select **Bold Type Code** from each column that applies)*

WC-WWS – N 2 A A U – 2 M1 – 14

SERIES	SHAFT TYPE	NO. OF ENTRIES	BODY MATERIAL	COVER MATERIAL	INDICATOR	NUMBER OF SWITCH	SWITCH OPTIONS	CERTIFICATE
WC-WWS- 1/2" NPT Conduit entries **WC-WWN-** M20x1.5mm Conduit entries	**N-** NAMUR Shaft EN15714 **S-** Short Shaft low profile style **T-** For NAF Turnex **D-** Double "D" 1/4 inch Flates	**2-** 2 conduit entries **4-** 4 conduit entries (2 according to "C" + entries opposite side with different type of threading)	**A-** Aluminum **R-** Engineered Resin	**A-** Aluminum **R-** Engineered Resin **P-** Polycarbonate Cover (clear)	**1-** No Indicator **2-** Flat Indicator **H-** Black/Yellow UltraDome™ (Black Close, Yellow Open) **U-** UltraDome™ (Red Close, Green Open)	**0-** No Switches (empty housing) **1-** 1 Switch **2-** 2 Switches	**M1** PE **MG** PP **F1** PT **F3** N8 **F5** NP **F6** NQ **F7** NR **F8** NS **FJ** NT **P4** N9 **P5** NW	**14-** General Purpose **15-** ATEX Ex ia **28-**cCSAus Ni **29-** cCSAus IS

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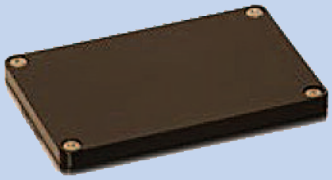
Aluminum or Engineered Resin Housing with Multiple Cover Options

Aluminum or Resin cover
Dome indicator



Aluminum or Resin cover
Blank without indicator

Aluminum or Resin cover
Flat indicator

Polycarbonate transparent cover
Dome indicator

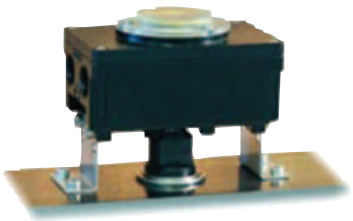
Polycarbonate transparent cover
Flat indicator

Aluminum housing
(Cover materials:
Aluminum and
Polycarbonate)

Resin housing
(Cover materials:
Resin and
Polycarbonate)

Mounting Kits

NAMUR Actuator Mounting Kit



Low Profile Mounting Kit

Part #	Description
WC-23648	Bolt Pattern Length 80 mm, Bracket Height 45 mm, Height 105 mm
WC-23649	Bolt Pattern Length 80 mm, Bracket Height 55 mm, Height 115 mm
WC-23650	Bolt Pattern Length 130 mm, Bracket Height 55 mm, Height 115 mm

Part #	Description
WC-KL01	Bolt Pattern 80/30 mm, Actuator shaft height 20/30 mm, height 80/90 mm
WC-KL02	Bolt Pattern 80/30 mm, Actuator shaft height 50 mm, height 110 mm

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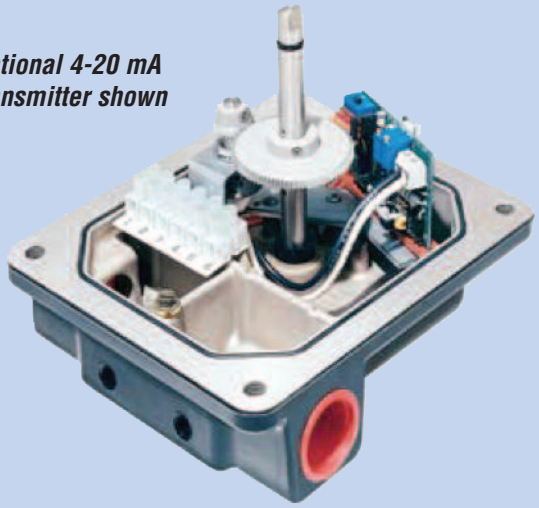
Rotary Switches

WXCL-Series UltraSwitch™ Position Indicators

The WXCL-Series UltraSwitch is a globally-certified explosionproof/flameproof position indicator for use throughout the world. The rugged die cast aluminum enclosure has a dichromate undercoat and electrostatic powder topcoat for superior corrosion resistance. The housing is certified to UL/CSA/ATEX standards and is available with optional position transmitter and a wide range of switches.



