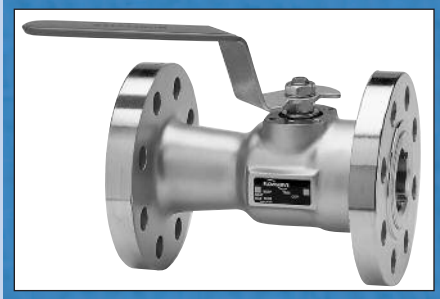


RATERMANN Cryogenics

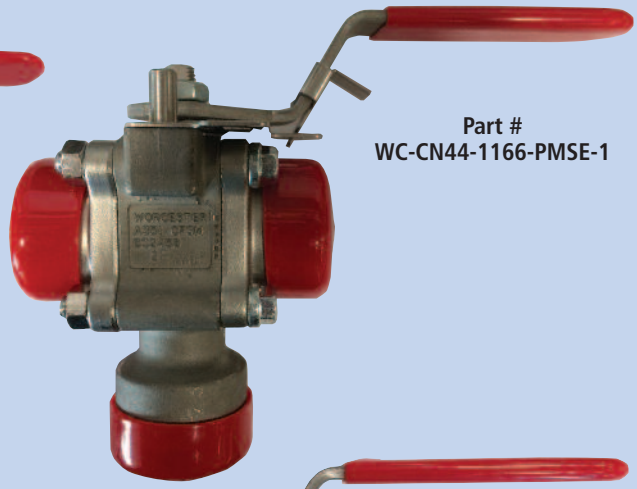
FLOWSERVE

INDEX

FLOWSERVE

Part #
WC-C44-1166-PMSE-1

Part #
WC-C44-6666-PMSE-2



Part #
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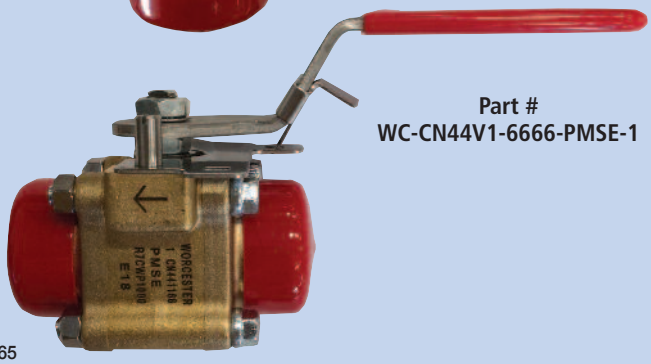

Part #
WC-CN44V1-6666-PMSE-1

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
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"

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

FOR MORE
INFO
CONTACT
RATERMANN
Cryogenics
PHONE
844-341-3433
FAX
844-341-3444
WEB
rmicryo.com

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

Part #
WC-F39S-15N-8

Worcester Spring Return Pneumatic Actuators

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)

