SHARPE®

Valves, Automation & Controls

SERIES V84

V-PORT CONTROL VALVE

HIGH PERFORMANCE 3-PIECE BALL VALVE

SMITH-COOPER®
INTERNATIONAL

Design & Features

3-Piece Design

In-line serviceable swing-out center section allows easy access to internal valve components without disturbing alignment of pipe.

Stem Design

Live loaded, bottom entry, blowout proof anti-static stem features packing that extends valve cycle life over conventional ball valves and is the best choice for actuation.

Fully Encapsulated Body Seals

A tongue and groove design between the body and the end cap aligns the pipe end with the ball.

ISO 5211 Integral Mounting Pad

Ideal for actuation. Centering lip feature assures precise alignment of bracket, stem and coupler. Actuators may be retrofitted on existing Series V84 without disruption of line integrity. Allows for secondary containment unit to be added when necessary.

No Play Coupler

Minimizes hysteresis between valve stem and actuator.

V Port Balls

The V84 utilizes characterized V ported balls permitting the use of soft seats and class VI shut off.

Choice of Seats and Seals

A wide variety of seat and seal materials are readily available for the most demanding applications, including Buna, Delrin, Nova*, PEEK, EPDM, Viton®, TFE, RTFE, TFM®, Grafoil, and UHMWPE.

Variety of End Combinations

A wide choice of optional end connections are available including, but not limited to threaded ends, socket weld ends, butt weld ends, flush bottom tank pads, flanged ends.

Encapsulated Body Bolts

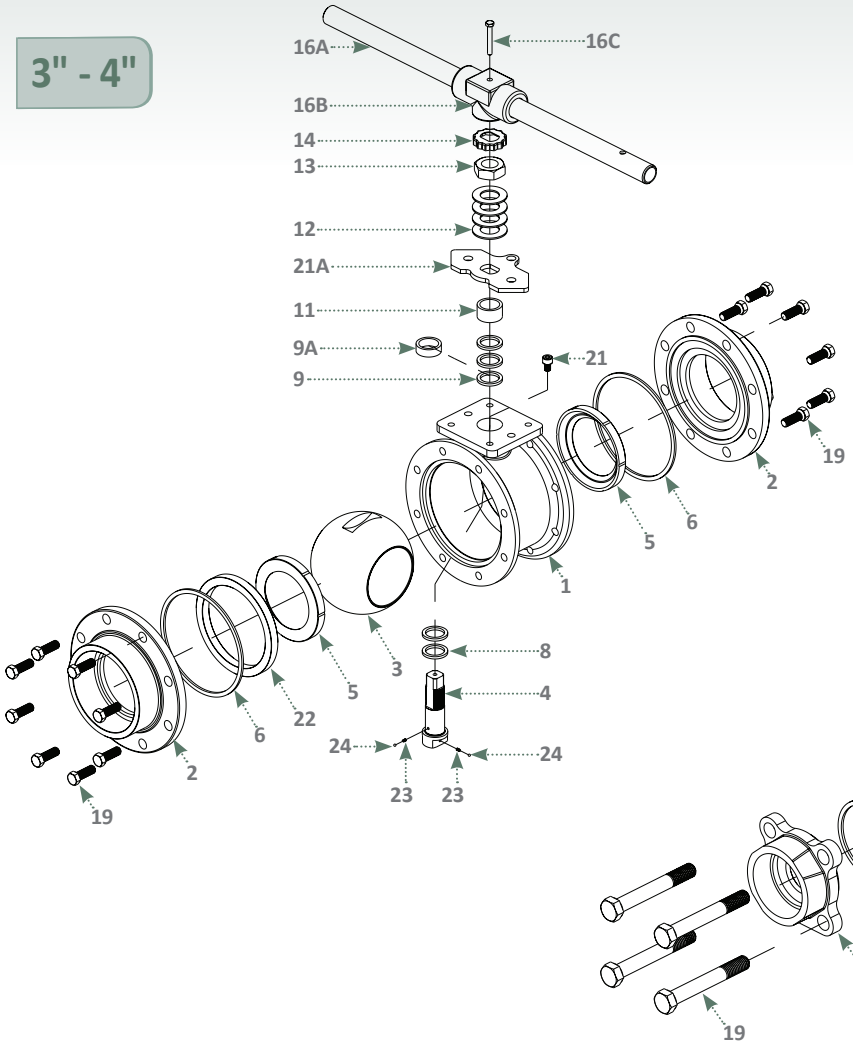
Heavy duty stainless steel bolting is protected from outside environment assuring valve integrity.