Optional 4-20 mA transmitter shown

Features:

- **UltraDome™** visual indicator provides high contrast, wide-angle viewing of valve position.
- **Quick-Set™** spring loaded cams are extra wide and splined to allow tool free limit switch calibration.
- **Switches** available in a wide range of options.
- **Terminal Strip** is multipoint and prewired.
- **Housing** is die cast aluminum with dichromate undercoat and electrostatic powder topcoat, UL/CSA/ATEX approved for hazardous locations.
- **Dual** ¾" conduit entries are standard.
- **NAMUR** mounting compliance eliminates coupling and maximizes interchangeability.
- **Captive** stainless steel cover screws.
- **Potting** compartments available for factory sealed leads.

How To Order *(Select **Bold Type Code** from each column that applies)*

WC-WXCL – D U 0 – 00 14 – 0 0 2 – 0 0

SERIES	SHAFT OPTION	INDICATOR OPTION	SWITCH	SWITCH TYPE*	CERTIFICATIONS	ANALOG OUTPUT OPTIONS	WIRING OPTIONS	OPEN TERMINALS (Minimum)	SPECIAL OPTIONS	COATING OPTIONS
WC-WXCL (2) 3/4" NPT Conduit **WC-WXML** (2) M25 Conduit	**D-** Double D Shaft (1/4" Flats)	**1–** Flat Top (no indicator) **U–** Red/Green (std) **C–** Pharos 90° 3–way **D–** Pharos 180° 3–way **E–** Pharos 180° 3–way Center Blocked **K–** Ektar Red/Green **H–** Black/Gray/Yellow **R–** Reverse (Red – Open, Green – Closed)	**0-** No Switches **1-** 1 Switch **2-** 2 Switches **4-** 4 Switches	**00-** No Switches **M1-** SPDT Mechanical **MG-** SPDT Mechanical Gold Plated **M3-** DPDT Mechanical **MA-** 3–Position Control **MD-** DA 3–Position Control w/Indication **MS-** SR 3–Position Control w/Indication **P4-** SPST Proximity **P5-** SPDT Proximity **PE-** SPDT Sabre **PP-** SPDT Phazer **PT-** SPST BRS **N8-** P+F NJ2–V3–N **FZ-** AS–I Communications Card	**14-** General Purpose **18-** UL/CSA/ATEX Explosionproof **19-** ATEX Explosionproof **M1-** Metal Nameplate UL/CSA/ATEX Explosionproof (Mechanical Switch) **M2-** Metal Nameplate UL/CSA/ATEX Explosionproof (Proximity Switch) **M3-** Metal Nameplate ATEX Explosionproof	**0–** None **T–** 4–20 mA Transmitter **D–** 180° Travel 4–20 mA Transmitter **A–** 0–1k Ohm Potentiometer **B–** 0–5k Ohm Potentiometer **C–** 0–10k Ohm Potentiometer	**0–** None (std) **H–** Heavy-Duty Terminal Strip	**2-** 2 open (std) **4-** 4 open **6-** 6 open	**0-** None (std) **P-** 180° Potentiometer Gearing **V-** Viton O–rings	**0-** Black Polyester Powdercoat (std) **E-** White Epoxy

*Consult Ratermann Cryogenics for additional switch options.