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

WARNING: Cancer and Reproductive Harm – **www.P65Warnings.ca.gov**
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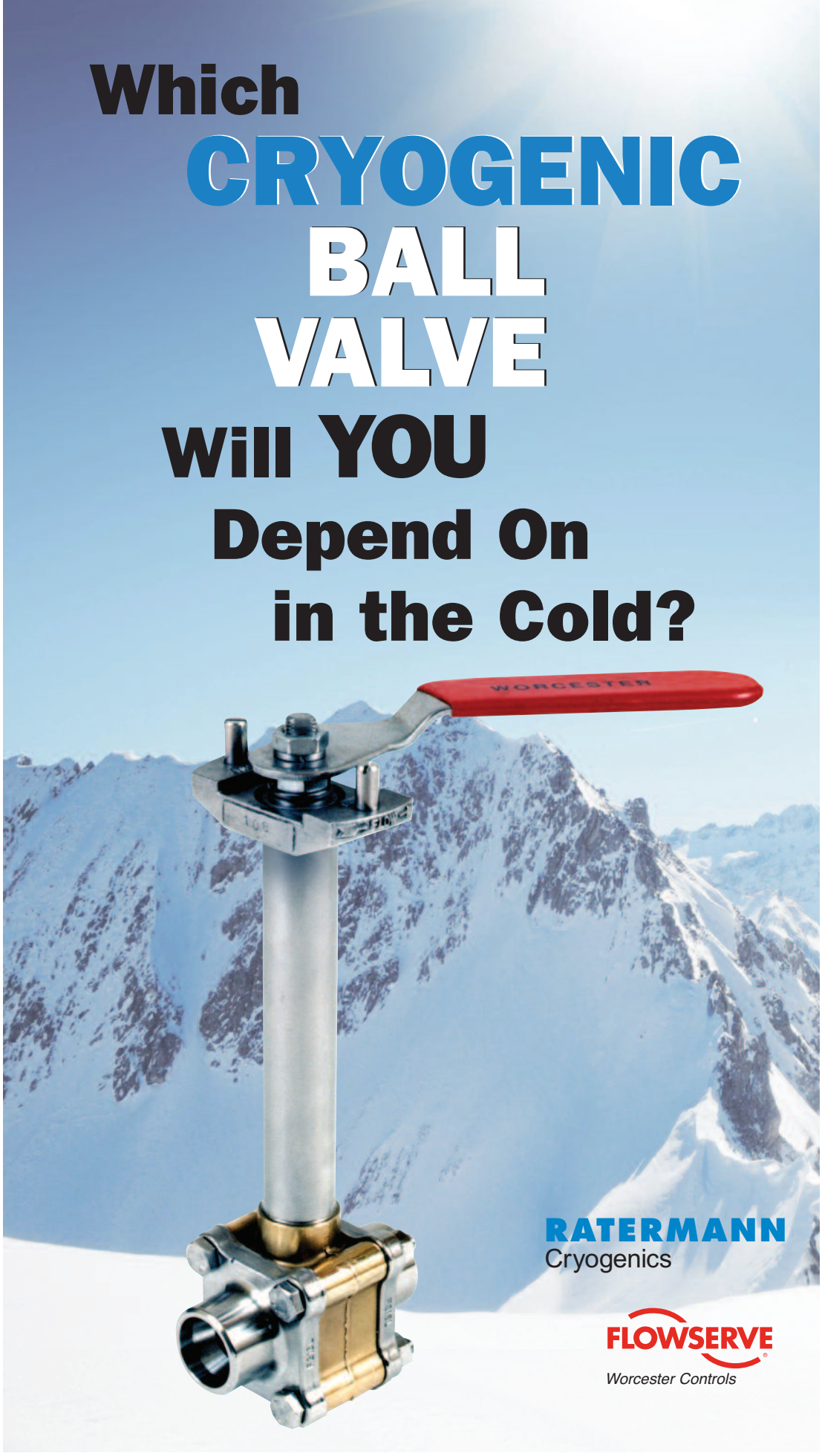
Which CRYOGENIC BALL VALVE Will YOU Depend On in the Cold?