Traceability

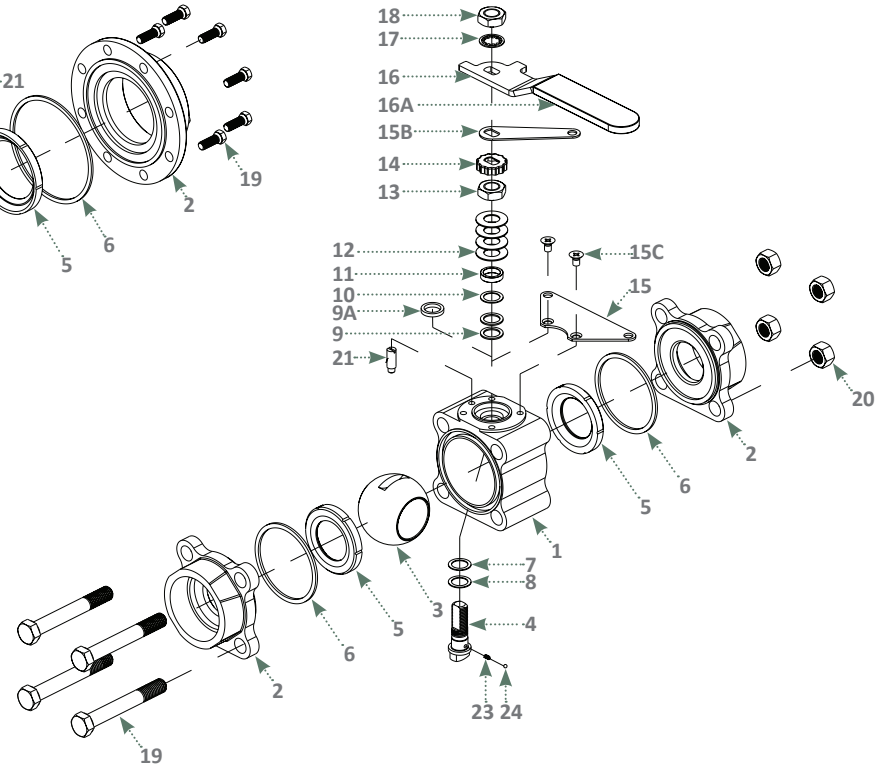
Heat numbers are provided on all valve bodies and ends. CMTR's (certified mill test reports) are available upon request.

Parts & Materials

3" - 4"



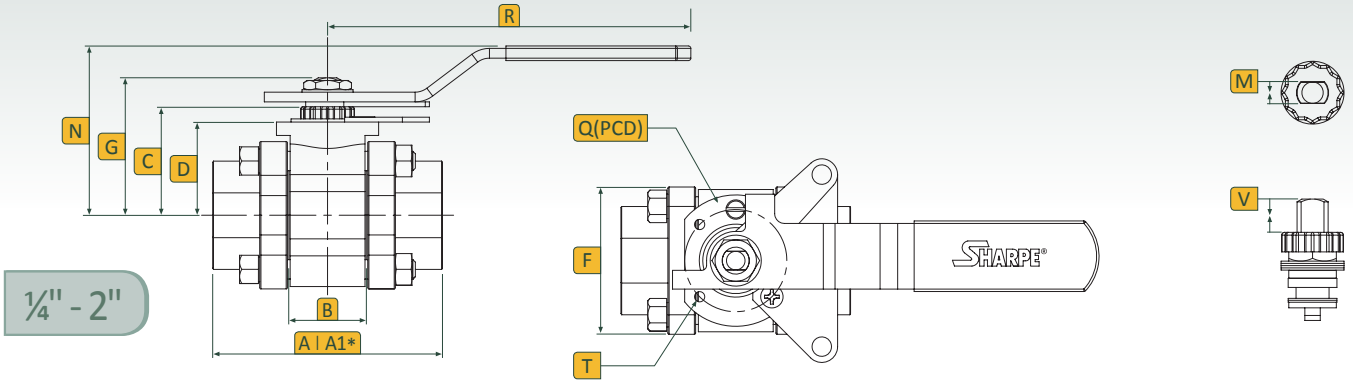
¼" - 2½"