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Aviator™ Integrated Valve Controller

WXV Series

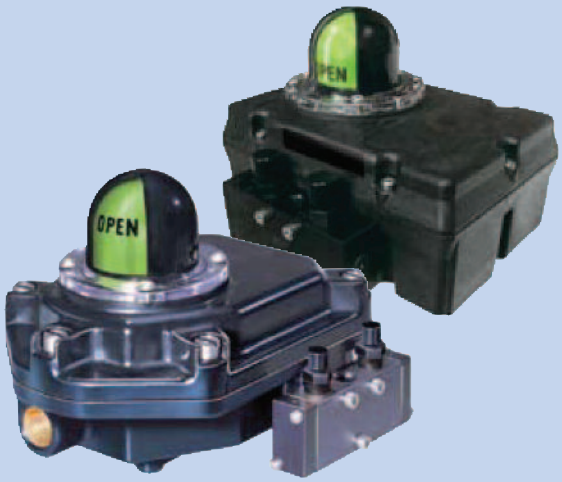
The Aviator integrated valve controller enclosure and solenoid valve provides an integrated package for position indication and control of supply air to rotary actuators. The WXV Series housing is designed for hazardous locations for NEMA 4, 4x, 7 & 9 and CENELEC EEx d IIB.

WWR Series

The WWR Series offers many features of the WXV Series in an engineered resin housing. The WWR Series housing is a non-metallic engineered resin and provides an excellent enclosure for harsh corrosive environments. The WWR Series Aviator is designed for easy upgrading to fieldbus communication protocols.

Features

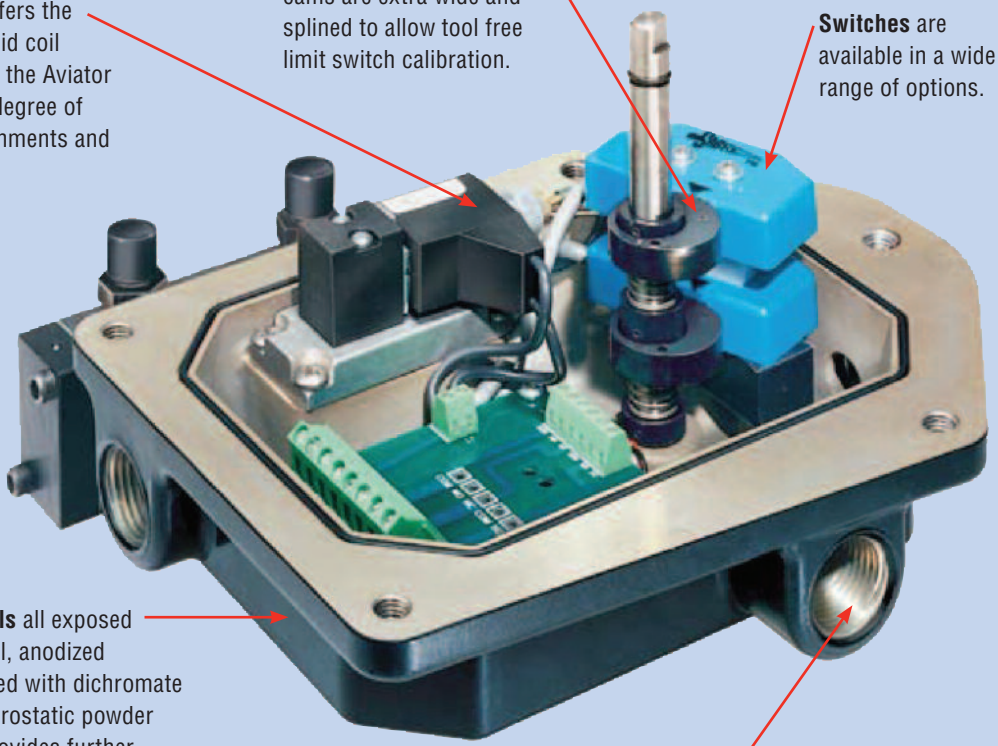
- **Captive** stainless steel cover screws.
- **UltraDome** visual position indicator provides high contrast, wide-angle viewing of valve position.
- **Fieldbus Upgradeability.** The Aviator has been designed to accommodate the circuitry required to interface with various fieldbus protocols.
- **NAMUR** mounting compliance eliminates coupler and maximizes interchangeability.



