APPENDIX C

VALVE LOSS COEFFICIENTS

C.1 GLOBE AND ANGLE VALVES

Flow coefficients C_v and loss coefficients K_L for fully open Cla-Val globe and angle valves are presented in the following table:

	Size, in	4	6	8	10	12	14	16	24
C_v	Globe	200	460	770	1245	1725	2300	2940	7655
	Angle	240	541	990	1575	2500*	3060*	4200*	---
K_L	Globe	5.8	5.7	6.1	5.8	6.1	5.0	5.2	4.0
	Angle	4.1	4.1	3.7	3.6	2.9	2.8	2.6	---

*Estimated

The factor C_v is the discharge, in U.S. gallons per minute, across a pressure differential of 1 lb/in^2 when water at 60 ^{o}F is flowing. The formula that relates C_v, the discharge Q, and the pressure drop Δp, may be written in three forms, which are

$$C_v = \frac{Q}{\sqrt{\Delta p}} \qquad Q = C_v\sqrt{\Delta p} \qquad \Delta p = \left(\frac{Q}{C_v}\right)^2 \tag{C.1}$$

in which C_v is the fresh water discharge rate in gal/min for a 1 lb/in^2 pressure difference, Q is the fresh water discharge in gal/min, and Δp is the pressure drop in lb/in^2.

Values of the resistance coefficient K_L for the valve are calculated from

$$h = K_L\frac{V^2}{2g} \tag{C.2}$$

in which h = frictional resistance, V = average velocity in ft/s, and g = 32.2 ft/s^2. The relation between C_v and K_L is

$$K_L = 890\frac{D^4}{C_v^{@}}$$

in which D = pipe diameter in inches.

Condensed from Cla-Val Automatic Control Valve Product Data Catalog, courtesy of CLA-*VAL, Newport Beach, CA*

The next table provides data on flow coefficients C_v for fully open valves for GA Industries globe and angle valves. The coefficient C_v is defined in Eq. C.1.

Size, in	6	8	10	12	14	16	18	20
Globe	447	831	1175	1750	2500	3260	4130	5100
Angle	600	1060	1800	2385	3245	4240	5365	6620

Figure C.1 illustrates how the flow coefficient varies with valve stroke. The graph applies to both globe and angle valves.

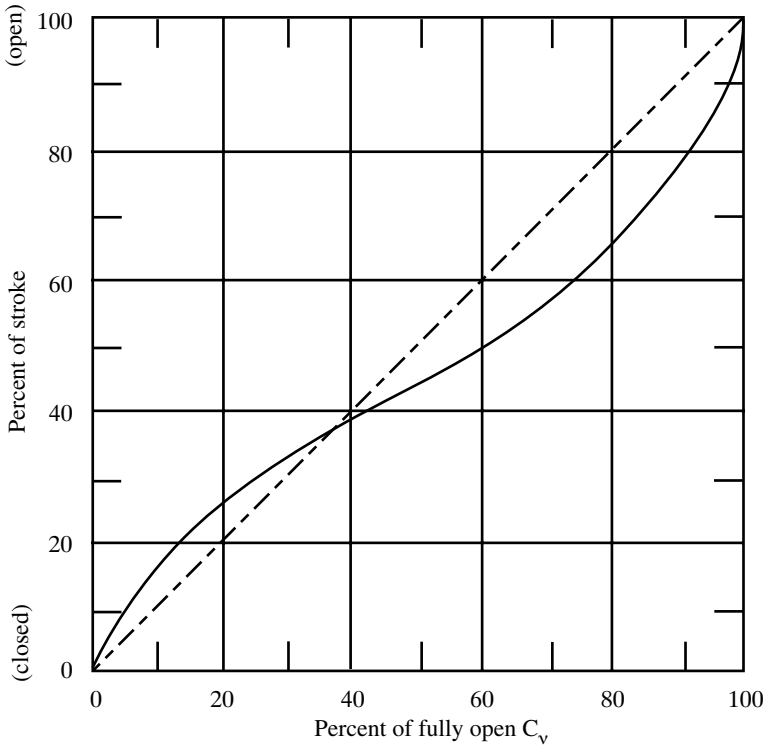

Figure C.1 The flow coefficient Cv as a function of percent of stroke.

Table and graph courtesy of GA Industries, Inc., Cranberry township, PA.

C.2 BUTTERFLY VALVES

This table presents the loss coefficient K_L, as defined in Eq. C.2, as a function of percent open for Pratt butterfly valves.

Degrees Open	3-in to 8-in Valves K_L	10-in to 20-in Valves K_L
5	15625	15625
10	3860	3860
15	935	935
20	337	337
25	145	145
30	71.8	71.8
35	39.6	39.6
40	21.6	21.6
45	12.7	12.7
50	6.61	7.42
55	4.00	4.41
60	2.62	2.64
65	1.79	1.59
70	1.25	0.952
75	0.948	0.620
80	0.800	0.496
85	0.718	0.460
90	0.689	0.447

C.3 BALL VALVES

For Pratt ball valves the following two tables provide (1) values of C_v for fully open valves and (2) percent of fully open C_v as a function of number of degrees that the valve is open. The coefficient C_v is defined in Eq. C.1.

Valve Size, in.	C_v
6	5250
8	9330
10	14600
12	21000
14	28600
16	37300
18	47300
20	58300
24	84000
30	131300
36	189000
42	257300
48	336000
54	425300
60	525100

Degrees Open	Percentage of fully open C_v
5	0.16
10	0.88
15	1.4
20	1.8
25	2.4
30	3.1
35	3.7
40	4.7
45	5.9
50	7.2
55	9.0
60	11.2
65	14.1
70	18.0
75	24.5
80	41.5
85	73.0
90	100.0

The tables in sections C.2 and C.3 are courtesy of Henry Pratt Co., Aurora, IL.