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

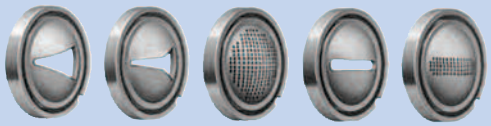
C4 Flanged

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

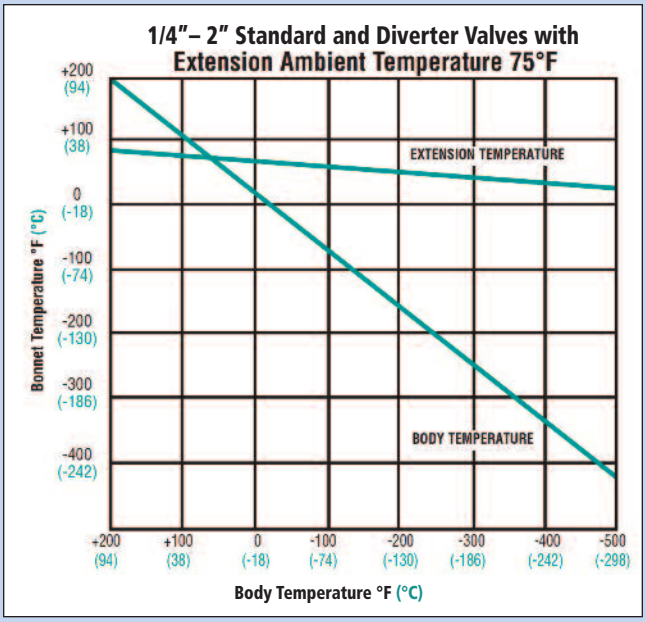
Series 39 Pneumatic Actuator

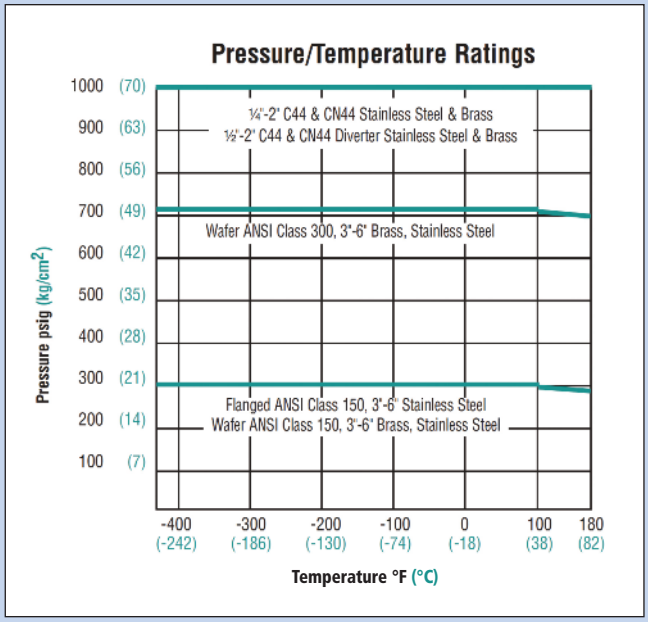
Series 39 Pneumatic Actuator with Pulsair Positioner

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

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

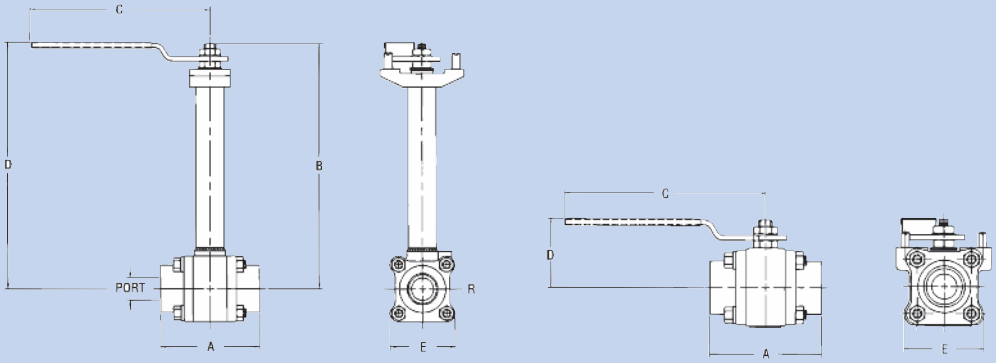
Pressure and Torque for Automated Valves