Internal Pilot Solenoid Coil offers the advantage of having the solenoid coil contained and protected within the Aviator housing. This provides a high degree of protection in hazardous environments and washdown applications.

Quick-Set™ spring loaded cams are extra wide and splined to allow tool free limit switch calibration.

Switches are available in a wide range of options.



Corrosion Resistant Materials all exposed parts are either stainless steel, anodized aluminum, or aluminum treated with dichromate undercoat and polyester electrostatic powder top coat. The WWR Series provides further protection with an engineered resin enclosure.

Three ½" conduit entries are standard (WXV Series).

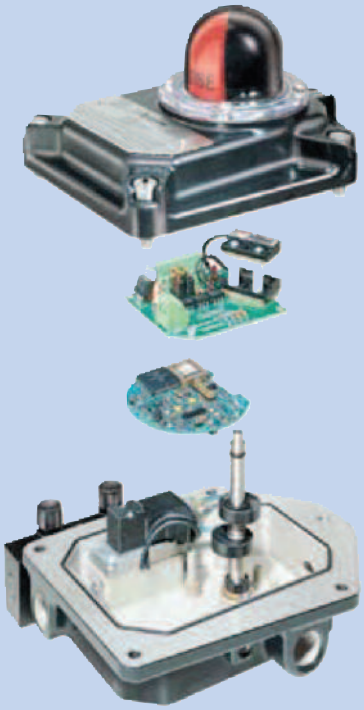
Rotary Switches

BUSwitch™ Integrated Valve Controller

The BUSwitch™ integrated valve controller provides all of the features of the Aviator but enables control and monitoring of automated on-off valves through fieldbus technology. The BUSwitch communication cards provide a gateway to fieldbus networks allowing seamless integration of the limit switches and solenoid valves. The integral BUSwitch functions assist the user with predictive and preventative maintenance. The intelligent valve automation package features AS-i, FOUNDATION Fieldbus, DeviceNet, and PROFIBUS DP protocols. The BUSwitch is available in both explosionproof aluminum or corrosion resistant engineered resin housings.

Protocol-Specific Features:

- **FOUNDATION Fieldbus** BUSwitch controls include cycle counter and timer functions. User-selectable failure modes permit valves to move to desired position on loss of communications. Dry-contact external input enables integration of emission-detecting pressure switch or other simple device.
- **PROFIBUS DP** BUSwitch features cycle counter, timer and alarm functions. User-selectable failure modes permit valves to move to desired position on loss of communications. Dry-contact external input enables integration of emission-detecting pressure switch or other simple device.
- **DeviceNet** BUSwitch offers basic on-off valve control with limited diagnostic capabilities. Solenoid coil continuity, stroke timer, and stroke counter provide important information for effective valve and actuator maintenance. A dry-contact external input enables integration of emission-detecting pressure switch or other simple device.
- **AS-i** BUSwitch provides simple on-off valve control in a very economical package. It is available in all limit switch enclosures, including the WGL, WPL and WXCL UltraSwitches.