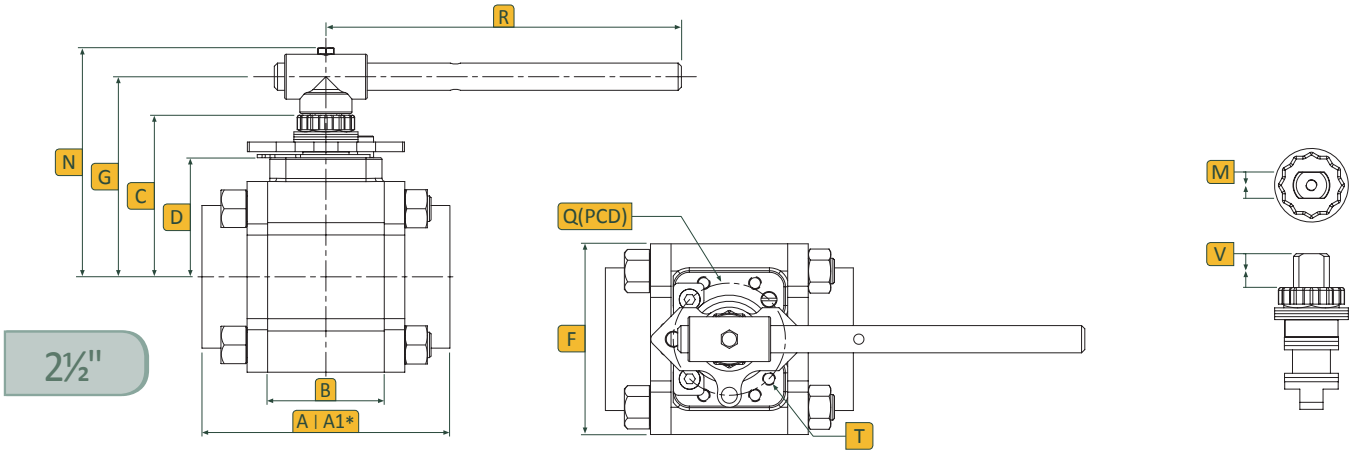


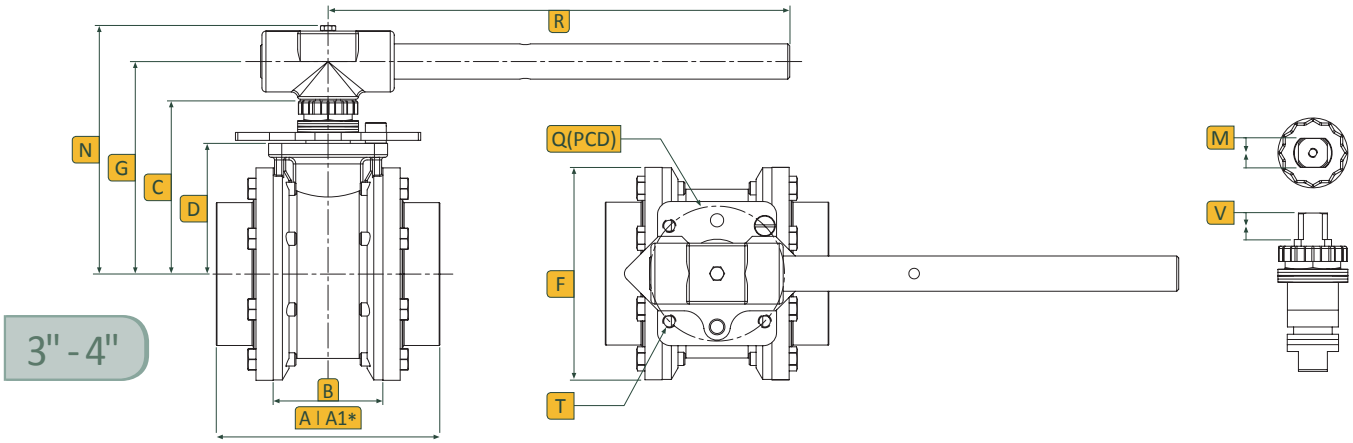
PART NO.	PART	QTY.	MATERIAL
1	Body	1	316 Stainless Steel ASTM A351 CF8M Carbon Steel ASTM A216 WCB
2	Ends Cap	2	316L Stainless Steel ASTM A351 CF3M Carbon Steel ASTM A216 WCB
3	Ball	1	316 Stainless Steel
4	Stem	1	316 Stainless Steel 17-4PH
5	Seat	2	PTFE RTFE TFM Nova Delrin UHMWPE PEEK
6	Body Seal	2	PTFE Graphite UHMWPE Buna Viton
7	Thrust Bearing	1	Nova (UHMWPE with UHMWPE Seats)
8	Thrust Bearing	1	PEEK (UHMWPE with UHMWPE Seats)
9	Stem Packing	2	Nova (UHMWPE with UHMWPE Seats)
9A	Stem Packing	1-2	Graphite
10	Seal Protector	1	PEEK