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

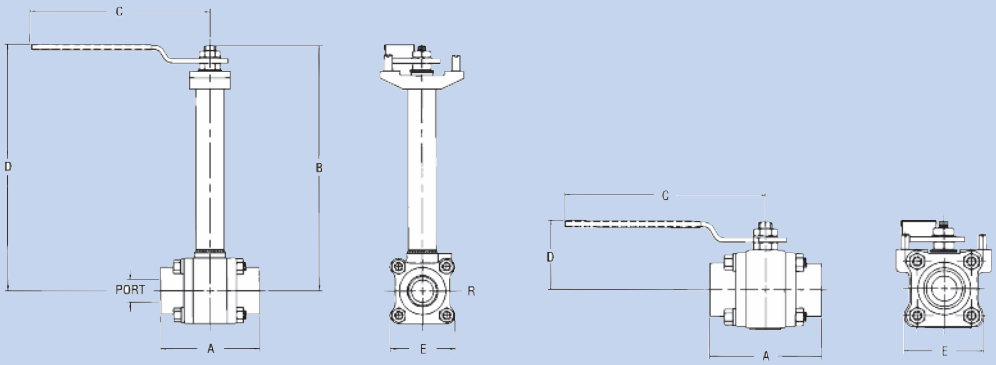
FLOWSERVE

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)

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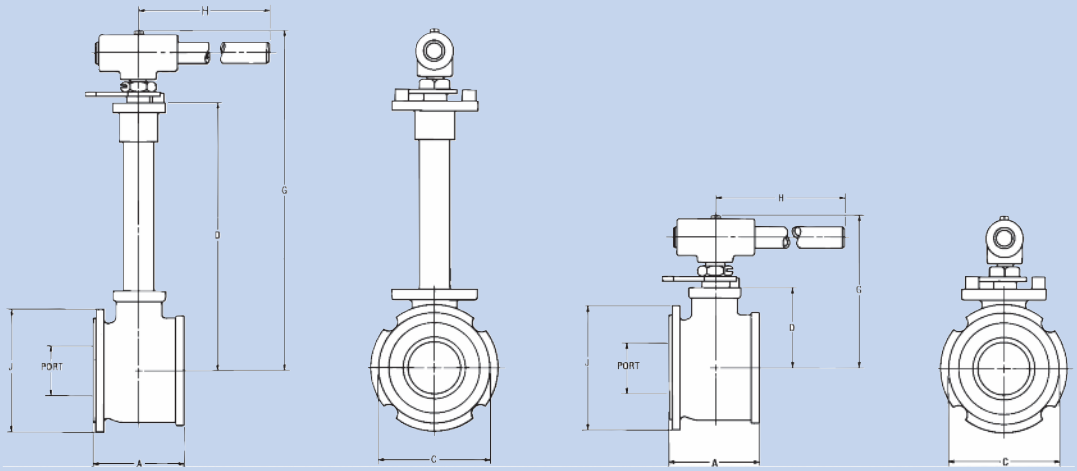
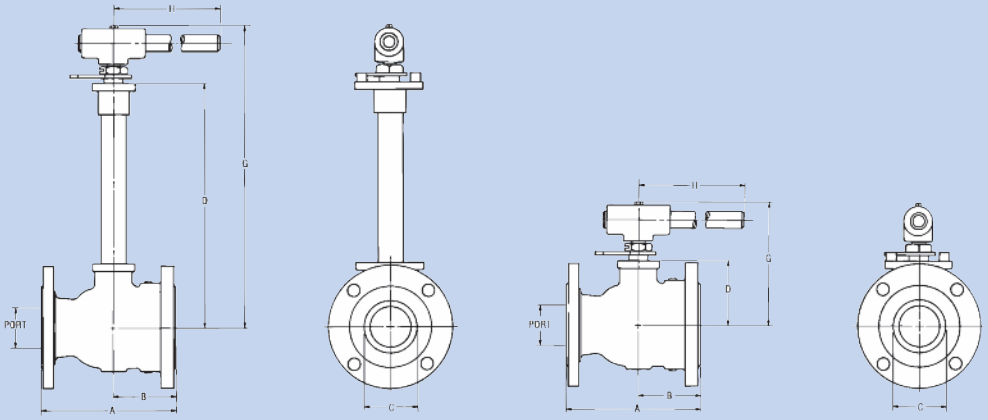
For further information on Proposition 65, please go to **www.oehha.ca.gov/proposition-65**

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)

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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