How to Order

*(Select **Bold Type Code** from each column that applies)*

WC-WXV – U M1 – 0 A 2 – N R

SERIES	INDICATOR	SWITCH	NUMBER OF COILS	SOLENOID COIL	SPOON VALVE	SHAFTS & COATINGS	SPOOL VALVE OPTIONS
WC-WXV Aluminum NEMA 4, 4x, 7 & 9	**U-** UltraDome Indicator	**M1-** SPDT Mechanical	**0-** Single Coil	**A-** 110 VAC 50/60 Hz	**1-** 3-Way Aluminum	**N-** NAMUR Shaft	**R-** Thermoplastic Rain Caps (Standard)
WC-WCV Aluminum Eex d IIB	**C-** 90° 3-way	**MG-** SPDT Mechanical-Gold Contacts	**1-** Dual Coil (WWR Series Only	**C-** 220 VAC 50/60 Hz	**2-** 3-Way Stainless Steel	**B-** Epoxy Coating/ NAMUR Shaft (WXV Series Only)	**M-** Thermoplastic Rain Caps/Momentary Manual Override
WC-WWR Resin NEMA 4, 4x	**D-** 180° 3-way	**R4-** (2) SPST Proximity	**2-** External Solenoid Coil (BUSwitch Only F4 option)	**F-** 12 VDC	**3-** 4-way Aluminum		**L-** Thermoplastic Rain Caps/Locking Manual Override
WC-WFR Resin I.S. Class 1, Div. 1 Groups A-D (F2 Foundation-Fieldbus protocol only)	**E-** 180° 3-way Center Blocked	**P1-** (2) Sabre SPDT Proximity		**G-** 24 VDC	**4-** 4-way Stainless Steel		**X-** Sintered Bronze Exhaust Mufflers
		PP- (2) Phazer II SPDT Proximity		**H-** 12 VDC Low Power			**Y-** Sintered Bronze Exhaust Mufflers/ Momentary Manual Override
		B4- (2) BRS SPST Proximity		**J-** 24 VDC Low Power			**Z-** Sintered Bronze Exhaust Mufflers/ Locking Manual Override
		S4- (2) P&F NJ2-V2-N (NAMUR)		**K-** 24 VDC Instrinsically Safe			**S-** Stainless Steel Exhaust Mufflers
		SE- (2) Efector Type IN-2002-ABOA		**BUSwitch Only**			**T-** Stainless Steel Exhaust Mufflers/ Momentary Manual Override
		Communication Protocol		**G-** 24 VDC			**U-** Stainless Steel Exhaust Mufflers/ Locking Manual Override
		F2-		**J-** 24 VDC Low Power			
		F4-		**P-** 24 VDC Piezo Ultra-Low Power (F2 Protocol only)			
		FD-		**0-** None			
		FA-					
		FN-					

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FLOWSERVE

Worcester Controls

Worcester Controls CPT Characterized Seat Control Valve

Customized Control for Severe Throttling Services

Experience In Motion

37Q

CPT Characterized Seat Control Valve

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

CPT Characterized Seat Control Valve

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.

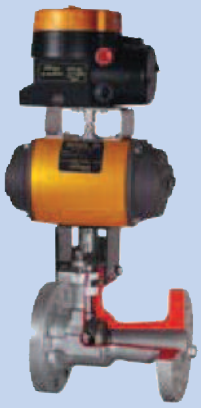
Valve Configuration
Cryogenic design, Three-piece (shown) or flanged
Model
C44, C51/C52
Sizes
¼", ½", ¾", 1", ½", 2", 3", 4"
Pressure Rating
1000 psi max.
End Connections
Screw end, socket weld, butt weld, ASME Class 150 or 300 flanges

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 Ratermann Cryogenics Custom Products Department.*

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For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

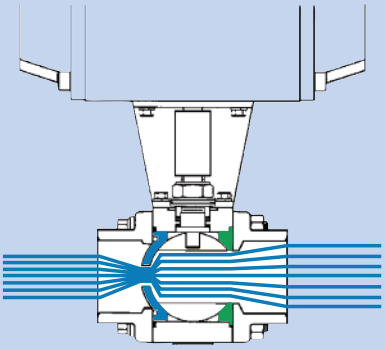
CPT Characterized Seat Control Valve

FLOWSERVE

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."



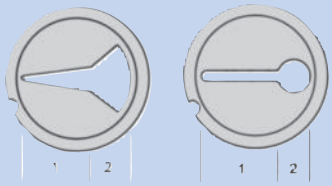
Toxic Fluids

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.