PART NO.	PART	QTY.	MATERIAL
11	Gland	1	300 Series Stainless Steel
12	Belleville Washer	4	300 Series Stainless Steel
13	Packing Nut	1	300 Series Stainless Steel
14	Lock Tab	1	300 Series Stainless Steel
15	Lower Lock Latch	1	300 Series Stainless Steel
15B	Upper Lock Latch Bolt	1	300 Series Stainless Steel
15C	Latch Bolt	1	300 Series Stainless Steel
16	Handle (¼"-2")	1	300 Series Stainless Steel
16A	Wrench (3" & 4")	1	Galvanized
16B	Wrench Block	1	300 Series Stainless Steel
16C	Hex Head Bolt	1	300 Series Stainless Steel
17	Lock Washer	2	300 Series Stainless Steel
18	Handle Nut (¼"-2")	1	300 Series Stainless Steel
19	Body Bolts	4	304 Stainless Steel
20	Nuts	4	316 Stainless Steel
21	Stop Pin	1	300 Series Stainless Steel
21A	Stopper	1	300 Series Stainless Steel
22	Seat Retainer	1	300 Series Stainless Steel Carbon Steel
23	Anti-Static Spring	1	Hard Drawn Stainless Steel
24	Anti-Static Ball	1	300 Series Stainless Steel

Dimensions







84	A	B	C	D	F	G	L	M	N	ø Q (ISO)	R	T	V
¼", ⅜", ½"	2.62	0.82	1.22	1.06	1.81	1.58	⅜"-24 UNF	0.220	2.15	1.42 (F03)	4.53	M5 x PO.8	0.34
¾"	2.87	0.97	1.27	1.13	1.94	1.65	⅜"-24 UNF	0.220	2.28	1.42 (F03)	4.53	M5 x PO.8	0.39
1"	3.72	1.25	1.73	1.51	2.38	2.23	⅛"-20 UNF	0.295	2.70	1.65 (F04)	5.79	M5 x PO.8	0.52
1¼"	4.25	1.61	1.90	1.70	2.78	2.43	⅛"-20 UNF	0.295	2.89	1.65 (F04)	5.79	M5 x PO.8	0.53
1½"	4.58	1.90	2.17	1.73	3.12	2.90	⅜"-18 UNF	0.342	3.15	1.97 (F05)	6.78	M6 x P1.0	0.73
2"	5.03	2.21	2.39	1.90	3.60	3.09	⅜"-18 UNF	0.342	3.37	1.97 (F05)	6.78	M6 x P1.0	0.73
2½"	5.88	2.87	3.98	2.85	4.77	4.88	M20 x P2.5	0.551	5.61	2.75 (F07)	8.73	M8 x P1.25	0.74
3"	6.65	3.27	5.01	3.89	6.46	6.14	1" - 14 UNS	0.748	6.14	4.02 (F10)	13.74	M10 x P1.5	0.69
4"	8.43	4.29	5.60	4.48	8.00	6.73	1" - 14 UNS	0.748	7.81	4.02 (F10)	13.74	M10 x P1.5	0.69