CPT Characterized Seat Control Valve

FLOWSERVE

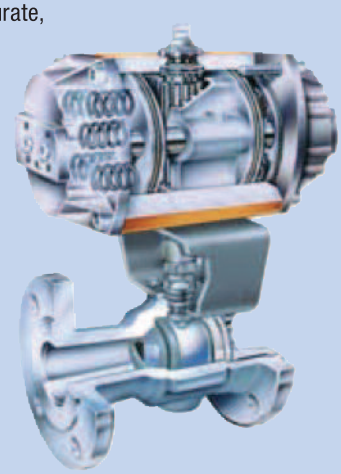
Applications

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.

CPT Characterized Seat Control Valve

FLOWSERVE

How to Order Characterized Seat Control Valves

WC-CPT44 – 44 66 – P M SE – 34 – 30

SERIES	BODY/PIPE	BALL/STEM	ROUND PORT SEAL	BODY SEALS	END CONNECTIONS	SIZE	SPECIFY CHARACTERIZED SEAT
WC-CPT44 3-Piece **WC-CPTC44** Cryogenic*	**4-** Carbon Steel **6-** 316 Stainless Steel **7-** Monel*** **A-** Alloy 20*** **C-** Hastelloy-C*** **1-** Brass	**6-** 316 Ni Pit 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 Ball **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)-** Buttweld Sch 10 (SS only) **SW-** Socketweld (pipe sizes) **SWO-** Socketweld (Tube OD sizes)	**14-** 1/4" **12-** 1/2" **34-** 3/4" **1-** 1" **112-** 1 1/2" **2-** 2"	Specify Metallic seat material code and configuations **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
WC-CPT151 Wafer 150 **WC-CPT301** Wafer 300 **WC-CPTC151** Cryogenic** **WC-CPTC301** Cryogenic**					**150-** ASME Class 150 Flanges **300-** ASME Class 300 Flanges	**3-** 3" **4-** 4"	
WC-CPT51 Flgd 150 **WC-CPT52** Flgd 300 **WC-CPT94** Flgd 150/300 **WC-CPTC51** Cryogenic** **WC-CPTC52** Cryogenic**						**12-** 1/2" **1-** 1" **112-** 1 1/2" **2-** 2" **3-** 3" **4-** 4"	

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.

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

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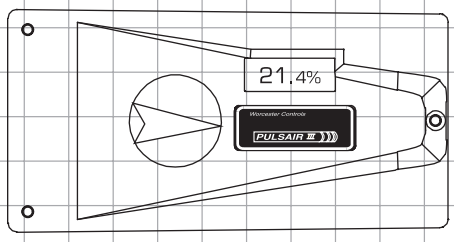
Worcester Control Valves

PULSAIR III

AN ISO 9001 REGISTERED COMPANY

HART
FIELD COMMUNICATIONS PROTOCOL



Loop Powered Microprocessor Controlled Positioner

Accurate, High-Speed Digital Process Control

37R

Loop Powered Microprocessor Controlled Positioner

PULSAIR III

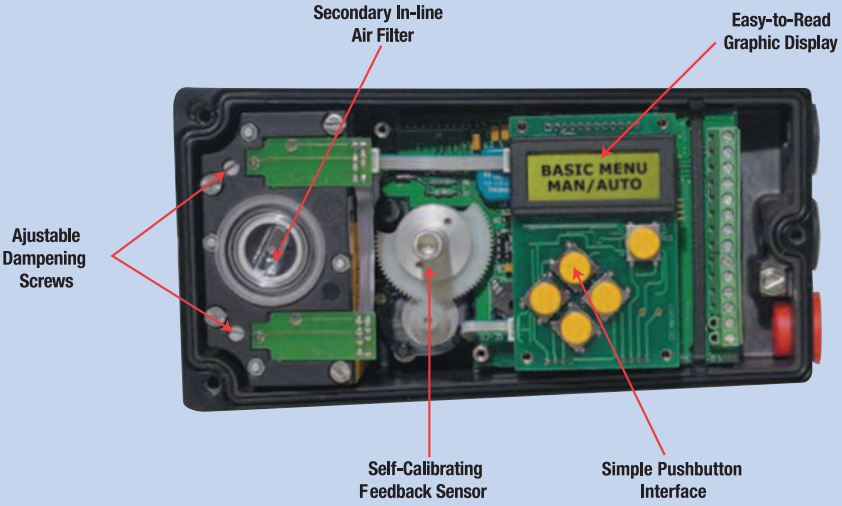
Digital Valve Positioner combines exceptional performance with user friendly HMI — Human Machine Interface

Through Cover Display
Type 4X Enclosure

Through Cover Display
XP Enclosure

The new PULSAIR® III has increased air delivery for superior performance with "sealed" piezoelectric elements to reduce moisture contamination.

The Simplicity of Advanced Technology



Menu and Pushbuttons

The positioner is programmed and calibrated using the five pushbuttons which are accessible when the aluminum cover is removed.

Auto Calibration includes:

- *Leak Test*
- *Air Delivery Optimization*
- *Diagnostic Message Center*

Programming Options:

- *Basic, Advanced and Expert*

Loop Powered Microprocessor Controlled Positioner

FLOWSERVE

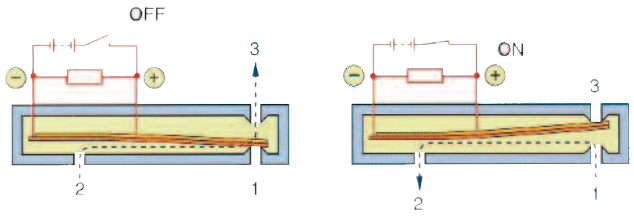
Features and Benefits

- **Sealed Piezoelectric Element**
  Reduce downtime caused by moisture-laden air
- **Internal Piezoelectric Air Filter**
  Additional protection from contaminated air
- **Sealed Electrical Compartment**
  Protects electronics from conduit moisture
- **Single and Double Acting**
  Combines both options
- **Rotary and Linear**
  Program selectable
- **HART® Communication Protocol**
  Remote configuration
- **Selectable Fail Mode**
  Open, closed, last position
- **Advanced Performance Programming**
  Improves process control
- **Advanced Diagnostics**
  Performance status with alarm monitoring

Explosion Proof Enclosure

Piezoelectric Elements

The core is a piezoelectric ceramic element, which is built in several layers. When voltage is applied, this element bends a few hundredths of a millimeter, which allows air to flow through the piezoelectric valve through port 1 to port 2.



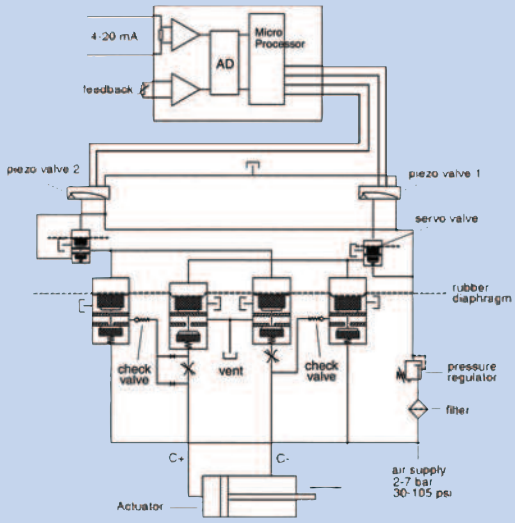
Pneumatic Block

The pneumatic block contains "poppet" valves that are controlled by piezoelectric elements, all in a glass fiber reinforced resin enclosure.

This unique design offers a true digital function, very low air consumption at steady state and high air delivery to provide good dynamic performance for large actuators.

The two piezoelectric elements control servo poppet valves which control larger poppet valves.