Technical Information

CONTROL VALVE Cv VALUES

VALVE SIZE	VALVE PERCENT OPEN (DEGREE OF ROTATION)										
	0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
1/4"-1/2" V15		0.05	0.14	0.25	0.37	0.51	0.66	0.84	1.03	1.26	1.36
1/4" - 1/2" V30		0.05	0.15	0.29	0.48	0.65	0.91	1.30	1.60	2.03	2.19
1/4" - 1/2" V60		0.11	0.28	0.55	0.80	1.17	1.72	2.45	3.43	4.48	5.18
3/4" V15		0.12	0.26	0.41	0.58	0.80	1.05	1.32	1.65	1.93	2.02
3/4" V30		0.13	0.29	0.50	0.80	1.09	1.50	2.03	2.61	3.11	3.31
3/4" V60		0.21	0.44	0.80	1.28	1.91	2.77	3.70	5.33	6.71	7.31
1" V15		0.13	0.36	0.63	0.90	1.33	1.84	2.37	2.97	3.53	3.78
1" V30		0.14	0.41	0.77	1.27	2.01	2.83	3.87	5.03	6.08	6.66
1" V60		0.25	0.69	1.34	2.31	3.59	5.34	7.55	10.29	13.28	15.04
1-1/2" V15		0.29	0.66	1.17	1.86	2.70	3.69	4.71	5.82	7.02	7.89
1-1/2" V30		0.33	0.88	1.75	2.89	4.42	6.23	8.31	9.97	12.19	13.91
1-1/2" V60		0.56	1.64	3.16	5.33	8.45	11.33	15.67	22.18	28.19	32.08
2" V15		0.39	0.93	1.79	2.74	3.97	5.37	6.68	8.28	9.51	10.81
2" V30		0.40	1.18	2.21	3.88	6.09	8.44	10.91	14.08	17.25	19.49
2" V60		0.71	2.22	4.48	7.26	10.50	15.72	21.52	29.38	37.46	43.54
3" V15		0.66	1.94	3.69	6.12	9.01	11.97	15.50	19.40	23.59	27.05
3" V30		0.72	2.56	5.49	8.99	13.51	19.68	26.45	34.29	42.85	52.41
3" V60		1.65	5.32	10.98	18.95	29.77	43.94	60.07	81.37	106.13	131.43
4" V15		0.97	2.97	5.82	9.35	13.56	18.60	24.24	30.51	37.44	44.27
4" V30		1.50	4.81	9.56	16.67	25.43	35.19	47.06	60.69	77.20	91.66
4" V60		2.57	8.33	18.61	30.01	47.66	70.85	98.75	133.52	174.99	215.11

Cv is defined as the flow of liquid in gallons per minute through a valve with pressure drop of 1 PSI across the valve.

VALVE SIZE		VALVE PERCENT OPEN (DEGREE OF ROTATION)									
	0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
F_L	0	0.96	0.95	0.94	0.93	0.92	0.90	0.88	0.86	0.82	0.75
X_t	0	0.98	0.77	0.71	0.67	0.64	0.63	0.62	0.55	0.43	0.40

F_L- Liquid Pressure Recovery Factor

X_t- Pressure Drop Ratio Factor (Gas)

Flow Coefficient - Cv - Standard Seat Control Valves - Round Port

VALVE SIZE	VALVE PERCENT OPEN (DEGREE OF ROTATION)										
	0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
1/4"-1/2"	0	0.15	0.29	0.46	0.70	1.09	1.76	2.60	4.30	6.40	8.00
3/4"	0	0.21	0.43	0.70	1.05	1.62	2.64	4.00	6.40	9.60	12.00
1"	0	0.58	1.15	1.90	2.80	4.30	7.00	10.50	17.00	26.00	32.00
1-1/2"	0	1.48	2.95	4.75	7.20	11.00	18.00	27.00	44.00	65.50	80.00
2"	0	2.16	4.33	6.95	10.50	16.20	26.40	39.60	64.0	96.00	120
3"	0	6.40	12.60	20.20	31.10	47.40	77.80	1151	87	280	350
4"	0	13.10	26.00	42.10	63.10	97.20	159	238	385	575	720