This design offers very high air delivery capacity together with low air consumption.



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Loop Powered Microprocessor Controlled Positioner

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Technical Specifications

Input signal	4-20mA
Air supply	30-105 psi (2-7 bar) Free from oil, water & moisture, (dewpoint at least 18°F below lowest expected ambient) filtered to min. 30 micron.
Air delivery	13.8 scfm (400 nl/min)
Air consumption	0.01 scfm (<0.3 nl/min)
Air connections	1/4" NPT
Cable entry	Three 1/2" NPT (Z enclosure two 1/2" NPT)
Electrical connections	One 14 point terminal strip, 14-22 GA wire (Z enclosure : one 8 point and one 3 point)
Linearity	<1%
Repeatability	<0.5%
Hysteresis	<0.4%
Dead band	0.2-10% adjustable
Display	Graphic, view area 0.6 x 1.6" (15 x 41 mm)
HMI	5 push buttons
Processor	16 bit
CE directives	93/68EEC, 89/336/EEC, 92/31/EEC
EMC	EN 50 081-2, EN 50 082-2
Voltage drop	<10.1V
Enclosure	Type 4x / IP66 (Type 4X & 7 (Class I, Div I, Group B,C,D)*
Material	Die-cast aluminum, A2/A4 fasteners
Surface treatment	Powder epoxy
Temperature range	-22 to 185°F (-30 to +85°C)
Weight	3 lbs (1.4 kg)
Alarm output	Transistor RI 1KΩ
Alarm Supply Voltage	8-28V

OPTIONAL FEEDBACK ACCESSORIES

Type 4 Housing-only

MECHANICAL SWITCHES (Optional)

Type	SPDT
Size	Sub Sub miniature
Rating	3A/125VAC 2A/30VDC

NAMUR SENSORS (Optional)

Type	Proximity DIN 19234 NAMUR
Load Current	(On) ≤ 1mA, (Off) ≥ 3 mA
Voltage range	5-25 VDC
Hysteresis	0.2%
Temp	-4°F to 185°F (-20°C to 85°C)

PROXIMITY SWITCHES (Optional)

Type	SPDT
Rating	5W/250mA/30VDC/125VAC
Operating time	0.7ms
Breakdown voltage	200V DC
Contact resistance	0.1Ω
Mechanical/electrical life	> $50x10^6$ operations

4-20 mA TRANSMITTER (Optional)

Supply	9-28VDC
Output	4-20 mA
Resolution	0.1%
Linearity full span	+/- 0.5%
Output current limit	30 mA DC
Load impedance	800 Ω @ 24 VDC

**Industry Approvals:*

FM:	Class I, Divi 1 Groups B,C,D Class II, Divi 1 Groups, E,F,G
CSA:	Class I, Divi 1, Groups C,D Class II, Divi 1, Groups E,F,G

How to Order

WC-93 – ____ – L ____ W ____ – P 4

SERIES	SPECIAL OPTIONS	CIRCUITRY	ACTUATOR	ENCLOSURE	LIMIT SWITCHES	POSITIONER	INPUT SIGNAL
WC-93	**(blank)-** No Options **4-** 4-20mA output **R-** Remote Mount	**L-** Loop powered not instrinically safe	**S-** Spring Return **(blank)-** Double Acting	**W-** Type 4x / IP66	**(blank)-** No Switches **M2-** 2 SPDT mechanical switches **P2-** NAMUR sensors **R2-** Proximity (REED) switches	**P**	**4-** 4-20 MA **H4-** HART
WC-93	**(blank)-** No Options **R-** Remote Mount	**4L-** **Note:** 4-20 ma std. with type z enclosure	**S-** Spring Return **(blank)-** Double Acting	**Z-** Type 4x / IP66 Type 7	**N/A**	**P**	**4-** 4-20 MA **H4-** HART

Due to continuous development of our product range, we reserve the right to alter the product specifications contained in this brochure as required.

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