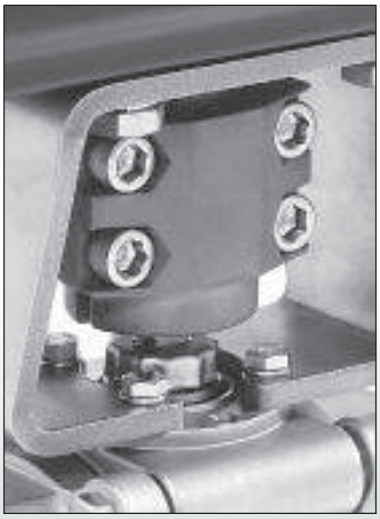
Cv is defined as the flow of liquid in gallons per minute through a valve with pressure drop of 1 PSI across the valve.

VALVE SIZE	VALVE PERCENT OPEN (DEGREE OFR OTATION)										
	0 (0)	10 (9)	20 (18)	30 (27)	40 (36)	50 (45)	60 (54)	70 (63)	80 (72)	90 (81)	100 (90)
F_L	0	0.92	0.91	0.91	0.90	0.86	0.86	0.72	0.65	0.61	0.50
X_t	0	0.78	0.74	0.71	0.67	0.62	0.56	0.49	0.38	0.26	0.15

F_L- Liquid Pressure Recovery Factor
X_t - Pressure Drop Ratio Factor (Gas-Choked Flow)

"NO PLAY" COUPLING

* 304 Stainless Steel Two Piece Coupling
* Designed For Process Control Critical High Cycle Automated Valves
* No Hysteresis Or Lost Motion



BASIC FLOW EQUATIONS FOR LIQUID SERVICE

PIPE REDUCER COEFFICIENTS

Loss Coefficients

$$K1 = 0.5 \cdot \left[1 - \left[\frac{d}{D1}\right]^2\right]^2$$

$$K2 = \left[1 - \left[\frac{d}{D2}\right]^2\right]^2$$

Bernoulli Coefficients

$$Kb1 = 1 - \left[\frac{d}{D1}\right]^4$$

$$Kb2 = 1 - \left[\frac{d}{D2}\right]^4$$

Summation

$$\Sigma K = K1 + K2 + Kb1 - Kb2$$

Pipe Geometry (Reducer) Factor

$$Fp = \left[\left[\frac{Cv^2 \cdot \Sigma K}{890 \cdot d^4}\right] + 1\right]^{-.5}$$

BASIC FLOW EQUATIONS

Flow Rate

$$q = Fp \cdot Cv \cdot \left[\frac{\Delta P}{G}\right]^{.5}$$

$$w = 63.3 \cdot Fp \cdot Cv \cdot (\Delta P \cdot \gamma)^{.5}$$

Pressure Drop

$$\Delta P = G \cdot \left[\frac{q}{Fp \cdot Cv}\right]^2$$

$$\Delta P = \frac{1}{4010 \cdot \gamma} \cdot \left[\frac{w}{Fp \cdot Cv}\right]^2$$

Flow Coefficient

$$Cv = \frac{q}{Fp} \cdot \left[\frac{G}{\Delta P}\right]^{.5}$$

$$Cv = \frac{w}{63.3 \cdot Fp \cdot (\Delta P \cdot \gamma)^{.5}}$$

NOMENCLATURE

Cv = valve flow capacity coefficent
d = valve end inside diameter (in)
D1 = inside diameter of upstream pipe (in)
D2 = inside diameter of downstream pipe (in)
Fp = piping geometry factor, dimensionless
K1 = pressure loss coefficient for inlet reducer, dimensionless
K2 = pressure loss coefficient for outlet reducer, dimensionless
Kb1 = pressure change (Bernoulli) coefficient for inlet reducer, dimensionless
Kb2 = pressure change (Bernoulli) coefficient for outlet reducer, dimensionless
G = specific gravity of liquid relative to water at 70°F
ΔP = pressure drop across the valve, or valve/reducer assembly (psi)
q = volumetric flow rate, US gpm
w = weight flow rate, lb/hr
γ = weight density of liquid, lb/ft^3

BASIC FLOW EQUATIONS FOR GAS AND VAPOR SERVICE

Flow Rate

$$q = 1360 \cdot Fp \cdot Cv \cdot P1 \cdot Y\left[\frac{x}{G \cdot T \cdot Z}\right]^{.5}$$

$$w = 63.3 \cdot Fp \cdot Cv \cdot Y(x \cdot P1 \cdot \gamma 1)^{.5}$$

Pressure Drop

$$\Delta P = \frac{G \cdot T \cdot Z}{P1} \cdot \left[\frac{q}{1360 \cdot Fp \cdot Cv \cdot Y}\right]^2$$

$$\Delta P = \frac{1}{\gamma 1} \cdot \left[\frac{w}{63.3 \cdot Fp \cdot Cv \cdot Y}\right]^2$$

Flow Capacity Coefficients

$$CV = \frac{q}{1360 \cdot Fp \cdot P1 \cdot Y} \cdot \left[\frac{G \cdot T \cdot Z}{x}\right]^{.5}$$

$$CV = \frac{w}{63.3 \cdot Fp \cdot Y \cdot (x \cdot P1 \cdot \gamma 1)^{.5}}$$

Factors Fk, x, and Y

Ratio of Specific Heats Factor: $Fk = \frac{k}{1.40}$

Presssure Drop Ratio: $x = \frac{\Delta P}{P1}$

Gas Expansion Factor: $Y = 1 - \frac{x}{3 \cdot Fk \cdot xt}$

Nomenclature:

Cv = valve flow capacity coefficent
Fp = piping geometry factor, dimensionless
G = specific gravity of gas relative to air at standard conditions (60°F, 14.7 psia)
ΔP = pressure drop across linesize valve, or valve/reducer assembly, psi
P1 = pressure at the inlet of a linesize valve, or valve/reducer assembly, psia
q = volumetric flow rate at standard conditions, ft^3/hr
T = temperature at the inlet of a linesize valve, or valve/reducer assembly, °R
w = weight flow rate, lb/hr
x = ratio of pressure drop across linesize valve, or valve/reducer assembly to inlet pressure, dimensionless
xt = terminal value of x for choked flow in linesize valves, dimensionless
Y = gas expansion factor, dimensionless
Z = gas compressibility factor, dimensionless
γ1 = density at the inlet of a linesize valve, or valve/reducer assembly, lb/ft^3

Notes:

1) Use the same equations for calculating Fp as for liquid flow calculations.
2) The equations above are for informational purposes, anc cover simple, linesize valve gas flow solutions. Where reducer effects or choked flow become involved, these calculations become considerably more complex, and beyond the intent of this document.

How To Order Series V84

1"	V84	-	6	6	R	G	-	TE	-	X
Size	Series		Body & Ends	Ball & Stem	Seat	Seal		Ends		Options

Valve Size
¼"
⅜"
½"
¾"
1"
1¼"
1½"
2"
2½"
3"
4"

Valve Series	
V84	Control

Body & Ends	
6	316 Stainless Steel
4	Carbon Steel

Ball & Stem	
6	316 Stainless Steel Ball and 17-4PH Stainless Steel Stem

Seat	
T	PTFE
R	RTFE
M	TFM®
U	Delrin®
N	Nova
P	Virgin PEEK
U	UHMWPE

Body Seal	
G	Graphite
M	TFM®
T	PTFE
U	UHMWPE
V	Viton®

Ends	
TE	Threaded Ends (NPT)
SW	Socket Weld
BW10	Buttweld SCH 10*
BW40	Buttweld SCH 40
BW80	Buttweld SCH 80*
1	150# Flanged RF
3	300# Flanged RF
6	600# Flanged RF

Options	
V15	V-Ball V15
V30	V-Ball V30
V60	V-Ball V60
X	Oxygen Clean as per MFG's Standards

*POA

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